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Eocretaceous (Neocomian-Gallic) benthic Molluska of the Southern Caribbean subprovince of Gondwanan province

Survival and evolution in a saline/hypersaline stressful environment

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CHAPTER **I.**

INTRODUCTION.

Among the most advanced ítems of Biostratigraphy, is the Atlas of Palaeobiography, (HALLAM, 1973-A, 1973-B) in which the Maps of Cretaceous fauna are distributed, stage by stage. Worth to mention, are the Cretaceous Bivalvia (KAUFFMAN in HALLAM, et alii., 1973-a), the Cretaceous Belemnites (STEVENS in HALLAM, et alii., 1973-a), the Cretaceous Rudistids (Bivalvia) (PHILIP, 1932; COATES, 1973), but there is a common feature on all these palaeogeographic maps: Venezuela is a black hole. This is very sad, taking in account that the Cretaceous sedimentary outcrops occupy 23.200 km^2 in Venezuela, and it harbors the main oil-producing horizons of the country, too (GONZALEZ DE JUANA et al., 1980). These sedimentary formations usually are quite fossiliferous, but the mediocrity of the oil companies' "paleontologists" towards the microfaunal studies made them miss the target (see YORIS, 1985). They despised and neglected the mollusks found not on the outcrops, but in the thin sections, too. They ignored that the identification of the Cretaceous period, and its subdivision in stages was made on basis of molluska (d'ORBIGNY, 1843-1847) and in many areas of the planet, Rudistida, Inoceramida and Nerineidae are still used for age determination, and local correlation.

In Venezuela, J. ROYO Y GOMEZ (1953) identified and illustrated a dozen of taxa of Bivalvia and one Gasteropoda from the Taguarumo Formation, who insisted in the high similarity with the Mesogean Tethys. E. VON DER OSTEN (1953, 1957) succeeded publishing his molluskan collection from the Morro Blanco and Taguarumo formations, 11 taxa of bivalvia and 25 of gastropoda. Unfortunately, the litterature available at Stanford University (California, USA) produced forced identifications with Texan molluskan faunas, which are mostly of Albian age. Even so, many of his new species are still valid: *Panis maroma* (Von der Osten), *Ludbrookia cumanesa, Angaria keenae, Metriomphalus schwarki, M. taguarumensis, Turritella pelusae, Rhabdocerithium krauskopfi, Columbellina catedralis,* considering the generic position which has changed. Most species were synonyms of previously published taxa from Europe and the Middle East. R. RUTSCH & A. SALVADOR (1954) published from the northern Mérida Andes four taxa of bivalvia of Late Albian/Early Cenomanian age: *Didymotis variabilis, Cameleolopha syphax, Psilomya cornueliana* and *Neithea (Neitheops) cf. occidentalis.* The black hole in the paleogeographic maps of the Cretaceous, is not justified, for Venezuela and Trinidad.

Venezuelan stratigraphy was started by German and French naturalists, as Alexander VON HUMBOLDT (1767-1835), Hermann KARSTEN, Karl GERHARDT and others. The first notice on recognition of Neocomian age molluska among fossils collected from Colombia by M. BOUSSINGAULT, is due to Alcide d'ORBIGNY (1842) with high identity of Neocomian stratotype areas of France. The mollusks cited were: 30 of Bivalvia, and eight of Gastropoda, all marine, and with them, the term Cretaceous was applied to Venezuelan sedimentary rocks for the first time. L. VON BUCH (1850) published also ammonites collected by H. KARSTEN in the limestones known presently as La Puya member of the Peñas Altas Formation (RENZ, 1956, 1980; Stratigraphical Lexicon of Venezuela, 1997) of Late Albian age. As part of an ammonite collection from Garcia Formation (Serranía del Interior Oriental) REINHARDT (1922) identified *Nucula bivirgata* (Fitton) Sowerby, 1836 (=*Acila [Truncacila] bivirgata* (Fitton).

The second stage in stratigraphy started in Venezuela during 1914, with the discovery of the Oil well Zumaque-I, Dutch and English geologists started arriving in Venezuela. After 1922, waves of US-Americans arrived after the blow-up of the well Los Barrosos nº 2, in Maracaibo Lake. By 1928, Venezuela was the second largest producer in the World, after the United States, and the whole country became oil-dependant (BROSSARD, 1993). The trans-national oil companies brought Paleontologists to work in the oil company's laboratories. Names as F. A. SUTTON, F. HODSON, V. WINKLER, H.A. GUILLAUME, H. BOLLI and J.P. BECKMANN who were hard-working scientists, but who had to face any sedimentary rock from Cenozoic to Cretaceous ages. Soon the benthic foraminifera were imposed over all the other faunas in the laboratories. This mentality persisted in the first Geology School (Escuela de Geologia, Minas y Metalurgia) founded in 1938 in Caracas by Geol. Victor M. LOPEZ and Guillermo ZULOAGA (both PhD-s from MIT). Despite having valuable paleontologists as Pedro J. BERMUDEZ (PhD, University of La Habana, Cuba)

and Frances CHARLTON de RIVERO (Columbia University, USA), with oil company field experience in Venezuela, they were opposed permanently by C. GONZALEZ DE JUANA (Mining Engineer, from Spain), who never understood the role of paleontology in biostratigraphy. Unfortunately, the last one became the school's chairman, and the anti-paleontology attitudes prevailed. The third stage arrived with the plate tectonics in Venezuela, when the interest on the evolution of the Caribbean Plate, attired the attention of Universities as Princeton, USA. Harry H. HESS, sent over 39 students at PhD level, who worked out mainly the Coastal Ranges and Islands and published most of the results focused mainly on tectonics and geochemistry. The exchange program between Venezuela and France – during the OPEC's price increases,- sent also a dozen of PhD students, mostly oriented to Geodynamics, which was a modified type of Plate Tectonics. This exchange program, included for first time, Venezuelan Geologists to realize PhD-level studies in France. All were Tectonics-oriented, except the author of this study, who dealt about Early Cretaceous Molluskan Biostratigraphy (1980). Meanwhile, Venezuela, Colombia and Trinidad became the favorite hunting-ground for high-level plate tectonic experts, who liked to "arrange" the planet at scales ranging from 1:20 to 1:80 million scale. Plates were invented, faulted, subducted, eroded, rifted, sutured and modified in different ways. There were three main hypothesis on the origin and evolution of the Caribbean Plate, and its influence on the South American Plate margin, and the Sedimentary Basins developed on it:

>>>> 1) Middle Jurassic rifting of Pangea, separating North America (Laurasia) from South America (Gondwana); Late Jurassic rifting separated Yucatan block from Gondwana; Early Cretaceous irruption of a fragment of Proto-Pacific (Farallon or Phoenix plates) on the rifted Proto-Caribbean, and finally, its collision on the South America's margin. This is the most popular of all the hypothsis, and was promoted by STEPHAN (1977, 1982), PINDELL (1985, 1993), STEPHAN et al., (1990), PINDELL et al., (1988, 1991), PINDELL & ERICKSON (1994), PINDELL & SCOTESE (1988), TARDY et al., (1994), called the PACIFIC MODEL.

>>>> 2) In situ CARIBBEAN model. It evolves largely through sinistral transtension between Laurasia and Gondwana during Jurassic-Early Cretaceous times. The Caribbean Plate became defined by island arcs in the Greater – Lesser – Aruba-Blanquilla Antilles and in southern Central America. This model does not involve large-scale rotations of elements such as the Maya and Chortis blocks. The minority that supports the in situ model, are: BALL et al., (1969), MEYERHOFF & MEYERHOFF (1971), SALVADOR & GREEN (1980), JAMES (1990, 1997, 2000, 2005a), FRISCH et al., (1992), LUGO & MANN (1995), MESCHEDE (1998A), MESCHEDE & FRISCH (1998) and CORIELLA-REGUERA (2000).

>>>> 3) The CARIB GRABEN model, proposed by R. HIGGS (2009-a), developed for Middle Jurassic (Bathonian) and Late Jurassic (Tithonian) times. Rifting west Laurasia from Gondwana, forming an inter-American ocean; and the future Greater Antilles terrane, and an extensive "Carib Graben" including Trinidad, Venezuela, Colombia and Ecuador, were the most important elements. This model has the advantage of joining intimately the evolution of the Proto-Caribbean Basin, and the "Graben" system formed along the northwest margin of the Gondwana super-continent. The rifting spanned (and bridged) two hemiglobal superplume events: (1) A Late Triassic-Early Jurassic event responsible for initial fragmentation of Pangea (227 – 183 Ma), and (2) a mid-Cretaceous event (120 – 80 Ma), fide VAUGHAN & STOREY (2007), responsible for the Caribbean Plateau overthickened Oceanic crust (90 – 75 Ma, LARSON, 1971) which moreover formed close to northern South America (MESCHEDE & FRISCH, 1998). A speculative "Colombian Mantle Plume" (HIGGS, 2009-a) may have been centered under the Central Cordillera plutonic belt. So, this would explain the "Cundinamarca Aulacogen" (FABRE, 1983) in Colombia and western Venezuela, but also would account for the Late Jurassic Hemigrabens in the rest of northern Venezuela (Text figures I-3a, I-3b). This one is the model that fits the best the paleontological results we have obtained from the study of Eocretaceous benthic Molluska of Venezuela, Colombia and Trinidad. Since the initial differentiation of ALLOCHTHONOUS terrains and the AUTOCHTHONOUS ones, introduced to Venezuela by J.-F. STEPHAN (1977) and C. BECK (1977), it became evident that quite different fossil assemblages should be present in age-equivalent sedimentary rocks. Several years were dedicated to this selective sampling (MACSOTAY, 1980-b) which resulted as follows:

1) Allochthonous phyllites, marls and limestones, contained scarce heteromorph ammonites, radiolarians and small molluska of Cretaceous age. Locally, carbonatic olistoliths carried shelfal molluska, usually of younger age than the in situ fossils (MACSOTAY et al., 1987, 2005).

2) Autochthonous sedimentary rocks, which formed the sedimentary cover of the craton, and never were significantly displaced from their original place.. A third category of terrains was recognized somewhat later:
3) Parautochthonous a terrain intermediate in tectonic character between the autochthonous and allochthonous (BATES & JACKSON, 1987). The whole Cretaceous sequence of the Serrania del Interior Oriental, resulted in tectonically detached and thrusted sediments which were originally deposited on the same craton, but in more external (=basinward) places (ROSSI, 1985; VIVAS, 1987; VIVAS et al., 1985). A greater tectonic transport was discovered, when the sediments of the Piemontine Nappe, were found to have originated as the slope and apron of the Gondwana Craton (BLIN, 1989; BLIN et al., 1990). The same would be true in the Lara Nappe (MACSOTAY et al., 1989).

I – 1. Approaches and Study Objectives.

This is a non-conventional paleontologic study. My purpose is to use the information of benthic Molluska to obtain paleogeographical, paleoceanographical and mainly, pPaleoclimatological results on the evolution of the shelves and parameters of the water above them.

I – 1.1.- Paleogeography.

During the last 40 years, at last 30 different paleogeographic reconstructions have been published dealing with the circum-Caribbean area. This biostratigraphic study is our opportunity to understand to which of the Plate Tectonic models of the PaleoCaribbean, fitted the models and when? Palinspastically reconstructed paleogeographic maps should be tested: do they displace facies boundaries? How did contemporaneous faulting influence sediment and/or fossil distribution? According to PINDELL & KENNAN (2002-b) "palinspastic approach restores observed deformation through time, allowing clarification "of origination of terranes, former relations of blocks, sources of clastic sediments and "reconstruction of regional paleo-environments."

I – 1.2.- Paleoceanography.

This one was a very neglected aspect of Plate Tectonic Research. Oceans were useful to accommodate rifts, volcanic arcs, transform faults, etc., but nobody bothered to evaluate the thermophylic or cryophylic benthic faunas, and their relationship to the paleogeographic position of the substrate. This lack of information is reflected by the scarcity of paleogeographic maps of Neocomian and Gallic epochs (GUILLAUME et al., 1972; ROSSI, 1985; VAHRENKAMP et al., 1993; PINDELL & ERICKSON, 1994; VILLAMIL & PINDELL, 1998 and HIGGS, 2009-b).

I – 1.3.- Paleoclimatology.

The whole Neocomian formations sampled, the presence of evaporitic minerals (gypsum, dolomite, anhydrite, chamosite) and the presence of small-sized bivalvian fauna suggests a strongly restricted and saline sea waters, in tropical setting. During Barremian stage , iron and manganese oxides and carbonates, suggest strong fluvial influence from the nearby continent; salinity persists, and bivalves still dominate de fauna. The Aptian stage with an increase of biodiversity, shows the invasion of cryophyllic molluska; the gastropoda increase. Albian sediments show higher biodiversity: big-sized bivalvia and gastropoda are characteristic; the salinity becomes gradually euhaline, due to the apport of fresh water from the shelves. Cenomanian and late Turonian still are dominated by calcitic-shelled bivalvia; the gastropods are mostly carnivorous, and the seas are saline alike the one in Africa.

I - 4.- Previous work.

The pioneer publications on Eocretaceous benthic molluska from Venezuela, Colombia and Trinidad, are the classics of L. VON BUCH (1850), A. D'ORBIGNY (1842), who succeeded to date their fossil molluska as Cretaceous, Neocomian, mainly on base of the associated ammonites. I. LEA (1840) identified the first Colombian Trigoniidae, but he considered them as of Jurassic age. A. D'ORBIGNY (1847) added some Cretaceous bivalvia from Chile; BAYLE & COQUAND (1851), GABB (1860) and R. A. PHILIPPI (1899) studied mostly bivalvia of Jurassic and Cretaceous age. Outstanding publication on Peruvian Bivalvia and Gastropoda of Cretaceous age was the one of W. M. GABB (1877), and later RICHARDS (1947), LISSON (1925), OLSSON (1934, 1944) and others. GERHARDT (1897-a; 1897-b) contributed with more taxa from Perú, Colombia and Venezuela. Molluska from Trinidad's Eocretaceous, by COX (1954), but reworked in turbidites of Paleocene age, were all identified in well-dated outcrops of the Serrania del Interior Oriental of Venezuela. From Brazil, WHITE (1888) and MAURY (1936) studied mostly Albian molluska from the rifting processus. From Argentina's Neuquen Basin, WEAVER (1931) with Neocomian-Aptian molluska, stratigraphically controlled with ammonites, is one of the most reliable of all the sources; see CAMACHO & RICCARDI (1978).

Two of the publications which encouraged me of to realize this study, was the paper on Cocuy Graben's Eocretaceous molluska (ETAYO SERNA, 1985) and the monograph on Trigoniacea of Argentina by LEANZA (1995).

To our surprise, the hard-to-get CONRAD (1852), LARTET (1872), HAMLIN (1884), BÖHM (1900), BLANCKENHORN (1980, 1927, 1934), DELPEY (1939) and VOKES (1946) from Lebanon, Palestine and Syria contained gastropoda and specially Bivalvia, with the highest number of taxa in common with the Southern Caribbean Subprovince. From the neighbouring Egypt, ABBASS (1962, 1963) publications confirmed the continuity of the faunal realm through Tunisia and Algeria, studied by COQUAND (1862), PERON (1889-1890) and PERVINQUIÈRE (1912).

Finally, in his biostratigraphy of Peruvian Cretaceous, BENAVIDES (1956), published the ammonite fauna but also cited Bivalvia, Gastropoda and Echinoidea from each formation, which resulted very helpful. The comparison with Mexico, also resulted helpful, as the studies of FELIX & LENK (1890), BURCKHARDT (1930), and IMLAY (1937, 1940) reported deep-marine molluska, too.

I - 2.1.- Cretaceous stage stratotype areas.

The original aim of the Eocretaceous molluskan studies in Venezuela, (MACSOTAY, 1980-b) was to establish a reliable stage by stage correlation with the European stratotype areas. The review started with the revision of the published literature on Eocretaceous mollusks of France: Berrisasian, Neocomian, Barremian, Aptian, Albian, Cenomanian and Turonian; of Switzerland: Valanginian and Hauterivian. Most of the molluskan studies were realized previously to the designation of the stratotypes (see: Colloque sur le Crétacé Inférieur, Lyon, 1963, September). The stratotypes themselves are not necessarily available for collecting, but there are plenty outcrops along the well-exposed Jura mountains (shared by France and Switzerland) and the pre-Alps and Pyrenees (last one, shared by France and Spain). The paleontological literature was copied and integrated to taxonomically organized file-cards, so the species could be grouped in up-dated genera and families. Synonymies were identified,, so many duplications were detected between European and North American literature. The most important works consulted on the stratotype areas, were: d'ORBIGNY (1842-1843. 1842, 1844-1847; 1850), LEYMERIE 1842), PICTET & CAMPICHE (1861-1871), DE LORIOL (1861, 1866, 1868, 1882), PICTET (!867), COSSMANN (1895-1925), DELPEY (1941, 1842); ROLLIER (1911-1917).

I - 2.2.- Age determinations.

This one was the most difficult point, and it contributed to the discredit of the Cretaceous benthic molluska, as age markers. Many of the early paleontologists, essentially were taxonomist biologists, with very weak knowledge of the handling of the time-lines, privilege of the true biostratigraphers. So, COQUAND (1862), MALLADA (1877) and BATALLER (1949-1959) placed all the Maestrazgo, Oliete and Mora de Rubielos Basin fossils of Spain in the Aptian stage. They actually include species from Hauterivian to Albian age. HARRIS & HODSON (1922) considered the rich *Amphitriscoelus waringi – Kipia – Praecaprina* rudist fauna as Cenomanian in age: MACSOTAY (1972-a) and MACSOTAY et al., (1986) sampled them from Barremian-Early Aptian age Taguarumo Formation of eastern Venezuela. The original rudist-fauna was collected in an olistostrome reworked in the Chaudière Formation, of Paleocene age. In western Venezuelan Lara Nappe, these rudists are widespread in the olistostrome of La Osa member of the hemipelagic Barquisimeto Formation, of Turonian age (MACSOTAY, PERAZA & COTILLON, 2005).

Laevinerinea bauga trinidadensis (Dietrich, 1939) is a nerinean gastropoda collected in the *Sabinia*-beds in Point-a-Pierre locality in Trinidad, also of Paleocene-Eocene age. In Venezuela, it is found *in situ*, in the lower Borracha Formation, of Aptian (Gargasian) age. This same species was published as *Nerinea pseudobella* Dvali, (1966) sampled from Late Barremian-Aptian carbonates in Georgia, suggesting a great distribution in the Tethys Ocean. Many years of careful biostratigrahic sampling are yet needed to restore to the benthic Molluska, their real value.

CHAPTER II

GEOHISTORY

The area of Colombia-Venezuela-Trinidad during the Jurassic Period, constituted the Northwest extreme of the Gondwana Continent. Jurassic and Eocretaceous paleogeographic reconstructions (Late Oxfordian, 156 Ma, PINDELL & ERICKSON, 1994, fig. 3b; Berriasian/Valanginian, 140 Ma, STEPHAN et al., 1989; Aptian, 118 Ma, STEPHAN et al., op. cit.) illustrate the breakup of the western half of the Pangea and the formation of the Atlantic and Indian Oceans. During the Middle Jurassic, the central North Atlantic opened as Africa separated from North America. The Tethys Ocean started as a rift system, during the Triassic Period in the east, (Indian Ocean) advancing during Jurassic times until it reached the Caribbean area (AUBOUIN, 1980; BERNOUILLI & LEMOINE, 1980).

So, Tethys Ocean was composed from east to west, of the NW Australian margin (5), the Paleo-Tethys opened by the drift of the Cimmerian continent (4), the Liguro-Piamonte Ocean, (3), the central Atlantic (2) and the Caribbean Tethys (1). This picture presents only the deep (bathyal or abyssal?) positions of the Tethys Ocean, and helps to explain the circulation problems among the different basins. The marine waters invaded the subsiding grabens of the initial rifting, later it extended upon the nearby shelves; initially, hypersaline conditions established with the precipitation of evaporites (COTILLON, 1993). Along the NW of African coast, these evaporites are dated as Late Triassic to the north, and Early Jurassic to the south. In the Gulf of Mexico area, Louann-Campeche evaporites in most of the stretched Gulf Basin, during Late Jurassic times (PINDELL & ERICKSON, 1994). The volume of the Salinas deposited in all the rifts associated to Pangea is estimated in 10 x 106 km3 (COTILLON, op. cit.). This resulted in the diminution of Oceanic salinity during the Mesozoic era (of which 20 % would be of Cretaceous age). This would affect strongly the evolution of benthic biota, where the molluska were important; the dramatic reduction of taxa at generic and family level at the end of Jurassic (ENAY, 1972, 1980) and the beginning of the Cretaceous is evident in the faunal composition of the South Caribbean Subprovince (MACSOTAY, 1980-b; MASSE & ROSSI, 1987).

II – 01.- PRE-CRETACEOUS TECTONIC AND PALEOGEOGRAPHIC EVENTS IN NORTHWESTERN GONDWANA. The Amazon Valley has long been recognized as a graben with rocks as old as Cambrian; the Espino Graben also has rocks from Cambrian to Jurassic. The Takutu rift in Guyana has recently been recognized as a Jurassic Graben. PERSAD (1991) postulated that all three grabens are aulacogens or intra-cratonic failed arms of triple junctions. The Espino Graben contains up to 6000 meters of Cambrian to Carboniferous sedimentary rocks, followed by 2500 meters of Jurassic red beds with volcanics of similar age (195 – 160 Ma, according to MOTICSKA, 1985). From the lineation, shape and age of the Jurassic rocks of the Espino Graben, it can be postulated that the early opening of North Atlantic, The Caribbean and the Gulf of Mexico, occurred almost simultaneously; the last one remained as a failed rift. Called La Quinta and Tinacoa Formations, they carry plants, palinomorphs and conchostraceans in most of the pelitic outcrops (L.E.V., 1997: 357-358); besides, the ganoid fish *Lepidotus* sp. has been sampled in La Quinta outcrops of the Mérida Andes mountains. Considered as restricted to the Late Jurassic (L.E.V., 1997) in the Uribante hemigraben, the ostracod *Cypridea valdensis (Sowerby),* -lower Hilston, north Germany – of Valanginian age (BENEDETTO & ODREMAN, 1977), proved the persistence of the red-bed facies, well into the Eocretaceous. In the San Lázaro hemigraben in Trujillo state, in R. GARCIA-JARPA collected in red mudstones of La Quinta Formation, casts of marine Bivalves (*Camptonectes cf. insutus /Cragin/)* and Brachipoda *(Pygope cf. diphyoides /d'Orbigny/)* of Tithonian to Berriasian age (MACSOTAY & PERAZA, 1997); these invertebrates were collected from the lower horizons of the upper member of La Quinta Formation; most of the overlaying 1.280 meters, is mostly of Cretaceous age. The San Lázaro hemigraben outcrops were relatively close to the marine shoreline of the Gondwana craton, during late Jurassic times.

PINDELL & ERICKSON (1994, fig. 5) published a palinspastically restored closure reconstruction between Yucatan peninsula and northern Gondwana. Several marginal salients and re-entrants are recognized, that mimic the geometry of the Tertiary thrust belt, and also fit well with the eastern Yucatan geometry, for Triassic-Early Jurassic times. The

Espino Hemigraben can be considered as an upper crustal failed rift that trended into the Barcelona re-entrant. As with most failed rifts and marginal re-entrants at passive margins PINDELL & ERICKSON (op.cit.), suggested that rivers may have preferentially coursed clastic sediments into these re-entrant settings due to relatively greater degrees of subsidence. The re-entrants would be logical settings for coarser, more deltaic clastic sections relative to the salients and linear sections of the margin, which may be more carbonate/pelagic prone. This is well illustrated by the documentation of Late Jurassic evaporites, followed by Tithonian-Berriasian shallow marine limestones (VIVAS & MACSOTAY, 1995-a, fig. 10) as representative for the Caracas salient. The *Calpionella*-limestones of the same area (BECK & FURRER, 1979) would represent the pelagic facies.

Drilling for petroleum, has evidenced the extension and importance of the Espino Hemigraben. This extensional structure was active during Jurassic times, where basement-originated faults controlled the sandstone-dominated sedimentation. The eocretaceous detrital quartz-rich sediments suggest a more humid climate, eroding basement-related rocks. These sediments were transported to the Barcelona embayment, where they were deposited in oligohaline waters (Bergantin Formation) or shelfal, tempestite-controlled mesohaline (Picuda Formation). Seismic refexions suggest that the top of Jurassic red-beds was truncated by tectonic uplift, but were later covered by Neocomian ar Barremian sediments, as in Urdaneta, San Lázaro and Uribante Hemigrabens. Desertic tropical conditions persisted locally during Early Cretaceous, as the highest red-beds contained Hauterivian palinomorphs in the Espino Hemigraben (S. OSUNA, 1995, pers. comm.) in eastern Venezuelan foreland basin.

In La Guajira peninsula, north-eastern Colombia, in the Cocinas hemigraben, Middle Jurassic sediments were deposited, in relation to the early opening of the Tethys Ocean; above, micaceous shales and sandstones containing ammonites of Kimmeridgian to Tithonian age (RENZ, 1956; ROLLINS, 1965) were called Cuiza Formation. In their palinspastic reconstruction of Late Oxfordian age, PINDELL & ERICKSON (1994) located the Cocinas Hemigraben with east-west orientation on the "predicted shelf section" in the extreme northwest of Gondwana continent. This points out a paleoposition on the former shelf of the Santa Marta's Promontory, as was suggested by KISER (1994).

II - 02.- RIFTING ON YOUNGER PROTO-CARIBBEAN SEA. Pangean rifting in Ecuador, Colombia, Venezuela and Trinidad supposedly ended during Late Jurassic time (PINDELL & DEWEY, 1982; STEPHAN, 1985; PINDELL, 1985) specifically during Oxfordian stage (PINDELL & KENNAN, 2001; MESCHEDE & FRISCH, 1998). HIGGS (2009-a) proposed to extend the rifting of the Proto-Caribbean until the end of the Coniacian stage. Our study of Neocomian-Gallic marginal marine sedimentary sequences, might contribute to clear the tectonic dispute, with paleontological arguments. HIGGS (2009-b) proposed a 'Carib Halite Formation', deposited in the 'Carib Graben' reaching from Colombia to Trinidad, during Neocomian times. He considered that this 'Halite Graben's evaporites were largely dissolved underground during Neogene times, following mountain uplift.

In Colombia, subsidence analysis of outcrops, boreholes and seismic profiles, in the Eastern Cordillera and Upper Magdalena Basin indicate that the entire pre-Santonian Cretaceous succession accumulated by syn-depositional normal faulting, i.e. in a rift setting (FABRE, 1987; COOPER et al., 1995; SARMIENTO-ROJAS et al., 2006). There is evidence for dual, eastern and western provenance of the sediments (GUERRERO et al., 2000). In the Cordillera Central of Colombia, granitoid plutons of Cretaceous age (124 – 168 Ma, K-Ar; ASPDEN et al. 1987) are interpretable as an AULACOGEN (SHATSKY, 1946a, b, in BATES & JACKSON, 1987) controlled by the Antioquia Batolith. This intra-Cratonic structure called properly Cundinamarca Aulacogen by FABRE (1987) was tectonically active since the Bathonian stage of Middle Jurassic to Early Albian stage of the Eocretaceous. Filled initially by Late Jurassic red-beds, it accommodated the thickest Cretaceous sequence of the planet earth: 11 Km fide BÜRGL (1962) and 10 Km, according to FABRE, (1987). The Cretaceous plutons are coeval with overlaying shallow marine deposits (COOPER et al., 1995; GONZALEZ, 2001), indicating that the plutonism occurred under a subsiding basin, as it is normal in aulacogens, but not in true rifts.

Aulacogens have a radial orientation relative to cratons, and are open outwards: the Cundinamarca aulacogen was open to the northwest, to the Proto-Pacific Ocean (ETAYO SERNA et al., 1976). An aulacogen is normally bounded by convergent normal faults, and this helps to explain the activity of part of Venezuelan hemigrabens. The axis of the Cocuy graben, seem to have followed approximately the western flank of the Eastern Cordillera, where the succession is predominantly argillaceous. The sequence thins and becomes progressively more arenaceous towards the Guayana Craton, which in

Colombia was the main source of sediment (FABRE, 1983).

The first cycle of sediment, of Tithonian to Valanginian age, adds up to 2.500 meters of turbidites grading upwards into black clays. A widespread marine transgression during Hauterivian times, started the second cycle, extending until Aptian times. The thickness of this cycle is about 3000 meters, exposed along the western flank of the Eastern Cordillera. Finally, the whole western Venezuela and Eastern Colombia is flooded by a sand-dominated delta-prodelta system during Albian times, as the third cycle. It adds 500 meters more, but seals the Cundinamarca Aulacogen, indicating the subsidence´s cease. These sands are also whitnessing the general uplift of the Brasilian-Guayana Craton, submitted to tropical erosion.

In the Venezuelan Andes and Perijá mountains and the Molasse Basins (Maracaibo, Barinas, Eastern Venezuela), irregular Eo- an NeoCretaceous isopachs likewise support a syn-rift setting up to, and including the classical source-rock formations (La Luna, Querecual, etc.), and their cratonward sandier equivalents (HIGGS, 2009-b). Notable "thicks" and "thins" include the Mérida Arch, El Baúl-Machete Arch and Espino Hemigraben (RENZ, 1959; FEO-CODECIDO et al., 1984; KISER, 1989; SAVIAN & SCHERER, 1993; ERLICH et al., 2003). The cratonward limit is interpreted as a fault by some authors (Canoa-Tigre Formations in PEREZ DE MEJIA et al., 1980, figs. 1-13 a & b). The cratonward limit of Lara-Trujillo and Uribante hemigrabens was proposed on Uribante-Caparo-La Soledad basement faults, during Early Cretaceous times (MACSOTAY in AGUASUELOS ING., 1990). In western Venezuela, the Hemigrabens Uribante, San Lázaro and Machiques have extensive outcrops, in which, besides Jurassic red-beds of plurikilometric thickness, Neocomian psefitic sediments, called Rio Negro Formation measure up to three kilometers (RENZ, 1959, KISER, 1989). During Early Aptian times, the sedimentation became carbonatic, and we consider a cessation of the rifting processus, as it started related to Antioquía Batholith. Post-rift thermal subsidence in western Venezuela, started during Albian times, allowing the accommodation of 500 meters of deltaic sandstones (Aguardiente Formation) that could not reach the shelf´s edge. The same is true for Upper Peñas Altas Formation on Lara-Trujillo shelf (ARNAUD et al., 1999). In Eastern Venezuela, the Early Albian subsidence allowed up to 700 meters of carbonatic and later siliciclastic sedimentation (VIVAS & MACSOTAY, 1995). The synsedimentary fault trends observed indicated very different tectonic orientations, than during Jurassic-Neocomian rifting (ARNAUD et al., 2000).

II - 03.- EVAPORITIC PHASE OF THE LATE RIFTING STAGE. In Trinidadian waters of the Gulf of Paria, three boreholes penetrated the anhydrite-dominated Couva marine Formation (SAUNDERS, 1997-B) whose age is inferred to be Tithonian and/or Berriasian by HIGGS (2009-b). One well proved a thickness exceeding 2 Km (BRAY & EVA, 1987) and anhydrite may reach westward to the venzuelan side of the Gulf, where a thrust-duplicated thickness of about 4 Km is interpreted seismically (FLINCH et al., 1999). Rather than recording a "succession of spills of the Atlanic Ocean (=Tethys) water into a fault-bounded "basin" (BRAY & EVA, op. cit.) the Couva anhydrite may reflect evaporate deposition confined to the extreme end of a long, Paleo-Pacific connected marine gulf of otherwise normal salinity occupying the Carib Graben (HIGGS, 2009-b). An eastern connection to the Tethys Ocean may have been blocked by the Bahama Platform, sliding past northwestward along a transform fault (cf. PINDELL & KENNAN, 2001-b, figs. 4-6; HIGGS 2009-A, fig. 2). Subsequent eustatic lowering, impairing the marine connection via Colombia, and possibly combining with increased aridity, led to Carib Halite deposition along much of the graben, as discussed below.

In Trinidad, the Laventille Formation outcrops contains gypsum (hydrated anhydrite) lenses up to 10 m thick (KUGLER, 1959; RODRIGES & SCOTT, 1985) is interpreted here as part of the Carib Halite solution residue. In Paria Peninsula, the Cariaquito Formation metasediments contain gypsum beds, with thichnesses up to 120 m, exposed for 40 Km in east-west sense (GONZALEZ DE JUANA et al., 1972); both are considered Neocomian in age (L.E.V., 1997). Gypsum beds 2-120 m thick, of kilometric lateral extent, crop out in the Lower Rio Negro Formation, in Uribante hemigraben (FIERRO & USECHE, 1985). In the Central Venezuela thrust belt, anhydrite-gypsum lenses and masses of uncertain stratigraphic affinity occur in the Tememure Formation or structural complex (EVANOFF, 1951; ROSALES & MACSOTAY, 1985; VIVAS & MACSOTAY, 1995A). In western Venezuela, anhydrite cement in Gobernador Formation sandstones (TORO & MAHMOUDI, 1997) may reflect precipitation after solution of deeper anhydrite. In northeastern Venezuela, low-angle thrust faults as Chuparipal (RIVAS et al., 1985) and strike-slip basement faults as El Pilar, gypsum blocks of 20 m or more, were transported tectonically to the surface (MACSOTAY et al., 1985). In the sub-surface of Portuguesa range,

thrusted by the allochthonous Lara Nappe, a thick evaporite deposit was discovered during oil exploration (J. LACAZE, 1993, pers. comm..) it is limited to the south by a normal basement fault, with a vertical displacement of 1 Km, in seismic profiles. The Serrania de Portuguesa did not revert during Late Miocene times, as did the Mérida Andes (LUGO & MANN, 1995). Threre are no water sources with Na-Cl composition among thermal sources in this area; they are rather Ca rich (URBANI, 1989). I supect the presence of gypsum and anhydrite, in the subsurface.

II - 04.- The Vanishing Carib Halite Formation Defense. Outcropping halite is confined to Colombia's Eastern Range. HIGGS (2009-b) argumented for buried halite in Colombia, Venezuela and Trinidad: drowning coastal geomorphology, solution pits, saline springs, mud volcano-fluid analysis, heat-flow analysis, gravity anomalies and thrust-belt structural style. The best argument to back up the presence of fossil evaporites in Venezuela and Colombia, are the Neocomian molluskan assemblages recorded and illustrated here. The strong anomalies during the Berriasian-Early Valanginian increase of salinity, preserves many Late Jurassic genera of Bivalvia, and the only true coral reef of the Venezuelan Cretaceous. Late Valanginian developed an Oceanic Anoxic Event (OAE), originating a shallow water Biota Crisis (SIMO et al., 1993), recognized along most of the Tethys Ocean, 136-138 Ma, along with an important withdrawal of the platforms. This long sedimentary break was followed by a brief transgression during Latest Valanginian – Early Hauterivian times (SIMO et al., op. cit.). This regressive event, which affected the whole Tethys Ocean, had the drastic salinity event, predicted by HIGGS (2009-b). The Early Hauterivian transgression, must have been related to disoxic phenomena, too, originating chemosymbiotic genera (KIEL et al., 2010), as *Inoceramus, Mytiloides, Acila (Truncacila)* and possibly *Stearnsia, Aenona?, Parmicorbula? Callucina?* and *Legumen?*. So, stressful marine conditions included; high salinity, low oxygen content and low hydrodynamism. All Venezuelan and Colombian Hauterivian-age sediments are rich in black muds, rich in organic matter, and by the end of the stage, another Anoxic/Disoxic event, provoked the extinction of many Bivalvia of the Purbeckian and Wealdian assemblages.

CHAPTER III

STRATIGRAPHY AND PALEOENVIRONMENTS.

In this chapter I expose the Eocretaceous (Neocomian – Gallic) sedimentary formations, in order to familiarize the reader with the collecting ground where the fossils described here, were sampled. Most of these units, - formations and members, - were previously published in at last one of the editions of the Stratigraphic Lexicon of Venezuela. (1º edition, 1956; 2nd. Edit., 1970 and 3rd. edit., 1997). An international edition (1978) was published as the Lexique Stratigraphique International, vol. V, Amérique Latine, Fascicule 3 A, Vénézuéla (C. PETZALL, R. M. STAINFORTH, C. GONZALEZ DE JUANA, C. MARTIN BELLIZZIA et al.,). My description is complementary to the lexicon description : only the dominant lithology is cited, the bedding style, but the attention is focused on the fossil molluska collected. The age calculated with Bivalvia, Gastropoda, Ammonites or Foraminifera, is cited. The emphasis is placed on the paleoenvironmental data obtained by the fauna or the mineral anomalies. Sequential stratigraphic data are included, as much as previous paleoenvironmental diagnosis are also discussed. All the discussed units belong to the Biochorema South Caribbean Subprovince (S.C.S.) of the Gondwana Province.

The Cretaceous sedimentary rocks have been divided in nine regions by MACSOTAY (1980-b, figure 2). These natural regions are ranged starting with the internal Cratonic position, and ending with distal, allochthonous units:

(1) Guyana Craton; **(2)** Uribante Hemigraben, including Sierra Nevada del Cocuy, Colombia. **(3)** Machiques Hemigraben,, Perijá range. **(4)** San Lázaro Hemigraben, mostly in Trujillo State. **(5)** Cocinas Hemigraben, northern Colombia, **(6)** Serrania del Interior Oriental, outlet of Espino Hemigraben. **(7)** Lara Nappe, allochthonous. **(8)** Piemontine Nappe, allochthonous, in Venezuela and Trinidad.

Cratonic Foreland Basin (1).
This región remained exposed and submitted to erosion during all the Eocretaceous. Active, normal basement faults separated this region from the "Carib Graben"; only towards the end of the Albian, the transgression started to cover most of the area. One

of these active faults, was the Caparo-La Soledad-Yacambu fault, whose Colombian extension is called Guaicaramo fault. The few sampled formations in stratigraphic order are:

ESCANDALOSA FORMATION. (L.E.V., 1997: 255).

Interbedded (1) quartz-glauconitic sandstones in massive beds with (2) black shales. The upper beds locally are ill-sorted carbonatic sandstones, with mollusk shells, which are mostly tempestites.

>>>Age: Cenomanian-Turonian, determined with ammonites.

>>>Paleoenvironments: The dominant molluskan fauna are calcitic-shelled Ostracea, as *Gyrostrea (Gyrostrea), Rhynchostreon, Ceratostreon, Ilymatogyra and Chondrodonta* ijn the sandstones, and endobenthic *Crassatina, Nagaoella, Aenona snd Nemodon?* In the shales. The carnivorous *Calorebama* was a predator on the ostracea. They suggest saline-water embayments, exposed to tropical storms.

CAPACHO FORMATION, LA GRITA MEMBER. (L. E.V., 1997: 105-106).

Interbedded (1) black limestones, locally macrofossiliferous, and (2) marls, laminated or not. These are the sediments where GERHARDT (1887-a, -b) collected his fossils near the town of Niquitao, Trujillo State, section that was included in La Luna Formation by GARCIA JARPA et al., (1980). Its main difference from the type area, in Uribante hemigraben, is the absence of pseudonodules ("concretions" auctt.) and the presence of in situ benthic molluska. Thickness variable between 5 and 50 meters.

>>>Age: Late Albian to Early Cenomanian, based on planktonic foraminifera and some ammonites from Quebrada La Bellaca (RENZ, 1960). The taxa *Rhynchostreon subsquammata subsquammata* and *R. s. servitensis* are extensively represented in Chipaqué Formation, Colombia, along the Albian-Cenomanian transitions (GUTIERREZ, 1972).

>>>Paleoenvironments: An unusual assemblage of *Astartemya (Freiastarte), Paraesa, Pseudodidymotis, Aenona and Nayadina* associated to *Rhynchostreo and Ceratostreon,* suggesting a shallow marine, but ill-circulated and poorly oxygenated environment. *Ilymatogyra, Pseudodidymotis* and the gastropod *Trochacteon (Neocylindrites)* were transported from a hypersaline lagoon, during a storm event. This oligomictic molluskan association is well related to La Luna disoxic/anoxic organic-rich marine environment (TRIBOVILLARD et al., 1991; ERLICH et al., 1999, 2000; MACSOTAY, ERLICH & PERAZA, 2003) and was part of the shoreline complex.

>>>Sequential stratigraphy: La Grita member of Capacho Formation is coincidentwith the maximum flooding surface of Late Albian age (SIMO et al., 1993), which was followed by a rapid descent of sea level. This drop, during Early Cenomanian times also started an Oceanic Anoxic Event (OAE), which caused a "crisis" of the shallow biota, event decisive in the installment of black shale facies of La Luna Formation (MACELLARI & DE VRIES, 1987; TRIBOVILLARD et al., 1991; ERLICH et al., 1999, 2000) all over western Venezuela and part of Colombia.

La Panela beds (megaolistolith in Chacual Complex (VIVAS & MACSOTAY, 1995-A). Previously undetected, AGUASUELOS ING. (1991, vol. 3, p. 349-357) published a heterolithic sedimentary unit of 80 meters of thickness, whose shallow marine fossils suggested Cenomanian age. The Chacual Complex is part of the Frontal Scale Unit, outcropping between Altagracia de Orituco and Unare lagoon area, and it was tectonically displaced from the Caracas salient to its present position, during Miocene times.

Alternation of (1) grey calcareous siltstones in metric beds, (2) conglomeratic limestones, made up by fragmentary rudists, exogyras, corals and gastropods, and (3) quartz and clay clast conglomerates with carbonatic cement forming decimetric beds, and (4) brownish-yellow marls with grain-flow and common *Rhynchostreon suborbiculatum suborbiculatum* shells, (5) micaceous, pyritic black shales with gypsum veins, at the top of the section. The second most common *in situ* fossil in the marls, was *Pycnodonte (P.) vesicularis vesiculosa,* which suggest a Cenomanian age.

>>>Paleoenvironment: The dominantly conglomeratic lithosomes suggest an episodic, shallow marine sedimentation, occurred at the base of a cliff, strongly affected by storm-vawe action. The mineralogy suggest Caribbean coastal-range, of metasedimentary rocks, but correlative with La Grita member of the Capacho Formation.

CAPACHO FORMATION, Guayacan Member . (Niquitao area, Trujillo state).

Interbedded, (1) massive limestones, plurimetric, fossiliferous, with (2) micaceous black shales, not carbonatic, and (3) clayey siltstones. Thickness in the area, varies between 40 and 50 meters. Characteristic are the calcite-filled and articulated *Cyclocardia and Maghrebella* shells. The fauna is dominated by bivalves: *Astartemya*

(Freiastarte) Didymotis ,Ambocardia, Nagaoella, Epicyprina and Brachymeris of small sizes. The gastropoda are represented by one specimen each: *Perissolax and Calorebama.* The frequency of *Nagaoella* and *Protocardia* (2 spp., each) suggest the abundance of organic matter rich soft bottoms. *Cyprimeria* suggest brackish-water influence.

>>>Age: The late Turonian *Coilopoceras* (RENZ, 1959: 19) is confirmed by the presence of *Didymotis cf. trinidadensis* , cited as an Early Coniacian species in Puerto Rico (KAUFFMAN, 1976).

>>>Paleoenvironments: Suspensivore bivalves are the dominant part of the molluska. The coquina facies was considered a shallow-marine, mostly protected environment (GARCIA JARPA et al., 1980: 28). ERLICH et al., (1999) considered the Guayacan limestones as a shelfal deposit, with a close resemblance to Upper Maraca Formation. A single valve of *Pharodina cf. cuneata,* suggests an only occasional influx of brackish waters, and none of the fauna remembers the hypersaline/saline character of the S.C.S. basin. The abundance of bivalvia in a strongly bioturbated sediment, confirms the predator habits of *Perissitydae (Perissolax)* and *Olividae (Calorebama).*while it proves the high oxygen consumption in this shelfal environment. ERLICH et alii., (1999-a, figure 10) on their palaeogeographic Turonian map of westernVenezuel, showed an inner-shelf continuity of Navay, Guayacan - shallow marine La Luna lithofacies following the paleo-shorelines, extending around El Baúl high, towards the east.

Uribante Hemigraben (2). Venezuelan extension of the Cocuy Graben, part of the Cundinamarca Aulacogen,which subsided synchronically with it. The sedimentary units of this hemigraben, tend to thin out against the Mérida Arch, whose subsidence was more slower (RENZ, 1960).

RIO NEGRO FORMATION. (l.E.V. 1997: 573-574).

Interbedded: 1) Oligomictic conglomerates and grits of grey color, 2) Cross-bedded, ill-sorted quartz sandstones, without cement; unidireccional planar cross-bedding, rarely bipolar, 3) Shales and grey mudstones, sometimes calcareous or gypsiferous, all in metric to decametric beds. The Rio Negro Formation, in San Cristóbal area, measures up to 1.500 meters of thickness, and is mostly alluvional and colluvional. Only taphoflora has been collected in the micaceous mudstones: *Hausmannia and Weichselia* ferns are the most common forms (PFEFFERKORN, 1977). Silicified tree-trunks in situ are locally present in the upper half of the conglomeratic sequence. The basal sequence in this area, exposes 200 meters of a marine, evaporitic sequence, that here is called the Chururú member.

RIO NEGRO FORMATION, Chururú Member. (new)

Interbedded 1) Black shales and mudstones, 2) dark grey gypsiferous siltstones, 3) glauconitic fossiliferous limestones, and 4) gypsum beds, up to 40 meters of thickness. This sequence, well exposed along Los Naranjos-La Fundación road, in Táchira state, was published by FIERRO & USECHE (1985: 674-675), but without naming it. The molluskan fauna collected by myself in the Chururú member, has to be studied separately in each lithotype. The gypsum beds are not fossiliferous The overlaying Glauconitic sandstones carry big sized bivalves, mostly articulated, but strongly weathered; the sample is MO-1305. They are:

Buchotrigonia (B.) cf. scheibei (Dietrich) *
(A) Saline, temperate
Megatrigonia cf. rogersi (Kitchin) *
(F) Saline, austral affinities
Steinmannella raimondi (Lisson) *
(F) Saline, austral affinities
Pterotrigonia (P.) cf. caudata (Agassiz)
(S) Marine, Tethys affinities
Anomia pseudoradiata (d'Órbigny)
(S) Marine, Cosmopolitan
Eocallista huarazensis (Fritzsche)
(S) Fluviatile, wealdian affinity
Callucina plicatocostata (d'Orbigny) *
(S) Brackish, wealdian affinities
Homomya scaphoides (Agassiz)
(F) Saline, hypersaline, detritivore.
Cyclorisma chia (d'Orbigny)
(F) Hypersaline, Purbeckian affinity
Acutostrea directa (Blanckenhorn)
(F) juveniles, transported, disarticulated
Corbulamella mosensis (de Loriol)
(F) hypersaline, Purbeckian affinities
Pleuromya inconstans (Castillo & Aguilera)
(S) infaunal siphon feeders

The overlaying black, micaceous mudstones, contain mostly small-sized Bivalvia with pelomorphic deformations. In M0-1306, articulated valves and biodegraded shell fragments:

Freiastarte rogeri subformosa (d'Orbigny)
(A) marine, saline

Buchia cf. blandfordi (Stoliczka) *
(F) marine, cryophyllic, bathyal
Maccoyella bogotina (d'Orbigny) *
(S) bathyal, cryophyllic
Nucula (Nucula) pusilla (Philippi) *
(F) detritivore, infaunal
Malayomaorica sp. Indet. *
(F) epifaunal, suspension feeder
Pholadomya cf. agrioensis Weaver *
(F) endobenthic, suspension feeder
Placunopsis senescens (Stanton) *
(f) bathyal, opportunistic, sessile
Caryocorbula neocomiensis (d'Orbigny)
(S) sediment detritus feeders
Legumen? cf. chapmani (Imlay) *
® Hypersaline, chemosymbiotic?
Nuculana (Rollieria) valangiensis (P. & C.)
® Hypersaline

These endobenthic detritivores, related to Izumi – Pacific Plates confirm the free commu-nication towards the west, proposed by ETAYO SERNA et al., (1976) during (*) Hauterivian-Barremian times. This explains the similitude with the Upper Macanal shales (FABRE, 1987). The shales do not have any genus in common with the underlaying glauconitic sandstones. The gypsum layers did not preserve any fossils.

Age: In the lower glauconitic sandstone horizons, the age suggested by the concurrent ranges of the genera *Buchotrigonia/Megatrigonia/Steinmannella* is Early Hauterivian. The black, micaceous mudstones by the concurrent ranges of *Nuculana (Rollieria)/Placunopsis/Astartemya (Freiastarte),* suggest Hauterivian age, undifferentiated.

Paleoenvironments: The lower glauconitic sandstones of the Chururú member carry a Trigonidae fauna, of taxa known from Neuquén Basin (Argentina) and Perú, suggesting low temperature marine waters in a shallow ill-circulated embayment. The only gastropoda, *Tylostoma and Nerinella*, suggests saline influence; *Eocallista, Corbulamella and Cyclorisma,* are reminiscent of the Portlandian-Ryazanian conditions. *Acutostrea* is represented by mostly juvenile, transported. *Homomya and Pholadomya*, usually found articulated, in situ. The opportunistic assemblage suggests 30 to 60 meters of paleodepth, and it represents a condensed surface.

The black micaceous mudstones contain mostly a small-sized bivalve fauna, rich in individuals, but low in biodiversity. The presence of *Buchia, Maccoyella, and Placunopsis* indicate a paleo-pacific affinity. KAUFFMAN (1976) proposed a Buchiidae dominated association in bathyal Pacific, of a very low diversity in which buchiids are associated to some oxytomid bivalve, as it happens in Chururú member. Substrates supporting these associations dominated by byssate epifaunal bivalves, may have been somewhat toxic internally (KAUFFMAN, op. cit.). Copper and phosphatic anomalies have been reported in the lower part of the mudstone sequences (P. MOTICSKA, internal report, MEM). The paleo-depth I am proposing here for the black mudstones is about 2000-3000 meters. This would explain the resemblance of the upper Macanal shales (ETAYO SERNA, 1985-b), deposited also in the Cundinamarca Aulacogen, too.

Sequential stratigraphy: The lower (Chururú) member of the Rio Negro Formation is part of the T.S.T. of the Early Hauterivian transgression (SIMO et al., 1993) in the S.C.S. Biochorema. The bathymetric difference between the glauconitic sandstone and the overlaying black mudstones indicates a minimum of 2000 meters, far superior to any eustatic oscillation. During early Hauterivian times, the Cundinamarca Hemigraben, must have developed an important subsidence. ETAYO SERNA et al., (1976) show extensive transgression between the Berriasian/Valanginian and the Hauterivian/Barremian maps, in Colombia, but we did not have previous evidence of this in western Venezuela. The Late Hauterivian times were regressive in the S.C.S. according to SIMO et al., (1993), and there started the rapid infill with psefites of the Uribante Hemigraben, with the humid tropical climate, related to Faraoni OAE.

AGUARDIENTE FORMATION. ***(L.E.V., 1997: 42-43***.
Interbedded: 1) Quartz-arenites, 2)Silty shales, carbonaceous shales and thin coal beds, 3) San/shale rhytmites, 4) Sandy limestones, usually with *Mesorbitolina.* The quartzarenites usually are cross-bedded, and can measure up to 30 meters. The shales, rhytmites and the limestones are usually burrowed, and pyrite is locally present. The thickness of the unit in the type locality (Concesión Barco, Colombia) is of 150-160 meters; near San Cristóbal reaches 500 m.

Age: Mostly Middle to Late Albian.

Paleoenvironments: The Molluska are bivalvia found in the silty shales and rhytmites: *Caryocorbula, Paralellodon, Megacucullaea, Trigonarca* and *Pleuriocardia*, which are all endobenthic and detritivors. Locally, are common

estuarine bivalves: *Eocallista, Crassatella (Sublandinia), Dentonia, Pachythaerus;* usually disarticulated fragments of a big-sized *Gyrostrea (Pseudogyra).* A small-sized *Ceratostreon (?Exogyra* auctt.) was found at the base of some sandy limestones. In black silty shales, several bones of a pectoral limb of an *Elasmosaurus* were associated to *Agnomyax paradoxa* (Steinmann). The thick cross-bedded quartzarenites are interpreted here as tempestites (see GHOSH & GARCIA JARPA, 1980: fig. 3) by their planar, unidirectional character. The oligomictic feature of the bivalvian fauna, suggests that the more realistic of the sedimentary models, was the one of STAUFFER (1994), where he proposed a supra-tidal delta plain which was wave-controlled along its northern and western borders.

Sequential stratigraphy: According to VILLAMIL & PINDELL (1998) "aggradation was "pronounced in the lower portions of the Early Albian, which was followed by "transgression and then by a slight regression:" But the fact is that the deltaic sandstone-dominated system was a passive infill of the Uribante Hemigraben. It is contemporaneous with the Upper sandstone member of Peñas Altas Formation (ARNAUD et al, 1999). The extensive distribution of this sandstone-dominated unit, confirms a mega-river, flowing from the south-east, insiude the "Carib Graben" as was suggested by STAUFFER (1994). The Aguardiente Formation is only the northward extension of the Une Formation (Colombia) and Inca and Chulec Formations (north-western Perú) with many taxa of non-marine taxa in common (BENAVIDES, 1956). It confirms the erosion of the Craton, after the fracturing of Gondwana to South America and Africa, with the presence of a quartz-gravel at Middle Albian levels.

CAPACHO FORMATION, LA GRITA MEMBER. (Type locality, Tachira state).

Interbedded (1) Black limestone, with pseudonodules, (2) Microlaminated marls, with calcareous nodules. Thickness in the area, 5 to 10 meters. Contains planktonic foraminifera, fish remains and *Inoceramus* fragments. The bivalves are concentrated in tempestites: *Gyrostrea, Ceratostreon, Exogyra (Costagyra),* and *Cameleolopha;* disarticulated and transported *Plicatula* shells, normally concentrate on the top of the limestone beds. The gastropod *Trochacteon (Neocylindrites)* is locally found in the shales.

Age: Late Albian to Early Cenomanian.

Paleoenvironment: RENZ (1959) considered marine pelagic setting, with euxinic conditions. ERLICH et alii. (1999) located this unit in the inner shelf, with a depositional depth of less than 40 meters. The presence of *Plicatula Nayadina* and *Trochacteon (Neocylindrites),* suggests hypersaline conditions. The Late Albian – Early Cenomanian transgression flooded the area and released nutrient-rich material (terrestrial organic matter, nitrogen, phosphorus, silica and calcium carbonate) into the water column in a geologically short period of time (ERBACHER et al., 1996 in ERLICH et alii, op. cit.). This contributes to explain the oligomictic character of the molluskan fauna. The common tempestites were interpreted as turbidites by a Symposium on Capacho Formation, held by Escuela de Geologia, Minas y Geofísica (2004).

(3) MACHIQUES HEMIGRABEN, Maracaibo Basin (4) and Perijá Range.

RIO NEGRO FORMATION (Type locality).

Interbedded 1) Conglomeratic Sandstones, 2) Coarse-grained arcoses, with channeling and conglomeratic lenses, often cross-bedded, and 3) Silty shales, all of light colors: grey, yellow, reddish. Locally, tuff is also interbedded (GONZALEZ PADILLA & ORTIZ, 1976) in beds of dark red or dark green colors, up to 1 meter. The shales are scarce and deeply weathered. Thickness varies from 1.600 to 3.000 meters. In the Yasa and Aponcito Seco rivers, at 50 and 22 meters below the topof the unit, a calcareous grit contained the following fauna: BIVALVIA: *Mediterraneotrigonia hondaana* (Lea) (F), *Rutitrigonia longa* (d'Orbigny), (S), *Ceratostreon boussingaulti* (d'Orbigny) (S), *Liostrea cunabula* (Seeley) (F), *Gyrostrea* sp. (F). GASTEROPODA: Pseudomelania spp. (F), *Cassioope aff. Strombiformis* (Schlotheim) (S), *Diptyxis cf. euphyes* (Felix) (S), *Nerinella cf. dupini* (d'Orbigny) ®.

Age: The molluskan assemblage is of Early Barremian age.This would be the top of the Rio Negro Formation in Perijá. I have no evidence of the age of the base, but it should be at last of Valanginian age, as a northern branch of th Cocuy Graben of Colombia.

Paleoenvironments: The fossils previously cited from Rio Negro Formation, were transported plants - taphoflora, - so these sediments were considered as fluvial-alluvial (LIDDLE, 1946; GONZALEZ DE JUANA et al., 1980). VAHRENKAMP et alii., (1995) correctly called them "deep-water clastics",

as they were related to the Cundinamarca Aulacogen of Colombia, filled with marine sediments. The fauna of the top, are a saline assemblage, in 20 to 60 meters of paleodepth, with wealdian elements. It resembles the fauna of Taguarumo and Yúruma Formations, in the stressed mixture of taxa.

TIBU FORMATION (RENZ, 1960, emend.)
(Note: This term was restricted to quite fossiliferous middle shelf carbonates, where no siliciclastic sediments as silts, sands or gravels are present; the carbonates are biostromal, MACSOTAY & VIVAS, unpubl. Ms.). Interbedded, 1) Biodetritic, shelly limestone, dark grey to bluish grey colors, 2) Marls, soft and light grey, 3) Nodular limestones. With an average thickness of 300 meters. It was separated from the Apón Formation, because the 7 Ma-long hiatus with the overlaying Machiques member of Apón Formation.

This unit is exceptional, because the biodiversity of Bivalvia, and the size attained by some genera: Ceratostreon (2 spp.), Megacucullaea, Pachymya (Arcomya), Homomya, Globocardium, Pleuromya, Pholadomya, Acutostrea, Eopecten and Noetia (Incanopsis). The Gastropoda are common, too, with carnivorous genera: Purpuroidea, Prisconatica, Euspira, and algofagous ones: Pseudomelania, Tylostoma, Pictavia. Echinids are frequent.

Age: In central Perijá mountain front the age is mostly Barremian,, but in northern Perijá it is Late Barremian-Early Aptian.

Paleoenvironment: The bivalve-dominated assemblage composed of detritivore and filter-feeder genera is suggestive of polyhaline salinity conditions . The abundance of *Ceratostreon boussingaulti (not Exogyra texana, auctt.), C. flabellatum weatherfordensis, Pterorigonia tocaimaana* and *Megacucullaea gabrielis* (RENZ, 1959) is evidence of turbid waters, and episodic sedimentation. The unusually big size of adult bivalvia, suggests not only abundance of nutrients, but scarcity of predators: *Globocardium, Acutostrea, Pholadomya, Panopea, Megacucullaea and Homomya.* The presence of Pectinids; *Eopecten, Neithea (Neitheops)* indicates periodical high energy of the water masses, improving the oxygen content.

Sequential stratigraphy: The Tibú formation coincides with the transgressive system tract of Barremian-early Aptian age of SIMO et al., (1993).

APON FORMATION, Machiques member (L.E.V., 1997: 426-427).
Interbedded, 1) Black, bituminous laminated limestones, 2) Marls and shales with carbonatic discoidal pseudonodules, 3) Shelly limestones, of decimetric bed-thickness. This black-shale facies unit measures 185 meters in the Apón river type locality (ROD & MAYNC, 1954). The molluska are all Bivalvia, of small (sub-centimetric) size, usually concentrated along the limestone/marl interphase: *Astartemya (Freiastarte),(3 spp.) Disparilia, Pulvinites, Birostrina, Anomia*, mostly represented by biodegraded fragmentary material.

Age: The concomitant zone of *Neodeshayesites and Engonoceras,* suggests the *Leymeriella tardefurcata* zone, of Early Albian age (BULOT, 1994). *Disparilia truncate* (von Buch) and *Astartemya (Freiastarte) sieversi* (Gerhardt) are well-documented from the Early-Middle Albian in Colombia. According to VILLAMIL & PINDELL (1998) the Machique lithofacies "agrees better" with the Early Albian, more than the Aptian one.

Paleoenvironment: ROD & MAYNC (1954) considered a restricted condition for the black shales, with well oxygenated for the shelly limestones, of epineritic to infraneritic depths. MARTINEZ & HERNANDEZ (1992) called it simply "pelagic". The small bivalves represent the bottom conditions of anoxic muds, with oxygen-poor marine waters above them. The dolomitization was related to stagnant and saline waters; seems to have been a regional phenomena, not necessarily related to lagoons. Small-scale listric faults (metric scale) could provide the necessary isolation for this process, at depths of **100 – 200 meters.** This allows the upper 40-50 meters for the activity of storms, responsible of carrying the ammonites and fishes from the open ocean.

Sequential stratigraphy: After a hiatus of 13 Ma, the Machiques member´s black shales start their deposition with the Albian transgression, synchronous with the Global Anoxic Event "Paquier" (ROBASZYNSZKY, 1989; COTILLON, 1989), so there is no need of inventions as the "condensed section" of MENDEZ BAAMONDE (1985, 1995) or enclosed "lagoons" as BARTOK et al., (1981), PARNAUD et al., (1995).

APON FORMATION, Píche member. (L. E. V., 1997: 526-527).
Interbedded: 1) Coquinoid limestone, dolomitized, cryptocristalline, in submetric to decimetric beds with 2) dark grey to black nodular limestone, and 3) bluish grey nodular marls. The coquinoid limestones are mostly tempestites, and the bivalvia are disarticulated valves: the abundance of *Linotrigonia aff. Fittoni, and*

Mediterraneotrigonia hodaana, originated the name "Trigonia limestones" (RENZ, 1959). Besides, are common in these beds, *Chondrodonta, Amhidonte, Ceratostreon, Arctostrea, Tortartica, Megalocardia and Gyrostrea (Pseudogyra),* exobenthic detritivores, mostly transported. In the marls, associated to *Mesorbitolina texana*, are endobenthic filter-feeders in situ: *Panopea* (7 species), *Pleuromya* (2 spp.), *Modiolus* (2 spp.), *Epicyprina, Eoursivivas, Homomya, Geltena, Trigonocallista, Pachymya (Arcomya)* and *Nayadina,* are favored by saline environmants, as was the gastropod *Pseudomelania.* Predator gastropods are locally common: *Gyrodes, Perissolax,* and *Perissoptera.* The Píche member´s thickness is variable between 70 and 165 meters.

Age: Late Early Albian, mollusks of the zone *Douvilleiceras mammillatum* (BULOT, 1994), whose range could reach Middle Albian, as suggested by *Oxytropidoceras* ex. gr. *multifidum* (BENAVIDES CACERES, 1956) on the top of the unit.

Paleoenvironment: The bivalvia dominate the molluskan fauna. There are two different assemblages: the first, endobenthic filter-feeders, with articulated shells, mostly in living positions together with the gastropod *Perissoptera, and Pseudomelania* with the echinoid *Enallaster (Washitaster).* Their paleobathyumetric range is of 80 – 140 meters. The second assemblage, - transported shells constitute thickets called "pelecypod mounds" by STAUFFER (1994, fig. 12), originated as tempestites. Both on the ocean side of the carbonate shoals and in the back of them, colonies of bivalves grew and formed mounds. Tidal currents and storms deposited bioclastic inter-shoal deposits in the channels between them, but left the heavier and bigger shells on the mounds. The paleobathymetry of the top of the mounds, extends from 16 to 60 meters, in a high-energy environment. The channel that extends towards Colombia (STAUFFER, op. cit.) was constricted, but not shallow. According to MENDEZ BAAMONDE (1995: 43-44) "the Píche "dolomites indicate a highstand system, with alternance of catch-up and keep-up cycles, "controlling the sedimentation. In the upper part of Píche, a transgressive cycle originates "a wackestone and packstone lithofacies, carrying *Mesorbitolina*." This dolomitic facies does not indicate a regressive cycle, bnut it suggests a highly evaporitic character of the waters of the "channel", due to the poor circulation of the bottom waters. And *Mesorbitolina* is not related to shallow waters, the algal fields were extended to all the photic zone, at middle shelf (ARNAUD et al., 1999), and the presence of organic-rich muds. The in situ molluska suggest also meso-haline affinities, reflecting the influence of two opposed active deltas (STAUFFER, 1994).

Sequential stratigraphy: The Píche member dolomites were deposited during the Early-Middle Albian transgression (SIMO et al., 1993),well documented in the Caribbean area.

LISURE FORMATION. (L. E. V., 1997 : 389-390).

Interbedded : 1)Glauconitic sandstones, bluish grey to greenish grey colors ; 2) Glauconitic sandy limestones, laminated, 3) Micaceous sandstones, alternating with bluish grey sand/shale rhytmites and, 4) glauconitic limestones and marls. With a variable thickness of 105-190 meters, the dominant fauna in the unit, are Bivalvia and Echinoida. The dominant Bivalvia are endobenthic detritivora, suggesting soft bottoms: *Aphrodina, Ludbrookia, Mutiella, Eoursivivas, Panopea, Nucula, Pleuriocardia, Venilicardia, Anomia, Idonearca and Rostrocardia etc.,* indicating the presence of organic matter in the sediment. Brachiopoda and Polychaeta suggest important presence of leptopel suspended in the water mass; mostly biodegraded echinoids, suggest active predation.

Age: Mostly Middle Albian, as was foretold by ROD & MAYNC (1954) in base of the unpublished echinoid fauna. The concomitant ranges of *Mytiloides aucellina* and *Birostrina subsulcata*, also suggests the same age. The *Mesorbitolina texana* is restricted to the lower third of the formation.

Paleoenvironment: BARTOK et al., (1981) described a "shallow marine, tidal "environment, with influx of fresh waters, lagoonal sediments with high energy towards "the top." The presence of Bivalvia as *Propeamussium, Thyasira, Nucula (Leionucula), Orthoyoldia, Parvamussium (Parvamussium)* and *Mutiella*, suggest a paleodepth of 120 – 220 meters, and the chemosymbiont *Mytiloides, Birostrina and Thyasira* suggest a disoxic marine environment. In the lower part of the unit, shallower Bivalvia are more common: *Venilicardia, Aphrodina, Pleuriocardia, Idonearca, Rostrocardia, and Maghrebella,* are endobenthic detritivors, but no brackish or parallic genera are present, as was stated by MACELLARI & DE VRIES (1987). Middle Albian times brought climatic changes, when the megariver of Aguardiente flooded with siliciclastics the middle shelf, during a high-stand type sedimentation

(MENDEZ BAAMONDE, 1995), and this is the reason why *Charophyta* was present (BARTOK et al., op. cit.) in Lisure Formation.

Sequential stratigraphy. After an initial regression, a new transgression deposited during the maximum of the Early-Middle Albian (SIMO et al., 1993). The initial regression, could be related to basement tectonics, as was registered in Eastern Venezuela's Interior Range by ARNAUD et al., (2000). Near the top of Lisure Formation in the Caño Maraca, a slumped limestone contained fragments of the Bivalvia *Ludbrookia, Trigonocallista, Pterotrigonia* and *Sphaera,* which are an **oliston,** displaced from a shallower facies, but contemporaneous sediments. This slumping probably was related to a listric fault.

MARACA FORMATION, (L. E. V. 1997 : 435-436).
Interbedded : 1) Bioclastic, coquinoid limestones, of plurimetric thickness, with thick-shelled bivalvia, 2) grey and brown marls and shales ; towards the base, glauconitic and calcareous sandstones, represent the transition to the underlaying Lisure Formation. Its thickness is variable between between 20 and 120 meters. Among the Bivalves the most common genera are: *Ceratostreon (2 species), Rhynchostreon (2 spp.), Cameleolopha, Ilymatogyra, Amphidonte, Texigryphaea, and Exogyra (Costagyra)* (Ostracea), but also *Neithea (3 spp.), Chlamys, Entolium,* (Pectinidae) and *Pterotrigonia, Linotrigonia and Arabitrigonia* (Trigoniacea), all adult shells, suggesting euhaline waters.

Age: Late Albian to Early Cenomanian,, withn the concomitant range-zone of *Camelelopha syphax, Ilymatogyra polygona, and Chondrodonta munsoni.* No ammonite have been found in the Maraca Formation. ARNAUD et al., (1999, fig. 3) reported foraminifera of Late Albian-early Cenomanian age in core samples of Maracaibo Lake.

Paleoenvironment: The Maraca Formation Bivalve fauna is composed mostly of epifaunal filter-feeders and detritivors: *Ctenoides (2 species), Pinna, Plicatula, Tortartica,, Grammatodon, Lima (Lima), and Protocardia* and the Ostracea cited already.. Brief episodes of high salinity are suggested by *Ludbrookia, Maghrebella, Idonearca and Epicyprina.* The Pectyinidae, suggest an agitated, well circulated and oxygenated waters of euhaline composition. *Chondrodonta, Pinna, Anisocardia, Pleuriocardia and Plicatula,* are all thermophyllic habitants of hard bottoms, which is the big difference with the Pícha member of Apón Formation. The only infaunal taxon is *Pholadomya.* The Bivalvia altogether suggest **40 to 120 meters** of paleodepth, in agreement with ERLICH et al., (1999: 220) proposal of Inner-Middle shelf carbonates. The Gastropod recognized is *Arcotia,* a predator, carnivorous genus, from high-energy environment alike to the Caribbean living species *Strombus (S.) pugilis* Linné, whose bathymetric range is alike (BAYER et al., 1970). According to BARTOK et al., (1981) and MENDEZ BAAMONDE (1995) the Maraca Formation is "intermareal, lagoonal, passing gradually to shallow marine, to "the top." The big-sized *Tylostoma* is the another gastropod, a grazer on sea-grasses, is restricted to the photic zone.

Sequential stratigraphy: According to SIMO et al. (1993) the Late Albian transgression suffers a brief regression during Early Cenomanian times; this event would help to define the ending of the Maraca sedimentation, followed shortly by La Luna Formation, whose paleodepth at its initial stages, would not differ of the **40 to 120 meters**, proposed by the molluska (ERLICH et al., 1999; ARNAUD et al., 1999). La Luna Formation, - the classic black shale facies of Western Venezuela and Colombia, - did not iniciate by a general subsidence, but to the release of nutrient-rich material of terrestrial origin in a geologically short period of time. The frequent occurrence of paleokarst at the top of the Upper Maraca Formation in western Maracaibo and northern Perijá indicates some period of subaerial exposure (CANACHE et al., 1994; TRUSZKOWSZKY et al. 1995). The karstification would be responsible of the dissolution of gastropod shells (mostly aragonitic) which originally must have flourished in such a paleo-environment. The *Amphidonte conica haliotoidea* attached its left valves to erosional surfaces, and submarine hardgrounds.

(4) San Lázaro Hemigraben, Trujillo state.

PEÑAS ALTAS FORMATION, (L. E. V., 1997:521).
RENZ (1959) proposed this term; ARNAUD et alii., (1999) divided it as follows: A Lower sandstone; a Lower Carbonatic member; Middle sandstones, an Upper Carbonatic member, and, Upper sandstones, followed by La Puya Member. The complete unit, in the type area, (Trujillo state) measures 700 meters of thickness, which increases to the northeast (Lara state). Only the carbonatic members were fossiliferous, so the sandstone units will not be considered here.

PEÑAS ALTAS FORMATION, lower Carbonatic member. Interbedded, 1) Hard, grey dolomitized limestones in plurimetric beds; 2)

Shales, of dark colors, 3) Sandstones, arkosic and calcareous. The lower member carries a Bivalve-dominated biodiverse fauna: *Ceratostreon, Pleuromya, Trigonarca, Sphaera, Neithea (Neitheops), Pinna, Idonearca, Nicaisolopha, Epicyprina, Loxo, Proveniella, Scittila, Amphiaraus, Eriphyla, Pholadomya* (associated to *Cylindroporella), and Globocardium.* No rudist or *Gervillaria* colonies are observed. Gastropods are less common: *Oonia, Pseudomelania, Neritoma (Neridomus), Leviathania, Cassiope, Microschiza, Acteonella, Trajanella and Tylostoma.*

Age: Late Barremian to Early Aptian (Bedoulian) age, by the joint presence of *Sinainella* and *Hensonella dinarica* (ARNAUD et alii., 1999). The same is true for the presence of *Nicaisolopha urgonensis, Scittila bogotina, S. carteroni* and *Oonia cf. capduri.*

Paleoenvironment: The molluskan fauna suggests saline marine waters, where endobenthic, detritivorous genera flourished: *Ceratostreon, Trigonarca, Amphiaraus, Globocardium,* etc. Among Gasteropoda, *Acteonella, Microschiza, Neritoma (Neridomus)* and *Trochacteon (Neocylindrites)* are taxa favored by high salinities, in the lower 1/3rd of the sections. Higher in the section, the Bivalvia as *Megacucullaea, Idonearca and Myopholas,* together with scarce *Neithea (Neitheops), Pterotrigonia, Megalocardia, Ambocardia, Epicyprina and Sphaera*, still belong to saline conditions. No brackish-water genera were observed. The paleodepth varied between 20 and 80 meters.

PEÑAS ALTAS FORMATION, upper Carbonatic Member.

Interbedded, 1) Marls and clayey limestones, often with *Mesorbitolina,* and 2) Bioclastic limestones with molluska and *Spongeliomorpha* on the top, both lithofacies in metric beds, 3) Micaceous silty sandstones, and 4) Coarse sandstones with plant remains and parallel laminations (ARNAUD et alii., 1999). With a maximum thickness of 50 meters, it includes the classical *Mesorbitolina texana – M. ovalis,- M. pervia* horizon, where it is associated with the *Caprinuloidea perfecta – Sphaerucaprina ex gr. foliaceus* of Early Albian age in all the S. C. S. The mollusks here are again Bivalve-dominated: *Pholadomya, Panopea, Pleuriocardia, Homomya and Cymbophora,* all are endobenthic detritivores, while *Trigonarca, Texigryphaea, Gyrostrea (Pseudogyra), Idonearca (5 species),* and *Epicyprina* (3 spp.), are exobenthic. *Protocardia, Modiolus* and *Cymbophora,* are endobenthic, saline affinity genera. Among the Gastropoda, mostly oligomictic, *Cassiope, Turritella (Torquesia), Mesalia and Ampullina also flourish in saline waters.*

Age: Latest Aptian to Early Albian, according to microfauna ((ARNAUD et al., 1999). Among the Bivalvia, the concomitant range of *Texigryphaea washitensis-Gyrostrea acuticosta-Idonearca terminalis*, and among the Gastropoda, the biochron of *Teleoptyxis peruvianus-Cassiope fraasi-Turritella (Torquesia) vibrayi,* indicate an Early Albian age.

Paleoenvironment: Saline marine, inner shelfal assemblages, where periodically entered a brackish water influx, carrying abundant organic matter. The organic-rich muds, carried from nearby rivers was the perfect substrate with algae and *Mesorbitolina* with infaunal bivalvia as *Pholadomya, Homomya, Panopea (Myopsis), Limaria and Rostrocardia*, found usually associated in the same bed. Brackish-water genera as *Cyclorisma, Flaventia, Trigonocallista* and the gastropods *Metacerithium, Mesalia and Ampullina* suggests periodical floods. The abundance of endobenthic detritivors of big size, as *Epicyprina, Idonearca, Megalocardia, Cymbophora, Venilicardia and Trigonarca;* and Gastropoda as *Tylostoma* (4 spp.), *Nerinella, Perissoptera and Drepanochilus,* confirm the saline character of the waters. The highest marls carry *Ludbrookia and Cassiope*, suggesting an increase of salinity. The paleo-depth was no different from the lower member.

Sequential stratigraphy: The upper carbonatic member was deposited at the beginning of the Early-Middle Albian transgressive cycle (SIMO et al., 993). And should have been affected by the Global Anoxic Event “Paquier”. This inner shelf deposit was away enough from the Tethys Ocean current system, that a GAE could not reach it. But the faunal exchange with the Gulf-Atlantic Coast Sub-province reached its optimum.

PEÑAS ALTAS FORMATION, La Puya member. (ARNAUD et alii., 1999)

Interbedded, 1) Fossiliferous limestone, in submetric beds, 2) Marls, both rich in epibenthic bivalves, echinoids and ammonite remains, 3) Higher, an alternation of marls and clayey carbonates, mostly with small-sized endobenthic bivalves, solitary corals and small ammonites. The total thickness usually does not reach 20 meters, but it is one of the more fossiliferous section in western Venezuela. The most common Bivalvia are: *Amphidonte, Cyprimeria, Actinostreon, Grammatodos (Nanonavis), Cuneigervillia, Maghrebella, Cameleolopha, Neithea (Neithea),*

Eriphyla, and Pleuriocardia are euhaline tropical warm-water genera. There are also brackish-water Bivalvia, too: *Protocardia, Panopea (Myopsis), Crassatina (Chattonia), Gyrostrea, Anisocardia* and others with saline affinities: *Ptychomya, Linotrigonia (Oistotrigonia), Ludbrookia, and Cymbophora.* The gastropoda are more scarce, but biodiverse: *Pseudomelania, Tylostoma,* (2 species, each), *Pterodonta, Vanikoro, Arcotia, Keilostoma, Amberleya* and *Aphanoptyxis.* There are also biodegraded echinoida and brachiopoda (ARNAUD et al., 1999), probably caused by the predator gasteropoda as *Gyrodes, Goniocheila, Arcotia and Vanikoro.*

Age: The ammonite *Brancoceras* was reported from the base, suggesting latest Middle Albian to Late Albian age. The topmost bed of La Puya member is ammonite-rich, containing *Venezoliceras, Parengonoceras* and *Hysteroceras* as the commonest, indicating a Late Albian age (ARNAUD et al., op. cit.).

Paleoenvironment: According the molluskan (Bivalvia+Gastropoda) evidence, the basal bed was deposited at 8 – 16 meters**,** but the topmost, ammonite-rich bed, at 46 – 80 meters (PERAZA et al., 2007). The salinity was holomarine but with periodical influx of muddy brackish waters. This is the reason for the total absence of scleractinian corals, rudists and Nerineans in this otherwise fossiliferous assemblage. The ammonites and belemnites were probably storm-transported from the open ocean. The joint presence of disarticulated valves of *Ceratostreon and Actinostreon* – highly predated, are the Eocretaceous equivalent of the *Crassostrea – Saccostrea* complex of the Recent shoreline fauna of the southern Caribbean Sea (MACSOTAY, in press); their fragments are common in the lowest bed.

Sequential stratigraphy: La Puya member is coincidental with the Late Albian transgression of the S.C.S. (SIMO et al., 1993). BRALOWER et al., (1993, fig. 2) documented a dysoxic/anoxic oceanic episode during *Biticinella breggiensis* foraminiferal zone.

(5) EASTERN VENEZUELA – SERRANIA DEL INTERIOR ORIENTAL.

PINDELL & ERICKSON (1994) proposed for northeastern Venezuela, a first sedimentary supercycle of Middle-Late Jurassic marine sediments, which measured 2.5 Km of thickness, seen in deep seismic data. This sequence is actually covered by the well-known Early Cretaceous-Eocene sequence, which would be the second supercycle. Both supercycles would be restricted to the Serrania area, being limited by the Barcelona Deflexion (=Urica fault system, VIVAS, BELLIZZIA & MACSOTAY, 1985) westward, and towards the south, with Mundo Nuevo an Pirital thrusts. Eastward, seismic profiles run on Demerara Rise, north of Surinam, revealed an Eocretaceous of kilometric thickness; the well Starbroek-1X, drilled by AMOCO offshore the shelf of Guyana, reported 800 meters of Eocretaceous limestones (Geol. G. NEWCOMB, pers. comm., 1994). This suggests the continuation of this facies not only in Brazil, but in Senegal, too.

The balanced cross-sections along Eastern Venezuela Range, as published by PASSALACQUA et al., (1995, fig. 6) show an Eocretaceous sedimentation, continuous from Pirital High, for at least 200 Km to the northwest. This sequence was deposited under eustatic control, exhibiting a constant thickness of about 2 – 3 Km. During the Neocomian Epoch, sedimentation was under evaporitic control, reaching kilometric thicknesses of Halite and Gypsum. During Hauterivian-Barremian and again in Albian stages, the basin became flooded by siliciclastic sediments which were widely distributed on the shelf. This is consistent with the model proposed by HIGGS (2007) of a generalysed hypersaline sedimentation along the northern area of South American Plate. During Albian times, the sea waters became holomarine, suggesting a PASSIVE MARGIN activity during all the Eocretaceous.

The sedimentary cycles are:

1) Syn-rift deposition in the Espino Hemigraben, during Berriasian-Early Valanginian times. The northern margin of the hemigraben extended to 10 degrees north, and its granitic outcrops supplyed milky quartz gravel, from the uplifted cratonic basement. Lithostratigraphic units included Formations Morro Blanco, El Cazón and Couva.
2) The second cycle, deposited during Early post-rift phase, with a span of Late Valanginian to Early Aptian. Active thermal subsidence dominated the rate of sedimentation. The units included are: Formations Bergantín, La Margarita mudstones, El Dantó dolostones, Picuda, Taguarumo, (Lope member), Chuparipal and Cuche.
3) The third cycle, deposited during Late Aptian to Middle Albian times, representing

a late post-rift phase. The sedimentation was pelitic and carbonatic, with brief clastic inputs, is typical of subsident passive margin, coincident with the Maximum Transgression Tracts. The units included are: Formations García, Borracha, El Cantil, Chimana, and its member Caripito, Valle Grande and Boquerón

Hiatus or Sedimentation Gaps.
Each cycle is separated from the others, by a hiatus of time of two and half to four Million years. These hiatuses are enhanced by erosion, as is the case of second cycle, where emersion was well documented (ROSSI, 1985; ERICKSON, 1994; ARNAUD et al., 2000) at the top units.

TECTONO-SEDIMENTARY UNITS OF SERRANIA DEL INTERIOR ORIENTAL

Five tectono-sedimentary Domains and two sub-domains were recognized in Eastern Venezuela (VIVAS & MACSOTAY, 1995, 1998):

1.- El Pato Domain, the most external (DEP, Spanish initials)
2.- Guaiquerí-Manare Archipel (DAGM)
3.- Guariquen-Caripe Domain (DGC) with its sub-domain La Paloma (sDLP),
4.- Bergantin-Guanta Domain (DBG), with its Pirital sub-domain (sDP)
5.- Tonoro Domain (DT) not sampled.

The sedimentary units inside a domain are the result of a common tectono-sedimentary history, not necessarily shared with other domains. Most of the domains were extensional-fault controlled, and the eustatic controls are not evident in the lithological sequence. But the fossil molluska registered the paleoenvironmental features, and give an idea about the basin evolution.

MORRO BLANCO FORMATION (L. E. V., 1997: 365) emend.

Interbedded 1) Wackestone limestones, with abundant hermatypic coral, molluska and shell fragments, often nodular and grey; and 2) Calcareous grey shale, locally with ripples and large *Trichites*-shells. It is restricted to DAGM domain (VIVAS & MACSOTAY, 1995), where it is transgressive above the Venados red-beds. 3)The siltstones and sandstones are ill-sorted and cross-bedded, suggesting storm-activity (tempestites). This unit is re-defined here, as the top is fixed on a condensed bed, rich in iron and manganese oxides, strongly radioactive. The thickness is highly variable, between 90 and 300 meters, probably due to the eroded paleo-topography of the underlaying red-beds. The frequent molluskan fauna is dominated by thick-shelled Bivalvia, of exobenthic genera: *Trichites, Rutitrigonia, Ceratostreon, Catinula, Spondylus, Curvostrea, Cretocardia, Ludbrookia and Buchotrigonia (Syriotrigonia)*. Endobenthic genera are few: *Gresslya, and Isoarca.* Besides a few gastropoda, hermatypic corals of sizes attaining 1 meter, are found some in place, some overturned.

Age: The assemblage of Bivalves, suggest Late Berriasian to Early Valanginian age, coincidental with the transgression proposed by SIMO et al., (1993) for S.C.S. Age diagnostic bivalves are: *Trichites, Ludbrookia, Pholadomya and Rutitrigonia.*

Paleoenvironment: The presence of a varied hermatypic coral fauna, is suggestive of shallow, tropical and agitated sea waters (CHARLTON DE RIVERO, 1964). Recognized genera are: *Actinastrea, Columnastrea, Myriophyllia, Periseris, Meandrophyllia and Elasmophyllia,* and are concentrated in the lowest 10 meters of Morro Blanco Formation. In the limestones higher in the section, the corals are replaced by stromatoporids, hydrozoans and pharetronid sponges. The paleo-depth proposed for the coral-bearing horizon is of **16 to 34 meters,** increasing to **40 – 60 meters** in the higher limestones, where the Bivalve fauna is dominated by Trigoniacea suggesting hypersaline waters. Among the few unbroken gastropods, are: *Leviathania, Prisconatica, Mayeria and Purpuroidea,* suggesting a *Thalassia*-type grass bottoms, with an active invertebrate fauna.

Sequential stratigraphy: The Morro Blanco limestone was deposited in saline and hypersaline waters in a strongly subsident bottom. It is coincident with a transgressive cycle during Late Berriasian-Early Valanginian times (SIMO et al., 1993).

EL CAZÓN FORMATION. (L. E. V., 1997: 223)

Interbedded 1) Black carbonatic shales, micaceous, 2) Yellow dolomitic limestones, with clayey concretions, and 3) dark grey siliceous limestones, in submetric beds. Proposed by GUILLAUME, BOLLI & BECKMANN (1972) as the lower member of the Taguarumo Formation, it is found in outcrops of the Guariquén-Caripe Domain (DGC) and its La Paloma sub-domain (sDLP), according to VIVAS & MACSOTAY (1995). Originally reported 170 meters of thickness, while YORIS (1985, fig. 8) cited 429 meters. The generally ill-preserved molluskan fauna is dominated by Bivalvia represented by genera

originated during the Ryazanian and Portlandian stages of Jurassic Period: *Gresslya, Catinula, Gyrostrea, Paleonucula, Placunopsis, Camptonectes, Tancredia, Entolium, Corbicellopsis, Palaeonucula, Platycardia and Cretocardia,* among others. The few Gastropoda, are mostly predators: *Microschiza, Pseudomelania, Aporrhais and Fibulella.*

Age: The concomitant biochrons of the genera originated in the Cretaceous, are: Cretocardia, Ludbrookia, Neithea (Neithella), Aetostreon, Ceratostreon, Xenocardita Virgotrigonia, Vepricardium (Perucardia) and Pycnodonte (Phygraea), suggesting Late Berriasian to Early Valanginian age.

Paleoenvironment: El Cazón Formation is the outer shelf equivalent of Morro Blanco Formation, and its deposition occurred synchronous with the Couva Formation's evaporites. Most of the articulated bivalves are exo-benthic, which thrived on hard bottoms, in warm, hypersaline marine waters, usually with low Oxygen concentrations. The endobenthic bivalves, usually found in shales,: *Nuculoma, Pholadomya (Procardia), Palaeonucula, Pleuromya, Tancredia, Agnomyax, Anisocardia and Corbicellopsis* are labial palp deposit feeders, and siphonated detritivors, inhabiting soft bottoms. This suggests high organic content and high microbial activity in the hydroplastic sediments, located under the pycnocline, at paleodephts of 120 – 220 meters, and the water immediately above. Abundant calcareous polychaeta, as *Parsmonia spp., Filograna and Glomerula* are the commonest genera, fixed not only on the preserved shells, but upon the dolomitized molds and casts, are very common in the unit. The whole of the fauna represents a highly stressed paleoenvironment: a highly saline, aphotic, stratified marine system, where episodic circulation allowed this unusual assemblage. It was erroneously interpreted as a brackish water (YORIS, 1985, fig. 9) sediment. The "tabular lenses" of VIVAS in AGUASUELOS (1994) are dolomitic beds up to 2 meters of thickness, remnants of a heterolithic sequence, which collapsed after the dissolution of the layers of salt, gypsum and halite. The conclusion is that El Cazón sediments were originally interfingered with the evaporites of the Couva Formation (BRAY & EVA, 1983).

EL DANTÓ dolostones (Unpublished)
Alternations of 1) Dolomitized limestones, 2) Coral-rich wackestones, 3) Biodetritic or micritic blue-gray mudstones, or 4) marls with rippled tops, alternating with grey shales, common in the lower part. Massive or horizontally laminated in the middle part, and with cross-bedded quartz sandstones near the top of the unit. The Dantó dolostones, with a thickness variable between 130-150 meters, is wide-spread in the distal domains: DP, sDLP, DAGM and DEP of the Serrania del Interior Oriental. The abundant but usually ill-preserved molluskan fauna is dominated by Bivalvia, specially detritivore and andobenthic genera: *Pholadomya, Nuculoma, Agnomyax, Thracia, Legumen, Gresslya, Ospriasolen, Priscomactra, Vepricardium (Perucardia), Fenestricardia, Virgatotrigonia, Pterinella and Iotrigonia.* Coincidentally, most of these genera are also Paleo-Pacific related. The first Cretaceous **chemosymbiotic genera,** as *Inoceramus, Mytiloides and Acita (Truncacila),* suggest organic rich muds, and dysoxic bottom waters. The rare Gastropoda, are mostly carnivorous predators: *Pseudomelania, Leviathania, Aporrhais, Dicroloma, Fibulella and Confusiscala,* suggesting an abundant worm-fauna in the muds.

Age: Many genera have their origination, as the rudists Matheronia and Monopleura, and the Bivalvia Pterinella, Rastellum (Arctostrea), Ostrea (Ostrea), Scittila, Mediterraneotrigonia and Fenestricardita. Among the Gastropoda, Diptyxis, Teleoptyxis, Aphanoptyxis, Helicocryptus, and Metriomphalus are originated in the lower beds of this unit, of Early Hauterivian age. Other genera underwent extinction as Catinula, Nuculana (Praesaccela), Paleoneilo, Gresslya and other Ryazanian-Purbeckian type fauna.

Paleoenvironment: In "Las 5 Ceibas" locality (DAGM) WELLS (1944) identified 16 species of hermatypic corals, one stromatoporoid, one pharetronid sponge, and one calcareous algae. Associated Gastropoda were: *Cassiope, Aphanoptyxis, Cedrosia,* and the Bivalves *Pterotrigonia and P. (Notoscabrotrigonia),* all articulated and adults. Their paleodepth is barely 30 – 60 meters, in the reach of storm-agitated marine waters (MACSOTAY, 1980-b). Eastward, in the Guariquén-Caripe Domain, the assemblages contain thin-shelled genera as *Buchotrigonia (Syriotrigonia), Agnomyax, Thracia, Gresslya, Syncyclonema, Ospriasolen and Priscomactra,* all mud-dwelling detritivors, suggesting 120 – 280 meters of paleo-depth. All these genera show strong affinities to hypersaline marine waters**,** completely the opposite to YORIS (1985) supposition. In the Carinicuao river area (DAGM), many Bivalve genera as *Acesta, Spondylus, Epicyprina, Gervilleia, Plicatula, Fenestricardita, Panis, Rastellum (Arctostrea), Xenocardita Hayamia (new) and Arcomytilus* are found, severely biodegraded. The shell fragments are scattered in the outcrop, but with no evidence of

mechanical transportation: they were victims of predation, probably by fish, but octopus can not be ruled out. This evidence of predation is restricted to biodetritic limetones, which were deposited during events of high energy, and the predated invertebrates were thick shelled: I propose a paleo-dpth of 80 – 120 meters, for this type of locality. These high-energy episodes should be related to climatic events, when oceanic surface circulation, was enhanced during periods o a year or more. This concept fits with the dysoxic paleo-environments and explains the co-existance of divergent biotas. The oxygen content would have fluctuated with the pycnocline, in the stratified water-masses. Pectinidae as *Entolium, McLearnia, Neithea, and Chlamys,* suggest short periods of oxygenated currents near the bottom. Among the few Gastropoda I mention: *Pseudomelania, (2 species), Leviathania, Tylostoma, Cassiope, Rhabdocolpus and Fibulella,* all salinity-prone.

Sequential stratigraphy: El Dantó dolostones were deposited during the Hauterivian general transgression proposed for the Caribbean by SIMO et al., (1993). A severe Global Anoxic Event (GAE) which caused deterioration of marine conditions, was documented during Late Hauterivian stage (ROBASZYNSKY, 1989), called Faraoni Event. Was well documented in all the North Atlantic region.

LA MARGARITA mudstones (unpublished**)**
Interbedded 1) Quartz sandstones and subarcoses, 2) Dark grey carbonaceous shales and micaceous and intensely burrowed siltstones with taphoflora. The bedding are bioturbated, decimetric alternations, very monotonous. Towards the base, quartz-gravel beds are present, and locally, thin limestone and black chert lenses were observed. Outcropping in La Paloma sub-domain, (sDLP), this sequence was previously included in Taguarumo Formation (GUILLAUME et al., 1972). The thickness is variable: almost 600 meters in the south, it decreases to 100 meters towards the north (ROSSI, 1985, fig. 21). Bioturbations belong to the *Cruziana ichnofacies, with Teichichnus and Chondrites* in the pelites and *Skolithos* in the psammites. Along the taphoflora, common casts and molds of disarticulated Bivalvia are observed: *Neomiodon, (4 species), Eomiodon,(2 spp.) Myrene, Desertella, Costocyrena* of fluvial and *Lycettia* of estuarine habitat. Associated in the same beds, are the Bivalves, usually arcticulated : *Nuculoma, Nuculana, Nucula, Protocardia, Ursirivus and Panopea*, of saline marine water.

Age: Extended from the top of the Valanginian to Late Hauterivian. It is the concurrent range zone of the taxa *Nuculoma planata, Nuculana valangiensis, Cercomya gurgitis* and *Pleuromya colombiana.* It is coincidental with the Hauterivian transgressive-regressive cycle proposed for the Caribbean area by SIMO et al., (1993).

Paleoenvironment; An unusual association from the cold, aphotic deep waters (300 to 460 meters) are: *Thracia, Cercomya, Cymella, Linearia, Inoceramus, Gervillella, Tancredia, Parmicorbula, Pleuromya, Aenona* and *Anisocardia,* with mostly articulated valves. These endobenthic Bivalves were the more influenced by the periodical anoxia or disoxia, that existed on the outer shelf and upper slope in most of the Tethys Ocean's south margins. Among them we have found few specimens of chemosynthetic bivalves, as *Inoceramus, Retroceramus, Acila and Legumen.* Some thick-shelled Bivalves are associated to slumping phenomena as: *Neithea, Idonearca, Linotrigonia (Oistotrigonia), Rutitrigonia and Flaventia.* They constitute allochthonous fossils, transported by gravity flows from shallow, high-energy environments: are an olistopaleobiocenosis. La Margarita mudstones are the distal fore-delta muds transported by the Espino Hemigraben's megariver.

PICUDA FORMATION. ***(L. E. V., 1997: 527)***
Alternation of 1) Sandstones in decametric beds, commonly dominated by very coarse-grained quartz, abundant cross-beds, 2) Purple and grey shales, often sandy. Beds and bed-sets are tabular: channel structures and scouring are rare. The original description (VON DER OSTEN, 1953) cited 425 meters of thickness, and is well represented in DAGM and DGC domains (VIVAS & MACSOTAY, 1995). The basal sequence of *Skolithos* –burrowed sandstones, can reach locally 200 meters. Carbonaceous siltstones with taphoflora are common, but they do not contain gypsum, as the overlaying Taguarumo Formation. In western outcrops, a submetric limestone carrying hermatypic corals of small size dasycladacean algae, also contained a rudist, *Praecaprina varians* (Paquier) and a gastropod, *Calliostoma,* suggest shallow marine paleoenvironment.

Age: Late Hauterivian, by stratigraphic position.
Paleoenvironment: The sedimentary structures suggest that the massive sandstones are amalgamated tempestites, fact that limits the paleodepth to less than 40 meters. The ichnofauna in the carbonaceous siltstones and rhytmites, suggest a transition from *Skolithos* to *Cruziana* ichnofacies (BUATOIS &

MANGANO, 2011), part of a Lower Shoreface of an extensive submarine shelf. The quartz sands were transported by the Espino Hemigraben river, and were distributed on the shelf, by storm-produced waves (VIVAS, 1987). The anoxic/disoxic oceanic event "Faraoni" must have originated a humid tropical weather, source of the Picuda sandstones.

Sequential stratigraphy: The Picuda sand-dominated unit is coincident with the general regression proposed for the Caribbean area by SIMO et al., (1993) during the Late Hauterivian. Picuda Formation grades laterally to the prodeltaic mudstones of La Margarita in La Paloma sub-domain.

TAGUARUMO FORMATION. ***(L.E.V., 1997: 630-631)***

Interbedded, 1) Sandstones of mostly very coarse-grained quartz, abundant cross-bedding and occasional hummocky cross-stratification, constituting the lower 2/3-s of the unit, 2) Purple and grey sideritic shale, often sandy (rhytmites) and 3) Sandy limestones, minor component. Siliciclastic beds an bedsets are tabular; channel structures and scouring are rare, but listric faults are common. Outcropping extensively in the DAGM and DGC domains, the easternmost sequence is composed by about the same thicknesses of the lithosomes 1) and 2)(GUILLAUME et al., 1972). The rhytmites are of grey and brown colors, locally are selenitic and jarositic. The intense burrowing of the pelites, belong to the *Cruziana* ichnofacies (BUATOIS & MANGANO, 2011), suggesting a shelfal environment, usually below storm-level. The mean thickness, varies from 250 to 365 meters. Together with its Lope member, are the richest unit in the Venezuelan Eocretaceous in benthic molluska, whose shells remained well preserved. They constitute a "Konservatlagerstätten", caracterised by a very high paleobiological information content (Jest RUST in SANCHEZ-VILLAGRA & MACLEOD, 1914).

Age: In the eastern domains (DGC, sDLP) the concurrent range zone of the Gastropoda Adiozoptyxis, Neoptyxis, Teleoptyxis, and Aptyxiella (Acroptyxis), suggest a Barremian age. The Bivalvia Aetostreon, Ceratostreon, Ludbrookia, Ptychomya, Sphaera, Gervillaria and Prohinnites indicate Barremian-Early Aptian age. In the western domain (DAGM), the sequence starts during Late Hauterivian age, with Fibulella, Praestomatia, Cedrosia, Leptomaria, Diozoptyxis and Perissoptera. Towards the top, the assemblage of Ampullina, Pictavia, Pterodonta, Microschiza, Turritella, Columbellina, Leviathania, Laevinerinea and Pseudmelania suggest a Late Barremian-Early Aptian (Bedoulian) age. In these beds ARNAUD et alii. (2000) identified the *Palorbitolina lenticularis-Eopalorbitolina charollaisi* concurrent range Zone.

Palaeoenvironments: GUILLAUME et al., (1972) explained the absence of ammonites, and the abundance of benthic foraminifera as a sublittoral environment on the inner shelf. My listing of fossil molluska of the Taguarumo Formation, shows a high biodiversity of Gasteropoda and Bivalvia, in iron-rich, saline waters, specially towards the western exposures. The Gastropoda *Trochacteon (Neocylindrites), Itieria (Campichia), Trobus, Cryptoplocus ,Nerinella, Columbellina, Metriomphalus and Boltenella?* were favored by high concentration of salinity. The Bivalvia as *Ludbrookia, Idonearca, Ptychomya, Neithea (Neitheops), Excorbula, Corbicellopsis, Parmicorbula, Acutostrea and Seendia* are their counterparts. Brackish-water influence is specially notorious towards the base: *Cassiope, Microschiza, Chilodonta, Rhabdocolpus, Ampullinopsis and Ampullospira* among the gastropods, and *Panopea, Amphidonte, Aenona, Gyrostrea, and Pseudaphrodina* among the bivalvia. The classical rudist assemblage *Amphitriscoelus waringi, Caprina, Praecaprina and Requienia* (MACSOTAY & ALVAREZ, 1987; MASSE & ROSSI, 1987) is well represented in the eastern outcrops, and rare in the west; they constitute banks of scattered individuals, never a bioherm (MACSOTAY & VIVAS, 1998). These banks existed associated to other mollusks – mostly gastropods,- whose depth-range fluctuated between 60 and 220 meters, (middle shelf) well below the lower limit of the tempestites. The absence of ammonites or belemnites is not an evidence of shallow waters; the salinity and oxygen anomalies of a bottom system with stratified waters are a good explanation. The abundance of taxa and individuals of Ostracea, in contrast with the scarcity of Pectinacea, is the best evidence of low oxygen concentrations. The abundance of Siderite and manganese oxydes in most of the pelites, is also an evidence of the nearness of the continental exposures.

The great inaccuracy of the oil company "experts" is illustrated by the analysis of the Taguarumo Formation in the Conomita road cuts in western Sucre state. The ALLEN et al. (1992) interpretation of these excellent exposures as a deltaic complex, is counterdited by the sedimentary structures of massive sandstones with frequent listric faults: Amalgamated and Distal Tempestites, followed by

submarine bars, interbedded with siltstones with Echinoida and Bivalvia. The siltstones and rhytmites carry abundant taphoflora. These sediments were deposited well offshore, at paleodephs of 60 – 260 meters**,** confirmed by the rich ichnofauna of *Cruziana ishnofacies* (BUATOIS & MANGANO, 2011).

Sequential stratigraphy: The Taguarumo Formation was deposited during the double transgressive system of the Caribbean area, as was proposed by SIMO et al., (1993). Most of the sandstone-dominated sequences in the Taguarumo Formation, are cut by metric-scale listric faults, which controlled this tabular beds. Locally, intrasequential folding and slumping is observed in the Mochima area (DAGM).

TAGUARUMO FORMATION, Lope Member. (unpublished)

Originally GUILLAUME et al., (1972) published the term Garcia Formation for a shale unit in the Bergantin-Guanta (DBG) of VIVAS & MACSOTAY (1995). The term was extended to the whole serrania (ERICKSON, 1994). In the Archipiélago Guaiquerí-Manare, the lithology and the malachofauna are quite different, so it was called "García" Formation (MACSOTAY, 1980-B). This unit has interbedded 1) Purple, brown and grey shales, and 2) White sandstones, intensely bioturbated, and 3) Reddish, sideritic shale/sand rhytmites. This shale unit, originally was the top of the Taguarumo member (VON DER OSTEN, 1954) is separated with the name of Lope Member of the Taguarumo Formation. This unit is restricted to the DAGM domain, mostly in the west and central part of the outcrop areas. The bioturbations are part of the Cruziana ichnofacies with several generations of burrows in which the last one tends to obliterate the formers. According to BUATOIS & MANGANO (2011) it suggests alternation of disaerobic with aerobic conditions. The unit measures 85 meters in Lope inlet, and 150 meters in Picuda Grande Island (GUILLAUME et al., 1972).

Age: Late Barremian to Early Aptian (=Early Bedoulian), suggested by the concurrent range zone of the Trigoniacea *Pterotrigonia, Rutitrigonia, Mediterraneotrigonia, Disparilia, Acutostrea* and *Parmicorbula,* and the Gastropoda *Acteonella (Pchelincevella), Aphanoptyxis, Ampullospira and Pileolus.*

Paleoenvironments: The Lope member evidences the same environmental conditions as the Taguarumo Formation, with tendency to hypersalinity (selenite) and an alternation of anoxic and disoxic (siderite) conditions. This stressful paleoenvironmental situation is explained by the presence towards the NW, of the subsided land extension of the left margin of the Espino Hemigraben, now covered by the shallow-water carbonates of Chuparipal Formation, which restricted the marine open water circulation, towards the north-east. The marine waters must have been zonated, so the fauna above the pycnocline is more biodiverse and varied than the one inhabiting below. The Lope member is definitely an episodic sediment, where the Klupfelian cycles (KLÜPFEL, 1917) or the empilement of regressive cycles in epicontinental seas (BAYER, ALTHEIMER & DEUTSCHLE in BAYER & SEILACHER, 1985) is well represented. From the green limestones of the top of the unit, VON DER OSTEN (1954) reported: *Mediterraneotrigonia, Pterotrigonia, Rutitrigonia, Pseudaphrodina, Metriomphalus, Angaria, Ampulllospira and Actaeonella* which inhabited a high-energy but also a high-salinity environment. The six meters of the top, are brown and grey shales, with fragmentary shells of *Acutostrea syriaca*, a sub-littoral Ostreidae , transported by storm activity from its original habitat, along a shoreline. Otherwise, the Lope member's fauna carries abundant thick-shelled Bivalvia (another difference with Garcia Formation, s.s.) among which are common *Nicaisolopha, Sphaera, Cuneigervilleia, Neithea, Panis, Ludbrookia, Idonearca and Panopea,* along with the Gasteropoda *Columbellina, Leviathania, Eunerinea and Nerinella* (abundant). Rudists are rare, while ammonites and belemnites are absent. In contrast, Polychaeta serpulids are very common: 8 genera were recognized.

Sequential stratigraphy: The Lope member shales were deposited during the second important transgression in the Caribbean realm as pointed out by SIMO et al., (1993). Even so, the development of the Klupfelian cycles along all the section, and the shallowing upward of the molluskan fauna, suggest a regressive tendency in this unit: 120 to 24 meters, of paleodepth, as a whole. The underlaying Taguarumo Formation, also is filled with regressive sandstone and shale sequences (ALLEN, et al., 1992) but the presence of *Cruziana* ichnofacies burrows suggest that the subsidence was generally compensated by the sediment supply.

CHUPARIPAL FORMATION . *(L. E. V., 1997 : 173-174).*

Alternation of 1) Light grey massive limestones, in plurimetric to decametric beds, 2) Greyish green sandy siltstones and marls in submetric beds, and 3)

Fine grained quartz sandstones with ill-preserved cross beding. At the top of the unit, dark grey marls with decimetric sized *Aetostreon latissimus* and a sideritic violet-red limestone (MACSOTAY & ALVAREZ, 1987), suggests a Taguarumo-type environment. Restricted to El Pato domain (DEP), the thickness of the unit, at the type locality is about 105 to 110 meters. The massive, bioclastic and biostromic limestones carry a rich Rudist fauna: *Amphiriscoelus, Praecaprina, Offneria, Kipia, Requienia and Retha.* Along with dasycladacean algae, *Aetostreon, Rastellum (Arctostrea),* some corals: *Thamnasteria,* and Echinoids: *Heteraster, Holectypus, Tetraromania, and Discoides* (determination by Dr. B. CLAVEL). The thin-bedded clayey limestones carry a Nerinean-rich Gastropod fauna: *Neoptyxis, Diptyxis, Adiozoptyxis, Plesioplocus, Phaneroptyxis, Teleoptyxis, Aptyxiella (Acroptyxis)* and *A. Tetraptyxis),* among the commonest. Other gastropods as *Itieria (Campichia), Harpagodes, Trochonerita and Ceritella* are rare, but ubiquitous.

Age: Based on Nerinean and rudist faunas, the age is Barremian to Early Aptian (Bedoulian Stage). The presence of *Eopalorbitolina charollaisi, and Palorbitolina lenticularis,* in concurrent range zone, confirms this age assignement (ARNAUD et al., 2000).

Paleoenvironment: The assemblage of Rudists and Nerineans, suggest a slightly saline, distal shelf environment, where only specialized benthic fauna dominated. The abundance of dasycladacean algae in all the limestones, indicates the photic zone, but absence of tempestites, and the thickness of the benthic molluska, suggests 60 to 150 meters of paleo-depth (MACSOTAY, 1980-b). The presence of rodoliths, suggests even deeper bottoms. (MACSOTAY & ALVAREZ, 1987). VIVAS & MACSOTAY, (1995) considered it a carbonatic bank deposited on a submarine high, whose paleoposition was at least 60 Km away from the Espino Hemigraben's river delta, and protected by NW trade winds. The absence of tempestites and a rudist reef (sensu KAUFFMAN & SOHL, 1974) formed only by clusters and thickets of dispersed individuals is in agreement of the proposed paleodepth. The sideritic limestone at the top contains abundant shells of *Aptyxiella (Acroptyxis) vogdti* and suggests a rapid subsidence in relation to the massive limestones: at last 100 meters more.

Sequential stratigraphy: The Chuparipal Formation conforms well with the Barremian-Early Aptian Transgressive System Tract, discussed by SIMO et al., (1993) in the Caribbean area. The subsident paleodepth profile is radically different from the Taguarumo Formation's Lope member, and is attributed to extensional tectonics (BALLY et al., 1980).

BERGANTIN Sandstones. (A. VON HUMBOLDT, 1825; non LIDDLE, 1946).

Interbedded, 1) Quartz sandstones, abundant cross-bedding, mostly uni-directional, 2) Dark grey micaceous shales, rhytmites and thin sandstone with *Weichselia* taphoflora, and rare, nillimetric *Chondrites* burrows. The sandstones are quartziutic and arcosic, in beds from 2 to 20 meters of thickness. The bedsets are tabular, channel structures and scouring are common. This 2.500 meter thick psammitic unit is the lowest exposed in the Bergantín-Guanta Domain (DBG). The original name, Bergantin was changed later to Barranquín Formation, by LIDDLE (1946); unfortunately, the latter was proposed on localities in the Archipiélago Guaqueri-Manare domain, in strongly deformed Picuda and Taguarumo Formations. All the mollusks found are molds, casts and impressions in the rhytmites and thin sandstones: *Myrene, Neomiodon, Musculiopsis, Lycettia and Cyclorisma,* all disarticulated bivalvia shells. The assemblage is not marine! The taxa are fluviatile and oligohaline. Top limestones of the Bergantin sandstones. FALCON (1989-b), BULOT (1994) and AGUASUELOS Rept. (1994) reported "light grey, fossiliferous dirty "limestones, calcareous shales, and white calcareous sandstones, with molluskan "fragments." Among the fossils, green algae, Bivalves (*Desertella, Ursirivus, Musculiopsis, Ceratostreon, Xenocardita and Linotrigonia)* and some Gasteropoda (*Ampullinopsis, Pseudomelania and Ampullina?)* are representatives of a very shallow, brackish environment.

Age: The limestones on the top, suggest a Late Hauterivian-Earliest Barremian age. Most of the unit, was deposited during Hauterivian stage, as is suggested by the bivalvian fauna.

Paleoenvironment: According to ERICKSON (1994), the Bergantin sandstones are a "concentration of fluvio-deltaic facies"; the distribution of grain sizes, and the sedimentary structures (see VIVAS, 1986, pls. 1, 2) indicate a deposition under variable currents, gravity currents and occasional storms. The *Weichselia-Hausmannia* taphoflora and the transported bivalves, suggest a big-sized paleoriver flooding a continuously subsident inner shelf. A big sized river drained most of central Venezuela and Colombia, through the Espino Hemigranben, during Hauterivian times. The fresh-water and oligohaline environments are now

known to harbor opportunistic colonizers of the *Skolithos* ichnofacies (BUATOIS & MANGANO, 2011). Extremely dense concentrations of *Chondrites* at the top of the tempestites may suggest the burial of high quantities of organic matter during storms (VOSSLER & PEMBERTON, 1988); *Macaronichnus* has also been observed in the upper horizons of Bergantin sandstones. Both ichnogenera were reported from the Eocretaceous fluviatile Nubia sandstones of Egypt.

Sequential stratigraphy: The lower horizons, the 'sand-dominated' massive sandstones (RAGUSA et al., 1994), could have been deposited during the Late Hauterivian when the Faraoni anoxic/dysoxic oceanic event, produced a tropical-humid climate on most Gondwana continent. This coincided with a prolonged drop of sea level, in the Caribbean area (SIMO et al., 1993). The following 'sandy- shale' and 'shaly-sand' are more related to the accommodation place supplied by the hemigraben, limited by the Mundo Nuevo normal fault, than to eustatic influence. Finally, the 'sandy-calcareous' topmost sequence, is a LST, related to the regression during Hauterivian stage of SIMO et al., (op. cit.). It is important the extensive tectonic activity of Mundo Nuevo fault, which allowed the accommodation of more than 2600 meters of siliciclastics during 3.0 - 3.5 Ma (7.42 – 8,66 mm/1000 years).

GARCIA FORMATION. (GUILLAUME et al., 1972, non FALCON, 1989).

Monotonous dark grey shales, interbedded 1) thin beds of fine-grained , glauconitic sandstones and limestones, which are very fossiliferous. Gastropoda and Bivalvia are the most common fossils followed by ammonites, echinoids and locally, belemnites. The average size of the benthic molluska is about 15 mm. Aragonitic shells were lost, but the calcitic ones, are usually well preserved. Mineralization by chamosite and glauconite, obliterated many fossils. The thickness in DBG, DGC and sDLP, varies between 70 and 180 meters, but the outcrops are poor and discontinuous.

Age: The biodiverse ammonite fauna – including some heteromorph genera, starts with Zones *Cheloniceras* spp. and *Dufrenoya furcata* (late Early Aptian or Bedoulian), followed by Zones *Aconeceras nisus, Acantoholites spp. and Parahoplites* spp. (Late aptian or Gargasian stage, according to GUILLAUME et al., 1972; BULOT, 1994).

Paleoenvironment: Deposited on a wide submarine shelf, open to the Tethys Ocean, which were periodically influenced by brackish water influx. Molluskan fauna allowed us to define an ecological profile for the Garcia Formation. Lowest Garcia formation: Goetite hard ground found locally, contains a Bivalve-rich fauna of mostly disarticulated valves: *Eocallista (*2 species), *Pleuriocardia (2 spp.), Lucina, Proveniella, Scittila, Barbatia, Isoarca and Flaventia.* Among Gastropoda, *Microschiza (2 spp.), Pseudomelania, Haustator (*bothj, 2 species each), *Harpagodas and Ampullina,* suggesting a polyhaline brackish-water assemblage. Transported valves of *Panopea, Eocallista and Eomiodon* of wealdian affinities suggest a complex paleotopography. The species indicate a Bedoulian age, and are part of an incised valley fill on the top of the Bergantin Formation (BULOT, 1993, ERICKSON, 1994). The important fresh-water influx at these levels, could be related to the Anoxic/Disoxic Oceanic Event "Selli", placed in the foraminifera zone *G. blowi* by BRALOWER et al., (1993) it is present locally only. Middle Garcia Formation: This monotonous shale interval, carries a small-sized biodiverse molluskan fauna, where thin Belemnites, Echinoids and Brachiopoda are frequent. Among the Gastropoda, *Tessarolax, Semisolarium, Nummocalcar, Conotomaria, Cirsocerithium, Hemicerithium, Keilostoma and Eucycloscala* are common in carbonatic horizons. The Bivalvia are even more common: *Acila (Truncacila), Astartemya (Freiastarte)* 4 species, *Grammatodon, Nuculana (Rollieria), Oxytoma (Oxytoma), Callucina, Plicatula, Entolium* and *Eryphila.* This assemblage suggests a paleodepth of 120 to 360 meters, which would encompass middle and outer shelf (MACSOTAY, 1980-b). The presence of saline-prone genera as *Proveniella, Sinonia, Nuculoma, Panzacorbula, Trigonocallista, Nicaniella (Trautscholdia), and Scittila* in glauconitic horizons, indicates the presence of a pycnocline, where cold, oxygen-rich and mineralized waters contacted the organic-rich muddy bottoms. All the Gastropoda and most of the Bivalvia, originated in the North European Province, and are cryophyllic genera. KEMPER (1987) in his paleoclimatic studies of northern Europe, documented the descent of Arctic deep water, through the North Sea entering the Tethys Ocean, bordering the Armorican Massif: this event happened during Late Aptian times, and coincided with warm surface water entering the temperate seas of Niedersachsiches Basin (KEMPER, op. cit., fig. 10). Extended glauconite-rich and phosphoritic sedimentation originated in Northern Europe at that time, forming the "Lower Greensand" in England and the Paris Basin. Also explains the glauconite and chamosite in the fossiliferous horizons of Middle Garcia Formation,

and the cryophyllic character of the benthic molluska. Local frequency of articulated shells of *stoy (Truncacila)* as a chemosymbiont taxon, suggests an oxygen-poor environment, while Serpulid-covered gastropods as *Keilostoma* spp., and *Pseudomelania* spp. are indicative of higher salinities, related to deficient water circulation. The *Schackoina cabri* zone assemblage was collected in this horizon (FALCON, 1989-a) but the paleodepth proposed by this author was too shallow. Upper Garcia Formation: This is the regressive portion of the García Formation, where the irregular echinoids are very common, and sandstone layers are increasingly frequent. This level is rich in Bivalvia as *Disparilia, Nicaniella (Trautscholdia), Veniella, Anomia, Panzacorbula, Mesolinga, Cymatophora; Plicatula and Eriphyla* (3 spp. each) dominate the assemblage suggesting tropical (Gondwanan Province) influence. Among Gastropoda, *Cirsocerithium, Hemicerithium? , Pterodonta, Strombus, Globiconcha, Oonia, Blackdownia and Eucycloscala* are the commonest. The assemblage is a brackish, polyhaline fauna, that lived between 60 and 100 meters, suggesting the distal influence of Espino Hemigraben´s river. The presence of *Microshiza, Pseudomelania and Haustator* (2 species each) as transported shells and worn, thick-shelled *Eodonax, Amphidonte and Ceratostreon* suggest that the sandstones are tempestites.

Sequential stratigraphy: Garcia Formation of the DBG and DGC domains, was deposited during the Maximum Transgression of the Aptian stage in the Caribbean Basin (SIMO et al., 1993). It followed the Disoxic/Anoxic Oceanic event (OAE) called "Selli" by ROBASZYNSKY in COTILLON et al., (1989) whose climatic anomaly only affected the lowest Garcia Formation. The important subsidence, that allowed the Boreal fauna to enter in Eastern Venezuela, should be part of the paleogeographic reorganization related to the separation of the Caribbean Plate from the Farallon Plate (PINDELL et al., 2005). The Middle Garcia Formation's cryophyllic molluska could be explained as the permanent thermocline displaced above the tropical shelf's outer and middle part as an upwelling**.** This upwelling was accelerated by the "Selli" event, caused by the Coriolis force, and endured at last 4 – 5 Ma.

BORRACHA FORMATION. *(L. E.V., 1997 : 83-84)*.

Interbedded, 1) Biostromic massive limestones, 83 %, 2) Calcareous shales, 13 %, and 3) Coarse grained quartzarenites, lensatic 4 %. Restricted to the DAGM domain, (VIVAS & MACSOTAY, 1995), it reaches 230 meters of thickness at its type locality, in overturned position. The lower 180 meters of massive limestones, are coquinoid, with common Gastropoda, Hydrozoans and Bivalvia, mostly Caprinid Rudists; they are interbedded with yellow marls, carrying Sponges and Exogyrid Bivalves: *Acutostrea and Aetostreon.* The following 25 meters are heterolithic, carrying biodegraded Molluska and calcareous algae. The whole unit is intensely bioturbated.

Age: The lower limestones are of Late Aptian (Gargasian-Clansayesian) age, in base of the rudists *Requienia, Toucasia, Pseudotoucasia and Amphitriscoelus,* and the Nerineans *Teleoptyxis, Neoptyxis and Adiozoptyxis.* The upper carbonates, contain also Rudists: *Caprinuloidea, Coalcomana, monopleura and Toucasia;* the Nerineans here, are: *Teleoptyxis, Multiptyxis, Eunerinea, Aptyxiella (Acroptyxis) and Carinia* suggesting an Early and Middle? Albian age.

Paleoenvironment: this unit was traditionally treated as a "rudist reef" (GONZLEZ DE JUANA et al., 1980), but these biostromic limestones exhibit individual rudists or small clusters, and lots biodegraded (GUILLAUME et al., 1972). The fauna is gastropod-dominated, and are outstanding the grass-eaters as *Tylostoma,* (7 species), *Ampullina* (2 spp.), and predators as *Euspira and Amaurellina,* (2 species each), *Gyrodes, Microschiza (Coronatica) and Perissoptera* which suggests a very active invertebrate life, related to oxygen-rich marine waters. Among the Bivalvia, are noteworthy the Ostreaca: *Acutostrea, Aetostreon, Planospirites, Amphidonte and Gryphaeostrea*, and some unusual Pectinidae: *Mimachlamys, Eopecten, Chondrodonta,* developing big sizes. Among the few endobenthic detritivores: *Pholadomya, Megalocardia and Eryphyla.* Most Mollusks are stenohalyne and thermophyllic in character; no brackish-water genera have been collected. The presence of hydrozoans and pharetronid sponges, still reflects the salinity of the Aptian waters; in the Early Albian sequence, reef corals and calcareous algae are more common. The "Paquier" OAE, promoted the abundance of planktonic fauna (BRALOWER et al., 1993; COTILLON, 1993), which could have contributed to the great size attained by some benthic Molluska.

Sequential stratigraphy: The lower limestones were deposited during Late Aptian shelf expansion stage of SIMO et al., (1993). In short regression near the Aptian/Albian boundary, originated the heterolithic middle member, with some quartz sandstones having been transported from El Cantil Formation, northward. The Early Albian

transgression pushed the beach-line, at last 150 Km southward, promoting a purely carbonatic sedimentation on the outer shelf. This transgression also flooded the Espino Hemigraben's megariver; the quartz sands were distributed mostly inland: The Canoa Formation (L. E. V., 1997: 95-96) in Monagas state.

EL CANTIL FORMATION. ***(L. E. V., 1997: 220, 221).***.
Alternation of 1) Limestones in metric to plurimetric beds; 2) shales and, 3) sandstones in which lateral changes to rhytmites or laminites are common (GUILLAUME et al., 1972; ROSSI, 1986; VIVAS, 1987). It is a dominantly carbonatic unit, widely exposed in the proximal areas of the shelf: DBG, sDLP and partially in DGC (VIVAS & MACSOTAY, 1995). This alternation is common in the DBG domain; in the sDLP, the unit starts with El Mapurite sandstone member, of 170 meters, covered by Guácharo limestone member of about 150 meters. Both members tend to decrease their thickness towards the northeast (ROSSI, 1985), and are interpreted as Listric Fault systems, active during the Aptian stage (ARNAUD et al., 2000).

Age: GUILLAUME et al., (1972), ROSSI (1985) proposed an age of Late Aptian to Early Albian, based on underlaying and overlaying units. In the DBG domain initiated with the *Mesorbitolina pervia-M. ovalis* concomitant range zone, as Clansayesian age (GÖRÖG & ARNAUD-VANNEAU, 1996). In the distal domains, (sDLP, DGC) the Guácharo member is dated as Early Albian, by the Rudist association *Caprinuloidea perfecta-Planocaprina cf. trapezoida;* and the Nerineans too: *Teleoptyxis peruviana-Eunerinea syriaca* (VIVAS & MACSOTAY, 1995). In Mapurite member's shell beds the gastropoda are of Albian age: *Semisolarium moniliferum* (M.) and others. (see Plate 1, for lateral relationships). These differences were not understood by VILLAMIL & PINDELL (1998: 315-316): the ages of similar lithologies in DBG are not the same as in DAGM; this was clearly demonstrated by ARNAUD et alii., (2000), too. The extension of El Cantil age to the Middle Albian, (VILLAMIL & PINDELL, op. cit.) is not justified paleontologically.

Paleoenvironments: The area of Las Callecitas (Estado Anzoátegui, DBG) is the most proximal of all the El Cantil outcrops (VIVAS, 1987), a Bivalvia-dominated benthic fauna of brackish-water endobenthic habitat: *Idonearca* (6 species), *Trigonarca, (3 sp.), Pterotrigonia and Cymbophora* (2 sp., each), *Pholadomya, Flaventia,* the most common. Mesohaline genera are: *Psilomya* (4 species), *Gyrostrea (Pseudogyra) and Crassatella (Sublandinia),* (2 spp. each), *Homomya, Ptychomya,* and *Pseudomiltha.* Among the Gastropoda, *Ampullina, and Microschiza (Cloughtonia)* were also meso-haline. In Cerro Grande-Pico Garcia in the same domain (DBG) but 100 Km to the east, Gastropoda become as biodiverse as Bivalvia, but still are dominated by mesohaline genera: *Tylostoma, Gyrodes* (3 species each), *Keilostoma, Ampullospira, Oonia, Metacerithium* and *Terebralia (Pyrazisinus),* which could have been mangrove-related. The associated Bivalvia, are less diverse: *Plicatula, Ilymatogyra, Protocardia and Ceratostreon,* epibenthic suspensivores, also suggesting estuarine, mixed waters, in paleodepths between 60 and 120 meters. Abundant echinoids (MO-6071) identified by B. CLAVEL(25/01/1995) include: *Heteraster mexicanus* (Cotteau) and *Macraster polygonus* Agassiz, suggesting mostly Late Aptian age.

The topmost limestone in Cerro Grande-Pico García, carries brackish and fresh-water Bivalvia, suggesting an emersion surface: *Myrene dürfeldi (*wealdian, Peru), *Pachythaerus myophoroides* (wealdian, Peru, and Aguardiente Formation), *Eoursivivas picteti* (Choffat) (Bellasian, Portugal). The faunule is composed of many disarticulated valves, somewhat biodegraded; it shows a regressive trend in relation to the main El Cantil Formation. Another locality, at Caripe river, (MC-264-B) exposes a shell-bed composed of the same species. In the distal domains, (sDLP, DGC) the common Bivalvia are Rudists, *Toucasia, Coalcomana, Agriopleura,* and Ostracea as *Texigryphaea and Rastellum (Arctostrea),* with frequent serpulids as epibionts. The carbonatic bottom was deeper than in Cerro Grande-Pico Garcia (100 – 240 meters) but the salinity was more euhaline, more mineral-rich and of lower temperature. This diagnosis coincides better with the *Mesorbitolina texana* , *Coskinolinoides* and pelagic foraminifera as *Hedbergella* reported by ROSSI (1985). The paleo-depth proposed by FURRE R & CASTRO of 40 meters, was pure guess-work. These phenomena were related to the OAE "Paquier", which affected the benthic fauna of the Guácharo carbonatic Member. It helps to explain the abundance of algae and hydrozoans, and the absence of hermatypic corals in a tropical sea. In the Mapurite sandstone member the only Bivalvia found, were *Pholadomya* (in situ) and *Nemetia* (disarticulated, fresh-water).

Sequential stratigraphy: The Late Aptian part of El Cantil Formation, was deposited during a generally regressive tract; during the Early Albian, a general transgression contributed to the active carbonatic sedimentation (SIMO et al., 1993) on

most of the shelf in all northern Venezuela. The quartz sands of Mapurite and Hormiguera members, were wave-transported from the Espino mega-river, re-activated by the fall of the sea level, in less than 20 meters of paleo-depth. This explains also the frequency of estuarine mollusks, besides the transported fluviatile, in the sandstone members.

VALLE GRANDE FORMATION. ***(L. E. V., 1997 : 677-678)*** (Plate 1).
Interbedded : 1) Shales, 2) Marls, 3) Glauconitic limestones, and 4) Calcareous sandstones in the type area, Valle Grande-San Juanillo road, Sucre State (DGC, fide VIVAS & MACSOTAY, 1995). Valle Grande Formation carries a rich fauna of Ammonites, Belemnites, and mostly a dwarf fauna of Bivalvia and Gasteropoda. Localities in Guariquén-Caripe domain (DGC) expose: carbonatic shales, nodular limestones, and clayey-glauconitic limestones. In the Carinicuao river, near the top of the sequence, outcrops a 15 meter-thick carbonatic slump structure, in which the matrix and the carbonates, are of the same age: Middle Albian (GUILLAUME et al., 1972). The total thickness of Valle Grande Formation is between 100 and 160 meters, and very rarely is preserved in continuous outcrop.

Age: It is extensive from the zone *Biglobigerinatella barri* (Late Aptian), and the zone *Praeglobotruncana rohri* (Middle Albian)(GUILLAUME et al., 1972). BULOT (1994) found it extended from the *Epicheloniceras martinoides* (Late Aptian) to *Hoplites dentatus* zones (Middle Albian).

Paleoenvironments: Outer shelf to Upper slope according to the exotic molluskan fauna: 360 to 460 meters. Typical Bivalve genera are: *Astartemya (Freiastarte),* (3 species), *Acila (Truncacila), Thyasira, Nuculana (Rollieria), Mimachlamys, Thracia, Propeamussium, Merkinia?, Isoarca, Amphiaraus,* and *Amphidonte.* The Gastropoda are common, too, with abundance of Aporrhaidae: *Goniocheila, Tessarolax, Perissoptera, Dicroloma, Protohemichenopus, Drepanocheilus, Aporrhais,* all predators. But detritus-feeders as *Nummocalcar, Semisolarium, Turritella Ataphrus,* and *Eucycloscala are* common, too. The presence of *Propeamussium, Parvamussium, Tancredia (Isotancredia), Camptonectes, Merklinia?* and *Periplomya* with five different Turridae Gastropods and *Eucycloscala,* suggest aphotic upper slope environment, deeper than 360 meters. Some unusual Polychaeta are also common: *Tubulostium, Filograna, Vepreculina,* etc., suggest also a rich biota of marine worms. The presence of shallow water biota at the base of Valle Grande Formation *Acutostrea, Anomia, Mutiella, Paraesa* and even brackish-water biota, as *Costocyrena, Eomyodon and Nicaniella (Trautscholdia),* confirms that important subsidence occurred along the Caripe fault during Albian times (ARNAUD et al., 2000), on the shelfal area.

CHIMANA FORMATION ***(L. E. V., 1997: 170-171)***
Interbedded, 1) Micaceous fissile shales of rose color, (87 %), 2) Lensatic brown kimestones with ferrolithic plates in the shales (3 %), and 3) glauconitic sandstones, specially common towards the top of the unit (4 %). In the type area (DAGM) it measures 120 meters, reaching 230 meters in Cumanacoa area (sDLP) . The fossils include Ammonites, Bivalves, Gastropods, Belemnites and Polychaeta. Distinctive of Chimana Formation, is the presence of glauconite and other ferrugineous minerals, suggesting reducing condition in the sediment, and proximity of cratonic sources.

Age: The ammonite zones *Douvilleiceras mammillatum* and *Hoplites dentatus* indicate an age of Early Albian to basal Middle Albian (GUILLAUME et al., 1972; BULOT, 1994) . Foraminifera of the *Biticinella breggiensis* zone (VIVAS in AGUASUELOS ING., 1994) suggests a higher horizon in the Middle Albian (VIVAS & MACSOTAY, 1995).

Paleoenvironment: The fauna of Bivalvia dominate over the Gastropoda, but both are rather oligomictic. Ther genera *Grammatodon, Plicatula, Pleuriocardia, Ludbrookia, Idonearca, Sinonia, Disparilia, Texigryphaea and Amphidonte* are exobenthic fslter feeders, while *Pholadomya, Epicyprina and Panopea* are endobenthic detritivors. The abundance of robust individuals, suggest saline waters. *Amphidonte conica* locally constitute colonies. MACSOTAY et al., (1986) and VIVAS (1987), suggest a paleodepth of 300 – 360 meters, proposed as the shelf/slope transition during Eocretaceous times by (MACSOTAY 1980-b), by the abundance of Ammonites, Belemnites, and the Echinoid *Pseudoananchys.* Among Gastropods, *Turritella (Torquesia), Haustator, Serrifusus, and Hemicerithium?* Suggest abundance of organic matter in the bottom sediments. The Polychaeta *Tubulostium* of free-living vagrant shells, is locally common. The most common ichnofossil, *Paratisoa ichnospp.* Is typical of the aphotic zone. FURRER & CASTRO (1997) reported laminated marlites, containg many small nodules of marcasite, and pyrite on their surface. The presence of fibrous gypsum filling fractures, also suggests a sulphur-rich pelitic sediment. These stressful conditions could be

explained by upwelling phenomena of cold, minarilzed dense waters entering from the deep Tethys Ocean.

CHIMANA FORMATION, Caripito Member. ***(L. E. V., 1997: 126)***

Historical References: This sand-dominated unit is restricted to the Bergantin-Guanta Domain (DBG), and its subDomain Pirital (sDP), and was published as "Chimana" Formation by VIVAS (1987). Previously named Caripito member of Chimana Formation by YORIS (1985) in base of a continuous section of 325 meters, exposed in Río Azagua, Monagas state.

Interbedded, 1) Glauconitic, ferrugineous and dolomitic sandstones, with individual thicknesses up to 50 meters, 2) Sandy and calcareous grey shales, 3) Sandy limetones, locally dolomitized, moderately fossiliferous, and 4) Arkosic microconglomerates, lensatic. The sandstones and the microconglomerates are usually tempestites, and carry molluskan fragments. The Bivalvia are mostly endobenthic suspensivores: *Idonearca, Protocardia*, Linotrigonia (Oistotrigonia)*, Gyrostrea*, Ptychomya*, Sphaerium*, Xenocardita, Grammatodon, Plicatula, Amphidonte, and Texigryphaea.* The genera marked* are saline water inhabitants. Higher in the section, gastropoda as *Ampullospira*,Gyrodes*,Leviathania* Tylostoma and Ampullina* associated to Bivalvia as *Ceratostreon and Arabitrigonia,* suggesting a shallowing upward sequence (VIVAS, 1987). Locally, storm-transported fragments af *Gyrostrea (Gyrostrea)* of decimentric size, are found. In Valle Solo area, the top carries a glauconitic sandstone, with pyritized molluska, is still unstudied.

Age: The association of common Bivalvia, *Idonearca glabra, Buchotrigonia abrupta, Grammatodon carinata and Protocardia texana,* suggests Late Early Albian to Middle Albian age.

Paleoenvironments: The Molluska of oligomictic assemblages suggest saline waters for all the unit, affected occasionally by storms, which helped to introduce brackish waters. Local presence of *Sphaerium* – a wealdian genus ,*-and Dentonia,* suggest fluvial detritus. Scattered disarticulated shells of *Protocardia, Texigryphaea, Cuneigervillia* and the big-sized *Gyrostrea (Gyrostrea)* suggest strong erosion along a mangrove-like shoreline. The carbonatic horizon in the middle of the unit, (VIVAS, 1987) was considered of 40 to 60 meters while the fossils of the higher horizons, could have been deposited at 0 – 40 meters**.** The glauconite and the iron oxides are detrital, but the dolomites are formed in situ, as is normal in the tropical evaporitic conditions in the present Caribbean Sea.

BOQUERON FORMATION. (ROD & MAYNC, 1954, emend. MACSOTAY et al., 1986).

Originally called Boqueron Formation by ROD & MAYNC (1954), for the "transition shale zone" between Chimana and Querecual Formations of HEDBERG (1950: 1189). They chose the type locality in the west end of Chimana Grande Island. MACSOTAY et al., (1986, fig. 6) corrected the location to the Eastern extreme of the island, where both contacts are observable. This unit shows lateral continuity with Majagual Formation, (not El Cantil, as thought originally), and Lower Querecual so it is definitely post-Chimana. The Cutacual Formation, - corrected to Putucual by YORIS (1985) – is only a junior synonym of Boqueron Formation. The detrital glauconite reported from the "Putucual" formation, is reworked from the underlaying Chimana Formation.

Interbedded: 1) Dark aphanitic limestones, finely laminated, 2) Shales partially calcareous, bituminous and carbonaceous, dark grey weathering to yellowish grey, 3) Microchrystalline bioclastic limestones, lensatic. In Puinare (=Chimana Grande) island it reaches a mximum thickness of 95 meters, and the beds vary from 0,5 to 2 meters. The presence of quartz sand in grain flow textures is ubiquitous in the DAGM domain outcrops, as is the *Zoophycos* ichnofacies: *Zoophycos (*2 icnospp.), *Chondrites* and *Phycosyphon. Planolites* is frequent at the top of the beds. The Boquerón Formation is present in the DAGM and the DGC domains (VIVAS & MACSOTAY, 1995).

Age: The age suggested by *Rotalipora appenninica, Hedbergella spp., Heterohelix sp. (BOLLI, 1985)* and the heteromorph ammonite *Mariella bergeri* is Late Albian to Cenomanian. The micromolluska collected in Puinare Island, confirm this age.

Paleoenvironment: The micromolluska are all disarticulated valves of Bivalvia: *Propeamussium, Parvamussium, Entolium* (Pectinacea) *Nuculoma and Mesosaccella* in the limestone beds. This association suggested to MACSOTAY (1980-b: 79, 85-86) a paleodepth of 500 – 2.000 meters**.** The protolith of Boquerón Formation was deposited in an oxygen-depleted soft sediment, but with bottom waters regularly oxygenated, where echiuran worms and other trace-making worm-like animals, burrowed densely the substrate. *Zoophycos* since Silurian Period, has established itself on deep shelf and slope areas (BOTTJER et al., 1988; BUATOIS &

MANGANO, 2011), far deeper than the originally proposed 50 to 300 meters. A labial palp deposit feeders as *Nuculoma and Mesosaccella* are typical of this aphotic but bacteria-rich environment. I consider possible that Boquerón Formation was deposited below the Oxygen-Minimum zone (DEMAISON & MOORE, 1980), at depths greater than the averge Querecual Formation, whose benthic fauna contains only chemosymbiotic genera: *Inoceramus, Mytilopsis and Didymotis.* The wide-spread grain-flow phenomena, suggests deposition at the base of an important normal fault, where the unconsolidated quartz (or the glauconitic) sand was gravitationally transported down-slope, and dispersed in the soft muds.

Sequential stratigraphy: The Boquerón Formation was deposited during the same Late Albian transgression as the Majagual Formation, but in deeper marine setting; the interfingering reported by METZ (op.cit.) was with limestones slumped from Majagual reefs (Rudists and Nerineans) to the slope facies. The slight regression cited by SIMO et al., (1993) at the Albian/Cenomanian boundary, and the strong one during th Early Cenomanian, must have exposed part of the Majagual reefs to subaereal erosion. These bioclastic limestones, diagenetized, were transported gravitationally into the deep slope, giving the impression of "turbiditic" facies in Boqueron Formation. CARMONA (1978) in YORIS (1985) reported from bioclastic lenses: Algae, Corals, Echinoida and benthic Molluska, shallow-water assemblages common in the Majagual Formation. Thermally driven regional subsidence was still active in Eastern Venezuelan continental margin during Late Albian-Cenomanian times.

(6) LA GUAJIRA DOMAIN (DLG). Outcropping in Northeast Colombia.

Domain proposed herein, to englobe the sedimentary sequence, of Berriasian-Campanian age, published by ROLLINS (1965) outcropping in La Guajira Peninsula, northeastern Colombia. The author never had the opportunity of sampling these units: they are evaluated through the geological literature. Overlaying Late Jurassic marine and continental sediments (Cosinas Group, fide RENZ, 1960), brown and purple graywackes and fossiliferous limestones of Valanginian age, were called Palanz Formation (RENZ, 1960). The Bivalve *Buchotrigonia (Syriotrigonia) lorentii* (Dana), is found in the Valanginian of Perú, and the Valanginian-Early Hauterivian of Colombia, is one of the index fossils of the hypersaline Carib Graben (HIGGS, 2009). It seems to have been deposited during a regressive cycles of the platform (SIMO et al., 1993). Unfortunately, no molluskan fauna of this unit, was ever illustrated and described.

Overlaying, a sequence of 350 meters of fossiliferous limestones, partially dolomitised, and sandy, marls and nodular limestones of Early Hauterivian age were called Moina Formation, (RENZ, 1960; ROLLINS, 1965). Marls in the middle member contained *Olcostephanus and Olcostephanus (Rogersites)*, suggest a Late Valanginian age; the origination of *Choffatella decipiens* suggests Early Hauterivian. It is related with an extension of the shelf (SIMO et al., 1993). According to RENZ (1960), the Palanz and the Moina Formations, were deposited in continuous sequence on the outer shelf. The Exogyrid and Trigoniid Bivalves are of great size, which together with Echinoids *Toxaster, Salenia and Heteraster*, suggest a saline sea, deposited on inner shelf, with normal hydrodynamisme.

PALANZ FORMATION, and KESIMA MEMBER.

RENZ (1960) and ROLLINS (1965) published the known information on thid unit. Te sequence comprises: 1) Lower buff sandstones, 2) Middle biohermal or marly limestone (Kesima member), and, 3) Reddish brown upper sandstone. The unit reaches a thickness variable from 592 to 972 meters. The Kesima member is composed of dense, massive, dark grey biodetritic limestones, which interfinger laterally with very sandy limestones, marls, nd calcareous shales, reaching a total thickness of 300 meters. The fore-reef facies carries an abundant macrofauna composed of Hermatypic Corals, Calcareous algae; the marly limestones have thick-shelled Bivalvia, terebratuloid Brachiopoda, and Ammonites. Among the Bivalvia, *Aetostreon, Ceratostreon, Trichites, Isognomon, Buchotrigonia (Syriotrigonia)* are the commonest.

Age: The presence of the ammonite *Argentiniceras cf. noduliferum* (Steuer) indicates a Berriasian to Valanginian age for the Palanz Formation's Kesima member. All the mollusks cited, are also found in Morro Blanco and El Cazón Formations, of eastern Venezuela, confirming the age of the ammonite.

Paleoenvironments: The paleoenvironment of Palanz Formation varied from continental to shallow-marine, along a W-E trend in the Cocinas Hemigraben. In the carbonatic Kesima member the monomictic presence of Hermatypic Coral, *Actinastrea* sp., in all the carbonatic horizons, - besides the Bivalvia cited,- suggest a strongly saline

environment. Thick-shelled Bivalves generally flourish in high-energy environments, inside the tempestite-forming sedimentation, from 10 to 60 meters of paleo-depth. This unit was part of the shelfal sedimentation, inside the Carib Graben.

MOINA FORMATION.

RENZ (1960) and ROLLINS (1965) published the known information about this unit. The Moina Formation at the type locality presents a three-fold lithic subdivision: 1) Lower limestones, in part massive, tan grey to black, interbedded with soft, grey marly fossiliferous shales, 2) A Middle marl and marly limestonme, with local lensatic sandstones, and 3) Upper massive limestone, coarsely chrystalline, containing specially abundant shell debris; they are generally sandy. The thickness of the unit is 307 meters. The dominant group of Mollusks, are thick-shelled bivalvia: *Aetostreon, Lucinoma, Catinula, Mediterraneotrigonia, Rutitrigonia, Megacucullaea and Idonearca.* No gastropods were observed.

Age: The Ammonites *Olcostephanus astierianus, Saynoceras, Crioceras,* and the Nautiloid *Nautilus cf. perstriatus* Steuer altogether indicate an age of Late Valanginian to Hauterivian (ROLLINS, 1965). Most of the Bivalvia are also found in the correlative El Dantó Formation, of Eastern Venezuela.

Paleoenvironments: According to ROLLINS (op. cit.) it was depoited "under the beach and near-shore shellbank environment." The presence of Ammonites, Nautiloids and *Choffatella sogamosae* (Karsten), in the middle marl member, suggest paleodepths down to 200 – 300 meters**,** and a good connection to the oceanic waters nearby. The upper massive limestones, bioclastic and sandy, sems to be a typical tempestite (EINSELE & SEILACHER, 1982), fitting well the regressive trend of the Late Hauterivian (SIMO et al., 1994). The "coarsely crystalline" character could suggest emersion of the bottom, where in tropical humid conditions, the vadous diagenesis re-crystallized the whole rock. The coarse grains of quartz were part of the sediments transported by the storms. The total absence of Gastropods would be the evidence of hypersaline water conditions.

YÚRUMA FORMATION.

According to ROLLINS (1965) is broadly divisible into two lithic units: 1) Lower marl and shales, and 2) Upper limestone. The lower marl is composed of soft, tan to grey, nodular marls and marly limestones, and grey to black, thinly bedded shales. Both are richly fossiliferous, and highly biodiverse. The upper limestone unit is composed of dense, evenly bedded, bituminous limestone and lesser amounts of interbedded black, calcareous shales. They are aphanitic, and contain a few small shell fragments. Near the top of the Upper Yúruma, the uppermost limestones are more massive, calcarenitic, and contain thick-shelled Molluskan fauna. The thickness measured is 269 meters (ROLLINS, op. cit.). The lower marl contains ammonites and echinoids. Among the Bivalvia, are common: *Pterotrigonia, Mediterraneotrigonia, Isognomon, Ceratostreon, Idonearca, Aetostreon, Ptychomya, Ludbrookia* and small-sized *Astartemya (Freiastarte)* which are mostly suspensivore and endobenthic genera. The only gastropod cited is the predator *Tessarolax boussingaulti.* All these are taxa in common with Taguarumo Formation of Eastern Venezuela.

Age: Early, Middle and Late Barremian, identified through the Ammonite fauna (ROLLINS, 1965).

Paleoenvironment: A biodiverse Ammonite fauna, composed of involute shells, as *Nicklesia, Haploceras, Pedioceras, Pulchellia, Pseudohaploceras,* and heteromorphicflores shells, as *Crioceras, Leptoceras, Ancyloceras and Ptychoceras,* suggest an outer shelf of paleodepth between 120 and 320 meters**,** exposed to oceanic currents. The abundance of taxa and individuals of *Ostracea,* and the absence of *Pectinacea and Rudists,* suggesting low concentrations of oxygen in the water above the bottom. The presence of black, bituminous limestone, is typical of a reducing environment called "euxinic facies" (RENZ, 1960-b). The presence of fish bones covered by vivianite in the middle member, and lensatic limestones evolving to pseudo-nodules (MACSOTAY, ERLICH & PERAZA, 2003) shows the similarities with the Late Cretaceous La Luna and Querecual Formations. The topmost massive limestone contains a distinctive fauna of large "Ostrea" and "Exogyra", and thus forms an "oyster bank" (ROLLINS, op.cit.). This is very much alike to *Aetostreon latissimus, Ceratostreon boussingaulti* and *Amphidonte subhaliotoidea* association, in a biostromal setting, frequently seen on the top of Taguarumo Fornmation (ARDAENS, ,1980, fig. 12) and also in Chuparipal Formation (MACSOTAY & ALVAREZ, 1987), all contemporaneous. This assemblage was erroneously interpreted as regressive, but it is the opposite: is a sign of rapid subsidence (MACSOTAY, 1980-b).

The Yuruma Formation in Atarigua para-autochthone. The Atarigua para-autochthone studied by STEPHAN (1977, 1982) consisted in Cretaceous sedimentary rocks exposed in a Tectonic Window,

between the Allochtonous Caribbean Lara Nappe and the Autochthonous Merida Andes sequences. Inside a gully in the Hacienda Escorzonera, State of Lara, a very fossiliferous sequence of violet-color sandy shales and marls in submetric beds, was reported by MACSOTAY (1980-b: 36-37, fig. 12). This sequence, with abundant solitary corals, and an elongated belemnite *Hibolithes?* is rich in Bivalves: *Aetostreon spp., Pterotrigonia, Pachytraga, Protocardia spp., Ludbrookia, Matheronia, Myophorella and Rutitrigonia.* The associated Gastropoda are: *Discohelix, Nummocalcar, Pseudomelania, Discotectus, Diptyxis and Nerinella,* are all taxa in common with Taguarumo Formation, and its Lope member.

Age: It is considered as Early Barremian, previous to the origination of the Caprinidae *Amphitriscoelus and Praecaprina.* The "Yuruma Formation" seem to fit well with the Lower marl and shale unit of the typical Yuruma Formation, of the Cosinas Hemigraben. The abundance of solitary corals and the frequent gastropoda, suggest good water circulation and an optimal oxygenation, in a saline water environment.

APON FORMATION (=Lower COGOLLO, fide RENZ, 1960; ROLLINS, 1965).

The sequence comprises: 1) Fine grained splintery bluish grey limestones in metric beds, interbedded with bioturbated marls, carrying small bivalves, 2) Black limestones thinly bedded with flattened ammonites; the transition is gradational. The top of the sequence is an alternation of aphanitic limestones and light brown cherts (silica), forming beds and nodules. This thinning and fining upward sequence measures 450 meters.

Age: In the lower beds, the ammonites *Colombiceras, Deshayesites, Parahoplites and Uhligella*, indicate a concurrent range zone of *Deshayesites deshayesi,* of Bedoulian (Early Aptian) age. From the middle marls, MACDONALD (1968) collected ammonites, which were identified by R. W. IMLAY, as of Late Aptian (=Gargasian?) age: *Cheloniceras, Uhligella, Acantohoplites and Gargasites.*

Paleoenvironments: RENZ (1960: 333-334) named this "lower unit of the Cogollo Group" as an "intermediate facies" between euxinic and neritic facies. Two guide-beds in the lower part of the unit, carry "big specimens" of *Exogyra (=Aetostreon latissimus)* and "oysters" (=*Arctostrea colubrine).* Both bivalve species have an unusual bathymetric ranges: they flourished on the middle-outer shelf, well below the Cretaceous tempestite-level, 60 meters. Benthic foraminifera and Radiolaria are common in all the section, including *Choffatella decipiens* Schlumberger. At Punta Espada locality, fish remains are also common, and the top of the lower section, "small Caprinids and big rudists", also mentions *Lopho (sic), =Gyrostrea (Pseudogyra)?.* The genera *Aetostreon and Rastellum (Arctostrea),* have an unusual bathymetric range: well below the Cretaceous tempestite-level, at about 60 meters. This reefal-looking horizon is sharply covered by black limestones alternating with black shales an pseudoconcretions, carrying a Late Aptian Ammonite association: *Parahoplites - Acanthohoplites* assemblage zone (BULOT, 1994). Above goes the 50 meter-thick sequence of limestone/marl alternations, with small Bivalves as *Astartemya (Freiastarte), Acila (Truncacila), Nuculoma,* an assemblage typical of the Garcia Formation, (DBG, DGC, sDLP) of eastern Venezuela. The Global Anoxic Event (GAE) named "Selli" by COTILLON (1989) and ROBASZYNSZKI (1989) is located in the Early Aptian, but its effects are still detected in the early Late Aptian. This included upwelling of deep, hypoxic waters on the tropical shelves, influencing readically the benthic fauna.

CHAPTER VI.
DISCUSSION

KAUFFMAN in HALLAM (1973) plotted the "average distributions" of Cretaceous biogeographic Units (=Biochoremas) based on Bivalvia relative to a DIETZ & HOLDEN (1970) palaeogeographic map of Turonian age. The results were 17 Provinces and Subprovinces for the whole planet. The attempt of finding these provinces and subprovinces in the Early Valanginian (140 Ma), Early Aptian (120 Ma) and Late Albian (100 Ma) palinspastic maps (BARRON et al., 1981, figures 3, 4, 5), showed me a quite variable frame.

During the Early Valanginian times, 17 Biochoremas were identified, with the distinction of an African Province (MASSE, 1985) replaced by Gondwanan Province here. There are four Subprovinces: Southern Caribbean, Maghrebian, Syrian and Somalian (See text fig. II-05). The Peruvian Subprovince is barely distinguishable from the S.C.S., due to the influence of the Proto-Pacific Ocean. The endemism is generally low, and the evaporitic sedimentation, dominates the shelves.

The Hauterivian age is marked by an increase of widespread outpourings of clastic wedges, from mayor deltas on North America (Missisaque Formation on the Nova Scotian shelf and the Grand Banks) on Europe, represented by Wealden deposits in England and the mainland of Europe, (see ALLEN, MONGIN and RAT in Colloque sur le Cretacé Inferieur, 1963) on northwest Africa (represented in the Tantan Formation, in the Tarfaya Basin of Morocco) on northcentral Africa (The Sened Group of Tunisia, fide BUROLLET, 1989) on the Cape Province of South Africa (represented in the Sundays River Formation, reported by RIGASSI & DIXON, 1972). Also great clastic wedges are located in Colombia-Venezuela borderland, as the Rio Negro Formation and in northeastern Venezuela (represented by Bergantin Sandstones and Picuda Formation) as an infill of active hemigrabens on the shelves. Scarcity of marine plankton, influenced a photic zone, extended from the surface down to 240 meters or more, whose lower limit was marked by a pycnocline, separating marine waters of different salinity and density.

For the Hauterivian age, was identified the Faraoni Oceanic Anoxic Event (see Plate 1)

in all the Western Tethys Region (BODIN et al., 2006). One of the outstanding features was the high rate of burial of phosphatic sediments. Hauterivian prodelta muds carried abundant organic matter, detrital plant remains and river-transported bivalvia shells, that originally lived in extensive lakes and brackish lagoons inland (La Margarita mudstones). The deep North Atlantic is thought to have been separated from the Pacific by two submarine ridges: the Bahamas-Blake tracts, and the Chortis and Tahamí-Calima shelves with their volcanoes (Text-fig. I-02), which only allowed the circulation of shallow waters.

During Barremian-Early Aptian the east-west oceanic communications improved, and the Tethys fauna reached easily the Eastern Japanese Islands and the guyots of the Izumi and Pacific plates. Salinity is still wide-spread on shelves, and Bivalvia still dominated above Gastropoda in the S.C.S. Echinoids were wide-spread and incrustant Polychaeta were abundant. During the Early Aptian times, 19 biochoremas were identified, with the differentiation of Eastern Mediterranean Subprovince in three units: Western European, Apulian and Balkanic Subprovinces. In the Taguarumo Formation, a saline shelfal environment is annually flooded by brackish waters, rich in iron and manganese salts carried by the Espino Hemigraben´s megariver: A Barremian-Aptian proto-Orinoco. The result is a "Konservatlagerstätten"characterized by a very high palaeobiological information content (RUST in SANCHEZ-VILLAGRA & MACLEOD, 2014). These habitats were well-oxygenated and nutrient-rich, explaining simultaneously the high abundance and diversity of benthic organisms: 192 taxa of benthic molluska and polychaeta were identified in Taguarumo Formation and its Lope member, the highest of all the Eocretaceous units of Venezuela. On the outer shelf, the contemporaneous Chuparipal limestones carry a rich *Nerinean* fauna together with big-sized gastropoda: *Harpagodes, Arcotia, Trochonerita*, suggesting euhaline waters from the open ocean. During the Early Cretaceous, the rise of predatory taxa, (TAYLOR et al., 1980) played an important role in the "Mesozoic Marine Revolution" (VERMEIJ, 1977). But *Trochacteonidae, Itieriidae and Phaneroptyxisinae* suggest saline waters. Rudists are minor components in these biotopes.

During Early Aptian times, the Selli Anoxic/Dysoxic Oceanic Event, (OAE) which in the Pacific Ocean

started during the *Globigerinelloides blowi* Zone, (BRALOWER et alii., 1993, fig. 2), affected the oceanic circulation, and the climates of the emerged lands. The stratigraphic record is based on the thicknesses of the TOC-rich horizons. In the Atlantic and Tethys Oceans the Selli OAE was registered in higher horizons, in the *Schackoina cabri* Zone, (ROBASZINSKI 1989) extended to the *Globigerinelloides algeriana* Zone (BUROLLET, 1989). Massive extinctions with *Dasycladacean algae, Orbitolinidae* and Rudists were registered along Bedoulian/Gargasian contact (Early-Late Aptian) by MASSE (1989). This event is located actually at 120 – 119 Ma, according to GRADSTEIN et al. (2012) in the stratotype area, France. It could be attributed to the decrease of the thickness of the photic zone.

The Late Aptian times (Gargasian and Clansayesian stages) in the whole Tethys Ocean area, represent a deepening of the oceans. Tectonic activity, as the beginning of subsidence of the neighboring plates to the east and west, started to delineate the future Caribbean Plate. With the subsidence of Bahamas-Blake Plateau and Chortis Block, increased the oceanic circulation, and the molluskan faunal exchange. Tipified in Eastern Venezuela by García shales and El Cantil-Borracha limestones, it shows a Bivalvia-Gastropoda relationship to 70 : 30, for first time during the Cretaceous Period.

During Albian times, two extensive transgressions cover areas emerged during Neocomian-Aptian times in the Caribbean area (SIMO et al., 1993). With the start of Early Albian, the Paquier OAE event introduced black shale facies in all the subsident areas of the Caribbean Graben. The S.C.S. reaches optimum faunal exchange with Gondwanan Province´s all subprovinces, favoring thermophyllic Bivalvia and Gastropoda both. The surface waters reach tropical conditions in all the Tethys-related seas (24ºC - 28ºC) with the salinity descending to Neogene levels. The exposure of the Ocean's surface produced extensive hurricanes all along the Tethys Ocean margins. New genera and families originate. On the continental margin of Eastern Brazil and western Africa, extensive evaporitic sedimentation is registered during Aptian-Albian times (CAMPOS et al., 1974), exrtending southward to the Rio Grande-Walvis Ridges.

Towards the end of Middle Albian, there was a general regression, related to the break-up of Gondwana into South America and Africa, iniciating the exchange of surface marine waters between Tethys Ocean and South Atlantic. A new Global Disoxic/Anoxic episode was registered at the start of the Late Albian (with no name) and carries important geochemical changes into the deep oceans (ROBASZYNKI, 1989). Tempestites became frequent on all the shelves around emerged lands, while the organic matter of continental origin flooded the whole water column (ERLICH et alii., 1999). Once again, *Bivalves* became favored in all shelfal environments, where flourished also locally a Gastropod fauna of *Actaeonellids* (saline) and *Nerineans – Tylostomas* (predators). Additional evidence on the high energy induced by frequent storm-seasons are the Bivalvians: more thick-shelled, strongly costulated valves during Albian times, than the preceding Aptian or following Cenomanian times. The outstanding families are: *Chondrodontidae, Exogyridae, Plicatulidae*, all calcitic shelled molluska.

The Latest Albian – Early Cenomanian time lapse was strongly influenced in all the Western Tethys Ocean, by a dysoxic/anoxic Oceanic Event, coincident with the *Biticinella breggiensis* Zone, (104-101 Ma)(BRALOWER et al., 1993, figure 2). According to ARNAUD et alii., (1999) this event would influence the La Puya member of Peñas Altas Formation, whose biodiverse ammonite fauna belongs to *Callihoplites auritus* Zone, proposed by O. RENZ (1971). The other unit, would be the Lower Majagual Formation, present in both distal domains (DAGM, DEP) of Northeastern Venezuela, whose rich *Nerinean* and Rudistid fauna are barely studied (VIVAS & MACSOTAY, 1998). This no-name event, originated a balanced Bivalve/Gastropoda relationship, when Brachiopoda became frequent. Since Late Berriasian times in the S.C.S. it would be the first euhaline, truly oceanic interval.

The first transgression, of Late Albian-Early Cenomanian may be due in part to a change in subsident rates in Western Venezuela (ERLICH et alii., 1999: 220). During Middle Cenomanian times and Oceanic Anoxic/Dysoxic Event called Bonarelli**,** originates a crisis in shallow water biota (SIMO et al., 1993), a totally anoxic environment is installed in eastern Venezuelan Querecual Formation (VIVAS, 1986). See Plate 1.

Late Turonian. In the S.C.S. area the Late Turonian times whitness a strong regression (SIMO et al., 1993). In all the Tethys and the Atlantic Oceans, the intense anoxia is replaced by dysoxia, and the thickness of the beds (limestone/shale) is gradually reduced (ROBASZYNSKI, 1989). The Guayacan Member of Capacho Formation, is representative of marine conditions on shelfal settings. Endobenthic thick-shelled suspensivore bivalves dominate, and

the few gastropoda are carnivorous in habits. The oligomixicity of the fauna suggests saline environment as was proposed by HIGGS (2009-B), counterdicting GARCIA JARPA alii. (1980).

ORIGIN OF THE HIGH SALINITY ON GONDWANA PROVINCE SHELVES.

Latitudinal Diversity Gradient (LDG). Did it exist during Eocretaceous times?

The study of 825 benthic molluskan taxa at planetary scale and a time-span of 54 Ma, is an outstanding opportunity to compare the LDG-s of the Cretaceous Period with those of the Quaternary and Recent. After all, the gradient we see today has been produced over geological time: most of the species living today having originated over long time scales, at last more than 100.000 years ago. (C. JARAMILLO in SANCHEZ-VILLAGRA & McLEOD, 2014). For many years, the Cretaceous maps of LDG have been based on distribution of bioconstructors, corals and rudists (COATES, 1973) and the distribution of Carbonate platforms (SIMO, SCOTT & MASSE, 1993).

Cretaceous Carbonate Platforms during the Middle Cretaceous, were more symmetric than today; sea level was 100 – 200 meters higher than present, (Text-Figure VII -06) and about 20 % of the continental area was flooded (BARRON et al., 1980). Also, warm water marine invertebrates were displaced significantly poleward with respect to their present location (SOHL, 1987; MASSE, 1992), indicative of a seasonally warmer climate in higher latitudes than today. The Cretaceous platforms occupied larger shallow-water areas and extended farther north and south of the 30º latitude than the Holocene platforms (SIMO et al., 1993, figs. 1 and 2).

However, ice-rafted deposits in both northern and southern hemispheres indicate seasonally cold climates (FRAKES & FRANCIS, 1988). Glendonites – pseudomorphs of calcite after ikaite,- collected in the Upper Deer Bay Formation, Valanginian of Sverdrup Basin (Arctic Canada), are among the minerals used as indicators of polar marine depositional environment (KEMPER, 1987: 19-25, Plate 1). Climatic modeling should be better constrained by geologic data as the distribution of climatically sensitive lithologies (evaporites and coal beds) of carbonate and siliciclastic platforms, faunal composition and changes (Text figure VII – 02 and 07).

The warmer Middle Cretaceous climate (>32 ºC, in tropical areas) and higher sea levels coincided with an increase in accumulation rates of organic carbon; approximately 60% of all known oil reserves are from the Cretaceous (IRVING et al., 1974; SCHOLLE & ARTHUR, 1980). Cretaceous climate and the increase in organic carbon (Text-figure VII-07) have been correlated to an increase in worldwide ocean crust production and mantle outgassing (LARSON, 1991) and a high primary productivity (PEDERSEN & CALVERT, 1990) due to warm, saline bottom waters (HERBERT & SARMIENTO, 1991) and anoxia (GRACIANSKY et al., 1984; SCHLANGER & JENKINS, 1976).

With the dominantion of Rudist Bivalves over corals in the Middle and Late Cretaceous reef ecosystems (SCOTT, 1988; KAUFFMAN & JOHNSON, 1988), Cretaceous biota differs from that of Holocene reefs. During the Eocretaceous, the dominantion of non-rudist Bivalves and Echinoids over Gastropods in the S.C.S. (this study) is the best evidence to the salinization of the extensive shelfal platforms, exposed to intensive sunlight. Palaeontological research during late years, evidenced a clear provincialism starting with Early Aptian times (MASSE, 1982): in the Mediterranean area three latitudinal provinces are observed: The European Province (including West European-Apulian-Balkanic subprovinces) the Gondwanan (S.C.S., Maghrebian, Syrian and Somalian subprovinces), and the East African Province. My explanation for these faunistic continuities of Bivalvian Genera around Gondwana Continent is that salinization was more determinant than temperature on epicontinental shelves in the migration pattern, at last during Neocomian and Gallic Subsystems. When KAUFFMAN in HALLAM (1973, fig. 2) published his concept of Cretaceous Biogeographic units, having no explanation for the trans-temperate genera that ranged widely on either side of the Tethys, (COATES,, 1973) but were not common within it. They reflect a Cretaceous climate, with broad gradational climatic zones not prohibitive to widespread migration of adaptable taxa. The relatively high percentage of cosmopolitan bivalves during the Cretaceous also reflects an evolutionary phenomenon of more Bivalve groups than is the case now. LDG is not a static pattern over Geological time-scales.

Relationship between the silicification and the hypersalinity/salinity phenomena.

When RYAN & CITA (1977) published their revolutionary study of Ocean-wide stagnation phenomena, they presented oceanic deep-water

sediments, establishing a relationship among the Atlantic and Indian Oceans during Cretaceous times. Now I am trying to do the reverse: finding bathyal-abyssal evidence as these influenced the sedimentation on the continental shelves and the palaeoclimate of the emerged lands.

The silica problem.

In his silica-anomaly studies of Cretaceous-Cenozoic deep oceans, A. T. S. RAMSAY (1973) presented a silica-anomaly map for the Early Cretaceous (Text-figure VII-01). With the up-dated knowledge of Plate Tectonics of the Caribbean region, (PINDELL & ERICKSON, 1994; VILLAMIL & PINDELL, 1998 and HIGGS, 2009-b) we see a clear coincidence with the areas of active rifting. The HIGG's (2009-b) model presents an active rifting separating North from South America, since Middle Jurassic (Bathonian) times, introducing in the Inter-Americas Ocean, an important volume of silica (Text-Figure I-02a, 02b). During Eocretaceous times, the collision of Tahamí-Calima Terrane against the Colombian Craton, introduced more silica in the Carib Graben´s waters.

The Cromwell Current.

The Equatorial undercurrent (Cromwell Current) located in the Pacific Ocean, flowing from west to east, and is centered in the thermocline at depths of 50 to 150 meters. It flows at speeds up to 150 cm/sec. This current is particularly well developed in the Central and east Pacific, (VALENTINE, 1973) where it attains 300 meters of thickness. It is 400 Km wide, and is symmetrical about the Equator (SAUNDERS in AUBOUIN et al., 1980). The transport of this current is remarkably high, about 40 x 10^6 m^3/sec (KNAUSS 1963). It is likely the largest current in the Equatorial Pacific Ocean.

The Cromwell Current is considered to be due to geostrophic flow, in response to the horizontal pressure gradient which would result fom mixing across the thermocline, at the equator. Its position would have remained stable through the Cenozoic Period, though its depth and strength would depend on the development of the thermocline (SAUNDERS, op. cit.). Plate motion studies show that the Caribbean and the Panama Gap were between 0º and 10º North, during the Paleogene and this is well placed to funnel the Pacific Equatorial countercurrent and undercurrent into the Caribbean.

Its activity during Cretaceous times is not demonstrated yet, but the important faunal migration of benthic molluska originated at the Pacific and Izanagi Plates (Text-Figures VII-04 A, B) to the S.C.S., is a good evidence of this activity during Neocomian-Barremian times.

A more powerful westward flowing current through the Caribbean would perhaps not have developed until the Late Cretaceous when the widening seaway of the South Atlantic would have allowed a strong flow of water to develop as the precursor of the North Ecuatorial Current System that has been important ever since (SAUNDERS, op. cit.). Flow of deep currents westwards through the Caribbean Basins would depend on the importance at the time (Neocomian-Barremian) of the North-South ridges – Bahamas-Blake plateau, (MEYERHOFF & HATTEN, 1974) Chortis and the Calima-Tahami terranes. This flow attained importance during Albian-Cenomanian stages, when a deep-sea channel was opened in Western Mexico (CORDOBA et al., 1980; TARDY et al., 1980), where the excess of saline and silica-rich waters were dispersed in the north Pacific; this is reflected in the Molluskan Fauna of California (ANDERSON, 1958).

Palaeobathymetric estimates of the Carib hemigraben.

When HIGGS (2009-b) proposed the Carib Graben (Text figure I – 02b) he gave no clue about the bathymetric cirumstances, except that it was not an active rift, and it was not an emerged land, either. ERLICH et alii., (1999, fig. 2) gave a better picture of Western Venezuela/Eastern Colombia area. It separated the deep intra-cratonic El Cocuy, Uribante, Machiques and Barquisimeto Troughs, (more than 200 meters of depth) from the remaining shelfal areas, (less than 120 meters). Santa Marta and Santander Massifs were emerging at the time, while Arauca, Mérida and El Baúl Archs were Cratonic remnants, subjected to erosion (Text-Figure VII – 02). This map has the advantage of fixing constraints to the palaeobathymetric ranges to paleogeographic maps as those of VILLAMIL & PINDELL (1998), at last in Western Venezuela. It is important to observe, the frequency of natural obstacles to water circulation, all along the wide shelf (300 Km in NW-SE sens in Venezuela, and >500 Km E-W sens, in Central Colombia). This circumstance is enough to develop an evaporitic basin, as was predicted by HIGGS (2009-b). The Neocomian-Barremian submarine volcanic activity of the deep-water-laid Tuff Series in the Greater Antilles also added important volumes of silica to the marine waters, contributing to the stratification of the seas. The Eocretaceous shelf extended offshore, down to 360-400 meters of palaeodepth (MACSOTAY, 1980-B), and it did not develop a shelf-break, until glacio-

eusacy originated it during Late Miocene-Recent times.

Paleontological evidence of the salinization during Neocomian/Gallic times of the Carib Graben.

GILLET (1963), was astonished (in pre-Plate Tectonic time) by the unusual northward migration of certain *Trigonia* species during Valanginian-Hauterivian times from the Patagonian Subprovince to South Africa and Texas, which defied all the established climatic zonations. The questioned taxa, were *Steinmannella (Transitrigonia), S. (Steinmannella),* (Text-Figure VII- 05) but many more *Trigoniidae* followed this path. Also have followed this distribution pattern, *Mediterraneotrigonia, Rutitrigonia, Buchotrigonia (Syriotrigonia)* and *Megatrigonia.* The Genus *Iotrigonia* supposedly endemic in the Indo-Pacific region (KAUFFMAN in HALLAM, 1973), migrated to Venezuela and Morocco, during Valanginian times. All are densely, and strongly costulated *Trigoniidae,* suggesting saline or hypersaline marine waters.

VILLAMIL (1992) described three species, *Buchotrigonia (B.) etayoi, B. (B.) kauffmani and B. (B.) perezi,* well differenciated taxa collected from the turbiditc sequence of the Cáqueza Group, Colombia of Berriasian age. They were associated with *Mediterraneotrigonia* and *Ptychomya,* also strongly ornamented bivalves. This evidence shows that the rapidly subsident Cundinamarca Aulacogen (FABRE, 1973) was filled with saline marine waters, since the very beginning of its formation. The following upfill of this aulacogen includes Rio Batá series, with halite and gypsum, Cáqueza and Macanal mudstones, Rosa Blanca evaporitic limestones, and Las Juntas sandstones.

The Eocretaceous was a time-lapse, with a deposition of Calcium-rich evaporitic silts on the shelves of most continental areas (Text-Figure VII – 06) coincidental with the generally transgressive sea level. The well known Urgonian-type limestone sedimentation, is characteristic, and it is not found during Late Cretaceous or Cenozoic times (L'Urgonien des Pays Méditerraneens, 1979, RAT & PASCAL, 1982).

RYAN & CITA (1977) wrote: "in the context of both land and sea areas, the Late Mesozoic "(Cretaceous) may have conceivably been the major carboniferous period of the earth "since the end of the Precambrian." The distribution of the Anoxic-Disoxic marine sediments about the Cenomanian-Turonian transition is necessarily the consequence of the earlier silicification-salinization processus in the enclosed oceanic areas (Text-Figure VII – 07). The detailed geochemical analysis of this processus is detailedly discussed in ERLICH, PALMER-COLEMAN & LORENTE (1999). The toxicity of the benthic sediments along the borderland of these anoxic/disoxic seas gave place to massive extinction of vertebrates and invertebrates; it was the opportunity for the necrophagous gastropods, as *Actaeonellidae, Trochacteonidae* and perhaps *Acteonidae,* to proliferate.

Evolution of the bioconstructions in the Tethys Ocean.

During the beginning of the Eocretaceous, the dominant associations, were the Coral-Stromatoporoid-Rudist buildups. In the Gulf-Atlantic Coast, the Western European and Somalian subprovinces, during Berriasian-Valanginian times, extensive banks of coral- stromatoporoid assemblages (FINNERAN et al., 1984; SCOTT, 1984) reached 100 m of thickness. These carbonatic ramps developed during the earliest Cretaceous transgressive progradational cycle. The same situation is observed in the basal Morro Blanco limestones, (VIVAS, 1987) and its seaward rampslope, where dolostones with micro-algae and stromatoporoids formed El Cazon Formation (FURRER & CASTRO, 1997). In Venezuela, a coral-stromatoporoid boundstone, with sponges, oncolites and the earliest rudist, is the patch-reef "Las Cinco Ceibas"(WELLS, 1944) with Late Hauterivian shelfal fauna, located in the lower Taguarumo Formation. The Coral-Algal-Rudist buildups in Venezuela, are mostly represented in the Chuparipal Formation, (Barremian), Tibú (Late Brremian-Early Aptian) and lower Borracha (Late Aptian) all in offshore paleopositions. They represent the Urgonian buildups of Western European and Balkanic subprovinces (COTILLON et alii., 1979, MASSE, 1980; RAT & PASCAL, 1982), in the S.C.S., and have no equivalents in Colombia, at all. These shelf-margin buildups are parts of prograding limestone facies complexes. A higher CO^2 content of the atmosphere will promote carbonatic deposition (BROECKER, 1971).

All Early Aptian-Early Albian bioclastic limestones in Venezuela, including the thickest of all, El Cantil Formation, are composed of algal, molluskan and echinoid detritus (ROD & MAYNC, 1954, ARNAUD et alii., 2000). Coral and rudist components, are rare or absent, suggesting the salinity anomaly. The Rudist-Dominated Biostromes, are restricted to the Majagual Formation, and Guayamure facies of the Peñas Altas Formation, (Late Albian-Early Cenomanian, 50 and 20 meters,

respectively) where the Caprinidae *Mexicaprina* is the dominant genus (VIVAS & MACSOTAY, 1998). Again, there is no equivalent in Colombia, where the hypersalinity endured more time, than in Venezuela. My explanation: the S.C.S. localities located near the tropical belt, were empoverished due to the saline/hypersaline condition of the marine waters, where the Scleractinian corals were definitely in disadvantage.

Negative evidence of the Salinity/Hipersalinity.

I am calling as "negative evidence"the fact that Invertebrate groups that are otherwise cosmopolitan or wide-spread in the Cretaceous seas, are totally or partially absent of a Biochorema or a great region within it.

STEVENS in HALLAM, (1973) analysed the palaeogeographic evolution of Belemnitids. As in Middle and Late Jurassic, climatic zonation is thought to have had a major influence on Cretaceous belemnite differentiation, although SALINITY, depth habitat and palaeogeography also contributed. Differentiation of Early Cretaceous belemnites into Boreal and Tethyan faunas is interpreted, like their Jurassic counterparts, as largely reflecting distribution of stenothermal animals adapted to life in cold-teperate-mixed waters (Boreal) and warm-temperate or tropical waters (Tethyan). Belemnite isotopic temperature studies support this interpretation STEVENS, (1971).

Divisions within the Early Cretaceous Boreal belemnites (Arctic and Boreal-Atlantic) probably largely reflect temperature divisions of sea water temperatures within the cold-temperate zone: Arctic Belemnites, because of their distribution peripheral to the Cretaceous North Pole, presumably being colder forms (STEVENS in HALLAM, op. cit.).

No Belemnitid was ever cited from Colombian Jurassic or Cretaceous. In Venezuela, a small individual of *Belemopsis sp.* was collected in the lower Carorita Formation, in the allochthonous Lara Nappe, in Valanginian-Hauterivian age, Lara state, Central Venezuela (MACSOTAY & PERAZA, 1997: 10, pl. 2-2a). *Belemnopsis* during Berriasian-Valanginian stages was reported from Himalayas, Madagascar, Botswana and Patagonia; during Hauterivian-stage, only survived in Patagonia (?)(STEVENS in HALLAM op. cit., plate 1).

In Venezuela´s autochthonous sequence, the only horizon where belemnitids were identified, *Neohibolites wollemanni* Stolley, and *N. minor* Stolley (Plate 40, figures 16, 17, 18) are localities of Valle Grande Formation, of Middle Albian age (DGC) in the Serranía del Interior Oriental. *Neohibolites* by contrast, seems to be a Tethyan genus, present also in Pakistan, India, Madagascar, Japan, western North America and Patagonia, during Aptian-Cenomanian times. This distribution, shared with *Parahybolithes,* is very similar to many calcitic-shelled bivalves as *Ceratostreon, Aetostreon, Mimachlamys, Grypheostrea and Rhynchostreon,* in euhaline-saline waters, subjected to hurricane-activities. Again, is a proof of absence of Latitudinal Gradients during the Eocretaceous.

Another important group, are the *Echinoids.* MOORE, LALICKER & FISCHER (1952: 703-709) stated: "Echinoids, like other echinoderms, are restricted to marine waters, where they "range from intertidal zone down into abyssal depths." In Venezuela and Colombia, Irregular Echinoids have been identified, as *Heteraster, Holaster, Holectypus, and Toxaster* are cited in the literature, mostly from carbonatic – mostly marly,- sediments. B. CLAVEL, (writt. comm., Jan. 25, 1995) identified *Heteraster mexicanus* (Cotteau), *Macraster polygonus* Agassiz, from El Cantil Formation, Late Aptian-Early Albian age where they were abundant. *Tetraromania moussoni* (Desor), *Holectypus macropygus* Agassiz, *Hemiaster minimus* Desor, *Discoides decoratus* Desor, *Holaster aff. H. prestensis* Desor, were identified from Chuparipal Formation, of Late Barremian age, are all Irregular Echinoids. By the contrary, *Rhabdocidaris cf. R. brasiliensis* (Maury) and *Pseudocidaris sp. indet.*, - from the Chimana and Valle Grande Formations, (DAGM) of Middle Albian age, are Regular Echinoids. From Western Venezuela, COOKE (1961) cited *Holectypus planatus aponensis* of Lisure Formation, *Phylobrissus zulianus* Cooke, from Tibú Formation, and *Enallaster (Washitaster) bravoensis* Böse, from Maraca Formation, are all Irregular Echinoids. It seems to be that the Irregular Echinoids had no problems to survive (and thrive) in saline waters, as much as there was enough sapropel suspended in the water.

Nautiloid Cephalopods. The only Nautiloid cited from Venezuelan Cretaceous is *Heminautilus etheringtoni* Durham in Tibú Formation of Late Barremian-Aptian age, (RENZ, 1959: 9).

Ammonites. Venezuelan eocretaceous sediments are poor, compared to those of Colombia, in their ammonite content. ETAYO-SERNA (1985a, 1985b; HAAS, 1960) have studied a moderately biodiverse Eocretaceous ammonite fauna in Colombia, present even in evaporitic facies. PERAZA (1999) plotted the Ammonite fauna studied by RENZ (1982) on the northern Venezuelan paleofacies map of PARNAUD et al., (1995) and concluded, that the ammonites

were of pelagic and nektonic habits during the short periods of Euhaline conditions, well above the pycnocline. And this, mostly happened during Late Cretaceous times. I attribute the heteromorph ammonites fauna of Colombia, to the paleodepth (1000-2000 meters) attained by the Cundinamarca Aulacogen, where the saline zone, was underlain by fresh, oceanic cold water, of Pacific origin. These conditions never existed in Venezuela´s Eocretaceous.

CHAPTER VII.

CONCLUSIONS.

A) Palaeoecology.

The weakest issue in Cretaceous paleobiological research are the Palaeoecological interpretations. Exceptions are some multidisciplinary publications as ARNAUD et alii. (1999, 2000), ERLICH et alii (1999-a, -b, 2000), and individual efforts as SANCHEZ (1977) and ERICKSON (1994) where we found well funded interpretations. In the 1940^{s} and 50^{s}, Oil Companies realized how useful microfossils could be in helping the exploratory process and they established extensive paleontological teams to develop biostratigraphic schemes that could be used to solve geological problems. In the 1980^{s}, however companies started to shut down their own biostratigraphical operations and shifted towards the use of consultants as providers of biostratigraphc data (JARAMILLO in SANCHEZ-VILLAGRA & MACLEOD, 2014).

Unversities and research groups followed a similar path, without realizing that microfossils will not solve palaeoceanograhical problems: Metazoarian Megafossils do, and among these are the usually conspicuous Molluska, marine and non-marine. This is the reason why the palaeobathymetric estimates are so different from the traditional ones in this study. Years ago, (1992) when the biostratigrahic results were presented to the geological community of Venezuela, I commented astonished, that abundant discoveries in Venezuela, as the *Melathrokerion*-Zone, well known in all the Mesogean areas, as *Palorbitolinas and Mesorbitolinas* (4 new species) were discovered only after 50 years of Oil Exploration, with repercussion on formational datations, got the following answer from General Manager Hans KRAUSE: “Company paleontologists are paid to find Oil, not to do research!!”

B) The Bivalvia.

The Bivalvia are the most conspicuous Molluskan Class in the Eocretaceous of the S.C.S. marine sediments. Found in all lithotypes, their natural associations (Biotopes) reflect natural parameters, as depth, salinity, turbidity, hydrodynamisme, oxygen content, and seasonal variations. Following STANLEY’s (1970) approach: Endobenthic siphon feeders proliferated in soft muds, and sands in shelfal and upper slope environments. Infaunal non-siphonate suspension feeders dominated brackish-water deltaic systems, being a minor component in outer shelf assemblages. Epifaunal suspension feeders occupied hard-bottom environments, and proliferated in leptopel-rich waters; high calcium concentrations in saline waters originated the monomictic coquinas of extensive geographic distributions: *Plicatula, Amphidonte, Rhynchostreon* and *Chondrodonta.* Small sized epifaunal suspension feeders together with labial palp deposit feeders frequented in bathyal upper-slope marine silts and clays. Infaunal mucus tube feeders were well dapted to leptopel-rich deltaic mus, and to chemosymbiontic bathyal environments. With longer Biochrons than Gastropoda, the Bivalvia genera are very useful in the detection of dominant parameters: the discovery of the Eocretaceous salinity /hypersalinity in the Carib Graben, was due mainly to Bivalvia. The abundance of hurricane-activity was first noticed as tempestites in shallow-water sediments (ARNAUD et alii., 1999, Fig. 9) and later, by the increase of thickness of the valves of big-sized species, and the roughness of the ornamentations. The river-transported bivalve shells, deposited in prodelta carbonaceous muds, indicate that inland, had a sabana-type topography, with extensive lakes, connected with meandering rivers. And intensive seasonal rainfalls.

C) The Gastropoda.

The Gastropopda were barely represented in the hypersaline/saline Neocomian formations of S.C.S. The frequency of *Pseudomelaniidae, Purpurinidae and Cassiopidae* suggest an abundance of soft-bodied worm population in the unconsolidated muds. The *Aporrhaidae* as infaunal detritus-feeders, decreased in biodiversity after the Late Jurassic times. The *Nerineidae* which were an evolved and well-adapted clade during Late Jurassic times, reacted with the hypersalinization/salinization, reducing the internal fold systems originating two-

fold forms (*Diptyxisinae*), reducing their sizes and with only one weak fold, (*Cryptoplocinae*), developing four folds, with or without a wide umbilicus, (*Adiozoptyxisinae*), developing five folds, of unequal sizes and shapes also with optional umbilicus, frequently sealed with calcite (*Ptygmatisinae*). If the comparison with the Neogene *Turritellidae* stands, following STANLEY's (1970) ideas, but applied to Gastropoda, *Nerineidae would be* superficial soft-sediment bacteria-feeders, (ALLMON, 1984) in mostly silt-sand organic-rich lithofacies. The *Nerinellidae* would be the equivalents which specialized in toxic silty substrates, with iron, manganese and other heavy metal of terrigenous origin. The *Trochacteonidae* and *Itieridae* would be carnivorous families that proliferated on carbonatic bottoms in saline waters, probably active predators of the early Rudistids, during Barremian times. A successful Eocretaceous *Ampullariidae* family with algophagous genera as *Tylostoma, Ampullinopsis and Ampullospira*, invaded all types of bottoms, in saline to brackish waters. Highly active predators invaded hard-bottom environments: *Naticidae, Colombellinidae, Strombidae, Fasciolariidae* since Late Hauterivian, but they became abundant during Albian times. The increased toxicity of the anoxic/dysoxic oceans, contributed to the evolution on necrophagous families as *Acteonellidae, Acteonidae* and *Trochacteonidae,* active until the end of the Cretaceous. Eocretaceous *Nerineidae* are so useful as biostratigraphic markers, - valid for all Gondwanan subprovinces, - as are the *Trochacteonidae* during the Late Cretaceous of Transcaucasian regions (PCHELINTSEV, 1952, 1960, 1965).

D) South Caribbean Subprovince of the Gondwanan Province.

The S.C.S. evolved during Aptian times, as "Caribbean Province"according to KAUFFMAN in HALLAM (1973: 366), who ignored the fact that the Neocomian fauna is definitely Paleo-Pacific in origin. Recent studies considered as Early Aptian as the beginning of the provincialism of the South Caribbean Subprovince (MASSE & ROSSI, 1987), with 10,6 – 16,7 % of endemism, exclusive of cosmopolitan taxa. These authors splitted the Mexican and Texas localities as "North Caribbean Province", without providing a faunistic reason for it. The Rudist Genera started during Hauterivian stage: *Monopleura* and *Retha; Amphitriscoelus, Caprina, Kipia, Offneria* and *Pachytraga* were found together in Barremian-age Chuparipal Formation. This is observed simultaneously in Venezuela, Cuba and South Mexico (MACSOTAY & ALVAREZ, 1987; ROJAS-CONSUEGRA, 2002). Really representative Bivalvia genera are: *Idonearca, Gresslya, Agnomyax, Cretocardia, Megacucullaea, Mediterraneotrigonia, Fenestricardita, Xenocardita* and *Ptychomya,* are all present in the Hauterivian. The few Gastropod Genera, would be *Leviathania and Globiconcha.* They constitute the critical fauna to differentiate the S.C.S., starting the endemism.

E) Synonymies.

The 825 taxa of benthic molluska studied here, were shown to have at last 1.400 synonym species and subspecies. This had the advantage of extending the palaeogeographical distribution, to several Subprovinces, and even Provinces. In few cases, also extended the origination data and sometimes, the extinction one. In most cases, the stratigraphic horizons evidenced to be the same in areas so far away as the Balkanic, Syrian and Somalian Subprovinces, evidencing the value as biostratigraphic markers of many Bivalvia and Gasteropoda. The lack of access to appropriate paleontological literature in most of the involved countries is a limiting factor for research. The ignorance of lenguages – so common among paleontologists - is another limiting factor. American or English authors simply ignore the huge volume of information published in French, Spanish, German, Italian, Russian and so. It is an important handicap.

F) Palaeogeography.

The most important palaeogeographic feature in all the S.C.S. during Eocretaceous times, was the Cundinamarca Aulacogen (FABRE, 1983, 1985), whose palaeogeographic evolution stage by stage was well discussed by ETAYO SERNA et al., (1976). So, when MENDEZ BAAMONDE (1996, figs. 2-A, 2-B, 3-A, 3-B) published palaeogeographic maps where the whole area called "Maracaibo Platform" was occupied by shelfal carbonates, ignoring the extension of the usually deep hemigrabens with SW-NE orientations, nobody protested, not even the Biostratigraphical Commission of PDVSA. Finally, the salinity hypothesis of HIGGS (2009) was proved to be true in S.C.S., and extended to most of the Subprovinces of the Gondwana Province, by the benthic molluska found in them.

G) Ichnology.

The high Palaeoecological identification realized by Ichnological studies, (SEILACHER, 2007; BUATOIS & MANGANO, 2011), has reached far beyond the one attained by the micropaleontological studies. The ichnofauna collected together with the benthic molluska, have been extremely useful in the facies identifications.

I - 3. - ACKNOWLEDGEMENTS.

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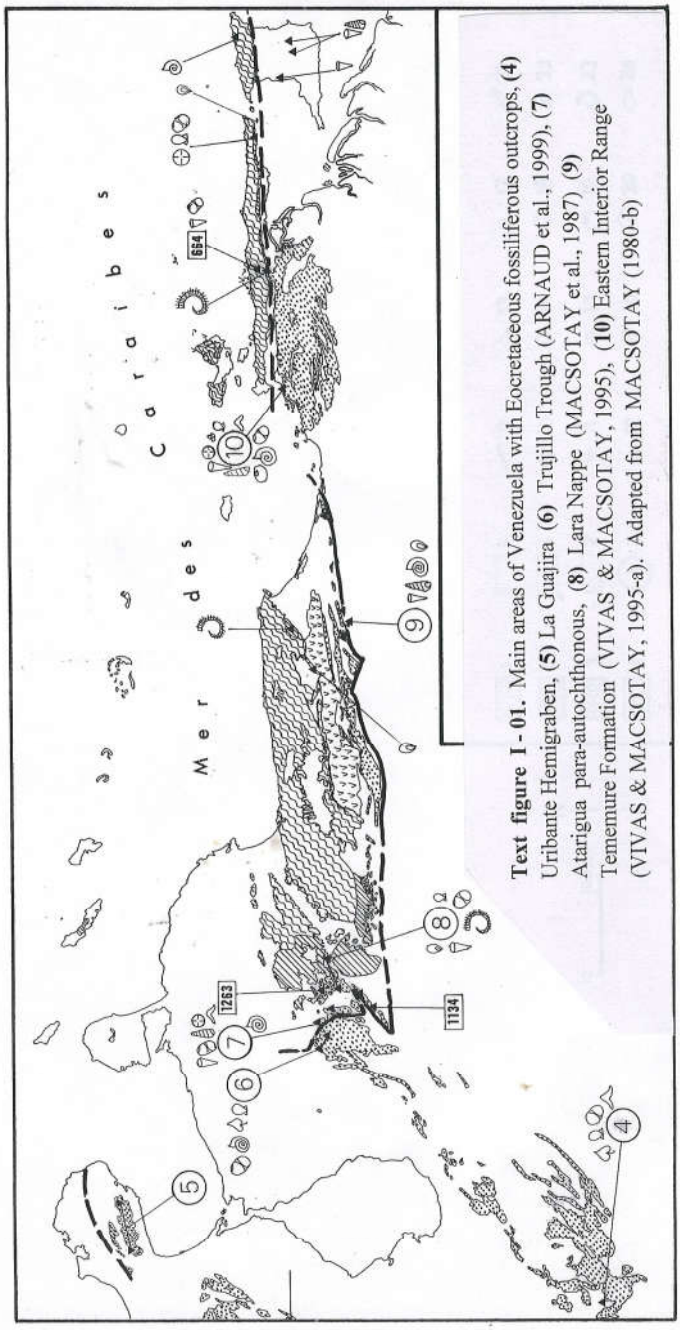
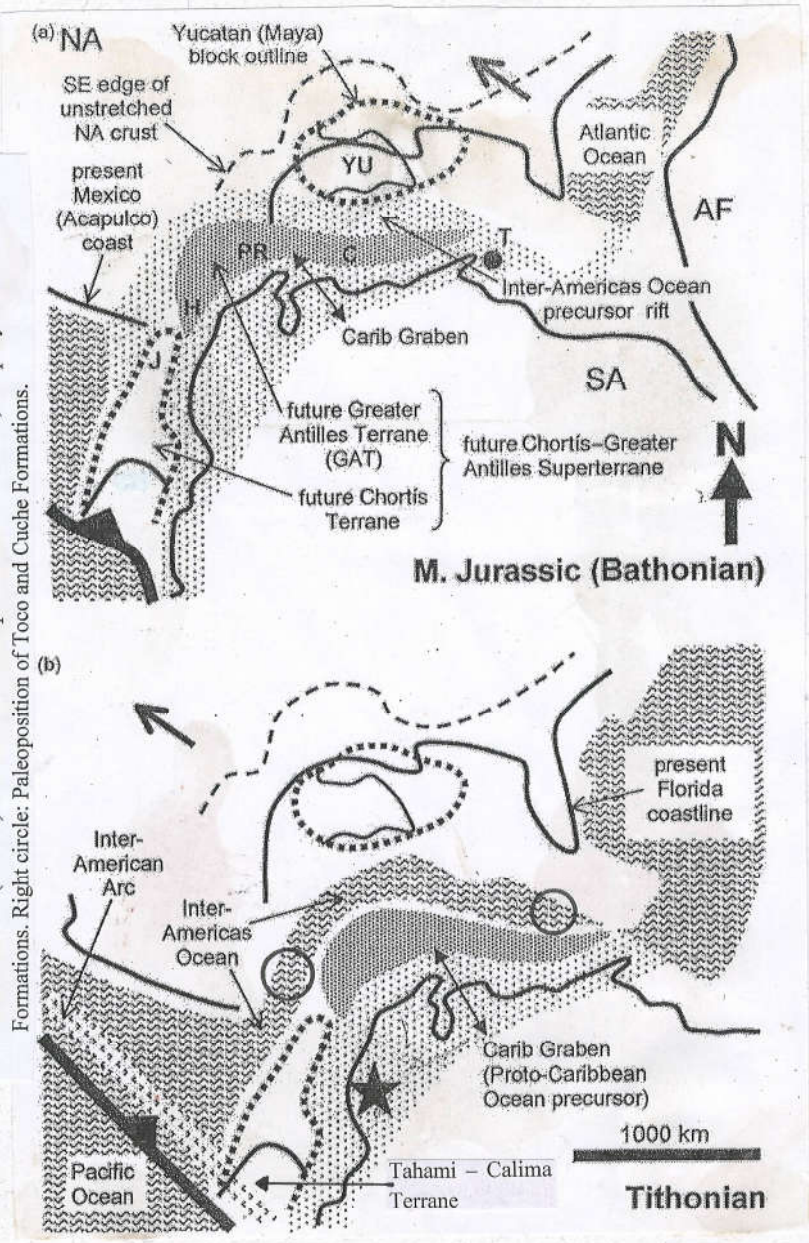
ABBREVIATIONS:

The following are the abbreviations used frequently in the text, with their English meaning:

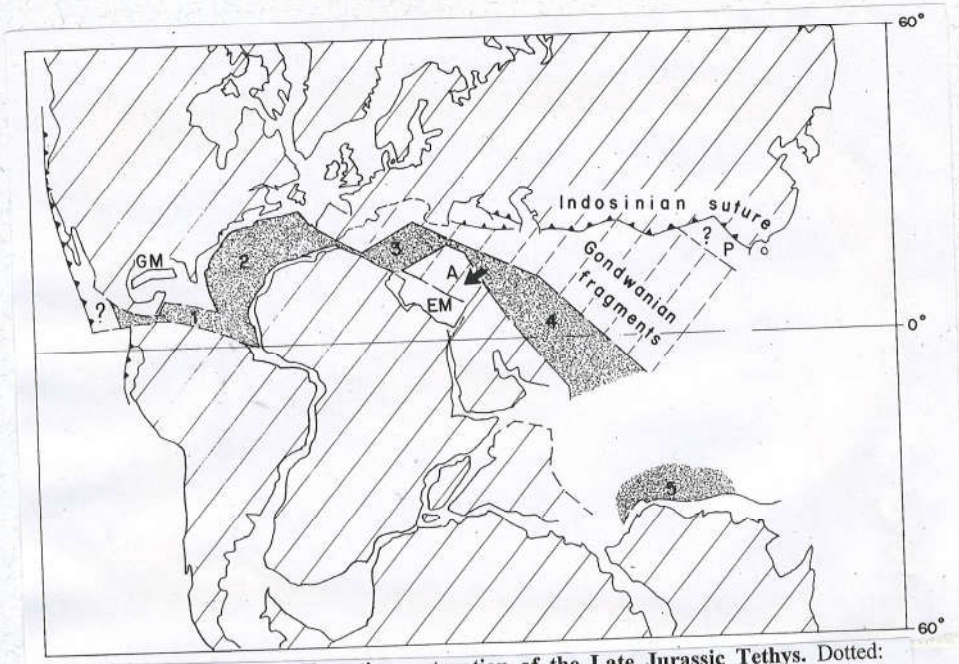
aff. - resembling to
auctt.- of authors
cf. – compared to
et al.,- and others
ex gr.,- of the same group
fig.(s)- figure (s)
ibid.-the same reference as former citation
ibidim.- formerly cited references
in situ.- in place
Km,- kilometer
LV. left valve
m- meter
Ma.- millions of years
mm.- millimeters
nom. mut.- replaced name;
nom. nov.- new name
nom.nud.- name without validation
non.- not of
OD.- Original Designation
part.- part of
RV.- right valve
sensu- according to
SD.-Subsequent Designation
s.l.- wide sense
s.s.- in the strict sense
=… junior synonym of.



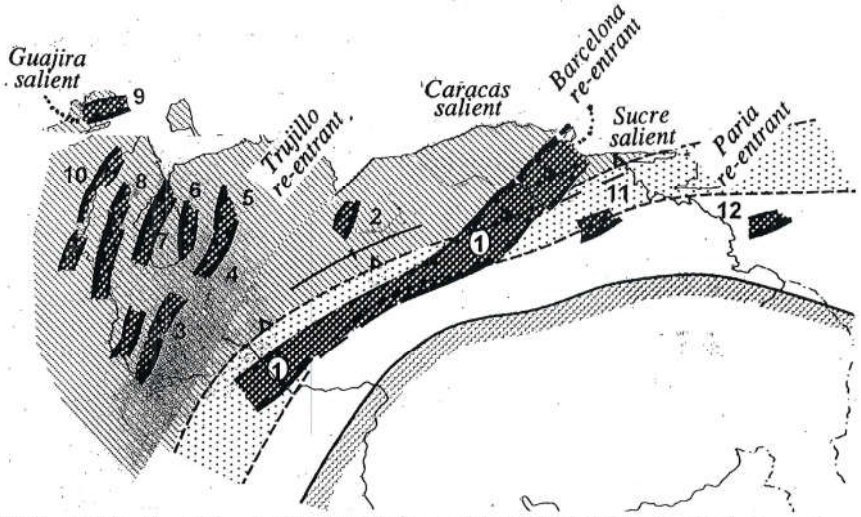
Text figure I - 01. Main areas of Venezuela with Eocretaceous fossiliferous outcrops. **(4)** Uribante Hemigraben, **(5)** La Guajira **(6)** Trujillo Trough (ARNAUD et al., 1999), **(7)** Atarigua para-autochthonous, **(8)** Lara Nappe (MACSOTAY et al., 1987) **(9)** Tememure Formation (VIVAS & MACSOTAY, 1995), **(10)** Eastern Interior Range (VIVAS & MACSOTAY, 1995-a). Adapted from MACSOTAY (1980-b)



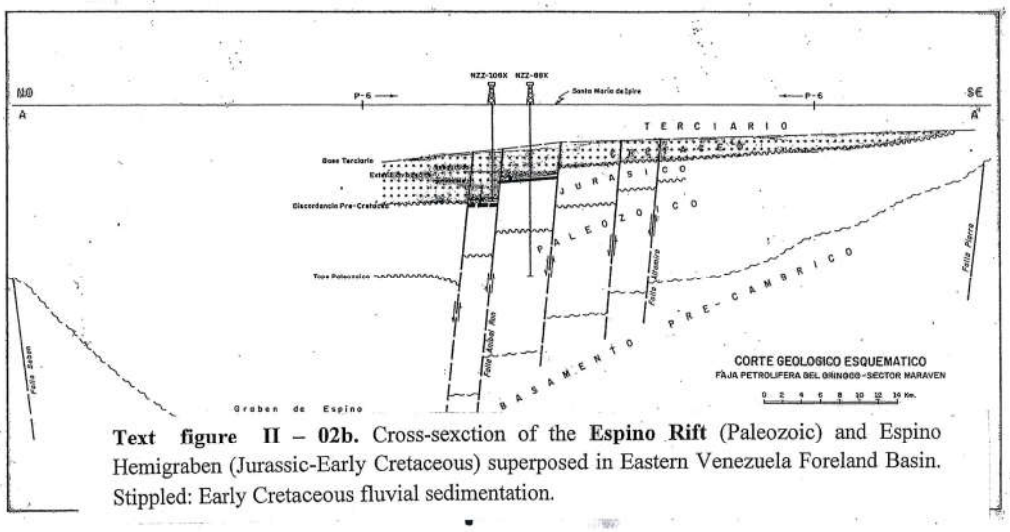
Text figure I – 02. Sequential plate reconstructions, Caribbean-Gulf of Mexico region from Middle to Late Jurassic. Wavy pattern is oceanic crust. Relative positions of North and South America Plates (NA, SA) through time from Pindell & Kennan (2001) in HIGGS (2009-a). **2a:** Middle Jurassic (Bathonian), **2b:** Late Jurassic (Tithonian). Taken from HIGGS (2009-b). Left circle: Paleoposition of Carorita, Mapuey and Bobare Formations. Right circle: Paleoposition of Toco and Cuche Formations.



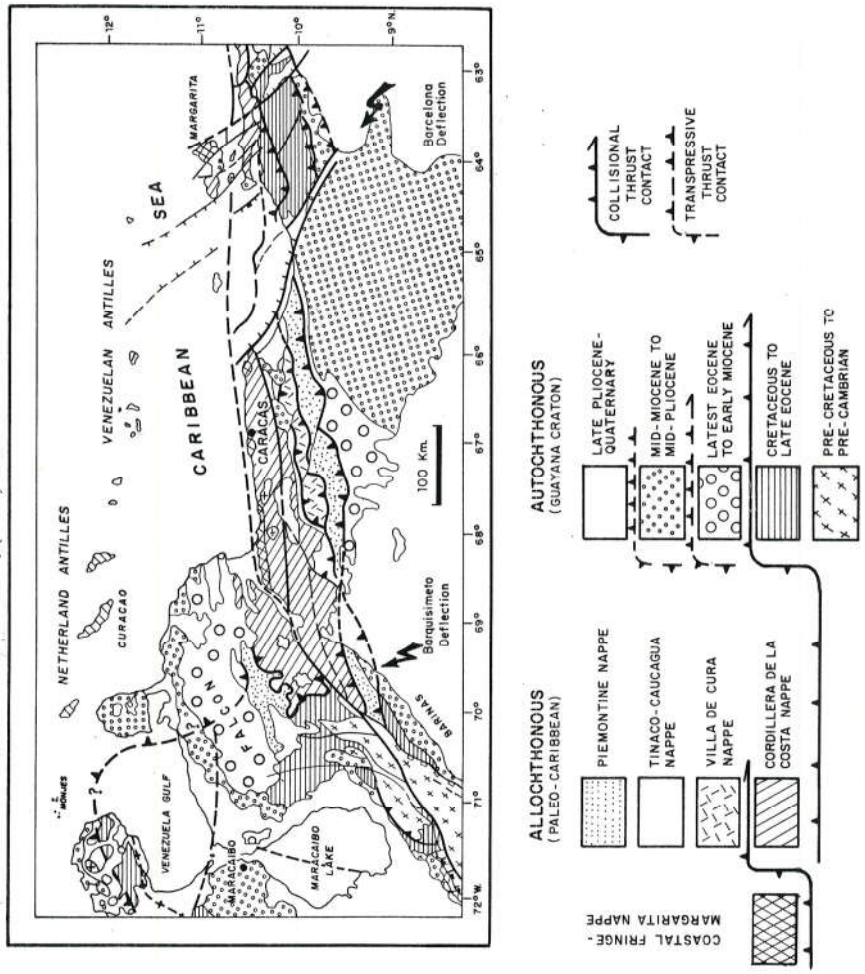
Text figure II – 01. Tentative restoration of the Late Jurassic Tethys. Dotted: Tethyan Jurassic Oceanic crust; 1. Caribbean Tethys, 2. Central Atlantic, 3. Piedmont-Ligurian ocean; 4. Oceanic Tethyus from the Vardar zone to the Indus-Tsang Po zone; 5. Northwest Australian margin; GM: Gulf of Mexico, A: Apulian block, EM: eastern Mediterranean. After BERNOULLI & LEMOINE (1980, fig. 4).



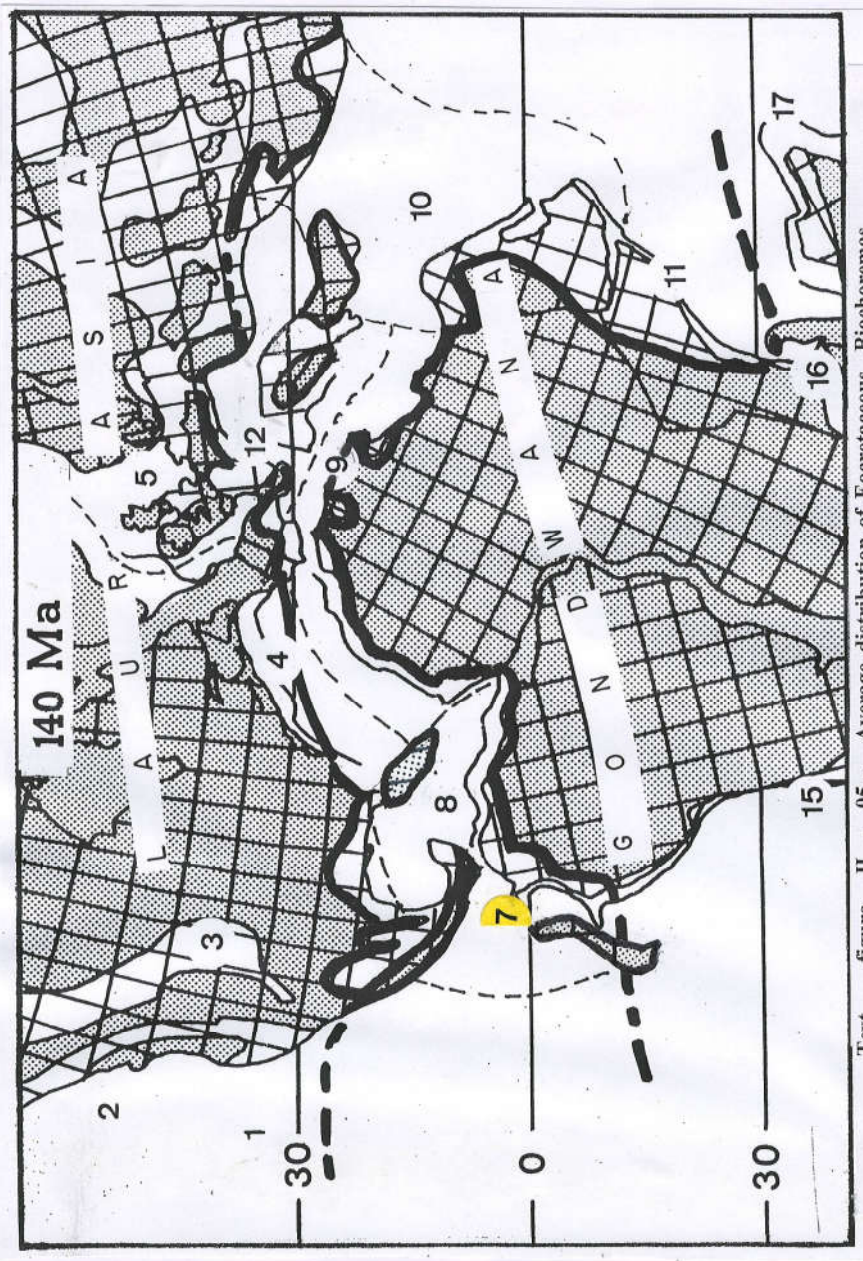
Text figure II – 02a. Active Aulacogen and Hemigrabens during Late Jurassic times, on palinspastic restoration of Venezuela and Trinidad, (STEPHAN, 1985; PINDELL, 1994) modified from Léxico Estratigráfico de Venezuela (1997, fig. 2). Coastal nomenclature taken from PINDELL & ERICKSON (1994, fig. 5). (1).-Espino Aulacogen/Hemigraben, (2).- Guacamayas, (3).- Angaraveca-Uribante, (4).- San Lázaro, (5).- Valera, (6) Bachaquero, (7).- Urdaneta, (8).- Machiques, (9).- Cocinas, (10).-Cerrajón, (11) San Francisco, (12).-Deltano.



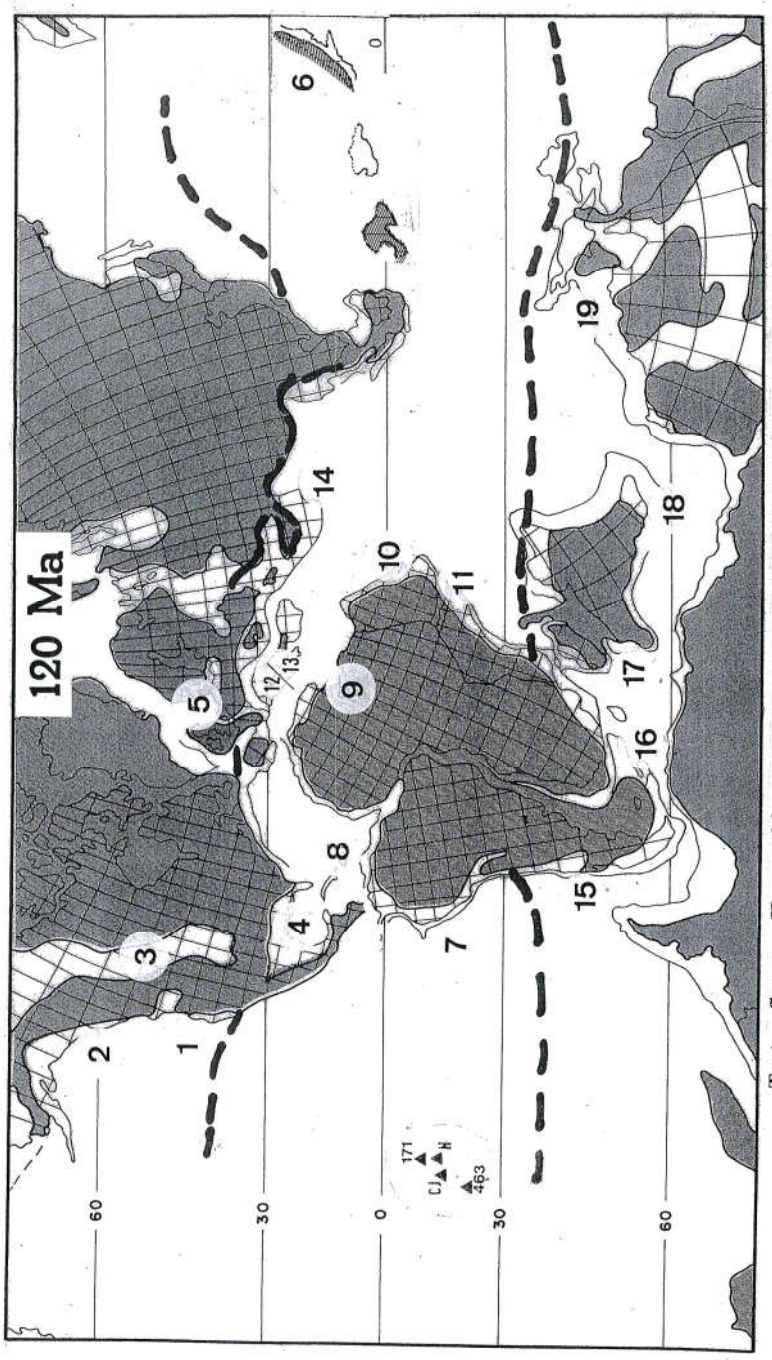
Text figure II – 02b. Cross-sexction of the **Espino Rift** (Paleozoic) and Espino Hemigraben (Jurassic-Early Cretaceous) superposed in Eastern Venezuela Foreland Basin. Stippled: Early Cretaceous fluvial sedimentation.



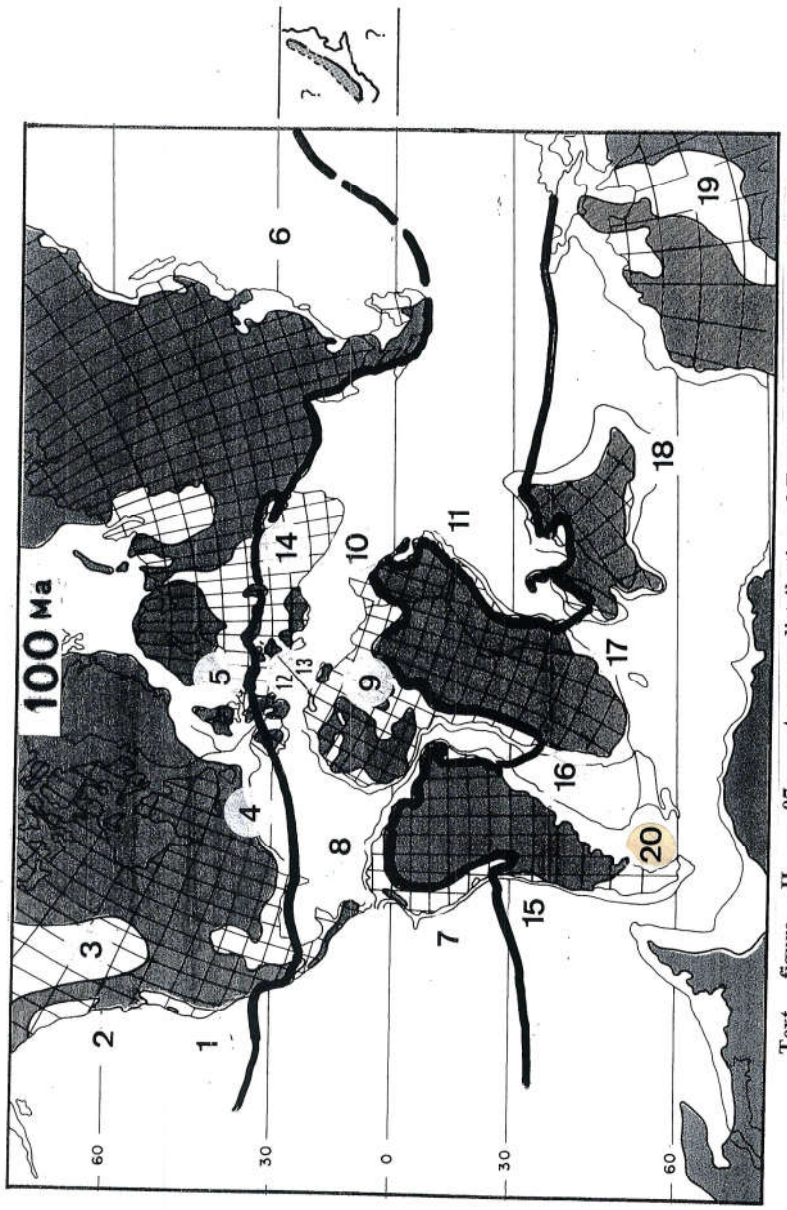
Text figure II - 04. Synthetic Geological Map of Northern Venezuela. Base map: BELLIZZIA et al., (1976), simplified version of C. BECK, (1977). Geology updated by MACSOTAY, VIVAS & PERAZA, (1997).



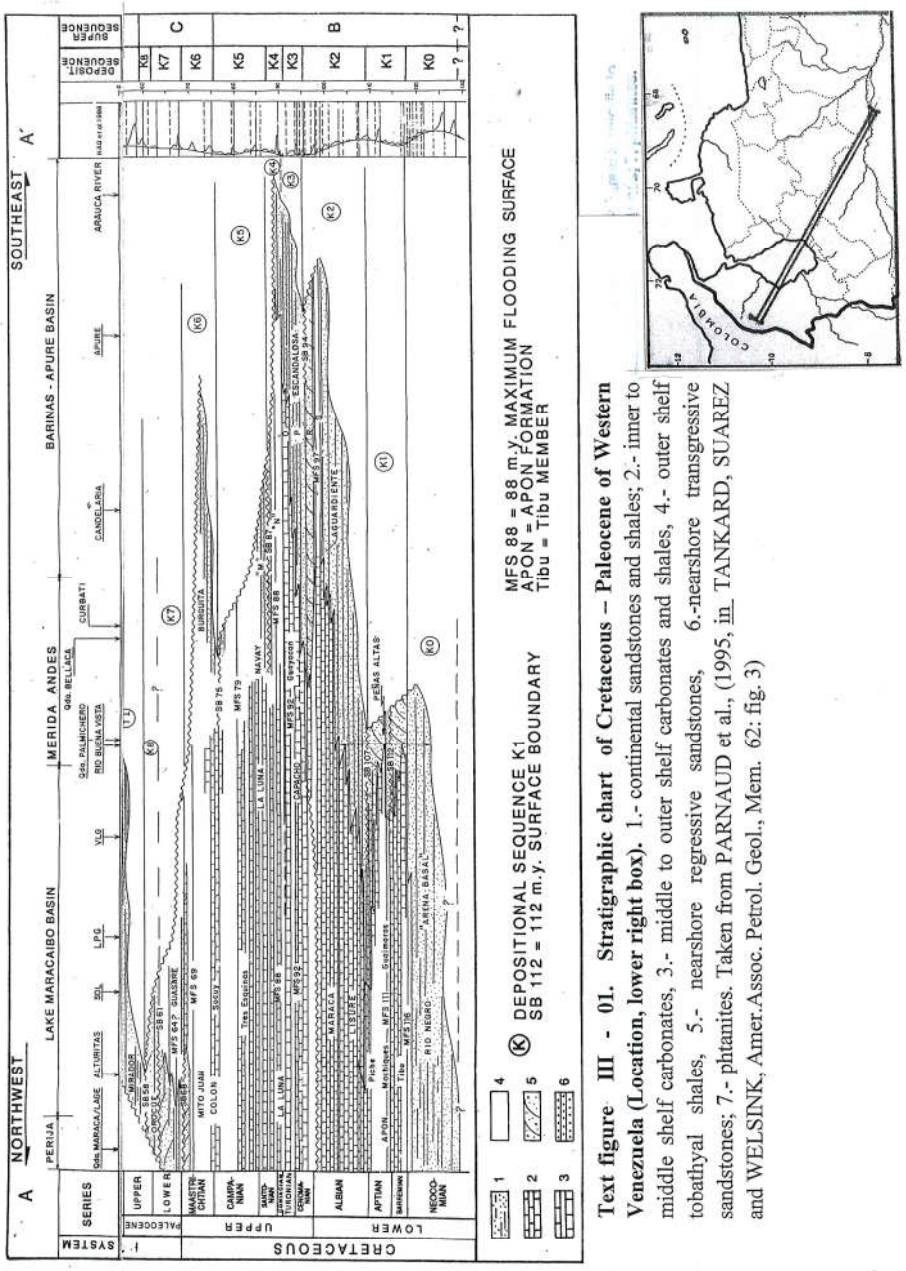
Text figure II - 05.- Average distribution of Eocretaceous Biochoremas (=biogeographic units) based on Bivalvia plotted on BARRON et al., (1981, plate 3) reconstruction following plate tectonic results. Note the provincial/subprovincial nomenclature of KAUFFMAN (1973) modified herein. Stippled areas are composite plot of continental areas not inundated during Early Valanginian stage (140 Ma).



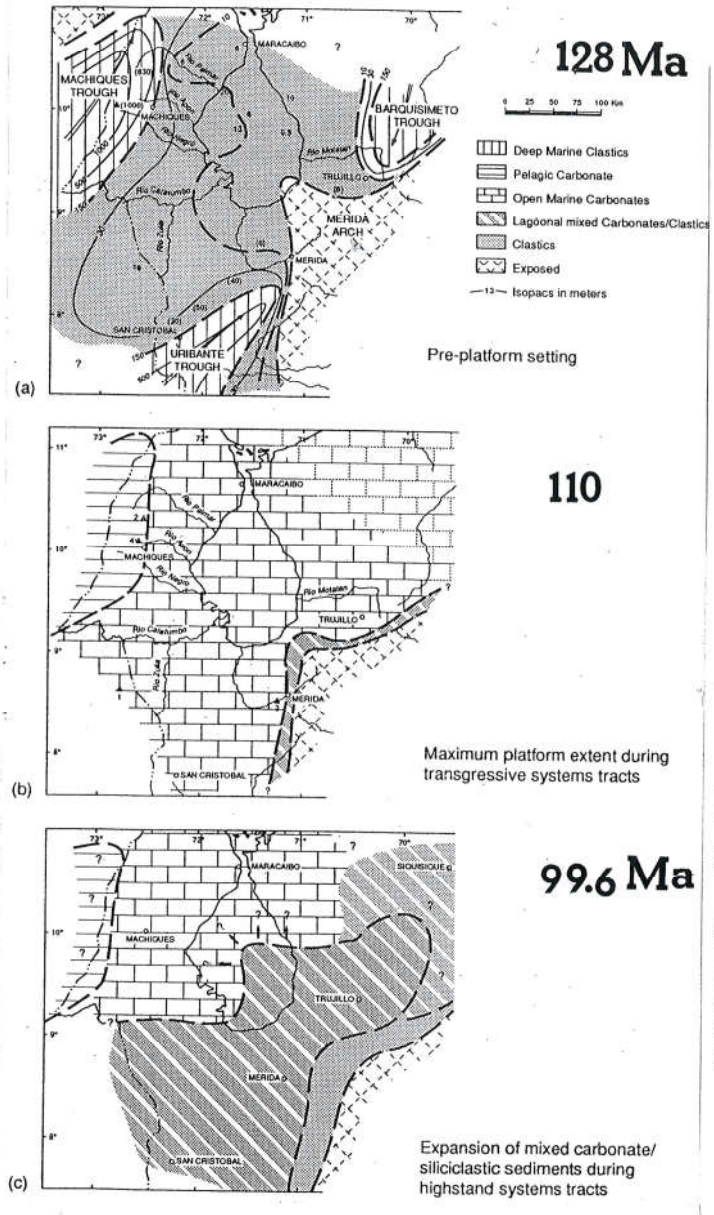
Text figure II - 06.- Average distribution of Eocretaceous Biochoremas (=biogeographic units) based on Bivalvia plotted on BARRON et al., (1981, plate 4) reconstruction following plate tectonic results. Note the provincial/subprovincial nomenclature of KAUFFMAN (1973) modified herein. This map represents 120 Ma., now considered as Early Aptian.



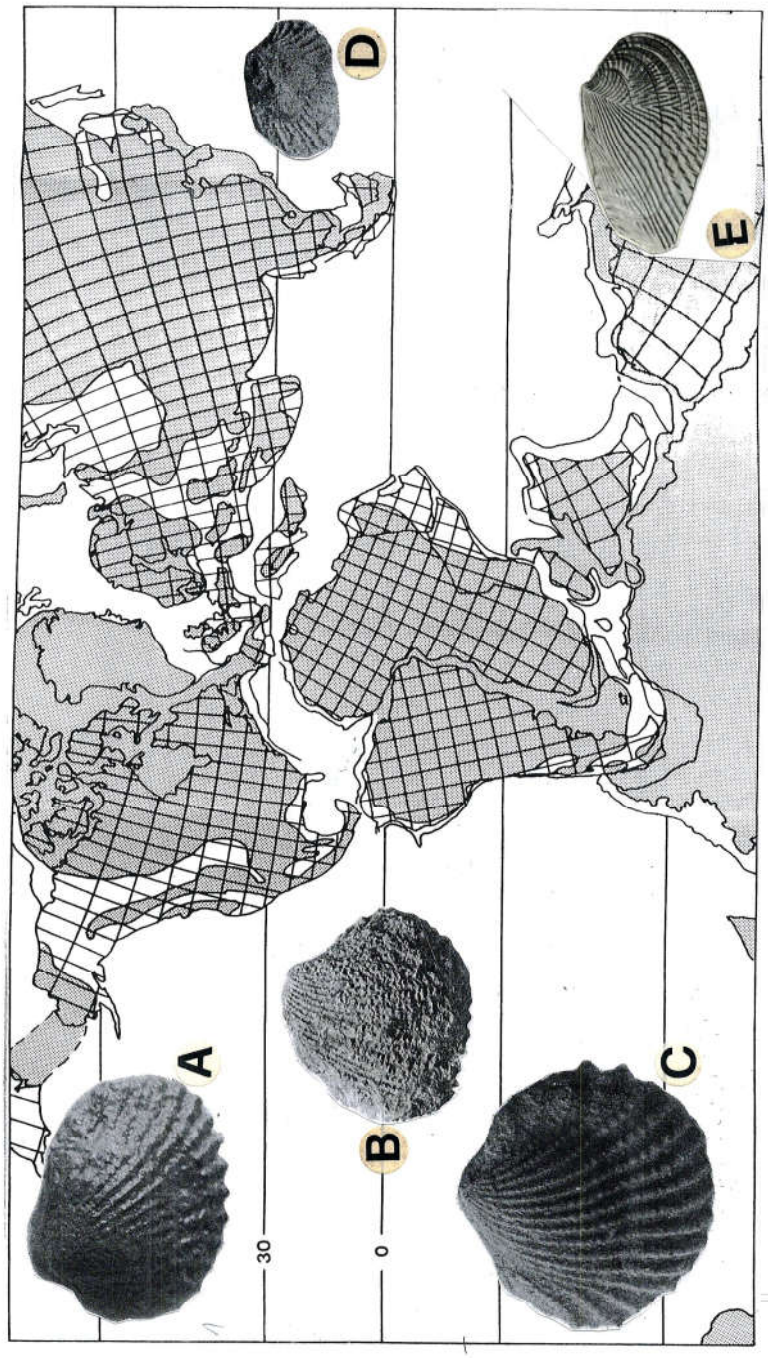
Text figure II - 07.- Average distribution of Eocretaceous Biochoremas (=biogeographic units) based on Bivalvia plotted on BARRON et al., (1981, plate 5) reconstruction following plate tectonic results. Thick line separates the bioconstruction-rich "tropical" from Boreal and Austral areas. Note the nomenclature of KAUFFMAN (1973) modified herein. Stippled areas are a composite plot of continental areas not inundated during Late Albian stage (100 Ma.)



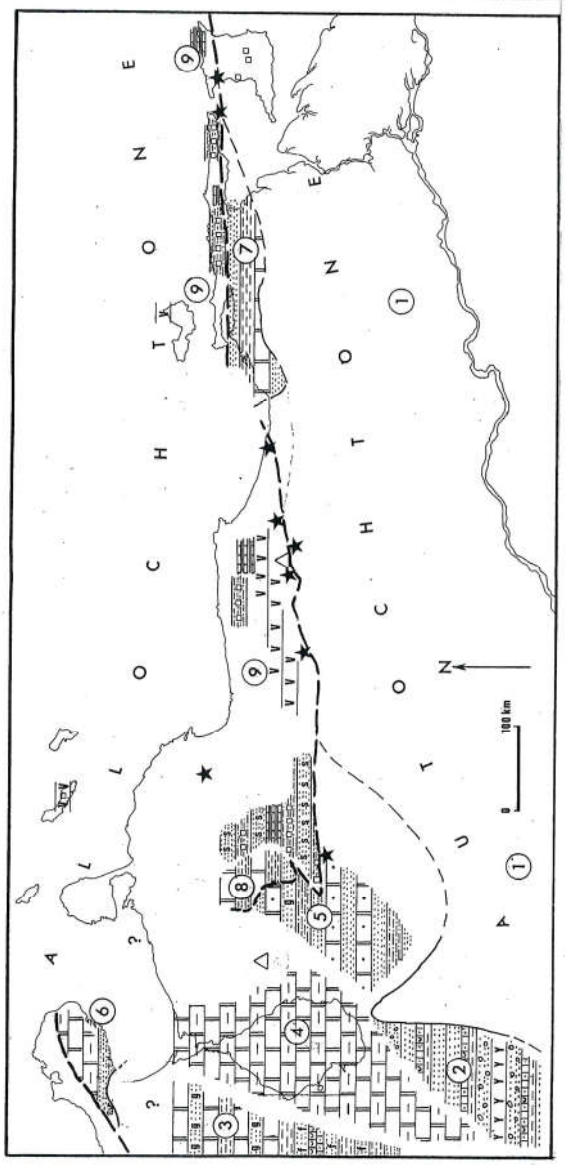
Text figure III - 01. Stratigraphic chart of Cretaceous – Paleocene of Western Venezuela (Location, lower right box). 1.- continental sandstones and shales; 2.- inner to middle shelf carbonates, 3.- middle to outer shelf carbonates and shales, 4.- outer shelf tobathyal shales, 5.- nearshore regressive sandstones, 6.-nearshore transgressive sandstones; 7.- phtanites. Taken from PARNAUD et al., (1995, in TANKARD, SUAREZ and WELSINK, Amer.Assoc. Petrol. Geol., Mem. 62: fig. 3)



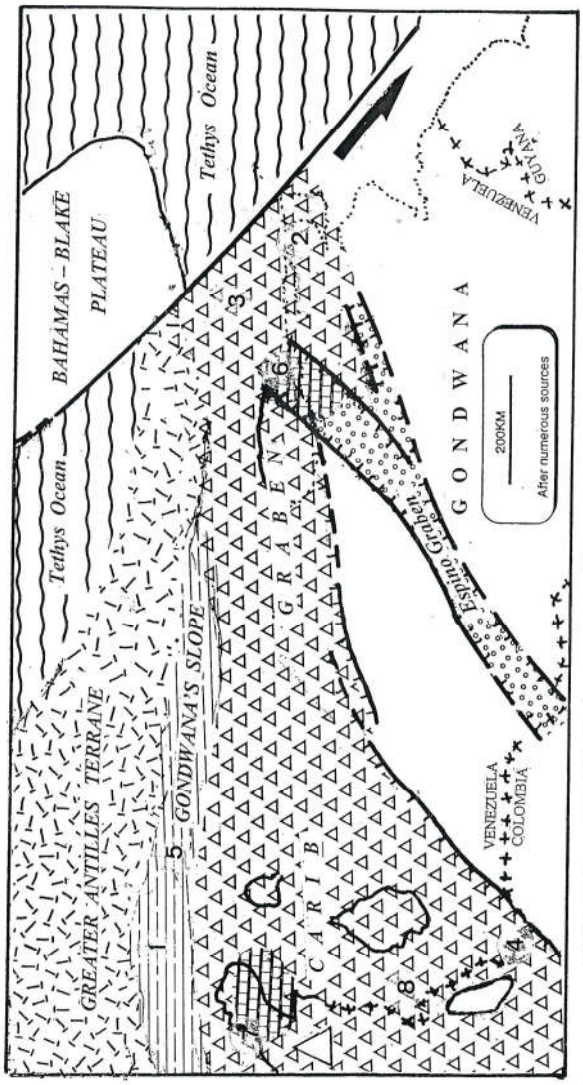
Text figure III - 04.- Paleogeography of the Carbonatic Platform evolution of Western Venzuela during Eocretaceous Gallic times, after VAHRENKAMP et al., (1993). (a) Barremian times, 128 MA, the hemigrabens are the depocenters of the sedimentation in saline waters; (b) Early Albian, 110 Ma, generalized carbonate sedimentation in saline waters. (c) Late Albian-Early Cenomanian, 99.6 Ma, heterolithic sedimentation in evaporitic and tempestite-affected shallow shelf (not lagoonal). Modified from BARTOK et al., (1981), ERLICH et alii.,(1999), VILLAMIL & PINDELL (1998).



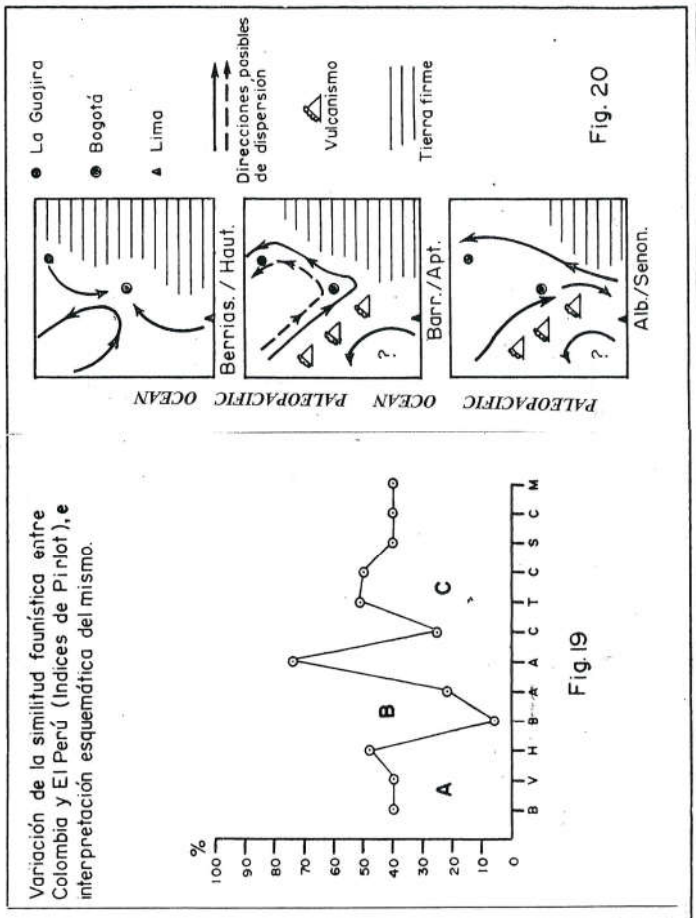
Text - Figure III - 05.- Unexplained relationship between the strongly costulated and ornamented *Carditidae* and the algal fields in the saline water-covered epicontinental shelves. A) *Cretocardia*, B-D) *Ludbrookia*, C) *Xenocardita*, *E)Ptychomya*.



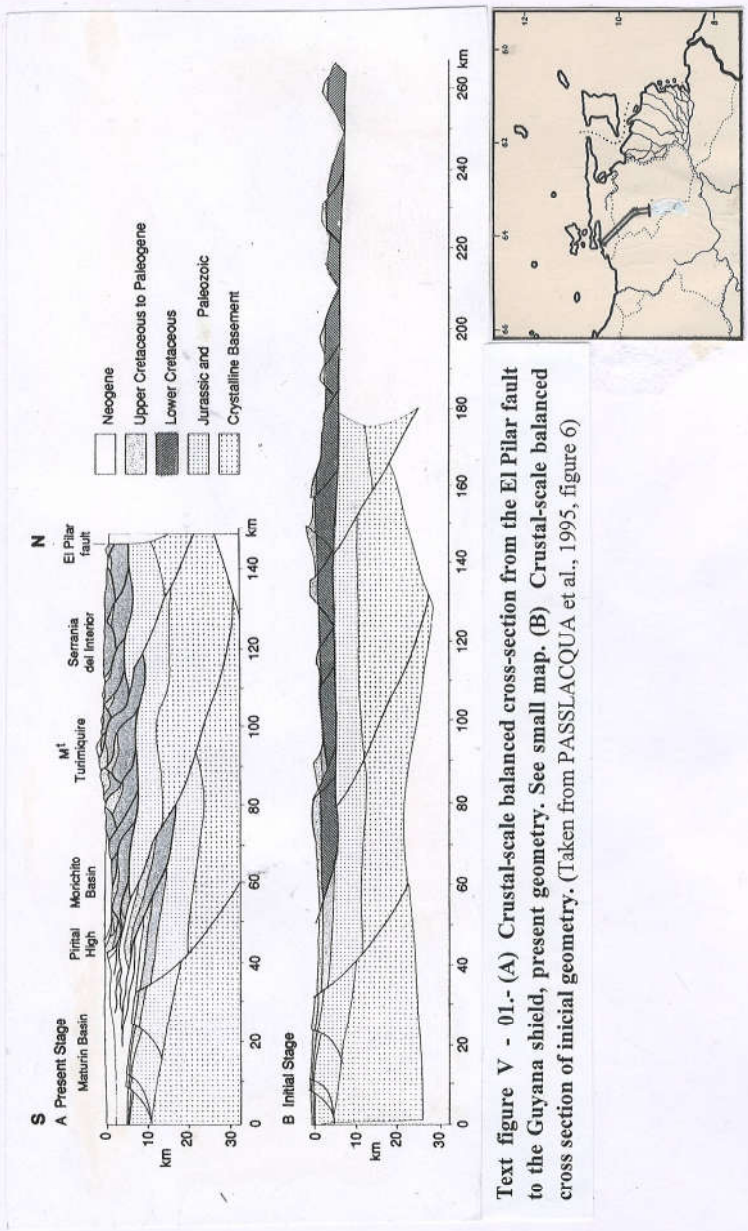
Text figure IV - 01.- Location of the Domains, following the system of MACSOTAY (1980-B), plotted on a Geologic Map of Venezuela, as found actually. (1) Intra-Cratonic Basins, (2) Uribante Hemigraben, (3) Perijá Mountains, (4) Maracaibo Lake, (5) Trujillo state (including San Jacinto Graben), (6) Cocinas Graben, (7) Serranía del Interior Oriental, (8) Lara Nappe, and Atarigua para-autochthon, (9) Piemontine Nappe, and Northern Range, of Trinidad. The black stars are klippes, where enigmatic Cretaceous fossils are frequently collected. White cubes: olistostromes with reworked Eocretaceous fossils.



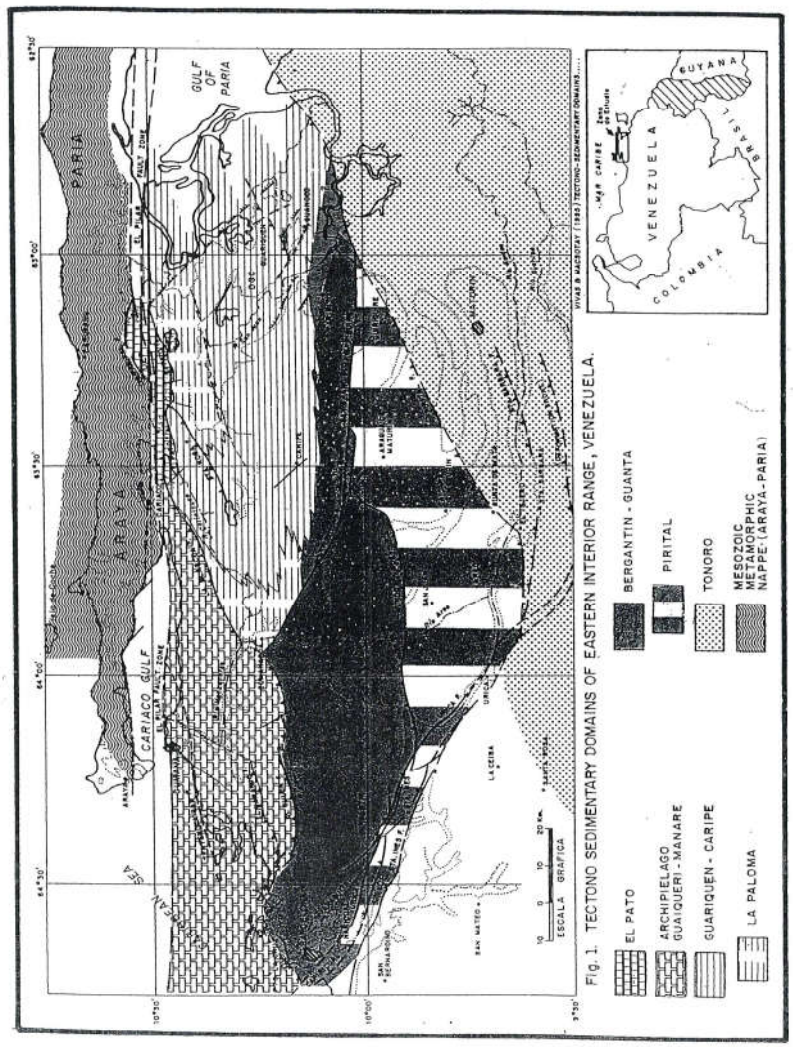
Text – Figure IV -03.- Palaeoceanographic reconstruction of western area of S.C.S., its Cratonic basement, and the active rifting of *GAT*, during Neocomian times. Stippled: submarine volcanism. Small triangles: saline/hypersaline sedimentation. Sampling areas: 1-5: Lara Group, 2-3: Serrania del Interior Oriental, 4: Uribante Hemigraben, 6: El Cantil Formation, 7: La Guajira basin, 8: Machiques Hemigraben. Black arrow: Transform fault movement.



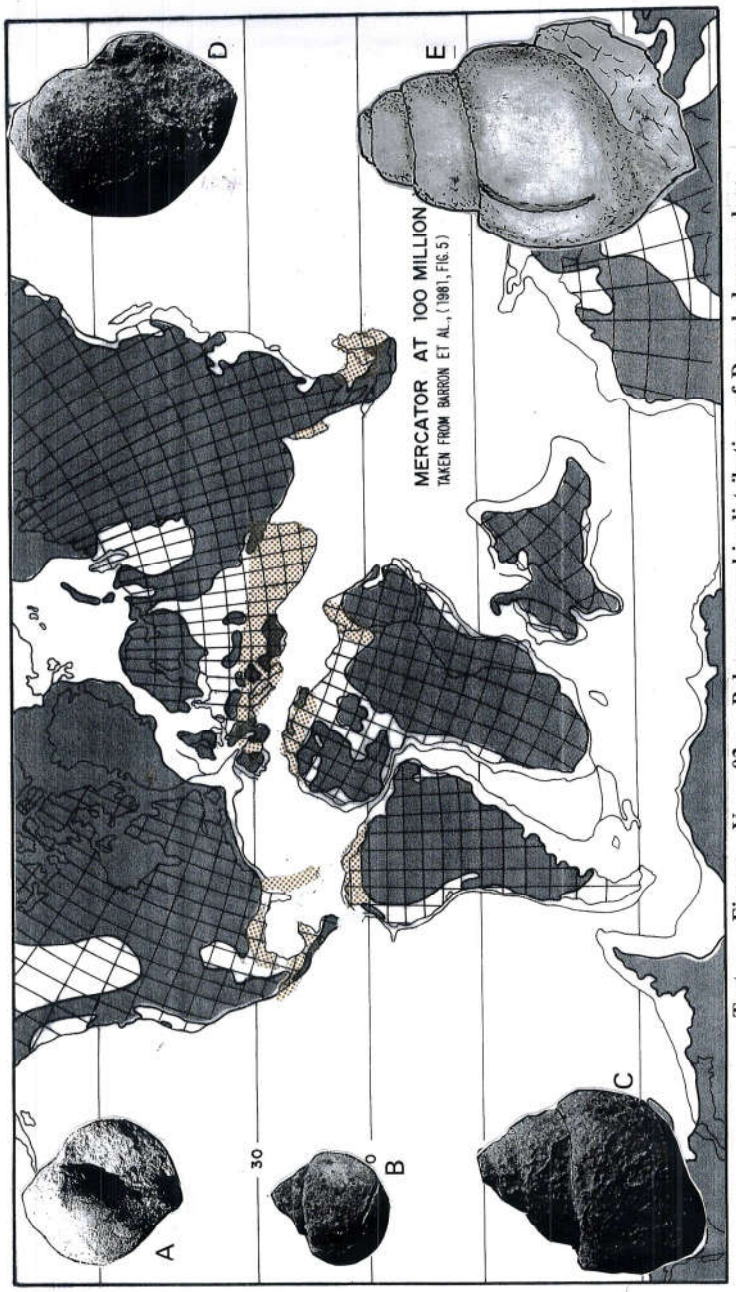
Text figure IV - 05.- Cretaceous Molluskan Paleo-migration routes in Perú-Colombia areas, by means of Pirlot index, according to ETAYO SERNA, RENZONI & BARRERO (1976, figs. 19, 20).



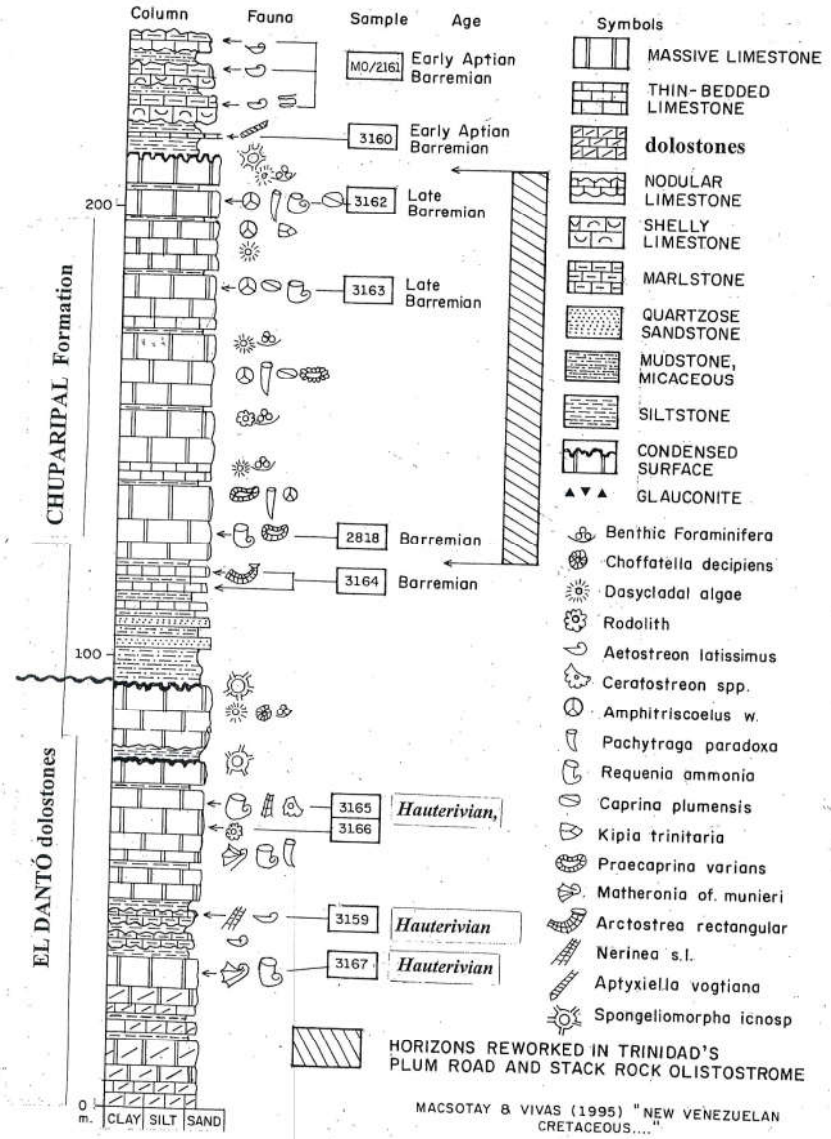
Text figure V - 01.- (A) Crustal-scale balanced cross-section from the El Pilar fault to the Guyana shield, present geometry. See small map. (B) Crustal-scale balanced cross section of inicial geometry. (Taken from PASSLACQUA et al., 1995, figure 6)



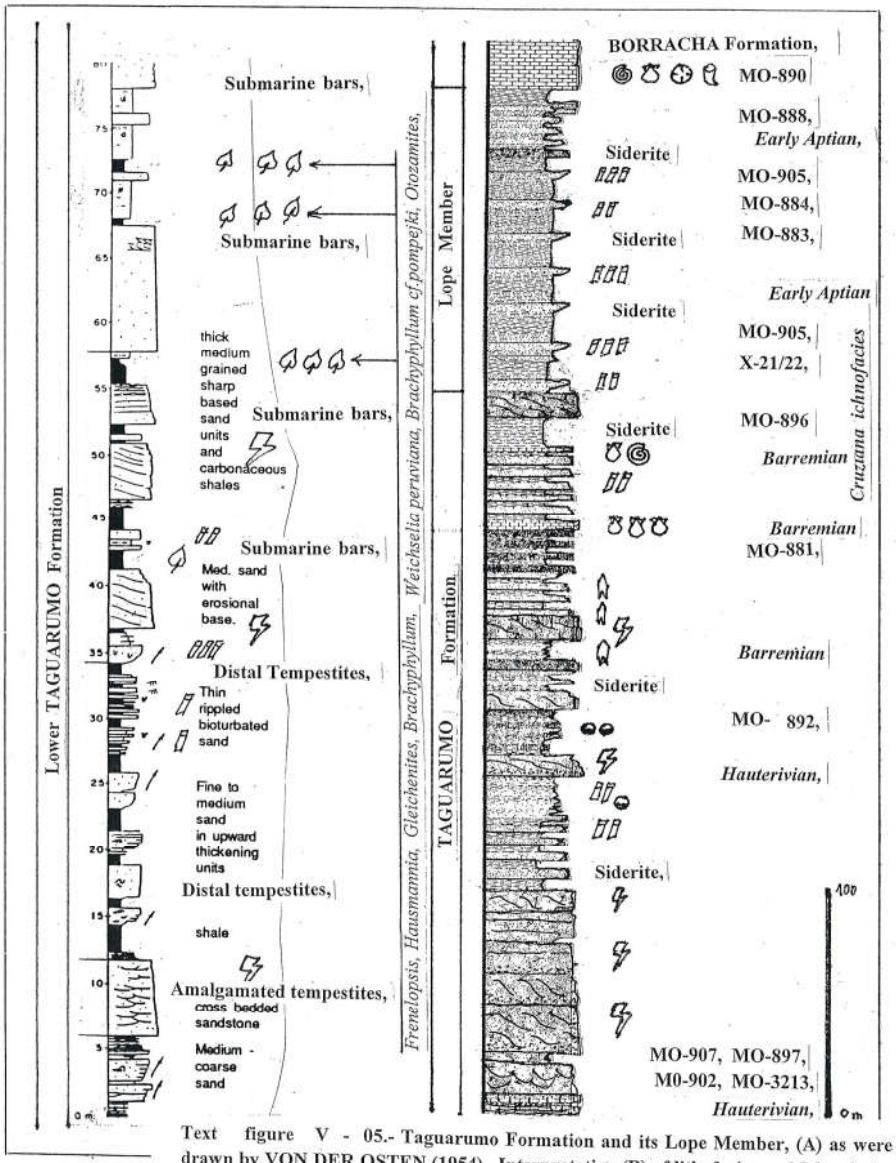
Text figure V - 02.- Tectono-sedimentary Domains and Subdomains of Eastern Interior Range, Venezuela, as was proposed by VIVAS & MACSOTAY (1995). All the cited Fossil Molluska were collected inside this area.



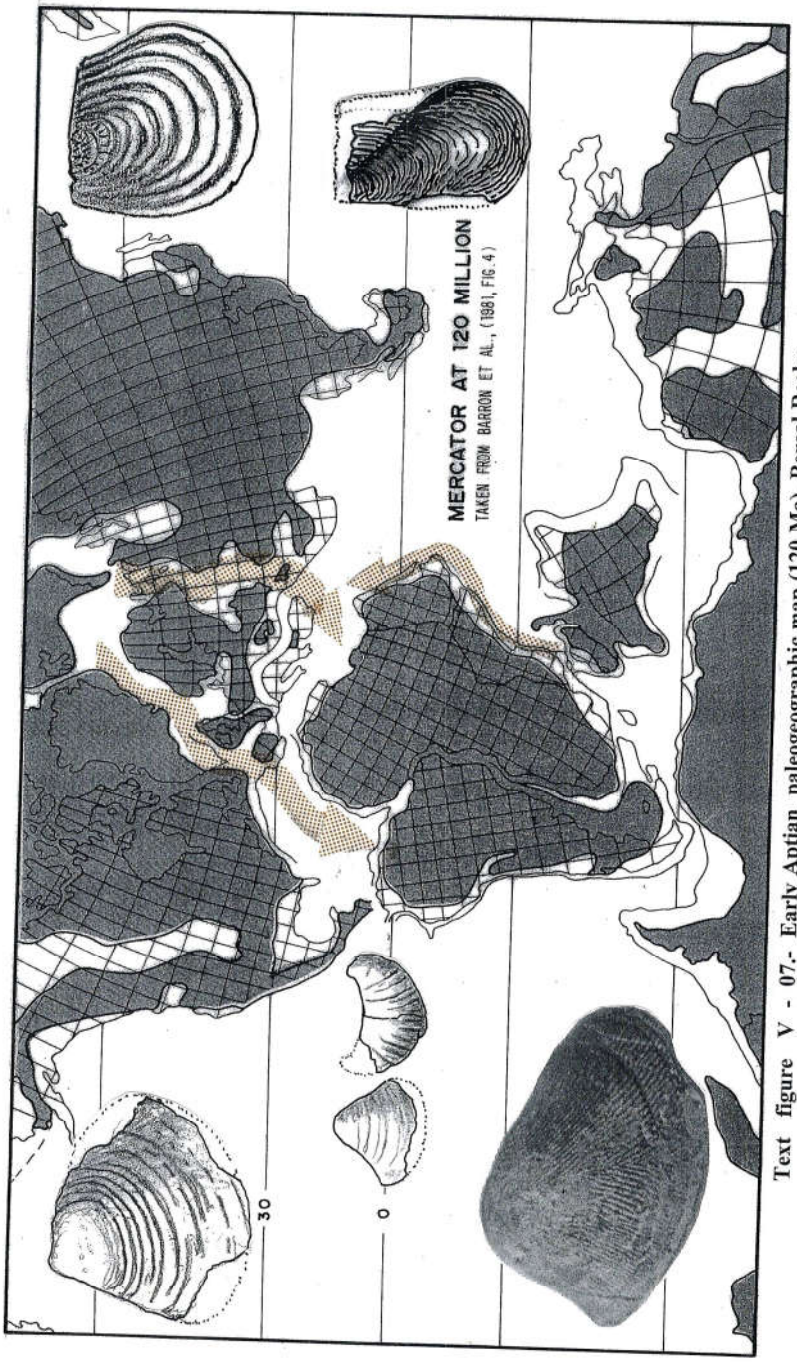
Text - Figure V - 03.- Palaeogeographic distribution of Dasycladacean algae (pointed) in the Barremian-Aptian-Albian shallow-water platforms, after Peybernes, (1979) and Peybernes & Conrad (1979). The presumed algophagous gastropoda are: A, B, C, E) *Tylostoma* and D) *Euspira*.



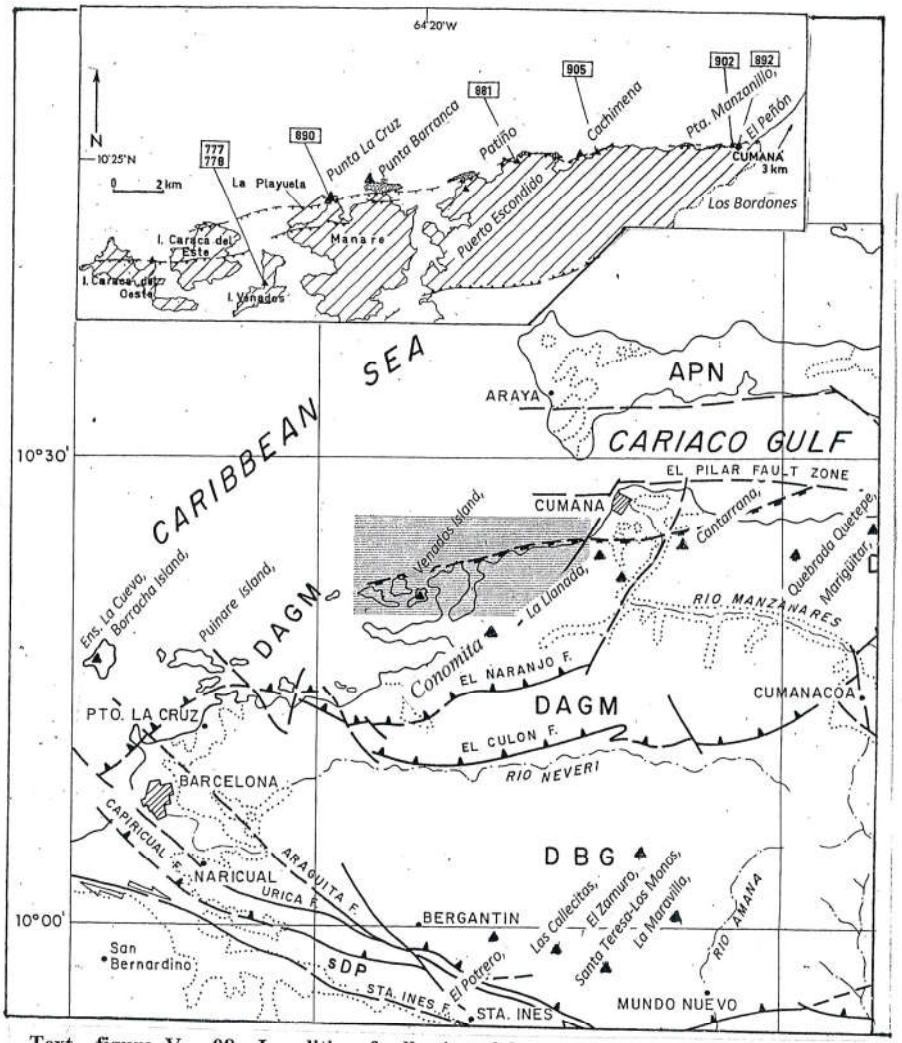
Text-Figure V - 04.- El Dantó dolostones and Chuparipal Formation in its type locality, Cerro La Pica, Sucre State. Exposes the original horizons, where the *Amphitriscoelus waringi – Kipia – Praecaprina* fauna was deposited, and then later reworked in Stack Rock and Plum Road olistostrome of Trinidad Central Range (HARRIS and HODSON, 1922).



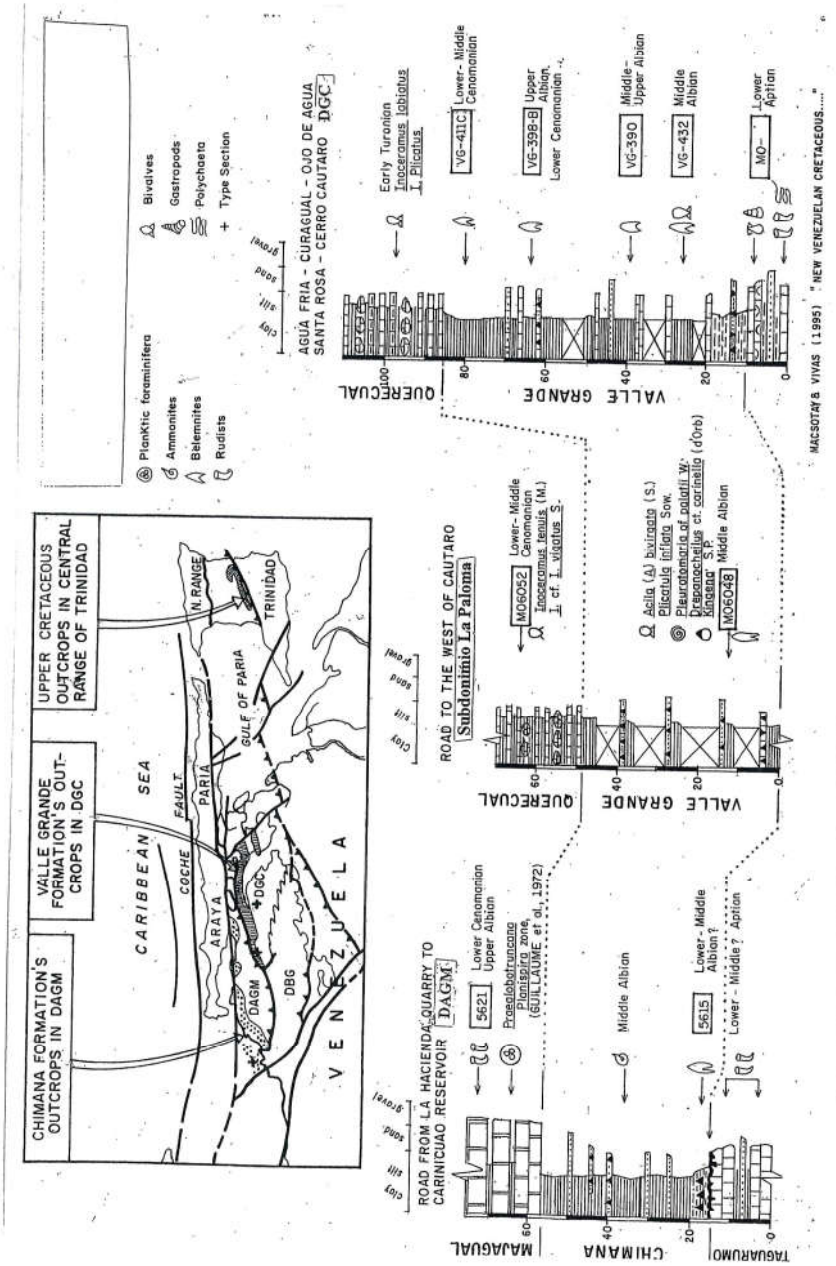
Text figure V - 05.- Taguarumo Formation and its Lope Member, (A) as were drawn by VON DER OSTEN (1954). Interpretation (B) of lithofacies and Ichnofacies of the lower part of the Taguarumo Formation in the Conomita road cuts. (ALLEN et al., 1992, Figure 10, modified by MACSOTAY, 2012).



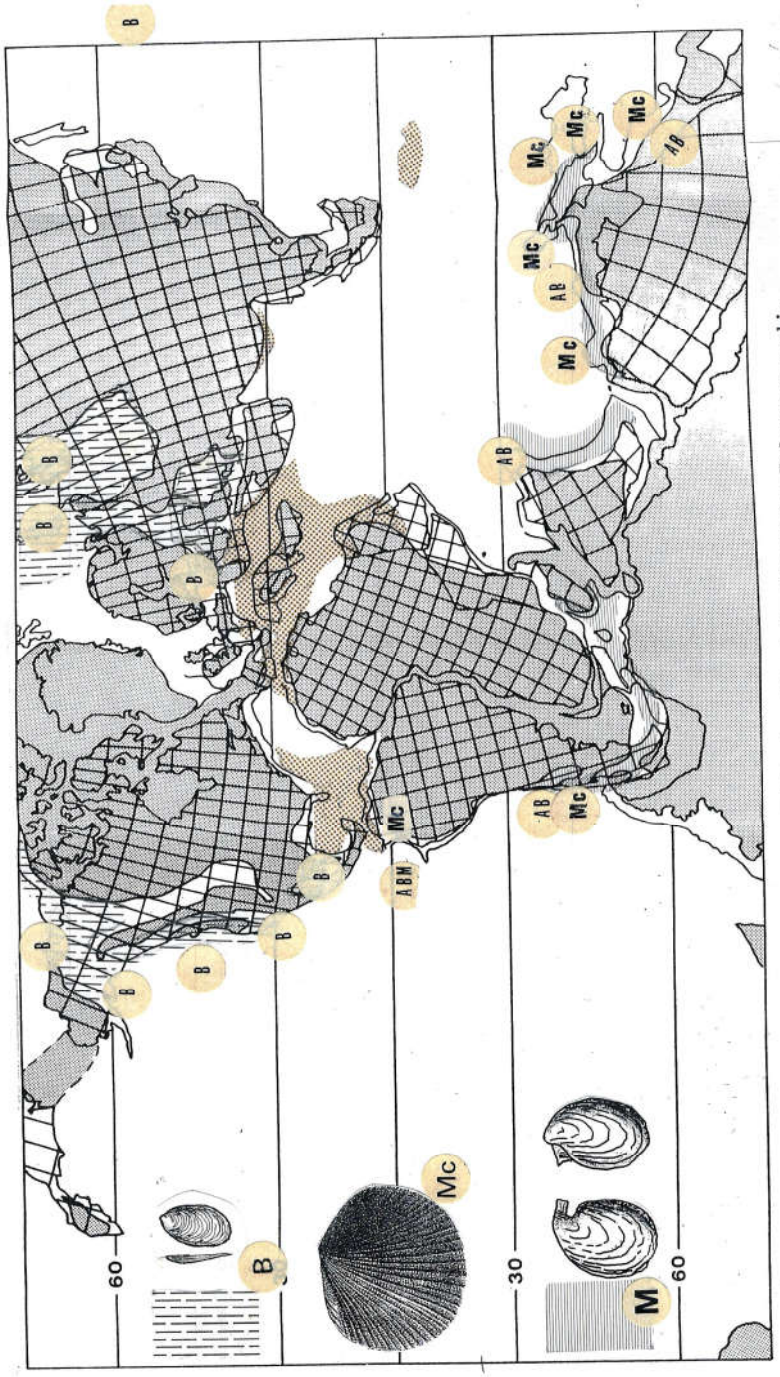
Text figure V - 07.- Early Aptian paleogeographic map (120 Ma). Boreal Realm low temperature water subsurface currents descending towards the Tethys Ocean´s saline waters. The chemosymbiont Bivalves profited from the proximity of the pycnocline on the outer shelf. Genera involved: *A. Inoceramus, B: Isoarca, C: Acila (Truncacila), D:Pseudodydimotis, E: Mytilopsis.*



Text figure V - 08. Localities of collection of the most important Late Berriasian-Late Albian fosils Molluska plotted on the eastern half of the Tectono-sedimentary Domain map of Eastern Interior Range (VIVAS & MACSOTAY, 1995). Taken from ROYO Y GOMEZ (1953), VON DER OSTEN (1954, 1957), MACSOTAY (1980-b) and VIVAS (1987, 1994).



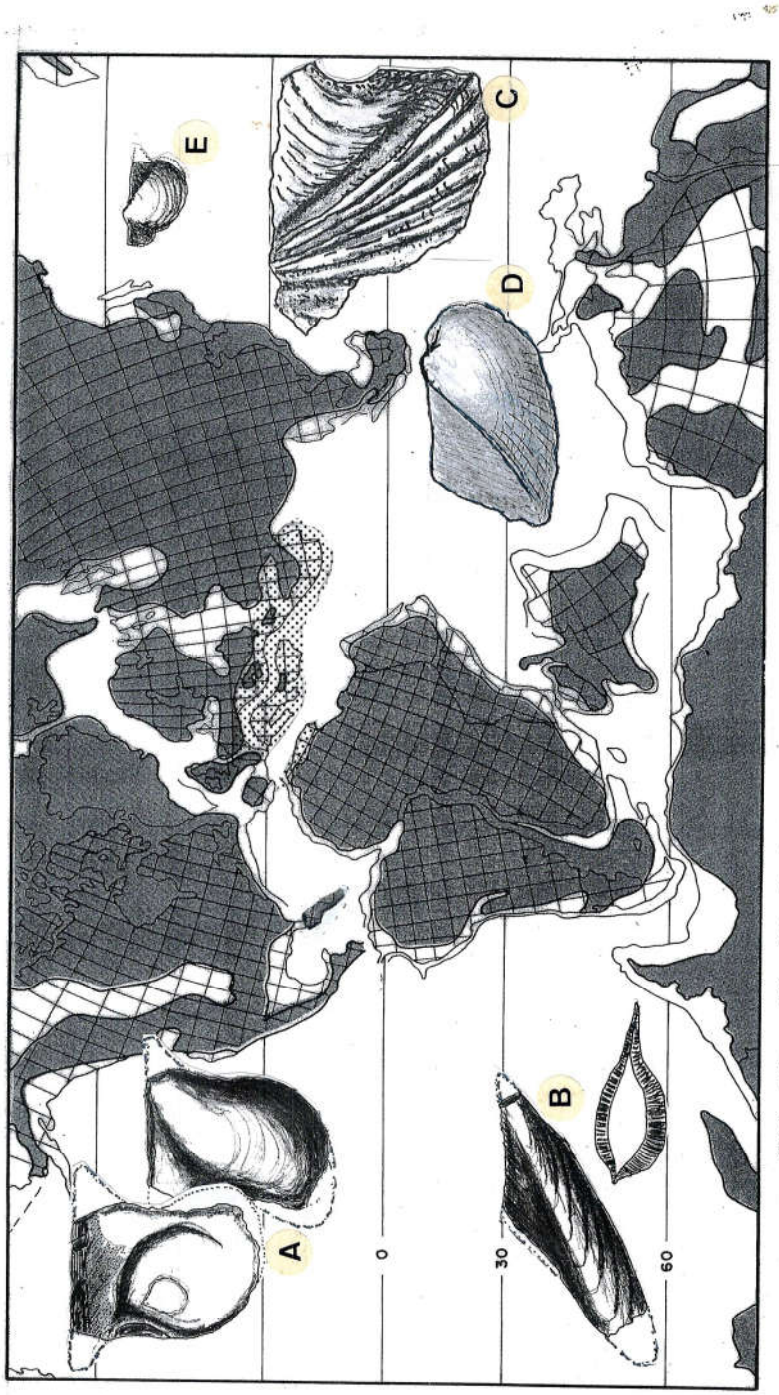
Text Figure V - 10.- Transition from Outer Shelf (Chimana Formation) to Upper Slope (Valle Grande Formation) facies of Middle Albian Transgression in Eastern Venezuela's Serrania del Interior Oriental and Trinidad (MACSOTAY & VIVAS, 1995).



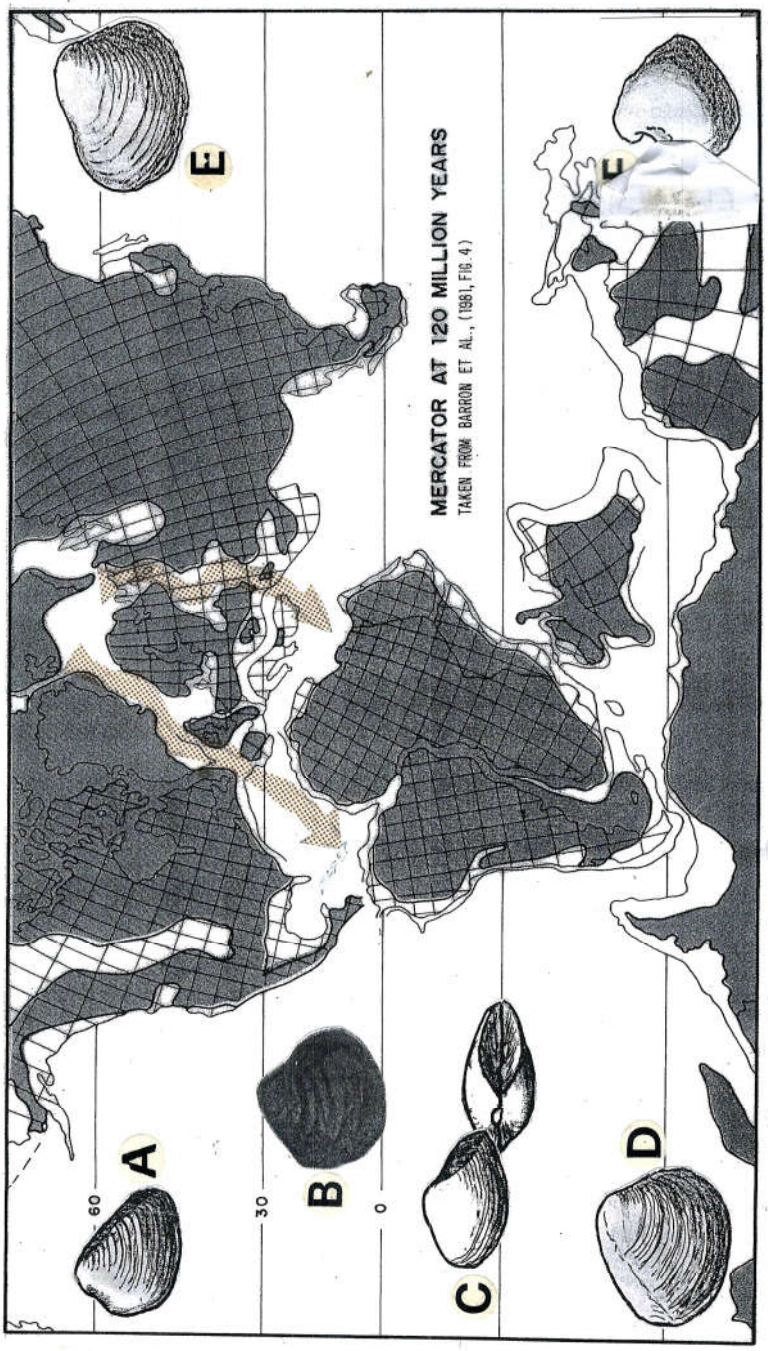
Text – Figure VI - 02.- Late Tithonique-Berriasian/Ryazanian Palaeogeographic distribution of *Calpionelles* (pointed pattern) (MAGNÉ & SIGAL in Colloque sur le Cretacé Inferieur, 1963) **plotted with contemporaneous wide-spread Bivalvia as *A: Aucellina, B: Buchia, M: Malayomaorica, Mc: Maccoyella***

Text Figure VI - 04.- Seasonal Hurricane activities were registered by the abundant Tempestites in the shelfal sediments (down to 60 meters of paleodepth), during Albian – Early Cenomanian times, (black arrows). Thick-shelled, heavily ornamented Bivalvia dominate the shelfal assemblages in all the tropical areas. Among the *Ostracea*, are: *A) Texigryphaea, B) Cameleolopha, C) Ilymatogyra, D) Actinostreon.*

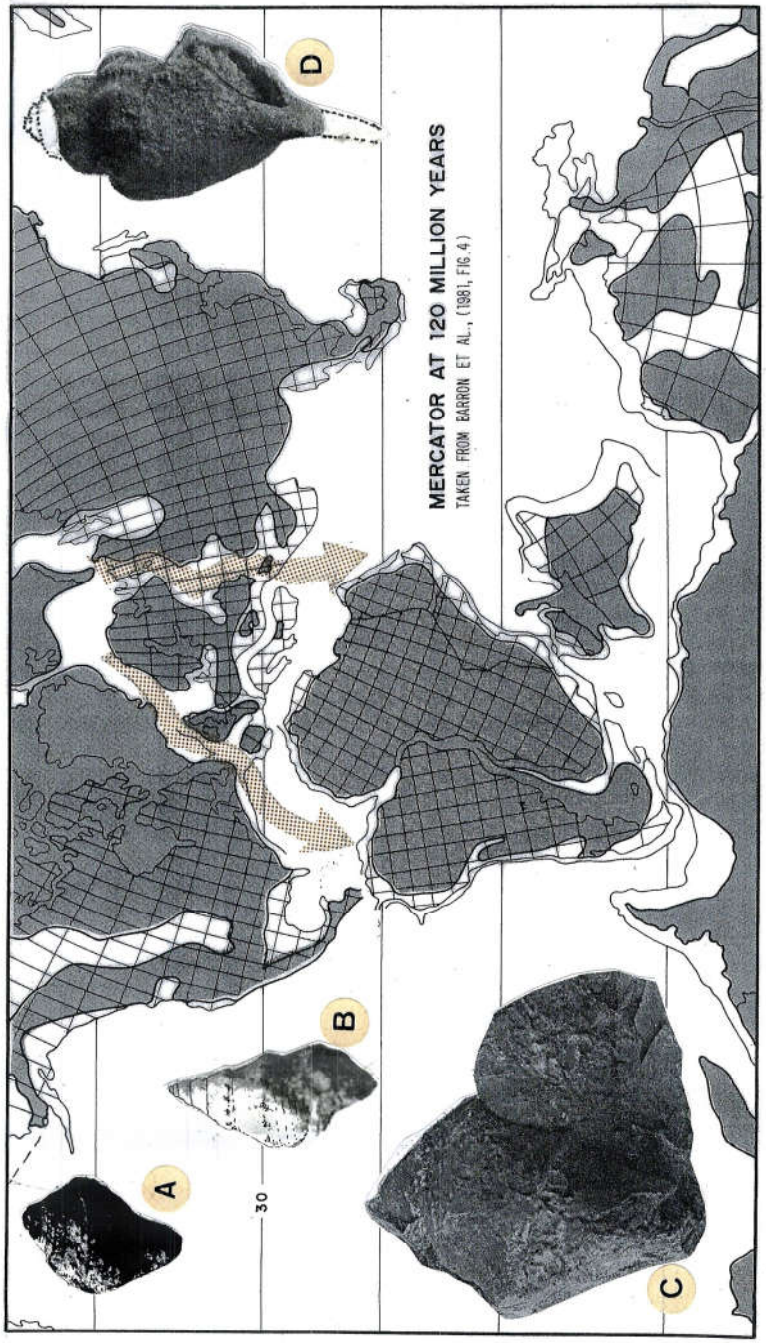
Text Figure VI - 05.- Late Albian/Early Cenomanian palaeobiogeographic distributions of *Ceratostreon flabellata flabellata* Goldfuss (A, grey) and its ecomorphotype *Ceratostreon flabellata aethiopica* Gortani (B, pointed). Their relative distributions were controlled more by salinity anomalies than by palaeotemperatures.



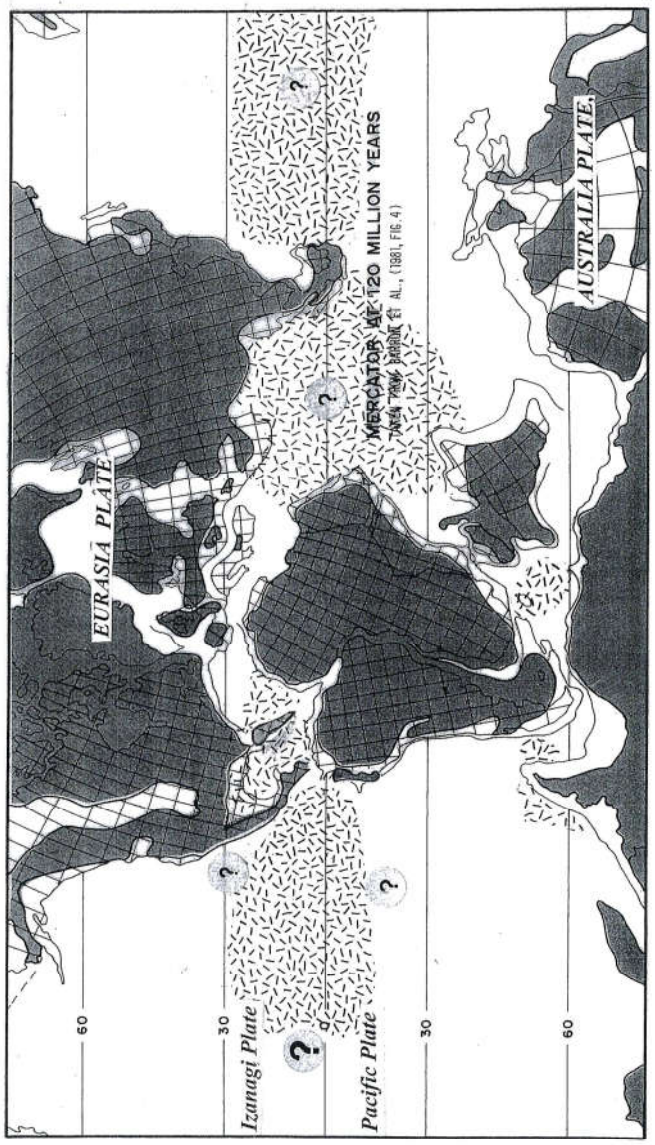
Text - Figure VI - 06.- Early Aptian (120 Ma.) palaeogeographic map (BARRON et al., 1981, fig. 4) showing areas where black shale facies carry members of *Bakewelliidae*, *Icanotiidae* and *Pteriidae* families. Byssate epifauna suggest the possibility of toxic muds , as substrate. *A) Pterinella, B) Gervillella, C) Costigervilleia, D) Noetia (Incanopsis) and E) Pteria.*



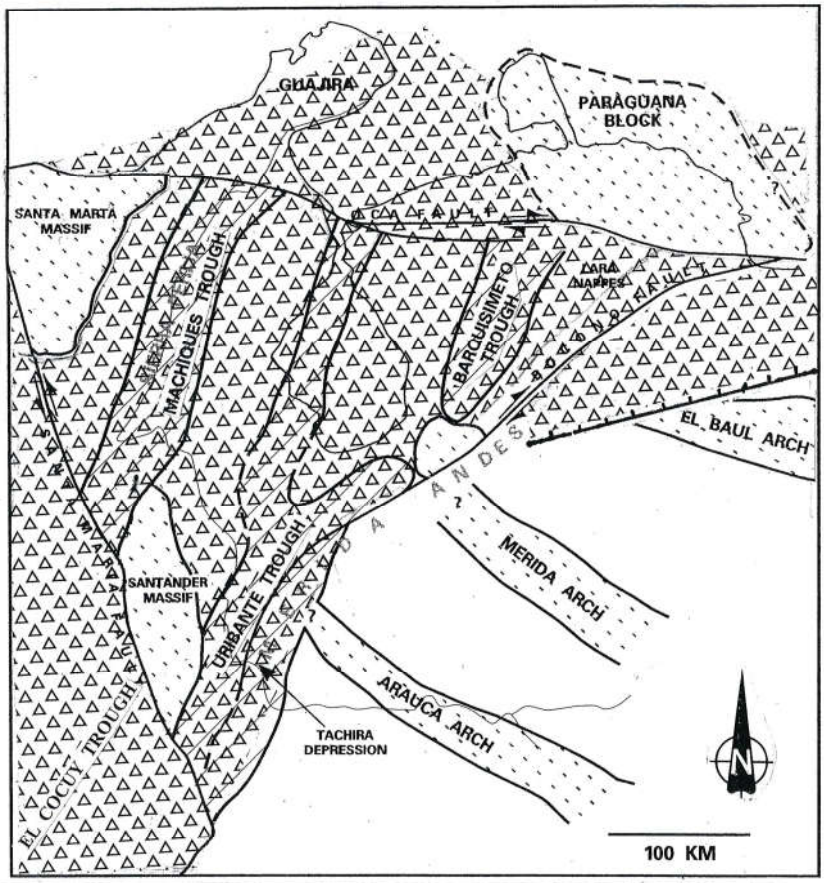
Text - Figure VI - 07.- Hauterivian distribution of wealdian Molluska on Paleogeographic map of BARRON et al., (1981, fig. 4). This distribution counterdicts the Latitudinal Diversity Gradients (LDG). Black triangles: deltaic deposits. Taxa involved: *A-D) Neomiodon, B) Costocyrena, C) Eomiodon, E) Cyclorisma, F) Pterocardia.*



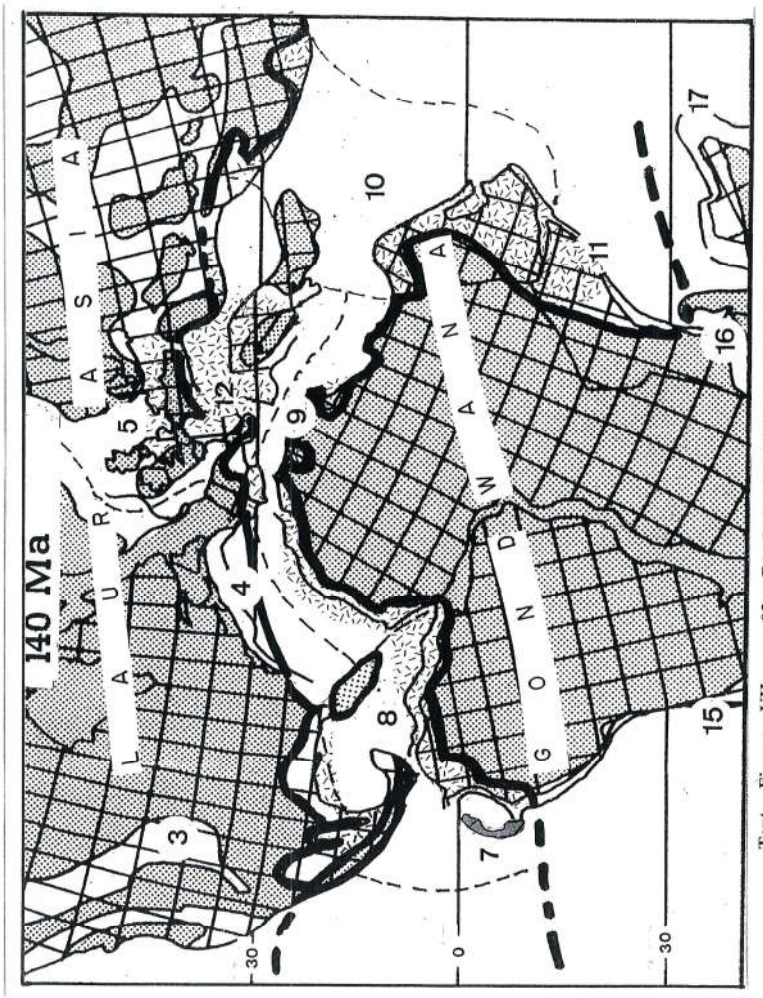
Text Figure VI – 08.- Early Aptian palaeogeographic map. Boreal Realm low temperature water currents descending towards the saline Tethys Ocean. Predator Gastropod Genera involved: *A. Mayeria, B: Serrifusus, C: Blackdownia, D: Boltenella.*



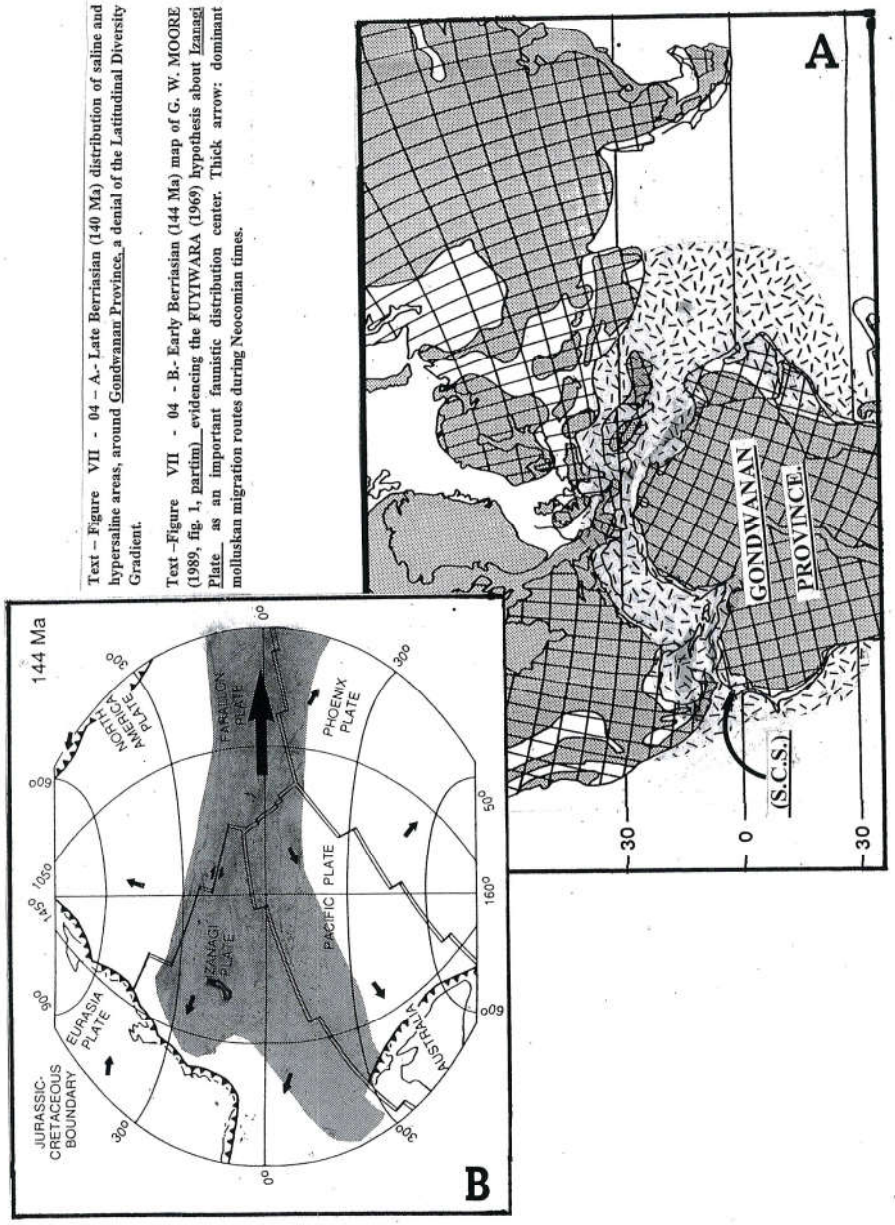
Text – Figure VII - 01.- Postulated Oceanic Silica-belts for the EoCretaceous according to A.T.S. RAMSAY (1973, figures 10, 11), based on LEG, JOIDES and many core analysis. Observe the silica-rich sediments originated by oceanic rifting, on both sides of Central America and the Bahamas bank, active barriers in the oceanic circulation pattern.



Text – Figure VII - 02.- Major tectonic elements of Cratonic Western Venezuela and Eastern Colombia. Triangles represent Neocomian-Aptian evaporitic marine sedimentation. Stippled pattern denotes Basin Uplifts: Santa Marta Massif, Santander and Paraguana blocks were all islands the shelfal sea. The area north of El Baul Arch, was the basin where the Caribbean Nappe was emplaced during Eocene times. Taken from R.N. ERLICH, S.E.PALMER-KOLEMAN & M. A. LORENTE (1999, fig. 2).

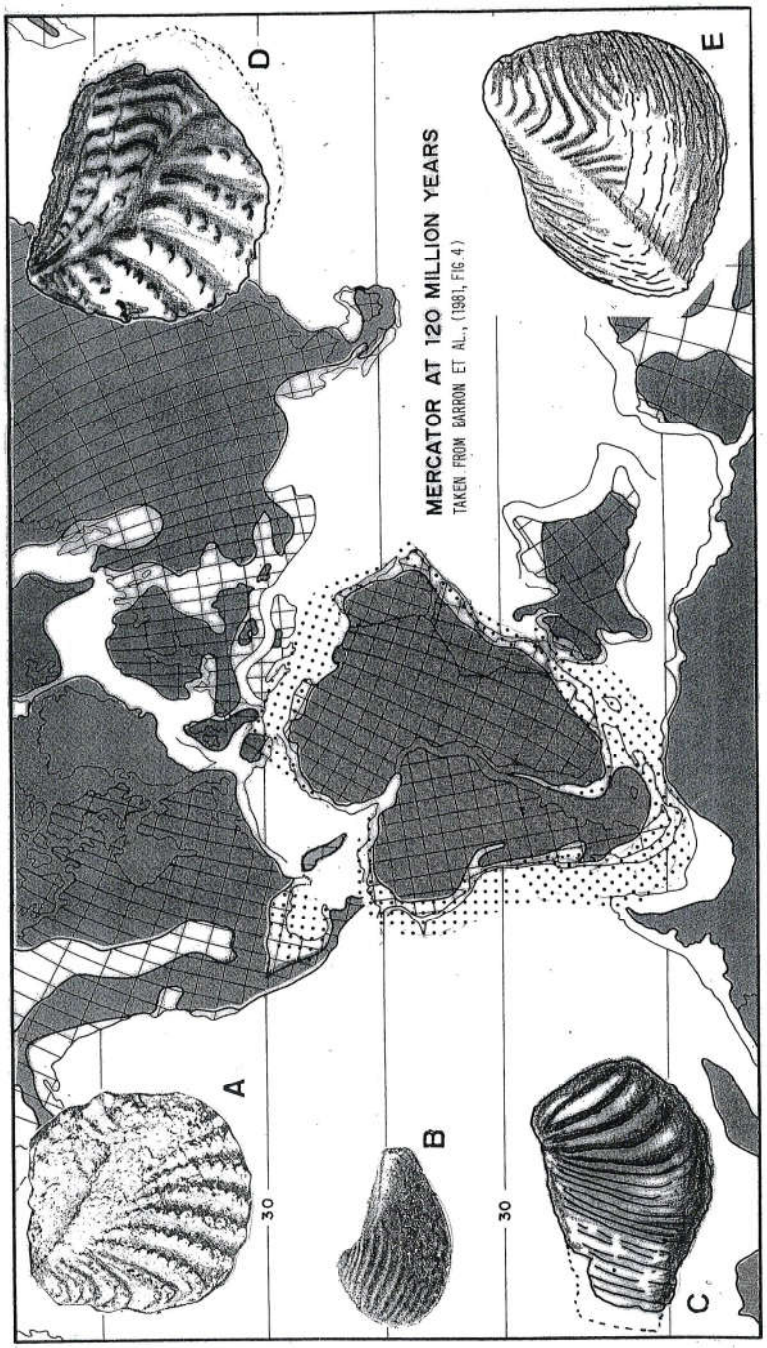


Text Figure VII - 03.- Berriasian-Valanginian Biochorema Map, showing extension of saline and hypersaline seas, (stippled pattern), inside and outside the Tethys Ocean, as suggested by the benthic Molluska and evaporitic minerals preserved in the sediments. The high salinity is not related to Latitudinal Diversity Gradients (L.D.G.).

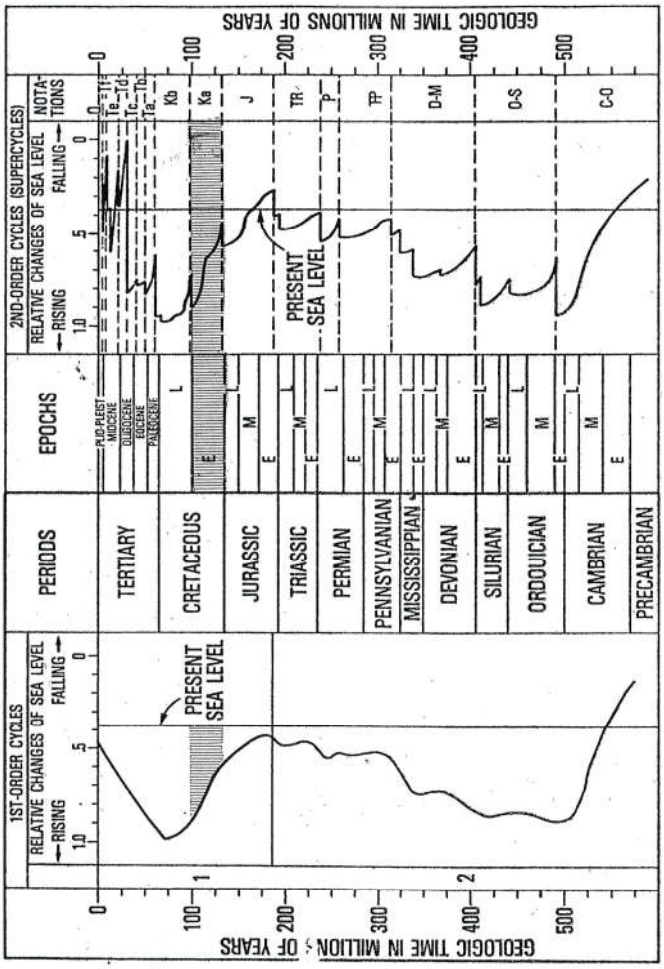


Text – Figure VII - 04 – A.- Late Berriasian (140 Ma) distribution of saline and hypersaline areas, around Gondwanan Province, a denial of the Latitudinal Diversity Gradient.

Text –Figure VII - 04 - B.- Early Berriasian (144 Ma) map of G. W. MOORE (1989, fig. 1, partim) evidencing the FUYIWARA (1969) hypothesis about Izanagi Plate as an important faunistic distribution center. Thick arrow: dominant molluskan migration routes during Neocomian times.

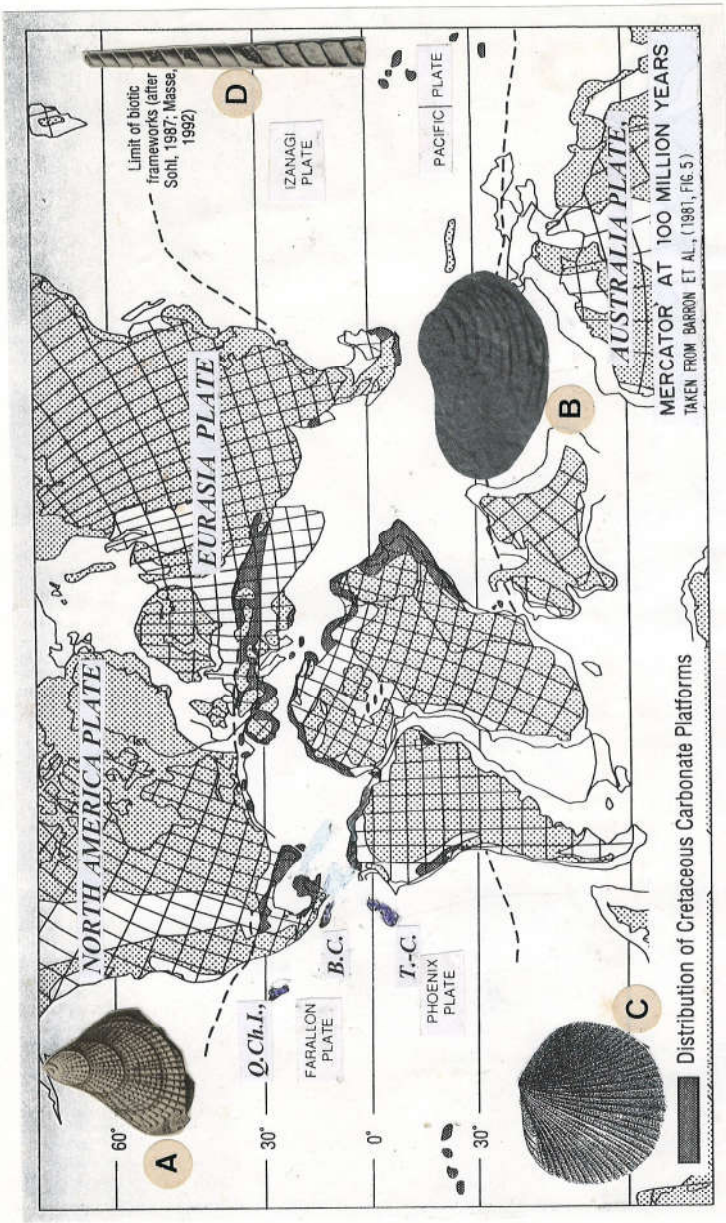


Text - Figure VII - 05.- During Valanginian-Hauterivian times (130 – 120 Ma) the Trigoniacea of the Southern Caribbean Subprovince (A, B) mixed up with the Austral-dominated genera (C, D, E) facilitated by saline waters of the epicontinental sheves (pointed). A) *Mediterraneotrigonia*, B) *Rutitrigonia*, C) *Megatrigonia*, D) *Steinmannella (Steinmannella*, E) *Buchotrigonia (Syriotrigonia)*.

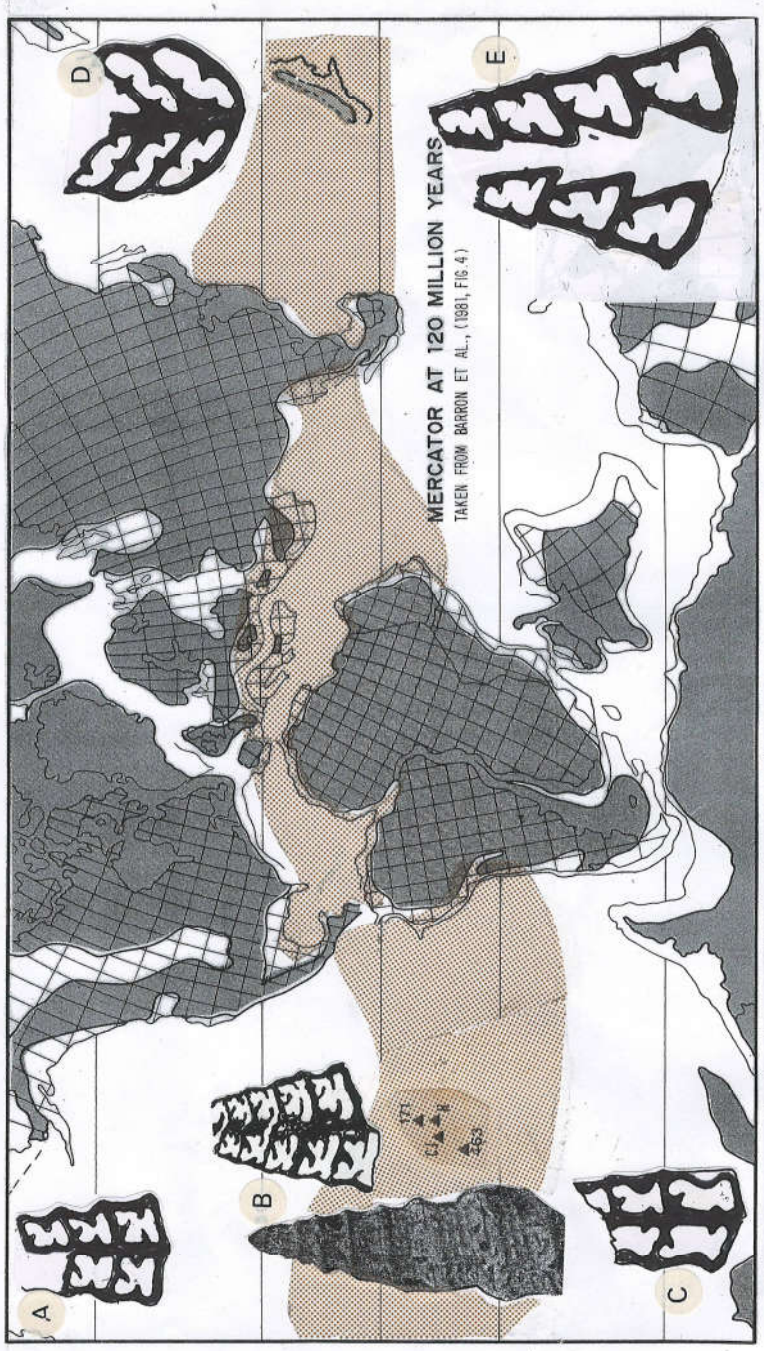


Text - Figures VII - 06.- First and second order global cycles of relative change of sea level during Phanerozoic time (VAIL et al., 1977). Eocretaceous unusual sequence of Calcium-rich evaporitic silts in most oceans nearby the continents (in grey) coincident with the generally transgressive sea level. Notice the mid-Cenomanian regression (ROBASZYNSKY, 1989).

Text – Figure VII - 07.- Extent of Anoxic/Disoxic marine sediments about the Cenomanian-Turonian transition (COTILLON, 1989, fig. 9). The Palaeogeographic sketch is plotted on Albian-Cenomanian boundary map, near the Bonarelli OAE. The Anoxia/Disoxia is not related to Latitudinal Diversity Gradient.



Text Figure VIII - 03.- **Distribution of Cretaceous Carbonate Platforms and the maximum extent of bioconstructions (SIMO, SCOTT & MASSE, 1993). The facilitated Oceanic communications are typified by four molluska: A)*Plicatula modioloides/allisoni*, B)*Pleuromya pleuromyaeformis/colombiana* C)*Maccoyella bogotina/barklyi*, D)*Nerinella maudiensis/itaporangica.*** Suspect Terrains: Queen Charlotte Island, Canada (QCh), Baja California, Mexico (BC), Tahami-Calima, Colombia (T-C), in their palaeo-positions (MUÑOZ et al., 1993, fig. 8).



Text Figure VIII - 04.- Early Aptian Biochorema Map, (120 Ma) showing the palaeogeographical distribution of salinophyllic Nerineacean genera, common in the S.C.S. Genera involved: *A: Eunerinea, B: Neoptyxis, C: Aptyxiella, D: Phaneroptyxis, E: Adiozoptyxis.* All belong to Taxa Group Two of SOHL (1987).

Systematic part

CHAPTER IV.

Class BIVALVIA.

INTRODUCTION.

The Bivalvia are a dominant element of most Jurassic to Recent macroinvertebrate assemblages in both numbers and diversity, and are relatively well preserved in a variety of sedimentary environments. A gret number of taxa are specifically adapted within narrow niches, and thus form an important basis for the recognition of Biogeographic Provinces and smaller ecological units (KAUFFMAN in HALLAM et al., 1973). This author proposed a system for differentiation of biogeograhic units using percentages of endemism, all calculated exclusive of cosmopolitan taxa at generic and subgeneric level: endemic centres 5-10 %; subprovinces 10-25 %; provinces 25.50 % and realms >75 %. PETUCH (1988, 2004) based his Biochoremas on selected taxa and not on the overall endemism of the assemblages, as suggested by his own '50 % rule'. LANDAU et al., (2008), agreed with WESTERMANN (2000) that the stability of biochorema names should be preserved, even when the respective biota change greatly over time. CECCA (2002: 90) suggested that all paleobiogeography of marine fossil invertebrates should be done at generic level, and I agree with him. CECCA & WESTERMANN (2003: 180) suggested biogeographical unit names should be geographic/geologic, not taxonomic. Priority 'rules' of synonymy and homonymy should be applied to Biochorema names, not rigorously but with common sense.

From now on, our study area will be called **SOUTH CARIBBEAN SUBPROVINCE, of the GONDWANAN PROVINCE, (S.C.S.)** as a Biochorema spanning from the Tithonian (Late Jurassic) to Turonian (Late Cretaceous) times.

THE DATA BASE.

Two principal sources of data were used in construction of Cretaceous biogeographic units based on BIVALVIA (KAUFFMAN in HALLAM et al., op. cit.). The basic source was the Treatise on Invertebrate Paleontology, part IV, Bivalvia (MOORE, 1969; STENZEL, 1971), the most modern summary of supraspecific taxa, their age ranges and their general biogeographic distribution. Earlier, GILLET (1924-1925) reviewed the Neocomian Bivalvia of the Mesogean areas. This was supplemented from an illustrated Cretaceous personal taxonomical file card system, obtained from European and Japanese literature, usually out of reach in South American libraries. Publications in French, German, Hungarian, Spanish, Polish and Russian language expanded the data-set. I am not proposing any improvements at taxonomic levels above Super-families, so I will abstain to repeat what can be obtained in the three parts of the Volume N of Treatise on Invertebrate Paleontology (1969, 1971).

WIDESPREAD AND COSMOPOLITAN BIVALVES.

Before and during the early stages of Mesozoic plate movements and continental drift, widely ranging to cosmopolitan genera, dominated the marine biotas. During the Late Jurassic and Cretaceous however, with climatic deterioration and continental separation well under way, the central Atlantic becoming a major ocean basin (BERNOULLI & LEMOINE, 1980) and subsequent genetic isolation of marine shelf faunas, biogeographically restricted taxa, became increasingly dominant and faunal regions, provinces and sub-provinces gradually evolved (KAUFFMAN, 1973). The Bivalvia are among the first groups to clearly show this trend. Widespread Cretaceous Bivalves are divisible into three major groups: (a) truly cosmopolitan forms; (b) inter-realm warm water taxa, which occur both in Tethys Ocean and in one or both of the warm-temperate zones that bordered it; and, (c) trans-temperate forms that ranged widely on either side of Tethys, but were not common within it. These reflect a **Cretaceous climate,** with broad gradational climatic zones not prohibitive to widespread migration of adaptable taxa. Trans-temperate bivalve distributions reflect either a Cretaceous migration route across Tethys, where it was becoming narrow or even discontinuous (most likely in the Proto-Pacific), and/or the ability of many trans-temperate bivalves to marginally inhabit tropical Tethyan environments, allowing at least restricted gene flow between preferred temperate habitats (KAUFFMAN, 1973). The same characteristics that give them such a wide

biogeographic range also promote "geologically instantaneous" dispersal across the world's oceans, specially large egg yield, broad larval and adult environmental tolerance and mobility and prolonged duration of the pelagic larval stage.

CLIMATIC INFERENCES.

There is good evidence of Cretaceous climatic deterioration in the Indo-Pacific and northern migration of cooler climatic zones into once tropical areas. An unstable, transitional Tethyan-temperate boundary is expected in this situation. Near the boundary, geographic fluctuations in the dominance of tropical and temperate biotas through time, produced interbedding of Tethyan and north temperate realm faunas in some areas (e.g., Mexico, Texas, East Africa). A realistic picture is obtained when we superimpose the Oceanic Surface circulation map of GORDON (1973) to a Paleogeographic map of Barremian age (Plate 2). The relationship between a free-circulating Proto-Pacific Ocean, and an obstruction-full tropical Tethys Ocean, with a quite isolated Boreal Sea, is shown here. An incipient Austral Province is beginning its activity, to become a realm during Late Cretaceous times, thanks to Rifting phenomena.

Another good example is the superposition of molluskan fauna of S.C.S. (=Tethyan) with the Peruvian and Neuquen sub-provinces in the Cocuy Hemigraben of Colombia during the Cretaceous Period (ETAYO SERNA, RENZONI & BARRERO, 1976). The Neuquen's fauna is related to the Indo-Pacific Realm temperate (cryophyllic) association, represented by Trigoniacea, Oxytomidae and Limidae, that has invaded the Carib Graben area. Tethys is temporally and evolutionarily the most madure Cretaceous biogeographic unit, having a long Mesozoic history and the greatest degree of environmental stability through time, except for the oceanic abyss. High diversity and endemism in Tethys was augmented by introduction of at least some warm water organisms which evolved outside Tethys during periods of climatic deterioration, as the OAEs, (VALENTINE, 1967; KAUFFMAN, 1973).

The South Caribbean Subprovince. (S.C.S.)

In contrast with the biogeographic maturity of the Indo-Mediterranean region (KAUFFMAN, 1973) equivalent to the Maghrebian (9) Syrian (10) and Balkanic subprovinces (14), the South Caribbean Subprovince (8) is tectonically, geographically and evolutionarily young. Opening of the Cretaceous Caribbean Sea and connection with the Mesogean Tethyan seaway across the Central Atlantic, did not begin until probably the Middle Jurassic. This new western arm of the Tethys extended through the 'Carib Graben' (HIGGS, 2009a) and periodically its continental margins and across Central America (only during Albian) in one or more places to northern Perú and Baja California. Neocomian Bivalves as the ones studied here, show low endemism and seem to be most closely related to those of Proto-Pacific, and not the European Tethys (KAUFFMAN, 1973). By Barremian time, with continued Atlantic spreading and geographic isolation of the South Caribbean Tethys from Europe, sufficient numbers of endemic Bivalve genera and subgenera had developed to establish the S.C.S as a distinct subprovince (10.6 – 16.7 %) endemism, exclusive the cosmopolitan taxa, during Barremian to Coniacian (MASSE & ROSSI, 1987).

TROPICAL BIOCHOREMAS.

On basis of the Eocretaceous Molluska studied here, I introduce modifications to the Biogeographic units (=BIOCHOREMAS) as they were proposed by KAUFFMAN in HALLAM (1973, Fig. 2) in the Tethys Ocean Realm. WESTERMANN (2000) recommended that each Biochorema should have a type region called Chorotype, and I have followed this advice with the newly proposed biochoremas. The numbers modified, are:

(7) Peruvian Subprovince (P.S.P.) (=West Central-American Sub-Province)
(8) South Caribbean Subprovince (S.C.S.) (=Antillean Sub-Province)
(9) Maghrebian Subprovince (MSP) (=Western Mediterranean Sub-Province)
(10) Syrian Subprovince (S.S.P) (=Eastern Mediterranean Sub-Province)
(11) Somalian Subprovince (So.S.P.) (=North Indian Ocean Sub-Province)
(12) Western European Subprovince: no change.
(13) Apulian Subprovince (A.S.P.) (=Western Mediterranean Sub-Province)
(14) Balkanic Subprovince (B.S.P.) (=Western Mediterranean Sub-Province)
(15) Neuquén Subprovince (N.S.P) (=Andean Sub-Province

The numbers (7), (8), (9), (10) and (11), are gathered under the Gondwanan Province, as they share 40 – 50 % of the Bivalvia genera.It would be unfair to forget the Patagonian Subprovince, of the Indo-Pacific Region, whose Bivalvian faunas became well differentiated from the Neuquen Subprovince and the East African Province (CECIONI, 1970; CECIONI & CHARRIER, 1974).

Preservation.
The bulk of the Molluskan fauna of the 36 lithostratigraphic units sampled, is preserved as casts and molds. The lithologies in which the fossils occur, are principally limestones, mostly near the interface with shales or marls; also at the intrabed discontinuities. The grainstones and bioclastic limestones are usually the most prolific in big-sized Bivalvia and Gastropoda. The marls are also a good collecting site, where all the aragonitic shells and structures have been removed; the original calcite usually is preserved. ARNAUD et alii. (1999, 2000) realized their excellent sequence stratigraphic studies, sampling only carbonates and marls. The mudstones, sideritic siltstones and calcareous shales were a good collecting ground for small-sized molluska, specially along the cliffs between Cumana city and Manare Peninsula. The differential weathering in calcareous shales in steep-dipping outcrops (as Cerro Los Encantados, ARNAUD et al., 2000, fig. 5) are great places to collect small-sized bivalvia and gasteropoda. The glauconitic sandstones are also good collecting places, but all the fossils are only pseudomorphs in siderite, with the consequent deformation. The worst collecting places are the dolomites or dolomitized limestones, where the aragonitic and the calcitic shells, became totally mineralized. The phosphorites, - very few in our area, - were not sampled, as mostly preserve bivalve molds.

SYSTEMATIC WORK.

Family NUCULIDAE Gray, 1824.
Genus ***Nucula*** Lamarck, 1799.

Paleoecology. Recent *Nucula* is an active burrower and sediment-detritus-feeder that lives at depths from 2 to at least 7900 m. It is abundant in silty muds and can tolerate salinities at least as low as 27 ‰. Ubiquitous genus and feeding on organic detritus in grey, green and brown muds rich in organic material. *Nucula* and other protobranchs are an important component of ancient and modern deep-water communities; their relative abundance in communities generally increases with depth (KAUFFMAN, 1975).

Nucula (Nucula) lingulata d'Orbigny, 1844
Plate 20, fig. 17;

- Syn.: *Nucula lingulata* d'Orbigny, Pal. Franc. Cret. III: 168, pl. 304, figs. 1- 3 ;

Locality : MC-342-A, in black mudstone, disarticulated left and right valves, and fragmentary casts. Our better preserved castmeasures 15 mm of length, against the 11 mm of the lectotype of Aube, FRANCE, of Early Aptian age.

S.C.S. occurrence: La Margarita mudstones, La Paloma sub-domain, of Guariquen-Caripe domain, of Hauterivian age.

Nucula (Nucula) pusilla (Philippi, 1899)
Plate 11, figure 20;

- Syn: *1899 Nucula pusilla* Philippi, Fos. Sec. Chila, p. 61, pl. 26, fig. 12 ;
- *?1901 Nucula pueyrridonensis* STANTON, p. 17-18, pl. 4, figs. 8, 9;

Locality: MO-1306, road to Fundación, Tachira State, Uribante Hemigraben, upper black shales, where two right valves, and part of a left valve, were collected. PHILIPPI (1899) reported it from Portezuelo de Tinguiririca, Chile of Hauterivian age. Traces of the anterior radial striations cited by PHILIPPI (op. cit.) are observable in one of our casts. A bigger-sized and more convex shell, *Nucula (N.) pueyrrydonensis* Stanton, - Belgrano Formation, of Argentina, of Berriasian age, - has the same contours as *N. (N.) pusilla,* indicating the cryophyllic character of the group. *Nucula (N.) simplex* d'Orbigny, (1842, Paleont. Franç., Terr. Cret., t. 3, pl. 301, figs. 11, 12) – Neocomian of North European Province, - has the anterior end more rounded. The clade must have been common in Neocomian bathyal environments. Dimensions: The most complete cast, measures: Length: 11 mm, Height: 7mm.

S.C.S. occurrence: Chururú member of Rio Negro Formation, Uribante Hemigraben. Others: Tinguiririca, Chile, Hauterivian?; Belgrano Formation, Argentina, Berriasian of Hauterivian age.

Sub-genus *Leionucula* Quenstaedt, 1830.

According to KAUFFMAN in HALLAM et alii., (1973: 358) this cosmopolitan subgenus, whose biochron is Cretaceous – Recent, has also a cryophyllic affinity, and a rather bathyal distribution.

Nucula (Leionucula) albensis d'Orbigny, 1844.
Plate 55, fig. 7;

- 1844 *Nucula albensis* d'ORBIGNY, Pal. Fr., Terr. Cret. III:172, pl.301, fig. 15-17;
- 1899 *Nucula albensis* d'O., WOODS, 24, Pl. 4, figs. 9-17;

- 1926 *Nucula albensis* d'O. RENNGARTEN: 68;

Locality: MO-3083, Caño Lisure, Perijá area, Lisure Formation, where it is frequent in glauconitic sandstones, as casts. It reaches big size for the genus: 15 mm of length. Is known from the Early Albian of Fontcouverte, France, and Folkestone of England. In the Middle and Late Albian, it is extended to North European Province, and to the Cenomanian of Westfalia, Germany.

S.C.S. occurrence: Lisure Formation, Perijá, Chimana Formation, DAGM, Sucre State; Guayamure Formation, Atarigua para-autochthon, Lara State.

Age: Middle Albian.

Nucula (Leionucula) incerta d'Orbigny, 1842.

- *Nucula incerta* d'Orbigny, Coq. and Echin. Foss. Of Colombia: 50;

"Mold on the same sample where *Cucullea tocaymensis, and Venus cretacea,* etc. were "collected, from Tena, near Tocayma, province of Santa Fe de Bogotá, Colombia. The "shape is trigonal, and the teeths are very long." (Transl. from d'ORBIGNY, 1842). According to ROYO y GOMEZ (1945a), it belonged to Villeta Group. Until better material is collected, this name should be kept as nomen nudum.

Genus ***Acila*** Adams & Adams, 1858
Sub-genus ***Truncacila*** Grant & Gale, 1931.

KAUFFMAN in HALLAM, et alii, (1973 : 359), considered this cosmopolitan sub-genus, as living in warm-water environments, from mid-temperate to the tropical climatic belts. With a bathymetric range of 80 – 400 meters, in oxygen-poor waters. Its biochron goes from Early Cretaceous to recent.

Acila (Truncacila) bivirgata (Fitton)
Plate 34, figures 1-3, 7, 8, 9, 10 – 15, 19;

- 1836 *Nucula bivirgata* FITTON, Trans. Geol. Soc., 4: pl. 11, fig. 8;
- 1844 *Nucula bivirgata* F., d'ORBIGNY, Pal. Fr., Cret., 3: 176-177, pl. 303, figs. 1-7;
- 1985 *Nucula cf. bivirgata* F., THIELUOY in ROSSI: Annexe, p. 24;
- 1995 *Acila (Truncacila) bivirgata* (Sowerby) VIVAS & MACSOTAY :133, 135;
- 1998 *Acila (Truncacila) bivirgata* (Sowerby) VIVAS & MACSOTAY: 133;

Locality: M0-1506, Arbol Redondo, along Pampam to Boconó road, Trujillo state, Guáimaros shale member of Peñas Altas Formation, of Early Albian age. This taxon originated in the Barremian of Maroc, profited the OAE Events of "Selli" and "Paquier"when the upwelling cold currents invaded most of the shelves inside the Tethys Ocean: Maghrebian subprovince, western European subprovince, (MONGIN, 1980) and finally getting extinct during the Early Cenomanian (FRENEIX, 1972)

S.C.S. occurrence: *A. (T.) bivirgata* is very abundant in the Garcia Formation in Bergantin-Guanta and Guariquén-Caripe Domains, of Late Aptian age. In Valle Grande Formation, (DGC) and Chimana Formation, (DAGM) are frequent on the Middle Albian horizons (VON DER OSTEN, 1954). The upper carbonatic member of Peñas Altas Formation, and Guaimaros member in Early Albian horizons, quite uncommon (GARCIA-JARPA et al., 1980). Few fragments were collected in Majagual and Boquerón Formations, of Late Albian-Early Cenomanian age.

Paleoecology: The association *Acila (Truncacila), Astartemya (Freiastarte), Anisocardia and Isoarca* are detritivore, andobenthic bivalves, inhabiting unconsolidated silty or clayey bottoms, intensely bioturbated. The great amount of articulated shells, suggests they had no predators. The associated gastropods are of small size, generally biodegraded, just like the scaphopoda. The assemblage inhabited in a bathymetric range of **100 – 240 meters,** mostly in aphotic waters. The bivalves must have fed on the abundant soft-bodied worms.

Age: Late Aptian to ?Early Cenomanian age.

Acila (Truncacila) cf. ***schencki*** Stoyanow, 1949
Plate 36, figures 18, 19, 21, 22;

- cf. 1949 *Acila (Truncacila) schencki* STOYANOW, Geol. Soc. Am., Mem. 38:61-63, pl. 8, fig. 1-8;

Description: Shell small, 16 mm of averge length, longer than high, oval-trigonal in outline, with the umbo located at the middle of the shell, or slightly anteriorly. The line bisecting the chevron, is slightly anterior to the greatest convexity of umbones, and anterior to the center of the shell. Ventral margin convex. Our shell is alike to the nominal species, collected in the Pacheta member of the Lowell Formation, California, of Late Aptian age, but is more convex, and the radial ribbing is finer all along the surface of the shell. No secondary divarication is observed, but there is a tendency of coarsening of the radial riblets, in the anterior and posterior extremes.

Dimensions: Length: 16,2 mm, thickness:9,5 mm (Figure 18). Length: 13,5 mm, Height: 11,4 mm

(Fig. 21); Length: 11,5 mm, Height: 12,2 mm (fig. 19).

C.S.C. occurrence: At locality PM-04-C, on road from Periquito to La Margarita mountain, Sucre state, in La Margarita mudstones, (sDLP, DGC) of Hauterivian age. Seven articulated adult shells, and two juveniles, with phosphates adhered to the shells.

Discussion: *Acila (Truncacila)* sp. SCHENCK (1936: 50) cited a small shell, with only primary bifurcation, radial lines very fine (185 microns wide) collected at Slate's Hot Springs, Monterrey County, California, was supposed to be post-Turonian, and prte-Danian. It could be co-specific of our shell, possibly originated in Neocomian horizons.

Age: Hauterivian, possibly Late? This would be the oldest citation of *Acila (Truncacila).*

Genus *Nuculoma* Cossmann, 1907

Euryhaline genus, favored by high salinity environments. Known from the Jurassic of Europe and Asia; during the Early Cretaceous from Gondwanan Province, and North European Province.

Nuculoma lamplughi (Woods, 1899)
Plate 7, fig. 2;

- 1899 *Nucula lamplughi* WOODS, Paleont. Soc. 1(1): 14, pl. 2, fig. 18 a, b; 19.
- 1985 *Nuculana sp. cf. gr. planata* (D.) BALLESTEROS & NIVIA, Proy. Cret. XIV-8;

This small species, was observed already by ROYO y GOMEZ (1942 c), an later by BALLESTEROS & NIVIA (1985) from the Ritaque Formation, Colombia of Valanginian-Hauterivian age. Originlly collected from Speeton Clay "D-beds"of England of Ryazanian-Valanginian age.

S.C.S. occurrence: Locality MC-329-D, Río Pajaral, El Cazón Formation, of Late Berriasian-Early Valanginian age dolomitised articulated three shells. Also at La Margarita mudstones flattened molds of disarticulated shells, of Hauterivian age, both from Guariquén-Caripe Domain, Eastern Venezuela.

Nuculoma naraensis (Mongin, 1951)
Plate 11, figure 2;

- 1951 *Nucula naraensis* MONGIN, Not. Ann.Min. Geol.Tunisie 1(1): 13-14, pl. 2, fig. 5;
- 1980 *Nucula narensis* MONGIN, Not. Serv. Geol. Tunisie 45: 118.

Small shell, about 12 mm of length, of this smooth and inequilateral species, belonging to a group extended from Valanginian (*N. obtusa* /Fitton/) to the Albian *(N. albensis /d'ORBIGNY/)* in Maghrebian Sub-Province, and North European Province. Common in the Neocomian of Djebel Nara, Tunisia, Maghrebian sub-province.

S.C.S. occurrence: Locality VG-556-A, río Morocoto-Caituco , Sucre state, of El Dantó Formation, of Hauterivian age (DGC).

Nuculoma peruana (Gabb, 1877)
Plate 61, figre 17;

- *Nucula peruana* GABB, J. Ass. Nat. Sc. Phila., 8: 292-293, pl. 41, fig. 11;

"Shell very small (Length: 5,5 mm), cuneiform, beaks placed a third of the length from the "anterior end, which is rounded; posterior end narrow and rounded, base nearly straight; "posterior cardinal margin sloping; surface marked by fine lines of growth." (GABB, 1877) The original shell, collected at Tingo, Prov. of Huari, Peru, where it was associated to undetermined species of *Trigonia.*

S.C.S. occurrence: MO-3212, Chimana Grande Island, eastern extreme, Boquerón Formation, (DAGM) of Late Albian-Early Cenomanian age. Casts of disarticulated shells in limestone/shale interphase.

Nuculoma planata (Deshayes, 1842)
Plate 20, figure 20;

- *1842 Nucula planata* DESHAYES in LEYMERIE: 7, pl. 9, fig. 3, 4;
- *1852 Nucula submucronata* CONRAD: 213-214, pl. 4, fig. 14;
- *1861 Nucula cornueliana* d'ORBIGNY, de LORIOL: 84, pl. 10, fig. 6;
- *1916 Nucula margaritifera* DOUVILLE: 177, pl. 21, figs. 19, 20, 21;
- *1967 Nuculoma planata (d'O.)* BUSSON & ALBANESI: 613, pl. 50, figs. 3 – 5;
- *1988 Nucula (Leionucula) planata (d'O.)* DHONDT & DIENI: 9-10, text fig. 2;

Size reaching 20 mm of lenght, this nuculid is of long biochron: Hauterivian to Campanian. Usually found in pelitic rocks in outer shelf environment. Its geographical distribution includes the North European Province, Western European Subprovince, and the whole Gondwanan Province (DHONDT & DIENI, 1988).

S.C.S. occurrence: La Margarita mudstones, (DGC), collected at three localities: PM-09-D, MC-446-C, of Hauterivian age.

Nuculoma cf. carthusiae (Pictet & Roux, 1853)
Plate 12, figure 3;

- cf. 1853 *Nucula Carthusiae* PICTET & ROUX: 477, PL. 39, Figs. 8a, b;

- 1895 *Nucula storrsi* STANTON, :52, pl. 6, figs. 13, 14;
- 1947 *Nucula turgida* RICHARDS, John Hopkins University, S. Geol. 15: 42, pl. 1, figs.

Description. Cast convex, highly inflated throughout; inequilateral, equivalve,attaining a large size; elongate, nearly straight; anterior margin rounded, produced; ventral margin broadly convex throughout, curving upward more rapidly in front than behind; posterior margin sharply rounded; posterior cardinal margin slightly concave; beaks small, pointed proximate and opistogyrate, situated one third of the length of the cast from the posterior extremity. Teeth as in *Nucula,* escutcheon suggested by a deeply excavated concave, smooth area, with an elliptical outline, starting just behind the beaks.

Dimensions: Length: 17,5 mm; Height: 9,1 mm, Convexity of articulated specimen: 8 mm.

S.C.S. occurrence: Locality MC-329, Pajaral river, El Dantó dolostones (DGC) of Early Hauterivian age. Also in El Cazón Formation, (DGC) of Berriasian-Valanginian age.

Discussion: Known from the Valanginian of Paskenta Group, California, and from Perú, in Valanginian-Hauterivian beds. In Switzerland, from Aptian shales. This unusual distribution, suggests a rather bathyal than shelfal habitat.

- Genus ***Palaeonucula*** Quenstedt, 1930.

Palaeonucula is a genus of Triassic-Jurassic biochron, (COX et al., 1969) flourished in Malgache Province, usually in hemipelagic sediments, associated to ammonites, so thermophyllic affinities are assumed.

Palaeonucula spitiensis (Holdhaus, 1913)
Plate 5, figure 21;

- 1913 *Nucula spitiensis* HOLDHAUS, Pal. Indica, 15(4): 428, pl. 95 figs. 11-13;
- ? 1887 *Nucula analoga* MAYER-EYMAR, :6, pl. 1, fig. 8;

I preferred to keep the term *P. spitiensis* (Holdhaus) –Nepal, Tithonian-Berriasian shales-, because it was fully preserved with its shell; *P. analoga* of the Berriasian of western Switzerland, has priority, but is was based on a cast only.

S.C.S. occurrence: Locality VG-376, Ojo de Agua-Santa Rosa road, Sucre State, El Cazón Formation, (DGC, sDLP), of Late Berriasian-Early Valanginian age, - seven fragmentary casts of articulated shells, collected in dolomitic limestones.

Discussion: One way of explaining the presence of a Bivalve of Nepal in Venezuela, - and Switzerland,- is placing *Palaeonucula* among the Bathyal genera (SANDERS & HASSLER, 1969), where the geographical distribution is unusually extensive. In La Casita Formation of Mexico, of Kimmeridgian age, IMLAY (1940a) cited *Nucula? antiqua,* a typical *Palaeonucula,* confirms its presence in S.C.S. during Late Jurassic times. *Paleonucula menkei* (Römer, 1836), of wide distribution in the Purbeckian of Germany, Switzerland and France, is present since the Late Oxfordian in all the North European Province. *P. spitiensis* (Holdhaus) is probably the last taxon of the genus *Palaeonucula,* whose range is extended to Early Neocomian times.

Family **MALLETIDAE** Adams & Adams, 1858.

The family Malletiidae with a biochron from Ordovician to Recent, is composed of soft-sediment inhabitants, as labial palp deposit feeders, proper of bathyal environments.

Genus Paleoneilo Hall & Whitfield, 1869.

A cosmopolitan genus, whose biochron goes from Ordovician to Mesozoic (COX et alii., 1969: N233). No citations were found from Venezuela (TELLO, 1975).

Paleoneilo? etayosernai n. sp., MACSOTAY
Plate 12, figure 2;

Description: Cast of small size, elongated,equivalve, inequilateral; valves slightly inflated, regularly and evenly rounded. Beaks small, appressed, and incurved, prosogyrous; anterior and posterior extremes are sharply rounded; basal margin gently rounded. Below the beaks, the cast exhibits horizontal ondulations: about 5 or 6 on both valves. Traces of concentric striae are preserved on the anterior half of the cast, but vanishes on the posterior 1/3. The hinge-line has been marked by a large number of very fine teeth, gradually increasing in size from the center onward, only visible posteriorly in our sample.

Etymology: This new species is dedicated to Paleontologist Dr. Fernando ETAYO-SERNA, who organized biostratigraphic revision of most of the Cretaceous sedimentary formations of Colombia (1965-1985), having published new species of molluska.

Types: The Holotype, (plate 12, fig. 2) UCVMG/IO-2323, whose dimensions are: Length: 22,25 mm; Heigth: 7,65 mm, Right valve.

Occurrence: Locality MC-329, río Pajaral, El Dantó dolostones, of Early Hauterivian age (DGC), Sucre state.

Discussion: The attribution to *Paleoneilo* Hall & Whitfield, is due to the long-lived character of the genus. The general shape of this new species, is more alike to the genus *Tropinuculites* McLearn, 1918, - Silurian, Canada – with its elongated shape, but without internal septum. Several species of Malletiidae of Cretaceous age are known:

>>> *Neilo renniei* DARTEVILLE & FRENEIX, (1970: 16-17, pl. 1, figs. 2, 3, 4) of the early Turonian of Mungo, Senonian of Logbatjek, and Maastrichtian of Dahomey, of the Maghrebian Subprovince. About the same size, but its postero-dorsal area is convex, not straight.

>>> *Perissonota?* sp. Indet., BAUMBERGER (1925: 257, Pl. 4, fig. 23) of the Valanginian of Sumatra, Indonesia, is very much alike but the posterior margin is more regularly rounded.

Maybe a new name would be useful for these small Cretaceous bivalvia.

Family ***NUCULANIDAE*** Meek, 1864.

Labial palp deposit feeders, with preference for unconsolidated siliciclastic sediments. During Early Cretaceous, showed a preference for Boreal realm distribution, suggesting cryophyllic habits (FRENEIX, 1959).

Genus ***Nuculana*** Link, 1807.
Subgenus ***Praesaccella*** Cox, 1940,

Biochron from Jurassic to Early Cretaceous (COX, et al., 1969: N237) in Asia (India, Japan) and in North European Province.

Nuculana (Praesaccella) seilacheri new species, MACSOTAY
Pl. 12, figs. 1, 5;

- *1977 Nuculana* sp., ALENCASTER, Univ. Nac. Auton. Mex., Ins. Geol. 1(2): 156, fig. 3;

Description: Shell small, elongate-ovate, anteriorly subrounded, posteriorly narrowed nd pointed; basal margin broadly rounded. Anterior dorsal margin straight, posterior weakly concave. Beaks rather depressed and located anterior to the middle of the shell, hinge line with 15 posterior, and 12 anterior teeth. Only mostly decorticated shells are available. Muscular and pallial impressions very obscure and are not visible on the casts. Wrinkles in the surface, suggest pelomorphic deformation. Anterior extremity extended and pointed alike *Yoldia (Kalayoldia)* Grant & Gale (1931), - Miocene to Recent, of western America.

Etymology: I have the honor of dedicating this new species to Dr. Adolf SEILACHER, - Tübingen University, Germany, and Yale University, U.S.A. - the founder of Modern ICHNOLOGY, and author of many studies on PALEOECOLOGY of mostly Mesozoic molluska.

Types: UCVMG/IO-2324, of four articulated casts, the best one the Holotype, (Plate 12, figs. 1, 5). Dimension: Length: 18,25 mm, Height: 9,75 mm. Convexity is not known, due to pelomorphic deformation.

Occurrence: Locality VG-555, río Morocoto-Caituco-Ojo de Agua road, El Dantó dolostones, (DGC), of Hauterivian age.

Discussion: *Nuculana* sp. fide ALENCASTER, (1977) collected in San Ricardo Formation , of Berriasian age, (Chiapas, México) , is probably co-specific with *N. (P.) seilacheri* n. sp. *Leda (?) corbuliformis* STANTON (1901: 18, pl. 4, fig. 11) – Berriasian of south Argentina – is alike, but without the regular concentric lines. *Nuculana (Praesaccella) distinguenda* CORNET & CHAVAN (1952: 82, figs. 7, 8) – Neocomian, Timendert, Algeria, - is strongly inflated. Also alike *Yoldia microdonta* Meek (1892, U.S. geol. Surv., Terr., 6th Annual report, p. 304; TWENHOFEL, 1924: 86-87, Plate 15, Figs. 11, 12) – Late Albian , Dennison Formation, Kansas and Texas, of Gulf-Atlantic Coast Subprovince- but in that shell, the posterior area is sharply rounded, and the size, smaller.

Subgenus ***Rollieria*** Cossmann, 1920
(=***Isonuculana*** COX, 1925)

Common in Upper Bathyal belt, in organic-rich muds. Associated to fresh-water bivalves in Valanginian sediments of Cordillera Central of Colombia, and to hypersaline fauna in the Neocomian of Venezuela (S.C.S.). Common in the Jurassic of Europe and India; during the Early Cretaceous, in North European and North Pacific Provinces from Berriasian to Aptian (GILLET, 1924, Mem. Soc. Geol. Fr., n.ser. 1(3,4): 11).

Nuculana (Rollieria) scapha (d'Orbigny, 1844)
Plate 36, figura 5.

- 1844 *Nucula scapha* d'Orbigny: Terr. Cret. 3: 167, pl. 301, fig. 1-3;
- 1899 *Nucula (Yoldia?) scapha* (d'Orbigny) WOODS,: 5, pl. 1, figs. 8, 9-14;

- 1926 *Nuculana scapha* (d'Orbigny) RENNGARTEN: 69;

Nuculana (Rollieria) scapha is a widely extended bivalve in the Tethys Ocean, In the North European , as in the Gondwana Province, from Valanginian to Early Albian times. It reaches its acme during *Leymeriella tardefurcata* zone, to become extinct at the end of it.

S.C.S. occurrence: Locality MC-446-B, Garcia Formation, (DBG) of Late Aptian age, 6 articulated casts, in a glauconitic sand bed.

Nuculana (Rollieria) valangiensis (Pictet & Campiche, 1866)
Plate 20, figure 18;

- 1866 *Leda valangiensis* PICTET & CAMPICHE, Pal. Suisse III :395, pl. 129 fig. 1a, b ;
- 1980 *Nuculana* sp., GARCIA JARPA et al., :9;

"Cast of an elongated shell, oval, quite compressed, slightly inequilateral. Posterior side "longer, subtruncated, weakly arched; anterior side shorter, acuminated."(transl. PICTET & CAMPICHE, op. cit.). Our cast has preserved part of the shell; in the umbonal area. there are 12-14 weak radial striae, which wanish distally. Concentric cords are restricted to a zone parallel to the distal margin, which is gently curved. Posterior area widely concave, with weak striae preserved in the distal half of it.

Dimensions: The best preserved cast, a right valve, measures: Length: 21,8 mm, and Heigth: 8,7 mm

Occurrence: Mudstones at Hauterive, Switzerland, the type section of the Hauterivian stage. Also at Brasso, Transylvania, in the same horizon.

S.C.S. Occurrence: Locality PM-8, Periquito-La Margarita road, La Margarita mudstones, (DGC) of Hauterivian age; three casts and many fragments. Also at locality MO-1305, in Chururú member of Rio Negro Formation, two casts.

Nuculana (Rollieria) vibrayi (d'Orbigny)
Plate 20, fig. 21;

- 1844 *Nucula Vibrayeana* d'ORBIGNY, Pal. Fr., III: 172, pl. 301, figs. 12-14;
- 1866 *Leda Vibrayeana* (d'O.) PICTET & CAMPICHE, Pal. Suisse, 3 : 399, 401, pl. 129, figs. 5, 6 ;
- 1899 *Nuculana Vibrayena* (d'O.) WOODS : 10, pl. 2, figs. 4, 5, 6;

This taxon is common in Aube, the Albian stratotype of France, and in the Clansayesian of Maroc (MONGIN, 1979). Present in the Cambridge greensand of England, of Aptian age.

S.C.S. occurrence: Locality MC-341-C, La Hacienda, on Rio Carinicuao, El Dantó dolostones, (DGC) of Hauterivian age. Also in Garcia Formation, in marls of Cerro de Piedra, as pseudomorphs in goethite, of Late Aptian age: MC-382-A.

Genus ***Mesosaccella*** Chavan, 1946

A taxon of extensive distribution: North European Province, Japanese –East Asian Subprovince, East African Province and Syrian Subprovinces, not frequent in Eocretaceous. The biochron goes from Early Cretaceous (Aptian) to Late Cretaceous (Maastrichtian).

Mesosaccella nuculoides (Gabb, 1877)
Plate 37, figures 12, 13;

- 1877 *Corbula nuculoides* GABB , Acad. Nat. Sci.Philadelphia Jour., 2nd. Ser, 8:283, pl. 40, fig. 10;
- 1897 *Perissonota nuculoides* (G.) GERHARDT, V. N. J. M. G. 11: 100-102, pl. 2, fig. 6a, b, c;
- 1930 *Nucula (Perissonota) nuculoides* (G.) STEINMANN : 130, Fig. 163 ;
-

Mesosaccella nuculoides (Gabb) is a wide-spread taxon in S.C.S., whose presence on the shelfal fauna was related to Dysoxic/Anoxic Oceanic events, with cold water upwelling.

S.C.S. occurrence: Locality MC-332-A, road to Yucucual, Boquerón Formation, of Late Albian-Cenomanian age (DGC); only disarticulated valves. Found also in Valle Grande (MC-86-I, MC-429), and Peñas Altas Formation, in Trujillo state.

Genus ***Ryderia*** Witton, 1830

Is a Jurassic genus, reported until now, from North European Province.

Ryderia cf. spathulata (Forbes, 1836)
Plate 32, figure 11;

- Cf. 1899 *Nuculana spathulata* (Forbes) WOODS, Paleontogr. Soc. 1(1): 1-2, pl. 1, figs. 1, 2, 3;

Shell thin, compressed, elongate, very inequilateral; short and rounded anteriorly; long end tapering poteriorly, with a faint carina extending from the umbo to the post-ventral extremity, cutting off a flattened area. The difference with *R. spathulata* s.s. lies in a deflexion on the antero-dorsal slope; the

umbones are even smaller than the nominal species. *R. spathulata* is known from England, since Valanginian to Barremian; its last occurrence was in the Paris Basin, France, in the Early Aptian (CORROY, 1925: 298).

Dimension: Length: 13,3 mm, Height: 5,2 mm.

C.S.C. occurrence: Locality MO-3213, Chimana Grande Island, on northeastern ridge (MACSOTAY et al., 1986, fig. 6), lower limestone of the Taguarumo Formation, (DAGM) of Late Hauterivian age. One left valve.

Genus/Subgenus ***Yoldia (Yoldia)*** Möller, 1789

KAUFFMAN in HALLAM (1973: 358) considered it cosmopolitan , with a biochron of Cretaceous to Recent. It is a cryophyllic taxon.

Yoldia (Yoldia) aff. kissoumi *McLearn, 1931*
Plate 35, figure 6;

Our specimens differs from *Y. (Y.) kissoumi* McLearn (1931, Royal Soc. Canada, 3º ser., 25(4): 7, pl. 1, figs. 2, 3) – Clearwater and Grandstand Formations, Alaska, of Aptian age,- in the lacking of the horizontal striations on the flank of the shell. Other related species are: *Yoldia microdonta* Meek, 1871, -Late Albian Kiowa Formation, of the Gulf-Atlantic coast Subprovince, and *Yoldia (Y.) nasuta* Gabb, 1864. – Late Cretaceous of the North Pacific Province.

S.C.S. occurrence: Mc-240-F, Río Azagua, Garcia Formation, DBG, of Aptian age. It is associated to *Acila (Truncacila) bivirgata,* in glauconitic limestones.

FAMILY ***ISOARCIDAE*** Keen, in COX et alii., 1969: N241.
Genus ***Isoarca*** Münster, 1842.

Good reviews of this genus, are the ones of NICOL (1947), and FRENEIX (1959); its biochron goes from Jurassic (Bajocian) to Late Cretaceous (Senonian).

Isoarca cantilensis n. sp., MACSOTAY
Plate 47, figs. 2, 3, 4;

Description: Cast oval or slightly subquadrate, rounded, length greater than height, much inflated, short anteriorly and long posteriorly, where the type specimen is somewhat damaged. Prosogyrate shell, where the beaks are very proximate. Ventral margin slightly curved. The shell was weathered off, but it must have been thick; pallial line continuous; margin of the valves smooth.

Etymology: The term cantilensis comes from El Cantil Formation, an important carbonate-dominated unit, typical of the Bergantin-Guanta Domain (DBG) of the Serrania del Interior Oriental (VIVAS, 1986; VIVAS & MACSOTAY, 1995, 1998), where this new species was collected.

Type: One well-preserved cast, the Holotype, is numbered UCVMG/IO-2325, which measures, of Length: 76,2 mm, of Height: 56,2 mm and Thickness: 68,5 mm.

S.C.S. occurrence: Locality MC-86-G, Pico Garcia, Monagas state, El Cantil Formation (DBG), of Early Albian age (ARNAUD et al., 2000).

Discussion: *I. cantilensis* n. sp., is alike to *I. globosa* (BOEHM, 1883: 569, pl. 65, figs. 2-4)- Berriasian of Kotzobenz, Czech Republic, - but it is more elongated. Another related taxon is *Isoarca?* sp., COX (1929, P.D.N.H. v. 50:141-142, pl. 1, figs. 1a, 1b) – Exogyra-sands, Portland beds, England, of Ryazanian age,- but the prosogyrous umbones are completely terminal, and the contour, ovoidal.

Isoarca cf. cordiformis (Zieten, 1831)
Plate 3, figs 6, 6ª;

Description: Cast oval, subequilateral and slightly pentagonal, rounded, height greater tan length, much inflated, almost equivalve. Ventral margin slightly angular; umbones large, subcentral, close together, curved forward. Surface ornamentation, not preserved. The absence of a strong concentric ornamentation, is the main difference with *Isoarca cordiformis* (Zieten) BOEHM, (1883, Palaeont., 8(2): 568, pl. 64, figs. 13-16) – Berriasian of Stramberg, Austria and southern Germany.

Dimension: Height: 27 mm, Length: 24 mm, Thickness of articulated shell: 24 mm.

S.C.S. occurrence: Morro Blanco Formation, type locality in Venados Island, (DAGM), of Late Berriasian-Early Valanginian age. Four articulated casts.

Isoarca crassicornis (Philippi, 1899)
Plate 19, figures 4, 5;

- 1899 *Arca crassicornis* PHILIPPI: 58-59, pl. 28, fig. 11;
- Cf. 1864 *Isocardia Montmollini* PICTET & RENEVIER: 70, PL. 7, FIG. 8;
- Cf. 1921 *Isoarca cf. Montmollini* (P. & R.) GILLET: 12, fig. 1;
- 1995 *Isoarca cf. montmollini* (P. & R.) VIVAS & MACSOTAY : 133 ;

Description: Cast of an articulated specimen, subtriangular, strongly swollen, subequilateral ;

umbo prominent, rounded, widely separated from each other; dorsal margins somewhat concave; ventral margin widely rounded; the surface shows a weak concentric sculpture.

Dimensions: Length: 26 mm, Heigth: 18 mm, Thickness: 32 mm; the measurements are made on the restitution of the whole cast (PHILIPPI, 1899, fig. 11).

Occurrence: Original description from Tinguiririca valley, Chile, of Neocomian age. In Switzerland, in the "calcaire à Spatangues"of Hauterivian age. In Wassy, France is scarce in Barremian age-sediments.

S.C.S. occurrence: Locality MC-341-C, La Hacienda in Rio Carinicuao, in marls with echinoids, bivalves and ammonites, in El Dantó dolostones, of Hauterivian age (DGC).

Isoarca freneixae n. sp., MACSOTAY
Plate 49, figures 5, 6;

- 1954 *Idonearca cf. I. glabra* (Parkinson) COX, J. Paleont. 28(5): 626-627;

Description: Cast medium-sized, rectangularly ovate, with incoiled and prominent beaks; inequilateral, aequivalve. Height greater than length, quite inflated, short anteriorly, long posteriorly, ventral margin widely curved. Umbones large, anterior, close together, prosogyrous. No ornamentation is observed on any of the casts.

Etymology: Named after the Paleontologist Dr. Suzanne FRENEIX, of the Institute de Paléontologie, Museum National d'Histoire Naturelle, Paris, France. For her outstanding studies on Cretaceous molluska of the Maghrebian Subprovince.

Type: UCVMG/IO 2146, Holotype, whose dimensions are: Height: 31,2 mm, Length: 29,2 mm, and Thickness: 31 mm.

S.C.S. occurrence: Localities MC-346-B, four casts, fragmnentary; MC-346-C, the Holotype, one adult specimen. All came from El Dantó dolostones, (DGC) of Hauterivian age. Locality MO-881, of Cachimena inlet, Mochima cliffs, (DAGM) of upper Taguarumo Formation, of Barremian age. Also HA-4367, Arbol Redondo section, dolomitised limestone, of lower Peñas Altas Formation, of Barremian age (ARNAUD et al., 1999). The specimen from Trinidad, was collected in Cuche Formation, of Hauterivian age.

Discussion: Our new species is alike to *Isoarca? montmollini* (Pictet & Renevier)(GILLET, 1921.A: 12, fig. 1) – Barremian-Aptian of Switzerland and France, and Hauterivian of the Jura mountains, - frequent in iron-rich sediments. The hinge-line is taxodont, and the beaks are strongly incurved. But *I. montmollini* is trigonal subequilateral, while *I. freneixae* is rectangular-ovate, ventrally rounded. *Isoarca orbignyi* COSSMANN (1918, Bull. Soc. Geol. France, 10(6): 410-411, pl. 15, figs. 8, 9) – Barremian of France, - is also very alike, but its shape is ovoidal-transverse, and rounded all around.

FAMILY ***ARCIDAE*** Lamarck, 1809.
Genus: ***Barbatia*** Gray, 1842.

This is a cosmopolitan genus, according to KAUFFMAN in HALLAM , (1973: 358). With a bichron of ?Triassic, Jurassic to Recent, proper to the shelf, mostly in Sublittoral belt.

Barbatia marullensis (d'Orbigny, 1844)
Plate 39, figure 4;

- 1844 Arca marullensis d'ORBIGNY, Pal. Fran. III: 206, pl. 310, fig. 3 – 5;
- 1918 *Barbatia marullensis* (d'O.) COSSMANN, 408-409, pl. 15, fig. 10;

This species, common in Western European and Balkanic Subprovinces during Hauterivian to Aptian times; invades North European Province, during Albian times.

S.C.S., occurrences: Locality MC-426-C, shaly depression in Tonoro, near Güiria, Garcia Formation (DGC) of Late Aptian age: two articulated adult specimens.

Barbatia raulini (Leymerie, 1842)
Plate 22, figures 16, 17;

- 1844 *Arca Rauliniana* d'ORBIGNY, Pal. Fran. III : 204-205, pl. 310, figs. 1, 2 ;
- 1921 *Arca (Barbatia) Rauliniana* Leym., GILLET: 12-13;
- 1951 *Barbatia aff. rauliniana (d'0)* GIGOUT: 352;

B. raulini is a common species in North European Province, and Western European and Maghrebian subprovinces. Its biochron goes from Valanginian to Early Aptian.

S.C.S. occurrences. Locality PM-08-B, Pajaral-La Margarita road, (DGC, sDLP) La Margarita mudstones, of Hauterivian age; in shales of the same age, in Colombia (HUBACH, 1957a). Only casts were found.

Discussion: *Barbatia cavata* (de LORIOL) – COX, (1925: 125, pl. 1, figs. 3-6) - lower Spilsby and Portland beds, of Ryazanian age, England, and Boulonnaise, France, coetaneous,- is a much smller and thinner shell, but it could be the ancestor of our species.

Family ***PARALLELODONTIDAE*** Dall, 1898.
Subfamily ***PARALLELODONTINAE*** Dall, 1898.
Genus ***Parallelodon*** Meek & Worthen, 1866.

It is a cosmopolitan taxon (COX et alii.,1969) whose biochron extends from Ordovician to Late Jurassic times. Cretaceous species survived until Albian times.

Parallelodon carteroni (d'ORBIGNY, 1842)
Plate 19, figures 21, 22;

- 1844 *Arca carteroniana* d'ORBIGNY, Pal. Franç., III: 202, pl. 309, figs. 4-8;
- 1866 *Arca carteroniana d'Orb.* PICTET & CAMPICHE, Pal. Suisse, :436, pl. 130, fig. 9 ;
- 1899 *Arca carteroniana (d'O.)* WOODS, :33, pl. 6, figs. 4, 5;
- 1974 *Arca carteroniana* (d'O.) DIMITROVA, :49, pl. 22, fig. 2;

Taxon widely distributed in North European Province, Western European and Balkanic Subprovinces, from Hauterivian to Albian stages.

S.C.S. occurrence: Locality VG-555-A, road rio Morocoto-Caituco-Ojo de Agua, in black shales of El Dantó dolostones (DGC) of Hauterivian age. Only casts were recovered.

Parallelodon tocaymensis (d'ORBIGNY, 1842)
Plate 51, figure 14;

- 1842 *Cucullaea tocaymensis* d'ORBIGNY, Coq. & Echin. Foss. Col.: 55-56, pl. 6, fig. 1-3;
- 1877 *Barbatia? Raimondii* GABB: 290, pl. 41, fig. 6;
- 1942 *Parallelodon raimondii* (GABB), LISSON: 99;

Description: Cast small, narrow, compressed; beaks one-fourth of the length from the anterior end; umbones low and broad; a broad shallow depression runs from the umbones downwards and backwards, reaching the base about a third of the length of the shell from the anterior end; base broadly and shallowly emarginated just a point opposite the umbones, at the termination of the superficial depression; posterior end rounded, without emargination near the hinge line. Area long and very narrow. The fine radiating ribs only have been seen in an external mould. The shell was quite thick.

Dimensions: Length: 21 mm, Height: 10 mm, Thickness: 9 mm. Apical angle: 128º. (d'ORBIGNY, 1842: 55).

S.C.S. occurrence: Locality MO-1757: Corozo, south of San Cristóbal, Aguardiente Formation, of Middle Albian age. Píche member of Apón Formation, of Early Albian age, partial external mold in yellow limestone (coll. G. BENEDETTO, 1976). Albian of Colombia and Perú.

Subfamily: ***GRAMMATODONTINAE*** Branson, 1942.
Genus : ***Grammatodon*** Meek & Hayden, 1853.
Subgenus: ***Nanonavis*** Stewart, 1930.

The ***Nanonavis*** subgenus is proper of the North-temperate realm, according to KAUFFMAN in HALLAM , (1973: 367), including Japan.

Grammatodon (Nanonavis) carinatus (Sowerby, 1813)
Plate 51, figures 21, 22, 23, 24;

- 1844 *Arca carinata* Sow., d'ORBIGNY, Terr. Cret., III: 214-215, pl. 313, figs. 1-3;
- 1853 *Arca carinata* Sow., PICTET & ROUX: 462-463, pl. 37, fig. 1;
- 1972 *Grammatodon (Nanonavis) carinatus* (S.) FRENEIX: 66, pl. 1, figs. 6ª-b; 7;
- 1974 *Grammatodon (Nanonavis) carinatus* (S.) DIMITROVA: 49, pl. 22, figs. 11, 13, 14 ;
- 1999 *Grammatodon carinata* (S.) PERAZA et al., : 68.

This species has the biochron of Late Aptian to Early Cenomanian, extended in the North European Province, Western European and Balkanic subprovinces. Is one of the species of the Albian stratotype, in Aude, France (MONGIN, 1979).

S.C.S. occurrences: Cited from Chimana Formation of Chimana Grande island (DAGM) *Parallelodon cf. brewerianus* fide VON DER OSTEN, 1954) of Early-Middle Albian age. In La Puya member of Peñas Altas Formation, of Middle Albian age, is a conspicuous fossil. Locality MC-426-D, shale in Tonoro, near Güiria (DGC)of Valle Grande Formation of Middle Albian age is where most casts were recoverd in Venezuela.

Grammatodon (Nanonavis) securis (Leymerie, 1842)
Plate 42, figures 10, 13;

- 1899 *Grammatodon securis* (Leymerie) WOODS: 44, pl. 7, figs. 14, 15; pl. 8, figs. 1, 2;
- 1907 *Cucullaea securis (L.)*, HAUPT: 213-214, pl. 9, figs. 8a-c;
- 1965 ?*Nanonavis (Nanonavis) yokoyamai* (YABE & NAGAO) HAYAMI: 238, pl. 27, figs. 8-13;
- 1988 *Grammatodon (Nanonavis) securis (L.)* DHONDT & DIENI, 11, pl. 1, fig. 2 ;

MONGIN (1980 : 119) published the biochron of *G.(N.)securis,* as Valanginian to Aptian in the North European Province, the Western European,

Maghrebian and Balkanic subprovinces, but also in the Japanese-East Asian subprovince. GILLET (1924: 15) the *carinatus* species would be a variety of *G. (N.) securis* , which would iniciate during the Aptian stage. There is another possibility: *carinatus* would be an ecophenotype of *securis*, in the same way as *guyanensis and lacerate,* are related to *Crassostrea rhizophorae* (Guilding) the Pliocene-Recent dominant oyster in the Caribbean Province (MACSOTAY, in press).

S.C.S. occurrences: Localities MC-118-A, MC-382-A, MC-90, MC-19, MC-446-D, JFS-134, JFS-144, VG-139-C, VG-139-F, all from Garcia Formation, of Early-Late Aptian age.

Genus *Hayamia new genus,* Macsotay

Diagnosis: Shell trapezoidal, relatively shorter than other *Grammatodontinae*; valve margins closed, without observable denticulations, the interior is unknown. Umbones placed in the anterior extreme of the valve. Externally with coarse growth lines; umbonal area with strong radial ribs in left valve, weak on the right valve. Thick shelled.

Material: Eight articulated shells, all mature, exceptionally preserved, the designated type is *Hayamia dantoensis* new species, OD.

Etymology: This new genus is named after the famous Paleontologist, Dr. Itaru HAYAMI, - University of Tokio, Japan,- whose Cretaceous molluskan studies contributed enormously to the comprehension of the Tethys Ocean's existence.

Distribution: The genus *Hayamia* n. gen., is known from the western side of American continent: the Peruvian, the South Caribbean and Neuquen Suprovinces. This is a typical Paciphyle genus, originated from Indo-Pacific Jurassic ancestors as *Grammatodon (Indogrammatodon) COX, 1935.*

Biochron: Early Cretaceous, stages Berriasian to Hauterivian .

Habitat: The Genus *Hayamia* n. gen., shows many features in common with the taxon *Anadara (Lunarca)* Gray, 1857 (COX et al., 1969, N254, figs. 3, 5) – Eocene to Recent, Southeast North America to Brazil, - in its thick, elongate, ovoid, shell and the presence of radial sculpture. The taxon *Anadara (Lunarca) ovalis* (Bruguière) fide CASTAGNA & CHANLEY (1973, Malacologia, 12(1): 61), had the habit of living attached to rocks, corals and buoys. It is abundant on the northern Brazil-Guyana coasts, known from the low salinity, due to the Amazon River Estuary (V. R. ALTENA , 1971, Zool. Verh., nº 119: 20-21, pl. 1, figs. 1-3). In Venezuela, it is the more abundant arcid in the Gulf of Paria, in depth of **0 to 24 meters,** in salinities variable between 13 and 30 ‰, (VAN ANDEL & POSTMA, 1954; MACSOTAY & CAMPOS, 2001). This geographic distribution (from Cape Cod, Massachusets, 42º N, to Uruguay , 38º S), suggests a wide tolerance to temperature changes.

The genus *Hayamia* could be an adaptation to the saline and hypersaline seas developed in the Western Tethys Ocean, during Neocomian times. The thick shell was a needed not only as protection against predators, but against chemical corrosion.

***Hayamia dantoensis* n. gen., n. sp.**, Macsotay
Platse 16, figure 1, 2, 5, 6, 9;

Diagnosis: Trapezoidal-oval , thick shell, big sized, whose coarse, regular, concentric sculpture is only traversed by radial riblets near the umbo.

Description: Big sized, heavy shell, ovoid, subtrigonal, ornated with irregular, sharp concentric cords, and few feeble, thin, radial costae, near the umbones. Prosogyrate, the umbos are subterminal; the margins are tightly closed, and protruding. The hinge-line and the teeth are unknown, the ligamental area, narrow and short. The antero-dorsal margin is slightly concave, and rapidly flows in the openly rounded distal margin. The postero-dorsal margin is widely convex all along the shell, to join the distal margin.

Etymology: This species is named after the litostratigraphic unit, (El Dantó dolostones), and the homonymous creek, located in the Municipio Andrés Eloy Blanco, of Sucre state, Venezuela.

Types and dimensions; UCVMG/IO-2326, Holotype, Height: 75 mm, Length: 84 mm (incomplete), Thickness: 60 mm. Incremental angle: 100º.

S.C.S. occurrence: Locality MC-338-H, El Cordón-rio Carinicuao road, El Dantó dolostones, (DGC), Sucre State, Hauterivian age.

Hayamia striatiumbonata (Imlay, 1940).

- 1936 *Cucullaea catorcensis* KELLUM: 1068; (not CASTILLO & AGUILERA, 1895)
- 1940 *Cucullaea striatiumbonata* IMLAY, Geol.Soc. Amer. Bull. 51(1): 142, 143, pl. 3, figs. 18 – 21;

Description: Robust shell, moderate in size, fairly ventricose, equivalve, inequilateral, subtrapezoidal in outline. Dorsal margin straight, making an angle about 110 º with the nearly straight posterior margin; anterior margin regularly rounded, meeting with

dorsal margin at nearly a right angle, rounding gradually into ventral margin; ventral margin gently convex, inclined somewhat oblique to dorsal margin, forming a subacute angle with the posterior margin. Beaks moderately separated, strongly incurved, situated about one-fourth of the length of the shell, from the anterior extremity. An angular carina extends from the beak posteriorly to the postero-ventral extremity. The carina is sharp, becoming obtuse towards the ventral margin. It is paralleled dorsally by a gently concave area. Surface ornamented with strong, concentric growth lines, and with radiating lines. The latter are raised and especially conspicuous on the umbo, and on the anterior slope, becoming fine and inconspicuous on the posterior slope. Dimensions are as follows: Length: 70 mm, Height: 54 mm, Convexity: 52 mm.

S.C.S. occurrence: Carbonera Formation, Sierra de Mapimi, Durango, México, of Berriasaian-Valanginian age. In Venezuela, locality VG-376-B, Ojo de Agua-Santa Rosa road, between Rio Grande and the quebrada del Medio, estado Sucre (GC) El Cazón Formation, of Late Berriasian-Early Valanginian age.

Discussion: *Hayamia striatiumbonata* (Imlay) is a shell with subtrapezoidal shape, but having in common with *Hayamia dantoensis* n.sp., the rough surface with irregular concentric and radial ornamentation, and strong prosogyrous beaks.

Hayamia mendozana (Weaver, 1931).

- 1931 Cucullaea mendozana WEAVER, Univ. Washington, Mem. 1: 190-191, pl. 13, figs. 49, 50.

Description: Shell moderately small, (length: 30 mm), greatly inflated, relatively short and high, equivalved, inequilateral, with umbones far apart, and sub-cuadratic in outline. The ligamental area is very broad and long, continuing for a distance of 95 % of the maximum length of the shell. Its surface is approximately horizontal and flat, except for a very slight marginal ridge. Upon it, on each valve are 10 ligamental grooves conforming to its marginal outline. The anterior and posterior ends are acute, usually forming angles of 35º or 40º. A prominent umbonal ridge extends from the umbones to the junction of the basal and posterior margins, but becomes less conspicuous in its downward course. The surface behind the umbonal ridge, is only slightly concave, forming an angle of 125º in front of the umbonal ridge. The umbones – between the middle and posterior fourth of the shell, are apart at least one-third of the width of the shell (main difference with *H. dantoensis)*. The posterior margin is straight and almost vertical, forming a sub-angular junction with the broadly convex basal margin. The anterior margin is subvertical, short and slightly concave. The surface is ornamented with evenly spaced, moderately heavy, concentric lines of growth, which are crossed by heavy radiating costae with interspaces of double or quadruple width. The radiating costae reach the distal margins. The radial ribs tend to be more pronounced on posterior and anterior ends, present on all specimens. "The hinge line resembles those of *Idonearca* but the details of the teeth "could not be determined except on the anterior end, here there are three ridges making "angles of 45º with the hinge line. They trend upwards toward the umbones, and the "upper ones are the longest." (WEAVER, 1931: 191). With a length of 30 mm, is the smallest of all the *Hayamia.*

Occurrence: The Lower Neocomian of Central Mendoza, Argentina, of Neuquén Subprovince.

Cucullaria Group, (COX et al., 1969, N258)
Genus ***Nemodon,*** Conrad, 1869.

?Nemodon simillima (Whiteaves, 1884)
Plate 44, figure 4 ;

- *1884 Nemodon fischeri*, WHITEAVES, Mes. Foss, 1(3): 234, pl. 31, fig. 5; (not d'Orbigny, 1850.
- 1937 *Parallelodon (Nemodon) simillima* (W) REINHART: 85;
- 1958 *Parallelodon (Nemodon) simillima* (W) ANDERSON: 94-95;

This taxon was collected on Maud Id., Queen Charlotte Archipel, British Columbia, Canada, in Yakoun Formation, of Late Albian age (ANDERSON, 1958).

S.C.S. occurrence: Locality HA-4581, río Santo Domingo, Escandalosa Formation, Barinas of Early Cenomanian age (ARNAUD et alii. 1999: Fig. 27). Only one, ill-preserved cast was recovered, so this genus remains to be confirmed in Venezuela.

Family ***CUCULLAEIDAE*** Stewart, 1930.
Genus ***Idonearca*** Conrad, 1862.

Cucullaea (Idonearca) was considered as belonging to North Temperate Realm, in all the Euramerican region, by KAUFFMAN in HALLAM et alii.,: 368; with a biochron of Jurassic-Cretaceous (COX et alii., 1969: N260). Reviewed the known species, the distribution is Proto-Pacific, and Tethys Ocean. Is conspicuous in all the subrovinces of the Gondwana Province. *Idonearca* was a shallow-water, epifaunal filter-feeder. It is comparable to the nestling habits of *Lunarca and Scapharca (Scapharca),* of the

Caribbean shelfs: carbonatic sands and gravels are preferred (MACSOTAY, 1982). Its predation by octopus is important.

Idonearca acuticarinata (Nagao, 1934)
Plate 49, figs. 22, 23;

- 1934 *Cucullaea acuticarinata* NAGAO: 192, pl. 24, figs. 10 – 14; pl. 30, fig. 5;
- 1938 *Trigonoarca sp. cf. ligerienis d'Orb.,* DIETRICH: 89, pl. 16, fig. 8; non figs. 7, 9;
- 1938 *Cucullaea n. sp.,* DIETRICH: 90-91(partim), pl. 17, fig. 5; non 4, 6;
- 1965ª *Cucullaea acuticarinata* N., HAYAMI, Kyushu Univ. 15(2): 242-245, pl. 27, fig. 15; pl. 28, fig. 1-10.

This medium-sized species, is common in the Hiraiga and Aketo Formations, of the Miyako Group, Japan, of Aptian-Albian age. It is a probable descendant of *I. cor* Matheron, -Hauterivian of Tethys Ocean.

S.C.S. occurrences: This species is well represented in the Villeta Group, of Colombia. Locality MC-445-A, Campo Alegre-Buena Vista road (Teresén) cerro La Torre, in clay-shales of Guacharo Member of El Cantil Formation, (DGC), Monagas state,. Venezuela.

The age is Early Albian. Also in Lisure Formation, of Middle Albian age, and Maraca Formation, of Late Albian age both in Perijá range. *Cucullaea gracilis* CRAGIN, (1893: 173) seems to be a closely-related form, from Glen Rose Formation, Texas, U.S.A.

Idonearca brevis (d'Orbigny, 1842)
Plate 49, figures 1, 2, 3, 4;

- 1842 *Cucullaea brevis* d'ORBIGNY, Coq. & Echin. Foss. Colombie: 55, pl. 5, figs. 2-4;
- 1938 *Cucullaea gabrielis* LEYMERIE, DIETRICH: 91, Pl. 17, Fig. 7; (pars)
- 1954 *Cucullaea brevis* d'O., BENAVIDES: 375, 380;
- 1985-a *Idonearca brevis* (d'O.) ETAYO SERNA , Proy. Cretacico, Publ. Geol.Especial 16: 24-9; 24-12; 24-15;

This taxon is one of the most common fossil Bivalva in the Peruvian and South Caribbean Sub-provinces with a biochron of Hauterivian to Early Albian age. *I. brevis* was proposed originally in a cast of big size: Length: 70 mm; Height: 70 mm, and Thickness: 50 mm; the apical angle of 91º (d'ORBIGNY, 1842).

S.C.S. occurrences: Locality An-77, Las Callecitas hill, Bergantin area, El Cantil Formation, (DBG, fide VIVAS, 1987), of Late Aptian age. From the Hauterivian age, is known from the Macanal shales and Lower Villeta Group, Colombia, and La Margarita mudstones, of Venezuela. From the Barremian, Las Juntas, Fomeque and La Paja Formations, Colombia. In the Aptin stage, Lope member of the Taguarumo Formation, lower Peñas Altas Formation, and upper Villeta Group, of Colombia. From the Albian, in the Chúlec and Inca Formations, Perú, and El Cantil, Venezuela.

Idonearca collignoni n. sp., MACSOTAY
Plate 49, figs. 15, 16;

Diagnosis: Trigonal cast, with high rounded beaks, and a postero-dorsal area with 2-3 furrows descending from the beak.

Description: Cast of an articulated shell, which was thick, swollen, trigonal. Hinge line short, shell posteriorly elongated and rounded. The valves are divided by an oblique crest, rounded; the posterior area exposes three furrows on the right valve, and two furrows on the left valve. Beaks are prominent, rounded. There is a lower crest in the middle of the anterior area.

Etymology: I have the honour of dedicating this unusual Bivalve to General Maurice COLLIGNON, of the French Colonial Army, who during the II World War, realized a huge collection of Cretaceous fossils in Madagascar, which he published later.

Type: UCVMG/IO-2150. The Holotype measures, Height: 42,8 mm, width: 32,4 mm, Thickness: 32 mm.

S.C.S. occurrence: Locality MO-2877, ojal del Purgatorio, Bergantin area, El Cantil Formation, (DBG), Anzoategui state, (VIVAS, 1987) of Early Albian age.

Discussion: Quite alike to *Idonearca coquandi* (MALLADA, 1887, Syn. Fos. España, III: 113, pl. 33, figures 1, 2)- Aptian of Maestrazgo Basin, Spain, but it is a relatively higher shell, and the furrows on the posterior slope do not match each other along the margins.

Idonearca cor (Matheron, 1842)
Plate 13, figure 4;

- 1842 *Cucullaea cor* MATHERON, Cat. Meth.: 232, pl. 19, figs. 3-4;
- 1879 *Cucullaea cor* MATHERON, Rech. Pleont. Pl. B-8, fig. 4;
- 1948 *Cucullaea cor* (M.) CHARLES, BMHnM, 6: 16, pl. 2, figs.2, 2ª;
- 1974 *Cucullaea (Idonearca) cor* (M.) DIMITROVA, Foss. Bulg., IVb: 52, Pl. 23, fig. 2;

This species is known only from casts, the shell was not preserved in any case. It was collected in south France, Switzerland, Marocco and Bulgaria, always from Hauterivian horizons. Illustrated specimen: Length: 74,6 mm, Height: 53,3 mm.

S.C.S. occurrence: Locality MO-3213, Chimana Grande Island, Lope inlet, Lower Taguarumo Formation, (DAGM) of Late Hauterivian age. Also in El Dantó dolostones in El Pato Domain.

Idonearca glabra (Parkinson, 1811)
Plate 49, figures 11, 12;

- 1899 *Cucullaea glabra* Parkinson, WOODS : 57, pl. 11, figs. 8-12; pl. 12, figs. 1-5;
- 1988 *Cucullaea (Idonearca) glabra* P. DHONDT & DIENI : 11-12, pl. 1, fig. 3; text-fig. 3;
- 1995 *Cucullaea (Idonearca) fibrosa* (Sowerby) VIVAS & MACSOTAY: 136;

DHONDT & DIENI (1988) gave the planetary distribution of this species in the Western and North European, Apulian and Balkanic Subprovinces; their biochron goes from Early Aptian to Cenomanian stage. Is present in the Albian stratotype in Aube, France.

S.C.S. occurrence: In Caripito member of Chimana Formation, Anzoategui state, (DBG) of Middle Albian age. In El Cantil Formation (DBG) and upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999) of Early Albian age.

Idonearca glabrata (Philippi, 1899)
Plate 32, figure 16;

- 1899 *Arca glabrata* Philippi, Foss. Sec. Chile: 52, pl. 26, fig.3;

Originally collected in Portezuelo de Tinguiririca, Chile, of Neocomian age, was a cast of an articulated specimen, with the shell of the right valve, partially conserved. Its size was: Length: 40 mm, Height: 25 mm: Thickness: 24 mm. The well exposed area measured, of Length: 31 mm, and 7 mm of width. Our shell, with the postero-dorsal alation broken off, also exhibits a well-defined carina, sharp along most of the extension, only gets weakened toward the postero-ventral curvature. Our two shells are partially replaced by siderite.

S.C.S. occurrence: Locality PM-29-A, on the road to La Pica, in Early Taguarumo Formation, (DAGM); in shales with ammonites of the *Colchidites* zone, of Late Barremian age. The limestone is a slumped material, with intraformational deformation, and its Bivalvia and Polychaeta suggest an older age: Late Hauterivian.

Idonearca knechteli (Richards, 1947)
Plate 49, figures 13, 17;

- 1947 *Arca Knechteli* RICHARDS, J. H. US.G. 15: 46, pl. 4, figs. 5, 6;

Taxon collected originally in Chulec Formation, Perú, of early Middle Albian age of *Knemiceras raimondii* ammonite zone (BENAVIDES, 1956: 373-375).

S.C.S. occurrence: Locality MO-2877, Ojal del Purgatorio, estado Anzoategui, (DBG), upper El Cantil Formation, of Early Albian age. Also found in Arbol Redondo section, in upper carbonatic member of Peñas Altas Formation of Early? or Middle? Albian age.

Idonearca terminalis (Conrad, 1857)
Plate 49, figures 14, 18; plate 51, figura 9;

- 1857 *Cucullaea (Idonearca) terminalis* Conrad: 148, pl. 4, fig. 2;
- 1903 *Cucullaea sp.,* SHATTUCK: 86: 23;

Idonearca terminalis (C.) is a common species in Glen Rose Formation, Texas, of Early-Middle Albian age; also found in Shoal Creek, Buda Formation, of Early Cenomanian age.

S.C.S. occurrence: Locality HA-4409, Arbol Redondo section, Trujillo state, of upper carbonatic member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, fig. 27).

Genus ***Dicranodonta*** Woods, 1899,
emend. KELLY, 1978.

This genus, whose type is *Cucullaea (Dicranodonta) benniworthensis* Kelly, 1978, was considered as synonymous of *Cucullaea* Lamarck, 1801 by COX et alii., (1969: N260).

This genus includes mainly Boreal species of big sizes (KELLY, 1984), but also small specimens in bathyal sediments of tropical seas. The biochron in Russia (North European Province, fide KAUFFMAN 1973) goes from Late Jurassic (Volgian) to Early Cretaceous (Ryazanian-Aptian). KELLY (1984: 24-25, Text-figure 19) stated that *Dicranodonta* is markedly different from *Cucullaea* sensu stricto because of the absence of a posterior adductor muscle scar plate, the more complicated exterior ornament, and the more horizontal teeth. The two Venezuelan species I am including in *Dicranodonta,* were recovered from deep shelf environments, affected by the cold-water upwelling, related to the Paquier Oceanic Anoxic event, present on all the southern Tethys margins.

Dicranodonta nana (Deshayes in Leymerie, 1842)
Plate 42, figure 7;

- 1842 *Cucullaea nana* DESHAYES in LEYMERIE: 7, pl. 9, fig. 1;
- 1980 *Cucullaea (Idonearca) nana* D. in L., MONGIN, N. serv. Geol. Tunisie, 45: 119-120;

This small-sized species, is known from Sidi Kralif Formation, Tunisie, of Berriasian age; in the Valanginian of Tunisia, and Hilston Formation, of Germany; in the Hauterivian-Barremian of Hilston Formation and Speeton clyas of England. During the Albian, it is rare in the Paris Basin, and the Vraconnian (Late Albian) of Suisse.

S.C.S. occurrence: Locality MC-86-I, north of Punceres anticline, Valle Grande Formation, of Middle Albian age. This sample, with ammonites, belemnites and a cold water association, was considered as of **200 – 300 meters** of paleodepth.

Dicranodonta valdensis (Pictet & Campiche, 1866)
Plate 13, fig. 11;

- 1866 *Arca valdensis* PICTET & CAMPICHE, Paleont. Suisse, III: 467, pl. 131, figs. 6, 7 ;
- 1867 *Arca Valdensis* P. & C., RENEVIER, Soc. Vaud. S.N., IX: 160;
- 1954 *Idonearca sp.* COX, Jour. Paleont. 28(5) : 627, pl. 66, fig. 3 ;

A shell with a prominent ridge on the posterior area, which divides the escutcheon in two parts, is very characteristic. Small size casts, measure 20-25 mm of Length. Common in the Vraconnian (=Late Albian) of Switzerland.

S.C.S. occurrence: Locality JFS-018, limestone with Brachiopoda on Guaruta-Blanco Lugar road, Guacharo member of El Cantil Formation, (DGC) of Early Albian age. The citation from Trinidad, (COX , op. cit.) deals with an olistostrome, reworked in Early Miocene Nariva Formation; this limestone was reworked from Eocretaceous outcrops of Eastern Venezuela.

Genus ***Megacucullaea*** Rennie, 1936.
(=?***Noramya*** Casey, 1961: 575)

According to KAUFFMAN in HALLAM et alii., (1973:) is a genus of the South Temperate Realm, including India; Austral and East African Province and S.C.S.; locally, Western European Subprovince. Recently, it was found in Patagonia, Argentina (RICCARDI, 1977) of the Neuquen Subprovince.

Megacucullaea gabrielis (Leymerie, 1842)
Plate 43, fig. 14; plate 49, figs. 19, 20, 24;

- 1842 *Cucullaea gabrielis* LEYMERIE, Mem. Soc. geol. Frânçe, 5: pl. 7, fig. 5;
- 1842 *Cucullaea dilatata* d'ORBIGNY, Foss. Colombie: 54, pl. 5, figs. 5-7;
- 1886 *Cucullaea dilatata* d'ORBIGNY, KARSTEN:18;
- 1925 *Cucullaea dutrae* MAURY, Mem. Soc. Geol-Min. Brazil, 4: 567, 569 pl.20, fig. 19;
- 1950 *Cucullaea sp.,* HEDBERG,: 1987;
- 1956 *Cucullaea gabrielis* L., BENAVIDES: 369;. Carhuaz Formation; 392: Chimú Formaton;
- 1957 *Cucullaea gabrielis* L., BÜRGL: Bol. Geol. (Colombia) 5(2): 156, pl. 7, fig.3;
- 1959 *Cucullaea gabrielis* (L.) RENZ: 9;
- 1985 *Idonearca gabrielis* (L.) ETAYO SERNA, Proy. Cretacico, 24-9; 24-12;
- 1987 *Cucullaea (Idonearca) gabrelis* (L.) VIVAS: 29, 32, fig. 21;
- 1988 *Idonearca gabrielis* (L.), DHONDT & DIENI, text-fig. 4; Global distribution chart.

An average adult cast, measures 75 mm of length, 96 mm of height, and 92 mm of thickness; but it can reach 130 mm of length (CHARLES, 1948: 15; Pl. 2, Fig. 1, 1a).

S.C.S. occurrences: *Megocucullaea gabrielis* (L.) is a common species in this subprovince; from Valanginian to Late Aptian, is ubiquitous in the hypersaline and saline marine water environments. In Perú, is associated to Cassiope *studeri, C. strombiformis* and *Eocallista huarazensis,* (BENAVIDES, 1956) considered as a typical wealdian assemblage. In Colombia, is common in the saline formations, as Macanal, Tablazo, La Paja, Rosablanca, Fómeque and Zipaquirá, and Villeta Group, where layered halite and gypsum are still preserved, all of Eocretaceous age. In Brazil, the Algodoes formation of Albian age, is associated to evaporites.

Locality MO-2804, quebrada La Gé, Perijá area, Píche member of Apón Formation, of Early Albian age. Also is common at An-77, cerro Las Callecitas, El Cantil Formation, (DBG) in the *Mesorbitolina texana-M. pervia* horizon, of Late Aptian age (GÖRÖG, 1983). In Tibú Formation, Perijá, of Late Barremian-Early Aptian. The youngest horizon in Venezuela, is the Caripito member of the Chimana Formation, of Early Albian age.

Discussion: *Cucullaea gabrielis fraterna* (IMLAY, 1940, Geol. Soc. America, Bull. 51(1): 143, pl. 4, figs. 1, 2) of the Barril Viejo shales, Coahuila, Mexico, of Hauterivian age- has the umbonal crest more angular, shorter anterior margin, and a wider and more depressed umbo. It did not reach the area

of Venezuela. It could be an ecophenotype of *Megacucullaea gabrielis* (Leymerie) , and would be related to local ecological variation.

Megacucullaea moreana (d'Orbigny, 1844)
Plate 9, figure 4;

- 1844 *Arca moreana* d'ORBIGNY, Pal. Franç. Cretacee, #3: 200-201, pl. 309, fig. 1 - 3;

Taxon related to *Megacucullaea gabrielis* (Leym.) by its shape, and the presence of ribs in the early stages of growth, but is distinguished by its less angular shape, and the presence of fine, radial striations. Its origination was in the Valanginian of the Canon du Verdon, France ,- where it was associated to big-sized Nerineas, and became a common species in the Hauterivian of the Paris Basin and Switzerland.

S.C.S. occurrence: Locality MC-388-H, El Cordón – Río Cariaco, El Dantó dolostones, Sucre state, (DAGM), of Hauterivian age. Scarce.

Megacucullaea ollonensis nomen novum, MACSOTAY
Plate 21, figures 7, 8, 9, 11;

- 1877 *Trigonarca orbignyana* GABB, Jour., A.N.S. Phila., nº 8:290, 291, pl. 41, figs. 7, 7a, 8, 8a; non *Cucullaea orbignyana* MATHERON, 1842.

"Cast very large, (length about 92 mm; height, - approximately,- 90 mm); beaks placed "about a third of the length from the anterior end, not approximating; anterior end nearly "vertical, most prominent near the base; posterior face abruptly truncated; base nearly "straight, slightly emarginated, and a little the most prominent directly under the beaks; "area small, short; internal plate, moderate; internal margin entire. Surface unknown; the "cast shows traces of numerous rather small radiating ribs. Associated with it is a cast of "smaller shell (figs. 8, 8a) an inch across, apparently of the same species, but with a more "convex base and flatter sides, attributed to the difference of ages." (GABB, 1877). Compared to another species, *Cucullaea dilatata (=Megacucullaea gabrielis)* – Valanginian-Early Albian of Colombia,- *M. ollonensis* has much higher and more approximate beaks, a straighter base, and a less produced posterior end.

Occurrence: "Neighborhood of Ollon, Peru, and of probably Cretaceous age."(GABB, op. cit.). The Peruvian subprovince is also part of the Gondwanan Province.

S.C.S. occurrence: Locality MO-1334, sharp curve of the Rio Negro, lowest marls of the Tibú Formation, Perijá mountain front, of Early Barremian age. The Peruvian locality should belong to Carhuaz Formation of Hauterivian-Barremian age (BENAVIDES, 1957).

Discussion: A proximal taxon, *Megacucullaea herculea* (TWENHOFEL & TESTER, 1926)(SCOTT, 1970, U.K.P.C., Art. 52: 60) – Mentor beds, Kiowa Formation U.S.A. late Albian,- is also a big species (Length: 90 mm; Height:70 mm, Thickness: 60 mm), but it is relatively longer than *M. ollonensis. Cucullaea* sp. ind. KRENKEL (1910, B-P.G.O.-U nº 23: 208, pl. 21, fig. 10;) – Barremo-Aptian beds from Niongala, Mozambique, - has also broken the posterior extremity, but the umbo is more rounded and lower than *M. ollonensis. Cardium (Protocardia) newberryanum* (GABB, 1881a, Acad. Nat. Sciences of Philadelphia, Jour., 2nd ser., v. 8: 344, pl. 44, fig. 17), a big cast (length 43 mm, height 38 mm) - was alleged by Gabb to have been collected by Newberry at Sapote Formation, Costa Rica, of Early Miocene age,- and considered as a Late Cretaceous fossil by Wendell P. WOODRING (1986). It is a *Megacucullaea* with its umbo placed in a more posterior position than *ollonensis,* reworked as an olistolith from the Chortis block's Early Cretaceous.

Megacucullaea orientalis (DOUVILLE, 1916)
Plate 59, fig. 3;

- 1916 *Arca (Idonearca) orientalis* DOUVILLE, :175, pl. 21, fig. 18;
- 1916 *Arca (Idonearca) deserti* DOUVILLE: 176, pl. 20, figs. 14 – 16;
- 1924 *Cucullaea recedens* CRAGIN, TWENHOFEL: 66, Pl. 15, Fig. 14: pl. 16, figs. 1-3; pl. 17, figs. 3-4;
- 1962 *Arca (Idonearca) orientalis* DOUVILLE, ABBASS: 21-23, pl. 2, fig. 7;
- 1898 *Arca gabrielis (L.)* GERHARDT: 179-182, pl. 5, fig. 4; non gabrielis (Leymerie, 1842)

Description: "Shell trapeziform, strongly inequilateral, and extended in a postero-"ventral direction. The cardinal area is wide, and the umbones are wide apart, and "placed anteriorly. The ligamental chevrons are well marked; the hinge line is about "2/3 of the lenth of the shell, with numerous teeth, which are short and almost "vertical in the middle but become nearly horizontal at both ends, especially on the "posterior side. The posterior area is marked by a strong keel which descends from "the umbo and ends at the postero-ventral angle.

Dimensions: length: 80 mm, height: “50 mm, semi-diameter: 29 mm (one valve).” (ABBASS, 1962).

Occurrence: Originally collected at Rishat Manzour, Sinai peninsula, Egypt, in the yellow, arenaceous limestones and ferrugineous oolites of Late Albian age.

S.C.S. occurrence: Locality in Venezuela, MO-1563, Pertigalete –El Chaparro main road, Chimana Formation (DAGM) of Middle Albian age. In Colombia, 1-2 km. eastward from Zacatoca (Santander) between Salitre Seco and Mayaguez, in a yellow weathered limestone of Aguardiente Formation, of the same age. In río Sube, Colombia, in the Mercedes Formation, of Early Albian age. In Texas, U.S.A., in Formations Weatherford, Middle Albian, and Kiowa Formation, Late Albian.

Family ***NOETIIDAE*** Stewart, 1930.
Subfamily ***NOETIINAE*** Stewart, 1930.
Genus ***Noetia*** Gray, 1857.
Subgenus: ***Incanopsis*** Olsson, 1944.

Noetia (Incanopsis) is a tropical taxon, present only in S.C.S., Peruvian and Syrian subprovinces of the Gondwana Province. Possible affinity to saline seas.

Noetia (Incanopsis) convergidens
(Gerhardt, 1897)
Plate 14, figures 10, 10-a;

- 1897 *Arca (Scaphula) convergidens* GERHARDT, Neues Jahrb. Min. Geol. U. Pal. B-Bd. 11: 98-99, pl. 2, figs. 5a, 5b, 5c;
- 1895-a *Pholadomya aff. gigantea* (J.Sowerby) ETAYO SERNA, Proy. Cret., XXIV-21, XXIV-22, pl. 1, figure 24; non J. SOWERBY, 1836; nec WOODS, 1909;

S.C.S. occurrence: This taxon, whose original collecting place was not specified by GERHARDT (op. cit.) was illustrated by ETAYO-SERNA (op. cit.) from the Upper Macanal shale Formation, of Late Valanginian age, under the erroneous identification of *Pholadomya sp. aff. gigantea.* In Venezuela, locality MC-342-C, La Hacienda/río Carinicuao, El Dantó dolostones, (DAGM), of Hauterivian age. Several fragmentary individuals, originally biodegraded.

Discussion: *Arca falsani* MATHERON, (1879, plate b-8: figs. 6ª, 6b;) - Neocomian, south France, - has the same shape, but there are radial ribs as ornate on the posterior and the truncated area. *Arca haugi* SIMIONESCU (1898: 96-97, pl. 7, figs. 3a, 3b, 4)-Neocomian of Transylvania, Padina Siruet, Valea Mueril and Délel Sasului,- is also covered by fine radial riblets, arranged in two categories. All these are small-sized species of *Noetia (Incanopsis).*

Noetia (Incanopsis) cf. ***palestina***
(Whitfield, 1891)
Plate 46, figure 8;

- Cf. 1891 *Trigonarca palestina* WHITFIELD: 395, pl. 5, figs. 1, 2;
- Cf. 1946 *Palestinarca palestina* (Whitfield) VOKES, Bull. Amer. Mus. Nat. Hist. 78: 155, plate 2, figure 1-5;

Description: Whitfield described this species as follows: “Shell in the adult stage measuring 9 mm in total length by 6 mm high at the beaks, and having a thickness through the valves at the fullest part of the umbonal ridge, of 5 mm.” But the following, fits our specimens: “Form subtrapezoidal, the beaks being large, prominent and situated more than 1/3 of the entire length from the anterior end; hinge-line very short; posterior end prolonged, acutely pointed at the basal angle; basal line, curved regularly (not straight) until the anterior end, regularly rounded. Posterior cardinal slope straight (not vertical, nor concave) and the umbonal ridge is rounded, (not acutely carinate). Our casts are devoid of all ornamentation, excepting few weak radii preserved on the cardinal slope.”

Dimensions: The size of the best preserved cast, measures: Length: 53,3 mm, and of height: 45,3 mm.

S.C.S. occurrences: Locality An-77, cerro Las Callecitas, estado Anzoategui, El Cantil Formation, in the *Mesorbitolina texana/M. parva* horizon (VIVAS, 1986), of Late Aptian age. Six casts of different stages of preservation in light grey marl beds.

Discussion: *N. (I.) palestina* (W.) was collected in sandstones of the Olive locality, near Abeih, Lebanon, of Aptian age.

Subfamily ***TRINACRIIDAE*** Mac Neil, 1937.
Genus ***Trinacria*** Mayer, 1868.

Trinacria is a small-sized Bivalve genus, restricted to the Eocene in the Euramerican region (COX et al., 1969, :N264). It is probable its extension to the Albian stage of Cretaceous Period.

Trinacria? sp. indet., MACSOTAY.

Plate 55, figs. 14, 16;

Description: Unique shell, a fragmentary right valve. Trigonal shell, strongly inequilateral; Opisthogyre, cardinal area small, triangular, indistinct, entirely below beaks; umbonal ridge broadly rounded; external surface with weak growth lines, without any radial sculpture. Ligamental area with remnants of radial striation.

Dimension: Height: 31 mm; Length: 31,5 mm (damaged).

S.C.S. occurrence: Locality VG-471, Caripito-Los Cuatro rumbos road, Santa Lucía town, in Caripito member of Chimana Formation, (DBG) Monagas state, of Middle Albian age. It was collected from an organic-rich limestone, intensely burrowed by *Chondrites* colonies, along the Chimana/Querecual boundary. Associated molluska suggested a paleo-depth of 150 – 350 meters.

Discussion: The other Cretaceous species of *Trinacria* are: *T. cor POPENOE (1937),* Holtz shale member of Williams Formation, common, and the type Chico beds in California of Campanian age; *T. galeata* (Müller, 1847) from Germany, also from Campanian horizons. Both are small size species, and were the oldest representatives of the Genus *Trinacria* in the Cretaceous, until now.

Family ***GLYCYMERIDIDAE*** Newton, 1922.
Subfamily ***ARCULLEINAE*** Newell in COX et alii., (1969: N268).
Genus: ***Trigonarca*** Conrad, 1862.

According to KAUFFMAN in HALLAM et alii., (1973: 359) is a Temperate genus, Cosmopolitan, found in Gulf – Atlantic Coast subprovince, the North European Province, but also East African and Austral Provinces (India). Its presence with 6 species in the tropical Tethys, suggests an opportunistic genus.

Trigonarca consobrina (d'ORBIGNY, 1844)
Plate 48, figure 13;

- *1844 Arca consobrina* d'ORBIGNY, Cret. Pal., Cretacée, III: 209, pl. 311, figs. 4-7;
- *¿1852 Arca declivis* CONRAD in LYNCH: 216, pl. 5, fig. 32;
- *1921-B, Arca (Trigonarca) consobrina* d'ORBIGNY, GILLET, B.S.S.H.n.Y: 75: 15;
- *1938 Cucullaea* n. sp., DIETRICH: 90-91, (partim), pl. 17, figs. 5, 6; non fig. 4;

S.C.S. occurrence: Locality MO-892, northwest of Puerto Escondido, Taguarumo Formation, (DAGM) Sucre state, of Barremian age; five articulated shells. DIETRICH (op. cit.) collected it at Anapoima, Colombia in the Villeta Group, at Aptian levels.

Discussion: Originally cited from the Hauterivian of the Jura mountains, of France and Switzerland. In the Aptian? Of Lebanon (?).

Trigonarca cuneus (Conrad, 1852)
Plate 49, figures 7, 8;

- 1852 *Arca cuneus* CONRAD, Appendix: 232, pl. 3, figs. 22;
- 1912 *Arca (Trigonarca) diceras* SEGUENZA, PERVINQUIÈRE: 102, pl. 8, figs. 25, 26;
- 1934 *Arca cuneus* Conr., BLANCKENHORN, Paleontogr. 81ª: 211;

This is a widely distributed taxon in all the Gondwana Province, from Colombia to Somalia (ABBASS, 1962: 23, pl. 2, fig. 10) with a biochron of Middle Albian to Cenomanian age. In Glen Rose Formation, Texas, U.S.A., in Early Albian limestones.

S.C.S. occurrence: Locality MO-2876, Cerro Las Callecitas, upper El Cantil Formation, (DBG) of Early Albian age. Also in Corral Viejo member of Chimana Formation, of Middle Albian age.

Trigonarca fittoni (Pictet & Campiche, 1866).

- 1866 *Arca fittoni* PICTET & CAMPICHE, Matér. Pal. Suisse, ser. 4(3) : 455 ; 471.
- 1899 *Cucullaea fittoni* (P. & C.) WOODS, Paleontogr. Soc. 1(1): 52, pl. 10, figs. 4a-d, 5-7;
- 1938 *Trigonarca sp. cf. ligeriensis* D'orbigny, DIETRICH: 89, pl. 16, figs. 7-9;

This, relatively rare species, is known from the Barremian to Albian, in North European Province, and Balkanic Subprovince.

S.C.S. occurrence: In Lisure Formation – of Middle Albian age,- in quebrada Santa Rosita, Perijá region, (coll. G.-L. BENDETTO) two molds almost identical of *T. fittoni (P. & C.).*

Trigonarca gerhardti OLSSON, 1934
Plate 44, figure 9;

- 1897 *Cucullaea brevis* GERHARDT: 182, pl. 5, fig. 4; (not d'ORBIGNY, 1844)
- 1934 *Trigonarca gerhardti* OLSSON, Bull. Amer. Paleont. 20(69): 25-26, pl. 7, figs. 5, 6;
- 1954 *Cucullaea brevis* G. BENAVIDES: 375;
- 1980 *Trigonarca gerhardti* OLSSON, GARCIA-JARPA et ali., 44 ;

- 1982 *Trigonarca gerhardti* OLSSON, STEPHAN, 47 ;

It is higher than *T. aff. elongata* Rennie (COLLIGNON, 1949: 19, Pl. 3, Fig. 1) – Early – Middle Albian of Madagascar. In the Peruvian Subprovince, in the Pananga Formation of Late Aptian age, and Chulec Formation, of Albian age, is a common species. In Colombia, is frequent in the Une Formation, of Albian age.

S.C.S. occurrence: Locality An-77, cerro Las Callecitas, El Cantil Formation (DBG), Anzoategui state, (VIVAS, 1986); Four casts of articulated specimens. In Trujillo state, in the Guáimaros shale of the Peñas Altas Formation, of Early Albian age.

Trigonarca peroblicua (Von Buch, 1839)
Plate 55, figs. 9, 10;

- 1839 *Arca peroblicua* VON BUCH, Ges. Sch. 4: 524-525, figs. 13, 14;
- 1899 *Arca Perryi* PHILIPPI, Fos. Sec. Chile : 53, pl. 27, figs. 1, 2 ;

Description : Cast very large, (Length : 100 mm, Height : 150 mm ; Total thickness : 143 mm) trigonal, elongate, slender, equivalv, inequilateral. Beaks high, narrow, almost terminal, slightly incurved, brad and blunt at the tips, slightly inflated. Anterior margin short, rounded, ventral margin curved; posterior mrgin rounded, truncated above; dorsal margin slightly concave. Side of the cast, with a depression extended from the beaks to the ventral margin. Surface marked with concentric lines of growth, crossed by weak radiating striae. The hinge is short and wide. Only articulated speciemens were seen.

S.C.S. occurrence: Colected originally by Mr. Degenhardt, at Tunja, Bogotá area, and at Leyva, Middle Magdalena Valley, in Albian-age levels according to KARSTEN (1886). In Venezuela, locality HA-4428, road from La Pastora to Jabón, upper carbonatic member of Peñas Altas Formation, Trujillo state, embedded in a hard, sandy limestone, a possible tempestite, of Early Albian age. Also has been seen in Aguardiente Formation, of Tachira state, of Albian age. In Chile, found at the Hacienda Ovalles, of Cretaceous? Age.

Discussion: *T. simondsi* (Whitney, 1911) - Middle to Late Albian of Texas,- is more elongated an smaller in size (1952 WHITNEY, Jour. Pal., 26(5): 700, pl. 88, fig. 1; pl. 89, fig. 1).

Trigonarca cf. peruana (Gabb, 1877)
Plate 22, figure 15;

- Cf. 1877 *Trigonarca peruana* GABB, J. Assoc. Nat. Sci. Philadlphia # 8: 291, pl. 41, figs. 9, 9a;
- 1954 *Trigonarca?* sp., COX, J. Paleont. 28(5): 626;

Our casts belong to a related form, being more elongated in shape than *T. peruana* Gabb, sensu stricto. Thy are definitely of smaller size than *T. ligeriensis* (d'ORBIGNY) - an Albian-Cenomanian taxon of Zululand, as figured by NEWTON (1909, pl. 4, figs. 15, 16).

Dimension: Our cast measures of length, 39,3 mm, and of height, 29,4 mm.

S.C.S. occurrence: Locality VG-382 B, road to "Ojo de Agua" village, where it traverses quebrada El Imposible, serrania de La Paloma ; El Dantó dolostones, (sDLP, DGC), of Hauterivian age, two fragmentary casts. In Trinidad, collected from Cuche Formation, of the same age.

Family ***MYTILIDAE*** Rafinesque, 1815.
Subfamily ***MYTILINAE*** Rafinesque, 1815.

The poor representation in the Eocretaceous S.C.S., is due the mosly saline and hypersaline conditions of the marine waters. Epifaunal suspension feeders, they were favored by abundant leptopel and hard susbstrates.

Genus ***Arcomytilus*** Agassiz in Sowerby, 1842

This genus has a long biochron: Early Jurassic to Eocene. Its distribution includes North European Province, Maghrebian, Balkanic, Neuquen subprovinces, and S.C.S.

Arcomytilus couloni (Marcou).

- 1866 *Mytilus couloni* Marcou, 1846, in PICTET & CAMPICHE, Pal. Suisse, v. III : 487-488, pl. 132, figs. 1, 2 ;
- 1881 *Mytilus Couloni Marcou,* BOEHM, Paleontogr., 8(2) : 168-169, ol. 31, figs. 6, 7 ;
- ?1899 *Mytilus solidus* PHILIPPI, Foss. Second. Chile. : 45, pl. 24, fig. 1 ;
- 1974 *Arcomytilus couloni* (Pictet & Campiche), DIMITROVA, Foss. Bulgarie 4b : 54-55, pl. 25, fig. 3 ;
- 1980-b, *Arcomytilus couloni* (Marcou) MACSOTAY : 49 ;

The biochron of this species is Tithonian (Late Jurassic) to Barremian (Early Cretaceous). The distribution comprises all the European Province, and S.C.S. and Neuquen subprovinces. In cerro Doña Ana, Chile, it is associated with Tithonian fossils.

S.C.S. occurrences: Locality MO-3172, Mundo Nuevo de El Pilar, El Dantó dolostones, (DEP), many fragmentary shells, biodegraded, of Hauterivian age (MACSOTAY & ALVAREZ, 1987). Also present in locality HA-4366, Arbol Redondo section, lowest fossiliferous limestone of lower carbonatic member of Peñas Altas Formation, Trujillo state, of Late Barremian age (ARNAUD et alii., 1999, figure 14).

Genus ***Lycettia*** COX, 1937.

During Jurassic times, known from England, India and northeast Africa, but during Eocretaceous times, besides North European Japanese-East Asian subprovinces, S.C.S., and Western Interior endemic center. During Late Cretaceous, survived in the Gulf Coast Subprovince, and the North European Province.

Lycettia lanceolata (Sowerby, 1823)
Plate 16, figures 7, 8;

- 1823 *Mytilus lanceolatus* SOWERBY, Min. Conch. V. 5: 55, pl. 339, fig. 2;
- 1900 *Dreissensia lanceolata (S.)* WOODS : 110-114, pl. 18, figs. 13-15;
- 1939 *Dreissensia lanceolata* (S.) MARLIÈRE: 107, pl. 6, figs. 7a, b;

S.C.S. occurrences: Locality PM-19-C, road to La Margarita mt., El Dantó dolostones, (sDLP, DGC), Monagas state, of Hauterivian age. Few scattered left valves, associated to taphoflora.

Discussion: *L. lanceolata* (S.) together with *L. membranacea* (Dunker, 1839)(1937, ARTHABER: 449, pl. 25, fig. 30) are typical Wealdian species common in North European Province, and Apulian subprovince, specially abundant during Hauterivian stage. They evidence humid climates on the Tethys Ocean estuaries.

Genus ***Septifer,*** Recluz, 1848.

The biochron of *Septifer* is extended from Triassic to Recent times, of Cosmopolitan habits in tropical and subtropical seas. Proliferates in brackish waters.

Septifer cuvieri (Matheron, 1842)
Plate 11, figures 11, 12;

- 1842 *Mytilus cuvieri* MATHERON : 179, pl. 28, figs. 9, 10 ;
- 1900 *Modiola cuvieri* (M.) WOLLEMAN : 68, 69 ;
- 1934 *Septifer lineatus* (Sowerby) BLANCKENHORN : 207, pl. 10, fig. 51;

This small species, known from North European Province, also from Western European and Neuquen subprovinces, was an inhabitant of the wealdian facies estuaries.

S.C.S. occurrence: Locality PM-19-C, road to La Margarita, La Margarita mudstones, (sDLP, DGC), Monagas state, of Hauterivian age. Two casts of this species, which, -partially lithified, - were transported from collapsed deltaic sediments. It is an oliston.

Subfamily ***MODIOLIDAE*** Keen, 1958.
Genus ***Modiolus*** Lamarck, 1799.

Considered cosmopolitan by KAUFFMAN in HALLAM, (1973: 359;) is a taxon whose biochron goes from Devonian to Recent.

Paleoecology. Recent species of *Modiolus* attach to a firm substrate by a byssus and filter food from the water. They are the most common from the intertidal zone to sublittoral depths in waters of marine to polyhaline (27‰) salinities. The genus was very common in the Portland beds (U.K.) the Hilsthon of Germany and the Terminetto beds of Italy, where polyhaline conditions prevailed.

Modiolus fittoni (d'ORBIGNY, 1847)
Plate 14, figure 7;

- 1844 *Mytilus reversus d'ORBIGNY,* Paleont. Franç. Terr. Cretacé : 264, pl. 337 fig. 1, 2 ;
- 1847 *Mytilus fittoni* d'ORBIGNY, Prodrome, : 81 ;
- 1868 *Mytilus fittoni* d'O., DE LORIOL : 33-34, plate 2, figure 10 ;
- 1887 *Mytilus fittoni* d'O., MALLADA , sinops. Esp., Cret. Inf., 3:115, pl. 38, figs. 3, 4;
- 1980-a *Modiolus fittoni* (d'O.) MACSOTAY: 26;

A Western European and Somalian subprovince inhabitant, with a biochron of Valanginian to Early Aptian stages.

S.C.S. occurrence: Locality MO-1305, quebrada Chururú, road to La Fundacion, Uribante hemigraben, Chururú hemigraben, of Rio Negro Formation.

Modiolus socorrinus (d'ORBIGNY, 1842)
Plate 55, figures 1, 2, 3;

- 1842 *Mytilus socorrina* d'ORBIGNY, Amér. Meridionale, 90, pl. 18, fig. 18;
- 1899 *Modiola andina* PHILIPPI, Fos. Second. Chile: 47, pl. 24, figs. 3, 5, 12;
- 1936 *Modiola decliva* White, MAURY, M.S.g-m. Brasil, nº 11: 183, pl. 10, figs. 7, 9;

- 1956 *Modiolus mutissus* Olsson, BENAVIDES: 375;
-

S.C.S. occurrence: Locality MO-2387, road to Monte Carmelo, Trujillo state, upper carbonate member of Peñas Altas Formation, of Early Albian age. This taxon became very wide-spread along all the coast-lines of S.C.S. The Píche member of the Apón Formation, of Perijá area, is also of Early Albian age. The Brazilian Ganhamaroba Formation, was as much under the Maghrebian sub-province, as the Caribbean.

Discussion: *Modiolus rectus* COLLIGNON (1949: 16-17, pl. 2, figs. 5, 6) – Early-Middle Albian of Madagascar,- is somewhat more narrow distally, and its umbo is not terminal. *Modiolus pallidus* (J. Sowerby) (1929, COX, Pr.D.N.H.: 50, pl. 2, fig. 8) – basal shell-bed of Portland Formation, U.K., of Ryazanian age, is also a big-sized (up to 90 mm) as are *M. socorrinus* and *M. rectus*, very different fom the dwarf-sized *Modiolus* of the Wealdian of all the North European Province. Was this a paleotemperature problem, or availability of the ion Calcium in the saline waters?

Family ***Pinnidae*** Leach, 1819.

The *Pinnidae* are epifaunal suspension feeders (STANLEY, 1968).

Genus & Subgenus ***Pinna (Pinna)*** Linné, 1758.

Cosmopolitan taxa, according to KAUFFMAN in HALLAM et alii., (1973: 359) whose biochron is Early Carboniferous to Recent.

Pinna (Pinna) comancheana Cragin, 1894.
Plate 43, figure 9;

- 1894 *Pinna comancheana* CRAGIN: Texas Geol. Survey, 4th Ann. Rept.: 3, Plate 14, fig. 3;
- 1924 *Pinna comancheana* C. TWENHOFEL, B.K.g.Survey, 9: 80;
- 1934 *Pinna ovata* BLANCKENHORN: 180, pl. 7, fig. 5;
- ?1888 *Pinna* sp. WHITE, Arch. Mus. Nt., Rio de Janeiro, 8:58;

S.C.S. occurrence: An-77, cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG), (VIVAS, 1978), of Early Albian age. Also in Maraca Formation, Perijá, of Late Albian age; many fragmented shell are characteristic of tempestites.

A common species in Comanche Peak limestone, in Texas, New Mexico and Kansas of late Albian age. In Brazil, also in Middle? Albian horizons. In Palestina, locally reported in Cenomanian-Turonian horizons.

Pinna (Pinna) robinaldi (d'ORBIGNY, 1844)
Plate 42, fig. 1;

- 1844 *Pinna robinaldina* d'ORBIGNY, Pal. Franç. Terr. Cret. 3: 251, pl. 330, figs. 1-3;
- 1906 *Pinna robinaldina* d'O. WOODS, Paleontogr. Soc. 2(3): 96-99, pl. 12, figs. 11-15; pl. 13, fig. 1;
- 1931 *Pinna robinaldina* d'O. WEAVER, U. Washing., Mem. 1: 197-198, pl. 13, fig. 54;
- 1965 *Pinna (Pinna) sp. cf. robinaldina* d'O. HAYAMI, M.F.S. Kyusu Univ. 15(2): 281-282 pl. 39, figs. 2, 3;
- 1988 *Pinna (Pinna) robinaldina* d'O. DHONDT & DIENI: 16-17, Pl. 2, Figs. 4, 5; pl. 3, fig. 1a, 1b; text-figs. 5A, 6; (distribution chart)

This taxon had a vast distribution in temperate and Tethyan (tropical) seas, including Japan and Chile, with a biochron of Valanginian to Early Albian age.

S.C.S. occurrence: Locality HA-4436, trail from San Pedro to Jabón, lower carbonate member of Peñas Altas Formation, of Late Barremian age (ARNAUD et alii., 1999, Fig. 18), two adult shells, in marls. Also in El Dantó Formation, (DAGM) , in shales, of Hauterivian age. In Colombia, ROYO Y GOMEZ (1942c), y ETAYO SERNA (1985a) reported a form "confer"from the Caqueza Formation and Las Juntas sandstones of Hauterivian-Barremian horizons.

Subgenus ***Plesiopinna*** Amano, 1956.

According to KAUFFMAN in HALLAM et alii., (1973: 359) this subgenus belongs to the North Temperate Realm. Discovered in the Late Cretaceous of southwest Japan, based on *Plesiopinna atriniformis* (AMANO, 1956: 71, pl. 1, figs. 1-5) who included two taxa from France: *Plesiopinna neptuni* (d'ORBIGNY, 1844: 255, pl. 333, figs. 1-3; 1850: 165) of the Cenomanian of Paris Basin, and *Plesiopinna ligeriensis* (d'ORBIGNY, 1844: 257, pl. 334; 1850: 196). FRENEIX in Colloque sur le Cretace Supérieur (1959: 213) doubted the second assignement. Also included here, are : *Pinna latissima* (Koenen, 1897), - early Cretaceous, Cameroun,- and *Pinna (Plesiopinna) kasimirensis* ABDEL-GAWAD, (1986) –Maastrichtian of Warszawa, Poland.

Pinna (Plesiopinna) atriniformis (Amano, 1956)
Plate 43, figure 12

- 1975 *Pinna (Plesiopinna) atriniformis* (Amano) HAYAMI, U.M.Univ. Tokyo, Bull. 10: 40, plate 1, figure 13;

This taxon was collected in the Gosyonoura Group in Shishijima island, in Albian?- Cenomanian horizon, in Kagoshima Prefecture, Japan. A single very small valve of a young *Pinna (Plesiopinna)* was described by STANTON (1895: 49, pl. 2, fig. 12) collected in the lower Paskenta Group, of Valanginian age, suggesting the presence of this subgenus in bathyal paleoenvironments.

S.C.S. ocurrence: Locality MO-1563, El Chorreron road to Pertigalete, Chimana Formation (DAGM), Anzoategui state, of Middle Albian age.

Genus ***Trichites*** (Plot, 1676) Quenstedt, 1857.

KARCZEWSKI (1974, Bul. Inst. Geol. Poland, 7: 94-95) gave a detailed analysis about the nomenclatural problems of the Genus *Trichites.* Never cited before of the Americas, it is considered now as the better adapted PINNIDAE to the saline/hypersaline oceans. According to KAUFFMAN in HALLAM et alii., (1973: 361) it was endemic in the Indo-Mediterranean Tethys Ocean, from Portugal to the Caucasus. Its biochron extends from Middle Jurassic (Bajocian) to Eocretaceous (Late Berriasian). The type species is *Trichites plotii* Lhuyd & Lycett (KARCZEWSKI, op. cit.) and not *T. saussuri*, as stated in COX et alii., (1969: N284).

Paleoecology: Individuals of *Trichites spp.* had the habit of associating several species in each limestone bed. In Portugal, 17 different species have been reported from Late Jurassic (Oxfordian-Kimmeridgian) sediments, (CHOFFAT, 1885/1888) although many of them could be ecophenotypes, NOT TRUE SPECIES. In Morro Blanco Formation, (DAGM), the sedimentation developed in a hemigraben, in shallow, saline and hypersaline oxygen-poor marine waters, periodically influenced by tropical storms, which intercalated ill-sorted terrigenous sediments. This suggests neritic conditions, in depths **less than 40 meters.**

Trichites picteti Campiche, 1869
Plate 4, figure 6;

- 1869 *Trichites picteti* CAMPICHE in PICTET & CAMPICHE, Mat. Pal. Suisse, 3º ser.,p. 76, plates 153, 154 ;
- 1926 *Trichites* sp. Indet., RENNGARTEN : 43 ;
- 1986 *Trichites picteti* Campiche, MACSOTAY et al., :7136 ;

Occurrences: Collected originally from limestones of Mont Salève, Switzerland, from level 13, of Valanginian age. In the Jura mt. of France, on the Doubs-Arcon road, we (Bernard CLAVEL, Robert BUSNARDO and myself), have sampled four specimens of the Calcaire Roux Formation, of Valanginian age (Early Valanginian to base of Late Valanginian, according BUSNARDO & THIELUOY (1979). Prof. M. R. BUSNARDO collected a well-preserved specimen (1979), at Djebel Melousi, Tunisie, at level MS-8, of Early Berriasian age. These samples are all deposited in Dept. Sci. Terre Musee.

S.C.S. occurrences: Above the basal coral-reef, the following three massive limestone beds, contain *Trichites picteti* Campiche, attaining sizes of 90 – 100 mm, in Los Andes quarry, La Rosa hill, in Lower Morro Blanco Formaton (VIVAS, 1986,FIG. 42). In the type locality of Morro Blanco Formation, (DAGM) south coast of Caracas del Este island, (VON DER OSTEN, 1954, figure 11) two adult and two fragmentary shells, were recovered.

Diagnosis: *T. picteti* differs from all the other species (or ecophenotypes) of this genus, in its smooth external surface, with only some rough concentric ribs; it attains a big size. The maximum length, was of 140 mm, measured from the beak to the distal margin.

Trichites saussuri (Voltz. In THURMANN, 1832)
Plate 4, figure 3;

- 1832 *Pinnigena (P.) Saussuri* (Voltz) THURMANN, Mém. Soc. Hist. Nat. Strasbourg, 1(4) : 13 ;
- 1913 *Pinnigena Saussuri* (V.) JOUKOWSKY & FAVRE, Mém. Soc. Phys. et hist. Nat. Genève, 37(4) : 328,385, 483, 489, 490.
- 1914 *Pinnigena (P.) Saussuri* (Voltz) ROLLIER, Soc. Paleont. Suisse, Mem. 40 : 373 ;

Occurrences : This unusual species was collected in the horizon with the rudist *Heterodiceras luci* (Defrance, 1819), called originally "infravalanginen", corrected by JOUKOWSKY & FAVRE (op. cit.) to Berriasian. In The Marbre Batard Formation, of Val du Fier, France, I have collected two well-reserved specimens. In the Paleontological Collection of Université Lyon-I, are good specimens from Carrière de la Monnetière, -La route des Arpisson, of the Vions Formation, of Late Berriasian age. The Marbre Batard was a gypsiferous limestone, where most of the gypsum was dissolved by diagenesis.

S.C.S. occurrences: Locality MO- 2850, east coast of Venados island, Archipiélago Guaiquerí-Manare

(DAGM) lower Morro Blanco Formation, of Late Berriasian-Early Valanginian age.

Diagnosis: The distinctive feature of this species, is the external sculpture: radial, vermicular, irregular radial ribs, all of the same thickness, separated by interrib areas of the same width, ornated by weak concentric striae. The thickness of both valves is lower than the observed in *T. picteti* Campiche, and the shell is less inflated in general.

Trichites seebachi Boehm, 1881. Plate 4, figures 1, 2, 5, 8;

- 1881 *Trichites seebachi* BOEHM, Paleontographica, 8(2): 170-171, plates 32, 33;
- 1974 *Trichites seebachi* B. KARCZEWSKI, Bul. Inst. Geol. (Polonia) 7:99-100, pls. 16, 17;

This taxon is a typical Late Jurassic *Trichites:* its biochron is known from the Oxfordian and Kimmeridgian of Poland and Portugal. Not known from the Portlandian (too brackish in most localities), but it appears in the Berriasian of Kelheim, Austria.

S.C.S. occurrence: Locality MO- , Los Andes quarry, La Rosa hill, second massive limestone above the coral reef horizon, Morro Blanco Formation, of Late Berriasian age. Many shells were observed at an abandoned quarry in Cantarrana, southeast of Cumaná, Sucre state, exposing the same formation.

Family ***PTERIIDAE*** Gray, 1847.
Genus ***Pteria*** Scopoli, 1777.

Epifaunal suspension feders, usually attached by a byssus to a firm substrate; in the Caribbean sea, the species are commonly associated to Hydrozoans, as *Gorgonia,* in euhaline marine waters. According to KAUFFMAN in HALLAM et alii., (1973: 359), the genus is cosmopolitan, living in warm seas. Its biochron goes from Triassic to Recent.

Pteria berriasensis Gillet, 1924
Plate 21, figure 1O;

- 1924 *Avicula berriasensis* GILLET, Mem. Soc. Geol.. Franç. 1(3, 4): 32, pl. 1, fig. 4;

Occurrence: Collected at Eygalières, Bouches du Rhone, France, in Berriasian limestones. Quite alike to the juvenile of *Pteria cottaldina* (d'ORBINY, 1844, pl. 389, fig. 2), - France, of Neocomian age, - but thje beak is more oblique, the anterior wing is more massive, and the surface exhibits fine radial and concentric striation, which are not present on our cast.

S.C.S. occurrence: Locality MC-338-A, Agua Caliente road, Sucre state, El Dantó dolostones (DGC) , of Hauterivian age. Fragments are common among the coral colonies, at the base of Morro Blanco Formation, Venados Island, (DAGM) of Late Berriasian age.

Genus ***MacLearnia*** Crickmay, 1935.

Originally ranged with *Pectinidae,* in the Group Incertain (COX, et alii., 1969: N373), while VOKES (1967: 164) ranged them with Family *Pteriidae* Gray, 1847). KAUFFMAN in HALLAM et alii., (1973: 371) included this genus in the North Temperate Realm-Northeast Pacific subprovince, inhabiting preferably in bathyal depths.

McLearnia occitanica (Pctet, 1863)
Plate 10, figure 1;

- 1863 *Hinnites occitanicus* PICTET, Mel., Paleont. Suisse, 2: 97, 98, plate 22.
- 1876 *Lima liourii* DUMAS, Strat. Gard., nº 2: 384;
- 1927 *Prospondylus occitanicus* (P.) GILLET: 54;

Description: Subcircular shell, depressed, composed by a weakly concave left valve, and an almost flat right valve. Anterior auricule elongated but low; posterior auricle subtriangular; the left valve with irregular radial ribs, about 20-22, with anintercalary intermediale smaller rib. Surface also has concentric swellings, stronger on the distal half of the shell; *M. occitanica* had this relationship at inverse: the concentric swellings were more proximal, but this was variable on different individuals. The size of the original fragmentary shell, was: length: 50 mm, and had an apical angle of 95 º.

Occurrence: In western European and Balkanic Subprovince, in hemipelagic sediments, of Berriasian to Barremian age (DIMITROVA, 1974) . In the stratotype of Berrias, France, it is frequent in banks 147 to 149 (LE HEGARAT, 1965: 11).

S.C.S. occurrence: MO-1303, Las Minas hill, southwest of Carorita Abajo village; Carorita Formation, Lara Nappe, of Valanginian age (MACSOTAY et al., 1987: 10-12, fig. 2).

Subfamily ***PTERINELLINAE*** Hayami, 1965a;
Genus ***Pterinella*** Toula, 1882.

The genus *Pterinella* was studied in detail by HAYAMI (1956-a, : 265). With a biochron of Hauterivian to Albian, with only four species, it had an unusual distribution: Japanese-East Asian, Balkanic, and Northeast Pacific Subprovinces and now, in the S.C.S. Due to many differences with

other *Pteriidae,* HAYAMI (op.cit.) erected a separate subfamily for them.

Pterinella petersi (Toula, 1882)
Plate 20, figs. 13, 14;

- 1881 *Pterinella Petersi* TOULA, Grundling. D. Geol. D. Westlich. Balkan: 31, pl. 3, figs. 1, 2;
- 1923 *Pterinella petersi* T., PETKOVIÇ, A. G. B. nº 7(2): 60-61;
- 1953 *Gervilleia (Gervilleia) alaeformis* (S.) ROYO Y GOMEZ, Asoc. Cient. Ven., 4(4): 138-139, figs. 1, 2; not Sowerby, 1819.
- 1974 *Pterinella petersi* T., DIMITROVA, Foss. Bulgarie, 4-b: 60, pl. 26, figs. 11ª, b; pl. 30, figs. 1ª, 1b;
-

This unusually big and thick *Pteriidae,* was discovered in Eastern Croatia, in limestones of Barremian age; and later found in Serbia and Bulgaria. It is found, forming colonies of many shells, adults and youngsters (*P. crassistesta, fide* HAYAMI, op. cit.) together, with a biochron of Hauterivian to Aptian.

S.C.S. occurrence: Locality MO-3213, southern point of Caracas del Este island, upper El Dantó dolostones (DAGM) of Hauterivian age. Also at MC-338, El Cordón, río Cariaco, also in El Dantó dolostones; from Suc-504, noreast side of cerro El Brasil, southwest of Cumana, in lower Taguarumo Formation of Early Barremian age.

Discussion: There exists the possibility, that the genus *Pterinella* originated in the hypersaline/saline tropical seas of S.C.S., as an infaunal non-siphonate suspension feeder, and migrated following the local developments of saline seas inside the Tethys Ocean, and outside, too. Queen Charlotte Island is an exotic terrain, which originally existed in the Tropical Pacific Ocean, as suggested by the associated benthic molluskan fauna.

Family ***BAKEVELLIDAE*** King, 1850
Genus ***Bakevellia*** King, 1848.

According to KAUFFMAN in HALLAM , (1973: 359) this is a cosmopolitan genus; many small-sized or dwarf species were common in the Wealdian facies of western Europe. Its biochron goes from Permian to Cretaceous.

Bakevellia inconspicua
(Gabb, 1877).

- 1877 *"Pteria" (Avicula) inconspicua* GABB, Jour. Assoc. Nat. Sci., Philad. 8:290, pl. 41, fig. 5;
- 1888 *Pteria linguiformis* Evans & Shumard? WHITE, Arch. Mus. Nac. Rio de Janeiro, 7: 50-52, pl. 4 figs. 5, 6; non Evans & Shumard, 1864;
- 1995 *Pteria inconspicua* G., VIVAS & MACSOTAY: 138;

Collected originally in the coal mines of Yauli, Pariatambo, Perú, of unknown age; later, collected in the Pará and Sergipe limestones, of Group Ganhamaroba, Brazil, of Middle Albian age.

S.C.S. occurrence: An-37, El Potrero, southeast of Bergantin, Anzoategui state, in El Cantil Formation, (DBG), of Early Albian age (VIVAS, 1987). Also in Caripito member of Chimana Formation, (DBG) of Middle Albian age, where it is common. Finally, in La Puya member of Peñas Altas Formation, (Trujillo state) in Late middle-Late Albian age.

Genus ***Aguilerella*** Chavan, 1951.

Aguilerella was considered a Jurassic genus (Toarcian to Oxfordian), with geographical extension in Eurasia and north Africa (COX et alii., 1969: 306-308). Discovered in lignitic calcareous clays, associated to bauxites of Cretaceous age, MONGIN (1970) attributed brackish water environment to this genus, but the Venezuelan species, were collected in saline waters.

Aguilerella cf. dissita (White, 1887)
Plate 47, figure 10;

- Cf. 1887 *Gervillia dissita* WHITE, Arch. Mus. Rio de Janeiro, 7: 54, 55, pl. 5, figure 1;
- Cf. 1936 *Gervillia dissita* W., MAURY, Mem. Serv.Geol., Min. Brazil, 11: 101, pl. 11, fig. 1;

Description: Suberect cast, much higher than wide, nearly equivalve; cardinal margin a little longer than the greatest transverse width of the shell; valves moderately convex, the convexity abrupt in front and sloping regularly backward from the anteriuor side; postero-dorsal portion of the shell compressed, but apparently not really auriculate; anterior ear prominent, comparatively thick but not vry large; hinge area of each valve rather broad, and furnished with 3 to 5 large, distant ligamental pits, one of which is included within the anterior ear. Height from base to cardinal margin, 36 mm; transvers with the same, 19 mm. Our shell, well preserved in calcite, is bigger than the Brazilian casts: height: 46 mm, transverse with the same, 29 mm. It is less cylindrical, widening on the distal half of the shell. Is alike to *Panis morellensis* (Coquand, 1865) but with the hinge-line of *Aguilerella.*

S.C.S. occurrence: Locality MO-8O9, Borracha island, Punta El Burro, lower Borracha Formation, of Aptian age, (DAGM)(VIVAS, 1987, Fig. 39).

Several disarticulated valves, in the same bed, with predator gastropodas. Locality HA-4343, La Urbina north section, Trujillo state, La Puya member of Peñas Altas Formation, of Middle-Late Albian age (ARNAUD, et alii., 1999).

Genus ***Costigervillia*** Cox & Arkell, 1948.

COX et alii., (1969 : N308) considered this a Jurassic (Bathonian-Oxfordian) genus, based on North European Province. But there are taxa belonging to it, in the Eocretaceous of Argentine and Mexico.

Costigervillia alatior (Imlay, 1940).
Plate 14, figure 4;

- 1931 *Gervillia alaeformis* Sow. WEAVER: 201 (partim.) pl. 15, figs.62, 63 non fig. 61;
- 1940 *Gervillia alatior* IMLAY, Geol. Soc. Amer., Bull. 51(1): 150-151, pl. 10, figs. 1,2; pl. 11, figs. 1-6;

Description: Thick, heavy shell, LV fairly convex, larger than the RV, which is less convex and less developed than LV. Hinge line straight, apparently as long as the greatest antero-posteriopr diameter, and forming an angle of 55 to 70 º with the umbonal ridge; hinge line moderately wide, with seven or eight large cartiladge pits which most are narrower than the spaces between them. Radial ribs are invariably stronger on LV than on RV. Estimated length: 66 mm, estimated height: 67 mm and thickness of articulated shell: 39 mm.

S.C.S. occurrence: Barril Viejo shale, Coahuila, Mexico, of Valanginian age. In Venezuela, Locality VG-382-B, quebrada El Imposible, El Dantó dolostones (sDLP, DGC) of Hauterivian age, several dolomitized shells.

Occurrence: In the Neuquen Subprovince, of Valanginian-Hauterivian age.

Genus ***Cuneigervillia*** Cox, 1954.

It is endemic in the North Temperate Realm in North European Province (KAUFFMAN in HALLAM., (1973: 369), with a biochron of Early Jurassic (Liassic) to Early Cretaceous. It is present in most of Ryazanian-Wealdian sedimentary formations.

Cuneigervillia neocomiensis (COTTEAU, 1855)
Plate 11, figure 1;

- 1855 *Avicula neocomiensis* COTTEAU, Bull. Soc. Des Sc. D l'Yonne, 9 : 104 ;
- 1905 *Avicula vulgaris* HARBORT : 34-35, Pl. 9, figs. 1-3 ;
- 1921 *Avicula neocomiensis* C., GILLET : 55, pl. 5, fig. 8 ;
- 1985ª *Cuneigervillia ?* sp. Ind., ETAYO-SERNA, Proyecto Cretacico XXiV-16 :

This small species attained a wide distribution: in the Late Valanginian of Hannover, Germany, and the *Spatangus* limestones in France, of Hauterivian age.

S.C.S. occurrence: Locality VG-555-A, Morocoto-Caituco rivers, Ojo de Agua area, El Dantó Formation, (DGC) of Hauterivian age. The dimension of our sample is Length:16,8 mm, Height: 13,,3 mm. In Colombia, is frequent in the Macanal shales, of Valanginian age.

Genus ***Gervillaria*** Cox, 1951

According to KAUFFMAN in HALLAM , (1973: 369) is proper of The North Temperate Realm, but endemic in North European Province, with a biochron of Jurassic-Cretaceous. In the western Tethys Ocean, and Pacific coasts of America, was also wide-spread, during the Cretaceous Period.

Gervillaria alaeformis (Sowerby, 1819)
Plate 32, figures 4, 5, 7;

- 1905 *Gervillia alaeformis* (S.) WOODS, : 79-83, 'pl. 11, figs. 9, 10, 11;
- 1938 *Gervilleia alaeformis* (S.) DIETRICH: 83, pl. 15, fig. 2;
- 1985 *Gervilleia alaeformis* (S.) MACSOTAY et al., : 7136;
- 1987 *Gervillaria alaeformis* (S.) VIVAS: 80;
- 1988 *Gervillaria alaeformis* (S.) DHONDT & DIENI,: 18-19, pl. 4, figs. 2-4, text figure 7; (paleogeographic map).
-

This species, - the type of genus *Gervillaria,*- is documented from wide areas: Western European, Neuquen, Maghrebian, Balkanic, Gulf-Atlantic coast Subprovinces, with a biochron of Valanginian to Late Aptian.

S.C.S. occurrences: MO-2796, El Potrero, Anzoategui state, Lower El Cantil Formation, (DBG) of Late Aptian age. It is frequent in the Taguarumo Formation, of Barremian age (deposited as UCVMG/IO 2134) and the lower carbonatic member of Peñas Altas Formation, Trujillo state, of Early Aptian age. In Colombia, is common in the Ubaqué Formation, of Barremian-Aptian age.

Genus ***Gervillella*** Waagen, 1907.

Gervillella is a cosmopolitan genus, whose biochron is Triassic to Cretaceous (COX et alii., 1969: N308).

Gervillella anceps (Deshayes in LEYMERIE, 1842)
Plate 20, figure 19;

- 1842 *Gervillia anceps* Deshayes in LEYMERIE: 9, PL. 10, FIGS. 3, 3a, 3b, 3c;
- 1871 *Gervillia anceps* D. in L., PICTET & CAMPICHE, Paleont. Suisse,: 82, pl. 155, fig.. 5 ;
- 1931 *Gervillia anceps* D. WEAVER, :203-204, plate 14, figs. 58, 59;

This specialized bivalve, - when complete,- can measure 205 mm of Height. Known from Western European, Apulian , Balkanic and Neuquen Subprovinces.

S.C.S. occurrences: Locality PM-8-C, Periquito-La Margarita road, La Margarita mudstones, (DGC, sDLP) of Hauterivian age. Also locality MC-338, El Cordon, Cariaco river, El Cazon Formation, of Berriasian-Valanginian age. Also in lower carbonatic member of Peñas Altas Formation, of Late Barremian age. Only disarticulated valves were found, and showing signs of depredation.

Genus ***Panis*** Stephenson, 1952.

According to KAUFFMAN in HALLAM , (1973: 359) it is distributed in temperate seas, as the ones of North European Province, and Gulf-Atlantic Coast subprovince. In the literature, Maghrebian and S.C.S. of the Gondwanan Province also hosts this taxon.

Panis maroma (Von der Osten, 1957)
Plate 18, figures 1, 5, 6;

- 1954 *Perna* sp., VON DER OSTEN, Bol. Geologia, (Caracas) 3(8) : 166, Pl. 5, fig. 1; pl. 6, figs. 1, 2;
- 1957 *Gervillia maroma* VON DER OSTEN, Jour. Paleont. 31(3) : 579, pl. 64, figs. 14, 21 ;

Description : Shell large, pyriform with alate posterior border ; sculpture consisting of about 15 spinose rounded ribs, on umbos only; well-defined, laminated growth-lines on rest of the shell; beaks prominent, nearly terminal, directed strongly inward and forward; anterior and posterior margins straight, joining at an angle of 90º, just forward of beaks; hinge strong, with four vertical cartilage pits. First pit very small, V-shaped, directly under beak; second pit, long and narrow; third pit about twice as broad as second; fourth pit, intermediate; dentition (in paratype) consisting of long, slightly curved, undefined dental ridges; muscle scars not visible (VON DER OSTEN, 1957: 579).

Dimensions: Height: 168 mm, length: 114 mm, thickness of articulated shell, 54 mm.

Discussion: Compared to the type species, *Panis cuneiformis* (Stephenson, 1952, U.S. Geol. Surv., Prof. p. 242: 67-68, pl. 14, figs. 15-17) – Woodbine Formation, Cenomanian age, Texas,- which is a more rounded, wedge-shaped, whose maximum inflation is well above the midheight and well forward the midlength, our shell's vertical margins are very distinctive.

S.C.S. occurrences: MMH locality Su-109, western coast of Picuda Grande island, lower Taguarumo Formation (DAGM) of Late Hauterivian age. Also El Dantó Formation, of Carinicuao river, (DGC) of Hauterivian age.

Family ***INOCERAMIDAE*** Giebel, 1852
Genus ***Inoceramus*** Sowerby, 1814.

According to COX et alii., (1969) it is a cosmopolitan genus, with a biochron of Early Jurassic to Late Cretaceous, Campanian stage. Recent studies showed it chemosymbiotic , explaining its widespread presence in black shale facies in all the Mesozoic oceans.

Inoceramus ex gr. neocomiensis (d'ORBIGNY, 1846)
Plate 16, figure 11;

- 1846 *Inoceramus neocomiensis* d'ORBIGNY, Pal. Franç. Terr. Cretacé, III: 503, pl.403, figs. 1, 2;
- 1910 *Inoceramus neocomiensis d'O.,* Paleontogr. Soc. 2(7): 262-263, plate 155, figs. 1, 2;
- 1974 *Inoceramus neocomiensis d'O.* DIMITROVA, Foss. Bulgaria, IV-b: 63-64, pl. 33, figs. 3, 4, 6;
- 1988 *Inoceramus ex gr. neocomiensis* (d'ORBIGNY) DHONDT & DIENI: 22;

It can not be excluded that *I. neocomiensis* of different authors does refer to more than one species, the stratigraphic range is too long for an inoceramid species (DHONDT & DIENI, op. cit.). According to J. SORNAY (1965: 393-394) this taxon in France, is known from Valanginian? to Barremian stages; is unknown from the Aptian stage.

Occurrence: Is known from the North European Province, and the Balkanic subprovince of the European Province, always rare.

S.C.S. occurrence: Locality PM-10, Periquito-La Margarita road, Monagas state, La Margarita mudstones, (sDLP, DGC), of Hauterivian age; also at

MC-338, MC-346-C, in calcareous shales at Catuaro, (DGC) in El Dantó dolostones, also of Hauterivian age.

Inoceramus sebianus Buchauer, 1897
Plate 19, figure 2;

- 1897 *Inoceramus sebianus* BUCHAUER: 67(5)-68(6), figure 3;
- 1924 *Inoceramus sebianus* B., GILLET: 265;
- 1958 *Venilicardia (?) sp.* BÜRGL, Bol. Geologia, Colombia, 6(1-3): 208, pl. 4, fig. 9;
- 1965 *Inoceramus sebianus* B., SORNAY: 395;

This taxon, known from Nierndorf, Germany (Neocomian) and La Fourie, France (Berriasian), is always scarce.

S.C.S. occurrence: Locality PM-10-B, Periquito-La Margarita road, La Margarita mudstones, (sDLP, DGC), of Hauterivian age. Locality MC-338-H, río Pajaral, El Cazón Formation, (DGC) of Late Berriasian-Valanginian age; all were left valves. In Colombia, from black shales of Río Batá, of Late Berriasian age, BÜRGL (1958) illustrated a big-sized (Height: 95 mm, Width: 34 mm) inoceramid, that could be related to *I. sebianus.*

Genus ***Birostrina*** J. de Sowerby, 1821 (ex De Luc, ms).

Small *Inoceramids* of Cosmopolitan distribution, and an intra-Cretaceous biochron: Neocomian to Cenomanian.

Birostrina concentrica braziliensis (White, 1888)

- 1888 *Aucella braziliensis* WHITE, Arch. Mus. Nat. Rio de Janeiro, 7: 56-57, pl. 3, figs. 11, 12, 13;
- 1936 *Inoceramus concentricus braziliensis* (W.) MAURY, Mem. Soc. Geol. Min. Brasil, 11: 107-108, pl. 8, figs. 9, 10, 13;

Birostrina concentrica (Parkinson, 1819)(fide DHONDT & DIENI, 1988: 22-24, plate 5, figs. 6-13c; text-fig. 9) s. s. – upper Lower Albian to Upper Albian - carries fine growth lines and many more delicate concentric lamellae, and the average adult shell size is about 45 mm of height. The *B. concentrica braziliensis* (White) is bigger: height: 70 mm, and width: 50 mm, for a left valve, and its sculpture is more alike to *I. tenuis* (Mantell, 1822): only regular growth-lines cover the whole surface. Taking in account the paleogeographical distribution of *B. concentrica,* (DHONDT & DIENI, op. cit., text-fig. 9) the taxon *braziliensis* must be an ecophenotype of *B. concentrica.*

Occurrence: The collecting place of this taxon, was at Garajau, Sergipe Province, - eastern coast of Brazil,- more related to the Maghrebian Subprovince, than the S.C.S.,but by the time – middle? Albian,- was under the influence of the saline waters of a narrow, tropical sea, like the S.C.S. Evaporitic sedimentation (CAINELLI & MOHRIAK, 1999: 209-210), and hypersaline and anoxic conditions dominated, during Early Albian to Early Cenomanian times all along this shoreline.

S.C.S. occurrence: Machiques member of Apón Formation, in Perijá area, quebrada Santa Rosita, (collected by G. BENEDETTO, 1976), of Early Albian age, two pelomorphically deformed fragments on black limestone slab. This is an additional proof for the saline/disoxic conditions in western Venezuela.

Birostrina subsulcata (Wiltshire, 1869)
Plate 52, figure 5;

- 1911 *Inoceramus concentricus subsulcatus* Wiltshire, WOODS: 268, pl. 47, figs. 3-14;
- • 1969 *Inoceramus (Birostrina) subsulcatus* W., COX et alii.: N315, fig. C46;
- 1974 *Inoceramus (Birostrina) subsulcatus* W., DIMITROVA: 66, pl. 34, fig. 3;
- 1985-c *Inoceramus (Birostrina) cf. sulcatus* Sowerby, ETAYO SERNA, Cord. Central, XXV-6;

This small species also had a wide distribution: North European Province, Balkanic Subprovince, East African and North Pacific Provinces, Austral Realm.

S.C.S.occurrence: Locality MO-1475, caño Cusare, in the topmost bed of the Lisure Formation, Perijá area, of late Middle Albian age. Also in Colombia, in the Cordillera Central.

Genus ***Mytilodes*** Brongniart, 1822.

Another *Inoceramid* genus, of cosmopolitan distribution: biochron form Early Jurassic to Late Cretaceous.

Mytiloides curacoensis (Weaver, 1931)
Plate 11, figure 15;

- 1931 *Inoceramus curacoensis* WEAVER, Univ. Washington, Mem. 1: 213, plate 16, fig. 71;
- Cf. 1906 *Inocermus ewaldi* Sch. WOLLEMAN: 272, Pl. 6, fig. 9;
- Cf. 1974 *Inoceramus ewaldi* Sch. DIMITROVA, Foss. Bulgarie, IVb: 64, pl. 33, fig. 1, 2;
- 1995 *Inoceramus cf. ewaldi* Sch. VIVAS & MACSOTAY: 129;

This species resembles *M. ewaldi* (SCHLÜTER, 1877), - In Westfalia, Germany, North European Province, they are markers of warm-water invasions. However, that species possesses a long straight anterior margin extending to the base, while in *M. curacoensis* it terminates above the middle height of the shell, and is continued as the posteriorly curving upper anterior portion of the base. In the European form the basal margin is very broadly curved, while in the South American species it is narrow and rather sharply arcuate. The posterior surface of the former is depressed and weakly concave, while in *M. curacoensis* it is slightly convex or inflated. The concentric ribs are of the same type in both species.

Dimension: Length, 42 mm; height, 43 mm , partially damaged shell from the upper Agrio Formation of Barremian or Early Aptian age, Neuquén Subprovince.

S.C.S. occurrence: Locality VG-555-A, río Morocoto-Caituco-Ojo de Agua road in dark grey shales, of El Dantó Formation, (DGC) of Hauterivian age.

Genus ***Retroceramus*** Koschelkina, 1957.
Subgenus ***Retroceramus*** Koschelkina, 1957.

This taxon, originated during ¿Late Triassic, Early Jurassic (Pliensbachian) to Early Cretaceous (Neocomian) age. Based on *Inoceramus porrectus* EICHWALD, 1871, from the North European Province, is also wide-spread in the Indo-Pacific Region. Is of cryophyllic affinities.

Retroceramus (Retroceramus) patagonicus
(Philippi, 1899)
Plate 9, figures 13, 14;

- 1899 *Inoceramus patagonicus* PHILIPPI, Fos. Secund. Chile: 43-44, pl. 23, fig. 2;
- 1974 *Inoceramus sp. aff. trapezoidalis* Thompson & Willey, KUGLER: 475, pl. 1, fig. 2;
- 1977 *Inoceramus sp.* II, RICCARDI: 224, fig. 2b;

Cast trapeziform in outline, slightly inflated; umbo is prosogyrous, acutely subtriangular; antero-ventral and postero-ventral margins rounded. Surface ornated with about 8 round, widely spaced concentric plicae separated by flat interspaces, which become coarser and more widely spaced towards the postero-ventral margin.

Dimensions: Length, 39 mm, height, 35 mm, diameter of articulated valves: 22 mm.

Occurrences: Studied from Cordillera del Viento, Chile, of Neocomian age. The cast is composed of ferrugineous claystone (PHILIPPI, op. cit.). In Springhill Formation, Argentinian Patagonia, a right valve, of Berriasian age.

S.C.S. occurrence: Locality MC-342, Garrapata hill, Carinicuao river, a calcareous siltstone in the lower part of La Margarita mudstones, (sDLP, DGC) of Hauterivian age. In Isla de Patos, in the Paria Gulf, in the Patos member of Laventille Formation of Neocomian age. It was a mold in a sandstone clast in the basal conglomerates (KUGLER, op. cit.).

Genus ***Anopaea*** Eichwald, 1861.

The biochron of *Anopaea* extends from Late Jurassic to Early Cretaceous (Albian?). The geographic distribution, according to KELLY (1984 was of North European Province, Japanese-East Asian Subprovince, Austral Province, and New Zealand. The Proto-Pacific must have been its distribution center.

Anopaea dispar (Philippi, 1899)
Plate 18, figure 17;

- 1899 *Inoceramus? (Aucella?) dispar* PHILIPPI, Fos. Secund. Chile : 96-97, pl. 42, fig. 1 ;
- 1915 *Gervilleia arenaria* Roemer, FUCINI : 63, pl. 7, fug. 6;
- 1937 *Venus cf. carditaeformis Roemer,* ARTHABER: 437-478, pl. 25, figs. 6, 7;

Collected at “locus ignotus”, Chile, this cast in a micaceous yellow claystone, has a good description: Ovalated shell, higher than wide, the LV is very convex, the RV is almost flat.

With a reverse pyriform shape, the anterior side is shorter and bends without an angle, to the dorsal margin which is weakly arched and not straight. The posterior margin joins the dorsal margin with a wide curve, and is longer than the anterior. Both lateral margins converge ventrally, forming a wide curve. A depression descends to the right side of the vertex; in the dorsal area a shallow furrow fades gradually below the beak. There is no trace of muscular pads or hinge structures preserved. Length: 53 mm, height: 82 mm.(translation from PHILIPPI op. cit.).

S.C.S. occurrence: Locality PM-09-F, road from Periquito to La Margarita mt., La Margarita mudstones, several biodegraded shells (sDLP), of Hauterivian age. The size of our individuals is smaller: Height: 35 mm, Length: 27,5 mm.

Occurrence: Two casts, with shell remains preserved, were collected at Mt. Terminetto, and Mt. Cascetto, Italy, in the wealdian sediments of the Apulian Subprovince, of Neocomian age.

Anopaea rugosa (Philippi, 1899)
Plate 12, figures 4, 7;

- 1899 *Trigonia? ? rugosa* PHILIPPI, Fos. Secund. Chile: 94, pl. 38, fig. 13, 13a;
- 1925 *Trigonia? rugosa* P., DEECKE, Foss. Cat., 30: 238; non Fischer.

Collected at Portezuelo del Tinguiririca, Chile, of Neocomian age. This small cast (25 mm of height) is inequivalve, inequilateral, subtrigonal-ovate , convex and irregularly rugose, of a LV. There is a furrow running parallel to the margin, reaching the half of the height. The furrow runs 1 mm of the margin, reaching 3 mm in the middle, and narrows uniformly towards both ends. The shell must have been very thin.

S.C.S. occurrence: Locality MC-448-A, Campo Claro road, (sDLP), La Margarita mudstones, of Hauterivian age.

Family ***ISOGNOMONIDAE*** Woodring, 1925.
Genus ***Isognomon*** Woodring, 1925.

With a biochron of Late Triassic to Recent, *Isognomon* is cosmopolitan (KAUFFMAN in HALLAM, 1973: 359) genus. They are epifaunal suspension feeders.

Isognomon militaris (Burckhardt, 1903)
Plate 21, figs. 1, 2;

- 1903 *Perna militaris* BURCKHARDT: 70, PL. 70, FIGS. 3-5;
- 1931 *Perna militaris* B. WEAVER: 211-312, pl. 15, fig. 65;
- 1960 *Perna cf. militaris* B., RENZ: 60, fig. 3a;

Occurrence: Discovered in Quintuco Fomation, Neuquen Subprovince, of Berriasian age, Argentina, where it is abundant along with ammonite faunas.

S.C.S. occurrence: Locality MO-905, northwest of Puerto Escondido, Sucre state, (DAGM) in lower Lope member of Taguarumo Formation, of Late Barreminan age; in this locality, is associated with dwarf colonial corals. From Colombia, it was reported in Moina Formation, of Hauterivian age, and Yúruma Formation, of Barremian age, associated with ammonites.

Discussion: The association with Ammonites and dwarf colonial corals, suggest an effort to survive in saline conditions, but where the storm seasons introduced euhaline marine waters, periodically- six months annually, could explain these associations, on hard bottoms.

Isognomon ricordeanus (d'ORBIGNY, 1846)

- 1846 *Perna ricordeana* d'ORBIGNY, Paleont. Terr. Crét., 3: 494, pl. 399, fig. 1-3;
- 1869 *Perna ricordeana* d'O., PICTET & CAMPICHE, Pal. Suisse, Cret., 93, pl. 157, fig. 1 ;
- 1931 *Perna ricordeana* d'O., WEAVER : 208-209, pl. 16, figs. 66, 67-70 ;

Is characteristic of the Valanginian-Hauterivian of Ste. Croix, Switzerland, and is also abundant in the eastern belt of the Quintuco Formation, -Berriasian,- of Neuquen Basin, Argentina.

S.C.S. occurrence: ROLLINS (1965: 24) reported it from the Kesima member of the Palanz Formation, of Berriasian-Valanginian age, where concentrates in the fore-reef facies. The locality Su-503, of Caracas del Oeste island, of Morro Blanco Formation, contained 4 articulated samples of this species.

Family ***MALLEIDAE*** Lamarck, 1819.
Genus ***Nayadina*** Munier-Chalmas, 1864.

According to KAUFFMAN in HALLAM et alii., (1973: 365) is a Late Cretaceous genus, (Cenomanian-Late Senonian) endemic in the Indo-Mediterranean region.

Nayadina larviformis (Gabb, 1877)
Plate 53, figures 5, 6;

- 1877 *Ostrea larviformis* GABB, Acad. Nat. Sci. Philadelphia, J., 2º ser., 8: 297, pl. 42, fig. 3;
- Cf. 1934 *Ostrea homarensis* BLANCKENHORN: 195, pl. 9, figs. 32-33;

The Peruvian shell, was collected at "Hill of Three Crosses, between Aguamiro and Huallanca, Province of Huamalíes at an altitude of more than 4000 meters, in Perú."

Description: Shell small, very inequilateral, oblique, arcuate, nearly equivalve; beaks terminal; posterior side and base, forming together a semicircle; anterior side produced, sometimes excavated above; surface marked by about seven large radiating ribs, alternating on opposite valves; the posterior two or three dividing into two near the margin. All are crossed by lines of growth. (GABB, op. cit.). The interior was concealed in GABB´s original sample. In our shell, the ligamental area is not well preserved, with one ligamental pit in the LV: muscle scar drop-shaped, small, without proyecting margins.

Dimension: LV: Length: 35,6 mm, Height: 25 mm, Thicknes: 11,3 mm;

S.C.S. occurrence: Locality MO-3220, La Grita river, the type locality of La Grita member of Capacho Formation, Tachira state, of Early Cenomanian age.

Discussion: *Nayadina gaudryi* Peron & Thomas, (1891: 200, pl. 26, fig. 4-15;) – Cenomanian of Tunisia and Egypt, has no radial ribs at all. *N. homarensis* Blanckenhorn (1938: 195, pl. 9, figs. 32-33) is a small species of Cenomanian horizons of Jordan and Palestina,- and has no radial ribs either.

Family ***POSIDONIIDAE*** Frech, 1909.
Genus ***Didymotis*** Gerhardt, 1897.

Warm water environments from mid-teperate to the tropical climatic belts during Cretaceous Period (KAUFFMAN, in HALLAM et alii., 1973: 359). Another genus with an unusual paleogeographic distribution: South America, Caribbean, North America (Mexico), Asia (Japan), and in Europe (Germany, Hungary, Spain). The biochron according to COX et alii., (1969: N344) is restricted to Turonian to Early Coniacian. Definitely, no *Didymotis* was ever found in Aptian horizons (auctt.). Distinguished from *Inoceramus* in the paper-thin shell, having inconspicuous subcentral beaks and a depressed area behind. Thepresence of radial rib, and hving no ligamentary fosette on the hinge-line. It is more elongated than *Posidonia.*

Didymotis ottorenzi new species, MACSOTAY
Plate 59, figure 16;

Description: Paper-thin shell, elongate-ovate, aequivalve and posteriorly subtruncate. The anterior area is short and rounded, the posterior margin is elongated and oblique; surface marked by concentric rugae, separated by narrow interspaces; the distal rugae are thicker on the distal part of the posterior area. Radial sculpture of 13-14 depressed radial ribs on the medial part of the shell, are thicker than on *D. variabilis* Gerhardt (1896: 178-179, pl. 5, fig. 3) – type species of the genus, of Coniacian age, in Venezuela, Colombia and Porto Rico) and our specimens do not show auricular area. The Venezuelan samples from La Luna Formation, RUTSCH & SALVADOR, (1954, pl. 40, fig. 2) show an uplifted umbonal area; they were obtained from pseudoconcretions (MACSOTAY et al., 2003), mostly concentrated in Turonian-Coniacian horizons (ERLICH et alii., 1999) in the Trujillo-Lara outcrops. Reports of Aptian ages, are all erroneous, due to the lack of knowledge of the local stratigraphy.

Etymology. I have the honor of dedicating this new species to the Swiss Geologist, Dr. Otto RENZ, author of the Cretaceous Ammonites of Venezuela (1982), and the best available study of the Cretaceous stratigraphy of the Country, made by a true field-geologist.

Types: UCVMG/IO-2151, a RV, the Holotype measures of Length: 50,6 mm, of Height: 24,6 mm (incomplete) and thickness of the shell near the umbonal region: 3 mm.

S.C.S. occurrence: Locality MO-2333, Yasa River, Perijá region, upper Maraca Formation, of Early Cenomanian age.

Discussion: *Didymotis ottorenzi* n. sp. is the earliest species stratigraphically proved in the genus. *Didymotis* could be an adaptation of the Genus *Aulacomyella* Furlani 1919, (COX et alii., 1969: N343) – Late Jurassic, Kimmeridgian stage, - to the seas with salinity anomalies, which became so common during the Eocretaceous. But still more evidence is needed, to support this hypothesis.

Didymotis cf. trinidadensis Sommermeier, 1918
Plate 56, figure 6;

- 1918 *Didymotis trinidadensis* Sommermeier, Centralblatt Miner., Geol. Paleont : 131 ;
- 1926 *Didymotis trinidadensis* S. WARING & HARRIS, The Johns Hopkins Univ. Studies in Geology, nº 7: 92, 94; pl. 16, fig. 5;

D. trinidadensis differs from *D. variabilis* Gerhardt (1897, Betr. Z. K. d. Kreideformation in Colombien: 178, pl. 5, figs. 3-a, b, c),- associated to *Barroisiceras rhombiferum* (Gerhardt), in La Luna Formation, of Turonian to Coniacian age,- not in the bundled radial ribs, but in the shorter shape of the shell. As stated by RUTSCH & SALVADOR, (1954) all the examined Venezuelan specimens have the few, simple radial ribs of *D. variabilis.*

S.C.S. occurrence: Locality MO-1154, Los Arillos creek, Niquitao area, Trujillo state, Guayacan member of Capacho Formation, of Late Turonian age. In Porto Rico, KAUFFMAN (1976: XXX-4 and XXX-5) reported *D. sp. aff. trinidadensis* Som. from three different localities all of Early Coniacian age.

Genus **Pseudodidymotis** Gillet, 1924.

Peudodidymotis is a genus proper of the North Temperate Realm, restricted to the North European Province (KAUFFMAN, in HALLAM et alii., 1973: 369) during the Early Cretaceous. All known species proliferated in oxygen-poor, muddy marine sediments, possibly were chemosynthetic.

Pseudodidymotis cf. buchii (Roemer, 1839)

Plate 11, figure 9;

- Cf. 1839 *Pecten buchii* ROEMER, Die Versteinerungen des Norddeutschen Oolithengebirges,: 27, Pl. 13, fig. 8;
- 1937 *Pecten sp. ind. ex aff. buchii* Rom., ARTHABER: 447-448, Pl. 25, fig. 28;
- 1945ª *Posidonomya* sp. n., ROYO y GOMEZ, G.E.O.G., Colombia: 6: 221;

Many casts and molds of small, thin shells, joined by their hinges. Their height and width are of the same size: 10 mm. Aequivalve and slightly inequilateral, they are are rather oblique. Hinge line straight, almost as long as the width; surface with strong concentric folds, with some weak radial rib, near the beaks (ROYO Y GOMEZ op. cit.).

S.C.S. occurrence: Locality VG-382-A, quebrada El Imposible, serranía de La Paloma, (DGC) El Dantó dolostones, of Hauterivian age. Also in Venezuela, the Chururú member of the Rio Negro Formation, also contained disarticulated shells. In Colombia, esquisto M-6, río Murca, Gachalá of Cáqueza Formation (ROYO y GOMEZ, op. cit.) of Valanginian age; also in the Middle Magdalena valley, the Rosablanca Formation, a strongly saline unit, of Late Valanginian-Hautervian age (BÜRGL, 1952).

Discussion: *P. cretacea* (FELIX, 1891: 163) – Middle Neocomian of Tlaxiuaco, estado de Puebla, México- is a quite proximal species, but it is a high and narrow species, while ours is almost as high as wide. The Mexican species was collected with uncoiled ammonites, suggesting a bathyal habitat for the genus. *P. valdromensis* (Gillet, 1924: pl. 7, fig. 13) – Vocontian Basin, Drome, France, of Hauterivian age,- is wider than high, being a cast, without external sculpture.

Pseudodidymotis sp. 1, *Macsotay*
Plate 53, figure 10;

- 1985-c, *Sergipia sp.,* ? ETAYO SERNA, Cordillera Central, XXV – 3;

S.C.S. occurrencce: Locality VG-398-B, outcrop north of rio Santa Juana, Cerro El Cautaro, serrania La Paloma, Valle Grande Formation, (sDLP, DGC) of Middle Albian age, associated to Belemnites.

Family ***Oxytomidae*** Ichikawa, 1958.
Genus ***Oxytoma*** Meek, 1864.

Oxytoma is a cosmopolitan genus, (KAUFFMAN, in HALLAM et alii., 1973: 359) whose biochron extends from Late Triassic to Late Cretaceous. In the Hole 317 A cores, was the second more important association of bathyal-abyssal Cretaceous: the *Oxytomidae*-dominated association, characterized by two or more oxytomid genera (byssate epifauna) commonly in association with pàper pectens (*Amusium* Group, Pectinidae) and infaunal suspension feeders like *Verticordia* and Lucinidae. This assemblage certainly represents the best benthonic environment for habitation, without severe environmental restrictions within or above the sediment-water interface, and in the presence of firm substrates for attachment of diverse byssate bivalves (KAUFFMAN, 1974: 510).

Subgenus ***Oxytoma*** Meek, 1864;

Oxytoma (Oxytoma) cornueli (d'ORBIGNY, 1846)
Plate 48, figure 15;

- 1905 *Pteria (Oxytoma) cornueliana* (d'O.) WOODS,: 57-59, pl. 8, figs. 1-7;
- 1921-b *Avicula (Oxytoma) inaequivlvis cornueliana* (d'O.) GILLET: 55;
- 1974 *Oxytoma cornueliana* (d'O.) DIMITROVA, Foss. Bularie, IV-b: 69, pl. 37, fig. 9 ;

Common species in the North European Province, the Balkanic Subprovince, with a biochron of Hauterivian to Albian stages.

S.C.S. occurrence: Locality MC-126-A, marl south of Piedra de Rayo mountain, Monagas state, lower Garcia Formation (DBG), of Aptian age: scarce, and usually biodegraded.

Subgenus ***Hypoxitoma*** Ichikawa, 1958.

With a biochron of Early to Late Cretaceous, this subgenus is cosmopolitan (KAUFFMAN in HALLAM et alii., 1973: 359).

Oxytoma (Hypoxytoma) arnaudi n. sp.,
MACSOTAY.
Plate 12, fig. 12, -A, -B;

- 1925 *Amusium sp.* BAUMGARTNER: 28-29, pl. 4, fig. 7;
- 2011 *Oxytoma (Hypoxitoma)* sp. indet., MACSOTAY & VIVAS, 1º Congr. Venez. Geociencias, fig. 3;

Diagnosis: Shell small, thin, whose LV is ornated by only seven curved, radial costae.

Description: Small, subovate shell, inequilateral and very slightly inflated; only the LV is available, which is ornated with seven smooth costae, curved backwards, from the umbo to the distal margins; no other sculpture is observable. Posterior alation is short, trigonal, and barely elevated. Anterior alation not observable.

Etymology: This beautiful small shell,is named after Dr. Hubert ARNAUD – Institut Dolomieu, rue Maurice Gignoux, Grenoble, France, - whose working group collected many of the fossil molluska in this study, and modernized the Venezuelan Cretaceous stratigraphy (1999, 2000).

Type: UCVMG/IO-2326. Holotype, measures of Length: 8,0 mm, and Height: 6 mm.

S.C.S. occurrence: Locality MO-1659, quebrada Guayamure, Guayamure Formation (Atarigua para-autochthon) , in light grey clay-shale, of Middle Albian age (MACSOTAY & VIVAS, 2011). The Guayamure Formation, was a bathyal unit, deposited on the slope of Gondwana continent, in oxygenated and well-circulated marine waters.

Discussion: *Oxytoma (Hypoxytoma) tardensis* (Stanton, 1901, p. 14-15, pl.4, figs. 6, 7) –Berriasian of Belgrano beds, Patagonian Argentina,- and *O. (H.) spitiensis* (Oppel, 1913: 400-401, pl. 97, fig. 1) – from the Spiti shales, Late Tithonian-Neocomian of Nepal,- both have an acute posterior wing, and the radial ribs are only developd distally. I all these formations, there is a datable Ammonite-fauna, so a deep-water sedimentation is deduced. Its presence in the Valanginian of Sumatra, -Inonesia- seems natural.

Genus ***Maccoyella*** Etheridge, 1892. (= ***Mimetostreon*** Bonarelli & Nagera, 1921).

Maccoyella is a typical Bivalve of the Austral Province (KAUFFMAN in HALLAM et alii., 1973: 373) with a biochron of Late Jurassic-Early Cretaceous. To the paleogeographic distribution: Australia, New Zealand, Patagonia (COX et alii., 1969: N346), we can add now Colombia and Venezuela.

Maccoyella bogotina (d'ORBIGNY, 1851)
Plate 39, figure 18;

- 1851 *Pecten bogotinus* d'ORBIGNY, Rev. Zoologie, 2.ser # 3:581-582, pl. 10, fig. 5;

An enigmatic cast of a Bivalve, a RV of regular size (Width: 60 mm) is oval, rounded, depressed, ornated with radial ribs with an intercalated secondary rib; distally, a third intercalated riblet appears. Concentric striae are present between the radial riblets. Auricules unequal and smooth. Collected at Tuluni, Colombia, in calcareous shales of presumed Aptian age (d'ORBIGNY, 1851).

S.C.S. occurrence: Locality MO-1305, road from Naranjal to La Fundacion, Chururú member of Rio Negro Formation, Uribante hemigraben, of Hauterivian age. Two casts of LV, half of the size reported by d'ORBIGNY (op. cit.), associated to *Astartemya (Freiastarte).*

Discussion: *Avicula carolinae* Gemmellaro (1870, : 53, pl. 8, figs. 3, 4) a small shell, rounded and slightly convex has a radial rib system of only primeries and secondaries, is a LV, collected in a limestone in Billiemi, Palermo, Italia. The author observed that this *Avicula* has no species alike in the Late Jurassic literature of western Europe: it is a paciphyllic *Maccoyella* advanced into the Tethys Ocean, during Tithonian-Berriasian times.

Observation: The orginal place or recollection, -Tuluni,- does not exist on Colombian maps. It must be a mis-spelling of Tuluá, a small city in the SW of the country. The locality is located on the Supraterrane (allochthonous) of Tahamí – Calima, (MUÑOZ, LOPEZ & TOUSSAINT, 1993, fig. 8), which accreted the craton during Late Cretaceous-Early Paleogene times. Its paleo-position was "several hundreds of km towards the south" during Late Jurassic times, explaining the presence of *Maccoyella*. Known eocretaceous limestones and coals are known from the Supraterrane, but they are not older than Late Aptian (TOUSSAINT & RESTREPO, 1993).

Family ***Entoliidae*** Korobkov, 1960.

Resembles and may have led to *Amusium.* Its biochron extends from Early Misissippian to Late Cretaceous (COX et alii., 1969: N346).

Genus ***Entolium*** Meek, 1865.
Subgenus ***Entolium*** Meek, 1865.

This taxon was considered as cosmopolitan by KAUFFMAN in HALLAM et alii., (1973:359) with a Biochron of Middle Triassic to Late Cretaceous. Mostly bathyal habitat; as aphotic, they could be present in deep shelfal environment, but always below the pycnocline.

Entolium (Entolium) angustum (Philippi, 1899)
Plate 3, figure 8;

- 1899 *Pecten angustus* PHILIPPI, Fos. Second. Chile : 27, pl. 16, fig. 3;
- 1931 *Pecten concentricus var. mlarguensis* Weaver, Univ. Washing. Mem. 1: 276, pl. 28, figs. 162, 163;
- 1937 *Pecten cf. concentricus malarguensis* W., Feruglio, M. I. G. Univ. Padova, 11: 32-33;
- 1937 *Pecten sp. b,* IMLAY, Jour. Paleont. 11(7): 568, pl. 74, figs. 6, 7 ; pl. 75, fig. 2 ;

Shell fairly small, subequilateral, subovate in outline, higher than long. Valves depressed convex but with fairly prominent umbonal regions. Beaks barely proyect above the hinge. Ears nearly equal in size, separated from the body of the shell by sulci. The upper margins of the dorsal slopes diverge from the beak at an angle of 80 to 85º and are nearly straight. Shoulders situated a little above the mid-height. Surface of shell marked by very fine closely spaced concentric lamellae. Length: 16 mm, height: 19 mm.

Occurrence: Originally studied from Portezuelo de Tinguiririca, Chile, of Neocomian age. In Argentina, is common in Vaca Muerta Formation, - Tithonian age,- Lago Argentino, Patagonia, of Berriasian age, and upper Quintuco Formation, of Valanginian age. In Mexico, is common in Carbonera Formation, of Valanginian age.

S.C.S. occurrence: Locality MC-329-F, Rio Pajaral marls, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age. Three disarticulated valves.

Discussion: The general outline and sculpture of this form resembles *Pecten concentricus* KOCH & DUNKER, (1839: 43, pl. 5, fig. 8) – Ryazanian, Late Jurassic – of Westfalia, Germany,- but differs in being much smaller, in having finer lines of growth, and straighter anterior and posterior mrgins. *Entolium (E.) cf. argentinum* (Stanton)(RICCARDI, 1977: 28, fig. 2i) – Spinghill Formation, Berriasian- of Patagonia, is more rounded and wide.

Entolium (Entolium) orbiculare *(Sowerby, 1827)*

1900 *Pecten Germanicus* WOLLEMANN: 41, pl. 8, fig. 13-19;

- 1902 *Pecten (Syncyclonema) orbicularis* Sow., WOODS: 145, pl. 27, figs. 1-3; 5-13;(non pl. 27, fig. 4= *Syncyclonema haldonensis)*
- 1960 *Syncyclonema orbiculare* (S.) KEY: 527;
- 1971 *Entolium orbiculare* (S.) DHONDT: 8, pl. 1, fig. 1;

This species, characteristic of the North Temperate Realm, but also in the northern margin of the Tethys Ocean, Camerun and Southeast Africa. Its biochron is Oxfordian to Late Cenomanian.

S.C.S. occurrence: Locality MC-375-B, microconglomeratic clayey red limestone from Cerro Grande/las Pozas Afuera, of El Dantó dolostone (DGC) of Hauterivian age; many fragments as clasts in conglomerate; also in MC-446-B, of Garcia Formation, of Aptian age. The Maracas Formation – Late Albian-Cenomanian age, is unconfirmed determination.

Entolium (Entolium) signollesae n. sp., Macsotay

Plate 30, figure 12;

Description: Suborbicular, elongated shape. Cast of a LV, well preserved fine concentric growth striations. Auricles of LV, proyecting above the hinge line, as angular wings (see opinion of N. D. NEWELL in COX et alii., 1969: N347): they are higher than any species we have notice of.

Etymology: I have the honor of dedicating this species to the Paleontologist Catherine Signolles, - Université Lyon-I, Dept. Sciences de la Terre, Villeurbanne, France,- whose help in the French redaction of my PhD thesis, was invaluable.

Dimension: Height: 45 mm (not including auricules), width: 44 mm (somewhat damaged anteriorly) with the complete auricules, the height would be 50,4 mm. Holotype.

Type: Le Dat, du Museum Géologique de Lausanne, (Vaud canton, Switzerland) nº 38.351, (plate 30, figure 12) of Berriasian age (Courtesy of Dr. Jean Charollais).

S.C.S. occurrence : MO-1294, Las Minas hills, type section of Carorita Formation, of the Lara Nappe (MACSOTAY et al., 1987: 10-12, figura 2). One fragmentary LV, preserving the auricules, but smaller in size, collected one meter below the thin limestone with *Leptoceras hubachi* Royo y Gomez, of Valanginian age.

Discussion: Quite alike to the type species, *Entolium demissum* (Phillips)(COX et alii., 1969: N347)- Middle Jurassic (Bajocian), Germany, - which is an almost perfectly circular shell; the auricules are less elevated above the hinge line. *Pecten (Entolium) theodosianus* Retowski (1893, B. S. I. N. M. 2(3): 78, pl. 6, fig. 23), - Theodosia-mergel, Krimea, Ukraine of Berriasian age – is of smaller size, and is higher than wide.

Genus ***Syncyclonema*** Meek, 1864.

This genus is typical of the North Temperate Realm (KAUFFMAN, in HALLAM, 1973: 368) of the "North American Subprovince-Province" which later was forgotten by the author. The biochron was Late Cretaceous according to COX et alii. (1969: N347). In my files, there are as much Early Cretaceous taxa than the ones in the Late. See European references in DHONDT, (1971).

Syncyclonema polylasmites (Gemmellaro & Di Blasi, 1874)

Plate 13, fig. 2;

- 1874 *Pecten polylasmites* GEMMELLARO & DI BLASI: 43, pl. 3, fig. 18;
- 1937 *Pecten* sp. A, IMLAY, J. Paleont. 11(7): 568, pl. 75, fig. 1;
- 1858-1860 *Pecten Agassizi* PICTET & de LORIOL : 43, pl. 9, figs. 2-4 ;
- 1974 *Propeamussium agassizi* (P. & de L.) DIMITROVA : 70-71, pl. 37, figs. 13, 14 ;

Description: Shell of small size, ovate in outline, very gently convex, with median pointed beaks; auricule subequal in the form of slender right-angled triangles not proyecting beyond the beak. The sulci are coincident with the upper margins of the dorsal slopes and diverge from the beaks at an angle of about 105º to 110º. Basal margin forming a semi-circular curve; surface smooth and polished with very fine lines of growth. Apparently is a RV. The figured specimen is 10,55 mm in height and 9,8 mm in width; the convexity of the single valve is less than 1,5 mm.

Occurrence: Collected in Palermo, Sicilia, Italy, in limestones associated to *Nerineidae, (Trochalia, Itieroptygmatis, Eunerinea)* of Berriasian age. These fossils, belong rather to the Maghrebian Subprovince, than to the Western European.

S.C.S. occurrence: Locality VG-383, Ojo de Agua-Santa Rosa road, between Río Grande and quebrada del Medio, Sucre State, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age. In Mexico, Tamaulipas, was reported from Carbonera Formation, of Valanginian age.

Family ***Amusiidae (=Amusium Group*** fide COX, et alii., 1969: N350***)***

The *Amusiidae* are primarily bathyal (200 to 4000 meters), most species are filter-feeding carnivores, feeding on small crustaceans and foraminifers. The average recorded water temperatures for the living *Amusiidae* are 1.7ºC to 11.6ºC and the preferred substrates are soft green and gray muds; globigerinid oozes are principal associated substrates (KAUFFMAN, 1976: 509). In Venezuela, several species of *Amusium* are very abundant (MACSOTAY & CAMPOS, 2001) on the outer shelf soft substrates, affected by upwelling phenomena.

Genus ***Propeamussium*** de Gregorio, 1884.

Are deep-water inhabitants, cosmopolitan in distribution (KAUFFMAN in HALLAM et alii., 1973: 359). The biochron is Early Jurassic to Recent.

Propeamussium agassizi (Pictet & de Loriol, 1858) Plate 30, figures 9, 14;

This small taxon is known from the Hauterivian of Rottier, Drôme, France, Bulgaria, and Voiron, Switzerland. From the Barremian of Gardinezza, South Tirol, Italy, and from Barrême, France (the stratotype).

S.C.S. occurrence: MO-1294, cerro Las Minas, Carorita Abajo, Carorita Formation, of Hauterivian age , Lara Nappe.

Propeamussium puinarensis new species, Macsotay Plate 58, figure 5;

- 1985 *Propeamussium* sp., MACSOTAY et al.,: 7144;

Diagnosis: Small, thin and flat shell, of ovoidal-elongate shape, with seven internal radial ribs, in the LV.

Description: Shell of medium size for the genus, ovoidal-elongate in shape; subequilateral exceot the auricules, nearly as high as wide, or slightly wider. Disarticulated valves are flat, on both vales antero or postero-dorsal margins are straight, forming an apical angle of approximately 90º; auricules are of moderate size, weakly defined, anterior and posterior of about the same size. Dorsaal margins of auricules scarcely rising above the hinge-line. About seven internal primary ribs diverging from umbonal area, extending for about 2/3-s of the apical-marginal area; no secondary ribs were observed. No concentric sculpture is preserved.

Type: The Holotype, UCVMG/IO-2152, measures, of Height: 8,9 mm, and of width: 9,4 mm. Seven disarticulated valves were collected.

Etymology: This taxon is named after the Island Chimana Grande also called Puinare, where it was sampled. This island has a surface of 8,42 Km2, and exposes Cretaceous fossiliferous sedimentary rocks (MACSOTAY et al., 1986).

S.C.S. occurrence: Locality MO-3243, Las Playuelas inlet, Puinare (Chimana Grande) island, (DAGM) Boquerón Formation, of Late Albian-Cenomanian age. Is associated to the ammonite *Mariella bergeri* (Brongniart)(MACSOTAY et al., 1986, VI Congr. Geol. Ven., Mem. 10: 7125-7174). Also at MC-332-B, dirt road to Yucucual, lower Boqueron Formation, in black, calcareous piritiferous siltstone, bioturbated by *Chondrites,* of Early to Middle Cenomanian age.

Discussion: This species can be compared to *Propeamussium ninae* (Karakasch)(DHONDT & DIENI, 1988: 26, pl. 3, figs. 2a, 2b),- Late Albian to Cenomanian of Balkanic Subprovince,- which has about 11 interior radial ribs, and can have intercalary secondary ribs. *Amusium* sp. (BAUMBERGER, 1925: 252-253, pl. 4, fig. 7) – collected in Sumatra, Indonesia of Valanginian age, is a *Propeamussium,* too, is very much alike the new species, but has 9-10 inner radial ribs.

Genus ***Parvamussium*** Sacco, 1897.

Treated as subgenus of *Propeamussium* De Gregorio by COX et alii., (1969: N350) and many authors. We adopt here I. HAYAMI's (1975) treatment, as an independent genus, which originated during Middle Jurassic times, independently. My personal opinion, is that they are a case of convergence of two different *Pectinacea* clades, as an adaptation to the bathyal but aphotic environments as filter-feeding organisms. According to COX et alii., (1969: N350-N351) this cosmopolitan taxon, has a biochron of Late Cretaceous to Recent. In Cenozoic sediments they became common in presence of oxygen-rich cold-waters, related to contouritic currents.

Parvamussium cf. kimurai (Hayami, 1965)
Plate 51, figures 8, 12, 13;

- Cf. 1965 *Variamussium kimurai* HAYAMI, M.F.S. Kyushu University, 15(2) : 320-322, pl. 46, figures 1-4 ;
- Cf. 1975 *Parvamussium kimurai* (H.) HAYAMI, U.M.Univ. Tokyo # 10 : 83 ;

Description : Molds of medium size for the genus, shape orbicular, very inequivalve, subequilateral except for the auricules ; nearly as long as high, weakly inflated. RV distinctly smaller than LV; in both valves antero and postero-doral margins are slightly concave forming an apical angle of about 100º. Our casts are ornated by 9-11 inner ribs (less than the typical species) which become curved distally; they stop abruptly atabout one mm of the distal margin. Auricles are devoid of ornamentation. The Japanese shells were collected in Neocomian (Hauterivian) beds.

Dimension: One LV (plate 51, figure 13) measures, of height: 8,2 mm; of width: 8,2 mm.

S:C:S. occurrence: Locality MC-332-B, five disarticulated valves in marls on the road to Yacacual, (estado Sucre) in Boqueron Formation, of Early Cenomanian age. It is associated to *Inoceramus* and Ammonites, deposited at a paleodepth of 400-520 meters. Locality JFS-171, Casanay-Caripito road, Valle Grande Formation, (DGC) sucre state, of Late Albian age. Marls with belemnites, and small sized Gastropoda and Bivalvia. Few fragments from Lisure Formation, of Middle Albian age.

Discussion: *Parvamussium sokolowi* (Retowski, 1893: 79-80, pl. 6, figs. 24, 25, 26) - Theodosia-mergel, Crimean peninsula, Ukraine, of Berriasian age,- has 13-15 strong ribs, bigger size, 24 mm of height and width. The ribs only are extended in the proximal 2/3-s of the LV. *Parvamussium inversum* (Nilsson) (DHONDT, 1971, Jr. S. n. B.B. # 47(32): 37-41) –Turonian to Maastrichtian, in the North European Province, with its maximum in the Campanian of Sweden,- is a small species of cryophyllic affinities.

Parvamussium parvum (Gabb, 1860).
Plate 61, fig. 4 ;

- 1860 *Anomia parva* GABB, Proc. Acad. Nat. S. Phila., # 12: 198, pl. 3, fig. 15;
- 1877 *Anomia parva* G., GABB, Jour. Acad. Nat. S. Phila., # 8: 233;

Description: "Shell thin, orbicular, very slightly convex, pearly; beak small but acute; "surface marked by concentric undulations, crossed by delicate radiating lines." (GABB, 1860). Collected at Chile, in Cretaceous beds. The illustration of GABB (1860, op. cit.) does not show any auricules, which is a common situation among these small species. The radial ribs are eight, start nearby the umbo, and end at about 1/3rd of the distance to the margin. The shell seemed to measure 5 mm of width, and 4,5 mm of height.

S.C.S. occurrence: MO-3243, La Playuela inlet Chimana Grande island, Boquerón Formation, of Early Cenomanian age, (DAGM), eight disarticulated valves. The biggest one, measures about 6 mm of width, and 5,5 mm of height.

Family ***PECTINIDAE*** Rafinesque, 1815.
CAMPTONECTES Group (COX et alii., 1969 : N351).
Genus ***Camptonectes*** Agassiz in Meek, 1864.
Subgenus ***Camptonectes*** Agassiz in Meek, 1864.

Camptonectes (Camptonectes) is a group of epifaunal suspension feeders of cosmopolitan distribution (KAUFFMAN in HALLAM et alii., 1973: 359). Usually concentrated in deep water facies and the slope; I have not seen any reference to salinity anomalies, but its frequence in the S.C.S.'s Neocomian horizons, suggests preference for high salinities, in aphotic conditions. The frequency of

Camptonectes nudus (Buvignier, 1852) in the Portland beds in England and France,-supposedly brackish- probably was the opposite: saline (COX, 1929: 161-162, pl. 3, fig. 2)

Camptonectes (Camptonectes) cottaldi *(d'ORBIGNY, 1847)*

- 1847 *Pecten Cottaldinus* d'ORBIGNY, : 590-591, pl. 431, fig. 7-11;
- 1902 *Pecten (Camptonectes) Cottaldinus d'O.,WOODS: 156-157, pl. 29, figs. 1, 2-a,b; 3 a-b;*
- 1942a, *Pecten (Camptonectes) cottaldinus* d'O. ROYO Y GOMEZ: 46-47;
- 1988 *Camptonectes cottaldinus* (d'O.) DHONDT & DIENI: 28, PL. 6, FIGS. 1-3; Text-fig. 12;(Distribution chart).

Distribution in North Temperate and Tethyan Realms extended to Central Asia. Its Biochron spans from Valanginian to Aptian, usually in pelitic sediments.

S.C.S. occurrence: In Colombia, was cited in Caqueza Formation, molds and casts associated to *Neocomites neocomiensis,* of Berriasian? or Valanginian age. ETAYO SERNA (1985-a) found it in Macanal shales – Valanginian age; in Valle medio del río Magdalena, in Santa Rosa de Viterbo shales, of Valanginian age. In Venezuela, locality MC-329-F, Pajaral River, in ferrolithic shales of El Cazón Formation, of Berriasian-Valanginian age (DGC).

Camptonectes (Camptonectes) aff. insutus *(Cragin) Plate 11, figure 19;*

- 1940 *Pecten (Camptonectes) aff. insutus* Cragin, IMLAY, Geol. Soc. Amer., Bull. #51(1): 146 pl. 3, fig. 23;

S.C.S, occurrence: VG-555-A, road from río Morocoto-Caituco-Ojo de Agua, in dark grey sales of El Cazón Formation (DGC), of Late Berriasian-Early Valanginian age. Two casts of disarticulated valves of this small species. A more rounded shaped shell was reported from high horizons of La Quinta Formation in red mudstones (MACSOTAY & PERAZA, 1997: 12, fig. 2A-11, 12) of Tithonian? age.

Camptonectes (Camptonctes) striatopunctatus (Römer, 1839) Plate 11, figure 18;

- 1847 *Pecten striato-punctatus R.* d'ORBIGNY: 592-593, pl. 432, figs. 4-7;
- 1868 *Pecten arzierensis* de Loriol: 47, pl. 4, figs, 3-5;
- 1972 *Camptonectes (Camptonectes) striatopunctatus* (R.) DHONDT: 13-18, pl. 1, fig. 2;

C. striatopunctatus is the only Early Cretaceous *Camptonectes* species, without concentric ornamentation, and is thus easily differentiated. Usually ill-preserved due to its fragility, was originally discovered in the Hils clays of Germany of Neocomian age. Its biochron is Valanginian to Albian, of the North European and the East African Provinces, and the Balkanic and Maghrebian Subprovinces.

S.C.S. occurrence: Locality MC-349-B, cerro Garrapata, Carinicuao area, El Cazón Formation, (sDLP, DGC), frequent fragments of this shell, preserved in limonite and siderite of Berriasian – Valanginian age.

Camptonectes (Camptonectes) placitus *(White, 1887)*

- 1887 *Camptonectes placitus* WHITE, Arch. Mus. Nac. Rio de Janeiro, #7:40, pl. 4, figs. 8, 9;
- 1936 *Pecten (Camptonectes) placitus* (W.) MAURY, Mem., Soc. Geol. Min Brazil # 11:134, pl. 4, figs. 12, 13;

Small-sized shell, compressed-lenticular, higher than wide; valves regularly and almost equally convex; hinge line not quite equal to the full width of the shell; beaks small, barely prominment; auricules of moderate size, the posterior one a little smaller than the other. Free margins of the shell, forming subelliptical curve from the base of the posterior auricule, to a point a little below the anterior auricule; from here, the margin slopes inward and upward to the base of the anterior auricule. Surface marked by numerous fine concentric lines of growth, with hardly a trace of radiating lines. (WHITE, 1887)

Dimensions: The largest shell, measures, Height, 20 mm; width, 17 mm. Collected in the Province of Sergipe, Brazil, considered of Middle Albian age.

S.C.S. occurrence: Locality VG-432, 6.3 km on the road Agua Fría Arriba-Campo Alegre Sucre state, Valle Grande Formation (DGC) of Middle Albian age. More than 17 disarticulated and biodegraded shells were collected, associated with belemnites ammonites and other molluska, suggesting **200 – 300 meters** of paleodepth.

Subgenus ***Hunanonectes*** Fang Zong-Jie, 1978.

This subgenus was proposed on base of *Camptonectes (Hunanonectes) sanduensis* by Fang ZONG-JIE (1978, Acta Paleont. Sinica # 17(4): 465-466) – Early Jurassic of Guandong

and Southern Hunan, China,- for shells with a peculiar delicate network pattern, and dissimilar ornamentation on both valves. The "Camptonectes-striations and radial costae co-exist in this subgenus. *Hunanonectes* may be a liking form between *Chlamys* and *Camptonectes (Zong-Jie, op. cit.)*. Several pectinids can be ranged in this subgenus:

>*Camptonectes (Hunanonectes) parachlamys,* (Zong-Jie, 1978) Early Jurassic age, China.

>*Pecten alpinulus* Mayer, (1867, in KAUFMANN, B. zg. K. d. Schweiz., Bd. 5:133-134, Pl. 7, fig. 2)- Neocomian of Acheregg and Lopperberg, Switzerland.

>*Pecten (Camptonectes) compressus* GERHARDT (1898, V.N.J.M.G. #11: 176-177, pl. 5,fig. 1) of Petaquero del Villeta (Cundinamarca) Colombia, supposedly from Aptian age. BÜRGL collected it (1962: 136) in the Central Range, on the road Dorada-Sonsón, asociada a *Deshayesites stutzeri* Riedel, of probable Late Aptian age.

Camptonectes (Hunanonectes) peruanus
(Rivera, 1951)
Plate 30, figure 12;

- 1907 *Syncyclonema* sp. ind., LISSON: 30, pl. 3, fig. 4;
- 1945ª *Pseudavicula?* Sp. n., ROYO Y GOMEZ, C.E.O.G., Colombia #6:220, 221, fig. 1; pl. 29, fig. 2;
- 1952 *Obliquipecten peruanum* RIVERA: 48, 49, pl.6, figs. 6-8;

Description: Several casts and molds; shells higher than wide. Surface with concentric growth lines, without any radial striae; LV with posterior auricle narrow and long, anterior area without auricle; LV less inflated than RV. Measurements of ROYO Y GOMEZ (op. cit.): Height: 22 mm, width: 17 mm, considered it *Pseudavicula* alike to several species of Queensland, Australia.

Occurrences: Puente Inga, of Puente de Piedra Formation, Perú, of Berriasian age, of Peruvian Subprovince.

S.C.S. occurrences: Locality VG-376, Ojo de Agua-Santa Rosa road, El Cazón Formation, (DGC), of Late Berriasian age. In Colombia, east of Sabana de Bogotá, Culebra Formation of Caqueza Group, (ROYO Y GOMEZ , op. cit.). Also in Colombia, M-6 shists, Mucra river, point 11, Gachalá Formation; greenish-black slates on the Km. 58.6 of Bogotá-Villavicencio road Cáqueza Group, attributed to Valanginian age.

Sub-family ***Chlamydinae*** Von Teppner, 1922(=*Chlamys Group,* COX et alii., 1969: N355).
Genus ***Chlamys*** Röding, 1798.

A cosmopolitan genus (KAUFFMAN, in HALLAM et alii., 1973: 359) with a biochron of Triassic to Recent. It shows preference for euhalyne marine waters, at last in Cenozoic sediments.

Chlamys raimondii (Gabb, 1877)
Plate 60, figure 13;

- 1877 *Pecten raimondii* GABB, Jour. A. N.S. Philadelphia # 8 : 293, pl. 42, fig. 1, 1a;
- 1947 *Pecten raimondii* (G.) RICHARDS: 58, pl. 7, fig. 7 ;

Description : Shell oblong, flattened, equilateral, slightly inequivalve, closed; surface of both valves covered with strong radiating rib, about 15 or 16 on each valve. These ribs are surmounted by three ridges, and the intercalary grooves carry also one or three radiating lines; all crossed by strong lines of growth becoming slightly squamose on crossing the ridges; anterior right auricle emarginate.

Occurrence: Hill of Potosí, on the road from Lima to Jauja, Peru, Cretaceous, considered of Middle Albian age by RICHARDS (1947: 58).

S.C.S. occurrence: Locality MO-2333, Yasa river, Perijá, Lower Maraca Formation of Late Albian age. Four strongly biodegraded valves, at the base of a limestone bed. Also reworked in olistoliths of Bobare Formation, western Venezuela.

Discussion: It is of the type of *Chlamys faujasi* (Defrance, 1825) (DHONDT, 1973:6-15, Pl. 1, Figs. 2A-E) – Turonian to Maastrichtian, in North European Province and Western European Subprovince.- and *Mimachlamys cretosus* (Defrance in Brongniart, 1822) (DHONDT, 1973: 77-92, plate 6, fig. 2; plate 7, fig. 1) – Turonian to Maastrichtian of North European Province, Balkanic and Maghrebian Suprovinces, - which it resembles in the style of the ribs, while it differs in their details and in general form, being a shorter and rounder shell.

Chlamys sp. ind.

- 1946 *Chlamys* sp. LIDDLE, Geology of Venezuela: 221;
- 1954 *Chlamys sp.* COX, J. Paleont. 28(5) : 628, pl. 66, fig. 5 ;

This genus is represented by a much eroded specimen about 24 mm high and 20 mm long. It has 11 squamose radial ribs separated by interspaces of their own width. (COX, op. cit.). More than one species could be present here.

S.C.S. occurrence: Tibú Formation, in the Apón river, Perijá range. Biodegraded shells of this taxon are present in at last 3 different limestone beds (G. Benedetto, 1975). Somewhat smaller shells were collected at VG-555, of El Dantó dolostones, of Hauterivian age. The shells from Trinidad, were collected at Point-a-Pierre, in an olistolith reworked in Chaudiere Formation, of Paleocene age.

Discussion: *Pecten compositus* (FITTON in SOWERBY, 1836: 342, pl. 18, fig. 20) - Portland beds, England, of Ryazanian (=boreal Berriasian) age,- is a small oblong with about 20 smooth, sharp radial ribs, joined with two rows of symmetrical scvales between them. It is a *Chlamys*-like shell, part of the dwarf fauna extended in the saline waters of the North European Province.

Genus ***Euthymipecten*** Dhondt & Dieni, 1988.

Euthymipecten seems to be restricted to the Cretaceous, and possibly it does not extend beyond the Cenomanian. Geographically it occurs mainly in Temperate climatic zones, but generally in fine-grained deposits such as the Gault clays. It represents a group of pectinids which lived not in littoral waters, but is somewhat deeper seas.
Species included: *Euthymipecten astierianus* (d'ORBIGNY, 1850), *Euthymipecten beaveri* (Sowerby, 1817) both from the Valanginian-Cenomanian. Both species have a relatively wide geographic distribution, but are restricted ecologically to pelitic deposits.

Euthymipecten astierianus (d'ORBIGNY, 1850)
Plate 10, figure 12;

- 1850 *Pecten Astierianus* d'ORBIGNY: 83, # 392;
- 1867 *Pecten Euthymi* PICTET: 96, pl. 21, figs. 1-3;
- 1974 *Eopecten euthymi* (P.) DIMITROVA: 78, plate 39, fig. 2;
- 1988 *Euthymipecten astierianus* (d'O.) DHONDT & DIENI: 30-32, plate 6, figs. 14a-15b ;

Description : RV suborbicular, covered with 16 to 21 primary radial ribs and several irregular secondary intercalary ribs ; fine commarginal ornamentation forms spine-like structures at the intersection with primary and secondary radial ribs ; anterior auricle elongate and with well developed byssal sinus, posterior auricle smaller and with almost right angle, both covered with strong commarginal lines which follow the exterior margins ; less developed radial lines can also be seen. LV somewhat more flattened than the right, bearing only 16-21 narrow radial ribs, divided by broad interspaces; anterior auricle with acute outer angle and covered with radial and commarginal lines, posterior auricle smaller (DHONDT & DIENI, 1988: 31) .

Dimensions: Height, 75 mm, width: 71 mm (Sardinia, Late Valanginian); height: 72 mm, width: 67 mm (Bulgaria, Valanginian); height: 70 mm; width: 72 mm (Berriasian, France). Our shell, tectonically deformed, (see arrows) measures of height: 55,5 mm.

S.C.S. occurrence: Locality MO- , Las Minas hill, near Carorita Arriba, Carorita Formation, 20 meters below *Olcostephanus (Olcostephanus) cf. astierianus*-bed, of Valanginian? age, Lara Nappe (MACSOTAY et al., 1987: 10-11, fig. 72).

Distribution : In France, the *E. astierianus* is wide-spread in the Vocontian basin, and equivalent deep-water sediments in Switzerland: Justisal, Thune See in Berriasian-Valanginian stages. In Sardinia, Bulgaria and Morocco in the same horizons, suggesting a bathyal dispersal in the Tethys Ocean. Still found in the Barremian of Gard, France. Only one dwarf shell was reported from Castellane, of Gargasian age.

Genus ***Merklinia*** Sobetski, 1960

This small genus, based on *Pecten asper* Lamarck, 1819, OD, whose biochron extends from Berriasian to Maastrichtian, is a wide-spread taxon, not cited by any of the reviewers. Of small size during the Eocretaceous, increased its size tenfold or more, from Cenomanian onwards, invading the outer shelves.

Merklinia? viteli (Pictet & Campiche, 1870)
Plate 51, figures 1, 1a;

- 1870 *Pecten Viteli* PICTET & CAMPICHE, Paleont. Suisse #4 : 206, pl. 173, fig. 6, 7 ;
- 1929 *Pecten sp. n.,* PASSENDORFER : T. S. geol. Paleont. # 2(4): 585, pl. 1, fig. 9;

Description: Cast of oval shape, higher (20 mm) than wide: (18,5 mm), weakly convex, slightly inequivalve. Apical angle: 80 º. Each valve is ornated by about eight straight radial ribs; these are regular, rounded, and separated by wide interspaces. The irregularities on the molds suggest the presence of nodules on the shell. Auricles unknown. Sampled in La Vracone, Switzerland, of Latest Albian age. (PICTET & CAMPICHE, op. cit.: 206).

S.C.S. occurrence: Locality MC-372, in shale outcrop northeast of Cautaro, Valle Grande

Formation, (DGC) of Late Albian age. Also found in La Puya member of Peñas Altas Formation, Trujillo state, of Late Albian age. A smaller cast, with only seven ribs, was collected in glauconitic limestone in Wielka Rówien, Poland.

Discussion: *Pecten octoplicatus* STANTON, (1901, P.P.U.E.Padova, #4: 14, pl. 4, figs. 2, 3), - Belgrano Formation, Lake Pueyrredon, Argentina, associated to Berriasian ammonites,- is also a *Merklinia,* with eight strong ribs on each valve, with an average height of 9 mm, for three valves. The ribs on the RV are subangular, not rounded.

Genus ***Mimachlamys*** Iredale, 1929.

The genus *Mimachlamys* was considered as synonymous of *Chlamys (Chlamys)* Röding, 1798 by COX et alii. (1969: N355). During the review of the European *Chlamys* Group, DHONDT (1973, Bol. Inst.r.S.n.Belgium #49 [1]: 56), found that this clade, is significant stratigraphically during Cretaceous and Cenozoic periods. With *Pecten asperrimus* Lamarck, 1819, as the type, O.D. by Iredale, 1929, DHONDT(op. cit.) included the following Cretaceous species: *M. cretosa* (Defrance), *M. robinaldina* (d'ORBIGNY), *M. fissicosta* (Etheridge) and *M. mantelliana* (d'ORBIGNY). The essential differences with *Chlamys (Chlamys),* are: shells higher than wide, with apical angle in adult specimens, covered with 12-40 radial ribs which are at least as broad as the intercostal intervals, always well developed and elevated above the shell surface, and often subdivided. The apical angle is narrower than 90º and the auricles are very unequal. *Mimachlamys* – alike Chlamys,- had preference for euhaline marine waters, so its presence in our saline formations, is rather poor.

Mimachlamys cf. daubrei (Coquand, 1865)
Plate 41, figure 9;

- Cf. 1865 *Pecten Daubrei COQUAND* 342, pl. 13, figs. 5-6;
- 1913 *Pecten (Chlamys) cf. Daubrei* Coqand, SOMMERMAIER: 388;

S.C.S. occurrence: Locality MO-890, Punta Manare, Mochima, Sucre state, lower Borracha Formation, (DAGM) of Late Aptian age. One biodegraded, partially preserved shell without auricules, among a rich fauna of Gastropoda and Bivalvia. It is documented from Spain, Algeria, Peru, always from Aptian horizons.

Mimachlamys vacaensis (Weaver, 1931).

- 1931 *Pecten vacaensis* WEAVER, Univ. Washington, Mem. #1: 277-278, pl. 28, fig. 161;

Description: Shell of moderate size, suboval to subcircular in outline, and with anterior wing about one-fourth larger than the posterior. The apical angle averages between 90º and 95º, with the LV slightly more convex than the RV, and is sculptured with about 40 slightly raised, flat topped, relatively broad radial ribs, with interspaces varying from ¼ to equal width. The RV is less convex, equal in outline, and with a similar ornamentation except that the major ribs are relatively wider, about 10 % fewer in number, and there are intercalary riblets , mainly on the anterior and posterior parts. The interspaces are relatively narrower. Lower Agrio Formation, Argentina, of Hauterivian age, abundant.

Dimensions: Length, 39 mm; height, 39 mm.
S.C.S. occurrence: Locality MO-892, Cachimena inlet, west of Cumaná, Lower Taguarumo Formation, in the basal limestones, of Hauterivian age. Four articulated shells.
Discussion: Resembles somewhat *Pecten puzosianus* WOODS, 1902 (plate 30, figs. 9, 10, 11), re-named *Mimachlamys henrici* DHONDT (1973, Bull. Ins. R.Soc.nat. Belgique # 49(1): 99-101, pl. 5, fig. 2) – Cenomanian in the Anglo-Parisian basin - but differs in ornamentation and relative proportions of the shell.

Hinnites Group. (COX et al., 1969: N364).
Genus ***Prohinnites*** Gillet, 1922.

This genus, has a short Biochron : Early Cretaceous (Berriasian to Aptian). The paleogeographic distribution includes Western European and Peruvian Subprovinces, and, S.C.S.. Always, associated to deep-water basins, in hemipelagic sediments.

Prohinnites leymerii (Deshayes, 1842)
Plate 32, figure 13;

- 1842 *Hinnites Leymerii* Deshayes in Leymerie, Mém. Soc. geol., # 5: 27, pl.14, fig. 1;
- 1870 *Hinnites Leymerii* Deshayes, PICTET & CAMPICHE, Pal. Suisse, # 4:224-226, pls. 174, 175 ;
- 1931 *Hinnites leymerii* D., WEAVER, Univ. Washington, Mem.#1: 286-287, pl. 29, fig. 175;pl. 30, fig. 177; pl. 31, fig. 178;
- 1838 *Hinnites (Prohinnites) cf. leymeriei (sic)* Des., DIETRICH: 85, pl. 15, fig. 4;
- 1980-b *Prohinnites leymeriei (sic) (D.)* MACSOTAY: 50;

Diagnosis: Subcircular shell, approximately as high as wide, irregular, of different thickness, where the LV usually attached, and the RV, free. Average size: 135 mm. There is a high variability of the growth depending on the irregularities of the adhering place. The Neocomian type of LEYMERIE (op.cit., pl. 14,

fig. 1) measured 190 mm of height. In central Neuquén, in the Agrio Formation, Argentina, the LV measured 180 mm of height.

Occurrence: In Western European, Magrebian, Apulian, Neuquen, Balkanic subprovinces and North European Province. Its biochron extended from Valanginian to Aptian stages. Portugal seems to belong to the Gulf-Atlantic coast subprovince.

S.C.S. occurrence: MO-892, Cerro Los Bordones, (DAGM), Sucre State, El Dantó dolostones, of Late Hauterivian-Early Barremian age. ETAYO SERNA (1985-a, # 24-15) cited it from Macanal shales, of Hauterivian age of Colombia. Two fragmentary articulated shells were collected in Carorita Formation, but they were not in situ.

Depository: UCVMG/IO2129.

Neithea Group. (COX et alii., 1969: N371)
Genus ***Neithea*** Drouet, 1825.

Neithea (Neithea) Drouet, 1825, is a well established cosmopolitan subgenus whose Biochron goes from Neocomian to Senonian (KAUFFMAN in HALLAM et alii., 1973: 359). As we have no living representatives, I propose to compare them with the clade *Pecten (Euvola)* Dall, 1898, whose type is *P. (Euvola) ziczag* Linné, 1758, recent, Caribbean Province. The author personally observed groups of 12-16 adult shells, swimming actively to escape from an attacking octopus, in eastern Cariaco Gulf, at depths of 8 to 25 meters (MACSOTAY, 1982: 169, pl. 1, figs. 1 – 4, Table 6). The Cariaco Gulf, is known from its periodical cease of circulation, when selenite chrystals are deposited in the dark green muds, so animals with tolerance of elevated salinity are favored.

Neithea (Neithea) aequicostata *(Lamarck, 1819)*

- 1819 *Pecten aequicostatus* Lamarck: 181, nº 13;
- 1902 *Pecten (Neithea) aequicostata* (L.) WOODS: 208-210, pl.40, figs. 8-9;
- 1946 *Neithea (Neithea) aequicostata* (d'O.) WINKLER in SUTTON, pl. 4, figs. 3, 4;
- 1962 *Neithea cf. aequicostata* (L.) ABBASS, Cret. Biv. Egypt: 51-52, pl. 6, fig. 16;
- 1973 *Neithea (Neithgea) aequicostata* (L.) DHONDT: 10-14, pl. 1, fig. 1a-c;

Occurrence: *Neithea (N.) aequicostata* (Lamarck) is the type species of the genus (COX et alii., 1969: N371), with a biochron from Albian to Turonian in Western European Subprovince and North European Province; less common in Gondwanan Province, Angola included and Balkanic Subprovince. Common in the Peruvian and Somalian Subprovinces.

S.C.S. occurrence: Locality: south bank of Río Apón, 100 meters upstream from La Luna contact, (Perijá) Maraca Formation, of Late Albian- Early Cenomanian age. In Colombia, from Neiva, near Cachay, Late Albian (ROYO Y GOMEZ, 1949a).

Neithea (Neithea) aethiopica *(Gortani, 1973).*

- 1934 *Neithea alpina* d'ORBIGNY, subspecies, OLSSON, Bull. Amer. Pal. # 20(69): 31-32; not d'ORBIGNY, 1847;
- 1973 *Vola aethiopica* GORTANI, Asoc. Nat. D. Lincei 4: 33-35, pl. 9, figs. 3-4ª-d;
- 1980 *Neithea cf. alpina* d'O., GARCIA-JARPA et alii,: 44;

Description: Big-sized thick shells, mostly right valves, with rounded triogonal shape; the umbo is inflated, strongly convex, where the maximum inflation is near the upper 1/3 of the height. The thickness is slightly greater than the 1/3 of the height of the shell. There are siux primary ribs, the strongest are the two in the middle, the others not so much; the intercostals spaces are narrow and deep in the apical region, and the weathering of the shell, increases the contrast between primaries, secondaries and tertiaries, which become reduced. Auricules are broken away on all our samples. ***N. (N.) aethiopica*** has resemblance to ***N. (N.) alpina*** (d'ORBIGNY, 1847) fide DHONDT (1973: 15-20), but the RV is somewhat more convex, and the secondary ribs are almost as coarse as the primaries.

Dimensions: The type, a RV, measures of height: 55 mm, and width: 49 mm, and apical angle: 73º.
Occurrences: The original two specimens were collected in Graua North, Ethiopia, of Albian age.
S.C.S. occurrences: Locality HA-4348, La Urbina north section, La Puya member of Peñas Altas Formation, of Early Late Albian age (ARNAUD, et alii., 1999, fig. 33), Trujillo state. In Perú, it was reported from Pananga Formation, of Albian age.
Discussion: *Vola lindiensis* KRENKEL (1910) (LANGE, 1914, Arch. Biont. #3(4): 212-213, pl. *16, fig. 6; pl. 17, figs. 1-3) – Barremian age Niongala beds, Tanzania,- is a big-sized Neithea,* but the primary ribs are composed of a group of four secondary ribs; it was also wider than high.

Neithea (Neithea) atava (F. A. RÖMER 1839)
Plate 21, figures 6, 10;

- 1839 *Pecten atavus* Römer, Verst., Nordeutsche Ooliten-Gebirgen, Nacht.: 29, pl. 18, fig. 31;
- 1870 *Janira atava* R., PICTET & CAMPICHE, Pal. Suisse, # 4 : 237, pl. 180 ;

- 1946 *Neithea sp. Cf. texana* (Romer) WINKLER in SUTTON: 1644;
- 1954 *Neithea atava (R.)* COX, Jour. Paleont. 28(5): 627, pl. 64, figs. 1, 4;
- 1985 *Neithea (N.) cf. atava* (R.) ETAYO SERNA, Proy. Cret., Publ. Esp. 16: 24-12;
- 1987 *Neithea atava* (R.) VIVAS: 65;

N. atava (R.) is recorded from the Valanginian to the Barremian in Western European Province; also in the Berriasian-Valanginian of Mexico; by Barremian times, it extended to Balkanic Subprovince.

S.C.S. occurrence: Locality HA-4451, section of Cerro Agua Dulce, lower carbonatic member of Peñas Altas Formation, Trujillo state (ARNAUD et al., 1999, fig. 17), of Late Barremian age. SUTTON (op. cit.) collected it in Mendoza Fría road, lower Peñas Altas Formation. In Taguarumo Formation, east of Patiño inlet, one adult shell, of Barremian age. In Colombia, is found in the Las Juntas sandstones, of Hautrivian-Barremian age. In Trinidad, found in Cuche Formation, of Barremian age.

Subgenus ***Neithella*** Hayami, 1960.

Neithella is a cosmopolitan subgenus, whose geographical distribution is Euramerica besides Madagascar and East Africa (KAUFFMAN in HALLAM et alii., 1973: 359), with a Cretaceous Biochron (Neocomian to Turonian).

Neithea (Neithella) valangiensis (Pictet & Campiche, 1870)
Plate 4, figure 7; plate 20, figures 1, 2, 7, 8, 9;

- 1870 *Janira valangiensis* PICTET & CAMPICHE, Pal. Suisse :242, 243, pl. 181, figs. 1-3 ;
- 1973 *Neithea (Neithella) valangiensis* P. & C., DHONDT: 70-72;
- 1988 *Neithea (Neithella) valangiensis* P. & C., DHONDT & DIENI: 33, pl. 6, fig. 13;

This is a small-sized species, whose average height is 28 mm, and the apical angle, 60º. It is wide-spread in Western European, Balkanic Subprovinces. Its biochron extends from Berriasian to Hauterivian, with only one shell found in Perte-du-Rhone, France in Early Aptian stage.

S.C.S. occurrence: Locality VG-382-B, Cerro El Imposible, río Coicual, Sucre state, of El Cazón Formation, (sDLP, DGC) of late Berriasian-early Valanginian age. Also in El Dantó Formation, (DAGM) of Late Hauterivian age.

Subgenus ***Neitheops*** Stewart, 1930.

Considered a cosmopolitan by COX et alii., (1969: N371) with a biochron of Cretaceous (Valanginian-Maastrichtian) age.

Neithea (Neitheops) cf. occidentalis (Conrad, 1855).

- 1954 *Neithea (Neitheops) cf. N. (N.) occidentalis* (C.) RUTSCH & SALVADOR, Jour.Paleont. 28(4): 422;
- ¿1946 *Pecten irregularis* (Böse) LIDDLE: 221;

S.C.S. occurrence: Locality HA-4407, Arbol Redondo section , in Upper carbonatic member of Peñas Altas Formation (ARNAUD et alii., 1999, fig. 25), of Early Albian age. Our Venezuelan representatives are fragments only (biodegraded) , but seem to agree perfectly well with the typical *N. occidentalis. Neithea (Neitheops) irregularis* Böse, from the Middle Albian of Mexico, is evidently identical with *N. occidentalis.*

Occurrence: *N. occidentalis* is a common and widely distributed type in the Fredericksburg Group of Texas and Kansas, (Gulf-Atlantic coast Subprovince) of Middle-early Late Albian age (STANTON, 1947: 43, pl. 27, figs. 1-4).

Neithea (Neitheops) quinquecostata (Sowerby, 1814)
Plate 61, figure 3;

- 1934 *Pecten (Neithea) quinquecostata* (S.) COLLIGNON: 18-19, pl. 3, figs. 1, 1a;
- 1939 *Neithea quinquecostata* (S.) TAVANI, Atti. Soc. Tos.Sc. Nat. #48 : 5 ;
- 1960 *Neithea (Neitheops) quinquecostata* (S.) KEY 3º Congr. Geol. Venez, #2: 527 ;
- 1973-b *Neithea (Neitheops) quinquecotata* (S.) DHONDT: 29-37, pl. 2, figs. 2a-c;

This taxon has an unusually long biochron: from Late Aptian to Campanian stages, with an almost cosmopolitan distribution, inside the Tethys Ocean.

S.C.S. occurrence: Locality HA-4335, La Aguada section, La Puya Member of Peñas Altas Formation, of Late Albian age. Also reported from Maraca Formation of Late Albian-Cenomanian age. It is present in Brazil and Perú, but not in Colombia.

Neithea (Neitheips) syriaca *(Conrad, 1852).*

- 1852 *Janira Syriaca* CONRAD, :230, pl. 1, fig. 6;
- 1858 *Janira Morrisi* PICTET & RENEVIER: 128-130, pl. 19, figs. 2ª-d;
- 1902 *Vola morrisi* (P. & R.) CHOFFAT: 147-148, pl. 3, figs.5, 6;

- 1930 *Pecten (Vola) quinquecostata morrisi* (P. & R.), STEINMANN, Geologie von Perú: 126, fig. 139;
- 1947 *Neithea (Neitheops) syriaca* (C.) VOKES: 166-167, pl. 4, figs. 1-7;
- 1954 *Neithea morrisi* (P. & R.), BENVIDES, :375;
- 1965-a *Neithea (Neitheops) amanoi* HAYAMI: 299-301, pl. 41, figs. 8-10; pl. 42, figs. 1-4;
- 1980-a *Neithea (Neitheops) syriaca* (C.) MACSOTAY,: 254;

Neithea syriaca (Conrad) is the most abundant in the Barremian and Aptian sediments of all the Gondwana Province. Its biochron is extended to Early Cenomanian. It is ornated by 5 primary ribs, and 4 intercalary riblets, whose number and intensity is variable. Its area is smooth, the apical angle is of 55º with an average height of 30 mm, approximately.

S.C.S. occurrence: Locality MO-884, west side of Patiño inlet, cliffs west of Cumana, in Lope member of Taguarumo Formation, of Early Aptian age (DAGM). In this area, it is found in most of the calcareous sandstone beds, usually associated to *Pterotrigonia tocaymaana,* and other Trigoniids. It is also common in La Margarita mudstones (PM-8C) of Hauterivian , Tibú Formation in Perijá and in Mendoza Fría, Trujillo state, (WINKLER in SUTTON, 1946) Barremian-Early Aptian age. In the Machiques hemigraben, in upper Rio Negro Formation, in Rio Yasa, of Barremian age. In Trinidad, reported from the Chert river, of Barremian? age.

"GROUP UNCERTAIN" (COX et alii., 1969: N373).

Genus ***Eopecten*** Douvillé, 1897.

MONGIN (1980: Notes serv. Geol. Tunisie: 112) defined this genus: Shells of medium to big sizes, not convexes, ornamentation more or less irregular, can have an allomorphic ornamentation. Inequivalves, with the LV convex, and the RV flat or concave, with traces of attachment near the beak; the anterior left auricle big, indistinctly marked, right auricle elongated, with a deep subauricular depression with a ctenolium at its base; posterior auricle is rather small. Ornamentation of radial ribs, arranged in 2 or 3 orders of strength, increasing by implantation. On the type species, *E. tuberculosus* Goldfuss, - Middle Jurassic of Germany,- (COX et alii., 1969: N372, fig. 4a : a LV) there is a *Hinnites*-type ornamentation on the RV: ribs are strong, spiny or tuberculated, flanked by unequal fine riblets; on the LV, fine, regular and equal riblets alike the ones of Recent *Chlamys multistriata.* The cardinal area (beaks and auricles) usually is not preserved; for taxonomy, the ornamentation of both valves is important.

According to KAUFFMAN in HALLAM et alii., (1973: N373) is proper of the North Temperate Realm. *Eopecten* originated during Triassic Period, and subsisted until Cenomanian stage, in the neritic, but also in the pelagic facies (GILLET, 1924: 54) specially during Neocomian times.

Eopecten covuncoensis (Weaver, 1931)
Plate 19, fig. 16;

- 1931 *Velopecten covuncoensis* WEAVER, Univ. Washington, Mem. # 1: 285-286, pl. 28, fig. 171;
- ¿1899 *Pecten tinguiricanus* PHILIPPI, Fos. Mesoz. Chile : 36, pl. 20, fig. 8 ;

Description : Medium-sized shell, ornated with 40-45 major flat to slightly rounded radial sinuous ribs with interspaces of equal or slightly greater width; the apical angle averages 95º . The maximum width and height are about the same and the hinge line is nearly 3/5 of the width of the shell.

S.C.S. occurrence: Locality MO-1324, curve of the Río Negro, lower Tibú Formation, Perijá area, of Late Barremian age. In Neuquen Subprovince, n the Agrio Formation, Argentina and Tinguiririca beds, Chile of Hauterivian-Barremian age.

Discussion: *Pecten milleri* FITTON in SOWERBY, (1836: 342, pl. 17, fig. 19) - Portland beds, England,- of Ryazanian age, is a dwarf relative of *Eopecten covuncoensis.* It differs from our species in being higher than wide, and both valves more inflated.

Eopecten studeri (Pictet & Roux, 1853)
Plate 10, figure 7;

- 1853 *Hinnites studeri* PICTET & ROUX: 504, pl. 45, fig. 1;
- 1903 *Velopecten studeri* P. & R., WOODS: 218, pl. 41, fig. 11; pl. 42, figs. 1-4;
- 1929 *Velopecten studeri* P. & R., PASSENDORFER, 2(4): 588, pl. 1, fig. 6;
- 1970 *Eopecten studeri* (P. & R.) DARTEVILLE & FRENEIX, 20: 77, pl. 9, fig. 13;

Occurrence: *E. studeri* is a relatively common species of Noth European Province, Apulian and Maghrebian Subprovinces with a biochron of Early Aptian to Cenomanian stages.

S.C.S. occurrences: Locality MO-1877, cerro La Pica, Sucre state, Chuparipal Formation, (DEP) of Late Barremian-Early Aptian age (MACSOTAY & ALVAREZ, 1987).

Family ***CHONDRODONTIDAE*** FRENEIX, 1959.

Following S. FRENEIX in STENZEL (1971: N1197), "it should be ranged in Pectinacea "according to STANTON (1947) and FRENEIX & LEFÈVRE (1967), it definitely does not fit "in Ostracea." Its biochron goes from Early Cretaceous (Albian) to Late Cretaceous (Campanian).

Genus ***Chondrodonta*** Stanton, 1901.

According to STENZEL (op. cit.) its biochron goes from Early Cretaceous (Albian) to Late Cretaceous (Turonian). It is a thermophyllic genera, in euhaline marine waters, and high energy bottoms. Its distribution is mainly in Gondwanan Province; from S.C.S. to Somalian Subprovince.

Chondrodonta cf. glabra Stanton, 1901
Plate 56, figure 22;

- cf. 1947 *Chondrodonta glabra* STANTON, U. S. Geol. Surv., pp. 911: 48, pl. 39, fig. 6;

S.C.S. occurrence: Locality MO-1147: El Alto, east of Guaríco town, Portuguesa state, limestone olistolith, associated to *Rhynchostreon subsquammatum* (d'ORBIGNY, 1850) –Late Albian-Cenomanian age—in Venezuela and Colombia. The precise origin of these samples is not known, but is the commonest olistolith in the Paraguito horizon of Matatere Formation, of Early Eocene age.

Occurrence: Is a common species in Glen Rose Formation, Texas, of Early Albian age.

Chondrodonta aff. munsoni (Hill, 1893)
Plate 58, figure 11;

- 1893 *Ostrea munsoni* HILL, Biol… Soc. Wash., Proc. #7: 105, pl. 12;
- 1947 *Chondrodonta munsoni* (Hill), STANTON, U.S. Geol. Surv.,#211: 48, pl. 41, fig. 9; pl. 44, figs. 3-6;
- 1980 *Chondrodonta cf. munsoni* (S.) GHOSH & GARCIA JARPA, Bol. Geol. 14(26): 119;

Occurrence: This species has a wide distribution in the Apulian and Balkanic Subprovinces, besides the Upper Edwards Formation, of Texas. Its biochron is restricted to Cenomanian stage.

S.C.S. occurrence: Locality BELI-4, quabrada La Bellaca, lower Escandalosa Formation, (Barinas state), of Cenomanian age. Upper horizons of Aguardiente Formation, on road to Zea, Merida state, also of Cenomanian age.

Chondrodonta urgonensis (PICTET & CAMPICHE, 1870
Plate 41, figure 8;

- 1870 *Hinnites urgonensis* PICTET & CAMPICHE, Pal. Suisse # 4: 229, pl. 177, figs. 1-4;
- 1889 *Hinnites cf. renevieri* P. & C., TOULA: 79, PL. 5, FIG. 6 ; non PICTET & CAMPICHE, 1870 ;
- 1974 *Prohinnites urgonensis* P. & C., DIMITROVA : 75-76, pl. 36, figs. 1, 2;

Diagnosis: Surface with straight radial ribs, separated by interspaces of the same size, and crossed by festoonesd concentric lamellae. Margins are also festooned. Originally described from Urgonian limestones, of France, Switzerland, and Bulgaria (up to late Aptian).

S.C.S. occurrences: Locality MO-890, Borracha Island, lowest limestone beds of Borracha Formation, (DAGM) of Late Aptian age.

Family ***Buchiidae*** Cox, 1953.

Buchiidae dominated associations of very low diversity in bathyal/abyssal assemblages, typical during Jurassic and Cretaceous times. It may suggest that *Buchiidae* are opportunistic and thus strongly dominate their community and/or that they can occupy marginally habitable benthonic environments which excludes many other types of benthos. Substrates supporting these associations dominated by byssate epifaunal bivalves may have been somewhat toxic internally (KAUFFMAN, 1976: 510).

Buchia aff. blandfordiana (Stoliczka, 1866)
Plate 17, figure 4;

- 1866 *Aucella blandfordiana* STOLICZKA, Mem. Geol. Surv. Ind., #5: 88;
- 1913 *Aucella blandfordiana* S., HOLDHAUS, Pal. Indica #15(4): 412-414, pl. 98, figs. 1-9;
- 1958 *Aucella aff. Blandfordiana* S. BÜRGL, Bol. Geol., Colombia, 6(1-3): 207-208, pl. 4, figs. 5-7;
- 1985 *Buchia* sp. FIERRO & USECHE: 6º Cong. Geol. Venez. #1: 674;

BÜRGL (1958) reported finding 15 valves, mostly left ones in the gypsum mine "Lusitania"as the following "the height forms with the cardinal border at 70º; LV "measures 38 mm of height, and 27 mm of width, and is more convex than the RV which "is less high. A shell of 30 mm high, exhibits 12-15 concentric cords very weak and low. It "is less obliquous than *B. blandfordiana* sensu stricto, (70º in place of 55º) and is less "convex. The ornamentation is the same."

S.C.S. occurrence: Locality MO-1305, road from Santa Rosa to La Fundación, in quebrada Chururú: Chururú member of Rio Negro Formation, Uribante Hemigraben, of Hauterivian age. Colombian localities belong to lower Macanal shales; also in the Culebra Formation of Cáqueza Group, all of Berriasian age;

Discussion: The small specimens of the Chururú member, probably belong to a different species, descendant of the one ones of BÜRGL. Additional specimens are needed.

Genus ***Malayomaorica*** Jeletzky, 1963.

COX et alii., (1969 : N376) gave a good description of this genus, known from Indonesia and New Zealand, of Late Jurassic (Kimmeridgian) to Eocretaceous (Neocomian).

Malayomaorica sp. indet. Macsotay
Plate 19, figs. 18, 19; text-fig. VI-2;

- 1945a *Pseudavicula?* ROYO Y GOMEZ, Comp. Est. Geol. Of. Col. #6:220-221, pl. 29, fig. 2;

Description: Casts and molds of a thin-shelled Bivalve, oval-shaped, higher than wide; surface covered with concentric striae and occasionally a concentric riblet. The umbo is opistogyre, with an auricle barely outstanding the posterior margin of the shell, fitting well the RV, while on the LV is well separated by a wide sinus: the shell is inequivalve. The LV is less convex than the RV, and the umbo is less prominent. A well preserved cast, measures 22 mm of height, nd 17 mm of width; another one, 32 mm of height, and 22 mm of width. (ROYO Y GOMEZ, 1945-a).

Occurrence: Found frequently in the black shales of Cáqueza Formation, and possibly in lower Macanal Formation, both of Valanginian age.

S.C.S. occurrence: Locality MO-1305, road to La Fundacion, Chururú member of Rio Negro Formation, Uribante hemigraben, of Hauterivian age; also in El Cazón Formation, also in dark shales, of Valanginian age; evidently, this is a paciphylic genus, migrated from Izumi and Pacific plates.

Family ***PLICATULIDAE*** Watson, 1930.
Genus ***Plicatula*** Lamarck, 1801;

According to KAUFFMAN in HALLAM et alii., (1973: 359) it is cosmopolitan, epifaunal suspension feeders. SQUIRES & SAUL (1997) considered a habitat in shallow-marine warm-water, with thermophyllic trait. The biochron is from Middle Triassic to Recent.

Plicatula carteroni d'ORBIGNY, 1843-1847
Plate 40, fig. 21;

- 1843-1847 *Plicatula carteroniana* d'ORBIGNY, Pal. Fr. Terr. Crét. #3: 680, pl. 462, figs. 5-7 ;
- 1865 *Plicatula aracne* COQUAND : 350, pl. 19, figs. 5-6 ;
- 1871 *Plicatula carteroni*, PICTET & CAMPICHE, Pal. Suisse, St. Croix, #4 : 265, pl. 183, figs.3, 4 ;
- 1974 *Plicatula carteroni DIMITROVA,* Foss. Cret. Bulgarie : 83, pl. 43, figs. 1a-c ;
- 1985-a *Neithea (Neithella) cf. notabilis* (V. Münster) ETAYO-SERNA, Proy. Cretacico, 24: 17, lam. 1, fig. 8; (non MUNSTER in GOLDFUSS, 1833: 56, pl. 93, figs. 3ª-c)

This small species has a biochron of Valanginian to Late Aptian, of Western European and Magrebian Subprovinces.

S.C.S. occurrences: Locality MC-426-B, Cerro de Piedra, marls of García Formation, (DGC) of Late Aptian age. In Colombia, is reported from the same horizon.

Plicatula fourneli Coquand, 1862
Plate 61, figure 12;

- 1862 *Plicatula fourneli* COQUAND : 220, pl. 16, figs. 5-6 ;
- 1937 *Plicatula fourneli* C., TREVISAN : 62, pl. 3, figs. 11 a-c ;
- 1958 *Plicatula fourneli* C., BARBER : 20, pl. 7, fig. 3 ;
- 1972 *Plicatula fourneli* C., FRENEIX : 84, pl. 4, fig. 11 ;
- ?1944 *Plicatula « maraensis »* NOTESTEIN et al., :165 ;(nomen nudum)
-

Widely distributed in shallow water sediments of Gondwana Province, with a biochron of Late Aptian to Santonian. Frequent on top of limestones, and in tempestites.

S.C.S. province: Locality MO-2125 Rio La Grita, between La grita and Seboruco, La Grita member of Capacho Formation, of Late Albian age: very abundant as oligomictic fauna. Reported from Maraca and Chipaqué Formations, of Early Cenomanian age.

Plicatula inflata Sowerby, 1823
Plate 37, figure 1;

- 1901 *Plicatula inflata* S., WOODS 1(3): 139, pl. 26, figs. 1-11;

- 1938 *Plicatula subgurgitis* Böse, JONES: 109, pl. 3, figs. 6, 7, 9, 11, 12;
- 1972 *Plicatula inflata* S., FRENEIX: 81-82, pl. 4, figs. 4, 5, 6;

Widely distributed in North European Province, Apulian, Peruvian and Balkanic Subprovinces. Its biochron extends from Late Aptian to Early Cenomanian; in France, it is considered one of the index fossils of the Albian stage.

S.C.S. occurrences: Locality JFS-004, Río Carinicuao, Valle Grande Formation, (sDLP, DGC) of Middle Albian age. Also in El Cantil (DBG) and Escandalosa Formations of Albian and Early Cenomanian age, respectively.

Plicatula modioloides White, 1888.
Plate 62, figure 5;

- 1888 *Plicatula modioloides* WHITE, Arch. Mus. Nac. Rio de Janeiro, #8: 48-49;
- 1936 *Plicatula modioloides* W., MAURY, M.S.G.M. Brazil #11: 147, pl.5, figs. 8, 9;
- 1997 *Plicatula allisoni* SQUIRES & SAUL, J. Paleont. 71(2): 292, figures 3.9-3.11;
- 2005 *Ostrea sp. ameghinoi rocana* Von Ihering, MYCZINSKI & ITURRALDE VINENT : 794, figs. 4-11,12, 13 ; non VON IHERING, 1931 ;

Description : Very similar to *P. placunea,* - Neocomian to Aptian,- but differs from it in the following features: RV with narrower interspaces between the primary ribs, LV with more radial ribs and nodes, and radial ribs and nodes on the LV more projecting than flattened out. The dimensions are: height: 33,2 mm, legth: 30,3 mm, thickness of articulated valves, 15 mm.

Occurrences: In Brazil, Jaguaruna and Pedreira de Joao Ferreira, Sergipe Province, of Middle Albian age. In Baja California, Punta San Isidro, Alisitos Formation, of the same age. In Republica Dominicana, Río Hatillo Formation, again of the same age.

S.C.S. occurrences: Locality MC-95-A, Cerro Piedra del Rayo, Caripito member of Chimana Formation, (DBG) of Middle Albian age. Also found fragmentary shells with regular echinoids and Belemnites, in Puerto Escondido inlet, west of Cumana, in Chimana Formation clay-shales, of Albian age(DAGM).

Discussion: *Plicatula torta* GABB, (1877: 295, pl. 42, fig. 5) is very much alike to *P. modioloides*, but the radial ribs are narrow and smooth.

Plicatula placunea placunea Lamarck 1819
Plate 37, figure 2 ;

- 1847 *Plicatula placunea* d'ORBIGNY,: 682, pl. 462, figs. 5a-b;
- 1901 *Plicatula placunea* d'O., WOODS: 134, pl. 25, figs. 1-4;
- 1988 *Plicatula placunea* L., DHONDT & DIENI: 33-34, pl. 7, figs. 1-3 ;
- 1985[a] *Plicatula cf. placunea (L.)* ETAYO SERNA, Proy. Cretacico, Publ. Esp. #16: 24-d;
- 1995 *Plicatula placunea* d'O. VIVAS & MACSOTAY: 135;

S.C.S. occurrence: Locality MC-126-A, Cerro Piedra de Rayo, edo. Monagas, Garcia Formation, (DBG) of Late Aptian age. It has been collected in 18 different localities of Garcia Formation: more than hundred shells collected. Usually is preserved articulated, with the shell somewhat calcified. Locality MO-5624, Cantera El Yaque, on the road to Casanay; near the top of Taguarumo Formation, of Early Aptian age; in yellowish brown marls, associated to *Neohibolites semicanaliculatus,* and *Pterotrigonia plicatocostata.* In Colombia, was frequent in Aptian sediments.

Occurrence: Distributed in the Western European, Balkanic and Maghrebian subprovinces , originated during the Valanginian, but reached its maximum distribution during the Aptian stage: both in Bedoulian and Gargasian substages.

Plicatula placunea macphersoni Nicklès, 1891.

- 1891 *Plicatula macphersoni* NICKLÈS, Ann. Hébert #1: 195-199, pl. 9, figs. 2, 2a ;
- 1930 *Plicatula placunea neocomiensis* ROCH : 320, pl. 22, figs. 2-5 ;
- 1940 *Plicatula torreonensis* IMLAY, Geol. Soc. Am., Bull. 51(1): 144-145, pl. 2, figs. 41, 42;
- 1940 *Plicatula aff. incongrua* Conrad, IMLAY, Geol. Soc. Am., Bull. 51(1): 137;

Diagnosis: Is a typical *P. placunea,* higher tan wide, but with the development of numerous, irregular radial costules in the distal ¼ of the RV. This subspecies originates in the Barril Viejo shales, of Late Berriasian- early Valanginian age, and in Carbonera Formation, -Valanginian, - Mexico. In Spain, in La Querola beds, and in Maroc, of Valanginian age, both.

S.C.S. occurrence: Locality VG-383, Ojo de Agua-Santa Rosa road, Sucre state, El Cazón Formation, (DGC).

Genus ***Atreta*** Étallon, 1862.

Atreta pulchra (Imlay, 1940)

- 1940 *Plicatula pulchra* IMLAY, Geol. Soc. Amer. Bull. 51(1): 144, pl. 3, figs. 1-9, 14-17;
- 1940 *Plicatula umbonata* IMLAY, Geol. Soc. Amer. Bull. 51(1): 145, pl. 3, figs. 10-13, 22;

Description: Shell subovate to trigonal-ovate in outline, the height greater than width; RV inflated, with small to médium attachment scars; LV flat or concave; surface ornated with numerous, fine, close-set radial ribs of subequal strength; irregularly spaced growth lines which mark constrictions of variable strength. Radial ribs slightly wavy and crenulated, spinate; about 120 to 150 on RV-s, increasing in number by bifurcation and implantation. The holotype, measured: height: 21,0 mm, width: 18,5 mm thickness of articulated shell: 7,0 mm. *Plicatula umbonata* IMLAY (op. cit.) was distinguished from *A. pulchra*, by being more elongated, more convex shell, and its finer ornamentation. I consider it an ecophenotype, grown in a soft, muddy bottom.

S.C.S. occurrence: Locality VG-376, Ojo de Agua-Santa Rosa road, between Rio Grande and Quebrada del Medio, Sucre state, El Cazón Formation, of Late Berriasian-Early Valanginian age. Many biodegraded fragments.

Discussion: A closely comparable species is *Atreta strambergensis* (Böhm)- Tithonian to Hauterivian age in Western European and Maghrebian Subprovinces,- (MONGIN, 1980: 123-124, pl. 4, fig. 1) which is a rounded shell, almost devoid of radial ornamentation.

Family ***SPONDYLIDAE*** Gray, 1826.
Genus ***Spondylus*** Linné, 1758.

Epifaunal suspension feeders (STANLEY, 1968: 216). Biochron of Jurassic to Recent (COX et alii., 1969: N378), cosmopolitan. According to KAUFFMAN in HALLAM et alii., (1973: 359) is Pantropical.

Spondylus cf. roemeri Deshayes in Leymerie, 1842.

- Cf. 1842 *Spondylus Roemeri* DESHAYES in LEYMERIE Terr. Cret. De l'Aube: 10-11, pl. 6, figs. 8, 9, 10;
- cf. 1846 *Spondylus Roemeri D.,* d'ORBIGNY, Pal. Fr. Terr. Cret #3:655, pl. 451, figs. 1-6;
- 1954 *Spondylus sp.* COX, Jour. Paleont. 28(5) : 628-629, pl. 66, figs. 6a, b ;

COX (op. cit.) reported two strongly eroded thick shelled Bivalves, with the ornamentation of many narrow radial ribs, crossed by thick growth lines, collected among the olistoliths reworked in Nariva Formation, Trinidad, of Eocene-Oligocene age.

S.C.S. occurrences: Locality MC-445-C, Campo Alegre-Buena Vista road, cerro La Torre, Guácharo member of El Cantil Formation, (DGC) of Early Albian age. Three thick shells, hardly embedded in calcareous hardground.

Spondylus cf. texanus Whitney, 1911
Plate 4, figure 4;

- 1852 *Pecten globosus* QUENSTEDT, ed. 1: 507, pl. 40, fig. 46;(non fig. 45);
- 1883 *Spondylus globosus* Q., BOEHM, Paleont.-M, # 4:644-646, pl. 10, figs. 3, 4;(non *Spondylus globosus* d'ORBIGNY, 1847 : 667-668, pl. 458;
- Cf. 1911 *Spondylus texanus* WHITNEY, #111: 14, pl. 2, figs. 1-3;

S.C.S. occurrence: Locality MC-349-B, Garrapata town, in the Río Carinincuao area, Sucre state, El Cazón Formation, (sDLP, DGC), of Late Berriasian-Early Valanginian age. Only one small cast was collected.

Discusion: This small shell, -which was reported from Cuche Formation of Trinidad,- Hauterivian age,- was originally reported from Buda Formation, Shoal Creek, Austin, Texas- of Cenomanian age. Probably are two different species.

Family ***TERQUEMIIDAE*** Cox, 1964.

Epifaunal suspension feeders (STANLEY, 1960: 216). Its biochron is ?Early Permian, Triassic to Late Jurassic, ?Cretaceous (COX et alii., 1969: N380).

Genus ***Placunopsis*** Morris & Lycett, 1853.

This comopolitan genus has a long biochron: from Middle Triassic to Late Cretaceous (Maastrichtian), had a bathyal habitat during the Neocomian stage (GILLET, 1924). Many species are found in Berriasian sediments in all the Tethys Ocean, probably was favored by high salinities.

Placunopsis iskodobouki (Rochebrune, 1882)
Plate 5, figure 9;

- 1882 *Ostrea iskodoboukiana* ROCHEBRUNE, Faune et Flore des Pays Çomalis : 28, figs. 2a-c ;
- 1905 *Placunopsis iskodoboukiana* (R.) DACQUE, 17 : 13 ;

Description : Shell oval, cuneiform, cardinal area narrow, more rounded distally; convex lower valve ornated with small riblets, interrupted; upper valve flat, weakly lamellar. Beaks are blunt and short; their extreme is broken off. Measurements are: height: 46

mm, width: 28 mm, thickness of articulated shell: 19 mm (ROCHEBRUNE, op.cit.).

Occurrence : Collected at Çuarsangélis mountains, Somalia, in supposedly Neocomian beds.

S.C.S. occurrence: Locality VG-376, Ojo de Agua-Santa Rosa road, El Cazón Formation, of Late Berriasian age (sDLP, DGC). Our best cast, measures of Height:22,7 mm, and width: 13,5 mm.

Placunopsis senescens (Stanton, 1895).

- 1895 *Anomia senescens* STANTON, U.S.Geol. Surv., Bull. 133: 35, pl. 2, fig. 2;
- 1938 *Anomia senescens* S., ANDERSON, Geol. Soc. Amer, Spec. pap., #16: 112;
- 1985 *Anomia cf. perbrasiliana* M. FIERRO & USECHE, 6º Congr. Geol. Venez. Mem. 1: 674; (non MAURY, 1936)

Description: Shell rather large, subcircular in outline, slightly oblique, depressed, convex; hinge line straight, nearly as long as the shell; beak inconspicuous, not proyecting beyond the hinge line, and situated near the middle of it; surface marked by faint concentric undulations. Length: 25 mm, height: 23 mm.

Occurrence: Upper Paskenta Group, California, associated to *Aucella crassicollis, "Olcostephanus" tricholomus,* of Hauterivian age.

S.C.S. occurrence: MO-1503: Los Naranjos-La Fundación road, Chururú member of Rio Negro Formation, black shale facies, Uribante Hemigraben, of Hauterivian age. Four disarticulated valves.

Family ***DIMYIDAE*** Fischer, 1886.
Genus ***Dimyodon*** Munier-Chalmas, in Fischer, 1886.

Middle Jurassic (Bathonian) according to COX et alii., (1969: N382). Triassic to Late Cretaceous (FRENEIX, 1959: 217). Boreal distribution in shallow waters, but deep waters in the Tethys Ocean.

Dimyodon strambergensis (Boehm, 1883)
Plate 9, figures 16, 17;

- 1883 *Plicatula strambergensis* BOEHM, Paleontogr., M-4 : 651, pl. 30, figs. 9, 10 ;
- 1887 *Plicatula alpinula* MAYER-EYMAR, B.g.K.S., 24(2) : 3-4, pl. 1, fig. 7;
- 1890 *Plicatula subrotunda* FELIX & LENK, Paleontogr. 37: 163-164, pl. 25, fig. 9, 9ª;
- 1924 *Plicatula subrotunda* F. & L., GILLET, Mem. Soc. geol. Franç, n.ser., 17(4):76;
- 1934 *Dimyodon cf. nilssoni* (Hagenow) COX in TRECHMANN, Geol. Mag., 45:173, pl. 5 fig. 1; (non VON HAGENOW, 1842).
- 1935 *Dimyodon sp. cf. D. nilssoni* (H.) THOMAS, Geol. Mag., 72(850) : 178-179 ;

Occurrence : Frequent in the hemipelagic facies of Western European Subprovince, in Berriasian-Valanginian horizons.

S.C.S. occurrence : Locality MC-329-D, Río Pajaral, Sucre state, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age; only disarticulated valves were found. In Trinidad, on reworked clast in Toco Formation, of Barremian age (LIDDLE, 1946: 715, 716). In Puebla state of Mexico, is common in the Tlaxiaco Formation, of Hauterivian age.

Family ***ANOMIIDAE*** Rafinesque, 1815.
Genus ***Anomia*** Linné, 1758.

According to COX et alii., (1969: N283) the taxon *Anomia (Anomia)* whose biochron goes from ?Permian, Cretaceous-Recent, and is present in Europe, Africa, Asia and North America. GILLET (1924: 73-74) observed its presence in the "Province méditerranéenne" and also in the "Province boréale" during Neocomian to Aptian times. Brackish water dwellers and oxygen-poor environments, on shelf and slope.

Anomia cf. convexa J. de C. SOWERBY, 1836.
Plate 32, figure 15;

- cf. 1836 *Anomia convexa* J. de C. Sowerby: 338, pl. 14, fig. 7;
- cf. 1899 *Anomia convexa* J. de C. Sow., WOODS, Paleontogr. 1(1): 29-30, pl. 5, fig. 10ª, b;

Diagnosis: Shell rather small, more or less orbicular or quadrate; surface smooth or with fine riblets. LV very much inflated with a rather prominent umbo (WOODS, op. cit.). Lower Greensand of Red Hill, (Reigate) and Atherfield Ferrugineous sand of Shanklin, England, of Early Aptian (Bedoulian) age.

S.C.S. occurrence: MO-888, Borracha Island, lower massive limestone of Borracha Formation, (DAGM) of Late Aptian (Gargasian) age.

Dimensions: Height: 16 mm and width: 15 mm., partially fractured specimen.

Discussion: *Placunanomia inornata* GABB, 1864, - abundant shell near San Diego, and north of Coral Hollow, California, U.S.A., of not specified horizon of Cretaceous,- has its surface marked by fine radiating lines, on the convex valve: it is an *Anomia. Anomia perbrasiliana* Maury (1935, Mem. Soc. Geol. Min. Brasil, #4: 565, 567, pl. 20, fig. 10) – Algodoes Formation, Brazil, of Albian age - has a sculpture of very

fine radial lines, covering the whole surface: our specimen only has the radial lines near the umbo.

Anomia laevigata SOWERBY in FITTON, 1836.
Plate 36, figure 16;

- 1836 *Anomia laevigata* Sowerby in Fitton, Trans. Geol. Soc. #4, pl. 14, fig. 6a-b;
- 1848 *Anomia laevigata* S., d'ORBIGNY: 755, pl. 489, figs. 4-6;
- 1899 *Anomia laevigata* S., WOODS: 29, pl. 5, figs. 6-9;
- 1902 *Anomia refulgens* Coq., REHBINDER: 156-158, pl. 4, figs. 10-14; non Coquand, 1865 ;
- 1936 *Anomia cf. laevigata* S., DIETRICH, #3 : 86, pl. 15, fig. 8 ;
- 1942c *Anomia cf. laevigata* S., ROYO Y GOMEZ: 49;

Ocurrence: Wide spread species in North European Province, Western European and Balkanic Subprovinces, with a biochron of Barremian to Late Albian stages.

S.C.S. occurrences: Locality JFS-0171, marls on the Casanay-Caripito road, Valle Grande Formation, (DGC), Sucre state, of Late Albian age. Associated to belemnites, small bivalves and gastropods. Deep water facies. It is frequent in the Barremian-Aptian of Colombia, and the Albian of Perú. In Venezuela, it was found in Garcia Formation (Late Aptian), in Machiques member of Apón Formation (Early Albian), in Valle Grande and Lisure Formations, of Middle Albian age.

Anomia peruana GABB, 1877
Plate 30, fig. 10; plate 38, figure 5;

- *1877 Anomia peruana* GABB, J. A. N. S., Philadelphia, #8: 295-296, pl. 42, fig. 6;
- 1893 *Anomia texana* HILL, B. S. W.P. #8: 22-23, pl. 1, fig. 5;
- 1974 *Anomia peruana* G., RIVERA & ALLEMAN: 94;

Occurrences: Quebrada del Alfalfar, ½ league south of Chachapoyas, Amazonas dept., Perú; it was asociated to *Megacucullaea ollonensis* new name, of Aptian age. In Arkansas, U.S.A., is relatively common in the Paluxy Formation, of Barremian-Aptian age.In Texas, is locally frequent in the Glen Rose Formation, of Early Albian age. In France, I collected in the stratotype of Barremian in the Vocontian basin, the specimen illustrated (Plate 30, figure 10), where it was not common.

S.C.S. occurrences: Locality FA-58-A, quebrada Agua Blanca, (DGC) El Guácharo member of Cantil Formation, of Early Albian age. In Lisure Formation, Perijá, it is preserved frequently on the interfase between glauconitic sandstones and shales.

Anomia pseudoradiata d'ORBIGNY, 1850.

- 1850 *Anomia pseudoradiata* d'ORBIGNY, Prodrome #2: 84;
- 1899 *Anomia pseudoradiata* d'O., WOODS, #1: 27, pl. 5, figs. 1-3;
- 1960 *Anomia cf. pseudoradiata* (d'O.) KEY: 519, 521;

Occurrences: In the North European Province, its biochron extends from Neocomian to Aptian; in the Peruvian Subprovince, from the Neocomian to Albian stages.

S.C.S. occurrences: Cited from Yuruma Formation, La Guajira peninsula, of Barremian age. In lower and middle Apón Formation in limestyones with *Choffatella decipiens,* of Aptian age.

Anomia cf. subobliqua (CONRAD, 1852)
Plate 12, figure: 13;

- Cf. 1852 *Orbicula subobliqua* CONRAD: 219, pl. 10, fig. 61 ½;
- Cf. 1946 *Anomia subobliqua* (C.) VOKES, Amer. Mus. Nat. Hist. 87(8): 169, pl. 4, figs. 10, 21-24;

Description: VOKES (op. cit.) discussed in detail this small *Anomia;* a collection of 23 specimens from the "Olive locality" of Lebanon. The LV moderately thick, subequilateral; more or less irregular in outline, but in general, subcircular to subelliptical; varying in ventricosity from relatively flat to strongly convex; umbones small, compressed, inconspicuous generally submarginal. Hinge edentulous, not well delimited. The muscle scars are moderately impressed; the dorsal (anterior) retractor scar is small and pit-like, and situated above the large reniform byssal scar. The posterior retractor scar is approximately one-half of the size of the byssal, and is almost centrally located below it, while the adductor scar is but little smaller than the posterior retractor and is situated inmeditely behind, and slightly ventral to that scar. These sars are so approximate to each other, that sem to be partially merged together. Localities: Abeih, Ain Ainub and Bhamdûn, Lebanon, of Aptian -?Albian age (BLANCKENHORN, 1890: 76).

Dimensions: The hypotypes measure, of length, 6,5 mm; height: 7 mm, diameter (LV):2.0 mm; the biggest one, length: 11,6 mm, height: 10,5, and diameter (LV) 2,8 mm.

S.C.S. occurrence: Locality MC-388, El Cordon – Río Cariaco, Sucre state, El Dantó dolostones, of Hauterivian age. Our best specimen measures of height: 22,5 mm; of width: 16,2 mm, so it is the double size, that the shells from Lebanon but

otherwise they are identical. Our shell, could be the ancestor of *A. subobliqua* (Conrad). Few fragments were collected in the intercalary shales of upper Bergantin Formation, of Barremian? age.

Family ***LIMIDAE*** Rafinesque, 1815

Limidae is a family poorly represented in Venezuelan Eocretaceous sedimentary rocks; Between North European Province, Western European and Apulian Subprovinces there are more than 2000 species registered. This is attributed to the elevated salinity during the Neocomian-Gallic times, in the S.C.S.

Genus ***Acesta*** Adams & Adams, 1858

According to KAUFFMAN in HALLAM et alii., (1973: 359), this taxon is Cosmopolitan, with a Biochron of Middle Jurassic to Recent.

Acesta cf. longa (Roemer, 1841)
Plate 21, figures 12, 13;

- cf. 1841 *Lima longa* Romer: 57;
- cf. 1904 *Lima (Acesta) longa* R., WOODS: 25-26, pl. 5, figs. 8, 9-11, 12ª-b; 13 a, b, c;
- cf. 1962 *Lima (Mantellum) longa* R., KRIMJOLTS: 43, pl. 46, fig. 2;
- 1985ª *Lima sp. juv. cf. longa* R. ETAYO SERNA, Proy. Cret., Publ. Esp. 16:24-12; 24-17;

Occurrence: *A. longa* (Roemer) has a biochron of Valanginian to Aptian stages; its distribution includes North European Province, Western European, Apulian and Balkanic Subprovinces.

S.C.S. occurrence: Locality MC-338-H, El Dantó dolostones, of Hauterivian age, fragmentary shells, biodegraded. In western Venezuela, upper Rio Negro Formation, at the type section, in a sandstone with calcareous-ferrolitic cement, of Barremian age. In Colombia, in Las Juntas sandstones, of Hauterivian-Aptian age.

Genus ***Ctenoides*** Mörch, 1853.

The *Ctenoides* species living in the Caribbean Sea are restricted to Euhaline marine waters, with high hydrodynamisme; carbonatic sandy bottoms are preferred (MACSOTAY & CAMPOS V., 2001).

Ctenoides canalifera (Goldfuss, 1836)
Plate 62, fig. 15;

- 1836 *Lima canalifera* GOLDFUSS: 89, pl. 104, fig. 1;
- 1872 *Lima canalifera* G. GEINITZ: 38, pl. 9, figs. 6-8;
- 1934 *Lima canalifera* G. ANDERT: 145-148, pl. 8, fig. 6;
- 1960 *Lima canalifera* G. KEY: 527;

Occurrence: This taxon is a common species in North European Province, with a biochron of Cenomanian-Campanian age; specially abundant in glauconitic sandstones (OEKENTORP & SIEGFRIED in KAEVER et al., 1974: 149, pl. 12, fig. 7).

S.C.S. occurrence: Locality MO-2333, Rio Yasa, Perijá región, Upper Maraca Formation, of Cenomanian age.

Ctenoides rapa (d'ORBIGNY, 1847)
Plate 62, figure 11;

- 1847 *Lima rapa* d'ORBIGNY: 546, pl. 319, figs. 1-4;
- 1904 *Lima (Ctenoides) rapa* d'O., WOODS: 40-42, pl. 7, fig. 1 ;

Occurrence : In France and England, North European Province, is an index species of the Cenomanian stage.

S.C.S. occurrence: Locality MO-2333, Rio Yasa, Perijá región, upper Maraca Formation, of Cenomanian age. Highly biodegraded fragments in situ near the top of the limestone beds.

Genus ***Limaria*** Link, 1807. (=*Submantellum* Olsson & Harbison, 1953)

According to COX et alii., (1969: N389) this cosmopolitan genus has a Biochron of Eocene-Recent; consequently, was not cited by KAUFFMAN in HALLAM et alii., (1973). In my files, there are 18 Cretaceous species and subspecies; they originated at Ryazanian stage, (Boreal Earliest Cretaceous) and became wide-spread during the Late Cretaceous.

Limaria (Limaria) wacoensis (Roemer, 1852)
Plate 56, fig. 20;

- 1852 *Lima wacoensis* ROEMER: 63, pl.8, figs. 7a, 7b;
- 1910 *Lima wacoensis* R., BÖSE : 90, pl. 14, fig. 7-13;
- 1928 *Lima wacoensis* R., ADKINS: 132, pl. 18, fig. 4;
- 1947 *Lima (Mantellum) wacoensis* R. STANTON, U.S.G.S. prof.paper #211:50, pl. 41, figs. 4-8, 10;
- 1960 *Lima (Mantellum) cf. wacoensis* R., KEY: 521;

Occurrence: An Amphiamerican species whose biochron goes from Early Albian to Cenomanian age. A typical specimen measures of length: 34 mm, height: 23,0 mm and has 24 radial ribs. In Texas, is present in all the Groups: Trinity, Fredericksburg and Washita.

S.C.S. occurrence: Locality MO-2351, quebrada Santa Rosita, Píche meber of Apón Formation, of Early Albian age. Also was found in the upper carbonatic member of the Peñas Altas Formation, above the *Mesorbitolina texana* horizon in the Arbol Redondo section, Trujillo state. Mostly biodegraded specimens are found.

Genus ***Limatula*** Wood, 1839.

According to KAUFFMAN in HALLAM et alii., (1973: 359) it is cosmopolitan. GILLET stated that (1924, Mem. Soc. Geol., Franç., n.s. 1(3, 4): 63) its biochron goes from Early Jurassic to Recent, of bathyal habitat. Abundant during Middle Jurassic, scarce during the Eocretaceous, but abundant again during Late Cretaceous. This could be related to oceanological conditions.

Limatula tombecki (d'ORBIGNY, 1847)
Plate 10, figure 8;

- 1847 *Lima tombeckiana* d'ORBIGNY, Pal. Franç. Terr.Cret. #3: 534, pl. 415, figs. 13-17;
- 1869 *Lima tombeckiana* d'O. de LORIOL & GILLIERON: 19, pl. 1, fig.17;
- 1904 *Lima (Limatula) tombeckiana* d'O., WOODS, Paleontogr. Soc., 2(1): 45-47, pl. 7, figs.7ª-b; 8ª-c; 9ª-b;
- 1974 *Limatula tombeckiana* (d'O.) DIMITROVA, Foss. Bulgaria, #4b: 89-90, pl. 44, figs. 11, 12, 13, 14;
- 1985 *Lima (Limatulella) sp.* USECHE & FIERRO: 674;

0ccurrence: With a biochron of Valanginian to Aptian, distributed in the North European Province, Western European and Balkanic Subprovinces. Mostly in outer shelf habitats. In Japan, in the Lower Miyakoan (Aptian) there is a *L. cf. tombeckiana* (HAYAMI, 1965a).

S.C.S. Occurrence: Locality PM-08-A, road from Pajaral to La Margarita mt., La Margarita shales, (DGC, sDLP) of Hauterivian age. Also in MO-1503, road to La Fundación, Uribante Hemigraben, Chururú member of Rio Negro Formation, also of Hauterivian age.

Discussion: *Limatula minuta* (Roemer), VON ALTH, (1881, pl. 27(10): 14) -Hils Formation, Germany, and Nizniow limestones, Poland, of Berriasian age- is a dwarf species, very much like, but the radial ribs are smooth and not granular or spiny.

Family ***GRYPHAEIDAE*** Vyalov, 1936.
Subfamily ***GRYPHAEINAE*** Vyalov, 1936.
Genus ***Catinula*** Rollier, 1911.

Diagnosis: Very small shells, (up to 35 mm of height) LV deep, capacious, scoop-shaped, often with geniculations, orthocline to opisthocline at 70º to hinge axis, commonly higher than long. Attachment area tiny to very large. LV with many narrow, crowded, rounded, divaricating irregular to fairly regular, discontinuous to subcontinuous radial costae and some nonappressed growth squamae. RV flat, operculiform, fitting into LV. Resilifer about twice the length of each bourrelet; ligamental area mostly less high than wide. Adductor muscle imprint orbicular to only faintly convex at its dorsal margin; commissural shelf well developed, extending all around; lacking chomata. *Catinula* probably evolved through neoteny from a costellate *Gryphaea.* (STENZEL in COX et alii., 1971: 1100-112, Fig. J75, 1-4).

Occurrence: Middle Jurassic, in Europe and North America (Louisiana subsurface).
Discussion: In my files, there are several *Catinula* species, reported from Eocretaceous sediments: *Exogyra cochlear* Philippi, 1899; *Ostrea eos* Coquand, 1869; *Catinula? oshimensis* Hayami, 1975; *Ostrea pulligera* Goldfuss, 1834; *Anomia refulgens* Coquand, 1865. Taking in account these species, the Biochron of *Catinula* is Middle Jurassic-Early Cretaceous (Aptian).
Paleoecology: The importance of the size of the attachment area on the LV, suggests the need of hard surfaces to attach on. It is possible to compare this feature with living *Saccostrea* Dollfus & Dautzenberg, 1920 (_STENZEL 1971, in COX et alii., N1134-N1138), - living circumglobal seas in tropical climates,- whose rudistiform ecomorphs grow in crowded situations not exposed to strong wave action. The surface of the precipitated halite or the gypsum could provide this surface.

Catinula eos (Coquand, 1867)
Plate 5, figures 17, 19, 20;

- 1869 *Ostrea Eos* COQUAND, Monogr. Genre Ostrea: 166, pl. 74, figs. 6-13;
- 1887 *Ostrea eos* C. MALLADA, Cretacico inferior #3: 140;
- 1897 *Ostrea eos* C. KARAKASH, Caucaso, : 36;

S.C.S. occurrences: Locality VG-381, Ojo de Agua-Santa Rosa road, Sucre state, El Cazon Formation, of Late Berriasian – Early Valanginian age. Three dolomitized groups of articulated shells. The mentioned localities in Spain and Georgia, probably were not of Aptian age, but Berriasian-Valanginian, too.

Catinula loryi (Mayer-Eymar, 1887)
Plate 5, figure 18;

- 1887 *Plicatula loryi* MAYER-EYMAR, Beitr. Geol. Karte Schweiz, 24(2): 4;
- 1940 *Plicatula azulensis* IMLAY, Geol. Soc. Amer. Bull. 51(1): 145, pl. 2, fig. 37-40;

Description: *Catinula loryi* MAYER-EYMAR, was based on a juvenile shell. The dimensions were: height: 10 mm, and width: 9 mm. Subtrigonal shell, compressed, ornated with 12 nodular, equidistant radial ribs. *Plicatula azulensis* was a bigger sized shell, width: 19 mm, height: 19 mm and Thickness: 5,7 mm. Is also subtrigonal, but with 16 radial ribs, which are coarser anteriorly. This size is coincidental with our shell.

Occurrence: In Switzwerland, collected from hemipelagic shales of Roendelengraben, of Valanginian age. *Catinula azulensis* Imlay, was sampled in Barril Viejo shales, Mexico, of Early Hauterivian age.

S.C.S. occurrence: Locality MC-441, La Guanota-La Güiria, Sucre state, in the Hacienda with cable car, in El Dantó dolostones, of Early Hauterivian age.

Catinula pulligera (Goldfuss, 1834)
Plate 5, figures 2, 3, 5, 7, 8, 12, 14;

- 1834 *Ostrea pulligera* GOLDFUSS, Petref. Germaniae, #2: 5, pl. 72, fig. 11;
- 1839 *Ostrea solitaria* SOWERBY, Man. Conch., pl. 468, fig. 1;
- 1851 *Ostrea pulligera* BAYLE & COQUAND, Mem. Soc. Geol. Franç., 21, pl. 5, figs. 4, 5;
- 1891 *Exogyra virgula* Defr., VON ALTH, pl. 17(10): 21;(non Defrance, 1820)
- 1899 *Ostrea pulligera* G., PHILIPPI, Foss. Secund. Chile: 8, pl. 3, fig. 5;

Occurrence; *C. pulligera* (G.) was the species of greater distribution among the Eocretaceous *Catinula.* The North Europan Province, the Apulian, Maghrebian, Western European and Balkanic Subprovinces. Its presence in the Neuquen Subprovince, always in Berriasian sediments, suggests a Proto-Pacific origin, probably from the Izumi Plate.

S.C.S. occurrence: Locality VG-383, Ojo de Agua-Santa Rosa road, El Cazón Formation, (DGC) of Berriasian age. Few fragments were recovered in Morro Blanco Formtion, Venados Island. In Chile, in Tres Cruces and Manflas, of Berriasian? age.

Catinula (subgenus?) refulgens *(Coquand, 1865)*
Plate 5, figs. 15 ;

- 1865 *Anomia refulgens* COQUAND, Mon. Pal. L'étage Aptien de L'Espagne. Mem. Soc. Emul. Prov., # 3 : 359 (partim) pl. 27, fig. 9 ; (non figure 8 = *Anomioa laevigata* Sowerby, 1836) ;
- 1877 *Gryphaea* sp., GABB, Acad. Nat. Sci. Philadelphia, Jour. 2nd. ser. # 8:298, pl. 41, fig. 13, 13a;
- 1887 *Anomia refulgens* C., MALLADA : 141 (partim) pl. 43, fig. 5 ; (non figure 4 = *Anomia laevigata* Sow., 1836).

Observations : According to STENZEL (1971 : 1102) species lacking ribs have been included in *Catinula* by some authors, but presumably they belong to a subgenus of *Catinula* as yet unnamed.

Occurrences: Originally collected from Upper Vallivana limestones, Maestrazgo, Spain, of Valanginian age fide CANEROT (1982, fig. 6.1.). Later, was discovered in Chimú Formation, Perú, of the same age. The oldest localities are from the Berriasian from Argelia and Austria.

S.C.S. occurrences: Locality MC-349-D, Garrapata village, Carinicuao river, El Cazón Formation, (DGC) of Early Valanginian age.

Subfamily ***PYCNODONTEINAE*** Stenzel, 1959.
Genus ***Pycnodonte*** Fischer de Waldheim, 1835.
Subgenus ***Phygraea*** Vyalov, 1936.

The biochron of the taxon *Pycnodonte (Phygraea)* extends from Eocretaceous (Aptian) to Neogene (Miocene). Apparently became Cosmopolitan during Cretaceous times, reducing its area later.

Pycnodonte (Phygraea) invalida (White, 1888)
Plate 40, figure 8;

- 1888 *Ostrea invalida* WHITE, Arch. Mus. Nac. Rio de Janeiro, # 7: 27, pl. 4, figs. 18, 19, 20, 21;
- 1898 *Gsryphaea wardi* HILL & VAUGHAN, : 49, pl. 1, figs. 1-16;
- 1928 *Gryphaea cf. wardi* H. & V., LIDDLE, Geology of Venezuela and Trinidad: 150;
- 1936 *Ostrea invalida* W., MAURY, Mem. Serv. Geol. Min., Brasil, # 11: 153, pl. 7, figs. 7, 8, 20, 21;
- 1947 *Gryphaea wardi* H. & V., STANTON, : 27, pl. 14, figs. 1-3, 6-11, 13;

Diagnosis: Shell of medium size, nearly circular in outline, substance thin and delicate. LV very convex, with a prominent beak; RV gently convex, or sometimes nearly flat, with the beak low and inconspicuous. Ligamental area very small, broader than high. Inner margin with fine chomata; surface almost smooth, marked only by fine growth lines, and very faint radial folds. Height: 11 mm, Width: 15 mm, bigger shells were all fragmentary.

Occurrence: Lastro, near Maroim, Sergipe state, Brazil, of Middle Albian age. In Texas, it is common in Glen Rose Formation, of Early Albian age.

S.C.S. occurrence: Locality HA-4409, Arbol Redondo section, upper carbonatic member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, figure 25). Also in M-2387, road to Monte Carmelo, Trujillo state, the same stratigraphic horizon. In Perijá, the Píche member of Apón Formation, contains many transported shells, also of early Albian age (SUTTON, 1946).

***Pycnodonte (Phygraea) scaphidium*?** (Philippi, 1899)
Plate 5, figure 13;

- ?1899 *Exogyra scaphidium* PHILIPPI, Fos. Secund. Chile : 17, pl. 7, fig. 2 ;
- 1883 *Ostrea (Gryphaea ?) sp.,* BOEHM, Geol. Paleont. M.,#4: 656;

Diagnosis: LV usually thick, very convex, more or less oval, the height greater than the width; slightly inequilateral, sometimes with a rounded ridge extended from the umbo to the postero-ventral extremity. Posterior part convex, and seprated from the rest of the valve by a furrow. This furrow is very prominent on our valve. Umbo prominent, rounded, strongly incurved. Surface smooth, no sculpture is preserved. The Chilean sample consisted in a cast of the LV, with only part of the shell preserved. Its dimensions are: height: 36 mm, width. 28 mm, and thickness, 16 mm (PHILIPPI, op. cit.).

Occurrence: Portezuelo de Tinguiririca, Chile, of Neocomian age. The Stramberg locality in Austria, - Berriasian age, - where two samples were found, whose similarity with *Ostrea vesicularis vesiculosa* has been recalled by BOEHM (op. cit.).

S.C.S. occurrence: Locality MC-349-B, Garrapata village, Carininuao river area, Sucre state, El Cazón Formation, (DGC), of Berriasian-Valanginian age.

Pycnodonta (Phygraea) vesicularis vesiculosa
(Sowerby, 1813)
Plate 58, figs. 14, 15;

- 1813 *Gryphaea vesiculosa* SOWERBY, # 4: 93, pl. 369;
- 1869 *Ostrea vesiculosa* Sow., COQUAND; 152, pl. 59, figs. 4-7;
- 1918 *Pycnodonte vesicularis vesiculosa* (S.) GRECO: 13-14, pl. 2, fig. 12;
- 1972 *Pycnodonte (Phygraea) vesicularis vesiculosa* (S.) FRENEIX: 102-104, pl. 10, fig. 1, 2, 3;

Occurrence: This taxon has a biochron of Albian to Turonian, but reached its acme during Cenomanian times: in the Maghrebian, Syrian, Balkanian and Western European Subprovinces of Gondwanan Province and East African Province.

S.C.S. occurrences: La Panela Hill, Morro de Unare, Anzoategui state, La Grita member of Capacho Formation of Early Cenomanian age (AGUASUELOS Ing., 1991).

Genus ***Texigryphaea*** Stenzel, 1959

This is a provincial genus: restricted to Southwest North America and Northern South America. Its presence in Portugal, suggests its relationship to the Gulf-Atlantic coast Subprovince (*T. szajnochai* Choffat). It was thermophyllic and strictly euhaline, and lived on bottoms composed of clay or lime mud. Its biochron extends from Early Cretaceous (Albian) to Late Cretaceous (Cenomanian).

Texigryphaea corrugata (SAY, 1823)

- 1823 *Gryphaea corrugata* Say, 1823, Acct. Exped. Pittsburgh to Rocky Mtns, #2: 410;
- 1947 *Gryphaea corrugata* S., STANTON: U.S. Geol. Surv., Prof.p.:211: 26, pl. 10, figs. 3-6; pl. 11, figs. 1,3,4;
- 1954 *Gryphaea cf. corrugata* S., COX, Jour. Paleont. 28(5) : 629, pl. 66, fig. 1 ;
-

Diagnosis : A highly variable species, typically medium-sized, with anterior flare and a variable, mainly weak sinus ; beak not greatly incurved, bet sightly to the side. Many individuals are deformed by large attachment scar. The specimen fromTrinidad, measures of height: 80 mm, width:65 mm, total thickness: 42 mm; posterior lobe well separated from main disc by a well-marked sulcus; the lobe is extended beyond the half of the height of the disc.

Occurrence: Kiamichi to Duck Creek Formations, of Lower Washita Group, Texas, of late Middle Albian to early Late Albian age; Kiowa Formation, of Kansas (SCOTT, 1970: 69), of Late Albian age.

S.C.S. occurrence: Locality MO-1575: Santa Teresa-Los Monos road, massive limestone at the base of Caripito member of Chimana Formation (DBG) of Middle Albian age (VIVAS, 1987, fig. 20). Also located, but not sampled at the top of the Guácharo member of El Cantil Formation, (DGC), of Early Albian age.

Discussion: *Gryphaea* was a free or cemented epifaunal filter-feeder, and probably preferred a higher salinity and greater depth than did *Ostrea* (SCOTT, op. cit.). Of the many ecological factors affecting the shape of *Gryphaea* shells, the firmness of the substrate may have been one of the more influential. Accordingly, each of the following species: *T. belviderensis, T. navia and T. hilli*, is interpreted as an ecophenotype, of *T. corrugata* that reflects substrate firmness. The deep dish-shape of *G. corrugata* suggests a substrate less firm than the substrate to which *T. navia and T. belviderensis* were adapted.

Texigryphaea cf. mucronata (Gabb, 1869)

Cf. 1869 *Gryphaea mucronata* GABB (in part): Geol. Surv. California, #2: 274;

- Cf. 1928 *Gryphaea mucronata* G., Univ. Texas Bull. 2338: 108, pl. 22, fig. 4;
- • 1946 *Gryphaea mucronata* G., LIDDLE: 194, 195;
- Cf., 1947 *Gryphaea mucronata* G., STANTON, U.S. Geol. Surv., Prof. paper 211: 28, pl. 18, figs. 1-26;
- Cf., 1970 *Gryphaea mucronata* G., SCOTT, Univ. Kansas Paleont. Contr. Art. 52: 70;

Diagnosis: Shell variable, typical form elongate oval, rather thick, external radial sinus slightly developed, orthogyre beak prominently incurved. Some individuals are thick, but less massive than *T. pitcheri* (Morton).

Occurrence: Walnut to Goodland Formations, in Texas, and Kiowa Formation, in Kansas, U.S.A., of Middle Albian and Late Albian, respectively.

S.C.S. occurrence: Locality VG-02, Los Hoyos de los Perez, Monagas state, Caripito member of Chimana Formation, (DBG), of Middle Albian age. Also in the top limestone of Guácharo Member of El Cantil Formation, (DGC) of early Albian age. The outcrop of Río Liboa, of El Cantil-Punceres anticline, in ferrugineous shales with dwarfed molluscan fauna, (LIDDLE, 1946) belongs to Caripito member of Chimana Formation, not to El Cantil, as was stated. Only disarticulated shells were found.

Texigryphaea pitcheri (Morton, 1834)
Plate 55, fig. 13;

- 1834 *Gryphaea Pitcheri* MORTON, Syn., pl. 15, fig. 9;
- 1869 Ostrea Pitcheri H. COQUAND, Cret. Ostracea: 40, pl. 9, figs. 9-12;
- 1928 *Gryphaea navia* HALL, ADKINS, Univ. Texas Bull., #2838: 106-107, pl. 12, fig.9;
- 1947 *Gryphaea navia* H., STANTON, U.S. Geol. Surv., Prof.p. 211: 27, pl. 19, fig. 1, 2;

Diagnosis: Typically rather massive, medium-sized shells, some with thick, imbricated shell layers; have prominent sulcus and pointed distal flare of shell margin; beak conspicuously bent to one side, but not elevated; a prominent sharply nrounded radial carina runs from beak to basal margin, and is paralleled by a prominent radial sinus.

Occurrence: Common species in southern Oklahoma, Texas and Mexico: Glen Rose, Edwards, Denton, Kiamichi Formations, and Buda limestones, with a biochron of Early Albian to Early Cenomanian. Maximum frequency at Middle Albian.

S.C.S. occurrence: Quebrada Aponcito Seco, top limestone of Píche member of Apón Formation, Perijá range, of Early Albian age. (Donated by Dr. Virgil W. WINKLER, former Paleontologist at Creole Petroleum Corp.,). In Cerro Muleros, México, in Late Albian-Early Cenomanian age limestones.

Texigryphaea washitaensis (Hill, 1898)

1898 *Gryphaea washitaensis* Hill, in Hill & Vughan, U.S. Geol. Surv., Bull. 151: 59, pl. 19, figs. 3-5; 7-19;

- 1910 *Gryphaea pitcheri washitaensis* H., BÖSE, Inst. Geol. México, Bol. 25: 110-112, pl. 20, figs. 1-13;
- 1947 *Gryphaea washitaensis* H., STANTON, U.S. Geol. Surv., Prof. p.#211: 29, pl. 16, figs. 1-4; 6-9;
- 1980-b *Texigryphaea washitaensis* (H.) MACSOTAY, : 63, pl. 11, figs. 19, 20;

Diagnosis: LV typically thin, beak only slightly incurved, not turned to the side; lateral expansions of shell margin flared, especially posteriorly, with the larger flare limited from rest of the shell by a shallow, sinus-like radial depression.

Occurrence: Wide-spread taxon, with a biochron of Middle Albian to Early Cenomanian stages. In Texas and Oklahoma, it is present from Kiamichi to Main Street Formations.

S.C.S. occurrences: Locality MO-1659, quebrada Guayamure, Atarigua para-autochthone Lara state, Guayamure Formation, (MACSOTAY & VIVAS, 2011) of Middle-Late Albian age. HEDBERG & SASS (1937) cited it from the Grupo Cogollo, in the Perijá area.

Subfamilia ***EXOGYRINAE*** Vyalov, 1936.
Genus ***Exogyra*** Say, 1820.
Subgenus ***Costagyra*** Vyalov, 1936.

Diagnosis: A group of *Exogyra* whose RV carry radial 7 – 12 ribs, that proyect beyond the periphery of the valve; interiorly with chomata. Biochron reduced to Late Cretaceous (Cenomanian to Turonian) whose dispersion included Maghrebian, S.C.S. and Western European Subprovinces. We presume a thermophyllic affinity.

Exogyra (Costagyra) olisiponensis (Sharpe, 1850)
Plate 62, figures 13, 14;

- 1912 *Exogyra olisiponensis* S., PERVINQUIERE, Tunisie, #2: 174, pl. 13, figs. 4, 5,9;
- 1913 *Exogyra olisiponensis* S., SCHLAGINTWEIT, N.J.f. Min., Biol. #33: 109-111;
- 1952 *Exogyra olisiponensis* S., DARTEVILLE & FRENEIX, : 118, pl. 22, figs. 1-2;
- 1957 *Exogyra olisiponensis* S., REYMENT, Paleontogr., # 109 A: 52, pl. 7, fig. 14;
- 1971 *Exogyra olisisponensis* S., COLLIGNON, Ann. Paleont. 57(2) : 174 (32), pl. F, fig. 5 ;

Occurrence : A common species, well dispersed in all the Gondwana Province : Somalian, Syrian, Maghrebian, S.C.S., Peruvian, Balkanic, Apulian and Western European Subprovinces. Thru Portugal, it is present in Gulf-Atlantic coast Subprovince, with a biochron of Cenomanian-Coniacian age.

S.C.S occurrence: Locality MO-2324, quebrada Santa Rosita, Perijá, in the Upper Maraca Formation, of Cenomanian age, where it is common (GONZALEZ DE JUANA et al., 1980: 242). In La Grita member of Capacho Formation, in Tachira state,- Early Cenomanian,- is more scarce.

Genus ***Aetostreon*** Bayle, 1878.

According to KAUFFMAN in HALLAM et alii., (1973: 369) this genus belongs to the North Temperate Realm, being endemic of North European Province. Reviewing the published species, *Aetostreon* inhabited both shores of the Tethys Ocean, down to East African Province, and Neuquen Subprovince. Probably was favored by saline seas.

Aetostreon aquilinum aquilinum (Leymerie, 1842)
Plate 19, figure 13;

- 1842 *Ostrea subsinuata aquilina* LEYMERIE, Mem. Soc. Geol. Franç., 1(5): 17, pl. 12, figs. 6-7;
- 1926 *Exogyra aquilina forma typica* (L) RENNGARTEN: 63;
- 1937 *Exogyra reedi* IMLAY Jour. Paleont. 11(7): 566, pl. 77, figs. 1-6; pl. 78, figs. 1-7;
- 1940 *Exogyra reedi* IMLAY, Geol. Soc. Amer., Bull. 51(1): 148-149, pl. 9, figs. 4-6; pl. 13, figs. 1-5;
- 1980 *Exogyra bicarinata aquilina* (L.) MONGIN, pl. 1, fig. 9;

Diagnosis: Shell of adult moderately thick, médium-sized, elongated, ventral margin curved posteriorly. LV much larger than the RV, very convex; proximity of beak marked by attachment scar. Apical portion strongly incurved, and more or less strongly bent laterally. A pronounced umbonal ridge extends from the beak backward in a curve conforming to thje twist of the shell, becoming somewhat rounder toward the margin. This ridge is so high and narrow, that the sides of the valve slope away at an angle less than 90º. RV with irregular surface, slightly concave, elongate, operculiform. Beak low and within the margin. Surface marked with faint growth lines. (IMLAY, 1937: 566).

Dimensions: Length: 24 mm , estimated height: 117 mm, convexity: 28.0 mm. Holotype of *Exogyra reedi* IMLAY (Synonym of *Aetostreon aquilinum aquilinum)*. Leymerie´s type, measures, of height: 60 mm, and width: 33 mm a LV.

Occurrence: Documented from the Menchaca limestone, Mexico of Berriasian age. From Berriasian-Valanginian age, Barril Viejo and Carbonera Formations of Mexico, and Cherahut, Tunisia. From Hauterivian levels came the types, in Aube, France; Mrhila? in Tunisia, and Taraises Formation in Mexico.

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, Sucre state, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age. Also was cited from the Moina Formation, Baja Goajira, Colombia, of Hauterivian age (RENZ, 1960: 60; ROLLINS, 1965: 30). The size of our shells, is alike the ones from Barril Viejo shales, Coahuila, Mexico.

Aetostreon couloni (Defrance, 1821)
Plate 40, figure 15.

- 1846 *Ostrea Couloni* d'ORBIGNY, Paleont. Franc., Terr. Cretacés, #3: 698, pl. 466, figs. 1-4 ; pl. 467, figs. 1-3 ;

- 1871 *Ostrea couloni d'O.,* PICTET & CAMPICHE, Paleontologie Suisse, 4(8) : 287, pl. 192, figs. 1a-b ; pl. 187, figs. 1-3 ; pl. 188, figs. 1, 2 ;
- 1899 *Exogyra couloni* Defrance, PHILIPPI, Fos. Mesoz., Chile : 16, pl. 7, figs. 1, a, b, c ;
- 1930 *Exogyra couloni subsinuata* ROCH, :319, pl. 22, figs. 6, 7 ;
- 1931 *Exogyra couloni* (Defrance) d'ORBIGNY, WEAVER, Univ. Washington, Mem. #1: 229-231, pl. 19, figs. 88-91;
- 1937 *Exogyra tamaulipana* IMLAY, Jour. Paleont., 11(7): 567, pl. 79, figs. 1-5;
- 1980 *Aetostreon couloni* (Defrance) MONGIN, Notes s. geol. Tunisie, #45: 126-127;
- 1985-b, *Aetostreon couloni* (d'O.) ETAYO SERNA, Proyecto Cret., Publ. Esp.: 16: 24-12;
- 1987 *Aetostreon* sp., MACSOTAY & ALVAREZ, Bol. Soc. Venez. Geol. 29: 16, figure 7;

Diagnosis: Shell large, oval, sub-quadrate, sub-triangular or sub-elliptical in outline, with great variation in form, thickness, convexity and contour. In young or mature specimens, the anterior margin is usually convex, while the posterior varies from straight to different degrees of concavity. The ratio of height to length varies greatly, but as a rule the younger individuals are considerably higher than wide; with maturity the differences become more equal, and many old shells are oval or sub-circular in outline. LV convex, usually with an umbonal ridge or carina extending from the umbo, to the lower end of the posterior margin. RV is a little smaller than the LV, but conforms largely to it in outline. The umbo is curved posteriorly, and there are no chomata in any of the valves.

Dimensions: Length: 65 mm; height: 80 mm (WEAVER, op. cit.).
Occurrence: It is the most abundant Ostreid in Neuquen Basin, and in the Northern Neuquen, where the Late Tithonian black shales grade over to the Neocomian, without any stratigraphic discontinuity, or change in lithology, *A. couloni* appears along with the ammonites, which are the first recognized as Berriasian. In Mexico, Tamaulipas, in Carbonera Formation, of Valanginian age. In Western European subprovince, specially common in the Hauterivian of France; in the Maghrebian Subprovince, in the Valanginian-Hauterivian of Morocco and Tunisia, and in the Neocomian of Algeria.
S.C.S. occurrence: Locality MO-3159, Cerro La Pica, El Pilar, Sucre state, El Dantó dolostones (DEP) of Hauterivian age. In Western Venezuela, is common in the Tibú Formation, of Barremian-Early Aptian age. In Colombia, in Macanal shales and Palanz Formation, of Valanginian age.

Discussion: I consider *A. couloni* (Defr.) an ecophenotype of *A. latissimus,* - the type species of the genus,- as they share territoriality in the same way as do *Crassostrea rhizophorae* and the forms guyanensis, and lacerata in the Caribbean realm (MACSOTAY, 2017). *A. couloni* would represent the fauna established in circumlittoral shelfal environment, with high hydrodynamic energy in the photic zone, in saline waters.

Aetostreon latissimum (Lamarck, 1801)
Plate 31, figures 2, 6;

- 1801 *Gryphaea latissima Lamarck,* Syst. Anim. Sans Vert., : 399 ;
- 1822 *Gryphaea aquila* Brongniart : Cuvier's Ossaments Fossiles, #2 : 332, 614, pl. 9, fig. 11 ;
- 1898 *Exogyra aquila* d'Orbigny, GERHARDT, N. J. M. G., Paleont. B. #11 : 68, 122, pl. 4, fig. 10 ;
- 1899-1903 *Exogyra sinuata* WOODS : 395-404, fig. 194-204 ; (not Sowerby, 1822)
- 1926 *Exogyra sinuata* (Sow.) HARRIS in WARING: 95, pl. 16, figs. 1-2;
- 1928 *Exogyra cf. americana* M., LIDDLE, Geol. of Venezuela and Trinidad: 150;
- 1938 *Exogyra couloni* (D.) DIETRICH, : 87, pl. 16, figs. 1, 2 ;
- 1954 *Exogyra latissima* (Lamarck) COX, Jour. Paleont. 28(5) : 629-630 ;
- 1954 *Exogyra aquila* (B.) BENAVIDES, Geol. Perú : 375 ;
- 1985 *Aetostreon couloni* (Defr.) G. GUZMAN, Proy. Cretacico, Ingeomin, Publ. 16: XII-1 to 14, pl. 1;
- 1987 *Aetostreon latissimus* (L.) MACSOTAY & ALVAREZ : 23, fig. 12;

Diagnosis: DHONDT & DIENI (1988: 38-40, pl.8, figs. 1ª-7; pl. 9, figs. 1-6) wrote: "*A. latissimum* has been so often and extensively discussed and interpreted in so many ways since more than 150 years that it seems completely useless to continue the discussion of its exact identity." On basis of the numerous articulated and disarticulated shells in the Venezuelan Barremian-Early Aptian marly sediments we conclude: that most *A. latissimum* examined have a very convex LV, a strongly developed keel and a steep posterior side. With the transitions of marl to calcareous shale, there is a tendency of more flattened LV.

Dimensions: The shells from Point-a-Pierre, Trinidad, measured of height: 130 mm, and Width: 180 mm (COX, op. cit.). Our sample of Lope member of Taguarumo Formation (plate 31, figure 2) measures of height: 155 mm (somewhat damaged) and width: 122 mm. From Cerro Brasil, southwest of

Cumana, a shell measured of height: 160 mm, and of width: 140 mm (ROYO Y GOMEZ, 1954).

Occurrence: *A. latissimum* (L.) is widely distributed in Temperate and Tethyan realms in South America, Africa, Eurasia (DHONDT & DIENI, op. cit., text-figure 18), with a biochron of Valanginian to Aptian. In Neuquén Basin, very common in Quintuco, Mulichinco and Agrio Formations (WEAVER, 1931); as an average, the austral individuals are smaller (height, 80 mm,and width, 65 mm) than the ones of the tropical Tethys Ocean.

S.C.S. occurrence: Locality JFS-48-A, Cantarrana, southwest of Cumana, Sucre state, in Lope member of Taguarumo Formation, (DAGM) of Late Barremian-Early Aptian age. Also at locality MC-264-B, lower Borracha Formation, of Late Aptian age (DAGM). The upper Chuparipal Formation (DEP) along its limestone-marl transition,of Late Barremian-Early Aptian age, exhibits a bank of these bivalves. In western Venezuela, in Tibú Formation, Perijá, of Late Barremian-Early Aptian age. In the Atarigua para-autochthonous, Yuruma Formation of Barremian age. In Trinidad, they have been reported from Toco and Cuche Formations, of Barremian age. From Colombia, they have been cited from Villeta Group, of Aptian age.

Discussion: A way to explain the broad variability of *A. latissimum* could be to assume that it was induced by environmental factors, especially the nature of the substrate on which the specimen lived and the space available when they formed "banks"(DHONT & DIENI, 1988: 40). My opinion is that the origination and proliferation of this taxon, is related to the salinization of the marginal seas of the Gondwana Continent. *A. latissimum* succeeded in soft clay-silt sized sediments of the outer shelf, (120 - 360 meters) in leptopel-rich, aphotic waters**,** while *A. couloni* settled in coarser type of carbonatic sediment, in more turbulent, and more competitive inner shelf (40 – 120 meters of paleodepth). This fits perfectly the concept of *A. couloni* being an ecophenotype of *A. latissimum*, where the transitional forms are no difficult to find.

Palaeoecology: In more than 80 specimens of Venezuela, the RV (originally exposed to sea-water) is densely covered by attached Polychaeta tubes, being *Glomerula, Filograna, (*see Plate 26, figure 26) and *Parsimonia,* (Plate 6,figures 7, 7a) the most frequently observed. These delicate worms would be favored by saline and even hypersaline waters. This environment also would propiciate the growth of the Bivalvia without being predated. Ninety percent of our shells were found articulated: the most important predators would abstain from entering such a stressful environment. The LV was covered in case of disarticulation by natural decease of the animal. Most probably the LV of the living animal, stayed partially immersed (GUZMAN, 1985) in toxic muds, as was suggested by KAUFFMAN (1976).

Aetostreon perazai n. sp., Macsotay
Plate 18, figures 16ª, 16b, 16c;

Diagnosis: Subquadrate shell, inequivalve, LV deep, RV flat to concave; LV with low, concentric swellings, parallel to the growth lines.

Description: Dolomitized shell of medium size, thick in the dorsal region and thinning to a knife edge at the ventral margin. The beaks are opistogyrous, small, non-prominent, and unequal, the LV rising slightly above the RV, located anteriorly. LV convex, evenly curved, with more or less regular swellings. Umbo strongly coiled, operculiform. The posterior margin is convex, while the anterior is concave. Anterior area marked by a shallow furrow, and the area preserves weakly the concentric swellings. No attachment scars are observable. Adductor scars not seen.

Etymology: This new species is dedicated to the Cretaceous Ammonite specialist, Ing. Geol. Tulio Peraza Lisi, one of the most active redactors of the Venezuelan Stratigraphic Lexicon, 3rd. edition (1997), now in exile.

Type: UCVMG/IO - 1111, Holotype, a disarticulated incomplete shell, measuring of incomplete LV: Height: 53 mm, and of width: 37 mm, and thickness of both valves: 25 mm The restored height would be 60 mm.

S.C.S. occurrence: Locality MC-403-A, Carinicuao river, north flank of El Cordón anticline, El Dantó dolostones, (DAGM), of Hauterivian age. Collected in a hard, dolomitized limestone, associated with *A. latissimum (L.)* and *Astartemya (Freiastarte) marcouana.* Only one articulated but fractured specimen was found.

Discussion: Our shell, with its concentric swellings, resembles to *Aetostreon* sp. indet. RICCARDI (1977: 231) – Berriasian, Springhill Formation, Argentine and possiblky, in Chile, but that shell has a strongly incurved and broad umbo, and the concentric swellings are more irregular and numerous. *A. imbricatum* (Krauss)- (KITCHIN, 1908: 77-81, from the Neocomian age Uitenhage Group, South Africa and Madagascar), has more lamellar concentric sculpture, with no swellings.

Aetostreon subsinuatus (LEYMERIE, 1842)
Plate 40, figures 19, 20;

- 1842 *Exogyra subsinuata* LEYMERIE: 17;
- 1905 *Exogyra potosina* (C. & A.) CRAGIN: U.S. geol. Surv., Bull. 266: 41-42, pl. 3, fig. 7; pl. 4, fig. 7; (non Castillo & Aguilera, 1895).
- 1954 *Exogyra aquila* ROD & MAYNC, :263;
- 1969 *Amphidonte subsinuata* (L.) TCHELTSOVA, Cret.Oysters: 71-72, pl. 14, fig. 1; pl. 15, figs. 1-3;
- 1980 *Exogyra bicarinata forma aquilina* (L.) MONGIN, pl. 1, fig. 9; (non LEYMERIE, 1842).
- 1987 *Aetostreon subsinuatus* (L.) MACSOTAY & ALVAREZ, figure 11;

Occurrence: Widely distributed in Western European, Apulian, Balkanic and Maghrebian Subprovinces. Its biochron goes from Early Valanginian to Late Hauterivian.

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, between Rio Grande and Quebrada del Medio, Sucre state, El Dantó Formation, of Hauterivian age. Two articulated shells, and four LV-s were collected. In locality MO-897, cerro Los Bordones, west of Cumana, in the basal limestone of Taguarumo Formation, (DAGM) of Late Hauterivian age, two adult shells. Also found in Yuruma Formation, Atarigua para-autochtnonous, Lara state, of Hauterivian age. One specimen was found in El Cazón Formation, of Late Berriasian-Early Valanginian age.

Genus ***Amphidonte*** Fischer de Waldheim, 1829.

According to KAUFFMAN in HALLAM et alii., (1973: 369) this genus is proper of the North European Province, - endemic restricted to the east (!). *Amphidonte* is common in the Cretaceous of Russia, in North America (Texas, mostly Albian) COX et alii., (1969: N1119) and South America, where they have a biochron of Neocomian to Turonian.

Amphidonte conica conica (Sowerby, 1813)
Plate 58, figures 10, 12, 16;

- 1813 *Chama conica* Sowerby, Min. Conch. G. Britain, #1:69, pl. 26, fig. 3;
- 1847 *Ostrea conica* S., d'ORBIGNY, Paleont. Franç. Terr. Crét. 3:726, pl. 478, figs. 5-8; pl. 479, figs. 1-3 ;
- 1867 *Ostrea conica* S., COQUAND, Monogr. Genre Ostrea, Terr. Cret.: 150, pl. 53, figs. 1-7 ;
- 1936 *Exogyra conica* S., MAURY, Mem. Soc. Geol. Min. Brazil, 11: 169-171, pl. 6, figs. 2, 4;
- 1985 *Aetostreon conica* S., MACSOTAY & VIVAS, VI Congr. Geol. Venez., Mem. 4: fig. 21;

Occurrence: With a biochron of Albian to Cenomanian, this taxon was extended in all the Gondwanan Province, North European Province, and the Western European, Apulian and Balkanic Subprovinces. In Nigeria and Madagascar, it survives until Turonian times (FRENEIX, 1972: 87).

Diagnosis: The shells of our collection, do not differ from the ones of the Albien-Cenomanien of England, Brazil, Mozambique and France: "coquille petite ou moyenne, lisse, á surface de fixation reduite (moins de la moitié de la valve gauche)."(d'ORBIGNY, 1848, pl. 479, fig. 3; NEWTON, 1909, pl. 2, figs. 8-10; WOODS, 1913, p. 411, figs. 215-218, 220-225; MAURY, 1936, op.cit.). This is a polymorphe species, with an average size of height: 20 mm, width: 15 mm, of most Albian- Early Cenomanian specimens. During Cenomanian times, shells of 2 or 3 times that size, are the dominant forms. In the agitated shallow waters, a rugose sculpture is developed; the smooth shells are supposed to have inhabited calm waters (FRENEIX, 1972, op. cit.).

S.C.S. occurrences: Locality MO-2876, quebrada Agua Blanca, Monagas state, upper El Cantil Formation, (DBG) of Early Albian age. Also in HA-4333, in La Aguada section, near Barbacoas, Trujillo state, La Puya member of Peñas Altas Formation, of Middle Albian age (ARNAUD et alii., 1999, Figure 32). Also in Chimana Formation, Pertigalete, Anzoategui state, of Late Albian age.

Amphidonte haliotoidea (Sowerby, 1813)
Plate 62, figures 8, 12;

- 1813 *Chama haliotoidea* Sowerby, Min. Conchology, #1: 67, pl. 25, figs. 1-5;
- 1871/75 *Ostrea haliotoidea* S., GEINITZ, Elbthalgeb., # 1: 184, pl. 41, figs. 1-13;
- 1936 *Exogyra haliotoidea* (S.) MAURY, Mon. S.geol. Miner. Brazil, #11 : 171, 173, 175, pl. 6, figs. 1, 9, 14 ;
- 1960 *Exogyra haliotoidea* (S.) KEY, 1º Congr. Geol. Venez., Mem. 2:527;

Diagnosis: A. *haliotoidea* (Sowerby) seems to be a well established taxon, by the extension of its attachment area, its elongated and narrow shape, a sharp ligamentary area, RV flat, thin, and without any keel (FRENEIX, 1972: 87).

Occurrence: In Brazil, collected from Lastro, Sergipe province, of Ganhamaroba Group, of Middle Albian age. Originally studied from North European Province, and later cited from Maghrebian Subprovince of Gondwana Province, mostly of Cenomanian age.

S.C.S. occurrence: Locality M0- 2333 , Yasa River, Perijá mts., Upper Maraca Formation, of Early Cenomanian age. Mostly disarticulated valves are found. In La Osa member of Barquisimeto Formation, Lara Nappe, - of Turonian age, - only transported valves were found.

Amphidonte subhaliotoidea (Nagao, 1936)
Plate 31, fig. 1; plate 57, figure 9;

- 1934 *Exogyra subhaliotoidea* NAGAO,Jour. Fac. Sci. Hokkaido Imp. Univ.,ser 4, 2(3): 203, pl. 30, figs. 1-4;
- 1975 *Amphidonte (Amphidonte) subhaliotoidea* (N.) HAYAMI, U. M. Univ. Tokyo, Bull. 10: 90, pl. 14, fig. 2;
  1987 *Amphidonte subhaliotoidea* (N.) VIVAS: 27, 28, 32, fig. 21;

Description: Shell medium-sized or large, inequivalve, inequilateral, *Haliotis*-like in outline, much higher than long; test fairly thick, neither plicated nor radially ribbed. LV moderately inflate, sharply edged, with a more or less concave attachment area of moderate width; anterior margin broadly arcuate, highly elevated; posterior margin subvertical, not raised; umbo strongly coiled backwards for 1, ½ volutions, in plane of valve, usually truncated by attachment area; a blunt carina extends cescentically from umbonal region, defining a very steep, or nearly vertical marginal belt, which is marked with numerous subvertical striae; surface marked with irregularly foliated concentric growth-lamellae. Inner valve margin marked with numerous faint chomata; ligament area elongated along dorsal margin, with incoiled apex, forming a deep groove, the boundary of which forms a tooth-like proyection over umbonal cavity. RV also *Haliotis*-like, but more weakly inflated and even slightly concave in posteror area anterior margin raised to form a rounded rim, posterior margin nearly flat; umbo strongly coiled, operculiform; ligamental area, provided with a conical tooth-like proyection; exterior of anterior rim marked wth numerous subvertical striae; adductor scar subcebtral, well marked; the chomata are obscured (HAYAMI, 1965a, M.F.S. Kyushu Univ., 15(2): 343-345, pl. 50, figs. 6-9; pl. 51, figs. 1, 2).

Dimensions: RV, Length: 66,5 mm, Height: 105,0 mm, Thickness: 27,0 mm; LV, Length: 54,0 mm, Height: 82,5 mm; Thickness: 26,0 mm.

Occurrence: Early and Late Miyakoan stage (=Aptian to Albian) in Japan. Calcareous sandstone and conglomeratic sandstone in Tanohata Formation; grey mudstone and calcareous sandstone in Hiraiga Formation. Also in Aketo sandstone and "Orbitolina" sandstone, near Raga all in Japan.

S.C.S. occurrence: Locality MC-271-D, east of Punceres anticline, Monagas state, shaly facies of lower El Cantil Formation, (DBG), of Late Aptian age. In An-77, Las Callecitas hill, in calcarenites of El Cantil Formation, associated to *Mesorbitolina texana-M. ovalis* of Late Aptian age. Locality MC-445-C, Cerro Garrapatero, of Borracha Formation, (DAGM) of Early Albian age. All the material consists of disarticulated valves, with signs of biodegradation. Less common are in Caripito member of Chimana Formation, DBG, of Early-Middle Albian age.

Discussion: The present species is similar to *Amphidonte parasitica* (Gabb, 1864) from the "Chico Group" of California, U.S.A., -Cenomanian-Turonian age- by the outline of the RV, but differs in dimensions and the shape of the adductor scar.

Amphidonte walkeri (White, 1879)
Plate 61, figures 1, 2;

- 1879 *Exogyra walkeri* WHITE, U.S. Geol. & Geogr. Survey, Terr., 4th Ann. Rept.: 278, pl. 1, figs. 1a, 1b;
- 1920 *Exogyra americana* (Marcou) ADKINS & WINTON, Tex. Univ. Bull., 1945: 66, pl. 14, figs. 1, 2; (not DEFRANCE, 1821; nor DESHAYES, 1830)
- 1947 *Exogyra walkeri* W. STANTON, U.S. Geol. Surv., Prof. p. 211: 39-40, pl. 31, figs. 1,2; pl. 32, figs. 1, 2;
- 1960 *Exogyra americana (Marcou)* KEY, 1º Congr. Geol. Venez., Mem. 2: 527;

Occurrence: Frequent in Goodland limestones, and Fort Worth and Duck Creek Formations, Texas, of Middle Albian age.

S.C.S. occurrence: Locality MO-2324, quebrada Santa Rosita, Maraca Formation, Perijá región, of Late Albian-Early Cenomanian age. Also found in olistons reworked in Bobare Formation, Lara Nappe.

Comparisons: *A. walkeri* is close to *A. subhaliotoidea:* the umbonal coiling of the last one is more conspicuous when viewed from the interior, and the RV is more convex than *A. walkeri,* which is definitely more rounded in shape.

Genus ***Ceratostreon*** Bayle, 1878.

According to KAUFFMAN in HALLAM, (1973: 369) this belongs to the North Temperate Realm: North European Province: endemic of Western European Subprovince. Evidently: this not true. The seven species studied here, show a wide distribution in all the saline basins of the Gondwanan Province. *Ceratostreon* evolved and proliferated in hypersaline and saline seas, of

tropical climate, on hard bottoms, usually associated to irregular echinoids as *Enallaster and Hemiaster,* in depths less than **60 meters** (MACSOTAY, 1980-b).

Ceratostreon boussingaulti (d'ORBIGNY, 1842)
Plate 5, figures 1, 11; plate 6, figs. 1, 2;

- 1842 *Exogyra Boussingaultii* d'ORBIGNY, Coq. et Echin. Foss. Colombie, 57-58, pl. 3, fig. 20 ; pl. 5, figs. 8, 9 ;
- 1869 *Ostrea Boussingaulti* d'O., COQUAND : 161, pl. 64, figs. 4-10 ; pl. 74, figs. 16-18, pl. 65 fig. 7 [non pl. 64, figs. 11-13 = *C. tuberculiferum* KOCH & DUNKER, 1887, nec pl. 64, figs. 19, 20 = *Ilymatogyra pellicoi* (DE VERNEUIL & COLLOMB, 1853)]
- 1946 *Exogyra boussingaulti* d'O., SUTTON : 1643 ;
- 1953 *Exogyra boussingaulti* d'O. ROYO Y GOMEZ, Acta Cient. Vzla., 4(4) : 140-141, figs. 3, 4 ;
- 1960 *Exogyra boussingaulti* d'O., Fraunfelter in KEY : 519 ;
- 1980-a *Ceratostreon boussingaulti* (d'O.) GARCIA-JARPA et al., 44;
- 1985 *Ceratostreon boussingaulti* (d'O.) GUZMAN, Proyecto Cretacico #16: (12): 1-14, pl. 2;
- 1988 *Ceratostreon boussingaulti* (d'O.) DHONDT & DIENI: 41-42, pl. 7, figs. 11a, 11b ;

Description : The venezuelan specimens agree with the descriptions given by previous authors. *C. boussingaulti* is the oldest in a series of similar species: *C. boussingaulti* (Valanginian-Aptian, ?Albian); *C. flabellatum* (Goldfuss) (Albian-Cenomanian); *C. pliciferum* (Dujardin) (Turonian-Maastrichtian). There is no doubt that *C. flabellatum and C. boussingaulti* are closely related, but the Early Cretaceous *C. boussingaulti* is consistently covered with fewer and somewhat broader generally undivided plications.

Occurrence: With a bichron of Berriasian?, Valanginian – Aptian, Albian? Of Gondwanan Province, S.C.S., Japanese - East Asian and Neuquen Subprovinces, East African Province, Western European, Maghrebian, Apulian and Balkanic Subprovinces, (DHONDT & DIENI, op. cit., text-figure 18).

S.C.S. occurrence: Locality VG-376-D, Ojo de Agua-Santa Rosa, entre Rio Grande and quebrada del Medio, Sucre state, El Cazón Formation, of Late Berriasian-Early Valanginian age. Also common in El Dantó (Hauterivian), Taguarumo (Barremian-Early Aptian), Chuparipal (Late Barremian-Early Aptian) and Lower Borracha Formation (Late Aptian age). In Lower García Formation, they are found with xenomorphisme, incrusting the eroded hard-ground (MC-86-E, of Early Aptian age) of the top of the underlaying Taguarumo Formation. In El Cantil Formation, (FA-58-A) are found in the lower limestones (Late Aptian). In Colombia, is frequent in Apón, Rosablanca and Tablazos Formations, all carrying a molluskan fauna of saline/hypersaline affinities.

Dimensions: d'ORBIGNY's type collected in the Neocomian of Colombia, measured, of Height: 70 mm, and width: 36 mm. The height of the best preserved specimen from the Early Hauterivian of Sardegna, measured 67 mm (DHONDT & DIENI op. cit.).

Ceratostreon boussingaulti minos (COQUAND, 1869)
Plate 14, figure 15;

- 1869 *Ostea Minos* COQUAND, Monogr. Genre Ostrea, : 183, pl. 64, fig. 1-3; pl.73, figs. 4-8; pl. 74, figs. 14-15;
- 1871 *Ostrea Minos* C., PICTET & CAMPICHE, Paleont. Suisse, # 4:278-280, pl. 195 ;
- 1931 *Ostrea minos* C., WEAVER, Univ. Waashington, Mem. 1 :222, pl. 18, figs. 82, 83 ;
- 1954 *Exogyra minos* (Coquand) COX, Jour.Paleont. 28(5) : 630, pl. 65, fig. 5 ; pl. 66, fig. 2 ;
- 1965 *Exogyra minor (sic) C.,* ROLLINS, : 29 ;
- 1969 *Ceratostreon minos* (C.) TCHELTSOVA, Cret. Oysters: 68, pl. 12, figs. 5-8;
- 1980 *Ceratostreon minos* (C.) MONGIN: 125-126;

Occurrences: In Argentina (Neuquen Subprovince) is frequent in Quintuco (Berriasian) and Agrio Formations (Hauterivian-Barremian). According to GILLET (1924-b: 70) its biochron goes from Valanginian to Aptian in all the Gondwanan Province.

Dimensions: A LV from Tunisia, measures, of height: 85 mm, of width: 75 mm, but the average shells in our collection, measure 63 mm of height.

S.C.S. occurrence: Locality VG-565, rio Morocoto-Caituco-Ojo de Agua road, El Cazón Formation, of Late Berriasian-Early Valanginian age (sDLP, DGC): two articulated specimens. In Taguarumo and Yuruma Formations, of Barremian age, are locally frequent. Its association to *Palorbitolina lenticularis* in "Pico Turimiquire" was observed by DIETRICH (1924: 183). In Trinidad, was collected in Cuche Formation, of Hauterivian age.

Discussion: It is not possible make a difference among *C. minos and C. bousingaulti,* by their LV. Meanwhile, on *C. boussingaulti,* the ribs are less in number and the beaks are less twisted. By their RV, the surface is smooth on *C. boussingaulti,* which become thick along the palleal margin, where the crenulations are developed in *C. minos*(MONGIN, 1980). In my opinion, *C. minos* is an ecophenotype of *C. boussingaulti.*

Ceratostreon aethiopicum (Gortani, 1973)
Plate 60, figures 2, 13;

- 1973 *Exogyra flabellata aethiopica* n. forma, GORTANI A.N. d. Lincei #4: 24-29, pl. 5, figs. 2-7;
- 1849 *Exogyra texana* ROEMER, Kreidebild. Texas: 69, pl. 10, figs. 1[a]-e;
- 1910 *Exogyra texana* Roemer, BÖSE: 112-113, pl. 20, figs. 14-16; pl. 21, figs. 1-11; pl. 22, figs. 1-9;
- 1937 *Exogyra flabellata* (G,) TREVISAN, Cenoman. Sicilia: 77, pl. 5, figs. 11, 12; text-fig. 8;

Diagnosis: *C. aethiopicum* (Gortani) has fewer radial ribs on both valves, that on *C. flabellata* sensu stricto, and this is constant on all the valves observed by us.

Descriprion: Outline narrow, elongate and crescentically curved, comma shaped with umbonal region forming larger end. Shell inequivalve, attachment area generally large. Both valves are keeled, each has a spirally disposed crest generally obscured by surface sculpture; anterior slope narrower, descending steeply to the anterior margin; posterior slope larger, descending more gently; concave on RV, gently convex on LV. Many dichotomous, unequal, rounded ribs, with proportional interspaces on both valves. Anterior region with strong an sharp ribs, or they decrease or evanesce distally. The ribs tend to meet along the crest. The whole surface is marked by irregular growth lines. Adductor muscle scar is suboval and subcentral. Chomata slender, situated along all the periphery of the valves, subcentrically located. The average size is about 40 – 50 mm of height (GORTANI, 1973).

Occurrence: It is frequent in the Albian-Cenomanian of Texas, Mexico, Portugal and Spain. Originally, was collected from Albian beds of Etiopia.

S.C.S. occurrence: Locality BELI-4, quebrada La Bellaca, Barinas state, Escandalosa Formation, of Early Cenomanian age. In Venezuela and Colombia, is usually scarce in Albian-Cenomanian sediments.

Discussion: M. GORTANI (1973) reported from the Graua north and Grauna south regions of Ethiopia a *Ceratostreon* found abundantly, which he considered a mutation of *C. flabellata*, and named it *aethiopicum.* The studed 150 samples were constituted by highly variable shell shapes, very much the ones found by us in Venezuela. Coincidentally, the *aethiopica* is wide-spread in the tropical Gondwanan Province, and its Subprovinces. The typical taxon *C. flabellata* belongs to the temperate North European Province (KAUFFMAN in HALLAM et alii., 1973) and *C. aethiopicum* deserves a species rank (MONGIN, 1980) .

Ceratostreon hilli (Cragin, 1893)
Plate 57, figure 5; plate 60, figures 7, 16;

- 1893 *Exogyra hilli* CRAGIN, Texas Geol. Surv., 4[th] Ann. Rept.,: 186;
- 1916 *Exogyra boussingaulti* (d'ORB.) DOUVILLE, Moghara: 171-172, pl. 21, fig. 16 ;
- 1947 *Exogyra hilli* C., STANTON, U. S. Geol. Survey, Prof. p. 221: 33, pl. 24, fig. 7; pl. 25, figs. 1-14;

Occurrence: Taxon known from the Travis Peak Formation, Texas and Arizona, - Late Aptian age,- and Glen Rose Formation, Texas, of Early Albian age. DOUVILLE's specimens were collected in yellow limestones with rares oolithes,in Djebel Manzour, Egypt, of Albian age.

S.C.S. occurrence: Locality HA-4336, La Aguada section, Trujillo styate, La Puya member of Peñas Altas Formation, of Late Albian age (ARNAUD et alii., 1999, fig. 32). Also in Píche member of Apón Formation, of Early Albian age.

Discussion: *C. hilli* (Cragin) belongs to the evolutive group of *C. boussingaulti-C. flabellatum,* but evolved differently to *C. aethyopicum.* Originated in more shallow and more hydrodynamic environment typical of the Albian times, a heavy shell was a factor for survival.

Ceratostreon maroimensis (White, 1888).

- 1888 *Ostrea maroimensis* WHITE, Ann. Mus. Nac. Rio de Janeiro, #7: 27-28, pl. 2, figs. 13, 14;
- 1936 *Ostrea maroimensis* W., MAURY, Mem. Serv. Geol. min. Brasil,#11: 153, pl. 7, figs. 12, 13;

Description: Shell small, sub-circular to sub-ovate, beaks low, ligamental area small, lower valve moderately convex and sculptured with rather closely-set, irregular, angular plications; RV nearly flat; adductor muscle scar placed well forwards.

Height and width about equal, measuring 20 mm (MAURY, op. cit.).

Occurrence: Coqueiro, near Maroim, Sergipe, Brazil, of Middle Albian age.

S.C.S. occurrence: Locality MO-1261, quebrada Guaruríes, Uribante Hemigraben, Tachira state, Aguardiente Formation, of Albian age. Two LV, partially attached to a *Plesiosurus* astragalus, deposited in M.E.M. collection, Merida.

Ceratostreon tuberculiferum (Koch & Dunker, 1837)
Plate 5, figures 4, 10;

- 1837 *Exogyra tuberculifera* KOCH & DUNKER, Nord-deutsch. Oolithgeb.: 54, pl. 6, fig. 8a, b;
- 1842 *Exogyra subplicata* LEYMERIE, Mem. Soc. géol. France, s. 2, 5: 18, pl. 11, figs. 4-6;
- 1900 *Exogyra tuberculifera* K. & D. WOLLEMAN, Neoc. Holl., Deutschl. : 13-15;
- 1910 *Exogyura tuberculifera* K. & D., WOODS, Paleontogr. Soc. 2(7): 404-406; pl. 61, figs. 7-11;
- 1956 *Exogyra tuberculifera* K. & D., ALENCASTER DE CSERNA, Pal. Mexic. #2: 12, pl. 1, figs. 7, 8;
- 1962 *Exogyra tuberculifera (K. & D.)* KRIMJOLTS, Atlas foss. Turkmen. 45, pl. 16, fig. 4;
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Diagnosis: Dwarf *Ceratostreon,* often mistaken for *C. boussingaulti.* The shell has rounded shape in the youngsters, and the LV is strongly ribbed. Chomata developed at all ages. In mature individuals, the ribbing gradually obliterate, old shells become almost smooth, that show resemblance with *C. conica* Sowerby (varieties of Hauterivien of Morocco).

Occurrence: North European Province, Western European, Maghrebian and Balkanic Subprovinces. Its biochron extends from Valanginian to Aptian (CORROY, 1925).In England, is present in all the Aptian stage, (CASEY, 1961: 607). In Mt. Salève, Switzerland, is found associated to *Leviathania leviathan,* of Berriasian age (MARIE & MONGIN, 1957: 416).

S.C.S. occurrences: Locality PM-29-A, road from Pajaral to La Pica, El Cazón Formation, (DGC), of El Cazón Formation, of Late Berriasian-Early Valanginian age. Two well preserved LV-s, with the typical lunated shape. Also at Locality MO-1305, road from Naranjal to La Fundación, Chururú member of Rio Negro Formation, Uribante Hemigraben, of Hauterivian age. The best samples came from SU-90 and SU-92, the basal limestone of Taguarumo Formation, of Hauterivian age. Disarticulated valves are occasionally found in El Dantó dolostones, of Hauterivian age. In Mexico, reported from Zapotitlan Formation, Puebla state, of Barremian age. Locally found in Tibú Formation,- Late Barremian-Early Aptian age, in Perijá range (HEDBERG & SASS, 1937: 78).

Discussion: GILLET (1921-B: 59) considered it essentially of littoral habitat. It could be a descendant of *Nanogyra catalaunica* (de Loriol) – Kimmeridgian-Portlandian age,- adapted to evaporitic sublittoral seas.

Ceratostreon weatherfordensis (Cragin, 1893)
Plate 38, figures 11, 12, 13, 14;

- 1893 *Exogyra weatherfordensis* CRAGIN, Texas Geol. Survey, 4th. Ann. Rept.: 188, pl. 45, figs. 7-10;
- 1919 *Exogyra weatherfordensis* C., BÖSE, Texas Univ. Bull. 1902: 5, pl. 1, fig. 1, 2;
- 1947 *Exogyra texana weatherfordensis* C., STANTON, U. S. Geol. Surv., Prof. p.211: 38, pl. 30, figs. 3-12;
- 1954 *Exogyra cf. texana weatherfordensis* (C.) VON DER OSTEN, Bol. Geologia, Caracas, 3(8): 166, pl. 7, fig. 2;
- 1995 *Ceratostreon texana weatherfordensis* (C.) VIVAS & MACSOTAY: 136;

Diagnosis: Shell smaller and more elongate than *C. flabellatum,* LV carinated, posterior slope with numerous plications, anterior slope with 6-12 oblique, subtriangular plications. RV flat, with concentric, imbricated lines; anterior margin thickened and milled.

Occurrence: In Texas and, in Glen Rose Formation, of Early Albian age; also in Walnut and Comanche Peak Formations, Fredericksburg Group, of Middle Albian age.

S.C.S. occurrence: Locality VG-465, Campo Alegre-Buena Vista road, cerro La Torre, Guacharo member of El Cantil Formation, (sDLP, DGC) of Early Albian age. Also in MC-95-A, north of Cerro Piedra de Rayo, Caripito member of Chimana Formation, (DBG) of Late Albian age. This species is documented in southern Mexico, but not in Colombia.

Genus ***Ilymatogyra*** Stenzel, 1971.

The genus *Ilymatogyra* is restricted to the Western Tethys Ocean, mostly in tropical and subtropical localities. Its biochron Late Cretaceous (Cenomanian) according to STENZEL (1971: N1119), but the published information extends this biochron to Aptian-Santonian.

Ilymatogyra polygona (Von Buch, 1838)
Plate 43, figures 7, 10;

- 1838 *Exogyra polygona* VON BUCH, Ges. Schriften, # 4:524, pl. 31, figs. 18, 19;
- 1852 *Exogyra densata* CONRAD in LYNCH, Foss. From Syria: 224, pl. 18, fig. 102;
- 1903 *Exogyra africana var. peruana* PAULCKE, N. Jhrb., M., G. Pal. 17: 265-266, pl. 15, figs. 2, 2ª, 2b, 3, 3ª.
- 1956 *Exogyra polygona* V. B. BENAVIDES, Geol. Perú: 382;
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Diagnosis: Ovate-oblong; LV ventricose, angulated about the región of the umbo, where it is very thick; surface with concentric laminated lines; umbo narrowed, somewhat flattened laterally; RV flat or slightly convex, with closely arranged rugose concentric prominent lines (CONRAD, op. cit.)

S.C.S. occurrence: Locality MC-126-A, Cerro Piedra de Rayo, Monagas state, El Cantil Formation, (DBG) of Late Aptian-Early Albian age. Citado de la Formación Maraca, -Late Albian-Cenomanian age, (KEY, 1960) and Escandalosa Formation, (LIDDLE, 1946), of Early Cenomanian age. Always represented by a single individual. In Colombia, descrito de una localidad no especificada, nunca ha sido citada de nuevo (VON BUCH, op. Cit.).

Occurrence: In Perú, documented from Culebra member of Mujarrún Formation, associated to *Knemiceras raimondi,* of Cenomanian age BENAVIDES (Op. cit.). Cited from the Albian of Ecuador, in Ursuyacu, at crossing of Quito-Napo road as *Exogyra aff. E. africana* Coquand, by REESIDE in WASSON & SINCLAIR, (1927, Amer. Assoc.Petrol. Geol., Bull. 11(12): 1271, figs. 3, 4, non COQUAND, 1865). In Palestina, collected in the mountains of Moab, half way between Dead Sea and Kerak, of Cenomanian? age.

Genus ***Planospirites*** Lamarck, 1809.

STENZEL (1971: N1122) considered as its biochron, the one of the type-species, *P. ostracina* (Lamarck, 1801) as Late Cretaceous (Maastrichtian). In my files, I have found ten taxa of *Ostreidae* which fit well the description of *Planospirites* Lamarck, 1809. Their biochcron ranges from Late Jurassic (Kimmeridgian) to Late Cretaceous (Mastrichtian).

Planospirites etalloni (Pictet & Campiche, 1871)
Plate 10, figure 15;

- 1871 *Ostrea Etalloni* PICTET & CAMPICHE, Pal. Suisse, #4 : 286-287, pl. 186, figs. 12-15 ;
- 1905 *Exogyra cf. etalloni* P. & C., HARBORT : 32 ;
- 1926 *Exogyra Etalloni* P. & C., RENNGARTEN : 59 ;

Occurrence : Originally collected in Cressier and Landeron, Switzerland, in the type locality of Hauterivian stage. Also found in the corallian facies in Censeau, of the same age. In France, found at Cinquetral, Combe-du-lac, -Valanginian age,- and at Morteau, Urgonian facies, of Early Barremian age. Also common in Baskuntsak, Turkmenistan, of Barremian age.

S.C.S. occurrences: Locality MC-329, marls in Rio Pajaral, (sDLP, DGC), in El Dantó dolostones, of Hauterivian age. The sample is a hard, dolomitic sandstone slab, where the upper surface was a hard-ground, colonized by the *Planospirites* shells.

Planospirites manarensis new name, Macsotay
Plate 27, fig. 15;

- 1864 *Exogyra parasitica* GABB, Pal. California, #1: 205, pl. 26, fig. 192; pl. 31, fig. 273;
- 1877 *Exogyra parasitica* GABB, Jour. Acad. Nat. Sci, Phila., #8 : 298, pl. 42, figs. 8, 8a; (non GABB, 1964)

Description : *Exogyra parasitica* GABB (1864 : 205) was re-named *Exogyra washingtoni* by COQUAND (1869,)(non Gmelin, 1789 Syst. Naturae, 13th edition, 1971: 3336). GABB's species was a Lower Coniacian-Campanian fossil, from Shasta Group, California, U.S.A.

S.C.S. occurrence: Locality MO-890, Punta Manare, west of Cumana, Sucre state, Lower Borracha Formation, (DAGM) of Late Aptian age.

Discussion: Attached to the dorsal area of the gastropod *Pterodonta aubouini* n. sp. (Plate 27, figure 14). Only the LV is preserved.

Genus ***Rhynchostreon*** Bayle, 1878.

According to STENZEL (1971: N1122) the biochron of the genus is extended from Cenomanian to Turonian. It is widely extended in North European Province, Gulf-Atlantic coast Subprovince, Western European, Apulian, Syrian, Somalian and Balkanic Subprovinces. S.C.S. and Neuquen Subprovinces, were forgotten; in these areas, the genus originates during Early Albian times.

Rhynchostreon subsquammatum (d'ORBIGNY, 1850)
Plate 58, figures 1, 2, 3, 4;

- 1842 *Exogyra squammata* d'ORBIGNY, Foss. Colombie, pl. 19, figs. 12-15; (non GMELIN, 1789);
- 1850 *Ostrea subsquammata* d'ORBIGNY, Prodrome, #2 : 108 ;
- 1869 *Ostrea subsquammata* d'O., COQUAND : 178, pl. 70, figs. 3 – 6;
- 1946 *Exogyra squammata* (d'O.) LIDDLE, Geology of Venezuela: 252;
- 1938 *Exogyra squamata (sic)* (d'O.) DIETRICH: 88, pl. 16, fig. 5;
- 1972 *Exogyra squamata (sic)* (d'O.) GUTIERREZ PALMA, Bol. Geol., 19(3): 89-95, pls. 1, 2, 3;
- 1977 *Exogyra cf. squamata* (d'O.) MACSOTAY en CAMPOS & OSUNA: 456;

S.C.S. occurrence: Locality MO-5885, quebrada Escandalosa, Escandalosa Formation, Tachira state, of Early Cenomanian age: abundant. In Maraca Formation (KEY, 1960). It is common in the olistoliths reworked in the Mucaria Formation (CAMPOS & OSUNA, 1977: 456) of Central Venezuela. In Colombia, is abundant in the Upper Villeta Group, of Cenomanian-Turonian age (ROYO Y GOMEZ, 1942c).

Rhynchostreon suborbiculatum suborbiculatum (Lamarck, 1801)
Plate 58, figures 6, 7, 10;

- 1913 *Exogyra columba* (L.) WOODS: 412, figs. 243-248;
- 1869 *Ostrea ratisbonensis* COQUAND: 121, pl. 45, figs. 8-12;
- 1924 *Exogyra suborbiculata* Lmk., JOURDY: 79, pl. 10, figs. 7-10;
- 1972 *Exogyra columba* (L.) FABRE-TAXY, Ann. Univ. Provence, 45: 254-255, pl. 1, figs. 6ª, 6b;
- 1985 *Rhynchostreon squamatum* ETAYO-SERNA, Proy. Cretacico, #24: 17, pl. 1, fig. 19; (non d'ORBIGNY, 1842 = *R. subsquammatum subsquammatum [d'O.])*
- 1985 *Rhynchostreon suborbiculatum* (L.) DHONDT, Kret. Res. 6: 61-63, fig. 3a;

Occurrence: Cosmopolitan species during Cenomanian stage in all the Subprovinces of Gondwanan Province. In Angola, is found from Aptian to Senonian.

S.C.S. occurrences: Locality MC-426-C2, in Tonoro, near La Güiria, Sucre state, Valle Grande Formation, (DGC) of Middle Albian age. Also in upper El Cantil Formation, of Early Albian age (DBG), and La Grita member of Capacho Formation, in Chacual Complex, Anzoategui state.

Rhynchostreon suborbiculatum mermeti (Coquand, 1869)
Plate 60, figure 5;

- 1862 *Ostrea mermeti* COQUAND, Géol. Et Paleont. Prov. Constantine : 234, pl. 23, figs. 3, 4,5 ;
- ?1899 *Exogyra columba* Lam., PHILIPPI, Foss. Sec. Chile : 15, pl. 2, fig. 3 ;
- 1917 *Ostrea mermeti* Coq., FOURTAU, D. G. S. E., Paleont. #3 :40-42 ;
- 1954 *Exogyra mermeti* C., BENAVIDES, Cretacous, Perú : 381 ;
- 1972 *Rhynchostreon columbum mermeti* (C.) FRENEIX, N. m. Serv. geol. Maroc, #228 : 98, pl. 5, fig. 4, 5;

Occurrence: Almost cosmopolitan species: Asia, Africa, and both Americas, with a biochron of Late Albian (Vraconnian) to Turonian (FRENEIX, op. cit.). In the Peruvian Subprovince, is common in the Yumagual Formation, of Early Cenomanian age.

S.C.S. occurrence: Locality MO-2333, río Yasa, Perijá region, Upper Maraca Formation, of Early Cenomanian age.

Rhynchostreon suprareticulatum (JOURDY, 1924)
Plate 58, figures 8, 9;

- 1924 *Exogyra suprareticulata* JOURDY, Ann. Paleont. 13: 80, pl. 10, fig. 1;
- 1938 *Exogyra squammata* DIETRICH: 88, fig. 6;
- 1957 *Exogyra squammata* BÜRGL, Bol. Geol. 5(2): 124-126;
- 1972 *Exogyra subsquammatum servitensis* GUTIERREZ PALMA, Bol. Geol.,(Colombia) 19(3): 89-95, pl. 4; pl. 5;

Discussion: *R. suprareticulatum* is a species near to *R. suborbiculatum suborbiculatum* (Lamarck) – the type of the genus,- by its general shape, the lamellar structure of the LV; it differs by the lateral position of the enrolled beaks, which is helicoidally twisted, and more detached of the shell's surface. Its distinctive character is on the RV, where the fine and regular growth lines constitute a hexagonal network, alike a honey-comb. This feature was part of the description of *R. suborbiculatum suborbiculatum,* well illustrated by d'ORBIGNY (1842, pl. 4, fig. 15) who compared this sculpture to fish-scales. In Oued Guessa, in the Cenomanian of Algeria.

S.C.S. occurrence: Locality MO-5185, Río Canagua, 5 Km. upstream from Libertad (LIDDLE, 1946: 521), lower Escandalosa Formation, Merida state, of Early Cenomanian age. Also in La Grita member of Capacho Formation, in Uribante Hemigraben, Tachira state, of the same age.

Tribe ***GRYPHAEOSTREINI*** Stenzel, 1971.
Genus ***Gryphaeostrea*** Conrad, 1865[a].

With a biochron extended from Early Cretaceous (Aptian) to Miocene (Tortonian) age. The paleogeographical distribution during the Cretaceous, included North European Province, Western European, Apulian and Balkanic Subprovince, and Gondwanan Province with its subprovinces.

Gryphaeostrea canaliculata (J. Sowerby, 1813)
Plate 41, figures 6, 7, 7a;

- 1904-1913 *Ostrea canaliculata* (S.) WOODS, Paleontog. Soc., #65(2): 8: 375, pl. 56, figs. 2-16;
- 1934 *Ostrea canaliculata* (S.) ANDERT: 183-185, pl. 10, figs. 7[a], 7b, 8[a], 8b;
- 1980 *Gryphaeostrea canaliculata* (S.) MONGIN & PEYBERNÈS, Paleo, Paleo, Paleo, 32(1980/81): 233;

Diagnosis: Shell inequilateral; LV inflated, with a medial keel extended from the beak, to the distal margin, bordered by two weak depressions ; RV flat, ornated by well marked, growth lamellae. Beak incurved, chomata only on posterior margin. Adductor muscle scar semilunar, central.

Occurrence: Considered an index fossil in the Albian stratotype, -Aube, France,- but its biochron goes from Late Aptian to Maastrichtian, in tropical seas (Tethys) and temperate ones (India).

S.C.S. occurrence: Locality MO-892, Ensenada La Cueva, Borracha Island, upper Borracha Formation, (DAGM) of Early Albian age.

Genus ***Gyrostrea*** Mirkamalow, 1963: 151.

STENZEL (1971: N1125-N1126) stated as the occurrence of the taxon *Gyrostrea (Gyrostrea)* in Central Asia, Italy, Tunisia, Palestina, Madagascar and North America, and a brief biochron: Cretaceous (Cenomanian-Turonian). I do compare *Gyrostrea (Gyrostrea)* to *Crassostrea* in the Miocene-Recent Atlantic Ocean fauna. When it is preserved in situ , it is located near the base of first limestone or sandstone of a transgressive sequence (TST). Frequently, only broken fragments of *Gyrostrea* , usually with the hinge and associated thick shell are preserved. This should be a marker of the littoral zone in Cretaceous sediments. In my files, there are 17 taxa of this genus, whose biochron extends from Berriasian to Maastrichtian.

Gyrostrea (Gyrostrea) africana (Lamarck, 1801)
Plate 62, figures 1, 9, 10;

- 1862 *Ostrea africana* Lamarck, COQUAND, Constantine: 233, pl. 22, figs. 12-13;
- 1869 *Ostrea africana* (Lamarck) COQUAND, Monogr. Gen. Ostrea: 134, pl. 89, figs. 5-12; pl. 55, figs. 10-12;
- 1962 *Exogyra africana* L., ABBASS: Cret. Pelecyp. of Egypt: 65-66, pl. 9, figs. 2[a], 3, 3[a];
- 1971 *Exogyra africana* (L.) COLLIGNON, Ann. Paleont. 1, 57(2) : 173-174, pl. F, figs. 2, 3, 4 ;

Occurrence : A widely distributed species in the Cenomanian stage in all the Subprovinces of Gondwanan Province, including the Peruvian, where it originated during the Middle Albian. In Madagascar it survives until Senonian times.

S.C.S. occurrence: Locality HA-4551, Río Calderas section, Barinas Basin, Lower Escandalosa Formation, of Early Cenomanian age, associated to shallow-water molluska. Also known from La Grita member of Capacho Formation, Tachira state.

Gyrostrea (Gyrostrea) delettrei (COQUAND, 1862)
Plate 61, figs. 3, 4;

- 1862 *Ostrea Delettrei* COQUAND, Pal., Constantine, pl. 18, figs. 1-7 ;
- 1877 *Ostrea Delettrei* C., LARTET , Mer morte : 145, pl. 10, figs. 8-9 ;
- 1912 *Exogyra delettrei* (C.) PERVINQUIÈRE Pal. Tunis. : 186, pl. 12,figs. 8, 9 ;
- 1962 *Ostrea (Crassostrea) delettrei* (C.) ABBASS, G.S.M.R.D., Paleont. ser. Mon. #1 : 75-76, pl. 10, figs. 4-5 ; pl. 12, fig. 4 ;
- 1971 *Exogyra delettrei* (C.) COLLIGNON : 172-173, pl. E, figs. 7, 8 ;

Diagnosis : Shell gryphaeoid to ostreiform, generally variable in ouline, slightly convex; LV is norte convex, tan RV; umbo depressed, ornament of strong, widely spaced concentric laminae.

Occurrence: Mostly of Cenomanian age, widespread in the Gondwanan Province's all Subprovinces extended to Palestina in the east, and Congo to the south, where it survives until Turonian times.

S.C.S. occurrence: Locality BELI-4, quebrada La Bellaca, lower limestones of Escandalosa Formation, of Early Cenomanian age: they are found all disarticulated, suggesting transport by strong currents. In La Grita member of Capacho Formation, Tachira state, of Cenomanian age (non vide). In Colombia, in the Lower Chipaqué Formation, of the same age (ROYO Y GOMEZ, 1939).

Gyrostrea (Gyrostrea) praelonga (Sharpe, 1850)

Plate 7, figure 9;

- 1849 *Ostrea praelonga* SHARPE , Quart. Geol. Jour.#6: 187, pl. 20, fig. 4;
- 1869 *Ostrea Pantagruelis* COQUAND, Mon. Ostrea, Terr. Crét.: 172, pl. 68, figs. 1, 2 ;
- 1911 *Ostrea praelonga* S., WOODS : 277, pl. 19, figs. 5-8;
- 1921 *Liostrea praelonga* (S.) GILLET : 24, pl. 2, fig. 15;
- 1890 *Ostrea (Exogyra?) dieneri* BLANCKENHORN: 7272, pl. 3, fig. 18; pl. 4, figs. 1ª-1b, 2, 3, 4ª-b; pl. 5, fig. 1;
- 1956 *Exogyra acuticosta* (N. & G.) ALENCASTER DE CSERNA: 11, pl. 2, figs. 1, 2;
- 1946 *Ostrea dieneri* B., VOKES: 164, pl. 3, figs. 15-19;
- 1980-b *Gyrostrea (Pseudogyra) acuticosta* (N. & G.) MACSOTAY: 36, pl. 11, fig. 18;

Diagnosis : Elongated shell, narrow, smooths and subequivalve. In the sub-umbonal area, there is a long and narrow channel, housing a big and elongated adductor muscle scar. RV with irregular concentric growth lamellae. *O. pantgruelis* was considered by PERON (1890: 110) – correctly,- only a very old individual of *G. (G.) praelonga* (S.). The size of the types, varies: Length: 100 – 120 mm, width: 25 – 32 mm, Praia de Maçams, north of the Cintra hills, Portugal.

Occurrence: Reported from Spain, Serbia, Algeria, Portugal and France, forming banks with lateral continuity, of Early Aptian to Late Albian. The earliest report came from the Barremian of France.

S.C.S. occurrence: Locality HA-4545, Cerro Los Curaries, Curarigua of Trujillo state, of the Lower carbonatic member of the Peñas Altas Formation, of Early Aptian age. Also found in Taguarumo Formation, associated to tempestites. The same situation is observed in the Caripito member of Chimana Formation, of Middle Albian age.

Subgenus ***Pseudogyra*** Mirkamalov, 1971.

Distinguished from *Gyrostrea (Gyrostrea)* by the presence of radial ribbing on the LV, by the comparatively slight convexity, and by the small size of the shell. Nearer to *Lopha* and to *Rastellum,* by the posterior position of the adductor muscle scar. With a biochron of Late Jurassic (Kimmeridgian) to Late Cretaceous (Coniacian) this thermophyllic genus became very extended in the saline/hypersaline marginal seas of the Tethys Ocean. Discovered in base of *Gyrostrea (Pseudogyra) pennata* Mirkamalov, of the Barremian of Turkestan, in my files are 18 taxa belonging to it.

Gyrostrea (Pseudogyra) acuticostata (Nyst & Galeotti, 1840)
Plate 31, figure 7;

- 1840 *Ostrea acuticosta* NYST & GALEOTTI Bull. Royal Acad. Bruxelles, #7: 213, fig. 2;

Occurrence: Taxon known from the Aptian of Tehuacan, Mexico, and Lebanon, the “Olive locality”. In the Early Albian, reported from Lebanon, Sokotra Island, and Gabon, Central Africa.

Description: Shell small, of oval to subcircular shape, inaequivalve and inaequilateral; LV very convex, with 13-15 outstanding and sharp radial ribs, continuous from the beaks to the distal margins, where they develop acute digitations. Interspaces are deep and narrow; umbones small and opistogyrate. RV flat, only with concentric growth lines.

Dimensions: Height: 23,0 mm, width: 19,0 mm, convexity: 12,5 mm.

S.C.S. occurrence: Locality MO-1502, section on track, Jabon-San Pedro, lower carbonate member of Peñas Altas Formation, of Early Aptian age. KEY (1960: 521) reported it from Píche member of Apón Formation, of the Alturitas field; Early Albian age.

Gyrostrea (Pseudogyra) cassandra (Coquand, 1865)
Plate 18, figures 16a, 16b, 16c ;

- 1865 *Ostrea Cassandra* COQUAND, Mem. Soc. Emul. Provence, #3 : 357, pl. 26, fig. 34 ;
- 1869 *Ostrea Cassandra* C. COQUAND : 173, pl. 68, figs. 3-4 ;
- 1949 *Ostrea cassandra* C., BATALLER, Syonp., # 8 : 166-167 ;

Description : Exogyriform shell, adherent : LV inflated, ornated with 7 to 10 sharp radial ribs, with wide interspaces, and covered by growth squamae; spiral beak prominent. RV flat, with many conspicuous growth squamae, no radial ribs observable. It differs from *G. (P.) palaemon* by the unequal beaks and the radial, curved ribs on the LV. There is some variability on the shells from Spain: one from Zorita, measuring 75 mm of height and 39 mm of width, and carries 17 radial ribs . Another from Morella, measures 55 mm of height, and 42 mm of width, and carries 13 ribs, which barely extend from the umbos to the half of the distance to the distal margin (MALLADA, 1887, Sinopsis, España, #3: 137-138, pl. 40, figs. 7, 8).

Occurrence: Maestrazgo Basin, Spain, of Western European Subprovince, of Aptian age.
S.C.S. occurrence: Locality MO-2767, El Algarrobo Hill, Monagas state, (DBG), el Cantil Formation, of Late Aptian-Early Albian age.

Gyrostrea (Pseudogyra) germaini (Coquand, 1969)
Plate 5, figure 16;

- 1869 *Ostrea Germaini* COQUAND: Mon. Ostrea, Terr. Crétacé, :101, pl. 66, figs. 14-16 ;
- 1871 *Ostrea Germaini* C. PICTET & CAMPICHE : 295-296, pl. 189, figs. 1a, 2 ;
- 1900 *Ostrea Germaini* C., WOLLEMAN : 18-19, pl. 1, fig. 1 ;

Occurrence : Species well documented from the Berriasian-Valanginian of the Jura mts., in France and Switzerland; in the Hauterivian of Dobrogea-south, Rumania.

S.C.S. occurrence: Locality MC-329-A, Río Pajaral, Sucre State, El Cazón Formation, of Late Berriasian-Early Valanginian age. Some fragments were recovered from Morro Blanco Formation, 1 meter above the coral reef.

Discussion: I s the probable descendant of *Gyrostrea (Pseudogyra) expansa* (J. Sowerby, 1819) (=*G. [P.] falcata* J. de C. Sowerby, 1836) (COX, 1925: 130-131) – from Kimmeridge clay, (Kimmeridgian) and Lower Spilsby Formation, (Ryazanian age) – both from England, France and Poland, but this last one was twice as big than *G. (P.) germaini.*

Gyrostrea (Pseudogyra) palaemon (Coquand, 1865)
Plate 57, figures 2, 3;

- 1865 *Ostrea Palaemon* COQUAND, : 166, pl. 27, figs. 5-7;
- 1887 *Ostrea Palaemon* C., MALLADA, Sinops. Foss. España, Cret. Inf.#3: 137, pl. 43, figs. 1-3;
- 1924 *Exogyra cf. Palaemon* (C.) DIETRICH: 184;

Occurrence : In Spain, Maestrazgo Basin, Late Aptian age.
S.C.S. occurrence: Locality MC-446-C, road from Campo Alegre to Buena Vista, Teresen area, Monagas state, Guácharo member of El Cantil Formation (sDLP, DGC) of Early Albian age. In Aguardiente Formation (Merida state) preserved as numerous fragments, in tempestites, of Middle Albian age.

Family ***OSTREIDAE*** Rafinesque, 1815.
Subfamily ***OSTREINAE*** Rafinesque, 1815.
Genus ***Ostrea*** Linné, 1758.

Recent *Ostrea* is a free or cemented filter-feeder common in relatively clear waters at salinities greater than 15‰ (mostly polyhaline-holohaline). In the southern Caribbean sea, are registered five species of *Ostrea (Ostrea)*, living on the open shelf, not near the shorelines (MACSOTAY & CAMPOS, 2001).

Ostrea (Ostrea) cotteaui COQUAND, 1869
Plate 19, figs. 8, 9;

- 1869 *Ostrea Cotteaui* COQUAND, Monogr du genre Ostrea: 185, pl. 62, figs. 25-27;
- 1871 *Ostrea Cotteaui* C., PICTET & CAMPICHE : Sainte-Croix : 285-286, pl. 191, figs. 1-3 ;
- • 1918 *Alectryonia cotteaui* (C.) COSSMANN : 396-397, pl. 12, fig. 28;

Occurrence: In Paris Basin and the Jura mountains, France, in Valanginian-Hauterivian sediments. Also in the white limestone of the Urgonian facies, of Barremian age, France. Also in the Crimean peninsula, Ukrania, in Neocomian sediments.

S.C.S. occurrence; Locality VG-382, quebrada El Imposible, Sucre state, El Dantó dolostones, of Hauterivian age. One articulated specimen. Definitely associated to deep shelfal benthic fauna, is the earliest true *Ostrea (Ostrea)* as I know.

Genus ***Acutostrea*** Vyalov, 1936.

According to KAUFFMAN in HALLAM, (1973: 368) this genus is proper to the North Temperate Realm – The Euramerican region, with a biochron of Late Cretaceous. LV with radial ribs; internally, has an adductor muscle imprint, that is clearly concave at its dorsal margin. Escept for the chomata, and smaller size, it resembles to *Crassostrea,* its probable descendant. All localities, are coarse grained sediments, near the base of the Transgressive System Tract, with salinity anomalies. Its known biochron extends from Valanginian to Campanian.

Acutostrea directa (Blanckenhorn, 1890)
Plate 14, figures 2, 2a;

- 1890 *Ostrea directa* BLANCKENHORN: 73-74, pl. 4, fig. 7;
- 1916 *Ostrea directa* B., DOUVILLE: Massif du Moghara: 172, pl. 21, fig. 17;
- 1929 *Ostrea Cornuelis var. mirallesi* BATALLER: 29, fig.
- 1949 *Ostrea Cornuelis var. mirallesi* BATALLER: 167-168;

Diagnosis: LV convex, and ornamented with weak radial ribs. RV flat, ornamented only with concentric lamellae.

Dimensions: Height: 60 mm, width: 31,5 mm (BLANCKENHORN, op. cit.). Height: 65 mm, width: 20 mm (BATALLER, op. it.).

Occurrence: Known from the Aptian of Spain and Somalia; Late Albian-early Cenomanian of Lebanon, Palestina and Egypt; in the Turonian of Igzim, Syria.

S.C.S. occurrence: Locality HA-4367, Arbol Redondo section, lower carbonatic member of the Peñas Altas Formation, dolomitic limestone, monomictic fauna, of Late Barremian age (ARNAUD et alii., 1999, figure 14)

Acutostrea syriaca (CONRAD, 1852)
Plate 21, figures 1, 2, 3, 4;

- 1852 *Ostrea Syriaca* CONRAD in LYNCH, Foss. Syria: 212, pl. 2, fig. 12;
- 1852 *Ostrea linguloides* CONRAD in LYNCH, Foss. Syria: 212, pl. 2, fig. 13;
- 1899 *Ostrea atacamensis* PHILIPPI, Fos. Secund. Chile: 5, pl. 3, fig. 4;
- 1934 *Ostrea syriaca* C., BLANCKENHORN, Paleontogr. # 31ª: 195, pl. 9, figs. 29 – 31;
- 1937 *Ostrea tamaulipana* IMLAY, Jour. Pal. 11(7):567, pl. 79, figs. 1-5;

Occurrences: Originally collected from Muchtarah, near Nebi Säfi, Mount Lebanon, but also in Bhamdun, 'Abeih, Lebanon. The age varies from Aptian to Albian. BLANCKENHORN (1934: op. cit.) cited it from the middle rudist-zone, at the Beirut-Damascus railroad cut of Chan Murad, Syria. In Mexico, is frequent in the Carbonera Formation, of Berriasian-Valanginian age.

S.C.S. occurrences: Locality VG-565, Río Morotoco-Caituco-Ojo de Agua, from El Dantó dolostones, (sDLP, DGC) Sucre state, of Hauterivian age. Also in Lope member of Taguarumo Formation, and Chuparipal Formation, as storm-transported disarticulated valves, Early Aptian age of locality PM-87-A. In western Venezuela, in Tibú Formation, of Río Apón, Perijá, only frequent, scattered valves (Fraunfelter in KEY: 519).

Dimensions: LV, length: 31 mm, Height: 65 mm, Convexity: 19 mm (IMLAY, 1937, op. cit.).

Discussion: Most of the valves of *A. syriaca* (Conrad) collected in Venezuela, were scattered, transported and fragmented before sedimentation; I conclude that they grew in coastal Mangrove-type lagoons, alike living *Crassostrea* in the Atlantic Ocean and Caribbean Sea. This parallelism suggest their utilization, as ocean paleo-coastlines where the hurricane-activities can be detected.

Subfamily ***Liostreinae*** Malchus, 1990;

MALCHUS (1990) considerably revised the classification of Mesozoic ostreids differing from that proposed by STENZEL (1971), emphasizing shell microstructure rather than valve morphology and ornamentation. On the basis of similar compact-foliate shell structure MALCHUS (op. cit.) grouped Mesozoic genera previously distributed among the *Grypheina, Exogyrinae, Ostreinae* and *Lophinae* together into the *Liostreinae* , as one of four ostreid subfamilies, and the only one with a Mesozoic record (KUES, 1997: 826).

Genus ***Liostrea*** Douvillé, 1904.

Liostrea, proposed on the basis of *Ostrea sublamellosa* Dunker, 1846, is, according to STENZEL (1971: N1103-N1104) has a bichron of Late Triassic (Rhaetian) to Jurassic , and a distribution in North European Province, Japanese-East Asian, and Balkanic Subprovinces. FRENEIX (1972: 96) quote studies demonstrating the phylogenetical relationship to *Gryphaea* Lamarck of Liassic age. The comparative study of the prodissoconch , and the form and position of the adductor muscle impression, suggest a relationship with *Crassostrea.* The ventral border of the muscle scar is elevated above the general surface of the valve indicating affinity with the Gryphaeidae (KELLY, 1984: 52). Here, we describe three Cretaceous species of *Liostrea.*

Description: Subequivalve shell, weakly convex; concentric lamellar ornamentation cover both valves; on some species, a weak radil ornamentation develop on the LV; ligamentary area upright, tripartite, little developed. Adductor muscle scars orbicular, cuadrangular, in postero-ventral position. Probably existed a promyary depression. The prodissococh is inequilateral. Prismatic layer sometimes present.

Liostrea cunabula (Seeley, 1861)
Plate 14, figures 1, 1ª, 1b;

1861 *Ostrea cunabula* SEELEY, Ann. Mag. Nat. Hist. ser. 3 #7: 117, pl. 5, fig. 1;

- 1910 *Ostrea cunabula* S., WOODS, Paleontogr. Soc. 2(7): 358-360, text fig. 141, 142;
- 1913 *Ostrea (Alectryonia) mecsekensis* VADÁSZ in HOFMANN & VADÁSZ: M.J. k. U.g.R.: 225-226, pl. 6, fig. 2;

- 1961 *Ostrea (Liostrea) cunabula* S., CASEY, Paleontology 3(4): 607;

Occurrence: Originally described from the Cambridge greensand of England, of Early Albian (zone *tardefurcata,* CASEY, 1961) age. Later VADÁSZ (1913) described from Barremian age beds of the Mecsek massif, Hungary, a shell that is identical with the *L. cunabula.* The species also was published from Bhamdun, Lebanon, of Early Albian age. In Japan, a related species was published from Tanohata Formation, Iwate Prefecture, of Aptian age (HAYAMI, 1965a, Mem. F.S. Kyushu Univ., #15(2): 336-337, pl. 49, fig. 7).

S.C.S. occurrence: Locality MO-2521, Río Negro, Perijá, upper Río Negro Formation , stratigraphically 30 meters below the top of the Formation, of Early Barremian age.

Liostrea leymerii (Deshayes in LEYMERIE, 1842)
Plate 19, figure 20; plate 24, figure 11;

- 1842 *Ostrea Leymerii* Deshayes in LEYMERIE: 28, pl. 13, fig. 4;
- 1869 *Ostrea Leymerii* D. DE LORIOL & GILLIERON: 27-28;
- 1869 *Ostrea pustulosa* SHARPE, COQUAND, Monogr. Du genre Ostrea: 169, pl. 73, figs. 12, 13; (non SHARPE, 1849) ;
- 1899 ¿*Ostrea crassa* PHILIPPI, Foss. Mesoz. Chile: 8, pl. 88, fig. 2;
- 1912 *Ostrea Leymerii* D., WOODS: 355, text-figs. 139-140;
- 1928 ?*Ostrea aff. subovata* SHUMARD, LIDDLE, Geology of Venezuela and Trinidad: 112; (non SHUMARD, 1854, *=Actinostreon subovata,* Albian of Gulf Coast subprovince).
- 1961 *Ostrea (Liostrea) leymerii L., CASEY,* Paleontology , 3:607;
- 1980-a *Nicaisolopha pasiphae* coquand, MACSOTAY*: 254; (*not COQUAND, 1869).

Diagnosis: This shell appears to have increased its depth and thickness, while adding very little to its circumference. It is frequently higher than high; and the large hinge area often covers more than a third of the area of the shell. These characters and the warty or pustulose appearance of the surface distinguish it readily (SHARPE, 1850: 188). Adductor muscle imprint clearly concave at its dorsal margin (Hennig, 1897, in STENZEL, 1971).

Occurrence: The biochron of this species extends from Barremian to Early Albian. Distributed in the North European Province, and Apulian, Balkanic subprovinces of the West European Province; also in the Gulf-Atlantic Coast subprovince, and East African Province, with Neuquen Subprovince.

S.C.S. occurrences: Locality MC-445-A, B, C, of Cerro La Torre, along Campo Alegre-Buena Vista road, of Guácharo Member of El Cantil Formation (sDLP, DGC) of Early Albian age. Several adult articulated individuals in calcareous-ferrugineous sandstone of reddish-brown color. Also in Tibú Formation, northern Perijá mts., of Early Aptian age. Near the top of Borracha Formtion, in Borracha Island, (DAGM) of Early Albian age, a colony was observed, but not collected.

Palaeoecology: A whole colony of juvenile shells attached to a big-sized *Gyrodes manueli* (Choffat) was collected in the eastern, carbonatic facies of Taguarumo Formation, (DAGM). The juveniles were attached to the cast, after the dissolution of the aragonitic shell; these limestones were biodetritic, with abundant *Palorbitolina lenticularis*, common valves of *Pachytraga* and some *Amphitriscoelus waringi.* The bioclasts in the limestone, contained abundant Sponbge and Holoturia spicules, but no corals at all. I conclude, that *Liostrea* was a saline water inhabitant, and was the growth, upon a space-reduced, irregular bottom, that originated the "pustulose" valves.

Liostrea speetonensis nom. mut,. Macsotay
Plate 33, figures 13, 13a, 13b;

- 1883 *Ostrea Walkeri* KEEPING, Upware and Brickhill, Cambridge: 103-104, pl. 4, figs. 4a, 4b, 4c; (non WHITE, 1879: 278, pl. 1, fig. 1; *Ceratostreeon*);
- 1910 *Ostrea Walkeri* K., WOODS, Paleontogr. Soc., 2(7): 360, pl. 55, figs. 1-3;(nec WHITE, 1879)
- 1961 *Ostrea (Liostrea) walkeri* K., CASEY, Paleontology, 3: 607;

Description: A variable oyster shell, plano-convex or concavo-convex, covered with rude, imbricating growth-lamellae; the shells are moderately thick. It is attached sometimes by the whle surface of the LV, but in other specimens only by a small area; the LV in the former case, has a thickened margin. Contour ovate, more or less irregular, beaks pointed; moderately deep. RV flat or concave and irregular with concentric growth striae or imbrications, which usually are less prominent than on the LV. Ligamental area large and triangular, (about 1/5th length of the whole shell), its base usually the broadest. A median gutter serves to divide it into three sub-equal parts; on RV the ligamental area is much smaller. Adduxtor muscle pad is of moderate size, situated near the anterior side of the shell, at about the midl of the shell (KEEPING, 1883, op. cit.).

Dimensions: Length: 31 mm, width: 22 mm, thickness: 13 mm. The biggest shell of Peñas Altas Formation, measures 38 mm of height.

Occurrences: Upware, Lower Greensand of Aptian age. Also in Speeton clay Formation, England.

Etymology: The new name, is taken from Speeton clay Formation, which in the Northern Sea Basin has a biochron of Valanginian to Aptian (KING et al., 1989) one of the collecting places of this Bivalve.

S.C.S. occurrence: Locality HA-4299, La Loma section, Trujillo state, (ARNAUD et alii., 1999, fig. 20) in the lower carbonatic member of Peñas Altas Formation. Collected at the top of a dolomitic sandstone bed of Depositional Sequence 4, of Early Aptian age. Four articulated shells, in situ.

Subfamily ***LOPHINAE*** Vyalov, 1936.
Genus ***Actinostreon*** Bayle, 1878.

The genus *Actinostreon* is cited for Western European and Gulf-Atlantic coast Subprovinces, with a biochron of Jurassic-Cretaceous (STENZEL, 1971). Eleven taxa of *Actinostreon* in my files, extends the distribution to Gondwanan Province, and Japan.

Actinostreon euzebioi (MAURY, 1936)
Plate 59, figure 12;

- 1888 *Ostrea (Alectryonia) palmetto?* WHITE, Ar. Mus. Nac. Rio de Janeiro, #7: 29, pl. 1, figs. 3-5;
- (non *Ostrea palmetta* Sowerby, 1818)
- 1936 *Lopha euzebioi* MAURY, Mem. Soc. Geol. Min. Brasil, #11: 159, 161, pl. 7, figs. 11, 14, 16, 17;
- 1944 *Ostrea (Alectryonia) staufferi* BERGQUIST: 15.16, pl. 19, figs. 1-10;

Ocurrence: It is frequent in Lastro, Ganhamaroba Group, Brazil, of Middle Albian age. In the U.S.A., the Coleraine Formation, -Cenomanian age,- harbors a species, synonym of *A. euzebioi.*

S.C.S. occurrence: Locality HA-4409, Arbol Redondo section, Trujillo state, (ARNAUD et al., 1999, fig. 25) of Upper carbonatic member of Peñas Altas Formation, of Early Albian age.

Genus ***Cameleolopha*** Vyalov, 1936.

Diagnosis: Both valves have 12 to 20 angular, narrow-crested dichotomous and intercalating radial ribs, that continue to commisure. LV convex to gibbous, RV flat. This thermophyllic genus, has a biochron of Late Cretaceous (Cenomanian to Campanian, Maastrichtian?). Restricted to Gondwanan Province tropical belt.

Cameleolopha syphax (Coquand, 1852)
Plate 57, figs. 4, 6, 7,10;

- 1852 *Ostrea syphax* COQUAND, Géol.constantine: 43, pl. 4, figs. 1-4;
- 1869 *Ostrea Syphax* C., COQUAND, Monogr. Ostrea: 138, pl. 55 fig.13; pl. 56, figs. 1-5; pl. 58.
- 1912 *Ostrea syphax* C., SCHLAGINTWEIT: 90, pl. 5, figs. 1-3;
- 1954 *Ostrea syphax* C., RUTSCH & SALVADOR, : 422-423, pl. 40, figs. 4, 5;
- 1954 *Ostrea syphax* C., BENAVIDES: Geol. Perú: 381;
- 1972 *Lopha syphax* (C.) FRENEIX, N.m.S.geol. Mroc #228: 93-96, pl. 6, figs. 1-5; pl. 7, fig. 1[a],b; pl. 8, fig. 1-4: text fig. 9;

Paleoecology: FRENEIX (1972: 93-96) studied a good collection of *Cameleolopha syphax* (C.) complex from the Tarfaya Basin, of southern Maroc: "About 30 shells, mostly disarticulated, were studied. Compared with the analysis of the functional morphology of *Arctostrea* by R. M. CARTER (1968), these were applied to *Cameleolopha.* The commissural plications on the margins, the plicae or folds are fairly high, developing funicuilar spines all around the valves. These structures tend to increase the water currents in the interior of the valves: they are effectively better developed where the inhalant flow should be stronger, the place where the ctenidies are more developed. The specimens of Cenomanian age, have the adaptation organs (ziczag borders, aliform expansions and tubular spines) less developed than the specimens of Albian age. This suggests more intense activity of hurricanes, the cause of the removal of clayey sediments in shallow environments."

Occurrence: This species is abundant in Albian sediments of Angola, Colombia, Perú and Ecuador. In Cenomanian sediments, in all the Gondwana Province, including Sicily and south Italy.

Dimensions: The type locality, Aïn Zairin, and Tabessa, Argelia, is in Cenomanian sediments. It measured of height: 120 mm, and width: 111 mm, characterized by equivalve, thick valves, and similar sculpture on both valves.

S.C.S. occurrence: Locality MO-2333, Río Yasa, Perijá region, Maraca Formation, of Cenomanian age; the same formation, locality MO-2314, quebrada Santa Rosita, Perijá region, of Late Albian age. On the road to Zea, Merida Andes, in glauconitic sandstones of Early Cenomanian age, Capacho Formation (GARCIA JARPA et alii., 1980). In Colombia, are common in Gachetá

Formation, of Late Cenomanian age. In La Guajira, in Maracas Formation (MACDONALD, 1968).

Genus ***Nicaisolopha*** Vyalov, 1936.

According to STENZEL (1971: N1164-N1165) recognized a wide distribution area: Gondwanan Province, Gulf-Atlantic coast and Peruvian Subprovinces, S.C.S., with a biochron of Late Cretaceous (Turonian to Maastrichtian). In Western European Subprovince, *Nicaisolopha* is known since Berriasian times.

Nicaisolopha neocomiensis (d'ORBIGNY, 1950)
Plate 11, figure 16;

- 1850 *Ostrea neocomiensis* d'ORBIGNY, Prodrome, # 2: 84;
- 1921-B *Ostrea neocomiensis* d'O. GILLET, B.S.S. Hn. Yonne: 75: 16-17, pl. 1f, 9;
- 1934 *Ostrea neocomiensis* d'O. COTTREAU, #23: 69, pl. 73, fig. 4;

Occurrence: Originated in Western European Subprovince during Berriasian times (Marbre Batard Formation, France and Switzerland) and expanded to Apulian, Maghrebian and Syrian Subprovinces, until Aptian times.

S.C.S. occurrences: Locality HA-4264, in cerro Los Curaríes near Curarigua (ARNAUD, et al., 1999, Fig. 23) Trujillo State, lower carbonatic member of Peñas Altas Formation, of Late Barremian age. Also in Morro Blanco Formation, in Isla Venados, (DAGM) four meters above the coral reef horizon, of Late Berriasian age. Only one solitary valve has been found in each locality.

Nicaisolopha pasiphae (COQUAND, 1865)

- 1865 *Ostrea Pasiphae* COQUAND, Mém. Soc. Emulation de la Provence, #3: 354, pl. 25, figs. 9, 11, 12 ;
- 1869 *Ostrea Pasiphae* C., COQUAND, Monogr. du gen. Ostrea : 173, pl. 63, figs. 4-7 ;
- 1913 *Ostrea Pasiphae* C., SOMMERMEIER : N.J.B., #36 : 390 ;
- 1949 *Liostrea Pasiphae* C., BATALLER, Synopsis Fos. Cret., 8(1) : 160-162 ;

Diagnosis : Shell wide, subtriangular, rather thin and smooth ; aequivalve shell, covered with growth lines. The whole shell is deformed in a wide fold, developed on the distal half.

Occurrence: In Spain, located in seven localities in the Maestrazgo Basin, of Aptian age. Also in northern Perú, in the same stratigraphic horizon. In Rumania, cited from the Urgonian limestones, of Late Barremian-Early Aptian age (NEAGU et al., 1977: 142).

S.C.S. occurrence: Locality MO-890, Punta Manare, Mochima Peninsula, Sucre state, lower Borracha Formation, of Late Aptian age.

Genus ***Rastellum*** Faujas-Saint-Fond, 1799 [?1802](=*Arctostrea* Pervinquière, 1910a)

Description : Shell outline tending to crescentic with both flanks parallel and very steep ; outlines long-tapering like comma, hjook or semicircle to almost full circle; commissure very serrate; serrae as many as 3 per cm. of commissure length. Tip of zigzags sharp-pointed, long and narrow. Distinction between *R. (Rastellum)* and *R. (Arctostrea)* is uncertain (STENZEL, 1971: N1165,- N1167). MONGIN (1980: 127) considered *Arctostrea as* synonymous of *Rastellum*, and I agree.

Remarks: KAUFFMAN in HALLAM et alii., (1973: 359) considered *Arctostrea* as a South Temperate Realm trans-temperate bivalve, of deep-shelfal habitat. Its biochron extends from Late Hauterivian to Maastrichtian, mostly in themophyllic associations.

Occurrence: Western European, Maghrebian, Somalian and Balkanic Subprovinces, which means a thermophyllic genus, representing an unique phylum.

Rastellum rectangularis (Roemer, 1839)
Plate 47, figure 7;

- 1839 *Ostrea rectangularis* ROEMER: 24, pl. 18, fig. 15;
- 1912 *Ostrea diluviana* WOODS, Cret. Lamell. England: 2:342, text fig. 98-138;
- 1924 *Lopha rectangularis* R., NEWTON, Malac. Soc. L., Proc.1& :143, pl. 7, figs. 1-3 ;
- 1947 *Ostrea (Alectryonia) carinata* STANTON, U.S.G.S., Prof. Paper, 211:18, pl. 7, figs. 8-13;
- 1954 *Lopha (Arctostrea) colubrina (Lamarck)* COX, Jour. Pal. 28(5): 630, 631; pl. 64, figs. 2, 3;
- 1980-b *Arctostrea rectangularis* (Roemer) MACSOTAY: 36, pl. 11, fig. 23;
- 1986 *Arctostrea carinata* (Lam.-) MACSOTAY et al.,: 7148;
- 1998 *Arctostrea colubrina (L.)* MACSOTAY & VIVAS: 72;

Diagnosis: Shell elongate, curved, nearly or quite equivalve, very slender, more or less strongly curved, especially near the extremities; with a prominent carina, from which thin, elevated, acute-topped straight or curved subparallel ribs run to the

zig-zag shell margin. Valves deep and capacious, becoming very thick in old age. In some species ear-like expansions develop near the beaks. Surface very strongly plicate with 25 – 40 or more radial ribs.

S.C.S. occurrence: Locality MO-905, Puerto Escondido inlet, Taguarumo Formation, of Late Hauterivian-Early Barremian age (DAGM): also in Chuparipal Formation, in cerro La Pica, (DEP), of Barremian age: uncommon. In Tibú Formation, - Perijá area,- of Barremian-Aptian age, few fragmented specimens. In Píche member of Apón Formation, of Early Albian age. In El Cantil-Punceres anticline, in shales interbedded with massive limestones, in El Guacharo member of El Cantil Formation, of Early Albian age, where it is frequent (LIDDLE, 1946: 191). Cited from Cuche Formation, Trinidad, of Hauterivian age.

Discussion: *Rastellum rectangularis* might not be very useful in stratigraphy, but I consider it of great help in the paleoenvironmental interpretation. *R. rectangularis and R. macroptera,* are adaptations to survive in dense, zoned, saline waters, where the hydrodynamisme was low. The big-sized *R. milletiana* (d'Orb.) is the response of an ocean with less zonation, and more agitated, of the Albian seas. In all the cases, *Rastellum* must have lived near the pycnocline, which is usually near the photic/aphotic boundary.

Rastellum macroptera (Sowerby, 1814)
Plate 31, figures 3, 4, 5;

- 1824 *Ostrea macroptera* Sowerby, Min. conch., pl. 478, figs. 3-5;
- 1869 *Ostrea macroptera* S. COQUAND, Monogr.du genre Ostrea: 164, pl.72, figs. 1-4;
- 1871 *Ostrea macroptera* S. PICTET & CAMPICHE, Pal. Suisse, #4: 300-301, pl. 184, figs. 5, 5a, 5b,
- 1913 *Ostrea (Alectryonia) nacroptera* S. HOFMAN & VADÁSZ, m. j. K. u., r: 226;

Observations: Confused with *R. rectangularis* by d'ORBIGNY, (1843, Paleont. Franç., #3: 695, pl. 465) many authors repeated this mistake. *R. macroptera* is distinguished by: Is shorter and wider shell; the aliforme expansion near the apical zone; the ribs are all thicker, and there is no any flat and smooth area. (PICTET & CMPICHE, 1871, op. cit.).

Occurrence: In North European Province, Western European, Apulian, Maghrebian and Balkanic Subprovinces. Its biochron is extended from Valanginian to Early Aptian. According to COQUAND (1869: 165) is specially abundant in the Urgo-Aptian limestones, and age-equivalent carbonates. In Hungary, in the Hauterivian of Mecsek mts.

S.C.S. occurrence: Locality MC-341-C, La Hacienda, Río Carinicuao, Sucre State, El Dantó dolostones (DGC, DEP) of Hauterivian age. Several fragmentary specimens in dolomitic limestones.

Tribe CURVOSTREINI

I am using this provisional grouping to deal with some genera, considered "nomina dubia" by STENZEL (1971: N1167-N1167) , because of the descriptions were not "sufficiently informative".

Curvostrea Vyalov, 1936.

Curvostrea Vyalov, 1936, proposed as a new genus, on base of *Ostrea rediviva* COQUAND (1869: 154, OD) of the Cenomanian of Dept. du Gard, France. All figured specimens of *Ostrea rediviva* have the valves closed (articulated), so nothing is known concerning muscle imprints, and other internal features (STENZEL, op. cit.). So, we will use *C. lotenoensis* (Weaver, 1931), for this purpose.

Description: Valves falcate, strongly inaequilateral, strongly inaequivalve. LV moderately convex, ornated with fine, concentric lamellae. Beaks short and ortogyre, adductor muscular print rounded; attachment area is rather small. RV is less convex, and also ornated with concentric lamellae. At early stage, there are many straight very fine radial threads.

Species attributed to *Curvostrea.* In my files, are the following species: *C. besairei* (Collignon),- Albian, Sahara, - *C. blakei (Cox),* -Ryazanian, England,- *C. castellobrancoi* (Maury) – middle Albian, Brazil,- *C. crescentica* (Packard), - Senonian, California; *C. geokderensis* (Prosorovsky), - Hauterivian-Barremian,- *C. goldfussi* (Holzapfel) – Early Senonioan, Germany and Mexico,- *C. indifferens* (Zittel), - Santonian,- *C. laevigata* (Sowerby),- Neocomian, Germany and Chile,- *C. rouvillei* (Coquand), - Cenomanian to Turonian, Gondwanan Province, from Peruvian to Balkanic Subprovinces; *C. semidentata* (Böhm), Albian, Germany,- *C. wegmanniana* (d'Orbigny), - Santonian to Campanian of western European Subprovince. The biochron of the genus is extended from Late Jurassic (Tithonian) to Late Cretaceous (Campanian).

Curvostrea lotenoensis (Weaver, 1931)
Plate 10, figures 9, 10;

- 1899 *Exogyra curvirostris* PHILIPPI, Sec. fossils of Chile: 16, pl.6, fig. 5; (non NILSON, 1827)
- 1907 *Ostrea curvirostris* Ph. HAUPT, Neues Jahrb. Für Mineral., etc., Beilageband 23: 208,, pl. 9, figs. 1-6;
- 1931 *Ostrea lotenoensis* Philippi (WEAVER) Univ. Wash. Mem. #1: 220-222, pl. 18, fig. 84, 85;

Description: Shll rather large, sub-circular to sub-crescentic in outline and with large and deep semi-circular indentation in the anterior end. The umbones are strongly curved forwards, but not twisted. The deep semi-circular embayment on the anterior end is always present, regardless of the contour of the posterior and basal margins. The LV is usually moderately convex and on the outer side sculptured with very heavy lamellose concentric growth ridges. The upper half shows fine radial striae which disappear altogether near the middle of the shell. In young individuals these lines are very strong and continue to the basal margin. The inner surface is moderately concave, with a nearly circular and moderately deep muscular impression, situated anteriorly and just behind the place of greatest concavity in the anterior embayment of the margin of the valve. The ligamental pit is very shallow and sometimes outwardly even slightly convex. It extends forward in conformity with the trend of the umbo, and is divided mesially by a slightly raised, rather sharp, angular ridge. The RV conforms in outline to that of the LV, and varies from flat to strongly concave. The muscular impression is nearly circular and very slightly depressed. Ligamental groove rather deeply excavated posteriorly and separated from the anterior portion by a slightly raised ridge. The groove extends to the tip of the umbo. LV with attachment area, on the stem of an unknown alcyonarian. RV shows the xenomorphic sculptures corresponding to the LV.

Dimensions: Length: 98 mm; height: 93 mm (WEAVER, op. cit.). Length: 40 mm; height: 37 mm (Plate 10, figures 9, 10).

Occurrence: This species is very abundant in the Cerro Loteno and Picún Leufu areas, Argentina, in calcareous clay shales near the boundary between Tithonian and Berriasian stages. In Chile, was collected from Tinguiririca valley, considered of Neocomian age (PHILIPPI, op. cit.), localities belonging to the Neuquén Subprovince. Scarce but present in the Marbre Bâtard Formation, of the Jura mountains of France and Switzerland, of Berriasian age.

S.C.S. occurrence: Locality FA-50-13, quebrada Quetepe, east of Cumaná, in Morro Blanco Formation, of Late Berriasian-Early Valanginian age. Sampled by Geol. Ing. Beatriz Lopez (1979).

Discussion: A coeval species, *C. blakei* (COX, 1929, Pr. D. N. H. 50: 149) is a dwarf equivalent of Ryazanian age, Portland beds, and lower Spilsby Formation, England. Also similar to *Deltoideum delta* (Smith, 1817 in STENZEL, 1971, N 1102) - Late Jurassic, Early Kimmeridgian stage) but *C. lotenoensis* has the beaks much more curved and anteriorly directed than in *D. delta.* The latter species posseses a pronounced sinus in the LV extending to the umbo, which is almost completely lacking in *C. lotenoensis.* The LV of *C. lotenoensis* is quite convex, and not flat, as in *D. delta* (HAUPT, 1907; WEAVER, 1931).

Paleoecology: WEAVER (op. cit.: 220) cited that valves of *C. lotenoensis* of Quintuco Formation, are covered by "large numbers of specimens of *Filogranula cincta* (Goldfuss, 1833) and *Texigryphaea roemeri* "attached to the outer side, suggesting saline waters. The attachment of a living *C. lotenoensis* to an alcyonarian stem, in the same way as the living *Dendostrea folium* (Linné, 1758) does in the Caribbean Sea (McLean, 1941: Notulae Naturae #67:7-8) - between 7 and 40 meters of depth. This is coincident with the paleodepth proposed for the Morro Blanco Formation.

Genus ***Anulostrea*** Vyalov, 1936;

Taxon considered typical of the Maghrebian Subprovince, (KAUFFMAN in HALLAM et alii., 1973: 365) and with a biochron of Coniacian-Santonian stages (STENZEL, 1971:N1167). The real biochron of *Anulostrea* is extended from Hauterivian to Santonian stages, which is coincidental with the salinity crisis in the peri-Gondwanan seas.

Anulostrea urgonensis (d'ORBIGNY, 1850)
Plate 9, figure 3; plate 10, figure 5;

- 1850 *Ostrea urgonensis* d'ORBIGNY, Prodrome 2:108, #738;
- 1907 *Ostrea urgonensis* d'O., COSSMANN, M.S.g.France, 37: 40-41, pl. 5, figs. 5-7;

Description: General outline of the shell, approaching rectangular, well-developed shoulders at ends of the ligament, and regularly ornated withj very fine, growth squamae; LV with large attachment area, (up to 90 %), growing out fairly flat, accommodated to the attachment surface. Resilifer about twice the length of each bourrelet;

ligamental area wider than high. Adductor muscle imprint shield-shaped, centrally located. Commisural shelf weakly developd, showing weak crenulations restricted to the anterior and posterior margins. No chomata are observed. By interior features, it should be included in the Subfamily *Liostreinae,* near the genera *Catinula* and *Deltoideum.*

Family ***MUTELIDAE*** Swainson, 1840.

This *Unionacean* family is of Gondwanan origin, where was characteristic and well established before the partition of South America and Africa. Is non-marine, with a biochron of ?Triassic, Cretaceous – Recent.

Genus ***Mutela*** Scopoli, 1777.

The taxon *Mutela (Mutela)* is known as an African genus, with a biochron of Cretaceous to Recent (COX et alii., 1969: N463). It has been recognized in South America, too, and Spain.

Mutela ? sp. indet., Macsotay.
Plate 17, figure 13;

- 1887 *Astarte? multilineata* C., MALLADA, Bol. Com. Mapa geol. España, 14: 89, pl. 31ª, figs. 3, 4;

Description: Eleven casts, of oblong-elongated contours, compressed; LV more convex than RV, no ornamentation was preserved. Postero-dorsal and antero-dorsal areas slightly concave; posterior margin short and slightly truncated towards the pallial region. Umbos wide, not prominent, but central in position. Ventral margin rounded, with a slight flexure just below the umbo.

Dimensions: Length: 26 mm, Height: 16 mm.
S.C.S. occurrences: Locality PM-8-B, road Pajaral-La Margarita, La Margarita mudstones, (sDLP, DGC) of Hauterivian age. The casts were in a plant-rich (taphoflora) greenish-brown claystone, intensely burrowed by *Chondrites furcatus (*Brongniart).
Discussion: *Astarte? multilineata* COQUAND, 1865, was based on shells collected in Maestrazgo Basin of Spain, in Obón and Tortosa. These localities are not of Aptian age, but of the wealdian Mirambell marls, of Hauterivian age (CANEROT, 1982). There was not marine malachofauna associated.

Family ***DESERTELLIDAE*** Dechaseaux, 1946.
Genus ***Desertella*** Munier-Chalmas in Haug, 1905.

Lacustrine genus, found abundantly in the Fort Flatters member of the Nubia sandstone (MONGIN, 1965). This Argelian location, was doubdfully attributed to ?Albian.

Desertella cf. foureaui Munier-Chalmas, 1905
Plate 20, figure 22 ;

Description : Cast medium-sized, equivalve, subequilateral, subtrigonal, but with posterior end high and subtruncate; our casts are longer than high, as a difference with *Desertella foureaui* Munier-Chalmas, (COX et alii., 1969: N467). Sharp diagonal ridge delimiting a relatively narrow posterior area; umbones moderately well inflated and incurved, slightly opisthogyrous; no lunule or escutcheon. Surface ornamented with fine concentric striae.

Dimensions: Length: 33 mm, Height: 27 mm.
S.C.S. occurrence: Locality MC-228-B, Río Quiriquire, Bergantin sandstones, in a sandy limestone, near the top of the unit, (DBG) of Barremian? age. It is associated to *Musculiopsis coycuarensis* n. sp., forming an assemblage of oligohaline composition. Also in MC-119, MC-271 and JFS-148, all localities of La Margarita mudstones, where they are associated to the taphoflora dominated by *Hausmannia,* in black, silty shales.

Discussion: *Desertella* is, until now, a monotypic genera. From the African references, we are aware of the lacustrine affinity of this Bivalve. Its presence, associated to another non-marine genera, as *Musculiopsis,* indicates continental fauna transported by flash-floods, related to tropical storms, into the fore-delta muds of the Espino paleo-river. Our *Desertella cf. foureaui,* must be the ancestor of the African form, which shared the interior lakes and rivers of the Gondwana continent.

Family ***TRIGONIIDAE*** Lamarck, 1819.

LEANZA (1993: 11) stated that Early Cretaceous trigoniid species in Argentina are confined to the Mendoza Group, and are present in shoreface facies and/or on the top of hardgrounds of Vaca Muerta, Mulichinco and Agrio Formations, of Tithonian-Barremian age. All the members of this family, are infaunal, non-siphonate suspension feeders, and became inhabitants of mostly terrigenous sediments, deposited in turbid waters, rich in leptopel. Very successful during Jurassic times, they adapted rapidly to the salinity anomalies, and preferred the Boreal and Austral temperate belts, during the Early Cretaceous (LYCETT, 1872-1879), (VAN HOEPEN, 1929), (NAKANO, 1960), (COX et alii.,

1969: N471-N489), (LEANZA, 1993). The species of *Trigoniidae* cited here, will not be distributed by Subfamilies in this study; I feel this family still needs review in the future.

Genus **Trigonia (Trigonia)** Bruguière, 1789.

Considered as cosmopolitan by KAUFFMAN in HALLAM et alii., 1973: 359) with a bichron extended from Middle Triassic (Anisian) to Late Cretaceous (Cenomanian).

Trigonia (Trigonia) cocuyensis nom. nov. Macsotay Plate 10, figure 12;

- 1907 *Trigonia cf. angustecostata* B., LISSON: 35, pl. 4, fig. 3;
- 1929 *Trigonia cf. Angustecostata* B. STEINMANN, Geol. Perú: 93, fig. 104;
- 1985 *Trigonia columbiana* ETAYO SERNA, Proy. Cretacico # 24: 18-19, pl. 1, figs. 2, 7; (non PACKARD, 1931: 23-24, pl. 11, figs. 1-3)

Diagnosis: Small-sized Shell, with anterior and ventral margins, convexe: posterior keel is moderately curved, and it is bordered by shallow depression, on which the concentric ribs are interrupted; the concentric ribs are continuous and thinner tan their interspaces. The holotype of *T. columbiana* ETAYO SERNA´s new species had 17; the posterior area is covered by radial striations, separated in three sectors by two fine keels. *T. angustecostata* Behrendsen (1892: 28, pl. 3, fig. 7) in LEANZA (1993: 24-25, pl.13, figs. 3-5) – Early to Middle Hauterivian age,- Agrio Formation, Argentina and in the Valanginian of Perú,- has a strong keel and the posterior area is covred by fine radial striations, all equal.

Etymology: This small species is re-named after the Cocuy Graben, the Colombian name for the Cretaceous Aulacogen, formely placed in the Cordillera Oriental (FABRE, 1983).

Genus ***Megatrigonia*** Van HOEPEN, 1929.

According to KAUFFMAN in HALLAM et alii., (1973: 373, 374) inhabited the Trans-Temperate Realm, where is endemic in the Indo-Pacific region.

Megatrigonia cf. rogersi (Kitchin, 1908).Plate 15, figure 7;

- 1980-b *Megatrigonia cf. rogersi* (K.) MACSOTAY: 26;
- 1985 *Megatrigonia cf. rogersi* (K.) USECHE & FIERRO: 674;

S.C.S. occurrences: Locality MO-1305, road from Los Naranjos to La Fundación, Chururú member of Rio Negro Formation, of Hauterivian age. The casts were collected from dark green glauconitic sandstone, together with other Trigoniidae.

Occurrences: *Megatrigonia rogersi* (Kitchin, 1908, F. L. Ann. South African Museum, 7: 99-101, pl. 3, fig. 3; pl. 4, fig. 1; pl. 5, fig. 2) is part of the Trigonia-fauna of Uitenhage Formation, South African Republic of Valanginian-Early Hauterivian age, and Coyahique Formation, Aisén province, Chile, of the same age. In Tanganyika, Mozambique and Madagascar, (East African Province) is found from Neocomian to Aptian.

Genus ***Iotrigonia*** VAN HOEPEN, 1929.

According to KAUFFMAN in HALLAM et alii., (1973: 374) this genus belongs to the South Temperate Realm, being endemic in the Indo-Pacific region; Neuquen Subprovince evidently was part of the latter.

Iotrigonia stowi aisenensis Reyes, 1970 Plate 15, figure 15;

- 1970 *Iotrigonia stowi aisanensis* REYES, I. I. Geol. Chile, Bol. 26: 13-15, pl. 2, figs. 1, 2;
- 1985 *Iotrigonia sp.* MACSOTAY et al.: 884;
- 1987 *Iotrigonia sp.,* LOPEZ: 134, fig. 33;

Occurrences: Basin of Coyhaique river, Aisén Province, Chile, in sediments of Hauterivian age. Description based on one specimen, with the LV well preserved.

S.C.S. occurrences: Locality ASU-238: Los Chirriaderos, affluent of río Chaguaramas, El Pilar, Sucre state, El Dantó dolostones, (DEP, fide MACSOTAY et al., 1985, VI Congr. Geol. Venez., Mem. 2: 884) of Hauterivian age. B. LOPEZ collected it in Quebrada Quetepe, in Lower Taguarumo Formation, of Hauterivian age.

Genus/Subgenus ***Steinmannella (Transtrigonia)*** Dietrich, 1933.

This taxon was based on *Trigonia transitoria* STEINMANN, 1881, from Caracoles, of Neocomian age. Its biochron extends from Late Jurassic (Middle Tithonian) to Early Cretaceous (Barremian-?Aptian). Its distribution includes Peruvian and Neuquen Subprovinces, and North Pacific Province.

Steinmannella (Transitrigonia) raimondii (Lisson, 1930)

Plate 15, figure 17;

- 1930 *Trigonia Transitoria var. raimondii* LISSON : 15-18, pl. 8, figs. 1, 2
- 1974 *Buchotrigonia transitoria raimondii* (L.) RIVERA & D'ANS : 89 ;
- 1985-b *Steinmannella aff. raimondii* (L.) MACSOTAY : 19, pl. 1, fig. 27 ;

Occurrences: Originally studied from Jauja, Junín department, Perú, from Valanginian-Hauterivian sediments; in Argentina, cited from Agrio Formation, of Hauterivian-Barremian age. In Colombia, in the Macanal shales, of Hauterivian age.

S.C.S. occurrences: Locality MO-1305, Los Naranjos-La Fundación road, Chururú member of Rio Negro Formation, of Hauterivian age, from Uribante Hemigraben, Tachira state. Five casts of this big-sized species, in the glauconitic sandstones.

Genus ***Anditrigonia*** Levy, 1967.

The *Anditrigonia* is an amphiamerican genera, so important stratigraphically, that LEANZA (1993, Bull. Amer. Paleont., 105(343): 45-46) proposed the Subfamily ***Anditrigoniinae*** to englobe the nine species belonging to it. Its biochron extends from Middle Jurassic to Early Cretaceous (Hauterivian).

Anditrigonia eximia (Philippi, 1899)
Plate 15, figure 21;

- 1899 *Trigonia eximia* PHILIPPI, Fos. Mesoz. Chile: 76, pl. 34, fig. 3;
- 1931 *Trigonia picunensis* WEAVER ,Univ. Washington, Mem. #1: 261-263, pl. 27, fig. 150;
- 1993 *Anditrigonia (Anditrigonia) eximia* (P.) LEANZA: 48-49, pl. 9, figs. 3, 4;

Occurrences: Originally cited from Pedernales, Lo Prado, San José, Lo Valdés, and Baños del Flaco Formations, of Neocomian age, Chile. In Argentina, Picún Leufú Formation, of Tithonian age, and Quintuco Formation, of Berriasian-Valanginian age.

S.C.S. occurrences: Locality MO-1598, Isla Venados, Morro Blanco Formation, in shale-sandstone alternations, (DAGM) of Late Berriasian age. In Colombia, ETAYO SERNA (1985-a: Proy. Cretacico, 16: 24-15) cited *Anditrigonia sp.* in the Macanal shale Formation, of Hauterivian age, in the Cocuy Hemigraben.

Genus ***Virgotrigonia*** Alleman, 1985, Nov.;
(=*Maputrigonia* Leanza, 1985, Dic.)

The biochron of *Virgotrigonia,* extends from Late Jurassic(Late Tithonian) to Early Cretaceous (Valanginian). Restricted to Neuquen, Peruvian Subprovinces, and S.C.S.

Virgotrigonia cf. paradisensis (Lisson, 1930)
Plate 19, figure 12 ;

- 1930 *Trigonia paradisensis* LISSON, : 18, pl. 9,figs. 1, 2, 3, 4, 5 ;
- 1985-a *Buchotrigonia ? aff., paradisensis* (L.) ETAYO SERNA, Proy. Cret., 16: 24-15;

Occurrence: Originally collected from Miembro La Virgen, La Herradura Formation, of Valanginian age; also in Perú, in the San Lorenzo Formation, of Berriasian age.

S.C.S. occurrence: Locality VG-376-B, Cerro El Imposible, on Ojo de Agua road, Sucre state, (sDLP, SGC) of El Cazón Formation, of Late Berriasian age. In Colombia, in the Macanal Formation, of Valanginian-Hauterivian age.

Genus ***Myophorella*** Bayle, 1878.

According to KAUFFMAN in HALLAM et alii., (1973: 359), *Myophorella* is a cosmopolitan genus, whose biochron goes from Early Jurassic to Early Cretaceous. Is interesting the biodiversity of *Myophorella* species in the Spilsby Formation in southern England: *M. cymba* (Contejean), *M. portlandensis* (Cox), *M. dorsetensis* (Cox), *M. aylesburyensis* (Cox), *M. buckmani* (Cox). The Spilsby Formation was deposited during the Jurassic/Cretaceous boundary, in the Temperate North European Province (KELLY, 1983), when the salinization started all along the margins of the Tethys Ocean.

Myophorella (Myophorella) blancheti new species, Macsotay
Plate 22, figure 8;

Diagnosis: *Myophorella* with narrow, smooth, posterior area, bearing only growth lines, delimited by a sharp carinae, without any ornamentation.

Description: Incomplete LV, having length in excess of 80 mm, and a height of 78,3 mm. Anterior short and umbo weakly projecting; beak inflated and slightly opistogyrate. Flank ornamented with 18 + narrow ribs, with wide interspaces; the radial ribs are covered by small beads on their crests. The carinae is smooth. Posterior area is feebly concave all along its extension, and ornamented by raised growth lines. Escutcheon damaged, but it seems to have been smooth.

Etymology: Dedicated with gratefulness to Geologist Dr. René BLANCHET, - Université de Bretagne Occidentale, Brest, France, - 0rganizer and President of the 26th International Geological Conference, (Paris, France, July 7-17) and a brilliant Geodynamist.

Types: The Holotype, registered as UCVMG/IO-2133,is illustrated on plate 22, figure 8. Two fragmentary samples were found in the same locality.

S.C.S. occurrence: Locality MO-892, northwest extreme of Puerto Escondido inlet, in the cliffs west of Cumaná city, (DAGM) of Sucre State. The locality is in the lower Taguarumo Formation, of Early Barremian age. *M. (M.) blancheti* n. sp., was collected in a sideritic red siltstone, together with *Ptychomya solita* and *Neithea syriaca*, so I presume, they all lived in saline environment.

Discussion: The nearest species seems to be *M. (M.) schultzi* LEANZA (1993, Bull. Amer. Paleont., 105(343): 30-31, pl. 8, figs. 8, 9) - Picún Leufú Formation, Late Tithonian, Neuquén Basin, Argentina,- in its general shape, and the widely spaced ribs on the flank, but our ribs are more numerous and thin; the umbos are more swollen.

Genus ***Rutitrigonia*** VAN HOEPEN, 1929.

Rutitrigonia is also a cosmopolitan genus, which had infaunal habits in Dysoxic muds. Had preference for saline and hyersaline marine waters, as is suggested by the biochron of the genus: Late Jurassic (Tithonian) to Late Cretaceous.

Rutitrigonia agrioensis (Weaver, 1931)
Plate 22, figures 3, 5, 6;

- 1931 *Trigonia agrioensis* WEAVER, Univ. Washington, Mem. #1: 266,pl. 27, figs. 142-146;
- 1944 *Trigonia agrioensis* W., LAMBERT: 373-374, pl. 5,figs. 1-4;
- 1978 *Rutitrigonia agrioensis* (W.) PEREZ & REYES: 14-15, pl. 2, fug. 2;
- 1993 *Rutitrigonia agrioensis* (W.) LEANZA, Bull. Amer. Paleont., 105(343): 54-55, pl. 16, figs. 1-3;

Occurrences: Originally, studied samples from Upper Agrio Formation, of Neuquen Basin, Argentina,- of Hauterivian-Barremian age. In Chile is widespread in black shales of Pabellón, Arqueros, Lo Prado and Lo Valdés Formations, of also Hauterivian age.

S.C.S. occurrences: Locality VG-556-A, road Rio Morocoto-Caituco-Ojo de Agua, Sucre state, El Dantó dolostones of Hauterivian age, (DAGM), associated to abundant echinoids.

Rutitrigonia cf. fortinensis (LAMBERT, 1944)
Plate 17, figure 6;

- Cf. 1944 *Trigonia fortinensis* LAMBERT, R. M. I. P., 2(14): 386, pl. 4, figs. 5, 8;

Description: Shell small for *Rutitrigonia,* oval-elongated shape, with prominent umbos, located at ¼ anterior position. Anterior dorsal margin, straight; the posterior, widely concave. Ventral margin curved, posterior extreme, rounded. Escutcheon carinae observable only near the umbo. Flank with 17 – 19 subconcentric ribs, parallel to the ventral margin, evanescent on 1/3 posterior of the surface. Area is not ornated radially: only growth lamellae are observed.

Dimensions: The better preserved shell, measures, of Length: 36,6 mm; of Height: 21,3 mm. Collection number: UCVMG/IO-2107.

S.C.S. occurrence: Locality MC-346, Catuaro town, Sucre state, Taguarumo Formation, (sDLP, DGC), of Barremian age. Found in Cachimena and Puerto Escondido inlets, west of Cumana, in the same formation (DAGM).

Discussion: *R. fortinensis* (L.) in Argentina, is found associated to *Anditrigonia eximia* (Phiilippi) and *Steinmannella haupti* (Lambert), - Quintuco Formation, Berriasian, and Mulichinco Formation, of Valanginian age in the Neuquén Basin. *R. cf. fortinensis* is a much more elongated shell, where the subconcentric ribs only cover the anterior half of the flank. Our shell is more related to *R. tatei* (Neumayr, 1881), Neocomian of South Africa and Mozambique, than to the North American species. With resemblance to *Rutitrigonia dietrichi* (Lange, 1910) – Neocomian of Tendaguru, Mozambique – in its small size, elongate shape, but its beak is lower and has 25 concentric ribs in place of 8-10. It is less inflated than most of the *Rutitrigonia.*

Rutitrigonia longa (Agassiz, 1840)
Plate 22, figs. 1, 2;

- 1844 *Trigonia longa* Ag., d'ORBIGNY, Pal. Franç. Cretacee #3: 130-131, pl. 285;
- 1934 *Trigonia longa* Ag., OLSSON, Bull. Amer. Pal., 20(69): 30;
- 1953 *Trigonia longa* Ag., ROYO Y GOMEZ, Acta Cient.Venez. 4(4): 142;
- 1954 *Megatrigonia (Rutitrigonia) longa* (Ag.) COX, Jour. Pal. 28(5): 633;
- 1979 *Rutitrigonia longa* (Ag.) YANIN: 150-151, pl. 2, figs. 4-6;
- 1980-a *Rutitrigonia lajoyei* Deshayes in Leymerie, MACSOTAY: 254;

- 1985 *Pterotrigonia cf. longa* (Ag.) ETAYO SERNA, Proy. Cretac, Publ. Esp.#16:24: 12, 15;
- 1986 *Rutitrigonia aff. longa* (Ag.) MACSOTAY et al., 6º Congr. Geol. Venez., Mem. 10: 7136;

Occurrence: This taxon has a long Biochron: from Berriasian to Aptian, with a wide distribution area: North European Province, Peruvian, Apulian, Balkanic, S.C.S. and Neuquen Subprovinces. The type measured, of length: 80 mm.

S.C.S. occurrence: Locality MO-882, Puerto Escondido inlet, Pholadomya bed, eight articulated shells, in Lope Member of Taguarumo Formation, (DAGM) of Early Aptian age. Also in VG-382-B, road to Ojo de Agua village, quebrada El Imposible, El Dantó dolostones, of Hauterivian age. In Colombia, in Macanal shales, Valanginian age, and Apón Formation, of Late Aptian age. On la Borrachita island, also in Taguarumo Formation (ROYO Y GOMEZ, op. cit.)

Rutitrigonia longa costatissima (Petter-Receveur, 1955)
Plate 22, figures 4, 7 ;

- 1955 *Trigonia longa var. costatissima* PETTER-RECEVEUR, Ann. Paleont., 41 :62-63, pl. 1, figs. 1, 2 ;

Diagnosis : *R. longa costatissima,* has the general features of *R. longa,* as the big size: length: 90 mm, Height: 55 mm, and being very inequilateral; but the longitudinal ribs in place of becoming thicker and separated as they displace from the umbo, they stay thin and crowded until the distal margin: there are 10 by 20 mm, in place of the five of *R- longa.* The constriction of the posterior extremity is even more pronounced.

Occurrence: Sampled in Aube, France, in Late Aptian (Gargasian) sediments.

S.C.S. occurrence: Locality MO-888, Promontory to the west of Punta La Peña, of Lope Member of Taguarumo Formation, of Early Aptian (Bedoulian) age. Associated to calcareous algae, and Bivalvia as *Panopea, Neithea (Neitheops) and Aetostreon.*

Genus/Subgenus ***Buchotrigonia (Buchotrigonia)*** Dietrich, 1938.

Trans-temperte Bivalves, Euramerica and the Austral Province: New Zealand and northwest South America. According to KAUFFMAN in HALLAM et alii., (1973: 359, 372) is a cosmopolitan genus. PEREZ & REYES (1980: 39-41) proposed the Biochron a Early Cretaceous in Peruvian, Gulf-Atlantic coast, Western European Subprovinces, and S.C.S.; during Late Cretaceous, in Neuquen Subprovince.

Diagnosis: (VILLAMIL, 1992: 230) Medium to large shells, (50-80 mm long) with trigonal to elongate-elliptical outline. Wide area with oblique costae in early growth stages, which diverges in chevron-like manner from those of the flank, then smooth. Flank with three different types of costae: eccentric in early growth stages, and subsequently subvertical and transverse. Flank costae in late growth stages are not continuous.

Buchotrigonia (Buchotrigonia) abrupta (Von Buch, 1839).
Plate 20, figures 3, 4, 10;

- 1839 *Trigonia abrupta* VON BUCH, Petrifications recueillies en Amérique par Mr. A. Von Humboldt et par Mr. Charles Degehardt: 17-20, pl. 2, figs. 21, 22 ;
- 1930 *Trigonia abrupta* V.B., LISSON : 21, pl. 10, figs. 1, 2, 3 ;
- 1938 *Trigonia (Buchotrigonia) abrupta* (L. v. B.) DIETRICH: 97-101, pl. 19, figs. 3-5; pl. 20, figs. 1, 2;
- 1953 *Trigonia (Buchotrigonia) abrupta* V.B., ROYO Y GOMEZ : Acta Cient. Venez., 4(4): 145-146, fig. 8;

S.C.S. occurrences: Originally studied from Colombia, from Loma La Yesera, Villa Leyva, of Albian age (BÜRGL, 1956-b). Also from Tablazo limestones, of Late Aptian age, and La Paja Formation, of Barremian-Aptian age. The oldest records are from Villeta Group, where it is rare in the Hauterivian, but abundant in the Barremian horizons. In Venezuela, were collected in locality An-317-A, Santa Teresa de los Monos, in Caripito Member of Chimana Formation, of Middle Albian age (VIVAS, 1987). In western Venezuela, was collected in the Píche Member of the Apón Formation, of Early Albian age. ROYO Y GOMEZ (1953) reported it from a calcareous breccia of Chimana Formation, of Middle Albian age.

Occurrences: In Perú, they were collected in the Chúlec and Inca Formations, both of Albian age, (BENAVIDES, 1954: 380). In Spain, reported from from Josa and Mirambel, in the Utrillas sandstones, which are considered now as Albian-Vraconian (CANEROT, 1982).

Buchotrigonia (Buchotrigonia) cf. ***scheibei*** (Dietrich, 1938)
Plate 33, figs. 7;

- 1938 *Trigonia (Laevitrigonia) scheibei* DIETRICH: 99, pl. 20, figs. 3a, 3b;
- 1985 *Buchotrigonia cf. abrupta* (V.B.) USECHE & FIERRO, 6º Congr. Geol. Venez., Mem 1: 674;
- 1985 *Buchotrigonia aff. scheibei* (D.) ETAYO-SERNA, Proy. Cretacico, Publ. Esp. 16: 24-18; pl. 1, fig. 12;

S.C.S. occurrences Locality CH-207, Cerro Los Bordones, acantilado frente al mar, El Dantó dolostones, (DAGM), of Hauterivian age. Geol. Beatriz López (1983) collected three fragmentary casts from Quebrada Quetepe, east of Cumaná, of the same horizon. In Tachira state, one cast from Chururú member of Rio Negro Formation, of Hauterivian age. In Colombia, *B. aff. scheibei* (D.) was reported by ETAYO SERNA (op. cit.) from Barremian-Aptian horizons., as a rare species.

Occurrence: *Trigonia (Laevitrigonia) scheibei* was originally described by DIETRICH (1938: 99) from bituminous black shales, which were considered by him, as of Aptian age. The listed outcrops as the geode-bearing grayish-black slates, belong to the Lower Villeta Group, of Late Hauterivian – Barremian age (ROYO Y GOMEZ, 1942c: 341); as in Fómeque Formation, (Cundinamarca) where it becomes the only *Trigonia* in some of the beds.

Genus/Subgenus ***Buchotrigonia (Syriotrigonia)*** Cox, 1952.

According to KAUFFMAN in HALLAM et alii., (1973: 366) is a Tethyan taxon, from the Eastern Mediterranean subprovince, the Syria-Lebanon endemic center. In Venezuela, it is present in units as Tibú Formation (Perijá), the Kesima Member of Moina Formation, and El Dantó dolostones, all deposited in saline or hypersaline waters, in terrigenous sediments associated to Bivalvia as *Eocallista, Megacucullaea and Mediterraneotrigonia.*

Buchotrigonia (Syriotrigonia) cf. ***deshayesi*** (Vilanova, 1863)
Plate 15, figure 2;

- Cf. 1863 *Trigonia Deshayesi* VILANOVA, pl. 6, fig. 7;
- Cf. 1949 *Trigonia Deshayesi* V., BATALLER, Synops. Fos. Cret.,#8 (1): 15-16;
-

Diagnosis: The difference of our shell and *B. (S.) deshayesi,* Vilanova, sensu stricto, is the restriction of the 11 – 14 concentric ribs to the peri-umbonal area, not reaching further. *B. (S.) deshayesi* carries 8 – 10 ribs on the flank, which evanesce about 2/3-s of the distance from the beaks.

S.C.S. occurrence: Locality SU-9385, (coll. B. Lopez) Quetepe Grande Inlet, Cariaco Gulf, El Dantó dolostones of Hauterivian age. The nominal species was collected at Josa, Teruel province, Spain, of "Aptian" age. The locality belongs to Mirambell marls, in western Maestrazgo basin, of Hauterivian age (CANEROT, 1982).

Buchotrigonia (Syriotrigonia) gerthi (Lisson, 1930)
Plate 15, figure 10;

- 1930 *Trigonia Gerthi* LISSON, B.M.I.C., ser. 2, #20 : 8-9, pl. 3, fig. 2 ;
- 1947 *Trigonia Mathewsi* RICHARDS, : 55-56, pl. 7, figs. 9, 10 ;
- 1956 *Buchotrigonia gerthii,* L., BENAVIDES : Bull. Amer. Mus. N.H., 108(4): 368, 369;

Description: Shell large, (up to 60 mm of length) fairly thick, highly inflated below the beaks. The surface of the valve is divided into two portions by a curved keel which passes backwards from just behind the beak to the extremity of the postero-dorsal margin; the lower portion of the flank is ornamented by about 17 ribs which are sharp-crested, near the beaks and inequilateral, inclined with the short side facing the beaks; the first 7 or 8 ribs are small, roundly curved forwards, followed by ribs which become larger toward the central margin, separated by successively broader interspaces. The upper portion of the flank is broad, flattened, and transversely plicated with numerous, very closely arranged, plain, sharpcrested cotellae, which show the same type of unsymmetrical development characteristic of the lateral ribs. The costellae originate at the keel, and finally disappear at the escutcheon, which is long, broad and concave.

Occurrence: *B. (S.) gerthi* Lisson, is frequent in Santa Formation, of Valanginian age ; also in Carhuaz Formation, of Late Valanginian age both in Perú, and not Aptian, as was stated originally.

S.C.S. occurrence: Locality VG-556-A, trail from Río Morocoto-Caituco-Ojo de Agua, of El Dantó dolostones, Sucre State, of Hauterivian age.

Buchotrigonia (Syriotrigonia) libanotica (Vokes, 1946)
Plate 15, figure 3;

- 1878 *Trigonia syriaca* O*, FRAAS* : 299, pl. 5, figs. 2-5; (not Conrad, 1852)
- 1886 *Trigonia syriaca* O. FRAAS, NOETLING: 856-860, pl.24, figs. 1-4b; pl. 25, figs. 1-3;
- 1925 *Trigonia syriaca* C., DEECKE, Foss. Cat., 30: 270;(not Conrad, 1852)

- 1946 *Trigonia libanotica VOKES,* Amer. Mus. Nat. Hist., 87(3): 168, pl. 4, figs. 8-12;

Occurrence: In Lebanon, it is common in the lower Trigonia-sandstone, in Abeih, Ain Anub, Djeba'a (Aptian) and in the upper Trigonia-sandstone in Azunije and Taumat Niha, in Syria. Over 400 specimens are in the Olive-locality collection.

S.C.S. occurrence: MO-1697, Río Macoita, on the road towards Hacienda El Salvador in Tibú Formation, Perijá region, of Early Aptian age, (collected in 1977, by Paleontologist G. Benedetto), from western Venezuela.

Buchotrigonia (Syriotrigonia) lorentii (Dana, 1850)
Plate 15, figure 1;

- 1850 ?*Trigonia lorentii* DANA, Wilkes Exped.,: 721, pl. 15, fig. 2;
- 1907 *Trigonia Lorentii,* D., LISSON, Contrib. Geol. Lima, : 26, pl. 3, figs. 2a-c ; 3 ;
- 1921 *Trigonia lorentii* D. DOUGLAS : 253, pl. 15, fig. 7 ;
- 1987 *Buchotrigonia syriaca* B. Lopez : 115 ;

Occurrence : La Herradura Formation, La Virgen member, of Early-Middle Valanginian age, in the *Lissonia riveroi* ammonite-zone (ALLEMAN, 1985, Bol. Soc. Geol. Perú, #75:2). Also in Isla San Lorenzo, Salto del Fraile Formation, of Hauterivian age.

S.C.S. occurrence: In La Guajira Peninsula, is common in the Kesima member of the Palanz Formation, of Valanginian age in purple-brown greywackes (RENZ, 1960). In the same area, in Cerro Queps, in Yuruma Formation, of Hauterivian age (ETAYO SERNA, 1976: 236). In El Diamante limestone, of Caqueza Group, of Hauterivian age (OLSSON, 1956). In Sucre state, B. Lopez found in río Quetepe, in possible El Dantó dolostones (DAGM) two casts.

Genus ***Mediterraneotrigonia*** NAKANO, 1965, emend. MONGIN, 1980: 129-130.

Mediterraneotrigonia is an Eocretaceous genus, which ranges from Berriasian to Albian, but its maximum extent was during Barremian to Aptian times. Typical of the southwest of Mediterranean region, from where it migrated to Spain and South America (GILLET 1924, NAKANO, 1974). The genus evolved in hypersaline and saline marine environments, and became extinct when the salinity became euryhaline again. As ETAYO SERNA (1985-a) suggested, the migration pattern was the opposite: they originated in S.C.S. and migrated eastward, to Maghrebian, Syrian and Western European Subprovinces.

Mediterraneotrigonia hondaana (Lea, 1840)
Plate 22, figures 9, 10, 13;

- 1840 *Trigonia hondaana LEA,* Notice on Oolith. America: 256, pl. 9, fig. 9;
- 1842 *Trigonia hondaana* L., d'ORBIGNY, Voy. Amer. Merid., #3(4): 85-86, pl.19, figs. 1-3;
- 1898 *Trigonia hondaana* L., GERHARDT, :183, pl. 5, fig. 6;
- 1938 *Trigonia (Quadratotrigonia) hodaana* L., DIETRICH: 91-94, pl. 18, figs. 1-7;
- 1953 *Trigonia (Quadratotrigonia) hondaana* L., ROYO Y GOMEZ, Acta Cient. Ven., 4(4): 144-145, fig. 7;
- 1954 *Yaadia hondaana* (L.) BENAVIDES, Geol. of Northern Peru: 375;
- 1980 *Mediterraneotrigonia hondaana* (L.) MONGIN, Notes du Serv. Geol. Tunisie, #45: 131-132, pl. 2, fig. 1, 2ª, 2b, 2c; pl. 3, fig. 3; figure 5;
- 1985-a *Mediterraneotrigonia hondaana* (L.) ETAYO SERNA, Proy. Cretácico, #24: 19;

Diagnosis: Shell large and fairly thick; junction of anterior dorasl and venbtral margins forms a broad, obtuse angle; beaks small and incurved, inconspicuous; the first 5-6 are small, shrp-crested and roundly curved from the keel to the anterior margin; succeeding ribs widely spaced, nearly perpendicular, only slightly curved forward near the ventral margin, and studded with tubercles. The ribs, crenelled, are widely separated among them by smooth intervalles, only with growth lines. Area very broad and ornamented by 6 – 8 straight, procumbent assymetrical ribs, which are succeeded posteriorly by a cancellated pattern of fairly close-set tubercles.

S.C.S. occurrences: Locality MO-3171, Mundo Nuevo river, west of ElPilar town, Sucre state, of El Dantó dolostones, of Hauterivian age. Also locality JFS-106, El Blanco Lugar, Sucre state, of Taguarumo Formation, eastern facies, of Late Barremian-Early Aptian age. Locality CH-207, cliff east of Puerto Escondido inlet, Lope Member of Taguarumo Formation, of Late Barremian-Early Aptian age. One medium-sized articulated shell, was located in Morro Blanco Formation, in Venados island, of Late Berriasian-Early Valanginian age.

Occurrence: In Colombia, is found in the Rosablanca, Moina and lower Villeta Formations, of Hauterivian age; in Lower Villeta, Fómeque, La Paja and Yuruma Formations, of Barremian age, when it extended to Perú and Chile, too. During Aptian

times, the species displaced to Maghrebian, western European and Syrian Subprovinces. The normalization of the marine salinity during Albian times, extinguished this species, and its varieties. In Píche meber of Apón Formation, of Early Albian age, two fragmentary LV-s, of *M. douvillei* (Lisson, 1930) were collected from the lower *Trigonia*-bed.

Paleoecology: MONGIN (1980:132) considered that the *M. hondaana* group, inhabited the circalittoral bottoms of the tropical seas of Gondwana continent. But nobody cited ever the hypersaline/saline character of the marine waters.

Mediterraneotrigonia valentina (Vilanova, 1867)
Plate 22, figures 11, 12;

- 1867 *Trigonia valentina* Vilanova: 819;
- 1887 *Trigonia Valentina* Vilanova, MALLADA: 105, número 353, pl. 32D, figs. 1, 2;
- 1954 *Trigonia hondaana* (L.) VON DER OSTEN, Bol. Geol., Caracas, 3(8) :16 7 (partim) , pl. 7, fig. 4; (non *hondaana {Lea}* .

Diagnosis: *M. valentina* (V.) is very near to *M. hondaana* (L.) in its size, and degree of inflation, but differs in being more subquadrate in outline, and having the ribs (18 – 20) of the flank, twisted upwards, and separated by wider interspaces.

Occurrence: The localities cited by COQUAND (1865: 136, pl.24, figs. 1, 2) from the Maestrazgo basin of Spain, as Obón, Josa, Montalbán, Alcaine, Aliaga, Benasal and Todolella, belong to the Mirambell marls and Mas de Querol limestones, of Hauterivian age; the Morella clays, are of Late Barremian age (CANEROT, 1982, fig. 6.1). They are not of Aptian age, as was originally stated.

S.C.S. occurrences: Locality MO-3213, Lope Inlet, Puinare island, lower Taguarumo Formation, (DAGM) of Late Hauterivian age. In locality MC-346-C, in yellow marls at Catuaro, of El Dantó dolostones (DGC) of Hauterivian age, too. In Colombia, are found in Lower Villeta Formation, in limestones of Late Hauterivian to Early Barrmian age (ROYO Y GOMEZ, 1942C: 347).

Discussion: MONGIN (1980: 131, 132) considered *M. valentina* (Vilanova)as a synonym of *M. hondaana* (L.) , but I considere the former as an ecophenotype of the last one.

Genus ***Pterotrigonia (Pterotrigonia)*** Van Hoepen, 1929.

According to KAUFFMAN in HALLAM et alii., (1973: 359) this taxon is cosmopolitan, with a biochron of Late Jurassic (Tithonian) – Late Cretaceous. I agree with COX, (1954: 631-633) and COX et alii., (1969: N487), that Notoscabrotrigonia DIETRICH (1933), has to be kept in synonymia with *Pterotrigonia (Pterotrigonia)* sensu stricto. They inhabited ill-sorted terrigenous sediments, in saline waters.

Pterotrigonia (Pterotrigonia) caudata (Agassiz, 1840)
Plate 17, figures 6, 7, 8, 9;

- 1945[a] *Trigonia cf. caudata Agassiz,* ROYO Y GOMEZ, C. E. O.G., Colombia, #6: 221, pl. 29, fig. 2b;
- 1985-a, *Pterotrigonia cf. caudata* (A.) ETAYO SERNA, Proy. Cretácico, Publ. Esp. 16: 24-15, pl. 3, fig. 7;
- 1985 *Buchotrigonia (sic)* cf. *caudata* (Ag.) USECHE & FIERRO: 674;

Diagnosis: Shell of medium size, with length of 35 – 40mm, and height: 25 – 30 mm., thin shell, anteriorly inflated, posteriorly constricted; flanks with radial or slightly sinuous ribs , barely denticulated.

Occurrence: *P. (P.) caudata* (Agassiz) has a biochron of Berriasian to Early Albian, in North European Province, Western European and Balkanic Subprovinces, also in the Neuquen Subprovince.

S.C.S. occurrence: Locality MO-2801, Cantera Rosarito, Perijá, Tibú Formation, Late Barremian-Early Aptian age, not common. Also in locality MO-1306, in Chururu Member of Rio Negro Formation, Uribante Hemigraben, of Hauterivian age. In El Dantó Formation, in Venados Island, (DAGM), of Hauterivian age. In Mexico, in the Barril Viejo Formation, of Early Hauterivian age, and in Cáqueza sandstones, Colombia, of the same age. It is common in the Macanal Formation, of Valanginian age. In the upper carbonatic member of the Peñas Altas Formation of Early Albian age, there is a related form.

Pterotrigonia (Pterotrigonia) plicatocostata (Nyst & Galeotti, 1840)
Plate 17, figs. 1-3, 5;

- 1840 *Trigonia plicato-costata* Nyst & Galeotti, Acad. Sci. Bruxelles, Bull., 7(2): 212, pl. 1, fig. 1;
- 1934 *Trigonia plicatocostata* MÜLLERRIED, Ins. Biol. Mexico, 5:56, text figs.30-32;
- 1954 *Trigonia tocaymana* VON DER OSTEN, Bol. Geol., Caracas, 3(8): pl. 8, fig. 3; (not figs. 1, 2)

- 1965 *Pterotrigonia cf. tocaymaana* (L.) GONZALEZ DE JUANA et al.: 266; (not Lea, 1840)
- 1987 *Pterotrigonia plicatocostata* (N. & G.) B. LOPEZ,: 134;

Diagnosis: Big sized shell, reaching a height of 70 mm, and a length of 98 mm. With a cuneiform shape, alike to *P. (P.) tocaymaana,* but with the flank ornated by 27 – 32 subconcentric and sigmoidal ribs, whose lower curvature is concave towards the anterior. Escutcheon covered by 20 – 25 narrow and rounded ribs, concaves forward.

Occurrence: In San Juan Raya Formation, of Barremian-Aptian age, in San Juan Raya, Puebla, México, where it is abundant (CORDOBA et al., 1980).

S.C.S. occurrence: Locality MC-375-B, Cerro Grande, las Pozas Afuera, Sucre state, in the Lope Member of Taguarumo Formation, of Late Barremian-Early Aptian age.

Pterotrigonia (Pterotrigonia) tocaymaana (Lea, 1840)
Plate 17, figures 12, 14, 15;

- 1840 *Trigonia tocaimaana* Lea, Trans. Amer. Philos. Soc. 2(7): 256, pl. 9, fig. 8;
- 1842 *Trigonia subcrenulata* d'ORBIGNY, Coq. et Echin. Foss. Colombie: 52, pl. 19, figs. 7-9;
- 1953 *Trigonia (Notoscabrotrigonia) tocaimaana* (Lea) ROYO Y GOMEZ, Acta Cient. Venez., 4(4):142-144, figs. 5, 6;
- 1954 *Pterotrigonia tocaymaana* (L.) COX, Jour. Paleont. 28(5): 631-633, pl. 67, figs. 1, 5;
- 1954 *Pterotrigonia tocaymaana* (L.) BENAVIDES, Geology of N.Peru: 375;
- 1957 *Trigonia tocaimaana* L. BÜRGL, Bol. Geologia, Colombia, 5(2): 39, pl. 7, fig. 4;
- 1987 *Pterotrigonia tocaymana* (L.) VIVAS, Bol. Geol., Caracas, 16(29): 28, 32, fig. 21;
- 1985[a] *Pterotrigonia tocaymaana* (L.)ETAYO-SERNA , Proy. Cretacico, Publ. Esp. 16: 24-9;
- 1995 *Pterotrigonia tocaymaana* (L.) VIVAS & MACSOTAY Bol. Geol., Caracas, Publ. Especial #11: 128;

S.C.S. occurrences: Locality MO-5624, El Yaque quarry, top of fossiliferous marls, Lope member of Taguarumo Formation, of Early Aptian age. In eastern Venezuela, it is common in El Dantó, Taguarumo and Chuparipal Formations, of Hauterivian to Early Aptian age, where it can constitute monomictic beds. It is less common in Late Aptian-Early Albian Borracha and El Cantil Formations, (DAGM and DBG) associated to *Mesorbitolina texana/M. ovalis* horizons. In Caripito member of Chimana Formation, of Middle Albian age, it is rare. In Colombia, where it was originally studied, is abundant in Lower Villeta Group, of Hauterivian-Aptian age; in Fómeque, La Paja and Tablazo Formations, of Barremian-Aptian age. The Formations Une and Lidita inferior, of Early Albian age, but the youngest horizon was at Cachay, Middle Albian. In La Guajira, is common in Yúruma Formation, of Barremian age. Olistoliths with this species are reworked in Güinimita Formation, of Turonian age.

Occurrence: In Perú, is present in Chulec Formation, of early-Middle Albian age; also in Inca Formation, of Early Albian age (BENAVIDES, 1954). Present in Pananga Formation, of Late Aptian-Early Albian age.

Pterotrigonia (Pterotrigonia) tocaymaana peruana (Paulcke, 1903)
Plate 61, figures 8, 8[a];

- 1903 *Trigonia crenulata peruana* PAULCKE, N. J. Min.-Geol.P.: 17: 272-273, pl. 15, figs. 9, 9[a], 9b;
- 1934 *Trigonia subcrenulata peruana* Paulcke, OLSSON, Bull.Amer. Pleont. 20(69):28-29;
- 1946 *Trigonia aff. crenulata peruana* P., LIDDLE, Geol.of Venez. and Trinidad: 220;

Comparisons: Broadly hatchet-shaped, with the posterior area which is wide, and plainly sculptured, are the main differences with *P. (P.) tocaymaana* sensu stricto, which is sub-elongate and sickle-like shape with a rather narrow and strongly sculptured posterior area.

Occurrence: Pananga Formation, of Late Aptian-Early Albian age, in northwest Perú. In Colombia, in the Une and Chipaqué Formations, of Albian and Cenomanian ages, respectively. PAULCKE (op. cit.) erroneously attributed it to Early Turonian age

S.C.S. occurrence: Locality HA-4335, La Aguada section, Trujillo state, in La Puya member of Peñas Altas Formation of Late Albian age (ARNAUD et lii., 1999, fig. 23). Previously known from Río La Gé, Perijá region, in the Píche member of Apón Formation, of Early Albian age, where it is an index-fossil. In Maraca Formation, only ill-preserved valves were found.

Subgenus ***Pterotrigonia (Acanthotrigonia)*** Van Hoepen, 1929.

This Subgenus has a short Cretaceous biochron: Aptian to Turonian, and a wide, circum-tropical distribution: Western European, Balkanic,

Japanese-East Asian Subprovinces and Gondwana Province.

Pterotrigonia (Acanthotrigonia) crenulata (Lamarck, 1819)
Plate 61, figures 10, 11;

- 1819 *Trigonia crenulata* Lamarck, Anim. Sans vert., 6:63;
- 1844 *Trigonia crenulata* L., d'ORBIGNY, Pal. Franç. Terr. Cret.,#3 :151, pl. 295;
- 1900 *Trigonia crenulata* L., WOODS, Paleontogr. Soc. 1(1):82-83, pl. 19, fig. 14;
- 1925 *Trigonia crenulata* L., DEECKE Foss. Catalog.: 124;

Occurrences: Widespread during Cenomanian times, in Western European and North European Provinces, Maghrebian (Angola included?) and Syrian Subprovinces, where it survives until (Abeih) Turonian times. Also in the Cenomanian part of Fredericksburg Group, Texas.

S.C.S. occurrence: Locality MO-2333, Río Yasa, Perijá, upper Maraca Formation, of Early Cenomanian age, few shells.

Subgenus Pterotrigonia (Scabrotrigonia) Dietrich, 1933.

Diagnosis.- LEANZA (1993: 60) defined this subgenus: Shell of medium size, crescent-shaped. Umbones prominent, with dorsal margin shallowly concave; flank ornamented usually by tuberculated or rarely smooth costae. Area narrow, ornamented by oblique costae that forms chevrons with the flank costae (diagnostic). Escutcheon depressed, wide, with transverse costellae. The biochron extends from Late Jurassic (Tithonian) to Late Jurassic (Maastrichtian). The distribution includes the Gulf-Atlantic coast , Western European and Neuquen Subprovinces, but also North Pacific Japanese-East Asian, and S.C.S.

Pterotrigonia (Scabrotrigonia) scabra (Lamarck, 1819)
Plate 62, figure 5;

- 1844 *Trigonia scabra* L., d'ORBIGNY, Paleont. Franç., Terr. Crétaces, #3: 153-154, pl. 296;
- 1871 *Trigonia scabra* L., STOLICZKA, Cret. Pelec. Southern India: 314, pl. 125, figs. 24-26; pl. 16, figs. 35-40;
- 1913 *Trigonia scabra* L., ROMAN & MAZERAN, L.A.M.H.N. #12: 85-86.pl. 8, figs. 3-8, 8ª;
- 1962 *Trigonia scabra* L., ABBASS, G.S.M.R.D. Pal., ser, Monogr.#1: 89-90, pl. 15, figs. 1, 2, 3, 3ª, 5, 8, 7, 7ª, 9;
- 1916 *Trigonia orientalis* DOUVILLE, Terr. Second. Moghara : 168, pl. 21, figs. 14, 15 ;

Occurrence : *Pterotrigonia (Scabrotrigonia) scabra* (L.) originated in the Late Albian of Egypt and France, but is during the Cenomanian-Turonian, when became one of the most common species in the marginal seas of the Tethys Ocean, from Spain to Madagascar and India, where is dominant form in Arrialúr and Trichinopoly Groups of Turonian to Santonian age. In Transylvania, in Solymos, along the valley of Maros river in Santonian –age sediments.

S.C.S. occurrence: Locality BELI-4, headwaters of quebrada La Bellaca, Barinas, in Lower Escandalosa Formation, of Early Cenomanian age. Also in the lower sandstones of La Osa Formation, of Turonian age, in the Atarigua para-autochthon.

Paleoecology: Recent *Neotrigonia* is a shallow-burrowing filter-feeder on sandy mud substrates at depths from 11 to 80 meters (MCALESTER, 1965 in SCOTT , 1970: 71), in euhaline marine waters. This suggests a parallelism with *Pterotrigonia (Scabrotrigonia) scabra*, a taxon which originated, when the salinity crisis was over, during Late Albian times. The paleodepth is coincident with the ill-sorted tempestite-ridden grits at the base of La Osa Formation (MACSOTAY et al., 1987: 21-23).

Genus ***Linotrigonia*** Van Hoepen, 1929.

Linotrigonia is a cosmopolitan taxon, according to KAUFFMAN in HALLAM et alii., (1973: 359). Its Biochron extends from Late Jurassic to Late Cretaceous, but its arrival to S.C.S. only occurred during Albian times, when the high hydrodinamisme and important influx of fluvial apports, started to normalize the salinity.

Linotrigonia cf. clavigera (Cragin, 1893)
Plate 61, figure 14;

- Cf. 1893 *Trigonia clavigera* CRAGIN, Invert. Paleont. Texas Cretaceous:212-213, pl. 46, figs. 12-13;

Occurrences: Cooke County, Texas, in Upper Washita Group, of Cenomanian age.

S.C.S. occurrences: Locality MO-2333, Yasa River, Perijá region, Upper Maraca Formation, of Early Cenomanian age. LIDDLE (1946: 220) collected it from Río La Gé, in grey arenaceous marls of "Upper Cogollo Formation"of Aptian-Albian age(?).

Linotrigonia limbata (d'ORBIGNY, 1844)
Plate 61, figure 7;

- 1844 *Trigonia limbata* d'ORBIGNY, Paleont. Franç., Terr. Cretacé: 156-157, pl. 298;
- 1862 *Trigonia distans* COQUAND, Prov. Constantine: 202, pl. 12, fig. 9 ;(non CONRAD, 1852)
- 1863 *Trigonia limbata* d'O., ZITTEL, :160, pl. 9, fig. 1[a];
- 1912 *Trigonia ethra* Coq., PERVINQUIÈRE, Pal. Tunisienne : 218, pl. 15, figs. 4-7 ;
- 1965 *Trigonia ethra* Coq., PALLA, Rev. Ital. Paleontologia, 71(1) : 1290-191 ;
- 1975 *Pterotrigonia limbata (*d'ORBIGNY), CZABALAY: 442-443;

Diagnosis: Shell very inequilateral, subtrigonal, with pointed opistogyre beaks; flanks with 20 slightly nodulous oblique ribs.

Occurrence: Originated at Late Albian (Vraconnian) in the Maghrebian Subprovince. During Cenomanian times, proliferated in all the Gondwanan Province, extending to India, Palestina and Angola. During the interval of Turonian to Campanian times, extended to Western European Gulf-Atlantic coast and Apulian Subprovinces.

S.C.S.occurrence: Locality MO-2333, Yasa River, Perijá, Upper Maraca Formation, of Early Cenomanian age. Also in La Osa Formation, Atarigua para-autochthon, of Turonian age.

Genus ***Oistotrigonia*** COX, 1952.

COX et alii., (1969 : N483) cited this taxon, as cosmopolitan, with a biochron of Early to Late Cretaceous. KAUFFMAN in HALLAM et alii., did not even mention this very interesting taxon. It thrived in brackish, mostly mesohaline but also oligohaline waters. *Oistotrigonia* is not associated to other genera of Trigoniacea, and if this happens, the degree of preservation of both is very different. In my opinion, *Oistotrigonia* since its origination, occupied lagoonal and deltaic complex environments, as the Purbeckian and Wealdian facies. Its resemblance with *Linotrigonia* Van Hoepen, is due to convergence, and they should be treated separately, as did ETAYO SERNA (1985a).

Oistotrigonia archiaci (d'ORBIGNY, 1844)
Plate 46, figure 5;

- 1844 *Trigonia archiaciana* d'ORBIGNY, Paleont. Franç, Cret., #3: 142-143, pl. 290, figs. 6-10;
- 1847 *Trigonia archiaciana* d'O., PICTET & ROUX, Moll. Foss. Grés verts etc.:453, pl. 35, fig.4 ;
- 1875 *Trigonia archiaciana* d'O., LYCETT, Monogr. Brit. Foss. Trigoniae: 140-141, ol. 23, figs.78; pl.25, fig. 10;
- 1954 *Trigonia archiaci* d'O., VILLATTE, B.S.H.N.T., #39: 202-203, pl. 1, figs. 3, 4, 5;

Diagnosis: Shell higher than long, weakly inflated, where the flank is separated from the area by a weak marginal keel; the area is flat and quite well developed; the escutcheon is at the base of a narrow and depressed region, near the posterior border. The flanks are ornated with concentric, regular ribs, covered by protruding ridges; these ribs constitute sharp chevrons, which point towards the beak. Over the area the ribs are narrow, and cut by longitudinal striations; on the flank, they form yuxtaposed small tubercles.

Dimensions: About 20 mm of height, and 18 mm of width; the shells are replaced by dolomite, and encrusted by ferrolite. Our shells are of about the same size, of the *O. archaici* of the Glauconitic sands of Paris Basin, and in the Pyreneés, of Early Albian age.

Occurrence: In England, characterizes the Lower Greensand, of the zone *mammillatum,* of Early Albian age (CASEY, 1961: 605). In Spain, was reported from Utrillas Formation, Teruel, Maestrazgo Basin, of mid-Late Albian age (CANEROT, 1984), and not Late Aptian, as was stated by MALLADA (1887). Utrillas Formation, is overlaying a lignite-carrying unit, the Escucha Formation, a regressive unit.

S.C.S. occurrence: Locality Santa Teresa-Los Monos, Anzoategui state, from Caripito Member of Chimana Formation, of Middle Albian age (VIVAS, 1978). Also in Arbol Redondo section, upper carbonatic member of Peñas Altas Formation, of Early Albian age.

Paleoecology: Usually found monomictic, associated to brackish-water bivalves. The reported ferrolite-incrusting of some sandstones cited by many geologists (ARDAENS, 1981; VIVAS, 1978) is mostly colloidal iron hydroxide, concentrated in tropical rivers, during the dry season, and not necessarily altered glauconite or pyrite.

Oistotrigonia ornata (d'ORBIGNY, 1843).

1844 *Trigonia ornata* d'ORBIGNY, Paleont. Franç. Cretacé, #3: 136-137, pl. 288, figs. 5-9;

- 1900 *Trigonia ornata* d'O., WOODS, Palentogr. Sc. 1(1): 85, pl. 19, fig. 13;

- 1900 *Trigonia ornata* d'O., WOLLEMAN, Neocom. Holl., Deutschl.,:88-89;
- 1921B *Trigonia ornata* d'O. GILLET, B.S.S.H.n. Yonne, 75: 5, pl.2, fig. 1;
- 1974 *Linotrigonia (Oistotrigonia) ornata* (d'O.) DIMITROVA, Foss. Bulgaria, #4b: 95-96, pl. 45, figs. 5, 6, 7;
- 1985-a, *Oistotrigonia aff. ornata (*d'O) ETAYO SERNA, Proy. Cretacico, #24: 18, pl. 1, fig. 3;

Diagnosis: Larger in size, than *O. archiaci* (d'Orbigny), has greater convexity, the umbones are much more prominent, and are more recurved; the ribs are also different; their anteal enlargement and posteal attenuation, and slight sinuation upwards are also different. Together with the superior surface forms a considerabl angle with the other portion of the valve. The costae (about 21) are large, rounded and closely arranged.

Occurrence: Species with wide diffusion in the Wealdian facies of North European Province, Balkanic and Maghrebian Subprovinces, in Valanginian to Aptian stages. In England, present in zones *martinoides, deshayesi and fissicostatus* (CASEY, 1961: 605).

S.C.S. occurrence: Locality PM-10-B, road from Pajaral-La Margarita, Margarita mudstones, (sDLP, DGC) of Hauterivian age. Few transported, disarticulated valves, associated to wealdian Bivalves: *Myrene, Eocallista,* etc. In Colombia, frequent in Macanal mudstones, and in Caqueza Group, of Valanginian-Hauterivian age (ROYO Y GOMEZ, 1942; ETAYO SERNA, 1985-a). Also in Palanz Formation, of Valanginian age (BÜRGL, 1960a).

Oistotrigonia spinosa (Parkinson, 1811)

- 1900 *Trigonia spinosa* Park., WOODS, Paleontogr. Soc., 1(1): 86-87, pl. 23, fig. 10; pl. 24, fig. 8, 9: pl. 28, figs. 1, 2;
- 1875 *Trigonia spinosa* Park., LYCETT, Monogr. Brit. foss. Trigoniae: 136-139, pl. 23, fig. 10; pl. 24, figs.8-9, non pl. 28, figs. 1-2;
- 1932 *Trigonia spinosa* Park, BASSE, Ann. Paleontologie #21: 123, pl.6, figs. 3-7 ;
- 1980 *Linotrigonia (Oistotrigonia) spinosa* (P.) MONGIN & PEYBERNES, Paleogeogr., Paleoclim., Paleoecol., 32(1980/81): 233;

Occurrence: This pecies, O. spinosa (P.), has an extended biochron: from Late Aptian to Maastrichtian. In North European Province, Western European and Maghrebian Suprovinces, it reached its acme during Cenomanian times. In Madagascar, it survived until Maastrichtian times.

S.C.S. occurrences: Locality HA-4343, La Urbina nord section, in the lowest fossiliferous bed of La Puya Member of Peñas Altas Formation, of late Middle Albian age (ARNAUD, et al., 1999, figures 33). In Colombia, cited from La Paja Formation, of Late Aptian age.

FAMILY ***LUCINIDAE*** Fleming, 1828.

Species of *Lucina* and the many related genera and subgenera range from littoral to abyssal depths; they are in general more typical of shelf depths, but small thin-shelled forms are most common in bathyal and outer shelf zones (KAUFFMAN, 1976: 509). Deep-water species have preference of green and brown clay-rich muds. They are mucus-tube feeders (STANLEY, 1968: 216).

Subfamily ***LUCININAE*** Fleming, 1828.

Genus ***Lucina*** Bruguière, 1797.

Its biochron ranges from Late Cretaceous to Recent, with distribution in Europe, Africa, Asia and North America (COX et alii., 1969: N492). Also in South America.

Lucina ?teutoburgensis (Wolleman, 1900)
Plate 37, figure 3;

- 1884 *Lucina cf. Sanctae crucis* PICTET & CAMPICHE, WEERTH, Neocomsandstein: 44, pl. 8, fig. 14, 15; (not PICTET & CAMPICHE, 1857)
- 1900 *Lucina teutoburgensis* WOLLEMAN, Neocom. Holl., Deutschl.: 105-106, pl. 5, figs. 4, 5;

Diagnosis: Small, subcircular in outline, higher than wide, regularly inflated. One RV with some of the shell preserved on its flank; sculpture is composed of concentric threads.

Occurrence: Relatively common species in the claystones of the Hilssandstein, -Late Aptian-Early Albian- of northern Germany.

S.C.S. occurrence: Locality VG-139, Río Aragua, north slope of the Cerro Grande, Monagas state, of Garcia Formation, DBG, of Late Aptian age. Few ill-preserved casts.

Genus ***Callucina*** Dall, 1901.

According to KAUFFMAN, in HALLAM et alii., (1973: 361) this taxon is endemic in the Indo-mediterranean Region. We add four species from the S.C.S.; its biochron would be Early Cretaceous (Berriasian) to Recent. This genus profited from the special condition of the saline

and hypersaline basins, as was S.C.S.: the great biomass of leptopel in suspension, where the mucus tube feeders would be in great advantage. Many of the predators of these Lucinids (crustaceans, fishes, etc.) would be simply absent. The enclosed basins would concentrate great volumes of clay-size sediments, which would facilitate the reproduction of genera as *Callucina. C. cornueli* (d'ORBIGNY) is a common fossil in the Paris Basin and the Jurassian region, with a biochron of Valanginian to Early Aptian; its maximum abundance is in the "calcaire à Spatangues", a saline deposit dominated by echinoida (GILLET, 1921B: 21, 22). In Switzerland, in Mont Salève, in the Bed nº 5, of Valanginian age (DE LORIOL, 1961: 79-80, pl. 10, fig. 3).

C***allucina cf. olea*** VOKES, 1946
Plate 40, figure 3;

- 1946 *Callucina olea* VOKES, Amer. Mus. Nat. Hist.:87(3): 190, pl. 7, figs. 14-17;

Diagnosis: This is a well-marked species, quite different from any of the forms referred to "Lucina"that have been reported from the Gondwanan Province. The peculiar nature of the concentric sculpture is distinctive and will serve to distinguish it: the general outline, with the straight posterior dorsal, and long straight posterior margins being sharply angulate at their junction (VOKES, op. cit.).

Occurrence: The "Olive"locality, of Lebanon, of Late Aptian-Early Albian age.

S.C.S. occurrence: Locality VG-110, West of Cerro Piedra de Rayo, in marls of Garcia Formation, of Late Aptian age.

Observations: About eight fragments were collected, the best, illustrating the sculpture: "The surface of the valves is marked by a coarse concentric sculpture as follows: a series "of concentric plates of gradually increasing size, overlapping "shingle-like" away from the "umbones." The illustrated fragment, of 20 mm of height, was part of a shell of about 50 mm of height. This is almost twice, than the size of the Holotype of VOKES (op. cit.), of 27,3 mm of height.

Callucina cf. horni (Whitney, 1952)
Plate 49, fig. 21;

- 1952 *Lucina (Phacoides) horni* WHITNEY, Jour. Paleont., 26(5): 705, pl. 89, fig. 4, 5;

Occurrence: Locality MO-2877, Ojal del Purgatorio, Bergantin area, Anzoategui state, El Cantil Formation, of Lower Albian age (VIVAS, 1987).

Dimensions: The cast measures, of Height: 49 mm, of Length: 56 mm and thickness: 15 mm. The original shell of *C. horni* (W.) - based of a small cast, of Height: 24 mm, of Length: 28 mm, and thickness, 10 mm, collected from the top of the Glen Rose Formation, of Early Albian age,- is the half of the size of ours, and are more flattened.

Callucina neuquensis (Haupt, 1907)
Plate 21, figures 14, 20;

- 1907 *Lucina Neuquensis* HAUPT, N.J.M.G., Paleont. #23: 217-218, pl. 10, figss. 3, 3ª;
- 1931 *Lucina neuquensis* H., WEAVER, U. Washington, Mem. #1: 352-353, pl. 39, figs. 238, 239 and 240;
- 1937 *Lucina neuquensis* H., FERUGLIO, M. I.G.Univ. Padova, #11: 19-20, pl. 1, figs.8, 11;
- 1977 *Lucina cf. neuquensis* H., RICCARDI, N. Jb. G., Paleont. Abh., 155(2): 233-234, fig. 3 l;

Observations: Medium-sized Shell, belonging to the clade of *C. cornueliana (*d'Orbigny, 1844) – Neocomian of France, northern Germany and Switzerland, - but it has more circular shape, and less inflated valves. The concentric growth lamellae are numerous and regularly separated; interspaces occasionally with fine concentric striae.

Occurrences: collected originally from the Neuquen Subprovince, Argentina and Chile, - from Tithonian to Valanginian – also in Springhill Formation, (cf.) Patagonia.

S.C.S. occurrences: Locality VG-382-B, quebrada El Imposible, Serrania de La Paloma, El Dantó dolostones, of Hauterivian age (sDLP, DGC). In Colombia, in the evaporitic Rosablanca Formation, of Valanginian-Hauterivian age (BÜRGL, 1952).

Callucina plicatocostata (d'ORBIGNY, 1842)
Plate 14, figures 14, 14ª;

- 1842 *Lucina plicato-costata* d'ORBIGNY, Coq. Foss. Colombia: 48-49, pl. 3, figs. 13, 14;
- 1886 *Lucina plicato-costata* d'O., KARSTEN,:18;
- 1938 *Lucina (Phacoides) plicatocostata* d'O., DIETRICH: 101, pl. 20, fig. 10;
- 1980-B *Lucina plicatocostata* d'O., MACSOTAY, : 26;
- 1985 *Lucina (¿) plicatocostata* d'O., ETAYO SERNA, Proy. Cret., Publ. Esp. 16:24-9;

Occurrences: Originally collected from a black limestone from Pitaquiro, between Honda and Bogotá, of the Villeta Group. Associated with the

ammonite *Pulchellia galeata*, its Barremian age was well established. Also in the Cáqueza Group, and upper Apón Formation, of Colombia. In Peru, in black limestones of Potreroseco, of Hauterivian age (PAULCKE, 1903: 290).

S.C.S. occurrences: Locality PM-04-C, road from Pajaral to La Margarita, in La Margarita mudstones, (sDLP), of Hauterivian age. In western Venezuela, in locality 1306, in Chururu member of Rio Negro Formation, of Hauterivian age. In lower limestone member of Peñas Altas Formation, of Late Aptian age; and La Puya member of the same unit, of Late Albian age. All the material collected in Venezuela, consisted in disarticulated shells, mostly biodegraded.

Genus ***Mesolinga*** Chavan, 1951.

According to COX et alii., (1969: N498) the biochron of this taxon is Late Jurassic-Cretaceous. KAUFFMAN in HALLAM et alii., (1973: 368) this genus is of North Temperate Realm, of North European Province, Gulf-Atlantic coast and Japanese-East Asian Subprovinces.

Mesolinga? argine (Coquand, 1865)
Plate 37, figure 14;

- 1865 *Dosinia argine* COQUAND, Mem. Soc. Emul. Provence, #3: 297, pl. 18, figs. 6, 7;
- 1887 *Venus (Dosinia) argine* C. MALLADA: Synopsis..España, #3: 92, pl. 33B, figs. 3-4;
- 1940 *Lucina kellumi* IMLAY, Geol. Soc. Amer., Bull. 51(1) : 153-154, pl. 4, figs. 3-6;

Occurrence: In Mexico, at the top of Barril Viejo shales, of Valanginian age. In Spain, in the Maestrazgo Basin, in Villarroya de Los Pinares Formation, Teruel, of Aptian (Gargasian) age (CANEROT, 1982).

S.C.S. occurrence: Locality HA-4285, La Loma section, lower carbonatic member of Peñas Altas Formation, Trujillo state, (ARNAUD et alii., 1999, figure 20) of Early Aptian age, associated to echinoids. Also in locality VG-139, outcrop on the road and bridge of Rio Cristalino, to Toma de Agua, Garcia Formation,(DGC) Sucre State, of Late Aptian age.

Subgenus ***Myrteinae*** Chavan, in COX et alii., (1969 : N499)
Genus ***Lucinoma*** Dall, 1901.

According to COX et alii., (1969: N500) this genus has a biochron from Oligocene to Recent. The biogeographic distribution extends from Europe, Red Sea, North America, Pacific Ocean, Australia and Japan. In my files, there are several Cretaceous species: *Lucinoma? kotoi* (Nagao) – Aptian-Albian, Miyako Group, - Iwate Prefecture, Japan, *Lucinoma nicaisei* (Coquand), - Albian of Aumale, Algeria, and Cenomanian of Egypt, *Lucinoma porrecta* (Gerhardt), - Aptian or Albian, of Villeta Group of Colombia, *Lucinoma valdensis* (Pictet & Campiche) – Late Aptian, Switzerland, Maroc and Sardinia, and, *Lucinoma* (?) HAYAMI, (1965b) – Aptian-Albian,- also fom the Miyako Group of Japan.

All these Cretaceous localities, are located along the Tropical belt , and I consider it a termophyllic genus.

Lucinoma porrecta (Gerhardt, 1898)

- 1898 *Lucina porrecta* GERHARDT, V. Neues Jahrb. Miner. Geol., #11: 162-163, pl. 3, fig. 13:
- 1938 *Lucina porrecta* G., DIETRICH, Min. Indus., T.Dept. Min., Petr.:101-102, pl. 20, figs. 11, 12;
- 1985-c, *Lucina porrecta* G., ETAYO SERNA, Proy. Cretac. #25-3;

S.C.S. occurrences: Originally collected from *Pulchellia*-carrying geodes, in Grupo Villeta, of Barremian age. The oldest horizon is Rosablanca Formaton, an evaporitic unit of Hauterivian age. Other units, are: La Paja and Moina Formations, of Barremian age. In Venezuela, is frequent in the Taguarumo Formation, (locality CH-207), always as disarticulated shells. In the Garcia Formation (locality VG-139; DGC) about six articulated shells, of a related species (cf.), of Late Aptian age.

Genus ***Mesomiltha*** Chavan, 1938.

According to COX et alii., (1969: N500) its Biochron is: Early Jurassic to Late Jurassic, ?Cretaceous whose distribution area is only Europe.

Mesomiltha? syriaca (Conrad, 1852)
Plate 33, figures 21, 22;

- 1852 *Lucina Syriaca* CONRAD, "…Palestine Expedition":219, pl. 10, fig. 57;

Diagnosis: Suborbicular, inequlateral, ventricose, suddenly contracte don the anterior and posterior submargins; umbonal slope angular; posterior margin subtruncated, direct; basal margin profoundly rounded. (CONRAD, op. cit.). Additional data from BLANCKENHORN (1934: 234): cast 17-20 mm of length, 19 mm of height, and 13 mm of thickness.

Occurrence: Orginally collected in Bhamdûn, Lebanon, whose age is Late Albian (Vraconnian?). Also cited in Argelia, in Albian sedimentary rocks.

S.C.S. occurrence: Locality VG-432, Km. 6,3 Km on the road Agua Fría arriba-Campo Alegre, Sucre State, Valle Grande Formation, of Middle Albian age. It is associated to belemnites, ammonites and dwarf gastropods. Also in Lower Borracha Formation, in shale interbed, Borracha Island, (DAGM) only casts, of Late Aptian age. No sculpture is preserved.

Discussion: *M. portlandica* (J. de C. Sowerby), (COX, 1929: 179-180; ALENCASTER, 1977: 175, figures 6a-c) of Portland beds, -Ryazanian age,- and San Ricardo Formation, Chiapas, Mexico, of Berriasian age, is very much alike, but *M. syriaca* (C.) is more inclined backwards, and is more inflated.

Subfamily ***MILTHINAE*** CHAVAN, in COX et alii., 1969;
Genus ***Pseudomiltha*** P. Fischer, 1887.

Pseudomiltha is a large-sized genus, with a Biochron of ?Jurassic, Eocene to Miocene. Its distribution includes Europe, Asia, South America, and West Indies (COX et alii., 1969: N504).

Pseudomiltha cf. cycloides (Philippi, 1899)Plate 46, fig. 1;

- 1899 *Trigonia cycloides* PHILIPPI, Fos. Secundarios de Chile: 87, pl. 37, figs. 1, 2;
- 1925 *Trigonia cycloides* P., DEECKE, Fossilium Catalogus #30: 126;

Description: Well preserved casts of a big-sized Bivalve, whose measurements are, of Height: 78 mm, -incomplete,- Length: 87 mm, the Thickness of cast: 45 mm (PHILIPPI, op. cit., pl. 37, fig. 1) the beak is missing. Of rounded shape, with long, narrow anterior scar, and rounded short posterior scar. Shell margin internally smooth.

Occurrence: Tinguiririca valley, Chile, associated to Neocomian Bivalvia. The cast is of limestone.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, El Cantil Formation, (DBG) of Late Aptian age. Two casts were collected, with their beaks fractured. The narrow anterior scar is relatively well preserved. The exposed surface of the cast was incrusted by several polychaeta shells (*Parsimonia)*, suggesting that the loss of the aragonitic shell happened in situ, due to the acidity of the oligohaline waters.

Discussion: Our cast, measures, of Height, 92 mm, (umbo fractured), of width: 89 mm, and Thickness: 28 mm. The cast from El Cantil Formation, is relatively higher, and less inflated than *P. cycloides* (Philippi).

Pseudomiltha germani (Pictet & Campiche, 1866) Plate 16, figure 12;

- 1866 *Lucina germani* PICTET & CAMPICHE, Paleont. Suisse, #3: 286, pl. 122, figs. 5, 5a ;
- 1953 *Lucina germani P. & C.,* MONGIN & TROUVË, Bull. Soc. Geol. Franç. 6(3): 236;

Diagnosis: Cast of a compressed shell, oval shape, wider (60 mm) than high, almost equilateral. Beaks moderately elevated, excavated in the place of the lunule but straight in the escutcheon's place. The anterior muscle scar starts near the border, and is elongated; the posterior, less visible. The palleal line is simple.

Occurrence: Collected in the *Nerinean* and *Harpagodes* limestones in Nozeroy, Jura mts., Switzerland, of Valanginian age. Also in the *Matheronia*-bed, of Point Sublime, France, in Early Valanginian age marls.

S.C.S. occurrence: Locality MC-338-H, El Cordon-Cariaco road, (DGC), El Dantó dolostones, of Hauterivian age. Our cast preserved the ornamentation: fine, numerous, regular concentric growth lines, which are stronger in antero-dorsal and posterior areas of the disc. The dimensions of our cast, are: Length: 72 mm, and Height: 64 mm.

Pseudomiltha ? rottierensis new species, Macsotay Plate 21, figures 1, 4, 5;

- 1972 *Bivalvia* gen. indet., THIELUOY, Geobios, 21/22, pl- 1, fig. 10; pl. 2, fig. 6; pl. 3, fig. 1;

Description: Well-preserved cast, of size exceptionally big, trigonal subovoidal, equivalve, moderately inequilateral, and regularly inflated. The umbos are prosogyrous, cleanly incurved over the cardinal line, and placed about the middle of the dorsal margin. The anterior region is subrectangular, elevated by a dorsal-marginal thin partition, which passes gradually to a short lunule. The posterior region, notably more developed than the anterior, is regularly convex over the dorsal margin, and symmetrically incurved towards the straight ventral margin. Escutheon is elongated and ovoidal. The flanks are regularly convex without a diagonal crest. The palleal line is a belt up to 1 to 2 cm, marked by dense radial striations. The surface of the cast near the beaks and the medial area of the flanks, is covered by a field of discontinuous radial grooves.

The shell – exceptionellement preserved, - was thin, and only with growth striations, with no radial component (THIELUOY, op. cit.). There is a wide palleal sinus (plate 30, figure 1) starting from the lower part of the anterior muscle scar, and finishing (?) near the posterior muscle scar. This feature is alike to *P. (P.) gigantea* (Deshayes), the type species of *Pseudomiltha* (COX et alii., 1969: N504).

Dimensions: Several of the casts were measured: Length: 210 mm, Height: 150 mm, and Thickness: 80 mm; Length: 160 mm, Height: 123 mm, and Thickness: 72 mm. (THIELUOY, op. cit.). Illustrated specimen: (plate 30, figure 1) Length: 139,5 mm, Height: (restored) 126 mm.

Paleoecology: The samples were collected in a carbonatic lens in a calcareous shale of the zones *jeannoti and nodosoplicatum,* of Hauterivian age, in the Vocontian Basin, France. It was considered as an analog to deep-sea hydrothermal vents, due to the unusual occurrence of large brachiopods, bivalves and gastropods (KIEL, CAMPBELL & GAILLARD, 2010). The brachiopod is *Peregrinella multicarinata* (Lamarck, 1819) which was a hydrocarbon-seep taxon (KIEL & PECKMAN, 2008) as was demonstrated by geochemical and petrographical analysis realized in the associated sediments.

Family ***THYASIRIDAE*** Dall, 1901;

Also infaunal mucus tube feeders (STANLEY, 1960). As the Family Lucinidae, they also preferred soft muds, in the aphotic deep-shelf and slope environments.

Genus ***Thyasira*** Leach in Lamarck, 1818.

With a biochron of Cretaceous-Recent, this genus had an unusual distribution: North European Province, North Pacific Province, Australian, Gulf-Atlantic coast Maghrebian and Syrian Subprovinces. Now we add S.C.C.

Thyasira sculpta f. barremiensis (MONGIN, 1980)
Plate 30, figure 6;

- 1844 *Lucina sculpta* Phil. D'ORBIGNY, Pal. Franç., Crétace, :118-119, pl. 283, figs. 1-4;(non PHILIPS, :122, pl. 2, fig. 15)
- 1979 *Lucina sculpta* P., BUSNARDO & THIELUOY : 36 ;
- 1980 *Thyasira sculpta* forme *barremensis* MONGIN Notes Serv. Géol. Tunisie, 45 : 134;

Diagnosis : Small sized shell, trigonal, with prominent beaks; surface ornated with irregular, rounded in section concentric ribs, with the posterior area and lunule relatively small, not delimited by a keel or a straight line. These characters are the distinction of *T. sculpta sculpta* Phillips.

Occurrence: MONGIN (op. cit.) proposed the shells of Djebel Oust, of Tunisie, as the type for the forme *barremensis.* But the French samples from the Vocontien Basin, are also more alike to the form *barremensis.* The *T. sculpta* PHILLIPS (1829, Geol. Yorks. Part 1: 122, pl. 2 fig. 15) was originally collected from Speeton clay (zone of *Belemnites minimus*) of Ryazanian – Valanginian, and Lower Gault of Folkestone (Aptian) and the Neocomian of Westfalia, Germany, all from the North European Province. The f. *barremiensis* is common in Barremian and Bedoulian hemipelagic sediments of Maroc and Tunisia.

S.C.S. occurrence: In Colombia, ETAYO SERNA (1985-c: 25-3) reported juveniles of *T. sculpta* (IGM 185 069) collected in Valanginian age sediments of the Cordillera Central. In Venezuela, from locality MO-6319, in hemipelagites from Carorita Formation, Lara Nappe, of Hauterivian age (MACSOTAY et al., 1987, fig. 2).

Thyasira cf. simplex (GAMAL MAHMOUD)
Plate 56, figure 3;

- 1916 *Anisocardia hermitei* DOUVILLE , Terr. Second. Moghara, Sinai: 156, pl. 19, figs. 14-16 ; (non CHOFFAT, 1902, Siphonidae, : 133-134, pl. 9, figs. 4-7 ; *=Ambocardia).*
- 1955 *Anisocardia (Collignonicardia) simplex* G. MAHMOUD, Faune Crét. Moghara, Sinai : 121, pl. 10, figs. 5-8 ;

Occurrence : Originally collected at Gebel Rishat Manzour, Maghara area, Sinai Peninsula, Egypt, in sediments of Middle Albian age. Belongs to Syrian Subprovince.

S.C.S. occurrence: Locality MC-431-A, hard ground with glauconite on the road west from Catuaro, La Hacienda, Valle Grande Formation, (DGC) of Middle Albian age. Well preserved casts, goethite pseudomorphs. In Guáimaros shales of Peñas Altas Formation, of Early Albian age, several pelomorphically deformed casts, probably represent this species (GARCIA JARPA et al., 1980).

Family ***MACTROMYIDAE*** Cox, 1929.
Genus ***Clisocolus*** Gabb, 1869. (=*Unicardium* d'ORBIGNY, 1850)

According to KAUFFMAN in HALLAM et alii., (1973: 368) this genus belongs to the North Temperate Realm: the North Pacific and the North European Provinces. Its Biochron extends from

Jurassic, - Early Cretaceous (Berriasian) to Late Cretaceous (Maastrichtian). It was a mud-dwelling taxon, mostly on the outer shelf.

Clisocolus ebrayi (de LORIOL, 1882)
Plate 47, figure 1;

- 1882 *Unicardium ebrayi* DE LORIOL, Mem. Paleont. Suisse, 9: 70, 71, pl. 8, figs. 13-16;

Diagnosis: A typical *Clisocolus,* has a thin shell, edentulous hinge, and is more elongated anteriorly than posteriorly. Length: 19 – 27 mm, collected in the Albian of Cosne, France.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, El Cantil Formation, (DBG) of Late Aptian age (VIVAS, 1987). The dimensions of our specimen are, Height and Length, 17 mm, both. Located 1 meter above the *Mesorbitolina texana/M. ovalis* horizon.

Clisocolus gaultinum (PICTET & ROUX, 1852)
Plate 45, figure 7;

- 1852 *Corbis gaultina* PICTET & ROUX, Moll. Foss. Grès verts de Genève, :448, pl. 34,fig.4 ;
- 1866 *Fimbria gaultina* PICTET & RENEVIER, : 282-283, pl. 122, figs. 3, 4<,
- 1907 *Unicardium ? gaultinum (P. & R.)* WOODS, Paleontogr. Soc., 2(4): 163-164;

Occurrence: The type was collected in Saxonet, and Samoens, -Switzerland – in Albian sediments; PICTET & CAMPICHE (1864-67) cited it from the Reposoir syncline, of Albian-Early Cenomanian age. RENEVIER (1867) reported it from the Vraconnian.

Diagnosis: Of medium size, (Length: 38 mm) subcuadrangular shape, irregular, ornated by concentric folds, covered by fine, radial striations.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, El Cantil Formation, of Late Aptian age, DBG.

Discussion: The best of the casts sampled, (plate 45, fig. 7) measured, of Width: 28,6 mm, and of Height: 25,3 mm. Only weak traces of the concentric sculpture, are preserved. In locality MC-125-A, in the Punceres anticline, in Guacharo member of El Cantil Formation, of Early Albian age, a better preserved left valve (Height: 25 mm) was found with concentric sculpture of rounded cords, separated by narrow interspaces. I presume is a well-preserved juvenile.

Clisocolus inornatus (d'ORBIGNY, 1844)
Plate 14, figure 13;

- 1844 *Cardium inornatum* d'ORBIGNY, Pal. Franç., Cretacé, #3:24, pl. 256, figs. 3-6;
- 1921b *Unicardium inornatum* GILLET, Bull. S.S.Hist. Nat. Yonne, 75:24;

Occurrence: Distributed in Western European, Maghrebian and Syrian Subprovinces, with a biochron of Late Valanginian to Hauterivian. In Ethiopia, in the Anthala Formation, of Hauterivian-Barremian age.

S.C.S. occurrence: Locality MC-346-C, Catuaro town, Sucre state, Taguarumo Formation, (DGC), of Late Hauterivian-Barremian age. The host-rock is a calcareous shale, of deep-water facies. The height is 32 mm, and the width: 31 mm.

Discussion: *Unicardium sp.* (STOYANOW, 1949, Geol. Soc. Amer. Mem. 38: 95, pl. 16, fig. 4) is a RV from Quajote member, of Lowell Formation, of Aptian age,- is a related form, but it is wider than high.

Genus ***Thetis*** J. de C. Sowerby, 1826.

According to KAUFFMAN in HALLAM et alii., (1973: 368) this genus belongs to the North Temperate Realm in the Euramerican Region. Its Biochron is intra-Cretaceous (Valanginian to Cenomanian). *Thetis* could be another genus well adapted to saline marine waters.

Thetis minor J. de C. Sowerby, 1826.
Plate 18, figures 14, 15;

- 1826 *Thetis minor* SOWERBY, Min. Conch.: 21, pl. 513, figs. 4-6;
- 1865 *Thetis laevigata* d'Orb. PICTET & CAMPICHE, Paleont. Suisse :203, pl. 112, fgs. 2, 3 ;
- 1899 *Thetironia minor S.,* ANTHULA, :88-89, pl. 4, fig. 3a-3d ;
- 1961 *Thetironia minor* J. de C. SOWERBY, CASEY: 606;
- 1988 *Thetis minor* Sow., DHONDT & DIENI, Mem. Soc. Geol., #11; 45, pl. 7, fig. 14;

Occurrence: Hauterivian – Aptian, ?Albian (DHONDT & DIENI, op. cit.). Its distribution includes North European Province, Western European, Apulian and Balkanic Subprovinces, but also in East African Province. In England, is known from *fissicostatus*-zone (Early Aptian) to *mammillatus*-zone, of Early Albian (CASEY, 1961: 606).

S.C.S. occurrence: Locality VG-384-A, Ojo de Agua-Santa Rosa road, between Rio Grande and quebrada del Medio, Sucre state, in Upper El Cazon Formation, of Early Valanginian age. Three casts, crushed by pelomorphosis. Also in MC-341-C, from La Hacienda/Rio Carinicuao, Sucre state, of El Dantó dolostones, of Hauterivian age.

Family ***FIMBRIIDAE*** Nicol, 1950.
Genus ***Mutiella*** Stoliczka, 1871.

According to KAUFFMAN in HALLAM et alii., (1973: 361) this genus is endemic in Indo-Mediterranean region. Its Biochron is Cretaceous, (Aptian to Senonian).

Mutiella pulchelliphila (Gerhardt, 1898)
Plate 56, figure 1.

- 1898 *Corbis pulchelliphila* GERHARDT, V. N. J. Miner. Geol. #11: 161-162, pl. 3, figs. 14a, 14b;

S.C.S. occurrence: Originally sampled from Loma del Petaquero, (Cundinamarca, Colombia) of the Villeta Group, of Barremian age. ROYO Y GOMEZ (1954b) collected it in Une Formation, of Barremian-Aptian age. In Venezuela, in locality MC-446-D, La Hacienda road west of Catuaro, three well-preserved casts in Valle Grande Formation, of Middle Albian age. FRAUNFELTER in KEY (1960: 521) cited it from Lisure Formation, of Middle Albian age.

Dimensions: Our cast, measures, of Width: 11.5 mm, and of Height: 10,0 mm (plate 56, figure 1).

Discussion: Our shell is related to another dwarf Bivalve, *Mutiella goldfussi* (Deshayes, 1843-1854) – Purbeckian, Late Jurassic saccaroid dolomites, of Jura mts., Switzerland, (MAILLARD, 1884, Paleont. Suisse, #11: 103-104, pl. 3, figs. 19, 21), which is more strongly inequilateral and inflated.

Genus ***Sphaera*** Sowerby, 1822.

According to KAUFFMAN in HALLAM et alii., (1973: 369) *Sphaera* is and endemic taxon in the North European Province. Its Biochron extends from Early Cretaceous (Berriasian) to Late Cretaceous (Turonian), so it was perfectly adapted to the hypersaline/saline paleoenvironments of the Tethys Ocean.

Sphaera americana (IMLAY, 1940)

- 1940 *Sphaera americana* IMLAY, Geol. Soc. Amer., Bull. 51(1): 153, pl. 7, figs. 2,3; pl. 8, figs. 8, 9;
- 1985-c, *Anisocardia cf. neocomiensis* (d'O.) ETAYO SERNA, Proyecto Cretacico, 24: 21, pl. 4, fig. 8; (not d'ORBIGNY 1843 , nor Agassiz, 1842).

Diagnosis: Shell subovate inoutline, equivalve, inequilateral, highly convex; beaks prominent , strongly incurved, close together, situated ¼ to 2/5 the length of the Shell, from the anterior extremity. Lunule depressed. Escutcheon triangular, adductor scars large, moderately impressed. Ornamentation of strong, concentric, unequal ribs with sharp summits, separated by broader furrows, on both of which are numerous small concentric ribs.

Dimensions: Length: 62 mm, Height: 59 mm and thickness: 51 mm.

Occurrences: In Barril Viejo shale, just below Padilla limestone, Coahuila, Mexico, of Hauterivian age. In Venezuela, reported in Isleta Lobo, northwest of Borracha Island,(DAGM) in El Dantó dolostones, of Hauterivian age (LIDDLE, 1946: 153, 154). In Colombia, in the Macanal shales, of Hauterivian age, a well-preserved cast of *S. americana,* was mistaken with *Ambocardia neocomiensis* (Agassiz), a Dicerocardiidae.

Sphaera corrugata J. Sowerby, 1822
Plate 10, figure 14;

- 1822 *Sphaera corrugata* J. Sowerby, Min. Conch., 4:42, pl. 335;
- 1842 *Venus cordiformis* Leymerie, Mem. Soc. Geol. France, 2(5) : 5, pl. 5, fig. 8 ;
- 1842 *Cardium galloprovinciale* MATHERON, Catal. Foss. Bouches-du-Rhone : 155, pl. 17, fig. 1, 2 ;
- 1907 *Sphaera corrugata* S., WOODS, Paleontogr. Soc. 2(4) : 157-159,pl. 24, fig. 24, plate 25, figs. 1-2; text-fig. 26;
- 1938 *Corbis (Sphaera) corrugata* S., DIETRICH: 102, pl. 21, figs. 1a, 1b;
- 1953 *Corbis (Sphaera) corrugata* S., ROYO Y GOMEZ: 147;
- 1957 *Sphaera corrugata* S., VON DER OSTEN, Jour. Paleont. 31(3) : 582, pl.64, figs. 12, 13 ;
- 1988 *Sphaera corrugata* S., DHONDT & DIENI, Mem. Soc. Geol., #11:46-47, pl. 10, figs. 7-10; text figs. 20;

Diagnosis: Thick, heavy shell, subequilateral, very inflated, with orthogyrous beaks, surface with corrugated concentric ribs.

Dimensions: An average articulated shell measures, of height: 61 mm, of width: 64, mm, and thickness: 50 mm.

Occurrence: Valanginian to Late Aptian, (?Cenomanian). Present in all the subprovinces of Gondwanan Province: S.C.S., Western European, Balkanic, Peruvian, Maghrebian, but also in North European and East African Provinces.

S.C.S. occurrences: Locality Suc-521 south of El Brasil hill, SW of Cumana city, Taguarumo Formation, (ROYO Y GOMEZ, 1953), of Barremian age. It is one of the most common Bivalve of the Taguarumo Formation, in all its outcrops (MACSOTAY et al., 1986: 7138). In Western Venezuela, in Tibú Formation, Perijá, of Aptian age. In Colombia, in Caqueza Group, of Valanginian age, in Yúruma , - Barremian,- and Fómeque Formations, -Aptian age. In Early Albian is present in Une Formation in Colombia, and Inca Formation, in Perú (BENAVIDES, 1954: 380).

Paleoenvironments: Disarticulated valves are found locally in Lope member of the Taguarumo Formation, of Late Barremian-Early Aptian age. Most of them are densely encrusted with the polychaeta *Filograna.*

Family ***UNGULINIDAE*** Adams & Adams, 1857.
Genus ***Brachymeris*** Conrad, 1875.

According to KAUFFMAN in HALLAM et alii., (1973: 365) it is part of the North Temperate Realm – The Gulf and Atlantic Coastal Plain Subprovince. Here, we are presenting five taxa of S.C.S., proving that *Brachymeris* was not cryophyllic but is an amphi-American genus. Its Biochron extends from Aptian to Turonian age (Gallic stage). *"Venus" icaunensis* d'ORBIGNY, (1845, Pal. Franç.,#3: 439, pl. 384, figs. 4-6) – of Hauterivian sediments in the Paris Basin, could be the first *Brachymeris.*

Brachymeris ex gr. aspera (STEPHENSON, 1952)
Plate 48, figure 14;

- 1952 *Lucina aspera* STEPHENSON, U. S. Geol. Surv., Prof. Paper 242: 101, pl. 24, figs. 15, 15;

Occurrence: Originally collected from Templeton member of Woodbine Formation, of Cenomanian age.

S.C.S. occurrence: Locality MC-95-A, cerro Piedra de Rayo, Monagas state, Caripito Member of Chimana Formation (DBG), of Middle Albian age.

Description: Our cast is medium-sized, thick-walled, subcircular in outline, strongly convex for the genus, slightly inequilateral. Beaks prominent, prosogyrate. Lunule small, and there is no escutcheon. Postero-dorsal slope weakly nexcavated. Surface marked by fine growth lines, and rendered rugged by four irregularly spaced pronounced resting stages. No radial sculpture is preserved. Half of the dital margin is broken off.

Dimensions: Our specimen is roughly six times bigger than *B. aspera* sensu stricto, measuring of height: 32,4 mm, and of length: 26,6 mm.

Observations: This is a new species, but more material is needed, to study the hinge-line, and could be one of the tropical species of *Brachytrema.*

Brachymeris cf. circulus (Wolleman)
Plate 37, figure 15;

- 1900 *Lucina circulus* WOLLEMAN, Neoc. Holland & Deutschl.: 105, fig. 2;

Occurrence: Originally collected in Kniestedt, Germany, in the Flammenmergel Grünsand of Aptian age. Also reported from La Caja Formation, Mexico, of also Aptian age.

S.C.S. occurrence: Locality VG-139, Garcia Formation, (DGC), of Late Aptian age.

Discussion: Taxon represented by three casts: shell fairly small, equivalve, inequilateral, subovate in outline, moderately convex. Beaks fairly prominent, curved inward and forward, situated at 1/3-d of the posterior margin. Dorsal margin concave in front of the beak. Anterior margin rounding abruptly into dorsal margin, posterior margin long and gently convex, lunule deeply impressed. No sculpture is preserved. Hinge unknown. It is more assymetrical than *B. circularis* Wollemann.

Dimensions: Height: 21mm (partly fractured) width: 18 mm (pl. 37, fig. 15, RV).

Brachymeris aff. fallax (FORBES, 1846)
Plate 56, figure 11;

- 1846 *Lucina fallax* FORBES, Trans. Geol. Soc., London, (2), #7: 143, pl.17, fig. 8)

- 1871 *Lucina fallax* F., STOLICZKA Cret. Funa S. India: 256, pl. 13, figs. 13, 15-17; pl. 14, figs. 3-5, 7-8;
- 1963 *Lucina aff. fallax* F., FAWZI, M. D. Geol. Mus., Paleont. #2: 66-67;

Occurrences: In Pondicherry, India, this species is present continuously from the Utatúr to the Arrialúr Groups, of Cenomanian to Maastrichtian age (STOLICZKA, 1871: 257). This is a highly variable shell, in its shape, and the thickness of the articulated valves. In Egypt, are common in Early Cenomanian horizons.

S.C.S. occurrence: Locality MO-1156, Los Arillos creek, Niquitao area, Guayacan member of Capacho Formation, of Late Turonian age.

Dimensions: Samples from La Grita, Tachira state, measured, of Height: 28 mm, and width: 25 mm. The plain variety of FAWZI (1963) is common in Niquitao area, and measures, of Height: 17,2 mm, and width: 17,3 mm.

Discussion: Comparing *B. fallax* with *B. circulus,* is evident the relationship among them: the first descended from the second, which migrated eastward, toward seas, where the oceanological conditions were not so stressful, as in S.C.S.

Brachymeris cf. seminalis (STEPHENSON, 1941)
Plate 48, figure 6;

- Cf. 1941 *Lucina seminalis* STEPHENSON, Texas Univ. Bull. 4101: 191-192, pl. 34, figs. 1, 2;

Description: It is very much alike to *B.seminalis* s.s. – of Navarro Group, of Campanian age, of Gulf-Atlantic Coast Subprovince,- but it differs in its more hexagonal outer shape. Beaks moderately prominent, in curved prosogyrate; hinge unknown; lunule short, broad and sharply outlined. Surface smooth, with shallow concentric depressions on the antero-distal area.

Dimensions: The measurement are: of Height: 10 mm, and Width: 10 mm.

S.C.S. occurrence: Locality An-77, Cerro las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Early Albian age.

Family ***CARDITIDAE*** Fleming, 1828.

Infaunal siphon feeders, according to STANLEY (1960). Biochron: Devonian to Recent.

Subfamily ***CARDITAMERINAE*** Chavan, in COX et alii., 1969: N548-N549.
Genus ***Cretocardia*** Conrad, 1877.

According to KAUFFMAN in HALLAM et alii., (1973: 366), *Cretocardia* belongs to Tethyan Realm, of the North Indian Ocean Subprovince. I dispose of five taxa from S.C.S. Eocretaceous sediments. COX et alii., (1969: N551) restricted it to Late Cretaceous. Our Biochron extends from Early Cretaceous (Berriasian) to Late Cretaceous (Turonian). Is one of the genera that profited from algal fields, in brackish waters.

Cretocardia cf. cottaldi (d'ORBIGNY, 1844)

- 1844 *Cardita Cottaldina* d'ORBIGNY, Pal. Franç. Terr. Cretaces, #3: 91, pl. 269, figs. 6-8;
- 1906 *Cardita Cottaldina* d'O. WOODS, Paleontogr. Soc. 2(3): 126-127, pl. 18, figs. 15,16:

Diagnosis: The shell is quadrate in outline, very convex, carinate, and somewhat longer than high. The ornamentation appears to consist of about 40 ribs, separted by interpaces of great width.

Occurrence: Present in Cenomanian of France and England.

S.C.S. occurrence: Locality HA-4431, road La Pastora-Jabón, upper carbonatic member of Peñas Altas Formation, Trujillo state, of Early Albian age. Is above the *Mesorbitolina texana-M. pervia* horizon (ARNAUD et alii., 1999, fig. 26).

Cretocardia* cf. *exotica (d'ORBIGNY, 1842)

- 1842 *Astarte exotica* d'ORBIGNY, Coq. Et Echionod. Foss. Colombie: 48, pl. 3, figs. 11, 12;
- 1877 *Cardita exotica* d'Orb., GABB: 287, pl. 41, fig. 2, 2a; non pl. 42, fig. 1 (=*Glyptoactris [Baluchicardia} beaumonti)*
- 1985[a] *"Epicyprina" exotica* (d'O.) ETAYO SERNA, Proy. Cretacico,#16: 24-2;

Occurrence: Casts originally collected from Las Palmas, Province of Socorro, Colombia, of Neocomian? age. In Perú, it was collected from Hacienda del Imperial, near Cañete, Dept. Huancavelica, of an undetermined Jurassic? age, corrected to Cretaceous by RAIMONDI.

S.C.S. Occurrence: ETAYO SERNA (1985A) interpreted it as an *Epicyprina,* collected in the Apón Formation, of Late Aptian age. We collected at VG-383-A, Ojo de Agua-Santa Rosa road, between Río Grande and Quebrada del Medio, Sucre State, El Cazón Formation, of Late Berriasian-early Valanginian age, one sample, preserving the shell, but pelomorphically deformed. The ornamentation of tuberculated radial ribs, suggests the genus *Cretocardia.*

Cretocardia monginae new species, Macsotay
Plate 8, figures 4, 6, 11; pl. 9, figure 7.

Diagnosis: Subquadrangular, moderately inflated shell, with prosogyrate beaks, situated in the anterior 1/3. External surface with 18-20 radial ribs, finely tubercular, separated by deep interspaces, wider than the ribs themselves.

Etymology: This new species is dedicated to Mme. Denise MONGIN, Eocretaceous Molluskan specialist of France and Tunisie , who was kind enough to provide me with paleontological literature.

Dimensions: The Holotype, UCVMG/IO-2576, measures, of Length: 23 mm, of Height:19 mm (pl. 8, figure 6); the Paratype, measures of length: 20 mm, and of Height: 13 mm.

S.C.S. occurrence: Locality VG-381, road Ojo de Agua-Santa Rosa, between Río Grande and Qebrada del Medio, Sucre State, El Cazón Formation, of Late Berriasian-Early Valanginian age, associated to the genera *Catinula and Gresslya.* Unfortunately, many of the shells are intensely deformed, not only due to the halite, but also de dolomitization.

Cretocardia cf. yaffarensis (Rochebrune, 1882)
Plate 6, figures 4, 5;

- 1882 *Cardium yaffarense* ROCHEBRUNE, : 33, pl. 2, fig. 4;
- 1988 *"Cardium" gillieroni* Pictet & Campiche, DHONDT & DIENI : 50, pl. 12, fig. 7 ; (non PICTET & CAMPICHE : 252, pl. 119, fig. 2 ; pl. 120, figs. 1, 2)

Occurrence : Originally studied from the Neocomian of d'Oursangelis, Somalia. From Sa Oche (Lanaitto), Sardinia, a cast of LV was illustrated from Early Valanginian horizon.

S.C.S. occurrence: Locality VG-376, Ojo de Agua-Santa Rosa road, between Rio Grande and Quebrada del Medio, (DGC) of ElCazón Formation, from the lowest bed, of Late Berriasian age. The presence of this taxon in Somalian Subprovince, and in S.C.S., in times of the Early Neocomian, suggests that the currents on the shallow shelf, kept circulating all along the Tethys Ocean, even in times of the maximum difficulty due to the tectonics.

?Cretocardia sp. indet. Macsotay
Plate 54, fig. 6;

Description: One fragment of the LV of a possible *Cretocardia sp.* fragmentary and biodegraded, having attached a stromatoporoid colony. The radial ribs, which are narrower than the interspaces, have on theit tops, fine bead-like structures.

S.C.S. occurrence: Locality MO- 3110 , Quebrada Santa Rosita, Perijá area, Piche member of Apón Formation, of Early Albian age.

Genus ***Cyclocardia*** Conrad, 1867.

The taxon *Cyclocrdia (Cyclocardia)* has a biochron of Late Cretaceous (Cenomanian) to Recent, and a cosmopolitan distribution (COX et alii., 1969: N551).

Cyclocardia circularis (Gabb, 1877)
Plate 9, figure 10;

- 1877 *Cardita (Cyclocardia) circularis* GABB, Jour. Acad. Nat. S. Philadelphia #8: 288, pl. 41, figs. 3, 3a;

Description: Shll nearly circular, compressed; beaks somewhat anterior, not very prominenty; anterior, posterior and ventral area forming continuously ¾-s of a perfect circle; cardinal margin sloping convexely; under the beaks the anterior end is slightly excavated; lunule very small; surface cpvered by 27 – 28 regular radiating ribs, each producing a corresponding crenulation on the inner margin. Height and width: 14 mm both (GABB, op. cit.). The shell was partially eroded.

Occurrence: Between Chonta and Quevopalco, Distrito Baños, Province Huamalíes, Huánuco department, Perú. BENAVIDES (1956) considered it from Santa Formation, of Berriasian-Valanginian age.

S.C.S. occurrence: Locality VG-384, Ojo de Agua-Santa Rosa road, between Río Grande and Quebrada del Medio, Sucre State, the uppermost dolomite bed of El Cazón Formation, of Early Valanginian age.

Cyclocardia dux (Gerhardt, 1897)
Plate 52, figures 6, 7;

- 1897 *Cardita (Venericardia) dux* GERHARDT, V. N. Jahrb. Min., Geol. #11:84-85, pl. 1, figures 8ª, 8b, 8c, 8d;
- 1975 *Cardita (Venericardia) dux* G., TELLO; Catálogo Fauna Venezolana, #8: Mollusca: 296;

Diagnosis: Strong, thick shell, beaks prominent, surface with 18 – 20 radial ribs, with narrow interspaces; lunule large, smooth and slightly convex. Cardinal area with strong teeth.

S.C.S. occurrence: La Teta de Niquitao, Trujillo state, La Grita member of Capacho Formation, of Late Albian-Early Cenomanian age. At locality MO-

1154, quebrada Los Arillos, Guayacán member of Capacho Formation, of Late Turonian age, where it is associated to *Freiastarte sieversi* (Gerhardt).

Genus ***Fenestricardita*** Casey, 1961.

According to KAUFFMAN in HALLAM et alii., (1973: 369, *Fenestricardia* sic) is widespread, endemic in North European Province. The type species, *F. fenestrata* (Forbes), is an Early Aptian taxon, from zones *fissicostatus-forbesi* (CASEY, 1961: 601). With three species known, the biochron of this genus goes from Valanginian to Cenomanian (ETAYO SERNA, 1985-a).

Fenestricardita cf. boyacaense ETAYO SERNA, 1985-a
Plate 13, figures 6, 8;

- 1985[a] *Fenestricardita boyacaense* ETAYO SERNA, Proyecto Cretacico, #24: 19, pl. 1, figs. 1, 14; pl. 7, fig. 5;

S.C.S. occurrence: Locality MC-341-C, La Hacienda/Río Carinicuao, Sucre state, El Dantó dolostones, of Hauterivian age. The Colombian nominal species was collected from Macanal Formation, of Valanginian age.

Discussion: Our shell, a RV, is also of small size, rhomboidal-rounded, elongated antero-postriorly, the anterior margin rounded, the posterior, truncated and straight. The difference with the nominal species, is the absence of the umbonal-marginal keel; our taxon is ornamented with 24 – 26 rounded, prominent, ribs, all of the same size, not differentiated as in *F. boyacaensis* and not crossed by commarginal concentric ribs. The ribs in the area near the beak, carry small beaded ornate; the intercostal spaces are narrow.

Dimensions: The best preserved shell, but still incomplete, measures, 26,5 mm of Height and Width.

Comparisons: *Fenestricardia fenestrata* (Forbes, 1845), - Late Barremian to Early Aptian, England (CASEY, 1961: 606) and Jura mountains of France- is also a small species, with the cancellated sculpture covering all the surface.

Subfamily ***CARDITESINAE*** Chavan in COX et alii., (1969: N556).

Genus ***Ludbrookia*** Chavan, 1951.

According to KAUFFMAN in HALLAM et alii., (1973: 368) this genus is representative of the Euramerican region, of the North Temperate Realm, with a biochron of Albian-Cenomanian. *Ludbrookia* was favored by high salinities, and high organic but low Oxygen content in the bottom waters. In the Maghrebian and S.C.S. they are well represented since Berriasian times. Their frequency, and good preservation (most shells articulated in the sediment) suggests the absence of natural enemies due to salinity. Comparable to Recent *Cardita ,* which is a filter-feeder in shallow marine waters attached to a firm substrate by a byssus.

Ludbrookia arivechensis (Heilprin, 1891)
Plate 56, figures 4, 5;

- 1891 *Cardita arivechensis* HEILPRIN: 452;
- 1910 *Cardita posadae* BÖSE: 126, pl. 25, figs. 4, 6, 7;
- 1952 *Cardita staffordi* WHITNEY: Jour. Pakleont., 26(5): 704-705, pl. 88, figs. 3, 4;
- 1970 *Ludbrookia arivechensis* (H.) SCOTT: 65-70, pl. 1, figs. 1-16; text-figs. 4 A-L;
- 1977 *Ludbrookia arivechensis* (H.) SCOTT: 1152, pl. 1, figs. 17, 18;
- 1987 *Ludbrookia arivechensis* (H.) VIVAS, Bol. Geol. Caracas, 16(29): 27;

Diagnosis: Moderate size, trapezoidal, strongly prosogyrate with incurved beaks; 22 – 25 angular ribs much narrow than U-shaped interspaces and with strongly arched, flaring nodes.

Occurrence: In Texas and northern Mexico, Fredericksburg Group, of Middle Albian age, and Upper Fredericksburg, Late Albian, associated to *Oxytropidoceras chihuhuense.* Scarce in Glen Rose Formation, of Early Albian age.

S.C.S. occurrence: Locality MC-271-C, south of Cerro Grande, northeast of Catuaro, Chimana Formation (DAGM); also in Caripito member of Chimana Formation, all of Middle Albian age. Also found in El Cantil Formation of Early Albian age (DBG) (VIVAS & MACSOTAY, 1995: 136). In western Venezuela, in upper carbonatic member of Peñas Altas Formation, 3 meters below of contact with La Puya Member an in the member, too; Late Albian age.

Ludbrookia cf. belviderensis (Cragin, 1894)
Plate 56, figure 17;

- 1894 *Cardita belviderensis* CRAGIN, :5, pl. 1, figs. 9, 10;
- 1970 *Cardita belviderensis* C. SCOTT: 71;
- 1977 *Ludbrookia belviderensis* (C.) SCOTT: 1154, pl. 1, figs. 17, 18;

Occurrence: Originally studied from Kiowa Formation, Kansas, U.S.A., of Late Albian age. In Colombia, was cited from Cenomanian sediments.

S.C.S. occurrences: Locality MO-2478, Yasa River, Perijá region, lower Maraca Formation, of Late Albian age. It is common in the basal limestone of the formation. In locality ED-08, in Quebrada El Dantó, coquinoid limestone, lens in Mapurite Member of El Cantil Formation, Latest Aptian of Earliest Albian age. This detrital limestone, intensely bioturbated by *Teicichnus and Rhizocorallium* ichnospp. The molluskan shells, - a thanatocenosic assemblage,- are heavily incrusted by polychaeta.

Ludbrookia cf. constanti (d'ORBIGNY, 1844)
Plate 54, figure 3;

- Cf. 1844 *Cardita Constantii* d'ORBIGNY, Pal. Franç. #3, Bivalvia: 89-90, pl. 269, figures 1-5;
- Cf. 1866 *Cardita Constantii* d'O., PICTET & CAMPICHE, Pal. Suisse : 337-338, pl. 126, fig. 10 ;
- cf. 1979a *Ludbrookia constantii* d'O. MONGIN, Stratotype Albian : 19, pl. 2, fig. 8;

Diagnosis: Trapezoidal short LV, with fine echinate ribs, and posterior depression; shell thich as in *L. constanti,* but the posterior area is wider, than the anterior. Also alike to *L. dupiniana,* which is ornamented by 26 radial ribs, but they are sharp and narrow, as in *L. constanti.*

Occurrence: Present in St. Croix, Switzerland, in Aube, France, in Early Albian sediments. In Middle Albian is common in the Paris Basin, and in Morocco.

S.C.S. occurrence: Locality HA-4502, section Cerro Los Platones (La Loma) of Early Albian age, (ARNAUD, 1999, Fig. 29), where it is associated to *Icanotia and Tylostoma.*

Discussion: *Maghrebella bisculpta* (Gerhardt) – Albian, Colombia.- is also elongated, but its radial ribs are restricted to the posterior half of the shell, and is of smaller size.

Ludbrookia cumanesa (VON DER OSTEN, 1957)

- 1957 *Cardita cumanesa* VON DER OSTEN, Jour. Paleont. 31(3) : 581, pl. 64, fig. 8 ;
- 1954 *Cardita cf. C. neocomiensis* d'O., VON DER OSTEN, Bol. Geologia, Caracas, 3(8): 169, pl. 9, fig. 1; (not d'ORBIGNY, 1843),
- 1985ª *Ludbrookia dietrichi* (R. y G.) ETAYO SERNA, Proyecto Cretacico, Publ. Esp. 16: 24-12; (not ROYO Y GOMEZ , 1942c)

Diagnosis: Shell small, subquadrate; sculpture consisting of 32 serrate, radial ribs, of which 22 extend from the beak to the ventral border, the other ten ornamenting the anterior and postrior margins; intercostal spaces about the twice as wide as the ribs; anterior <and posterior margins nearly straight, joining at an angle of 80º.

Dimensions: Height: 19 mm, Length: 21 mm, depth (only RV), 9 mm

S.C.S. occurrences: Locality MMH-Su-110, west coast of Picuda Grande Island, (DAGM) Taguarumo Formation, of Barremian age (VON DER OSTEN, op. cit.).

Comparisons: Is similar to *Ludbrookia belviderense,* Cragin, - Kiowa Formation , Kansas, of Late Albian age,- but is distinguished by its smaller size, the form of the beak, and the more numerous and narrower ribs.

Ludbrookia dietrichi (Royo y Gomez, 1942c)
Plate 32, figures 3, 12;

- 1938 *Cardita (Venericardia) cf. neocomiensis* DIETRICH, Lamel. Cret. Cord. Oriental: 100, pl. 20, figs. 6-7;
- 1942c *Venericardia dietrichi* ROYO Y GOMEZ,: 341-342;
- 1953 *Cardita (Venericardia) dietrichi* (ROYO Y GOMEZ) Acta Cientifica , 4(4): 146-147;
- 1985ª *Ludbrookia dietrichi* (R. Y G.) ETAYO SERNA, Proyecto Cretacico, #24:19;

Diagnosis: Shell thick, oblong-cuadrangular slightly inflated, ornated with strongly tuberculated ribs, 24 – 26 in number.

Dimensions: Our sample, UCVMG/IO2120, measures, of Length: 30,7 mm and Height: 27,7 mm. ROYO & GOMEZ (1953: 146) reported it from Borracha Formation, Height: 33 mm, width: 42 mm and thickness: 27 mm.

Occurrences: Originally collected in Lower Villeta Formation, of Late Hauterivian to Barremian age, and Lower Yúruma Formation, of Barremian age. According to ETAYO SERNA (op.cit.) its biochron in Colombia extends from Hauterivian to Aptian.

S.C.S. occurrences: Locality VG-376-D, Ojo de Agua-Santa Rosa road, between Río Grande and Quebrada del Medio, of El Cazon Formation, (DGC) of Late Berriasian-Early Valanginian age. Eighteen well-preserved articulated shells were collected. Another locality is MO-5617: fourth pass over the Río Carinicuao, in Taguarumo Formation biodetrital limestones, of Barremian age (DAGM): mostly disarticulated valves. Reported from Lower Tibú Formation, Perijá, of Late Barremian-Early Aptian age (KEY, 1960: 519). Locality VG-110-A, of Lower Garcia Formation, of Early Aptin age: only disrticulated valves.

Ludbrookia neocomiensis (d'ORBIGNY, 1842)

Plate 9, figure 15;

- 1842 *Cardita neocomiensis* d'ORBIGNY, Paleont. Franc. Terr. Cretace, #3:85, pl. 267, figs. 1-6;
- 1900 *Cardita neocomiensis* d'O. WOLLEMAN, : 93-94, pl. 4, fig. 10;
- 1921B *Cardita neocomiensis* d'O. GILLET: 17;

Occurrences: In the "Calcaire à Spatangues", Paris Basin, Jura mts., and in Gildehaus sandstones, in Northern Germany, of Hauterivian age, is one of the most wide-spread bivalves. In Elligser Brink, the measurements are, Width: 13,5, Height: 12 mm, and thickness of both valves: 11 mm. In North European Province, it survives until Cannonenberges marls, of Barremian-Aptian age.

S.C.S occurrences: Locality VG-382 B, Ojo de Agua village, quebrada El Imposible, El Dantó dolostones, of Hauterivian age. Our shell is of bigger size, than the European: Width: 27,5 mm, Height: 25 mm.

Discussion: *L. neocomiensis* seems to be closely related to *Ludbrookia struckmanni* Von ALTH (1881: pl. 27{10}: 1, 5) of the Nizniow limestone, of Ryazanian age, southern Poland. This small shell exhibited beading on the top of the radial ribs, but the wide interspaces are ornated by four fine rdial striae. This could be the first true *Ludbrookia,* confirming the salinization in most of the Western Tethys Ocean, in the opposite shoreline of Gondwana continent.

Ludbrookia stabileana (de LORIOL, 1866)
Plate 32, figures 8, 9;

- 1866 *Cardita stabileana* de LORIOL in FAVRE: 73-74, pl. C, fig. 5;

Diagnosis: Is rapidly distinguished by the 32 – 33 radial ribs, which are narrow and with serrated tops. It was considered near to *L. neocomiensis* (d'O.) by de LORIOL. The proximity of many growth lamellae, forms the serrated tops. The orginal decriptiopn was based on one RV; we dispose of a LV, which is very inequilateral, nd pounded posteriorly. Young specimens are ven more echinate (Plate 32, figure 8).

Dimensions: The width: 12,5 mm, and the height: 11,5 mm: UCVMG/IO-2121, three adult LV, one juvenile.

Occurrence: In the Grand Salève mountain, in the Urgonian limestones, of Barremian age, western Switzerland.

S.C.S, occurrence: Locality VG-672, Nueva Colombia, Sucre State, Taguarumo Formation, of Barremian age; associated to *Amphitriscoelus waringi* and *Eunerinea hicoriensis*.

Ludbrookia valdensis (PICTET & CAMPICHE, 1853)
Plate 9, figure 5;

- 1866 *Cardita valdensis* PICTET & CAMPICHE, Paleont. Suisse, #3: 332-333, pl. 126,fig. 3 ;
- 1916 *Cardita brouzetensis* COSSMANN in BRUN, Plaeontogr., #51: 37-38, pl. 4, figs. 23-25;

Occurrence: The casts that originated the name, *L. valdensis,* were found in la Rusille, in a bed between the Pierre Jaune de Neuchatel, (Hauterivien) and the base of the Urgonian limestones, of Late Barremian age. The synonymous "*Cardita" brouzetensis,* was collected with well-preserved both valves articulated, at Angustines, Orgon, France, of Barremian age.

Dimensions: Antero-posterior diameter: 16 mm; umbono-palleal diameter: 11 mm; thickness of articulated valve: 10 mm (COSSMANN in BRUNN, op. cit.).

S.C.S. occurrences: Locality VG-382, Ojo de Agua-Santa Rosa road, type locality of El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age.

Ludbrookia cf. villersensis (Pictet & Campiche, 1856)
Plate 7, figs. 4, 9, 10, 17;

- Cf. 1866 *Cardita villersensis* PICTET & CAMPICHE, Pal. Suisse, #3 : 332, pl. 126, fig. 2a, b, c, d ;

Diagnosis : Dwarf species with the same shape as *L. neocomiensis* (d'Orbigny), but differs in the ornamentation, reduced to granular concentric cords, the radials are very small and secondary to the concentric cords. Length: 10 mm, Height: 7,5 mm.

Occurrence: In the limonite of Villers-le-Lac, Switzerland, of Valanginian age.

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, between Río Grande and Quebrada del Medio, Sucre State, El Cazón Formation, of Late Berriasian-Early Vlanginian age. Also cited from Macanal Formation, Colombia, of the same age (ROYO Y GOMEZ, in ETAYO SERNA, (1964: 98) as *Venericardia cf. sanctae-crucis* (Pictet & Campiche).

Genus ***Xenocardita*** Vokes, 1946.

According to KAUFFMAN in HALLAM et alii., (1973: 366) is a Tethyan genus, of the Syrian-Lebanon endemic center, in Eastern Mediterranean Subprovince. Now we report it from Venezuela (S.C.S.) evidencing that this genus was present in all the northern margin of Gondwanan Province. Is thermophyllic and favored by saline seas. Its biochron extends from Berriasian to Aptian.

Xenocardita ferryi new species, Macsotay
Plate 8, figures 1, 3, 7, 8, 13;

Description: Shell small, roundish-quadrangular, a little longer than high, tumid, inequilateral, more or less scaly ribs, separated by V-shaped furrows. Umbones oblique, incurved, closely approximate antemesial. Anterior and posterior margins rounded, the hinge margin gently sloping backwards, the ventral regularly rounded. Surface sculptures with 16 – 19 radial, compressed scaly ribs; the scales suberect, round at the end, imbricate; interspaces of the ribs wide and deep, much wider in the antero- and postero-dorsal area. Lunule small. Characters of the interior, unknown.

Dimensions: The dimensions are, of the Holotype, Height: 16 mm, the Width: 17 mm; the Paratype, Height: 20 mm, the Width: 17,6 mm. The holotype, is UCVMG/IO-1777, and the paratype, UCVMG/IO-1778.

Etymology: Dedicated to the hard-working Sedimentologist M. le Prof. Serge Ferry, - Departement des Sciences de la Terre, Université Claude Bernard, Lyon, - whose research cleared many of the sedimentary anomalies of the Vocontian Basin, in France.

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, between Rio Grande and Quebrada del Medio, Sucre State, of El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age. Also in MC-341-C, La Hacienda/Río Carinicuao, Sucre State, of El Dantó dolostones, of Hauterivian age (DAGM).

Discussion: *X. ferryi* n. sp., keeps resemblance with *X. lacunaris* (Hamlin) emend. VOKES (1946, Amer. Mus. Nat. Hist. 87(3): 182, pl. 7, figs. 1-8) – the type of *Xenocardita,*- which is common in the *Trigonia*-sandstone of Abeih and Naaman, of Aptian age. The differences are almost the twice in size, more rounded shape, and more numerous and tuberculated radial ribs. *X. ferryi* could be the ancestor of *X. lacunar,* always in the saline tropical seas. *X. amanoi* (Hayami) - Hagino Formation, Lower Monobegawa group, Japan, of Aptian age,- is also a small-sized species, with 20 spinose radial ribs, which is more like to *X. cottaldina* (d'Orbigny) – Upper Greensand, Albian of North European Province.

Xenocardita pinguis (Coquand, 1865)
Plate 13, figure 7;

- 1865 *Cardita pinguis* COQUAND, Mem. Soc. Emul. Prov. #3: 122, pl. 15, figs. 3-4;
- 1924 *Cardita pinguis* C., GILLET: Lamell. Neocom.: 118;
- 1954 *Cardita sp.,* COX, Jour. Pal. 28(5) : 633, pl. 64, fig. 5 ;

Diagnosis : A well preserved, subquadrate, posteriorly subcarinate, radially ribbed RV; the ribs are 24, and they are narrower than their interspaces. With the serrated top of the ribs, and almost terminal umbones is very much alike to *X. pinguis,* (C.) of the Maestrazgo Basin of Spain. It is about 30,0 mm long, and 25,5 mm high, with an inflation of 14 mm.

Occurrences: The localities cited from Spain, as Alcaine, Obón(Teruel), Zorita (Castellón) and Loma de Guyón were considered as Aptian by BATALLER (1949, Sinopsis… 8{1}: 21-22). These localities are called now Mirambell marls, and their age is Hauterivian-Early Barremian (CANEROT, 1982).

S.C.S. occurrences: Locality MC-341-C, La Hacienda/Río Carinicuao, Sucre state, of El Dantó dolostones of Hauterivian age. This corroborates the correction of the Spanish ages. In Trinidad, eroded shells were found in the Cuche Formation, of Hauterivian age COX (op. cit.).

***Xenocardita* sp. indet. 1,** Macsotay
Plate 13, figure 9;

Description: A wheathered cast, belonging to a RV, which is higher than long, with 20-22, ill-preserved radial ribs, and high and inflated umbones, was collected on the ground. The ribs are of the same size, but narrower than their interspaces. Near the umbos and on the anterior side of the cast, some bead-like ornamentation is still preserved. It is not alike any of the species of *Ludbrookia, Maghrebella or Xenocardita* in my files, has more of the characters of the last one.

Dimensions: The cast measures, of Height: 20 mm, and of width(incomplete): 17,3 mm.

S.C.S. occurrence: Locality VG-556-A, Morotoco-Caituco-Ojo de Agua road, Sucre State, of El Dantó dolostones, (sDLP, DGC), of Hauterivian age.

Xenocardita sp. indet. 2, Macsotay
Plate 9, figure 12;

Description: Ovoidal-elongated shell, deformed due to differential compaction. Inequilateral with nodulose rounded ribs, separated by interspaces wider than the ribs themselves. Umbones subterminal, tumid, reminding the taxon *Glyptoactis (Glyptoactis)* (STEWART, 1930), but without marked posterior depression.

Dimensions: The crushed shell, measures, of length: 20 mm, and of height: 14,4 mm.

S.C.S. occurrence: Locality MC-441-A, siltstone in Hacienda with cable-car, La Guanota-La Güiria, el Cazón Formation, of Late Berriasian-Early Valanginian age.

Genus ***Maghrebella*** FRENEIX, 1972.

Genus proposed for *Cardita nicaisei* COQUAND (1862: 200, pl. 14, figs. 1-17) - of Cenomanian age, Tunisia, of the Maghrebian Subprovince. Includes Carditidae of subrectangular shape, with umbones in anterior position , almost terminals, prosogyrous, and turned inward in the shell. Ornamentation of simple, radial ribs, spiny or nodular, which weaken along the palleal bord, and in the posterior area. Species attributed to genus *Maghrebella* Freneix:

- *M. bisculpta* (Gerhardt), -Neocomian,- *M. deserti* (Douvillé), -Albian- *M. forgemoli* (Coquand), -Cenomanian.- *M. meriani* (Pictet & Roux), - Cenomanian,- *M. posadae* (Böse), - Cenomanian,- *M. perantiqua* (Conrad), - Cenomanian ?- and *M. subparallela* (Gerhardt), - Albian, ?Turonian.

This list suggests, that *Maghrebella* is a thermophyllic, tropical genus, endemic to the Gondwanan Province's Tethyan subprovinces. The Biochron extends from Berriasian to Cenomanian, ?Turonian.

Maghrebella cf. bisculpta (Gerhardt, 1898)
Plate 7, figure 13;

- Cf. 1898 *Cardita (Venericardia) bisculpta* GERHARDT, V. Neues Jahrb. Miner., Geol., #11: 184-185, pl. 5, figs. 7ª, 7b, 7c, 7d;

Comparisons: The only LV found, shows some differences with the nominal species: 1) Dorsal and ventral margins are parallel, and the shell is rather convex, and 2)Posterior area has 5 – 6 radial ribs, restricted to the posterior half of the shell; *M. bisculpta* has 8 – 10 ribs, which are thinner.

Dimensions: The bigger specimen, measures, of Width: 24 mm, of Height: 19,5 mm; the smaller specimen, of Width: 23,5 mm,and of Height: 15,5 mm.

S.C.S. occurrences: Locality VG-381, Ojo de Agua-Santa Rosa road, El Cazón Formation (DGC), of Late Berriasian-Early Valanginian age.

Occurrences: 1 – 2 Km eastward of Zapatoca, Santander, in the Macanal shales, Colombia, of Valanginian age. This species is the oldest of the genus *Maghrebella.*

Maghrebella deserti (Douvillé, 1916)
Plate 51, figure 20;

- 1916 *Cardita Dupini* d'Orbigny, *var. deserti* Douvillé : 162, pl. 21, figs. 1,2 ;
- 1962 *Venericardia deserti* (D.) ABBASS, Geol. Soc. M.R.D., Pal. Ser., 1:114, pl. 17, figs. 5-7;

Diagnosis; The ornament consists of narrow and relatively high radial ribs,(26 – 28) separated by interspaces twice as wide. They carry rounded tubercles of which the concave surface is downward, and which are by their own width apart.

Dimensions: Length: 12 mm, Height: 10 mm, Thickness: 8 mm. (ABBASS, 1962, op. cit.); Length: 19 mm, Height: 16 mm, Thickness: 13 mm (DOUVLLE, 1916, op. cit.).

Occurrences: In Egypt, Gebel Manzour, Maghara, Sinai peninsula, of Middle to Late Albian age.

S.C.S. occurrence: Locality HA-4347, La Urbina North section, La Puya member of Peñas Altas Formation, Trujillo state (ARNAUD et alii., 1999, fig. 33) of Middle Albian age. In Colombia, at Ubaqué, Bogotá, of Aptian? age (DIETRICH, 1938: 200-201, [pro parte} pl. 20, fig. 6; non fig. 7).

Maghrebella subparallela (Gerhardt, 1897)
Plate 60, fig. 10;

- 1897 *Cardita subparallela* GERHARDT, V.Neues Jahrb. Miner. Geol.,#11: 104-106, pl. 2, figs. 9a, 9b, 9c, 9d;
- 1954 *Cardita subparallela* G., BENAVIDES, Geology of Northern Perú: 375;
- 1985ª *Ludbrookia cf. subparallela* (G.) ETAYO SERNA, Proy. Cretacico, # 16: 24: 19;

Occurrences: Originally studied from Colombia, possibly Chipaqué Formation, of Late Albian age (ROYO Y GOMEZ, 1941); in the Catatumbo area in the Guayacan member of Capacho Formation, of

Late Albian-Early Cenomanian age (NOTESTEIN et al., 1943). In Perú, is common in the Pariatambo and Chúlec Formations, of Early-Middle Albian age (BENAVIDES, 1954).

S.C.S. occurrence: Locality MO-2478, Yasa River, Perijá, Maraca Formation, of Late Albian age. Also in Lisure Formation, of Middle Albian age, mostly biodegraded disarticulated valves. In Trujillo state, was collected in La Puya Member of Peñas Altas Formation, of Late Albian age (PERAZA et al., 1998).

Family ***ASTARTIDAE*** d'Orbigny, 1844.

Infaunal non-siphonate suspension feeders (STANLEY, 1968). Its Biochron, is extended from ?Middle Ordovician, Devonian to Recent.

Subfamily ***ASTARTINAE*** d'Orbigny, 1844.
Genus ***Coelastarte*** Böhm, 1893.

Coelastarte Böhm, has a Biochron of Early Jurassic (Aalenian) to Late Cretaceous (Turonian), (GILLET, 1924: 104-105) whose distribution includes Western European Subprovince, and East African Province (COX et alii., 1969, N568). *Coelastarte* Böhm, was proposed for *Astarte excavata* Sowerby, 1819 – Jurassic, Bajocian of western France,- as a subgenus. This relationship was retained by European authors as: ROLLIER (1912), COSSMANN (1916), GILLET, (1924), RENNIE (1947) and KRIMJOLTS (1962). COX et alii. (1969: N567) kept it as subgenus of *Neocrassina* Fischer (1886), but CORROY (1925) and HAYAMI (1975) treated it as a full genus. I agree.

Coelastarte leanzai new species, Macsotay

Plate 49, figures 9, 10;

Description: Cast of ovate shape, of a medium-sized shell, very inequilateral, quite equivalve, well inflated; curved, regular beaks, no external sculpture is preserved. Anteriorly, the contour is gently curved; posteriorly elongated, rounded, ventrally gently curved, almost parallel to the postero-dorsal margin. Palleal impression is entire, weakly marked; muscle scars are also relatively weakly marked.

Etymology: Dedicated to the Paleontologist Dr. Hector A. Leanza, the greatest living Jurassic-Cretaceous Bivalvia specialist, and authority in *Trigoniacean* of South America.

Dimensions: Measurements are: Length: 26 mm, Height: 24 mm, the Holotype, is registered as UCVMG/IO-1778.

S.C.S. occurrence: Locality MO-2790, Cerro Las Callecitas, Anzoategui state, (DBG) Upper El Cantil Formation, of Early Albian age.

Discussion: The nearest species is *Coelastarte mantica* (de Loriol, 1868, Paleont. Suisse, #4: 29-30, plate 2, fig. 8) – Early Valanginian, Switzerland,- which has a subcuadrangular shape, not ovoidal, which was also based on a cast.

Genus ***Neocrassina*** Fischer, 1886.
Subgenus ***Neocrassina*** Fischer, 1886.

COX et alii., (1969, N567) cited this taxon with a Biochron of Early Jurassic to Late Cretaceous (Turonian). Its distribution goes from North European Province, Western European and Eastern African Subprovinces.

Neocrassina (Neocrassina) obovata (J. de C. Sowerby, 1822)
Plate 51, figure 3;

- 1822 *Astarte obovata* J. de C. Sowarby: 73, pl. 353.
- 1857 *Astarte obovata* S. PICTET & RENEVIER: 86, pl. 11, fig. 1;
- 1906 *Astarte (Eriphyla) obovata* S., WOODS: 113-115, pl. 15, figs. 15-18; pl. 16, figs. 1-3;
- 1961 *Eriphyla (Neocrassina) obovata* J. de C., S., CASEY: 606;
- 1974 *Astarte obovata* S. DIMITROVA, Foss. Bulgarie, #4b: 103, pl. 50, fig. 4;

Diagnosis: Shell large, oval, transverse, moderately inflated; surface with strong, close, somewhat irregular concentric ribs; escutcheon and lunule deep. Length: 74 mm, Height: 58 mm, Perna-bed, Atherfield.

Occurrence: In England, is found from zone *fissicostatus* to zone *deshayesi,* both of Early Aptian age. In Bulgaria also Aptian age. Also in the Upper Greensand of England.

S.C.S. occurrence: Locality MO-3110, Quebrada Santa Rosita, Píche member of Apón Formation, Perijá area, of Early Albian age. Fragmentary shells were collected in La Puya member of Peñas Altas Formation, Trujillo state, of Mid-late Albian age.

Neocrassina (Neocrassina) cf. obovata (J. de C. Sowerby, 1822)
Plate 41, figure 11;

- 1887 *Astarte obovata* Sow., MALLADA, Synopsis Cret. España: 101-102, pl. 33ª, fig. 5, 6, 7; (not J. de C. Sowerby, 1822)
- 1985-b *Astarte sp. cf. obovata* S. ETAYO SERNA, Proy. Cretacico, #24-35, pl. 1, fig. 17;

Discussion: This is defintely not the species studied from Aptian sediments of England and France. It has a consistently lower size, and the strong , close, irregular concentric ribs are restricted to the umbonal and central area of the flank. Its length is always less than 35 mm; *N. obovata* usually reaches 80 mm, and its concentric sculpture covers the whole flank.

Occurrence: Between Morella and Chert, Spain, from the Chert Formation, in western Maestrazgo Basin, of Early Bedoulian age (CANEROT, 1982).

S.C.S. occurrence: Locality MO-890, Punta Manaure, Sucre state, Lower Borracha Formation, (DAGM) of Late Aptian age. In massive limestone, associated to *Adiozoptyxis coquandi.* In Colombia, collected from Barremian horizon (ETAYO SERNA, op. cit.).

Genus ***Nicaniella*** Chavan, 1945.
Subgenus ***Trautscholdia*** Cox & Arkell, 1948.

COX et alii., (1969: N567) considered it a taxon of Middle to Late Jurassic Biochron with northwestern Europe and Japanese-East Asian Subprovince, as distribution area. During the Neocomian, it thrived in Northern European Province (boreal), and the deep marine facies in South France and western Marocco (Maghrebian Subprovince), mostly in hypabisal clayey sediments (GILLET, 1924: 102). HUCKRIEDE (1967) reported the taxon in brackish and fresh-water environments in Westfalia, Germany. In Venezuela, is restricted to deep shelf environments affected by upwelling, to **200 – 360 meters of paleodepth.**

Nicaniella (Trautscholdia) claxbiensis (Woods, 1906)
Plate 39, figures 15, 16;

- 1906 *Astarte claxbiensis* WOODS, Paleontogr. Soc., #2(3): 108-109, pl. 14, figs. 25-28;
- 1924 *Astarte claxbiensis* W. GILLET: 102, pl. 2, figs. 6a, 6b, 6c, 6d, 6^{e}, 6f ;
- 1930 *Astarte claxbiensis* W., ROCH, Noes et Mémoire S.m.C.g. Maroc #9 : 383 ;

Diagnosis : Shell small, thick, oval, longer than high, ornated with strong narrow, concentric ribs, separted by deep furrows; lunule large, ovate with sharp edges; escutcheon lanceolate, smooth, distinctly limited. Margins crenulated.

Occurrence: In Spilsby sandstone, -Ryazanian- and Claxby ironstone, -Valanginian- of England. Also found in Ida ou Tanan, Baroudi, Maroc, in Gargasian sediments.

S.C.S. occurrences: Locality JFS -144, road from Río Cristalino to Toma de Agua, Sucre state, Garcia Formation, of Late Aptian (Gargasian) age. Mostly small bivalves collected in this marl, with Belemnites and small gastropods. Also in locality VG-280-A, of El Dantó Dolostones of Hauterivian age.

Subfamily ***ERIPHYLINAE*** Chavan, 1952.
Genus & Subgenus ***Eriphyla (Eriphyla)*** Gabb, 1867.

According to KAUFFMAN in HALLAM et alii., (1973) this taxon belongs to the Euramerican Region, of the North Temperate Realm. We must add S.C.S. to its distribution. Shows preference for saline marine waters, according to our observations. Its predation must have been high, most valves are found disarticulated. Its Biochron is intra-Cretaceous extended from Hauterivian to Albian times.

Eriphyla (Eriphyla) cf. miyakoensis (Nagao, 1927)
Plate 18, figure 3;

- Cf. 1927 *Astarte miyakoensis* NAGAO in YABE, pl. 4, fig. 5; (nom.nud.)
- Cf. 1934 *Astarte miyakoensis* NAGAO: 218, pl. 30, fig. 8;
- Cf. 1965b *Eriphyla (Miyakoella) miyakoensis* (N.) HAYAMI, M.F.S. Kyushu Univ.#17(2): 101-104, pl. 10, figs. 1-8; pl. 11, figs. 1-8;
- Cf. 1975 *Eriphyla (Eriphyla) miyakoensis* (Nagao) HAYAMI, U.M.Univ. Tokyo, Bull. 10: 128, pl. 6, figs. 6, 7;

Discussion: Shell suborbicular in outline, nearly as long as high. Similar to *E. upwarensis* (Woods, 1906) – Lower Greensand, Aptian, England,- but *E. miyakoenis* exceeds 30 mm in length and height, in place of 20 mm of the former. In *E. miyakoensis* the convexity stays very regular, not as strong ventrally as *E. upwarensis. E. argentina* (Burckhardt, 1903) – Neocomian, Neuquen Basin,- but the outline is morte elliptical, and the surface is ornamented with more prominent concentric lines, than in the present species.

Occurrence: Lower and Upper Miyakoan (Aptian to Albian) found in calcareous sandstones, conglomeratic sandstones, and calcareous sandy shales, Japan.

S.C.S. occurrence: Locality MC-260-B, Cerro Los Encantados, Sucre state, Garcia Formation, (DGC) of Late Aptian (Gargasian) age. Found in gray marl, associated to the Gastropod *Drepanocheilus,* a cold-water predator. Our casts are very near to *E. miyakoensis,* but ventrally are less rounded, and no denticulations can be observed on the distal margin. Also found in Taguarumo Formation, of Barremian age.

Eriphyla (Eriphyla) pikensis (Hill, 1888)
Plate 18, figure 10;

- 1888 *Corbicula pikensis* HILL, Arkansas Geol. Surv., Ann. Rept.#2: 134, pl. 2,figs. 13, 13a, 14, 15, 16, 17;
- 1893 *Eriphyla pikensis* HILL P.B.S.W. #8: 28, pl. 4, figs. 4, 5, 6;
- 1928 *Astarte (Eriphyla) pikensis* H., ADKINS, Univ. Texas Bull. 2838: 155;
- 1936 *Astarte cf. obovata* Sow., DIETRICH: 100, pl. 20, figs. 4-5; (non Sowerby, 1822)

Diagnosis: Shell small, triangular-subovate species, basal margin broadly rounded; ornamentation of numerous, narrowly raised, concentric ridges, and wide interspaces. Distinct anterior and posterior lateral teeth present. Length: 15 mm.

Occurrence: Pike County, Arkansas, Trinity Group, of Barremian-Aptian age, abundant. In the plant bed of Paluxy Formation, Texas, of Aptian age.

S.C.S. occurrence: Locality HA-4387, Arbol Redondo section, Trujillo state, lower carbonate member of Peñas Altas Formation, of Early Aptian age (ARNAUD et alii., 1999, Fig. 21). In Colombia, collected in the Ubaqué brown-green and yellowish slates, of Barremian age.

Eriphyla (Eriphyla) pseudostriata (d'ORBIGNY, 1850)
Plate 39, fig. 20;

- 1842 *Astarte substriata?* LEYMERIE, Mem. Soc. Geol. Fr.#5: 4, pl. 6, fig. 3;
- 1850 *Astarte pseudostriata* d'ORBIGNY, Prodrome, #2: 77; (nom. nov. Leymerie, 1842, non Brown, 1835)
- 1857 *Astarte texana* CONRAD, :152, pl. 5, fig.9;
- 1897 *Astarte pseudostriata* d'Orb., KARAKASCH: 69, pl. 1, figs. 20, 21, 22;
- 1900 *Astarte substriata* l. WOLLEMAN: 100-101;

Diagnosis: Shell almost as high as long, rounded in contour, compressed, subequilateral, escutcheon deep and narrow; lunule narrow and excavated. Height: 45 mm, Length: 52, thikness: 26,5 mm. (LEYMERIE, op.cit.).

Occurrence: Documented from Hauterivian to Aptian, in Western European, Apulian and Balkanic Subprovinces, and North European Province. Possibly in Western Texas.

S.C.S. occurrences: Locality MC-119-A, Cerro Piedra del Rayo, western side, in marls, strongly bioturbated, of Garcia Formation (DBG) of Late Aptian age.

Eriphyla (Eriphyla) trapezoidea (Anthula, 1899)
Plate 41, figures 3, 5;

- 1899 *Astarte trapezoidea* ANTHULA, B.P.v. G. Österreich-Ungarns 12(3): 85-86, pl. 3, fig. 1ª, 1b;
- 1964 *Astarte trapezoidalis (sic)* A., ETAYO SERNA: 23;

Diagnosis: Shell thick, of big size (Length: 86 mm, Height: 75 mm, Thickness: 37 mm) subequilateral, trapezoidal, with pointed beaks; depressed lunule, narrow escutcheon.

Occurrence: Originally collected at Daghestan, Balkanik Subprovince, in Albian sediments.

S.C.S. occurrence: Locality MC-271-A, east of Punceres anticline, Upper El Cantil Formation, Monagas state, (DBG) of Early Albian age; mostly casta, with fragments of shll, preserved Also in Upper Borracha Formation, Borracha Island, (DAGM) of Early Albian age. In Colombia, in Villeta Group, of Albian age (BASSE, 1936).

Subgenus ***Dozyia*** Bosquet in Dewalque, 1868.

According to COX et alii., (1969: N568-N569), its distribution is in the North Pacific, North European Provinces and Western European Subprovince. Its Biohron extends from Albian to Senonian.

Eriphyla (Dozyia) cf. striata (J. de C. SOWERBY, 1828)
Plate 33, figures 16, 17, 18;

- Cf. 1826 *Astarte striata* J. de C. Sowerby, Min. Conch. 6: 35, pl. 20, fig. 1;
- Cf. 1906 *Astarte (Eriphyla) striata* S. WOODS, Paleontogr. Soc., 2(3): 116-118, pl. 17, figs. 2-7;

Diagnosis: Shell with rounded outline, moderately inequilateral, moderately convex. The types from Upper Greensand measure, Length: 41,5 mm,Height: 40,5 mm, thickness of one valve: 11 mm. All our casts are alike *E. (D.) striata,* but both valves are more inflated than the nominal species (See figure 17).

Occurrences: Biochron of Albian-Cenomanian from North European Province. According to CASEY (1961: 606) it is found in *Jacobi zone,* of Late Aptian in England.

S.C.S. occurrences: Identified in the Maracas Formation, Perijá, of Late Albian-Early Cenomanian age (KEY, 1960: 527). Also in MC-431-A, Road to the west of Catuaro, La Hacienda, of Valle Grande Formation, of Middle Albian age, three casts of articulated specimens, in glauconitic hard-ground.

Observations: Could be cognate with *E. (D.) umbonata* Gabb, -Turonian of California.

Genus ***Amphiaraus*** Vokes, 1946.

According to KAUFFMAN in HALLAM et alii., (1973: 366) *Amphiaraus* is a Tethyan genus, of the Syria-Lebanon endemic center of the Eastern Mediterranean Subprovince. It is not a surprise its presence in S.C.S.

Amphiaraus seleniscus VOKES, 1946
Plate 42, figure 2;

- 1946 *Amphiaraus seleniscus* Vokes, Amer. Mus. Nat. Hist., 87(3): 176, pl. 6, figs. 22- 24;

Remarks: The nature of the posterior portion of the hinge area, the long, deep escutcheon bounded by a carinate posterior umbonal ridge, and the unusually long posterior dorsal margin of the valve, together with the nonexcavated lunule, will serve to distinguish this species from those that have been referred to *Eriphyla,* and some called *"Lucina".* Length: 29,6 mm, Height: 26,9 mm, Diameter (RV): 7.2 mm (VOKES, op. cit.).

Occurrence: Olive locality, Lebanon, of Aptian age.
S.C.S. occurrence: Locality HA-4455, Loma de Agua Dulce (San Pedro) section, lower carbonatic member of Peñas Altas Fomation, of Early Aptian age (Trujillo state, ARNAUD et alii.,1999, fig. 17). Also in MC-372-B, Tonoro, near Güiria, Sucre State, of Valle Grande Formation, of Late Albian age. One cast, embedded in glauconitic sandstone.

Genus ***Freiastart***
Chavan, 1952.

Freiastarte was proposed with the type, *F. praetypica* Casey (1961-a: 579), a species characteristic of the *Jacobi* Zone, of the Sandgate beds of Latest Aptian age. GILLET (1924: 102) cited eleven species (and synonymes) from the East African Province, and the Maghrebian, Western European, Neuquén, Balkanic and Apulian Subprovinces. COX et alii., (1969: N570) degraded it to subspecies of *Astartemya* Stephenson, 1941, a proposal that I reject. KAUFFMAN in HALLAM et alii. (1973: 373, 374) considered it of trans-temprate realm, extending it to India, with a Biochron of Cretaceous - ?Paleocene. MACSOTAY (1980-b, Tableau 1) proposed a paleodepth range of 200 to 1000 meters, restricted to the aphotic zone, that mostly lived below the pycnocline.

Freiastarte marcouana (Pictet & Campiche, 1866)
Plate 3, figure 1;

1866 *Astarte marcouana* PICTET & CAMPICHE, Paleont. Suisse, #3: 305, pl. 124, figs. 5 – 7 ;

Diagnosis : Shell small, subrounded, almost as high as long (Length :8 mm) whose apical angle is 120º, ornated with 12 or 15 concentric ribs, of trigonal profile; in the anterior ¼, the strong ribs are replaced by many small striae.

Occurrence: Limonite de Métabief, Switzerland, of Valanginian age. In Mount Salève, at horizon nº 13, where is associated to *Trigonia picteti* Coquand, in organic-rich muds. Collected by me in Calcaire Roux Formation, - France, -of Valanginian age. Also in Djebel Meloussi, Tunisia,- of Berriasian age.

S.C.S. occurrence: Locality MC-346-C, Catuaro, Sucre state, El Dantó dolostones, in yellow dolomitic shales, of Late Valanginian-Early Hauterivian age.

Freiastarte numismalis (d'ORBIGNY, 1844)
Plate 39, figures 1, 17;

- 1844 *Astarte numismalis* d'ORBIGNY, Pal. Franç., Cret. #3: 63-64, pl. 262, figs. 4-6;
- 1921b *Astarte numismalis* d'O., GILLET, Bull. S.S. Hist. nat. Yonne, 75:18,
- 1988 *Astarte (Astarte) numismalis* d'O. DHONDT & DIENI, Mem. Soc. Geol. Sardinia, #11: 47, pl. 11, fig. 1;

Description: Shell small, relatively convex, subtriangular, moderately inequilateral. Antero-doral margin concave, anterior and ventral matgins rounded. Ornamentation consists of 7-8 prominent commarginal ribs. Length: 8 mm. Apical angle: 95º.

Occurrence: Biochron of Valanginian to Aptian, of North Temperate and Tethyan Realms.
S.C.S. occurrence: Locality PM-12-A. La Margarita mt., Monagas state, La Margarita siltstone, (DGC, sDLP), of Hauterivian age. It is common in the siltstone intensely bioturbated by *Chondrites intricatus* Brongniart. Also found in locality JFS-133, JFS-136 (DBG) of Lower Garcia Formation, of Early Aptian age (VIVAS & MACSOTAY, 1995: 135).

Freiastarte rogeri subformosa (d'ORBIGNY, 1850).

- Cf. 1843 *Astarte Fittoni* Deshayes in Leymerie, Mem. Soc. Geol. France #5: 5, pl. 4, fig. 2)
- Cf. 1844 *Astarte Formosa* d'ORBIGNY, Pal. Franc, Ter. Cret. #3: 65, pl. 262, figs. 10-12;

- Cf. 1850 *Astarte subformosa* d'ORBIGNY, Prodrome de Pal.: 77, nº272.
- 1980 *Astarte rogeri subformosa* d'O., MONGIN, Notes du Serv. Geol. Tunisie,#45: 135-136, pl. 5, fig. 1;
- 1980 *Astarte subformosa* (d'O.) MACSOTAY: 26;

Occurrence: In the Paris Basin, it originated during Hauterivian times, but became common in the Early Barremian times (CORROY, 1925: 153). In Tunisia, it is common since Berriasian times until Hauterivian.

S.C.S. occurrence: Locality MO-1305, road to La Fundación, Táchira state, Chururu Member of Río Negro Formation, of Uribante Hemigraben, Hauterivian age. It is rare in La Margarita mudstones, of Hauterivian age.

Freiastarte debilidens (GERHARDT, 1897)
Plate 39, figures 6, 7;

- 1897 *Astarte debilidens* GERHARDT, V. N. Jb. Miner., Geol. #11: 102-103, pl. 2, figs. 7ª, 7b, 7c;
- 1930 *Astarte debilidens* (G.) STEINMANN, Geologie von Perú: 138, fig. 164;
- 1933 *Astarte debilidens* G. OLSSON, Bull. Amer. Paleont. #20(69): 43;
- 1956 *Astarte debilidens* G., BENAVIDES: 375;

Occurrence: In Perú, it is known, from Yauli Formation, of Early-Middle Albian age; Late Aptian-Early Albian, Pananga Formation; in the Early-Middle Albian, Chúlec Formation, and in the Late Albian Pariatambo Formation.

S.C.S. occurrence: Locality MC-372, shale south of Cerro Grande, northeast of Cautaro, Valle Grande Formation, of Early to Middle Albian age, (DGC) all bivalves are goethite pseudomorphs well preserved. Associated, are four species of small turridae gastropods, and some belemnitids. Paleodepth proposed: 230 to 440 meters. Other nine localities of Valle Grande Formation, and also in Lisure Formation, of Perijá, where is relatively common. In Machiques member of Apón Formtion, - Early Albian age,- only disarticulated valves were found (LIDDLE, 1946: 191, 194). In Colombia, Magdalena medio valley, carries it in Loma La Yesera Formation, of Albian age.

Freiastarte sieversi (GERHARDT, 1897).

- 1897 *Astarte sieversi* GERHARDT, V. N. J. Miner. Geol. #11: 85-86, pl. 1, figs. 7a, 7b, 7c;

Occurrences: Locality MO-1156, El Molino creek, Niquitao valley, Trujillo state, Guayacán member of Capacho Formation, of Late Turonian age. Not found elsewhere.

Freiastarte subcostata (d'ORBIGNY, 1843)
Plate 39, figures 3, 10;

- 1842 *Astarte laticosta* Deshayes in LEYMERIE Mem. Soc. géol. France, 2(5): 4, pl. 4, figs. 4, 5;
- 1844 *Astarte striato-costata* d'ORBIGNY, Pal. Franç., Terr.Crét.#3: 64, pl. 262, figs. 7-9 ;(non Römer, 1836)
- 1850 *Astarte subcostata* d'ORBIGNY, Prodrome de Pal., #2: 77;
- 1906 *Astarte subcostata* d'O., WOODS, Paleontogr. Soc. 2(3): 109-111, pl. 14, figs. 29-36;
- 1956 *Astarte subcostata d'O.,* ALENCASTER DE CSERNA, Paleont. Mexicana, 2:15, pl. 3, fig. 3;
- 1967 *Freiastarte subcostata* (d'O.) BUSSON & ALBANESI: 620-621, Pl. 52, Figs. 3ª, 3b;

Description: Shell small, convex, subtriangular, very inequilateral; antero-dorasl margin concave; anterior and ventral margins rounded; postero-dorsal margin long, nearly straight, posterior margin more or less truncated. Lunule smooth, ovate, with a sharp edge; escutcheon smooth, deep, long. Flank with 7 to 9 sharp, prominent concenbtric ribs, with steep dorsal and gentle ventral slopes. Between ribs, there are 3-4 very small concentric striae and fine radial striae. Length: 7 mm, Height: 5 mm. (WOODS, op. cit.).

Occurrence: In Paris basin and Jura mts., its biochron extends from Hauterivian to Early Aptian. In North European Province, is mostly Neocomian; in Magrebian Subprovince it extends from Berriasian to Aptian; in Somalia, is Barremian.

S.C.S. occurrence: Locality MC-342-A, Cariaco-Aguas Calientes road, La Margarita mudstones, (DBG) of Hauterivian age: 16 articulated shells, together with juveniles. Locality MC-260-B, Cerro Los Encantados, Sucre state, Garcia Formation, of Early-Late Aptian age, (DGC) in grey marls. In Yúruma and Bergantin Formations, of Barremian age, are rather rare (VIVAS, 1987: 20).

Genus ***Disparilia*** Chavan, 1953.

According to KAUFFMAN in HALLAM et alii., (1973: 365) is wide-spread in the Mediterranean Province, as characteristic. In S.C.S. is endemic, quite common in black shale facies; is a possible chemo-symbiotic genus.

Disparilia amygdala triangularis (Coquand, 1865)
Plate 18, figure 13;

- 1865 *Astarte amygdala triangularis* COQUAND, Monogr. Paleont. De l'étage Aptien en Espagne : 317, pl. 15, figs. 7-8 ;
- 1887 *Astarte amygdala triangularis* C., MALLADA, Sinopsis : 103, pl. 33B, figs. 5, 6;
- 1967 *Astarte cf. amígdala triangularis* C., BUSSON & ALBANESI: 619, pl. 52, figs. 1ª, 1b;

Occurrence: The "variety" *triangularis* was collected at Obón, Mirambel and Chert, of western Maestrazgo Basin, localities of the Mirambell marls, of Hauterivian age (CALZADA PASTOR, 1976: 23; CANEROT, 1982) and are not of Aptian age. In south Tunisia are also found in Hauterivian sediments.

S.C.S. occurrence: Locality MO-3213, Chimana Grande Island, Lope inlet, Lower Taguarumo Formation, (DAGM) of Late Hauterivian age.

Disparilia bogotina (d'ORBIGNY, 1842)
Plate 21, figure 19;

- 1842 *Tellina bogotina* d'ORBIGNY, Coq. Echin. Foss. Colombie: 49, pl. 3, fig. 15;
- 1877 ?*Crassatella Bogotina* d'O., GABB, Jour. Acad. Nat. Sci. Phila, #8 :319 ;
- 1935 *Tellina dutrae* MAURY, Monog. Serv. Geol. Min. Brasil #4: 571, pl. 22, fig. 2;

Diagnosis : Small shell, length : 12 mm, apical angle 108º, rounded anteriorly, rostrted posteriorly; flank with regular concentric cords, well marked distally, weak proximally; sharp keel extended from umbo to pointed posterior extreme.

S.C.S. occurrence: Collected at Tabio, Pacho-Zipaquirá region, Colombia, in Upper Villeta Group, of Aptian age. In Brazil, in the Algodoes Formation, of ?Albian age. In Venezuela, in Locality HA-4371, Arbol Redondo section, lower carbonate member of Peñas Altas Formation, of Barremian-Aptian age (ARNAUD et alii., 1999, fig. 14).

Comparison: Alike to *Crassatella? cuneola* COSSMANN, (1918: 416, 417, fig. 30)- Orgon, Barremian to Early Aptian of France,- but *bogotina* is more elongated.

Disparilia charollaisi new species, Macsotay
Plate 41, figure 10;

- 1985-c *Disparilia n.sp., aff. disparilis* (d'ORBIGNY) ETAYO SERNA, Publ. Esp. 16: 24-12; (not d'ORBIGNY, 1843)

Description: Shell medium-sized, depressed, convex-elongate, subtrigonal, equivalve, inequilateral; umbonal ridge weakly developed; beaks non-prominent, slightly incurved, slightly forward of the middle; postero-dorsal and antero-dorsal margins slightly concave. Posterior margin is weakly rounded, meeting sharply the ventral margin, which is broadly rounded; inner margins finely crenulated; lunule and escutcheon excavated, but short.

Dimensions: The Holotype measures, of Length: 37 mm, of Height: 24,5 mm; Thickness: 11, 5 mm. Sample UCVMG/IO-1779.

S.C.S. occurrence: Locality MO-890, Punta Manare, Mochima Peninsula, Sucre State, lower Borracha Formation, (DAGM) of Late Aptian (Gargasian) age. Collected in a marly interbed: besides the Holotype, four fragmentary shells. In Colombia, it was reported from Arenisca de La Juntas, of Hauterivian-Aptian age.

Etymology: This species is named after the Paleontologist Dr. Jean Charollais, -Genêve, Switzerland,- who kindly facilitated many deep-water Neocomian Molluska of the Neuchâtel collections, for comparative studies.

Comparisons: The nearest species seems to be *Disparilia trapezoidalis* (Stanton, 1985) – Paskenta Group, California, of Valanginian age,- but its ventral and postero-dorsal margins are not parallel at all.

Disparilia truncata (Von BUCH, 1839)
Plate 39, figures 5, 9;

- 1839 *Astarte truncata* VON BUCH, Ges. Sch. #4: 521-522, figure 17;
- 1886 *Astarte cf. subdentata* KARSTEN: 18; non ROEMER, 1841;

Occurrences: In Colombia, collected in Villeta Group, -Barremian age,- associated with *Pulchellia galeata* and *Trigonia alaeformis.*

S.C.S. occurrences: Locality JFS-172, Casanay-Caripito road, of Valle Grande Formation, of Middle Albian age; hard marl with Belemnites, and small Bivalves and Gastropods. Also in locality PM-12-A, on Pajaral-La Margarita road, Monagas state, La Margarita mudstones, of Hauterivian age. Locally, common in Garcia Formation, - late Aptian,- associated to *Freiastarte.* In western Venezuela, the upper carbonatic member of Peñas Altas Formation, of Early Albian age, scarce in the *Mesorbitolina* marls.

Genus ***Seendia*** Casey, 1961.

According to KAUFFMAN in HALLAM et alii, (1969: 369) *Seendia* is widespread endemic in North European Province of the North Temperate Realm. Its Biochron extends from Middle

Jurassic (Bajocian) to Late Cretaceous (Cenomanian) fide GILLET (1924: 103). In tropical localities (Maghrebian Subprovince, S.C.S.) it proliferated in brackish or saline conditions.

Seendia cf. elongata (d'ORBIGNY, 1844)
Plate 21, figures 15, 17, 18;

- Cf. *Astarte elongata* d'Orbigny, Pal. Franç. #3: 68-69, pl. 263, figs. 8 – 11;
- 1980 *Seendia cf. elongata* (d'O) MONGIN, N. Serv. Geol. Tunisie: 135;
- 1985ª *Seendia sp. juv., cf. elongata* (d'O.) ETAYO SERNA , Publ. Espcial, 16:24-12;

Occurrences: In France and Tunisia, this taxon extends from Berriasian to Hauterivian, in organic-rich mudstones and shales, suggesting saline environments.

S.C.S. occurrences: Locality MC-329-F, Río Pajaral, Monagas state, dark grey sandy shales, of El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age. Also locality MO-881, Patiño inlet, El Dantó dolostones, of Hauterivian age (DAGM), (figures 15 – 18). In Colombia, it was found in Central Cordillera, in Valanginian sediments (ETAYO SERNA, 1985-c).

Comparisons: It resembles to *Anatina cf. gibbosa* (Etallon, (MAILLARD, 1884, pl. 2, fig. 41a, 41-b) – Purbeckian of Swiss Jura mts., but both dorsal margins are convex and not concave. Our shells are different from the nominal species, in having less concentric cords, which become thicker towards the ventral margins.

Seendia isodontoides (Cragin, 1905)
Plate 13, figure 5;

- 1906 *Astarte elongata* d'O., WOODS, Paleontogr. Soc., 2(3): 102-103, pl. 14, figs. 2ª, 2b, 3; (non d'ORBIGNY,. 1844).
- 1905 *Astarte? isodontoides* CRAGIN, U.S.Geol. Serv., Bull. 286: 67-68, pl. 11, figs. 8, 9;
- 1940 *Astarte durangensis* IMLAY, Geol. Soc. Amer. Bull. 51(1) : 151, pl. 8, figs. 10, 11;
- 1985c *Seendia* sp., ETAYO SERNA, Proy. Cretacico, Publ. Esp. 16: 25 – 3;

Diagnosis: Shell small, gibbous, inequilateral, oblong-ovate, base nearly straight; lunule narrow. Surface of shell concentrically striate, or ornamented with numerous linear elevations, whose development varies, and is more regular on the proximal part of the shell, while on the distal part there are one or two excavated zones bounded by high lines.

Dimensions: Height: 13 mm, Length (restored) about 18 mm; thickness: 10 mm. (Cragin, op. cit.) Height: 11 mm, Length: 16 mm, thickness: 8 mm (plate 13, fig. 5).

Occurrence: In Mexico, is frequent in Carbonera Formation, of Berriasian-Valanginian age.

S.C.S. occurrences: Locality MO-3213, Chimana Grande island, Lope inlet, Lower Taguarumo Formation, (DAGM), of Late Hauterivian age: also in El Dantó dolostones; in Colombia, in Las Juntas sandstones, of Valanginian age.

Comparisons: *S. californica* (Stanton, 1895: 57, pl. 6, figs. 19-21) – Neocomian of California, - ha a narrower umbo, finer ribbing, and is less elongated than *S. isodontoides. S. concentrica-plicata* (Von Alth, 1881) – Nizniow limestones, southern Poland, of Ryazanian age,- has a higher umbo, a rhomboidal shape, and regular concentric cords all over the surface.

Family ***CRASSATELLIDAE*** Férussac, 1822.

This family, as all the Veneracea, are infaunal siphon feeders. In S.C.S., most of the Cretaceous genera are of brackish mesohaline to oligohaline habits, where the tropical rivers and creeks, flooded with leptopel, the already turbid, warm, shallow waters of the deltas and estuaries.

Subfamily ***CRASSATELLINAE*** Férussac, 1822.
Genus/Subgenus ***Crassatella (Crassatella)***
Lamarck, 1799.

According to KUFFMAN in HALLAM et alii., (1973: 368) this taxon is proper of North Temperate Realm- the Eurasian Region. Its Biochron extends from Mid-Cretaceous (Turonian) to Miocene.

Crassatella (Crassatella) cf. sabaudi (PICTET & ROUX, 1853)
Plate 44, figure 2 ;

- 1853 *Crassatella Sabaudiana* PICTET & ROUX, Grés verts : 440, pl.33, figs. 3a, 3b, 3c ;
- 1867 *Crassatella Sabaudiana* P. & R., RENEVIER, S.V.S.N.,#9 : 156 ;
- 1880 *Crassatella sp.* COQUAND, 1880, Bull.Acad. Hippone #15, pl. 3, fig. 14 ;
- 1987 *Crassatella cf. sabaudiana* P. & R. VIVAS, Bol. Gol., (Caracas) 16(29): 28, 32, fig. 21;

Diagnosis: Thick shell, of trigonal shape, as high as long (28 mm), umbos wide, and approximated, palleal line well marked: distal margin crenulated. Apical angle of 108º.

Occurrence: Originally collected casts in Saxonet and Tanneverges, -Late Albian, Switzerland- and later in the Cenomanian of Algerie.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, in Lower El Cantil Formation, (DBG) of Late Aptian age, associated to *Mesorbitolina texana.* In our shell, the preservation allows to observe a regular, commarginal concentric cord system.

Subgenus ***Sublandinia*** Freneix, 1972.

The Biochron of *Sublandinia* is Early Cretaceous (Albian) to Late Cretaceous (Maastrichtian). Usually associated to oligohaline Bivalves. Its distribution includes Western European, Apulian and Maghrebian Subprovinces.

Crassatella (Sublandinia) caudata GABB, 1877
Plate 43, figure 8; plate 44, figures 4, 6; plate 48, figure 5, 10, 11;

- 1877 *Crassatella caudata* GABB, Acad. N.S. Philadelphia, Jour. 2º ser.#8:287, pl. 40, figs. 18, 18a;
- 1881b *Cyrena Dürfeldi STEINMANN:* N. J.M. G. Pal. #2:144-145, pl. 8,, figs. 6, 7;
- 1987 *Crassatella caudata* GABB, VIVAS, Bol. Geol. (Caracas) 16(29): 28, 32, fig. 21;
- 1933 *Crassatella caudata* G., OLSSON, Bull. Amer.Paleont. 20(69) : 44, pl. 4, fig. 4, 6 ;

Diagnosis: Shell elongated, medium sized, cuneiform, with anterior beaks: with the posterior cardinal margin sloping nearly straight to the posterior end, which is narrow, and obliquely truncate; anterior end sloping nearly straight from the beaks tp near the bas, where it is prominent and rounded. Surface marked only by coarse lines of growth; lunule deep and cordate, its margin rounded. Height: 19 mm, Length: 22 mm.

Occurrence: Abundant in the black shale of the Pariatambo coal mines, -Albian,- of depart. Junín,. Perú. Also in Peru, Pananga Formation, of Late Aptian-Early Albian age.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, Upper El Cantil Formation, of Early Albian age. Articulated shells, 5 meters above the *Mesorbitolina texana* horizon. In western Venezuela, in Aguardiente Formation, -Doradas River, Middle Albian age,- disarticulated bed are locally found. Locality JFS-148, trail west of Quebrada Grande, Bergantin Formation, (DBG) in micaceous siltstones with taphoflora, of Barremian age, many casts and molds, well preserved.

Paleoecology: STEINMANN (1881, 1930) was surprised by the resemblance of the Peruvian taxon, to common Wealdian mollusks of North European Province as *Cyrena caudata* ROEMER (DUNKER, 1846: 40, pl. 12, fig. 209) and *Cyrena donacina* DUNKER (op.cit.:41, pl. 12, fig. 18) both belonging to the genus *Neomyodon,*- which have corbiculoid teeth (COX et alii., 1969, N653). The resemblance is in the external morphology of the Bivalves, an adaptation to the fresh-water habitat in active river's sands. It is a case of convergence.

Genus ***Pachythaerus*** Conrad, 1869.

According to KAUFFMAN in HALLAM et alii., (1973: 368) this taxon is proper of North Temperate Realm, the Western Interior Endemic Center, the North European Province, the Gulf-Atlantic Coast, and Japanese-East Asian Subprovinces. Its Biochron extends from Middle Cretaceous to Middle Eocene. Full rank genus according to VOKES (1946) and HAYAMI (1965-b); it was of oligohaline habits, flourished coincident the maximum fluviatile apport during the Albian stage (this study).

Pachythaerus myophorioides (Steinmann, 1881)
Pl. 42, fig. 7;

- 1881b *Cyrena myophoroides* STEINMANN, N. Jahrb. F. Min., Geol., Pal. .#2 :145-146, pl. 8, fig. 5;
- 1897 *Crassatella (Pachythaerus) myophoroides* S. GERHARDT, V.N.J.M.G. #11:109-110, pl. 2, fig. 12;

Diagnosis: Small shell, *Myophoria*-like, with prominent dorsal slope, abd well marked posterior angulation; ornated by 14 – 16 regular concentric cords, separted by interspaces of the same width; lunula small, shallow; escutcheon elongated, hart-shaped.

Occurrence: Pariatambo Formation, Perú, of Middle Albian age.

S.C.S. occurrence: Locality MO-1261, Quebrada Guaruríes, Aguardiente Formation, Tachira state, Uribante Hemigraben, of Middle? Albian age. Sampled from the base of a fluvial channel-sandstone, associated to *Ceratostreon maroimensis* (White).

Pachythaerus cf. collignoni (Freneix, 1972)
Plate 44, figures 1, 3; plate 46, figure 3 ;

- 1947 *Liopistha sp. Aff. Liopistha (Psilomya) gigantea* (S.) RICHARDS, Johns Hopkins Univ. Stud. Geol.#15: 67-68, pl.8, fig. 13; (non Sowerby, 1818).

- Cf. 1972 *Crassatella (Pachythaerus) collignoni* FRENEIX, Notes et Mem. Serv. Geol. Maroc#228 : 146-149, pl. 15, figs. 5a, 5b, 6, 7 ; text figure 32.

Diagnosis : Cast fairly large, subovate, highly inflated, inequilateral ; anterior margin short, gently curved dorsally, rounded ventrally. Beaks highly inflated, high, strongly incurved, prosogyrate, proximate; ornamentation of numerous, (26-28) closely-set, evenly spaced, rounded concentric ribs, which begin at the anterior keel and run to the postero-dorsal, and posterior margins; the ribs become weaker and more closely spaced as they approach the venter. Interspaces broadly U-shaped, shallow, are not as wide as the adjacent ridges.

Dimensions: Measurements, Length: 32,7 mm, Height: 30,6 mm (plate 44, fig. 1); Length: 17,9 mm; Height: 24,9 mm (plate 44, fig. 3).

Occurrence: Northwest of Hammada El-Gueblia, Morocco, in Late Albian, *Dipoloceras cristatum Zone.* In Perú, was collected at four localities, of mostly Middle Albian age.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age (VIVAS, 1987). Also at MC-372-B, of Valle Grande Formation, of Middle Albian age.

Comparisons: The illustrated specimens, are very related to *P. collignoni* (Freneix, 1972), but the concentric cords do not run into the postero-dorsal area, (plate 46, fig. 3), which only has growth lines. *P. subregularis* (Douville, 1916) – Gebel Lagama, Egypt, of Late Aptian age,- belongs to the same group, but with more concentric cords.

Genus ***Anthonya*** Gabb, 1864.

The Genus *Anthonya* Gabb has a Biochron extended from Cretaceous (Neocomian) to ¿Eocene. Its distribution includes North Pacific and North European Province, and Gulf-Atlantic Coast, Japanese and Eastern Asian Subprovinces; also in East African Province, and Australian Subprovince. In S.C.S. was very common in Hypersaline-Saline waters, not brackish.

Anthonya aff. cantiana (Woods, 1906)
Plate 12, figure 14;

- Aff. 1906 *Anthonya cantiana* WOODS 1906, Paleontog. Soc. 2(3): 130-131, pl.19, figs. 4, 5;
- 1921A *Anthonya aff. cantiana* W., GILLET, Bull. Soc. Geol. Frânçe, 4(21): 14-15;

Remarks: *A. cantiana* is a well-known species of the Folkestone beds, Barremian-Early Albian of England and Wassy, France, Barremian age.

S.C.S. occurrence: Locality MC-264-A, Caripe River, top of El Cantil Formation, (DBG), of Early Albian age. In the upper beds of Bergantin sandstones, of Barremian age, disarticulated, worn valves. The main (but constant) difference with the nominal species, is in the rounded and more extended anterior margin.

Anthonya cornueli (d'Orbigny, 1844)
Plate 7, figures 1, 3, 5, 6, 7;

- 1844 *Crassatella cornueliana* d'ORBIGNY, Pal. Franç. T. Cretacé, Biv:74-75, pl. 264, figs. 7-9;
- 1897 *Pandora (?) aequivalvis* D., KARAKASH: 82, pl. 2, fig. 7;
- 1921-B, *Crassatella cornueliana* d'O., GILLET: 25;

Diagnosis : Small shell, quite compressed, inequilateral, with suborthogyrous beaks; anteriorly rounded, posteriorly much elongated and tapering. Apical angle 128º.

Occurrence: Neocomian in North European Province, Western European and Balkanic Subprovinces.

S.C.S. occurrences: Locality VG-381, Ojo de Agua-Santa Rosa Road, El Cazón Formation (sDLP, DGC) of Late Berriasian- Early Valanginian age. Maximum size attained, 21,6 mm of Length (Figure 3). Also in La Margarita mudstones, of Hauterivian age.

Genus/Subgenus ***Crassatina (Chattonia)*** Marwick, 1928.

According to COX et alii., (1969: N575), this taxon has a Biochron of Paleocene to Recent, in places as Western Europe, Australia and New Zealand. In this study we propose the extension, from Early Cretaceous (Albian) to Late Cretaceous (Maastrichtian), and a Paleogeographic distribution to AmphiAmerica, and Syrian, Somalian Subprovinces.

Crassatina (Chattonia) cf. maroimensis *(White, 1888)*
Plate 59, figure 9;

- 1887 cf. *Crassatella maroimensis* WHITE, Arch. Mus. Nac. Rio de Janeiro #7: 76, pl. 7, figs. 10, 11;

- 1897 cf. *Crassatella (Plionema) conservata* GERHARDT,V.N.J.M.G.,#11:106-107, pl. 2, fig. 10 ;
- 1930 cf. *Crassatella conservata* G. STEINMANN, Geologie von Perú : 139, fig.169 ;
- 1936 cf. *Crassatellites maroimensis* (W.), MAURY, M. S. Geol., Miner. #11 : 65-67, pl. 11, figs. 1, 3 ;
- 1938 *Cyrina (Venilicardia) sp.,* DIETRICH, pl. 21, fig. 2 ;

Description. Cast rather small, subtetrahedral in marginal outline ; umbos elevated ; valves moderately convex ; anterodorsal margin sloping downward and forward ; basal margin broadly convex ; posterodorsal margin moderately long, sloping downward and backward , and joining the posterior margin at an obtuse angle; posterior margin rather short, nearly straight or slightly convex. Surface marked by somewhat coarse concentric striae.

Dimensions: Length: 22 mm, Height: 19 mm, Thickness, articulated cast, 12 mm (WHITE, op. cit.); Length: 9.2 mm, Height: 7,5 mm, Thickness: 4,5 mm (GERHARDT, op. cit.). Our shells from La Puya member, measure, of Length: 16,4 mm, and Height: 14 mm.

Occurrence: In Perú, Yaulí Formation, of Albian age; in Brazil, in Porto dos Barcos, Coqueiro and Engenho Pamona, Sergipe Province, attributed to Ganhamaroba Group, of Middle Albian age.

S.C.S., occurrence: Locality HA-4335 La Aguada section, Trujillo state, La Puya Member, of Peña Altas Formation, (ARNAUD et alii., 1999, fig.32) of Mid-Late Albian age. In Colombia, calera southwest of Sopé, Cundinamarca, Une Formation, of Albian age. In lower Escandalosa Formation, Mérida state, of Cenomanian age.

Subgenus ***Scambulinae*** Chavan, 1952.
Genus ***Remondia*** Gabb, 1869, emend. STANTON, 1897.

According to KAUFFMAN in HALLAM et alii., (1973: N577) *Remondia* is a genus of the Euramerican region, of the North Temperate Realm. GILLET (1924: 105) considered that the thick shells as *R. tirnova* (Toula, 1882) – Urgo-Aptian limestones of Croatia,- inhabited high-energy beaches, alike the Genus *Donax.* The greatest resemblance, in shell morphology and size is with *Eucrassatella (Hybolophus) adelinae* (Tryon, 1872) –common on the mid-shelf of north-east Venezuela at depths of **26 to 60 meters,** in euhaline waters, affected by upwelling.

Remondia guanguararica (Maury, 1936).

- 1936 *Corbula ganguararica* MAURY, Mon. Serv. Geol. Minero Brazil, #11: 87-89, pl .8, figs. 4, 5;
- 1943 *Corbula ganguararica* M. OLIVEIRA & LEONARDOS, pl. 24, fig. 24;

Diagnosis: Small shell, (maximum length: 10 mm) moderately convex, subequivalve, somewhat inequilateral. Posteriorly longer than anteriorly; the carina is post-dorsal. Flank with 12-13 concentric cords, moderate umbo in the anterior 1/3-d of the shell.

Occurrence: Collected at Ganguarari, near Santa Luzia, Sergipe, Brazil, attributed with doubt to Middle Albian.

S.C.S. occurrence: Locality VG-471, in Santa Lucía, on the Caripito-Los Cuatro Rumbos, upper Chimana Formation, of Late Albian age, bioturbated (*Chondrites cf. arbuscula [Brongniart])* gray limestone. Many disarticulated valves.

Genus ***Stearnsia*** White, 1887.

This Genus, is restricted to Early Cretaceous (Hauterivian-Albian). Its distribution is in Western European, Gulf-North Atlantic and Maghrebian Subrovinces.

Stearnsia subacuta (d'ORBIGNY, 1844)
Plate 12, figure 13;

- 1844 *Astarte carinata* d'ORBIGNY, Paleont. Francaise, Terr. Cretacé: 63, pl. 262, fig. 1-3;(non PHILLIPS, 1829)
- 1850 *Astarte subacuta* d'ORBIGNY, Prodrome: 77, nº 267;
- 1906 cf. *Astarte subacuta* d'O., WOODS, Paleontog. Soc. 2(3) : 103-104, pl. 14, fig.14, fig. 4-6;
- 1921b *Astarte subacuta* d'O. GILLET Bull. Soc.S. H. n. Yonne: 18;

Diagnosis: Shell triangular, much compressed, length greater than height, slightly inequilateral. Both dorsal margins concave or nearly straight. Umbones very acute, projecting, often nearly median, and not curved; lunule narrow, with a sharp edge; escutcheon very narrow. Ornamentation of prominent concentric ribs separated by broad interspaces. In d'ORBIGNY's type, and in our specimens, there are 10-12 ribs, in WOOD's, only eight.

Occurrences: The Biochron of this species, is of Hauterivian to Earliest Aptian.

Dimensions: The measurements are: Length: 10,5 mm, Height: 8,8 mm.

S.C.S. occurrences: Locality An-85-A, road from Bergantin to El Zamuro, Anzoategui state, Bergantin Formation, of Hauterivian age (VIVAS, 1987: 20). The dwarf molluscan fauna was sampled in glauconitic, silty rhytmites.

Family ***CARDIIDAE*** Lamarck, 1809.
Sub-family ***CARDIINAE*** Lamarck, 1809.
Genus ***Cardium*** Linné, 1758.

Cardium granatense Karsten, 1859, nomen nudum.

- 1856 *Cardium granatense* Karsten, Zeitschrift der deutsch. Geologishen gesellschaft, Berlín, :473;
- 1886 *Cardium granatense* K., Karsten: 29;

Discussion: All we know is: "*Cardium granatense* ein sehr schön erhaltenes Exemplar, die erste in Neu-Granada aufgefundene Art der Gattung *Cardium* Linné." It was found in Colombia, in shales associated to *Pulchellia galeata* (von Buch). The sample was not found and the name should be discarded.

Genus ***Pleuriocardia*** Scott, 1978.

According to SCOTT (1978: 893-894) this genus occurs Euramerican Temperate Region, including both the Gulf-Atlantic Coast and the North European Provinces. Its Biochron extends from Early Cretaceous (Albian) to Late Cretaceous (Campanian). ABDEL-GAWAL (1986) extended this genus to the Latest Maastrichtian. Here we prove its origination in the tropical subprovinces of Gondwanan Province in Neocomian time, from where it migrated to Temperate regions.

Pleuriocardia bidorsata (COQUAND, 1865).

- 1865 *Cardium bidorsatum* COQUAND, Soc. D'Emul. Provence, Mem. #3:121, pl. 12, figs. 5, 6;
- 1898 *Cardium bidorsatum* C., GERHARDT: 187;
- 1956 *Cardium cf. cottaldinum* d'O., ALENCASTER DE CSERNA, Paleont. Mexicana, 2:19, pl. 3, figs. 4, 6, 7; non d'ORBIGNY, 1843.
- 1985 *Cardium cf. bidorsatum* C., ETAYO SERNA, Proy. Cretacico: 26; 24-12;

Diagnosis: Medium-sized shell, ovoidal, inflated, equivalve, slightly inequilateral, ventral margin convex; dorsal margins concave; ornated with fine, regular, radial ribs, more prominent on the posterior area of the shell.

Dimensions: Length: 31,0 mm, Height: 31,5 mm.

Occurrence: Originally studied in Spain, from the Chert Formation, of the Maestrazgo Basin of Lower Bedoulian age (CANEROT, 1982). In Zapotitlan Formation, Early Aptian of Mexico, and in Apón Formation, Colombia, of the same age.

S.C.S. occurrence: Locality MC-119-A, west of Cerro Piedra de Rayo, lower Garcia Formation, of Bedoulian age.

Pleuriocardia severiense (HILL, 1888)
Plate 40, figures 1, 2;

- 1888 *Cardium? Severiensis* HILL, :134-135,, pl. 2, figs. 21, 21A;
- 1978 *Pleuriocardia (Pleuriocardia) severiense* (H.) SCOTT: 895, pl. 1, figs. 8-11;

Diagnosis: Shell small, subquadrate outline, with slightly truncated posterior; rounded radial ribs wider than interspaces; ribs with faint concentric threads; distinct umbonal ridge.

Occurrence: Originally discovered in Dierks limestone, Arkansas, of Early Albian age.

S.C.S. occurrence: Locality VG-110, Tonoro, before reaching La Güiria, Sucre State, Valle Grande Formation, of Early? Albian age. Also in Arbol Redondo section, Upper carbonatic member of Peñas Altas Formation, (Trujillo state) of Early Albian age.

Pleuriocardia syriaca (Conrad, 1852)
Plate 59, figure 13;

- 1852 *Cardium Syriacum* CONRAD, Palestina Expedition: 217, pl. 7, fig. 45;
- 1852 *Cardium crebriechinatum* CONRAD, Palestina Expedition: 217, pl. 6, figs. 41, 42, 43; pl. 15, fig. 17;
- 1884 *Cardium (Acanthocardia) Syriacum* C. HAMLIN: 48, 49, pl. 3, figs. 7a, b, c;
- 1916 *Granocardium simplex DOUVILLE: 159-160,pl. 20, fig. 6,7;*
- 1928 *Protocardia coloradoensis* (Shumard) ADKINS, Univ. Texas Bull.#2838: 159;
- 1955 *Granocardium cf. simplex* D., MAHMOUD: 127, pl. 11, figs. 18-20; pl. 12, fig. 1;

Diagnosis: Triangular cast, apical angle 75º -80º; length and height about equal, inflated in umbonal region; anteriorly rounded, posteriorly truncated, postero-dorsal margin straight. Fine concentric striae anteriorly; radial striae posteriorly.

Discussion: *Pleuriocardia syriaca* (C.) is a wide-spread fossil in Albian-early Cenomanian of Maghrebian, Syrian and South Caribbean

Subprovinces. To the south, extended to Angola, and to the north, to Texas.

S.C.S.occurrence: Locality HA-4508, Cerro Los Platones, La Puya member of Peñas Altas Formation, of Mid-Late Albian age (ARNAUD et alii., 1999, fig. 29). Also in Lisure and Maraca Formation, Mid-Late Albian of Perijá range, always as casts.

Genus ***Vepricardium*** Iredale, 1929.
Subgenus ***Vepricardium*** Iredale, 1929.

COX et alii., (1969: N586) suggested a Biochron of Late Cretaceous to Recent, with a distribution area of Europe-Africa-East Indies and Australia. With the *V. (V.) cazonensis,* the Biochron changes to Early Cretaceous (Berriasian) – Recent.

Coincidentally, this taxon originated in saline-hypersaline seas of Gondwanan Province. A thick shell, ornated with coarse ribs with granular nodes on their tops is quite dissimilar to other cardiidae in the area. It resembles *Trachycardium* Mörch, but differs by the character of the nodes ornamenting its ribs which are simple granules, sometimes greatly enlarged and not the roofed, scale-like spines of the latter genus. From *Granocardium* Gabb, which it resembles by its rounded, inflated form, it differs in having the nodes seated on the summit of the ribs, and not in their interspaces.

Vepricardium (Vepricardium) cazonensis **n. sp.,**
Macsotay
Plate 8, figures 2, 9, 12; plate 9, figure 10;

Description: Shell of medium-size, rounded, ventricose; the umbos are very wide, inflated with small beaks, closely adjacent to the hinge-line; the umbos are sub-central, in position; there is no differentiated, posterior dorsal area. Sculpture of low, but regular ribs, with well-marked interspaces. The ribs are elevated, 15 – 17 on the RV, developing nodular ornament well preserved distally; the interspaces are flattened grooves, and are as wide as the ribs. The ribs on the LV develop narrow grooves on their tops, at last distally.

Dimensions: The Holotype (plate 8, fig. 2) measures of Height: 23,7 mm, and of Length: 23,6 mm. The paratype (plate 8, fig. 12) measures of Height: 18 mm, and of Length: 18,2 mm. Their catalog number is UCVMG/IO-2141.

Etymology: It is named after El Cazón Formation, originally El Cazón member of Taguarumo Formation, of GULLAUME, BOLLI & BECKMANN (1972: 1627-1628) who did not recognize its real age, because did not consult any mollusk specialist.

S.C.S. occurrences: Locality VG-381, Ojo de Agua-Santa Rosa road, between Río Grande and Quebrada del Medio, Sucre state, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age. Associated to *Catinula pulligera, Gresslya laventillensis,* and many polychaeta.

Comparisons: It resembles to *Vepricardium vindinense* (d'ORBIGNY, 1844: 38, pl. 249, figs. 10-14) – Mans, (Sarthe) France, of Cenomanian age,- which is still smaller, (length, 7 mm) and has 40 radial ribs, which are thicker than their interspaces. *Vepricardium pilatum* (Stoliczka, 1871: 218, pl. 13, figs. 6-7) – Ninnyor beds, India, and Algerie, of Campanian-Maastrichtian age,- in which the ribs are topped by granulations as thick as the ribs themselves. All these taxa, resemble much more to *Vepricardium (Vepricardium)* than to the Subgenus *Perucardia*, so I chose the first option. But *V.(V.) cazonensis* could be the ancestor of *Vepricardia (Perucardia) brüggeni* (Olsson) the type of the subgenus, which by Santonian-Maastrichtian times was well distributed, in Peru, Colombia and Venezuela (TELLO, 1975).

Vepricardium (Vepricardium) sp. indet. Macsotay
Plate 8, figures 5, 10;

Description: Thick-shelled, rounded, subequilateral; hinge platform thin, teeth are small; flank with 18-20 radial ribs beaded, weak at umbonal area, more developed distally; the 6 ribs on the posterior area, show a coarser beading; the incremental lines conspicuous in interspaces. Inner margins strongly crenulate

Dimensions: It measures, RV, of Height: 24 mm, of Length: 26 mm (plate 8, fig. 5), a disarticulated LV, measures: of Height: 19 mm (damaged), and width: 20 mm (plate 8, fig. 10).

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, El Cazón Formation (DGC) of Late Berriasian-Early Valanginian age.

Comparisons: Resembles to *Vepricardium (V.) cazonensis* n. sp., Macsotay, but it is less inflated, with more radial ribs; the coarser ribs on the posterior area, are distinctive. More specimens are needed to separate it as a new species.

Subfamily ***PROTOCARDIINAE*** Keen, 1951.
Genus/Subgenus ***Protocardia (Protocardia)*** Von Beyrich, 1845.

With a Biochron of Late Triassic to Late Cretaceous, is a Cosmopolitan genus. It must have been an

euryhaline taxon, with an habilty to adapt to oxygen plankton-poor and calcium-poor paleoenvironments. In Ryazanian and early Neocomian sediments, dwarf species were present; survived in saline seas, and by Albian euhaline seas, the size of the species increased four or five times.

Protocardia (Protocardia) appressa (Gabb, 1877).

- 1877 *Cardium (Protocardium) apressum* GABB, Acad. Nat. Sci. Philad. J.38: 286, pl. 40, fig. 17;
- 1980 *Protocardia apressa (G.)* GARCIA JARPA et. al.: 44;

Occurrence: Originally studied from Pariatambo Formation, Perú, of Albian age.

S.C.S. occurrence: Arbol Redondo section, upper carbonatic member of the Peñas Altas Formation, (Trujillo state) of Early Albian age.

Comparisons: Near *P. (P.) purbeckiensis* (de LORIOL, 1865: 43, pl. 3, figs. 12-16), one of the dwarf species of the evaporitic -the Uppermost Jurassic Purbeckian of Swiss Jura – which is usually a more elongated shell.

Protocardia (Protocardia) biseriata (Conrad, 1852)
Plate 47, figure 7;

- 1852 *Cardium biseriatum* CONRAD, Expedit. Palestine: 216, pl. 6, figs. 38, 39; not pl. 6, fig. 40;
- 1887 *Cardium (Nemocardium) brasiliense* WHITE, Arch. Museum N. Rio de Janeiro,#7: 91, pl. 6, figs. 3, 4;
- 1942 *Protocardia biseriata* (Conrad), VOKES: 3-6, figs. 1-7;
- 1954 *Protocardia texana* (C.) VON DER OSTEN, Bol. Geol. 3(8): 148; non Conrad, 1857;

Diagnosis: Rotundate-cordate, ventricose, subequilateral; posterior side rather longer than the anterior; the margin subtruncated and nearly direct; beaks prominent, acutely rounded; basal margin profoundly rounded anteriorly, obliquely truncated posteriorly; surface of the valves marked with concentric lines as far as the umbonal slope; posterior submargin with about 15 slender minutely echinated radii; posterior margin crenulated within. (CONRAD, op. cit.).

Dimensions: Length: 46,0 mm, height: 40.5 mm, diameter (RV) 23.0 mm; Length: 34.8 mm, height: 33.3 mm, diameter (articulated) 23.5 mm Lectotype and Lectoparatype, Peabody Museum, Yale Univ.). One well-preserved cast, from Aguardiente Formation, in silt-interbed at Uribante-Caparo cuts: Length: 50 mm, Height: 46 mm, Diameter: 32 mm. (donation of Sra. Maria Neyra de Gómez, 1983).

Occurrence: Abeih, Mt. Lebanon, Lebanon, in the Upper sanstones with *Trigonia,* of Late Aptian or Early Albian sediments. (VOKES, op. cit.). In Maroim, Sergipe, Brazil, in Ganhamaroba Group, of Middle? Albian age. In Morocco, in Clansayesian (Late Aptian) sediments (GILLET, 1925).

S.C.S. occurrence: Locality MO-2772 (=An-37) El Potrero, Anzoategui state, Caripito Member of Chimana Formation,(DBG, fide VIVAS & MACSOTAY, 1995) in marls and nodular limestones of Early-Middle Albian age. In black piritic shales, with taphoflora, of Aguardiente Formation, in Caño Urumales (LIDDLE, 1946: 254), of Middle Albian age.

Discussion: Usually confused with *P. (P.) hillana* (Sowerby, 1813), -Late Cretaceous, Western Europen Subprovince,- but *P. biseriata* is more elongated in proportion of the height; the number of radial ribs is greater, 13-18 (fide BLANCKENHORN, 1890: 89) while are from 10 to 15 (usually 12-13) in *hillana.* The concentric ribbing is coarser, there being 8-10 ribs in 10 mm.

Protocardia (Protocardia) coquandi (SEGUENZA, 1882)
Plate 56, figure 7;

- 1882 *Cardium coquandi* SEGUENZA: 86, pl. 9, fig. 1;
- 1912 *Protocrdia coquandi* (S.) PERVINQUIÈRE: 266, pl. 19, figs. 22-24 ;
- 1970 *Protocardia (Protocardia) coquandi* (S.) DARTEVILLE & FRENEIX : 176-178, PL. 30, FIGS. 2-3;

Occurrences: This taxon is wide-spread in the tropical subprovinces of Gondwanan Province, during Cenomanian times; it extends to Congo, during Coniacian times.

Dimensions: Measurements: Length: 48 mm, Height: 48 mm; a younger specimen, Length: 31 mm, Height: 37 mm, Thickness: 23,2 mm, both from the Guayacan member.

S.C.S. occurrence: Locality MO-1154, Quebrada Los Arillos, Niquitao, Guayacan member of the Capacho Formation, Trujillo state, of Late Turonian age.

Protocardia (Protocardia) elongata Gerhardt, 1897.

- 1897 *Protocardium elongatum* GERHARDT, V.N.J.M.G., #11: 111-113, pl. 2, figs. 14a, b, c;
- 1881 *Protocardia sp.* STEINMANN: 149-150, pl. 6, figs. 3, 3a;

- 1954 *Protocardium elongatum* G., BENAVIDES: Geol. of Northern Perú: 375;

Occurrences: Chulec Formation, Perú, of Early to Middle Albian age, of the *Knemiceras raimondi* Zone, which includes the Pariatambo Coal mines.

Dimensions: A cast of a RV measures, of Length. 12 mm, and of Height: 10,3 mm.

S.C.S. occurrence: Locality HA-4511, Cerro Los Platones, (La Loma, fide ARNAUD et alii, 1999, fig. 29) Trujillo state, of Lower Carbonatic member of Peñas Altas Formation, of Early Albian age. It is associated with *Cyclorisma* and *Flaventia*, both of brackish-water habitat.

Protocardia (Protocardia) impressa (Deshayes, 1842)
Plate 14, figure 11;

- 1842 *Cardium impressum* Deshayes in LEYMERIE, Mem. Soc. Geol.France, 5(6):6, pl. 8, figs. 1, 2;
- 1954 *Pachycardium sp.* VON DER OSTEN, Bol. Geología, (Caracas):3(8): 146;
- 1865/1866 *Cardium comes* COQUAND, Soc. Emul. Prov.,Mem.#3: 309, pl. 19, figs. 3, 4; 1988 *Protocardia impressa* (D. en L.) DHONDT & DIENI: 51-52, pl. 13, figs. 15 -17;

Occurrence: Has a wide distribution in Western European, Apulian, and Balkanic Subprovinces, with a Biochron of Hauterivian to Late Aptian.

S.C.S. occurrence: Locality MO-1725, Hacienda Escorzonera, Lara state, Atarigua para-autochthone, Yúruma Formation, of Barremian age (MACSOTAY, 1980-b). In Eastern Venezuela, also in Taguarumo Formation, of Late Barremian age, and Lower Borracha Formation, of Late Aptian age, both in DAGM, associated to Nerineacean gastropoda.

Protocrdia (Protocardia) pauli (COQUAND, 1862)
Plate 52, figure 9;

- 1862 *Cardium pauli* COQUAND, Soc. Emul. Provence, Mem.#2 : 204, pl. 10, figs. 5, 6 ;
- 1862 *Cardium triangulare* COQUAND, Soc. Emul. Provence, Mem. #2: 206, pl. 11, figs. 1, 2;
- 1912 *Cardium (Protocardia) pauli* C., PERVINQUIÈRE: 265, pl. 19, fig. 21;
- 1932 *Cardium (Protocardia) pauli* C., RIEDEL, D.S.P.g.l., Abh.: 53-54, pl. 10, fig. 3; pl. 11, fig. 8;
- 1970 *Protocardia (Protocardia) pauli* (C.) DARTEVILLE & FRENEIX, #20: 175-176, pl. 30, figs. 4ª-c, 5, 6ª-b;

Occurrence: Widespread in all the tropical subprovinces of Gondwana Province, during Cenomanian to Coniacian times, extending to Cameroun and Gabon in Central Africa.

S.C.S. occurrence: Locality MO-2324, Quebrada Santa Rosita, Perijá región, in Upper Maraca Formation, of Early Cenomanian age. Also present in the Guayacan member of Capacho Formation, of Late Turonian age.

Protocardia (Protocardia) peregrina (d'ORBIGNY, 1842)
Plate 7, figure 21;

- 1842 *Cardium peregrinorsum* d'ORBIGNY, Coq. & Echinod. Foss. Colombie: 46, pl. 3, figs. 6-8;
- Not 1844 *Cardium peregrinorsum* d'ORBIGNY, Pal. Franç. Terr. Cretace #3: 16, pl. 239, figs. 1-3 ;
- 1884 *Cardium deltoideum* MAILLARD, Pal. Suisse #11: 101-102, pl. 3, fig. 17 ;
- 1912 *Protocardia coycuarensis* MAURY Acad. Nat. Sci. Philadelphia, Jr. 2(15) : 54, pl. 9, fig. 7 ;
- 1980-b, *Protocardia peregrinorsa* (d'O.) MACSOTAY, Thèse : 36-37 ;
- 1985-a, *Protocardia peregrinorsa* (d'O) ETAYO SERNA, Proy. Cretacico, Publ. Esp. 16:24-12;

Diagnosis: Cast pentagonal, subequilateral and aequivalve; umbo in central position, prominent; moderately inflated; original shell lost by diagenesis of dolomite.

Dimensions: The original shell collected between Tena and Tocayma, (Bogotá, Colombia) in a black coquinoid limestone, measured, 20 mm of height and length (d'ORBIGNY, op. cit.) and 16 mm in thickness. MAILLARD's type measured 30 mm of length and 25 mm of height. Our cast measures, 22,5 mm of Height, and 25,5 mm of Length (plate 7, fig. 21). MAURY's shell measured, of Length: 24 mm, and Height: 23 mm.

Occurrence: Collected in Villeta Group, and Rosablanca Formation, (Colombia) of Valanginian-Hauterivian age. Also in Las Juntas sandstones, of Hauterivian-Aptian age. In Loma La Yesera in Villa de Leiva, and Santa Rosa de Viterbo, both evaporitic formations of Valanginian age (ROYO Y GOMEZ, 1942c). Also known from Russia (Crimea, Caucasus) of Valanginian-Hauterivian ?Barremian ages. *P. deltoideum* was collected at Feurtilles, Swiss Jura mts., in Purbeckian (Late Jurassic) evaporites. According to DHONDT & DIENI, (op. cit.) Aptian ciatations probably refer to *P. subhillanum* (Leymerie).

S.C.S. occurrence: Locality MO-1724, a tectonic vindow at Hacienda La Escorzonera, Lara state, Yúruma Formation, of Hauterivian age. Also locality VG-381, Ojo de Agua-Santa Rosa road, between Río Grande and Quebrada del Medio, Sucre state, El Cazón Formation, of Late Berriasian-Early Valanginian age. MAURY (1912, op. cit.): "Collected it on the trail from Parare to Coycuar, 6 miles south of Parare, (Serranía de La Paloma) in black shales"; she considered it of Turonian age, because the outcrops of Querecual Formation in the region. It is part of the outcrop areas of El Cazón Formation, as was mapped by V. VIVAS in AGUASUELOS Ing., (1994).

Protocardia (Protocardia) colombiana Dietrich, 1938.
Plate 14, figures 5, 6;

- Cf. 1868 *Cardium petilum* DE LORIOL, Palenont. Suisse, #4: 26, pl. 2, figs. 3, 4 ;
- 1938 *Protocardia colombiana* DIETRICH : 103, pl. 21, fig. 5 ;
- 1942c *Protocardia cf. peregrinorsa* (d'O.) ROYO Y GOMEZ: 47;
- 1985c *Protocardia peregrinorsa* (d'O.) ETAYO SERNA, Proy. Cretacico, Publ. Esp.16, #24-20;

Description: Shells oval-elongated; longer than high; ornamentation of concentric and radial ribs (in the posterior area), area form belts of the same width, separated by very narrow furrows. Radial ribs, about 25; near the margin, the ribs develop granulations on their tops. DIETRICH (op. cit.) proposed the term *colombiana*, for this particular shell, different from *P. peregrinorsa* (d'Orbigny, 1842).

Dimensions: The better preserved of the casts measure, of Height: 18,7 mm; of width: 20,2 mm and of thickness: 16,8 mm. Lectotype,

S.C.S. occurrence: DIETRICH's samples were collected at Villa de Leiva, about one km towards the east, in red, sandy slates, considered Barremian by E. A. Scheibe. Further sampling in carretera Corrales, in Santa Rosa, Colombia, by J. ROYO Y GOMEZ, (1942c) corrected the age to Valanginian, because the association with *Neocomites neocomiensis*. In Venezuela, locality MO-2850, Cliff on east side of Venados Island, Morro Blanco Formation, of Late Berriasian-Early Valanginian age. Only casts were collected, without shell remains, it is not rare.

Comparisons: This shell has an elongate-ovoidal rather than trigonal shape as *Protocardia (P.) petilum* (DE LORIOL, 1868) where is common in Marbre Batard Formation, -Berriasian - in jura mts. of France and Switzerland,- but its umbo is less swollen. Also reported in San Ricardo Formation, Chiapas, Mexico, of Berriasian age.

Protocardia (Protocardia) texana (Conrad, 1857)
Plate 49, figures 17,18;

- 1857 *Cardium (Protocardium) texanum* Conrad: 150, pl. 6, figs. 6a-c;
- 1924 *Protocardia texana (C.)* TWENHOFEL: 80, pl.20, figs. 1-6;
- 1954 *Protocardia texana* (C.) VON DER OSTEN, Bol. Geologia 3(8): 148;
- 1960 *Protocardia texana* (C.) PERKINS, Geol. Soc. Amer., Mem. 83: 73-74, pl. 21, figs. 1-8;

Occurrence: A taxon frequent in Fredericksburg to Wasita Groups, of Late Middle Albian to Early Cenomanian age, mostly in siliciclastic sediments, in Texas, New Mexico, Kansas and Arizona, U.S.A. Upper Aurora limestone, Coahuila state, Mexico, of Late Albian age.

S.C.S. occurrence: Locality MO-3110, Quebrada Santa Rosita, Perijá area, Píche member of Apón Formation, of Early Albian age. Also in Caripito Member of Chimana Formation, (DBG), of Middle Albian age. In Trujillo state, la Puya Member of Peñas Altas Formation of early Late Albian age (Geol. Carlos BELTRAN, collected 4 articulated specimens).

Discussion: Study of several collections of *P. texana* from Texan Fredericksburg Group indicates that this species is highly variable. Specimens range in length from 2 – 8 cm; the outline varies from nearly circular to oval; thickness of shell ranges from moderately biconvex to globose (PERKINS, op. cit.).

Genus ***Globocardium*** Hayami, 1965.

According to KAUFFMAN in HALLAM et alii., (1973: 368) it was included in the South Temperate Realm, accepting its subordination to *Protocardia* . Its Biochron extends from Early Cretaceous (Berriasian to ?Albian, HAYAMI, 1975). It is one of the clades that evolved in the saline Ocean Tethys, and became extinct with the "normalization" of the oceanic waters. Its distribution includes East African Province, Japanese-East Asian, Western European and Balkanic Subprovinces, and it should be treated as a full-rank Genus, following HAYAMI (1975).

Globocardium ascanioi new species, Macsotay
Plate 33, figure 5;

Diagnosis Shell large, globose, longer than high; disk ornamented with widely spaced irregular

concentric costae, well-marked on the distal half, and obliterated on the proximal. Umbo swollen, outstanding, the shell is thick nearby. The radial ribs are weak, and discontinuous fourteen on our only sample. Interior unknown.

Dimensions: The measurements are: Length: 74 mm, Height: 68 mm, Thickness of articulated valves, 34 mm. Holotype, UCVMG/IO-2142.

Etymology: Species dedicated to Field Geologist Gustavo Ascanio, whose exploration works solved the tectono-stratigraphic complex of Late Pliocene-Pleistocene of Caigüire Hills, Cumana, Sucre State.

S.C.S. occurrence: Locality MO-2489, Río Macoíta, Perijá area, Tibú Formation, of Barremian-Early Aptian age. The shell was collected in situ, in a 1 meter-thick limestone with many *Aetostreon couloni* shells. Also in HA-4371, Arbol Redondo Section, Trujillo state, in Lower carbonatic member of Peñas Altas Formation (ARNAUD et alii., 1999, fig. 14) of Late Barremian-Early Aptian age. In dolomitized limestone, with *Disparilia elongata* (d'ORBIGNY), pelomorphically deformed specimen.

Discussion: Whem HAYAMI (1965b) published the definition of *Globocardium*, stated clearly: "posterior area nearly smooth, without any conspicuous radial ribs, and posterior carina obsolete….". This fact, apparently suggested a *Protocardia,* but all the pre-Albian species are small, with thin shells. The presence of weak radial ribs, could be related, to the fact of being somewhat eroded. Further samples are needed.

Globocardium gillieroni (Pictet & Campiche, 1866)
Plate 9, figure 9;

- 1866 *Cardium gillieroni* PICTET & CAMPICHE, Paleont. Suisse, #3 : 252-253, pl. 119, fig. 2 ; pl. 120, figs. 1, 2 ;

Diagnosis : Casts indicating a subglobular shape, with thick shell, inequilateral, the length equal to the height (55 mm), beaks outstanding, slightly opistogyrous. A well-marked keel runs from the beaks to the posterior margin: bordered by a relatively deep depression where are the muscular pads; the palleal impression is simple (PICTET & CAMPICHE, op. cit.).

Description: Originally studied on base of many casts, whose muscle impressions and hinge-line are typically *Protocardiidae*. Our shell is a complete, articulated sample, with no ornamentation, except for fine concentric growth lines; the shell's length equals the height: 30 mm. Could be a juvenile.

Occurrence: In the Calcaire Roux, and the Bryozoaria-marls in Nozeroy and Vigneules (Switzerlnd) and Villers-le Lac (France), always in Berriasian-Valanginian horizons. Not uncommon.

S.C.S. occurrence: Locality MC-329-D, Río Pajaral, taphoflora-carrying black claystones, of El Cazón Formation, of Late Berriasian-Early Valanginian age.

Globocardium sphaeroideum (Forbes, 1845)
Plate 55, figures 5, 6;

- 1845 *Cardium sphaeroideum* FORBES, Quart. Jour. Geol. Soc. #1 :243, pl. 2, fig. 8 ;
- 1852 *Cardium Neckerianum* PICTET & ROUX, Moll. Foss. Grés verts: 424, pl. 30, fig. 3a-b;
- 1908 *Protocardia sphaeroidea* (F.) WOODS, Paleontogr. Soc., #2(5) : 195-196, pl. 31, figs. 2, 3 ;
- 1965b *Protocardia (Globocardium) sphaeroidea* (F.) HAYAMI, M.F.S. Kyushu Univ. :17(2) :117-119, pl. 16, figs. 1-6 ;
- 1974 *Protocardia sphaeroidea* (F.) DIMITROVA, Foss. Cret. Bulgaria, #4b: 108, pl. 158, fig. 1;

Diagnosis: Shell large for the genus (Length: 61,0 mm, Height: 66,5 mm) suborbicular and subequilateral in outline, strongly inflated and never carinated; antero-median surface ornamented with flat-topped concentric ribs, about 2 mm in breadth, separated by narrow grooves and become denser towards the ventral periphery of an adult shell.

Occurrence: With a Biochron of Upper Neocomian to Early Cenomanian, the distribution includes: North European Province, Japanese-East Asian, Somalian and Balkanic Subprovinces.

S.C.S. occurrences: Locality HA-4427, La Pastora-Jabón section, upper carbonatic member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999). Also was found in Tibú Formation, in Quebrada Aponcito Seco, of Late Barremian-Aptian age, where is common, but intensely biodegraded.

Genus/Subgenus ***Nemocardium (Nemocardium)*** Meek, 1876.

According to KAUFFMAN in HALLAM et alii., (1973: 359), this taxon is Cosmopolitan. With a Biochron of Early Cretaceous to Recent, this taxon is not common in tropical America.

Nemocardium (Nemocardium) birdanum (Whitfield, 1891)
Plate 21, figure 4;

- 1891 *Cardium (Protocardia?) birdanum* WHITFIELD: 405, pl. 6, figs. 7 – 10;
- 1934 *Protocardia birdana* (W.) BLANCKENHORN, Paleontogr, #81:241-242 pl. 131 figs. 132-a, 132-b;
- 1946 *Nemocardium birdanum* (W.) VOKES, Amer. Mus. Nat. Hist, #87(3): 185, pl. 7, figs. 22-25;

Occurrence: All specimens were collected in the Abeih sandstone, of Aptian age in Duccûn, Lebanon. Characteristic are the 20-28 spiny, fine radial ribs on the posterior area.

S.C.S. occurrence: Locality MO-888, Punta La Peña, upper Lope Member of Taguarumo Formation, of Early Aptian age.

Nemocardium (Nemocardium) subhillanum (Leymerie, 1842)
Plate 21, figures 3, 5;

- 1842 *Cardium subhillanum* LEYMERIE, Mem. Soc. Geol. Françe#5:5, pl. 7, fig. 2;
- 1866 *Cardium subhillanum* L., PICTET & CAMPICHE, Mat. Pou la Paleon. Suisse, #3 : 256, pl. 121, figs. 3, 4 ;
- 1887 *Cardium sub-hillanum* Leymerie, MALLADA, Sinop. España, Cret.3 : 97, pl. 30B, fig. 4, 5;
- 1985 *Protocardium (Nemocardium) biscriatum* (C.) USECHE & FIERRO : 674 ; (sic, non biseriatum Conrad, 1852)

Occurrences : The Biochron of this species extends from Valanginian to Barremian, in ferrolithic sediments in North European Province, Western European and Balkanic Subprovinces. In Maestrazgo Basin, Spain, collected from Mirambell marls, of Hauterivian age, not Aptian (CANEROT, 1982). Length: 22 mm.

S.C.S. occurrence: Locality MO-3213, Lope inlet on Chimana Grande Island, lower Taguarumo Formation (DAGM), of Late Hauterivian age. Also in M0-1306, road to La Fundación, Chururú Member of Rio Negro Formation, of Hauterivian age, in black mudstones.

Subfamily ***LAEVICARDIINAE*** Keen, 1936.

In COX et alii. (1969: N589) stated the Biochron of *Laevicardiinae* as Eocene to Recent, and KAUFFMAN in HALLAM et alii., (1973) ignored it. HAYAMI (1965-b) reported the presence of the subfamily in Japan, since Neocomian times. The Paleogeographical distribution is wide: North Pacific Province, Northeast Pacific, Western European, Gulf-Atlantic Coast, and Japanese-Eastern Asiatic Subprovinces.

Genus ***Laevicardium*** Swainson, 1840.

HAYAMI (1965-b: 123-125) stated that the generic reference of *L? ishidoense* is provisional. In my files, there are some taxa that should be included in *Laevicardium s. l.:*

- *Cardium altum* FORBES, 1839 :221, pl. 12, figs. 1, 1a, 3; Cenomanian, India.
- *Cardium besairei* BASSE, 1932: 130(42), pl 6, figs. 1, 1A; Turonian, Madagascar.
- *Laevicardium corpulentum* (Amano, 1957b): Aptian, Hagino Formation, Japan.
- *Laevicardium? Ishidoense* (Yabe & Nagao, 1926): Late Neocomian-Albian, Japan.
- *Laevicardium holmesi* Russell, 1943: 284-285, Cenomanian, Central Canada.
- *Protocardia delicatula* Spengler, 1923, (non STOLICZKA, 1871), Campanian, India.
- *Cardium (Protocardium) madagascariense* Collignon (1934), Turonian, Madagascar.
- *Cardium pondicherriense* d'Orbigny, 1847: 100, pl. 12, figs. 1, 7; Senonian, India.
- *Cardium ventricosum* d'ORBIGNY, 1844: 41-42, pl. 257, figs. 1-3; Turonian, France.
- *Cardium* sp., WOODS, 1908: 205, pl. 32, fig. 17a-c; Senonian, England.
- *Laevicardium (?) sp.*, TRECHMANN, 1927: 60, pl. 2, fig. 9; Campanian, Jamaica.
- *Laevicardium sp.,* TRECHMANN, 1927: 61, pl. 3, figs. 12, 13; Campanian, Jamaica.
- *Fulvia tenuis* WHITFIELD, 1886: 139, pl. 20, fig. 8; Early Maastrichtian, U.S.A.

With all this paleontological evidence, I follow Hayami's (1975) suggestion accepting *Laevicardium?* as part of the Cretaceous marine fauna, as a trans-temperate taxon.

Laevicardium? cf. ishidoense (Yabe & Nagao, 1926)
Plate 14, figure 8;

1926 *Cardium ishidoense* Yabe & Nagao in Yabe, Nagao & Shimizu: 48, pl. 12, figs. 9, 16, 18;
1975 *Laevicardium? ishidoense* (Y. & N.) HAYAMI, U. M. Univ. Tokyo, Bull. 10: 134;

Description: Shell medium-sized for *Laevicardium:* aequivalve, inequilateral, subtrigonal-ovate, elongated postero-vetrally and is much higher than long; strongly inflated; test rather thin; umbo prosogyrous, incurved, rising highly above the

antero-dorsal margin which is ahort, slightly concave; postero-dorsal margin much longer, is rectangularly truncated; ventral margin gently arcuate, antero-dorsal area slightly flattened; anterior and posterior carinae hardly discernible. External surface wholly marked by concentric growth lines; the postero-dorsal area marked with numerous fine riblets.

Occurrence: In Japan, the nominal species was collected in Ishido and Yatsushiro Formations (grey sandy shales), of Late Neocomian to Albian age. "Late Neocomian" in Japan (HAYAMI, 1965, Table 1) meant Barremian.

Dimensions: Only one RV collected: Height: 30 mm, Length: 21 mm.

S.C.S. occurrence: Locality PM-4C, road from Pajaral to La Margarita mt., (sDLP, DGC) La Margarita mudstones of Hauterivian age. *L. cf. ishidoense* should be the oldest species of this new genus.

Comparison: Its difference with *Laevicardium? ishidoense* (Y. & N.), is the presence of concentric growth striae on most of the surface; only the postero-dorsal margin has radial striae.

Discussion: The present species probably belongs to a thermophyllic unnamed genus of the *Laevicardiinae.* The genus *Pachycardium* Conrad (type-species, *Cardium spillmani* Conrad, 1858), has a test much thicker, the hinge heavier, and the umbo less salient than in the present species. The anterior area of *Pachycardium* is widely flattened. Taxa that could be related to this unnamed genus: *Cardium beasirei* (BASSE, 1932) –Turonian of Madagascar,- is a thick-shelled Bivalve, and its ornamentation is of fine growth-lines. *Cardium (Protocardium) madagascariense* (Collignon, 1934) – Turonian of Madagascar- which is again a thick shell, ornated by thick concentric ribs, restricted to the central area of the flank. In the S.C.S., *Laevicardium (?)* (TRECHMANN, 1927) of the Providence shales, Jamaica, of Campanian age,- are big shells: 70 mm of Height,- thin, inflected, whose young shells ornated with very fine radial ribs.

Family ***MACTRIDAE*** Lamarck, 1809.

The genera of this family, are infaunal siphon feeders (STANLEY, 1968: 216). Their abundance in the hypersaline and saline deposited sediments, suggests their affinity to this type of paleoenvironment. In Venezuela, Colombia,Ecuador, Perú, and all the tropical Subprovinces of Gondwanan Province, the genera *Cymbophora and Priscomactra* proliferated in species and individuals.

Genus ***Cymbophora*** Gabb, 1869.

According to KAUFFMAN in HALLAM et alii., (1973: 368), *Cymbophora* belonged to the North Temperate Realm, - the Euramerican region. This statement is erroneous, because the maximum amount of species, (46 taxa) lived from S.C.S. to Syrian Subprovinces. Even the type species, *C. ashburneri* (Gabb, 1864) inhabited California during Late Cretaceous, when subtropical fauna dominated (SQUIRES & SAUL, 1997) the area.

Cymbophora charltonae new species, Macsotay
Plate 14, figure 9;

Description: Shell of medium size, subtrigonal in outline, laterally compressed, with irregular growth lines, preserved near distal margins. Subequilateral, equivalve; beaks low, narrow, strongly incurved, prosogyrate, situated about two-fifths of the length of the shell. The umbonal ridge is non-prominent, obtusely sub-angular. On the dorsal slopes, the growth markings are somewhat coarser and sharp-crested. Only articulated specimens were recovered; inner features not visible.

Etymology: Named after Dr. Frances Charlton de Rivero, the best Paleontology teacher of the Escuela de Geología, Minas y Metalurgia, Central University, Caracas, (1960 – 1967), who published the first Paleoecology studies in Venezuela.

Types: The Holotype and six paratypes are stored with the number UCVMG/IO-2143. The Holotype measures, of Length: 26,2 mm, and Height: 17,3 mm.

S.C.S. occurrence: Locality VG-382, trail to Ojo de Agua, Quebrada El Imposible, Serranía de La Paloma, El Dantó dolostones (DGC) of Hauterivian age.

Comparisons: Alike in its general shape, to *Cymbophora dupiniana* (d'ORBIGNY, 1844: 367, pl. 368, figures 3, 4, 5) – Hauterivian in La Chapelle, Marolles, of Paris and Jura Basins, in France,- but *C. charltonae* is higher, thinner, and with convex dorsal margins. *C. verneuili* (Landerer, 1865: 36, pl. 6, figs. 35, 36), – Aptian of Spain, and Lebanon,- is still more elongated in form and thinner in shape.

Cymbophora cf. peruana (Steinmann, 1930)
Plate 56, figure 16;

- 1930 *Mactra peruana* STEINMANN, Geologie von Perú: 130, fig. 147;

- 1946 *Mactra sp. cf. peruana* (S.) WINKLER in SUTTON: 1644;
- 1985c *Mactra? Peuana* S., ETAYO SERNA, Proyecto Cretacico, Publ. Esp. 16: 24-9;

Description: This species was base don casts, - collected nearby Celendin, Perú in sediments of Aptian? age, whose dimensions were: Length: 66 mm, Height: 60 mm (approximately). Our casts have a more swollen umbonal area, and preserve a sculpture of concentric cords, irregular on most of the exposed surface, except the poterioor slope. Umbonal angle: 90º.

S.C.S. occurrence: Locality MC-444, Campo Alegre-Buena Vista road, cerro La Torre, Guacharo member of El Cantil Formation, (DGC), of Late Aptian-Early Albian age. In Colombia, in the Cocuy Hemigraben, reported from Apón Formation, - of Late Aptian age.

Comparisons: It is near to *Cymbophora schucherti* STEPHENSON (1952: 121, pl. 31, figs. 22-28) – Lewisville Member of Woodbine Formation, of Cenomanian age,- but the posterior area is wider on our specimens.

Cymbophora pervetus (CONRAD, 1852)
Plate 45, figure 6;

- 1852 *Mactra pervetus* CONRAD, Expedition Palestine: 218, pl. 8, fig. 48;
- 1852 *Mactra Syriacus* CONRAD, Expedition Palestine: 218, pl. 8, fig. 51;
- 1877 *Homomya incurva* GABB, J. A. N. S. Philadelphia, #8:285-286, pl. 40, figs. 13, 13a;
- 1934 *Mactra? pervetus C.,* BLANCKENHORN, 259, pl. 14, figs. 165, 166;

Diagnosis: Subtriangular, slightly ventricose, equilateral; beaks prominent, angulated, not approximate; anterior margin rounded, posterior margin very oblique, nearly rectilinear or slightly contracted below the umbo; posterior extremity truncated; basal margin rounded.

Occurrence: Bhamdûn, of Late Albian (Vraconian) age; Aïn Homar, southwest of Es-Salt of Cenomanian age, both of Lebanon. Ollon, Perú, of Albian age.

Dimension: Length: 22 mm; Height: 17 mm, Thickness: 10,5 mm; Length: 44 mm, Height: 38 mm, Thickness: 21 mm. (BLANCKENHORN, op. cit.).

S.C.S. occurrence: Locality An-77-C, Cerro Las Callecitas, Anzoategui state, (DBG) El Cantil Formation, of Late Aptian age (VIVAS, 1987).

Cymbophora petrosa (CONRAD, 1852)
Plate 45, fig. 5;

- 1852 *Mactra petrosa* CONRAD, Expedition Palestine: 218, pl. 8, fig. 48;
- 1862 *Venus didonis* COQUAND: 195, pl. 8, figs. 9-10 ;
- 1912 *Mactra moevusi* C., PERVINQUIÈRE : 281, pl. 20, fig. 18 ;
- 1934 *Mactra petrosa* C., BLANCKENHORN : 258, pl. 14, fig. 264;
- 1958 *"Cymbophora" moevusi* (COQUAND), BARBER, Rec. Geol. Soc. Nigeria#2 : 27-28 ;

Occurrence: *C. petrosa* is documented from Late Aptian to Early Coniacian times, from all the tropical Subprovinces of Gondwanan Province, including Nigeria.

Dimensions: Length: 40 mm, Height: 32 mm and Thickness of an articulated specimen: 25 mm.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian to early Albian age (VIVAS, 1987). Also in HA-4398, in Arbol Redondo section, Trujillo state, (DBG), top of Lower carbonatic member of Peñas Altas Formation, of Early Aptian age (ARNAUD, et alii., 1999, Figure 14).

Cymbophora syriaca (CONRAD, 1852)
Plate 52, figures 12, 12a;

- 1852 *Tellina Syriaca* CONRAD, Expedition, Palestina: 219, pl. 10, figs. 59, 60, 61;
- 1864 *Mactra-like shell*, GABB, Paleontology of California: 209, pl. 16, fig. 275;
- 1901 *Mactra (?) sp.* STANTON, P. P. U.E.P.# 4, Cret. Pal., : 25-26 ;
- 1937 *Cyprina aff. cuneata* FERUGLIO, Mus. Ins. Geol. U. Padova#11: 17-18, pl. 1, figs. 9ª, 9b;(non *Pharodina cuneata [Sowerby, 1836]*

Description: Subtriangular, convex; beaks distant from the anterior extremity; umbos acute; anterior side slightly reflected; posterior margin rounded. This fossil, occurring only as casts, in Aptian-Albian sediments, seem to be the most abundant in Bhamdûn, and Khân el-Mezrâ'ah, in the Palestina collections, excepting *Ceratostreon boussingaulti* (d'Orb.)(CONRAD, 1852). Two specimens very much alike to *C. syriaca,* collected east Mount Diablo, California, (Albian?) still preserve part of the shell, exhibiting fine, regular concentric growth lines, and are somewhat more pointed posteriorly. *C. syriaca* is an unusual *Mactridae* species: the specimens from the Berriasian are not differentiable from those of the Hauterivian of Lower Taguarumo Formation, or the Mid-Late Albian of La Puya member of Peñas Altas Formation: about 40 Ma.

Dimensions: Length: 37 mm, Height: 30 mm. El Cazon Formation specimen, measures, of Length: 26 mm, and of height: 20 mm.

Occurrence: Collected in Springhill Formation, Lake Pueyrrydon, Argentina, of Berriasian age. Also known from Palestina, California, and Morocco.

S.C.S. occurrence: Locality HA-4337, La Aguada section, Trujillo state, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, Figure 32) of Late Albian age. In Eastern Venezuela, locality MC-329-D, Río Pajaral, Monagas state, El Cazón Formation, of Late Berriasian-Early Valanginian age; in mudstone with ferrolite and taphoflora (sLP, DGC).

Comparisons: It is alike *C. emmonsi* (Meek) – Cenomanian-Turonian of Western American endemic center,- *C. gratiae* Russel (1943), - Bearpaw Formation, Cenomanian, Canada,- and *C. spooneri* Stephenson, (1954: 121-122), - Woodbine Formation, Cenomanian, which are higher and more equilateral shells.

Cymbophora verneuili (LANDERER, 1872)
Plate 37, figure 9;

- 1872 *Arcopagia Verneuili* LANDERER, Aptian of Tortosa : 36, pl. 6, figs. 35, 36 ;
- 1887 *Venus Verneuili* L., MALLADA, Synopsis Fos. España, Cret.inf. #3 :91, pl. 36, figs. 11, 12;
- 1891 *Veleda elliptica* WHITFIELD, Bull. Amer. Mus. Nat. Hist. #3 :406, pl.7, figs. 1-2;
- 1934 *Veleda elliptica* W., BLANCKENHORN, Paleontogr.# 31-A: 249;

Diagnosis: Cast of oblong-triangular shape, compresssed; anterior margin short, and forming a right-angle with the palleal margin; beaks small and contiguous; palleal impression parallel to ventral margin, for 2/3 of the length, where a deep and angular palleal sinus is present. Between the pallelal line and the margin, 2 – 3 striations are noted on the cast (LANDERER, op. cit.).

Dimensions: Length: 22 mm, Height: 19 mm, and of thickness, 7 mm. (LANDERER, op. cit.). The casts from Abeih, Lebanon, measure of Length: 20 mm, of Height: 13 mm, and thickness, 6 mm (BLANCKENHORN, op. cit.). Our casts measure, of Length: 24,5 mm and of Height: 24,2 mm.

Occurrence: Ermita de la Providencia-Coll de Alba de Tortosa, of the Villaroya de los Pinares Formation, Maestrazgo Basin, Spain, of Late Aptian age (CANEROT, 1982). In Lebanon, in the sandstones below Abeih locality, of Aptian age.

S.C.S. occurrence: Locality MC-126-A, south side of Piedra de Rayo mt., in marls of Garcia Formation, (DBG) of Early Aptian age.

Comparisons: It is alike to *C. vassiacensis* (d'ORBIGNY), which is a thicker, and proportionally wider shell.

Genus ***Geltena*** Stephenson, in Vokes, 1946.

According to KAUFFMAN in HALLAM et alii., (1973: 368), *Geltena* belongs to the North Temperate Realm, where they are endemic Bivalves. It is a saline-prone genus, not a brackish one. Its Biochron is Berriasian-Campanian.

Geltena cf. mactriforma (VOKES, 1946)
Plate 20, figure 23;

- Cf. 1946 *Geltena mactriforma* VOKES, Amer. Mus. Nat. Hist.87(3): 204, pl. 9, figs.22-25;

Diagnosis: *Geltena mactriforma* is smaller, more triangular in outline than the genotype species, (*G. subequilatera* [Stephenson]- Lewisville Formation, Cenomanian, Texas,- and differs from it both in details of ornamentation and in the extent of the development of the resilial depression.

Dimensions: the Holotype, measures Length: 11,2 mm, Height: 9,4 mm, Diameter(LV):3,6 mm. Our shell measures, Length:12,8 mm, Height: 11 mm.

Occurrence: Abeih sandstone, Lebanon, of Early-Middle Aptian age, a common species.

S.C.S. occurrence: Locality MC-349-b, Cerro Garrapata, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age; all casts are Goethite pseudomorphs, of unusual preservation. Also at MC-346-C, outskirts of Cautaro town, Sucre state, in shales of El Dantó dolostones (DAGM) of Hauterivian age. One well-preserved cast was collected by Geol. B. LOPEZ, (1987) in Morro Blanco Formation, Quebrada Quetepe, of Berriasian-Valanginian age.

Observations: In locality MC-349-B, the dwarf molluskan assemblage suggested low temperature, saline waters at paleodepths of **120 to 220 meters.** *G. cf. mactriforma* seems to be the oldest taxon of the genus.

Genus ***Priscomactra*** Stephenson, 1952.

According to KAUFFMAN in HALLAM et alii., (1973: 368) belongs to the North Temperate Realm, Northeast Pacific and Gulf-Atlantic Coast Subprovinces. The Biochron extends from Early Cretaceous (Berriasian) to Late Cretaceous (Maastrichtian).

Priscomactra bussoni (BUSSON & ALBANESI, 1967)
Plate 9, figure 2;

- 1967 *Trigonarca bussoni* BUSSON & ALBANESI: 615-616, pl. 50, figs. 6-10; pl. 51, figs. 1-6;

Occurrence: In South Tunisia, this taxon is common in *Freiastarte*-carrying Dolomites, of Hauterivian age.

S.C.S. occurrence: Locality MO-3213, Chimana Grande Island, Lope inlet, (DAGM) Lower Taguarumo Formation, of Late Hauterivian age. Collected also at other localities of El Dantó dolostones, of Hauterivian age.

Dimensions: Measurements: Length: 27 mm, Height: 22,5 mm.

Priscomactra cf. callosa (ROEMER, 1836)
Plate 37, figure 5;

- Cf. 1915 *"Cyprina" callosa* Roemer, FUCINI : 88, pl. 10, fig.16;
- Cf. 1937 *Mactra callosa* R., ARTHABER: 439, pl. 25, fig. 10;

Occurrences: In Wealdian facies of Terminetto Formation, Italy, of Hauterivian age: scarce. Is quite common in the Hilsthon Formation, of Lower Saxony, of Hauterivian age (ROEMER, 1836, Nordd. Oolithgeb.: 123, pl. 6, fig. 3).

S.C.S. occurrences: Locality MC-119-A, west of Cerro Piedra de Rayo, in marls of Lower Garcia Formation, of Early Aptian age. Associated to the brackish-water *Filosina gregaria*, suggesting estuarine conditions.

Priscomactra hessi new species, Macsotay
Plate 14, figure 15;

Description: Shell small, subtrigonal in outline, moderately inflated, inequilateral, equivalve; anterodorsal slope concave, posterodorsal slope is convex. Lunule not observable. Beaks prominent, prosogyre, incurved, situated at about one-fifth of the length of the shell from the anterior extremity. Ventral margin broadly rounded, posterior margin subangular at the end of umbonal ridge, steeply descending. Over the main surface, the incremental lines are fine, becoming a little coarser near the ventral margin. On the anterodortsal and posterodorsal slopes, the incremental lines become much sharper. Inner margin smooth.

Dimensions: The Holotype, a well preserved LV of an articulated shell, except the antero-ventral margin, damaged, measures: Length: 25 mm, Height: 17 mm, Thickness: 11 mm. Its catalog number is: UCVMG/IO-2144, and includes 3 paratypes.

Derivatio nominis: I have the honor of dedicating this new species, to the Geologist Harry H. Hess, (1906-1969) – Geology Department of Princeton University, U.S.A.,- who actively studied the Plate Tectonic origin of the Caribbean Plate.

S.C.S. occurrence: Locality VG-382-B, trail from Ojo de Agua to Santa Rosa, Sucre State, El Cazón Formation (DGC) of Late Berriasian-Early Valanginian age.

Comparisons: *Priscomactra cf. syriaca* (Conrad) Macsotay, - pl. 13, figure 12,- is also found in Berriasian-Valanginian horizons of Venezuela and Argentina, but its beak is more centrally located. Two taxa: *Priscomactra cf. callosa* (Roemer)-ARTHABER (1937: 439, pl. 25, fig. 10) of Terminetto Formation, Italy, of Hauterivian age, and *P. bussoni* (Busson & Albanesi), plate 9, figure 2, of El Dantó dolostones, of Hauterivian age, both are higher and with more prominent beaks than *P. hessi* n. sp.

Family ***CULTELLIDAE*** Davies, 1935.
Genus ***Ospriasolen*** Conrad, 1868.

According to KAUFFMAN in HALLAM et alii., (1973) restricted it to the North Temperate Realm, i.e., The Gulf and Atlantic Coastal Plain Subprovince. The suggested Biochron of Late Cretaceous is completed to Valanginian-Maastrichtian. A list of species:

O. aequalis (d'ORBIGNY) – Cenomanian-Turonian, France; *O. alisoensis* Packard, Senonian, California; *O. australis* (Gabb), Senonian, Chile; *O. cretaceous* (Gabb), Maastrichtian; *O. desori* (Pictet & Renevier), -Aptian, France and Switzerland; *O. huerfanensis* (Stanton), Turon, Utah, Minnesota; *O. humei* Fourteau, - Cenomanian to Maastrichtian, Maghreb; *O. kayseri* (Pervinquiere), - Maastrichtian, Algerie; *O. mentorensis* (Twenhofel), - Late Albian; *O. pricei* (de Loriol) –Albian, Switzerland,- *O. pealei* (Meek), - Turon, Utah, *O. mangolfae* (Shalem), -Senonian, Palestina; *O. provincialis* (Matheron) – Campanian, France; *O. limata* (Stoliczka),- Maastrichtian, India. This is completed with the following species :

Ospriasolen erlichi new species, Macsotay
Plate 12, figure 8;

Description: Shell long and narrow, inequilateral, somewhat compressed, gaping at both ends. Dorsal margin very slightly convex; basal margin widely

convex; both ends are broadly rounded, but the anterior end is slightly narrower than the posterior. Beaks small, prosogyrous, located a little in advance of the middle. The shell is thin, marked on the surface by very faint lines of growth, and by a few larger irregularly arranged concentric undulations. Pallial sinus not observed; only muscular impression observable is the anterior one, elongated and narrow. The shell is flattened by compaction.

Etymology: I have the honor of dedicating this new species to Robert N. ERLICH, one of the rare Oil Exploration Geologist, who obtained a well-deserved PhD (1999) at the Vrije Universiteit, Leiden, Holland.

Dimensions: The Holotype, UCVGM/IO-2145, measurements, Length: 53 mm, Height: 30 mm, LV, on black, micaceous shale. Two fragmentary casts.

S.C.S.occurrence: Locality VG-382-B, Quebrada El Imposible, near Ojo de Agua village, El Dantó dolostones, (DGC) of Latest Valanginian-Hauterivian age.

Discussion: Among the fourteen cited species of *Ospriasolen,* "*Siliquaria" pricei* (de LORIOL, 1882,: 50-51, pl. 5, fig. 22) – Albian, Switzerland,- is the more alike, but *O. erlichi* is more convex ventrally, and its umbo is in more forward position. *O. erlichi* is the oldest representative of this genus.

Family ***TELLINIDAE*** De Blainville, 1819.

Infaunal siphon feeders (STANLEY, 1968: 216). The Biochron of the family, extends from Early Cretaceous to Recent (COX et alii., 1969: N613).

Genus ***Aenona*** Conrad, 1870.

According to KAUFFMAN in HALLAM et alii., (1973: 369) during the Cretaceous Period,- is proper of the North Temperate Realm, the Gulf – Atlantic Coast Subprovince, where is supposed to be endemic. The oldest representatives of this genus, are in the saline/hypersaline marine formations of S.C.S.

Aenona andium (Gerhardt, 1879)
Plate 18, figure 4;

- 1897 *Tellina (Linearia) andium* GERHARDT, Beitr. Z. Kennt.d. Kreide Columbien: 187, pl. 5, fig. 9;
- 1938 *Clementia (Flaventia?) ricordeana* DIETRICH, Lamel. Cret. Cord. Oriental: 104, pl. 22, figs. 1-2; (non d'ORBIGNY, 1844)
- 1985-c, *Tellina ¿ andium* G., ETAYO SERNA, Proy.Cret. Publ. Esp. 16: 24-12;

Occurrence: This taxon was collected by GERHARDT on the road to La Laguna in Ubaque (Cundinamarca, Colombia) in outcrops of Lower Villeta Formation, of Cenomanian age. Also collected in Cáqueza shales, associated to *Buchotrigonia,* spp., of Barremian age (ROYO Y GOMEZ, 1942c: 342-343).

S.C.S. occurrence: Locality MO-892, Cerro Los Bordones, west of Cumana, Sucre state, of El Dantó dolostones, (DAGM), of Hauterivian age. Also found at PM-06-C, road from Pajaral to La Margarita mt., in La Margarita mudstones, mostly fragmented shells. In Colombia, cited from Apón Formation, of Late Aptian age (ETAYO SERNA op. cit.).

Aenona? carteroni (d'ORBIGNY, 1844)
Plate 14, figure 3;

- 1842 *Tellina angulata* DESHAYES in LEYMERIE, Mem. Soc. geol. France, #5, pl. 3, fig. 6; (non *angulata* Gmelin, 1791)
- 1844 *Tellina Carteroni* d'ORBIGNY, Paleont. Franç. #3 : 420, pl. 380, figs. 1-2 ;
- 1924 *Tellina carteroni* d'O., GILLET, Mem. Soc. Geol. Fr., n.s. 1(3, 4): 136;

Occurrence: In the Paris Basin, France extends from Valanginian to Barremian, in Germany, only in the Hauterivian. In the Lower Greensand, England, restricted to Early Aptian.

S.C.S. occurrence: Locality MO-905, cliff to the northwest of Puerto Escondido, Lower Lope Member of Taguarumo Formation, (DAGM), in shales, disarticulated valves, of Late Barremian age.

Dimensions: The measurements are, Length: 17 mm; Height: 10 mm.

Comparisons: It is very much alike to *"Tellina" renauxi* MATHERON (1842, R.T.S.M. #6: 143, pl. 13, fig. 11) – Turonian to Campanian, Germany and France.- but *A. carteroni* is a shorter shell.

Aenona elliptica (Whitfield, 1891)
Plate 56, figure 8;

- 1891 *Veleda elliptica* WHITFIELD: 406, pl.7, figs. 1, 2;
- 1946 *"Tellina" elliptica* (W.) VOKES, Amer. Mus. Nat. Hist. 87(3): 198, pl.9, figs. 18-21; (non Brocchi, 1814)

Discussion : H. E. VOKES (op. cit.) discussed detailedly the evolution of the terminology of this taxon. The precise description of this author, allow us to preserve this name, including it in *Aenona* Conrad, 1870, specially with the detail of dorsal margins of shell serving as lateral teeth, and the palleal sinus broad, not confluent.

Occurrence: Frequent at the "Olive locality" Lebanon, of Late Aptian age.

S.C.S. occurrence: Locality MO-1156, Quebrada El Molino, Niquitao area, Trujillo state, in the *Acteonella*-bed, of Guayacan Member of Capacho Formation, of Late Turonian age. Also in Escandalosa Formation, Merida State, of Cenomanian age.

Genus ***Agnomyax*** Stewart, 1930.

According to KAUFFMAN in HALLAM et alii., (1973: 367) *Agnomyax* is restricted to the North Temperate Realm, North America, North Europa? And Asia?, with a Late Cretaceous Biochron. Three species were found in sediments of Valanginian to Albian of saline/hypersaline affinities in Venezuela.

Agnomyax aubouini new species Macsotay
Plate 12, figures 6, 11;

Description: Shell medium sized, inequilateral, anterior dorsal slope regularly convex; anterior extremity slightly excavated underneath the beak; and regularly rounded, passing smoothly to the ventral margin. Umbones tumid, opistogyre, with blunt beaks. Lunule ill-defined, inner margin smooth. Posterior area with smoothly curved radial ribs, anterior two thirds covered with concentric regular threads, alike *Tellina (Eurytellina)* (COX et alii., 1969: N615). There are 18-20 concentric threads by 1 cm, in the center of the flank.

Dimensions: The Holotype, (pl. 12, fig. 6), measures, of Length: 36,6 mm; of Height: 27,5 mm. The Paratype, (pl. 12, fig. 11), measures of Length: 30,9 mm, and of Height: 25,4 mm. Both are LV, and were cataloged with the number UCVMG/IO-1976.

Etymology: This species is dedicated to Monsieur Le Prof. Jean AUBOUIN, Université Pierre et Marie Curie (Paris VI), Paris, France, - who selected the best of his Geology PhD students, to send them to Venezuela (1976-1980).

S.C.S. occurrence: Locality MC-341-C, La Hacienda, Río Carinicuao, Sucre State, El Dantó dolostones, (sDLP, DGC) of Early Hauterivian age.

Discussion: Having radial ribs on the posterior slope of the shell, is a character in common with *Protocardia (Protocardia)* (COX et alii., 1969: N588), but the *Arcticidae* –shape introduces a doubt, that only will be solved, when samples with their hinge-lines will be studied.

Agnomyax australis (Gabb, 1877)
Plate 12, figure 9;

- 1877 *Pholadomya australis* GABB, Acad. Nat. Sci. Philad.,Jour. #2: 8: 284, pl. 40, fig. 14;

Description: Cast medium-sized, oblique, very inequilateral, convex; beaks placed close to the anterior end, large, incurved; anterior end narrowly rounded; posterior broad, regularly rounded, and slightly oblique. Surface smooth in advance; seven radiating ribs run from the beaks to the base, (9-11 in El Dantó specimens) their ends occupying almost the entire basal margin; posterior to these, the surface is covered with small, rounded, concentric ribs, faint traces of which can be seen between the radials; posterior to the beaks and adjoining the cardinal margin, is a small, narrow, cordate area, slightly concave and bounded by a slight angle (GABB, op. cit.).

Dimensions: Measurements of our shell: Length: 28 mm, Height (somewhat damaged): 23,3 mm. Gabb's figure 14: 6,1 mm of Length.

Occurrence: In the Peruvian Subprovince, was collected in Hacienda of Macanga. Additional samples from Cajamarca and Huari provinces, with no ornamentation. Age according to Lisson: Cenomanian.

S.C.S. occurrence: Locality VG-555-A, Rio Morocoto-Caituco-Ojo de Agua trail, Sucre state, El Dantó dolostones, (DGC) of Hauterivian age. Our casts are four times the size of the Peruvian fossil; even so, they must belong to the same species.

Comparisons: *Tellina monilifera* GABB (1864: 157, pl. 22, fig. 134) – from the Late Cretaceous of California,- the type of *Agnomyax,*- is also a small-sized shell, (14.1 mm of length) but its umbo is lower, and in a more central position.

Genus/Subgenus ***Linearia (Linearia)*** Conrad, 1860.

According to KAUFFMAN in HALLAM et alii., (1973) this genus belongs to the North Temperate Realm, The Gulf and Atlantic Coast Subprovince, though COX et alii (1969: N621) also signaled the Maghrebian Subprovince.

Linearia (Linearia) cf. subhercynica *(Maas)*
Plate 19, figure 14;

- Cf. 1895 *Tellina (Arcopagia) subhercynica* MAAS, Z.D.geol. Ges. #47(2): 258, pl. 6, figs. 3, 4;
- Cf. 1900 *Arcopagia subhercynica* (M.) WOLLEMAN, Neocom. Holl., Deutsch: 122-123;

Diagnosis: Small elliptical shell, whose relative dimensions are variable. A tyìcal shell measures: Length: 9 mm, Height: 5,5 mm, and thickness, 4,4 mm; apical angle: 130º. Sculpture of fine, concentric lines, with superimposed radial ribs at both extremes of the shell.

Occurrences: In brownish-red limestones of Gersdorfer Burg, Hilston Formation, of Neocomian age; in marls of Kannonenberges Hils sandstein, of Barremian-Aptian age. This Bivalve is part of the "dwarf" fauna of the Wealdian Facies of Northern Germany and Holland.

S.C.S. occurrences: Locality PM-06-C, road from Pajaral to La Margarita mt., La Margarita mudstones (sDLP, DGC), of Hauterivian age, seven well-preserved casts and molds. These shells from Venezuela, are somewhat of bigger size, than the ones of European wealdian facies.

Subgenus ***Liothyris*** Conrad in Kerr, 1875.

According to COX et alii. (1969: N621), this subgenus belongs to Gulf-Atlantic Coast Subprovince during Late Cretaceous times. This taxon is extended to North European Province, the Western European and Balkanic Subprovinces. It originated in Aptian-Albian times, in Syrian and South Caribbean Subprovinces.

Linearia (Liothyris) olea VOKES, 1946.
Plate 52, fig. 15;

- 1946 *Linearia olea* VOKES, Amer. Mus. Nat. Hist., 87(3): 200, pl. 9, figs. 10-16;

Description: The shell is moderately small, subelliptical in outline, depressed, convex: umbones small, slightly prominent, prosogyrous, situated 3/5s of the length of the shell. The anterior and posterior dorsal margins diverge from the umbones at an angle of about 130º. The dorsal margins are straight of slightly convex. The anterior end of the valve is very broadly and regularly rounded; the ventral is staright (VOKES, op. cit.). The only complete cast did not preserve the shell, so we can not describe any ornamentation; the lunule is narrow and deeply impressed and it is more than half of the length of the anterior end of the valves. No palleal sinus is observed.

Dimensions: The seasurements are: Length(incomplete): 38 mm, Height: 27,5 mm (plate 52 fig. 15); the originals from the Olive locality measure Length(incomplete): 20 mm, Height: 14,1 mm, Diameter (articulated shell): 5.9 mm.

Occurrence: Olive locality, Lebanon, of Late Aptian age.

S.C.S. occurrence: MO-1940, La Cueva inlet of Borracha Id., Upper Borracha Formation, (DAGM) of Early Albian age.

Comparisons: *Linearia (Liothyris) obruta* (Conrad, 1852: 219, pl. 10, fig. 58) – El Gurbh el-Toqany, - Aptian, Lebanon, is posteriorly more cuneiform.

Genus ***Palaeomoera*** Stoliczka, 1870.

According to KAUFFMAN in HALLAM et alii., (1973: 365) *Palaeomoera* belongs to the Western Mediterranean Subprovince (=Maghrebian, in this study), with a Biochron of Late Cretaceous. In S.C.S. it originated during Aptian times.

Palaeomoera cf. moreana (d'ORBIGNY, 1844)
Plate 40, figure 10;

- Cf. 1844 *Tellina moreana* d'ORBIGNY, Paleont. Franç. Terr. Cretacé #3: 421, pl. 380, figs. 3, 4, 5 ;
- Cf. 1865 *Tellina moreana* d'O., PICTET & CAMPICHE : 136 ;

Description : Oval-oblong shell, compressed, inequivalve, subequilateral. Posterior extreme is narrower, subacuminated. The surface of our cast is smooth, except an area in postero-ventral area, where concentric ribs of two categories are observed. Weak impression of the adductor muscles, both ovate in form. Our shell is near *Palaeomoera moreana* (d'Orbigny), - Albian of France and Switzerland,- but the anterior extreme is more truncated, with a steeper antero-dorsal slope; apical angle diverges 120º; its ventral margin is more arched than *P. moreana.*

Dimensions: Length: 24 mm, Height: 16,6 mm; convexity: 3-4 mm.

Occurrence: In Albian sediments of Paris Basin, and Switzerland, usually rare.

S-C.S. occurrence: Locality MC-41-F, Quebrada La Lisboa, Monagas state, Garcia Formation, (DBG) of Late Aptian age, deep-water facies, with ammonites and belemnites.

Comparisons: Our casts are smaller, but relatively thicker than *P. parkerana* (Stephenson, 1952: 114-115,, pl. 28, figs. 1-5) – Woodbine Formation, Cenomanian, U.S.A.- but the beaks are more elevated an the anterior extremity is more rounded. In *P. jabolii* GORTANI (1973: 69, pl. 14, fig. 8a-c) – Albian, Etiopia,- is somewhat more elongated, with the umbo anteriorly placed, and the postero-dorsal area is concave.

Family ***ICANOTIIDAE*** Casey, 1961.

Icanotiidae was proposed by CASEY (1861A: 581) as "closely allied derivatives of the "Jurassic *Tancredia* to the life in a burrow. Equivalve, closed, compressed, elongate and "fragile Tellinaceans, which include the Genera *Icanotia* Stoliczka, and *Scittila* of "Cretaceous age." This strategy suggests the adaptation to hypersaline and saline marine waters. The Biochron of Cretaceous (Hauterivian to Maastrichtian) tends to confirm this.

Genus ***Icanotia*** Stoliczka, 1870.

COX et alii., (1969 : N635) stated a distribution area , as North Temperate Realm, but its extension to South America, suggests that the control was the salinity and not the temperature. It is never common.

Icanotia cf. peruviana Olsson, 1934
Plate 45, figure 13;

- Cf. 1934 *Icanotia peruviana* OLSSON, Bull. Amer. Paleont. 20(69): 55-56, pl. 5 fig. 5;
- 1980 *Icanotia cf. peruviana* O., GARCIA JARPA et al.:44;

Occurrence: In the Peruvian Subprovince, in Pananga Formation, of Late Aptian to Early Albian age.

S.C.S. occurrence: Peñas Altas Formation, Guáimaros shale member, of Early Albian age. Few disarticulated shells were found in Arbol Redondo section. In locality MC-271-F, east of Punceres anticline, in El Cantil Formation's upper limestones, of Early Albian age, one well preserved fragment.

Dimensions: Length (damaged shell): 53 mm, Height: 24 mm, Semidiameter, LV: 3,50 mm.

Discussion: The oldest species of this genus, are: *Icanotia? togata* (Trautschold, 1858)(GERASIMOV, 1955, T. B. R. G. M.,#1660: 64, pl. 8, figs. 6, 7) – Kotelniki sandstone, Late Volgian age, Province of Moskva, Russia. *Icanotia inaequistriata* (Alth, 1881) –Nizniow limestone, Ryazanian,- Southern Poland. The Biochron of *Icanotia* extends from the Late Jurassic (Volgian) to Maastrichtian. Cretacous age species were listed by OLSSON (op. cit.).

Genus ***Scittila*** Casey, 1961.

According to KAUFFMAN in HALLAM, (1973: 369), *Scittila* belongs to the North Temperate Realm, but it is not endemic of Europe: Japan and S.C.S. are part of its distribution area. Its Biochron is Cretaceous (Valanginian to Aptian).

Scittila carteroni (d'ORBIGNY, 1843)
Plate 39, figure 11;

- 1843-1847 *Tellina Carteroni* d'ORBIGNY Pal. Franç, Terr. Cret.#3: 420, pl. 380, figs. 1-2;
- 1900 *Tellina carteroni* d'O., WOLLEMAN : 121-122,
- 1974 *Tellina carteroni d'O.,* DIMITROVA, Foss. Bulgarie, #4b : 109, 110, pl. 59, fig. 12 ;

Occurrence : *S. carteroni* (d'O.) is abundant in the Hauterivian-Barremian of Westertn European Subprovince, extending to Balkanic and Apulian Subprovinces during Aptian times. Reaches Spanish Guinea, West Africa, during Albian times.

S.C.S. occurrence: Locality MC-446-D, Campo Alegre-Buena Vista road, Cerro La Torre, Guacharo Member of El Cantil Formation, (DGC) of early Albian age; only disarticulated valves were found. Also at locality MC-341-C, of Garcia Formation, of Late Aptian age.

Scittila nasuta radiata (Casey, 1961)

- 1961 *Scittila nasuta radiata* CASEY, Paleontogr. 3(4): 583;
- 1907 *Tellina Carteroni* (d'O.) WOODS, Paleontogr. Soc., 2(4): pl. 26, fig. 17; (non d'ORBIGNY, 1845: 420)
- 1985c *Scittila nasuta radiata* C. ETAYO SERNA, Proy. Cretacico, Publ. Esp. 16: 24-9;

Diagnosis: It is proposed to apply the combination *S. nasuta* to the Lower Greensand form previously described and figured by WOODS as *S. carteroni.* Radial ornament in the posterior part, may be seen faintly under magnification in the typical *S. nasuta* and it is much more conspicuous in the variety *radiata.*

Occurrences: Atherfield beds, of Aptian age, England.

S.C.S. occurrences: In Colombia, Graben del Cocuy, Apón Formation, of Late Aptian age.

Scittila putucualensis new species Macsotay

Plate 33, figures 1, 11

Description: Shell elongate, much compressed, inequilateral, anterior margin rounded, curving rapidly to join the slightly curved ventral margin; posterior margin oblique, forming an angle with the ventral margin. Umbones small, prosogyrate. Surface of the shell, covered by many fine, regular concentric striae, better preserved posteriorly; their weakening on the carina. A weak carina extends in a curve from the umbo to the postero-ventral angle, and cuts off a narrow, flattened postero-dorsal area. No radial ornamentation is observed.

Etymology: The species is named after the Putucual River, Municipio Andres Mata, Sucre State.

Dimensions: Measurements are: Length: 15,5 mm, Height: 8,2 mm LV, Holotype UCVMG/IO-1941; Length: 14 mm, Height: 9 mm, RV, Paratype, UCVMG/IO-1942;

S.C.S. occurrence: Locality VG-185-A, road from Santa Rosa to Río Putucual, Sucre state, lower Borracha Formation, of Late Aptian age. Disarticulated left valves: 17; right valves: three, all from the same bed. This unit was studied as El Cantil Formation, by METZ (1969).

Discussion: Compared to *S. nasuta* CASEY (1961: 583, pl. 80, figs. 1,2; text-figs. 9b, 9c) –Aptian of England,- our shell lacks the shallow furrow descending from the umbo to the middle of the ventral margin. *S. japonica* HAYAMI (1965-b) – Late Neocomian to Aptian of Japan, - is a more elongated shell, with a dozen or more broad concentric plications. In general shape, our species is near to "*Cardinia" suprajurensis* Struckmann (1882: 17, pl. 3, figs. 11, 13) – Upper Portlandian Bückeberg Schichten, Niedersachsen, Germany, and Terminetto Fomation, Italy, of Hauterivian age- whose umbos are more centrally located, and does not have the medial furrow in the shell.

Scittila valangiensis (Pictet & CAMPICHE, 1865) Plate 14, figure 12;

- 1865 *Psammobia valangiensis* PICTET & CAMPICHE, Paleont. Suisse, #3 :148, pl. 109, figs. 9, 10 ;
- 1882 *Cardinia suprajurensis* STRUCKMANN, Paläont. Abhand. 1 : 17, pl. 3, figs. 11, 13;
- 1931 *Psammobia valangiensis* P. & C., WEAVER, Univ. Washington, Mem. 1:358-359;
- 1938 *Tellina cf. carteroni* d'Orb., DIETRICH: 105, pl. 22, figs. 6-7;
- 1942[a] *Tellina sp.* ROYO Y GOMEZ: 47;

Description: Shell moderately large, elongate, rectangular-ovate, in outline and somewhat compressed; the umbones are situated between the middle and anterior third of the shell, and are not prominent. Postero-dorsal is straight, with a very slight downward slope, where it makes almost a right angular junction with the nearly vertical, somewhat truncate posterior margin. The basal margin is almost parallel to the dorsal, and curves anteriorly to join the nearly vertical anterior margin. The antero-dorsal margin slopes downward from the umbones at an angle of 15º.

Dimensions: Length: 52 mm, height: 21 mm, Thickness of articulated shell: 14 mm (WEAVER, op. cit.). Length: 34 mm (uncomplete); Height: 12 mm (DIETRICH, 1938). Length: 14 mm; Height: 6,5 mm (ARTHABER, 1937, N.J.b.Geol. Pal. Abh. 77: 412, pl. 23, fig. 1).

Occurrence: In Valanginian sediments: Calcaire Roux Formation, Switzerland, Lower Agrio Formation, Argentina. In Hauterivian sediments: Terminetto Formation, Italy; Hilsthon Formation, Germany, wealdian.

S.C.S. occurrence: Locality MC-346-C, Catuaro, Sucre State, shales interbedded in El Dantó dolostones, (DAGM), of Hauterivian age. Also in PM-08-C, in Margarita mudstones, of the same ahe: only fragmented shells were recovered.

Discussion: The three different sizes in the same species, are the response to favorable or disfavorable environmental parameters. No separate names are needed.

Family ***SOWERBYIDAE*** Cox, 1929:
Genus ***Sowerbya*** d'ORBIGNY, 1850.

COX et alii. (1969: N639) stated this genus as European, of Late Jurassic (Oxfordian) age. We extend this Biochron to Early Cretaceous (Valanginian) and its distribution to S.C.S.

Sowerbya cf. crassa (d'ORBIGNY, 1850). Plate 7, figure 11;

- Cf. 1850 *Sowerbya crassa* d'ORBIGNY, Prodrome: 175;
- Cf. 1969 *Sowerbya crassa* d'O., COX et alii., :N639, fig. 122, 2 ;

Description : Shell of medium size, compressed, elongate, with the length twice the size of the height ; umbones prominent, about the middle of the shell ; antero-dorsal margin convex; posterodorsal margin feebly concave, truncating the shell vertically; posterior slope with an obtuse ridge. Ventral margin regularly convex; anterior dorsal

margin sloping very slightly towards the rounded anterior extremity. Surface smooth, except for growth-lines.

Dimensions: The measurements are: Length:23,3 mm; Height: 14,0 mm;

S.C.S. occurrence: Locality VG-386, Ojo de Agua-Santa Rosa road, between Río Grande and Quebrada del Medio, Sucre State, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age.

Discussion: Our specimen only differs from *S. crassa* (d'ORBIGNY) in having a more roundly convex ventral margin.

Family ***TANCREDIIDAE*** Meek, 1864.

Tancrediidae (Biochron: Late Triassic to Late Cretaceous), seems to have adapted well to the hypersaline conditions dominant in the S.C.S. since Berriasian times. The unusual distribution patterns of the genera of the *Tancrediidae* suggest a Pacific origin (Pacific and Izumi Plates) for this family.

Genus/Subgenus ***Tancredia (Tancredia)*** Lycett, 1850.

The taxon *Tancredia (Tancredia)* was considered extinct during Oxfordian times (COX et alii., 1969) but survived as a minor faunal element during the Eocretaceous. *T. (T.) subcurtansata* Lycett (ALENCASTER, 1977) cited from San Ricardo Formation, Mexico of Berriasian age *T. (T.) stelcki* McLearn (IMLAY, 1961) cited from Alaska, of Aptian age are the evidences.

Subgenus ***Isotancredia*** Chavan, 1950.

According to COX et alii., (1969: N640) during Middle-Late Jurassic,this taxon was cosmopolitan. KAUFFMAN in HALLAM, (1973: 374) consideres it typical of East African Province-Subprovince, during Eocretaceous times. Three taxa are reported here from S.C.S., with the extension of the Biochron to the Middle Albian.

Tancredia (Isotancredia) alpina (d'ORBIGNY, 1850)
Plate 7, figure 19;

- 1850 *Isoarca alpina* d'ORBIGNY, Prodrome, 3: 317;
- 1934 *Isoarca alpina* d'O., COTTREAU, Ann. Paleontologie 23: 67, pl. 72, figs. 20, 21;
- 1937 *Tancredia cf. autissiodorensis* C., ARTHABER: 348, pl. 25, fig. 8;

Occurrence: Collected at Jabron (Var, south of France) in Hauterivian sediments; also in Terminetto Formation, Italy, of also Hauterivian age.

Dimensions: The measurements are, Length: 25 mm, Height: 15.5 mm (plate 7, fig. 19).

S.C.S. occurrence: Locality VG-384, Ojo de Agua-Santa Rosa road, Sucre state, El Cazón Formation (DGC) of Berriasian-Valanginian age, seven articulated specimens. In El Dantó dolostones and La Margarita mudstones, of Hauterivian age, scarce disarticulated specimens were found.

Tancredia (Isotancredia)* cf. *gibba *(*Coquand, 1865)
Plate 37, figures 8, 12;

- Cf. 1865 *Tellina gibba* COQUAND, Mon. Soc. Emul. Prov.,#3 : 291, pl. 8, figs. 9-10 ;
- Cf. 1887 *Tellina gibba* C. MALLADA, Sinops. España, Cret. Inf.#3:88, pl. 32, fiogs. 9, 10;
- Cf. 1949 *Tellina (Trapezium) gibba* C. BATALLER, Sinops. #8(2): 117-118;

Occurrence: Chert, ermita de la Providencia de Tortosa, Chert Formation, Maestrazgo Basin, of Early Bedoulian age (CANEROT, 1984), not Late Aptian, as was stated originally.

Dimensions: Length: 35 mm; Height: 25 mm, LV, (plate 38, fig. 8).

S.C.S. occurrence: VG-398-B, Creek affluent of Santa Juana River, Cerro El Cautaro, estado Sucre, Valle Grande Formation, of Middle to Late Albian age.

Discussion: Our shell has twice the size of *Tancredia gibba* sensu stricto, (Length: 20 mm, Height: 8 mm, and Thickness: 6 mm) and does not show the sharp keel extending from the umbo to the posterior margin

Tancredia (Isotancredia) cf. tellina *Lange, 1914.*
Plate 7, figure 22;

- Cf. 1914 *Tancredia (Isotancredia) tellina* LANGE, Arch. Biont., 3(4): 248-249, pl. 22, fig. 11;

Occurrence: Kigombo, Tendaguru, Mozambique, of Neocomian age.

Description: Small shell, subtrigonal, sugequilateral, with dorsal margins weakly concave, both extremes equally rounded, not cuneiform. Its umbo is more central, and more gibbous as *T. (I.) tellina* Lange, and the whole shell is more inflated.

Dimensions: Maximum length: 27 mm, maximum height: 18,4 mm, Thickness disarticulated shell: 6,5 mm (LANGE op. cit.). Our specimens measure, Length: 36 mm, Height: 25,3 mm (plate 7, figure 22).

S.C.S. occurrence: Locality MC-329-D, siltstones of Río Pajaral, El Cazón Formation, (sDLP, DGC), of Late Berriasian-Early Valanginian age.

Genus ***Corbicellopsis*** Cox, 1929.

COX et alii (1969: N642) considered it an European genus, with a Biochron of Middle Jurassic (Bajocian) to Eocretaceous. It is a stenohalyne genus, favored by Hypersaline conditions. I report three species from S.C.S.

Corbicellopsis claxbyensis (WOODS, 1907)
Plate 9, figure 8;

- 1907 *Corbicella claxbyensis* WOODS, Paleontogr. Soc. 2(4): 157, pl. 24, figs. 20-23;
- 1924 *Corbicella claxbyensis* W., GILLET, Mem. S.G. Françe:#1(3, 4): 125;

Occurrence: Claxby beds, Spilsby Formation, England, of Ryazanian (=Berriasian) age.

S.C.S. occurrence: Locality VG-381. Ojo de Agua-Santa Rosa road, between Rio Grande and Quebrada del Medio, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age.

Corbicellopsis görögae new species
Macsotay. Plate 14, figure 12;

Diagnosis: Sub-trigonal in outline, rounded beaks, subequilateral, with beaks posterior to the mid-line; anterior cardinal margin straight, no gape.

Description: Cast of medium size, inequilateral, with low and rounded umbos. Postero-dorsal and antero-dorsal are flat, and only distally, convex. Inequivalve, RV slightly more inflated than LV. The outline is sub-trigonal, the ventral margin is broadly convex; beaks small, slightly distant. The surface mostly worn away, but fairly strong rounded irregularly distributed concentric ridges are preserved on the distal half of the RV.

Etimology: I have the honor of naming this new species after the Hungarian Paleontologist, Dr. Agnes GÖRÖG, of the Eötvös Loránd University, who published the wide-spread Late Aptian-Albian *Mesorbitolina* species of Venezuela (1996) after fifty years of sterile Petroleum Exploration.

Types & Dimensions: The Holotype (UCVMG/IO-1943) measures of Length: 33,2 mm, Height:25 mm, and thickness (both valves): 9,5 mm.

S.C.S. occurrence: Locality MO-3213, Chimana Grande Island, Lope Inlet, Lowest Taguarumo Formation, (DAGM) of Late Hauterivian age. Also locality VG-556-A, Río Morocoto-Caituco-Ojo de Agua, (DGC), El Dantó dolostones, of Hauterivian age. Sampled from grey shales, with abundant *Chondrites*-burrowing.

Discussion: *C. görögae* seems to be related to many of the species belonging to the "dwarf"fauna of the Ryazanian age of the North European Province. Among them, *C. radiata* (von ALTH, 1881 Beitr. Z. Paleontol. Österreich-Ungarn n. Orients, pl. 9, figs. 11a, 11b)-Nizniow limestone, southern Poland, but it is much smaller and elongated. Compared to *C. laevis (J. Sowerby)*- the type of the genus, of Late Jurassic, Oxfordian are,- is a medium-sized shell exhibiting a concentric ornamentation of somewhat irregular and strong ribs. *C. laevis* has a concave postero-dorsal slope.

Genus ***Eodonax*** Cox, 1929.

COX et alii. (1969: N642) considered it an European species with a Biochron of Late Jurassic to Early Cretaceous age. In Ryazanian Portland beds of England COX (1929) reported four species, but none were reported previously from the Americas.

Eodonax cf. unioniformis (PHILIPPI, 1899)
Plate 7, figure 16;

- 1899 *Trigonia? unioniformis* PHILIPPI, Fos. Secund. Chile: 93, pl. 38, fig. 9;
- 1925 *Trigonia? unioniformis* P. DEECKE, Foss. Catalogus#30: 280;

Occurrence: Portezuelo de Tinguririca, Chile, of Neocomian age.

Diagnosis: Original sample was a cast, with part of the shell preserved on the RV, which is thicker distally, than proximally.

Dimensions: Lenth: 28 mm, Height:16 mm; Thickness: 7-8 mm (PHILIPPI, op. cit.). Our sample, measures of Length: 22,6 mm, Height: 16 mm (Figure 16).

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, Sucre State, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age.

Discussion: Our cast has a great resemblance to *E. unioniformis* (Philippi), but differs in the profile of the posterior are, which is pointed in the nominal species, and regularly rounded in ours. Consequently, our specimens are shorter.

Eodonax hartenbergeri new species, Macsotay
Plate 40, figure 1;

Description: Sub-trigonal shell, RV more or less pointed anteriorly, rounded and truncated posteriorly. Beaks subcentral, prominent; no gape at all; no teeth observed; dorsal area and center of the disc, is broken; it allows the observation of the thickness of the shell.

Etymology: Dedicated to Professor Louis Hartenberger, a very active Paleontologist dedicated to Cenozoic micro-mammals, who studied fossil mammals of Venezuela's molassic sediments in its mountain fronts.

Dimensions and type: RV, moderately well preserved, measures, of Length: 21,3 mm, Height: 21,3 mm. The holotype, UCVMG/IO-1944.

S.C.S. ocurrences: MC-126-A, Cerro Piedra de Rayo, southern slope, Monagas state, Garcia Formation, DBG, of Late Aptian age. Only disarticulated, transported valves were found.

Discussion: In general shape, it is alike to *E. dukei* (Morris & Lycett) – Type of *Eodonax,* of the Portland beds of Ryazanian age of England,- but is different in the strong curvature of the ventral margin and the proportion of Height/Length relationship.

Genus (Subgenus)***Meekia (Meekia)*** Gabb, 1864.

According to COX et alii. (1969: N642) the distribution of this taxon includes the North Pacific Province and the Japanese-East Asian Subprovince, with a Biochron from Albian to Maastrichtian. Our finding extends its lower limit to Late Berriasian and S.C.S. and increases our presumption of a Paleo-Pacific origin for the whole *Tancrediidae* family.

Meekia (Meekia) cf. exotica Saul & Popenoe, 1964
Plate 5, figure 22;

- Cf. 1964 *Meekia exotica* SAUL & POPENOE, Univ. California, P.G.S. 40(5): 297, pl. 2, figs. 10-12; text-fig. 2;

Discussion: It differs from all other members of of *Meekia (Meekia)* in having no trace of radiate sculpture and in lacking the external punctuations so characteristic of the subgenus *Meekia.* Its trigonal outline, inflated posterior region, a wide lunule, and a rather thick shell will distinguish it from all the species of the subgenus *Mygallia.*

Occurrence: The original sample was collected in a conglomerate, in Curry Canyon, southeast of Mt. Diablo, Contra Costa Co., and was considered of uncertain Albian age, by SAUL & POPENOE (op. cit.). Six-seven specimens were collected in clasts in North Fork of Cottonwood Creek, from conglomerate below the mouth of Helen Creek, Shasta Co., California.

Dimensions: Length (incomplete): 16 mm, Height: 13,3 mm, convexity: 5,3 mm (SAUL & POPENOE, op. cit.). Length: 24 mm, Height: 20,5 mm, RV, (cf. *exotica)* .

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, Sucre State, El Cazón Formation, (sDLP, DGC) of Berriasian-Valanginian age.

Discussion: Our specimen (plate 5, fig. 22) - an unique RV,- seems to be more evenly rounded posteriorly and ventrally, but otherwise is very much alike to *Meekia (M.) exotica* Saul & Popenoe. The lunule is wider and better defined. With this evidence in hand, we propose an Early Neocomian age for the California fossils, which means an important erosional event of Intra-Cretaceous (Gallic) age in that area.

Family ***ARCTICIDAE*** Newton, 1891.

The members of this family are all infaunal siphon feeders (STANLEY, 1968). According to GILLET (1924) they abound in cold and temperate regions, where they attan the biggest sizes. In S.C.S. area, - tropical,- they are favored by pro-delta organic-rich muds, where the individuals reach big sizes, because the lack of predators. Maybe it is not the low temperature, but the salinity – hypersalinity with its leptopel, the positive factor, for the abundance and biodiversity of *Arcticidae.* This also explains why the family is absent from the "facies coralligènes": the food requirements are very different.

Genus ***Agapella*** Vokes, 1946.

According to KAUFFMAN in HALLAM et alii., (1973) it is a Tethyan genus, with Eastern Mediterranean Subprovince provincialism lower than of Western Mediterranean. It is not true: it is a thermophyllic genus, and is distributed equally in all the Tropical Subprovinces of Gondwanan Province, and Japanese-East Asian Subprovince. Its Biochron is Cretaceous (Barremian to Albian - ?Senonian).

Agapella normandi (RENEVIER, 1867)
Plate 54, figure 8;

- 1867 *Cyrina? Normandi* RENEVIER, Bull.Soc. Vaud. Sci. Nat. #9 : 152, pl. 7, fig. 5 ;

Diagnosis: Shell of medium size, inflated, almost circular in outline, with relatively high, inflated, prosogyrate umbones. Lunule small, immediately below the termination of the umbones. Escutcheon-like dorsal area, delimited by two low, and inconspicuous umbonal ridges: a small one, sharp, bordering the ligamentary area, the other, big and obtuse, traversing the posterior area. Surface ornamented only by lines of growth.

Occurrence: Cheville, Vaud, Switzerland, *Pecten asper* Zone, Late Albian (RENEVIER, op. cit.).

Dimensions: Height: 33 mm, Length: 32 mm (incomplete, fig. 8). Our shell is 30 % bigger in size, than the original, from Switzerland.

S.C.S. occurrence: Locality HA-4520, Cerro El Cocuy, Curarigua, Trujillo state (ARNAUD et alii., 1999, fig. 22), where it is associated to *Aptyxiella* spp., and *Amphitriscoelus waringi* (Harris & Hodson), in Lower carbonatic member of Peñas Altas Formation, of Early Aptian age.

Genus/Subgenus ***Anisocardia (Anisocardia)*** Munier-Chalmas, 1863.

This taxon has a Biochron of Middle Jurassic (Bajocian) to Early Cretaceous (Aptian), and a distribution of Syrian, Somalian, Western European and Apulian Subprovinces; now, extended to S.C.S. and Peruvian Subprovinces. It seemed to proliferate in muddy bottoms, in disoxic or anoxic marine waters.

Anisocardia (Anisocardia) cf. paquieri *(ROLLIER, 1913)*
Plate 7, figure 14;

- Cf. 1913 *Anisocardia Paquieri* ROLLIER, Foss. Du Jura: 191, pl. 15, fig. 1 ;
- Cf. 1925 *Anisocardia Paquieri* R. STEFANINI, S. Egypt, Geol. Surv.: 175-176;
- 1929 *Anisocardia cf. autissiodorensis* (C.) COX, Proc. Dorset N. H., 50: 174-175, pl. 5, fig. 12;(non *Isocardia autissiodorensis* COTTEAU, 1854)

Description : A cast of the shell, inequilateral, subtrigonal, heart-shaped, dilated, thick, of medium size ; the buccal region is short, the anal region is dilated and winged, the pallial margin rounded; the cardinal margin is not visible; umbones prosogyrous, relatively much curved and prominent; the ornamentation is not preserved.

Dimensions: The best preserved specimen measures in Length: 40 mm, Height: 47 mm, and Thickness: 49 mm (STEFANINI, op. cit.). Length: 33 mm, Height: 26 mm, (cf., plate 7, fig. 14).

Occurrence: Bihendula, Egypt, of Berriasian age. Also in Portland sand beds, England, of Ryazanian age, associated to *Nanogyra*- fauna. In France, are in the "Mid-Portlandian" of Yonne, of the same age.

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa road, Sucre state, El Cazón Formation (sDLP, DGC), of Berriasian-Valanginian age.

Discussion: Our specimen is an allied from of *A. paquieri* (Rollier),- Late Callovian to Ryazanian (=Berriasian) age,- but differs being consistently lower, and the posterior margin more rounded.

Anisocardia (Anisocardia) valangiensis
(PICTET & CAMPICHE, 1865)
Plate 7, figures 6, 15;

- 1865 *Isocardia valangiensis* PICTET & CAMPICHE, Paleont. Suisse,#3 : 237-238, pl. 156, figs. 4a, 4b, 4c ;
- 1985 *Cyprina valangiensis* P. & C., ETAYO SERNA, Proy. Cretacico, Publ. Esp. 16:24-15;

Occurrences: Calcaire Roux Formation, Ste. Croix, Switzerland, of Valanginian age.

Diagnosis: Description based on casts, longer than high (Length: 27 mm, apical angle , 100º) subtrigonal, slightly inequilateral, regularly inflated; beaks in submedial position, prosogyrate; inner ventral margin, finely crenulate.

Dimensions: The measurement are: Length: 32 mm, Height: 29,5 mm; RV; Length: 35 mm, Height: 27,5 mm.

S.C.S. occurrence: Locality MC-329-D, ferruginous siltstones at Pajaral, El Cazón Formation, (sDLP, DGC) of Late Berriasian-Early Valanginian age. In Colombia, it was reported but not illustrated from Macanal shales, of Valanginian age. Related species in the "dwarf" fauna of Purbeckian facies are: *A. veneriformis* de Loriol (MAILLARD, 1884), and *Anisocardia pulchella* de Loriol, (von ALTH, 1881) from the Niznyow limestone, - South Poland, of Ryzanian age, both are more elongated in shape.

Subgenus ***Collignonicardia*** Mahmoud, 1955.

The original description of this genus is largely reproduced by COX et alii., (1969: N646) as follows: Sculpture of fine serrate concentric riblets; shell trigonal, with blunt posterior carina: hinge unknown. I can add: The umbones are greatly elevated and

prosogyre; a pronounced umbonal ridge runs to the junction of basal and posterior margins, and the surfaces of the shell in front and behind of this ridge, make angles varying from 80º just below the beaks, to 95º near the basal margin. The surface behind this ridge is approximately flat. The shell material appears to have been thick (up to 10 mm), near the basal margin. These were essentially solid shells, specialized to live in high energy environments associated to the Transgressive System Tracts.

Biochron extended from Middle Jurassic (Callovian) to Neocretaceous (Turonian) stage, and was widely distributed all along the tropical subprovionces of Gondwanan Province, an evolution parallel to *Anisocardia (Anisocardia).* It could be a paleogeographic subgenus, and it should be kept as subgenus of *Anisocardia,* as was proposed by MAHMOUD (1955). Included in *Collignonicardia,* I propose:

Anisocardia (Collignonicardia) aquilina (Coquand), Early Cenomanian-Turonian,

A. (C.) *macanalensis* Etayo Serna, Hauterivian,
B. *(C.) branneri* (White), Albian,
C. *(C.) lapuyana* n. sp. Macsotay, Early Albian,
A. *(C.) montserratensis* (Vilanova), Aptian,
A. *(C.) simplex* (Mahmoud), Albian to Turonian
A. *(C.) simplex tanoutensis* Schneegans, Cenomanian.

According to KAUFFMAN in HALLAM et alii. (1973: 366) it is a Tethyan taxon, of North Indian Subprovince.

Anisocardia (Collignoniocardia) macanalensis
ETAYO SERNA, 1985
Plate 20, figure 15;

- 1985 *Anisocardia macanalensis* ETAYO SERNA, Proyecto Cretacico #16: 24: 20, 21, pl. 3, fig. 5; pl. 7, fig. 1;

Diagnosis: Shell trigonal, subovate, inaequilateral, umbones in position anterior to the middle; Prosogyrous beaks. Ventral margin moderately convex, passing to the anterior margin, quite convex; posterior margin is truncated and is limited by a marginal ridge, wich evanesces against the postero-ventral margin. Surface of the shell with a finely (irregular) reticulated sculpture, where some of the commarginal cords are outstanding.

Dimension: The measurements of the illustration (ETAYO SERNA, 1985a, pl., 3, fig. 5) are: Height: 29,3 mm, Length: 30 mm.

S.C.S. occurrence: Collected in the upper Macanal Formation, of Hauterivian age, locality Nº 185903, in the Cocuy Hemigraben, Colombia, (ETAYO SERNA, op. cit., fig. 7), associated to iron-rich nodules. In Venezuela, locality PM-11-E, road from Pajaral to La Margarita mt., La Margarita mudstones, (sDLP, DGC) of Hauterivian age.

Discussion: Considered (op. cit.) near to *Ambocardia neocomiensis* (Agassiz, non d'Orbigny)(PICTET & CAMPICHE, 1865: 235, pl. 116, figs. 1 – 3)- Valanginian to early Aptian,- in North European Province, Western European, Apulian, Balkanic and Neuquén subprovinces, but the Colombian species is remarkably asymmetric.

Anisocardia (Collignonicardia) lapuyana new species, Macsotay.
Plate 52, figure 8;

Description: Cast large, posteriorly elongate, subtriangular in outline, inflated, and shell material thick; Umbones are elevated, the beaks prosogyrous; the anterior end is short, concave above and convex below, and passing in a regular curve into the broadly rounded base, which has an inflexion, so part of the basal curvature is subparallel with the postero-dorsal margin; the posterior margin slopes down from the umbones at an angle of 40º, and makes a rounded angle with the base; an umbonal ridge extends from the umbones to the postero-basal margins; hinge plate not observable.

Dimensions: The measurements are, Length: 51 mm, Height: 50 mm. The Holotype is registered as UCVMG/IO-1945. Is the biggest bivalve in the basal bed of the member.

Etymology: This new species is named after La Puya member of Peñas Altas Formation, RENZ (1960), where it was collected by Ing. Geol. Tulio PERAZA.

S.C.S. occurrence: Locality HA-4333, La Aguada de los Chivos, Trujillo state, La Puya member of Peñas Altas Formation, of Middle Albian age (ARNAUD et alii., 1999, fig. 32). It is common in the lower limestone of the member, where many thick-shelled bivalves suggest shallow, high-energy waters.

Comparisons: It has a strong resemblance with *A. (C.) macanalensis* ETAYO-SERNA (op. cit.) – Hauterivian, S.C.S.-, but the more longated shape, and the flexured basal margin, differentiates it.

Anisocardia (Collignonicardia) montserrati
(Vilanova, 1863)
Plate 39, figure 14;

- 1863 *Isocardia montserrani* VILANOVA, J., Prov. de Teruel… pl. 7, fig. 3;

- 1891 *Platopis? triangularis* WHITFIELD: 401, pl. 5, figs. 16, 17;
- 1934 *Platopis? triangularis* W. BLANCKENHORN, Paleontogr #81A: 221, pl. 11, fig. 82a, b,. c;
- 1949 *Anisocardia montserrati* V., BATALLER, Sinopsis Fas. Cret. 8(1): 29;

Occurrences: Originally collected in Maestrazgo Basin, Spain, in Villaroya de los Pinares Formation, of Gargasian, -Late Aptian age. Also in Abeih sandstones, Lebanon of Aptian age.

S.C.S. occurrences: Locality MC-861, Río Azagua, marls of Garcia Formation, of Late Aptian age (DBG) associated to many thin-shelled bivalves.

Dimensions: Length: 30 mm, Heigth: 28 mm, and Thickness: 22 mm (MALLADA, 1887).

Genus ***Epicyprina*** Casey, 1952.

According to KAUFFMAN in HALLAM, (1973: 359) this genus is Cosmopolitan, in "warm-water" environments, from the mid-temperate to tropical climatic belts. Its Biochron intra-Cretaceous (Aptian to Albian).

Epicyprina angulata (J. Sowerby, 1814)
Plate 42, figures 5, 20; Plate 45, figure 2;

- 1907 *Cyrina (Venilicardia) angulata* (J. Sow.) WOODS, Paleontogr. Soc. 2(4): 141-143, pl. 22, figs. 1-4; text figs. 23, 24;
- 1931 *Cyprina angulata* (S.) WEAVER, Univ. Washington, Mem. 31: 325-326;
- 1946 *Cyprina sp.* LIDDLE, Geology of Venezuela and Trinidad: 197;
- 1974 *Venilicardia angulata* (S.) DIMITROVA, Foss. Bulgaria, #4b: 111, pl. 54, fig. 2ª, 2b;
- 1985c *Epicyprina cf. angulata* (S.) ETAYO-SERNA, Prpy.Cretacico, Publ. Esp. 16: 24-9; 24-15;
- 1987 *Epicyprina angulata* (S.) VIVAS: 28, 32;
- 1999 *Epicyprina angulata* (S.) VILLAMIL & PINDELL: 315;
- Not 1957, *Epicyprina angulata* (S.) VON DER OSTEN: 581, pl. 64, fig. 6; (=Eocallista? hamlini (Whitfield, 1871).
-

Diagnosis: Shell large, subcuadrate, rounded, very inequilateral, moderately inflated. It varies in its relative height and length, and the position of the prosogyrate umbones: the shell is usually stout; escutcheon narrow, deep, limited by sharp carina.

Dimensions: A shell from the Lower Greensand, Blackdown, England, measures, of Length: 103 mm; of Height :92 mm; the synonymous *Cyprina ervyensis* LEYMERIE, 1842,- Aptian of Switzerland and France, Albian of France,- length: 90 mm, Height: 79 mm.

Occurrence: With a Biochron from Barremian to Cenomanian, and a distribution of Western European, Apulian, Balkanic and Neuquen Subprovinces.

S.C.S. occurrence: The earliest report of this species is in the Macanal Formation, of Valanginian age, in Colombia. In Venezuela, locality An-77, Cerro Las Callecitas, El Cantil Formation, (DBG) of Late Aptian age (VIVAS, 1987). It is present in El Cantil Formation, and its member, Guácharo, of Early Albian age, where it is frequent. Also in Píche member of Apón Formation, of Early Albian age.

Epicyprina expansa (Coquand, 1865)
Plate 59, figure 7;

- 1865 *Cyprina expansa* COQUAND, Emul. Provence #3: 299, pl. 18, figs. 4, 5;
- 1920 *Cyprina expansa* C., MENGAUD: 163;
- 1949 *Cyprina expansa* C., BATALLER, Sinopsis Fos. Cret.: 105-106;

Occurrence: Ollon, Maestrazgo Basin, Spain, in Forcall marl Formation, of Early Aptian age. Also in the Albian of Cantabria, Spain.

S.C.S. occurrence: Locality HA-4424, La Pastora-Jabón road, just above *Mesorbitolina texana* marls, near the beds of passage *Tuocasia/Pseudotoucasia,* near the Aptian-Albian boundary. Peñas Altas Formation´s upper carbonatic member (ARNAUD et alii., 1999). Also in the Píche member of the Apón Formation, of Early Albian age. In Colombia, it was cited in La Paja Formation, of Barremian age (ROYO Y GOMEZ, 1945-b).

Epicyprina grauae (Gortani, 1973)
Plate 60, figure 4;

- 1973 *Cyprina grauae* GORTANI, Acta N. d. Lincei#4: 51, pl. 11, figs. 7ª, 7b;

Occurrence: Originally collected at Graua, Ethiopia, in clastic sediments of Late Albian age.

S.C.S. occurrence: Locality HA-4511, Cerro Los Platones (La Loma), upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 29) of Middle Albian age.

Epicyprina indurata (Conrad, 1852)
Plate 60, figure 14;

- 1852 *Venus indurata* CONRAD in LYNCH, Palestine Expèdition: 219, pl. 9, fig. 53;
- 1934 *Venus indurata* C. BLANCKENHORN: 250, pl. 13, figs. 150ª, 150b;

Diagnosis: Subtriangular, ventricose; anterior margin rounded, posterior side cuneiform, extremity rounded; posterior margin oblique and nearly straight; basal margin rounded. (CONRAD, op. cit.).

Dimensions: Length: 33,5 mm, Height: 32,5 mm, Thickness: 24 mm (BLANCKENHORN, op. cit.).

Occurrence: 'Aklim el-Jourd, Jurd el-Toquany, Bhamdun, Lebanon, in sediments of Albian age.

S.C.S. occurrence: Locality HA-4335, La Aguada section, Trujillo state, La Puya member of Peñas Altas Formation, of Late Albian age (ARNAUD et alii., 1999, fig. 32).

Epicyprina syriaca (Conrad, 1852)
Plate 56, figure 14;

- 1852 *Venus Syriaca* CONRAD, in LYNCH, Exped. Palestine: 218, pl. 9, fig. 52;
- 1934 *Anisocardia orientalis* (C.) BLANCKENHORN: 247, pl. 13, fig. 138;
- 1961 *Anisocardia orientalis* (C.) ROSSI & ALBANESI: 284, pl. 24, figs. 1-3;
- 1973 *Cyprina sp.* GORTANI, A. N. d.Lincei, #4: 52, pl. 12, fig. 2;

Diagnosis: Cordate, ventricose; margins rounded, umbones broad, beaks rounded; the inner margin appears to have been entire (CONRAD, op. cit.). Length: 18,6 mm, Height: 18,2 mm; Thickness: 14,6 mm, Cenomanian of Lybia.

Occurrence: El-Jourd, el Jurd, el-Toqâny, Lebanon, in Turonian limestones. In Madagascar, Anantiloky, also in Turonian sediments. In the Maghrebian, Syrian and Somalian Subprovinces, in Albian to Turonian. In Portugal, Cenomanian to Turonian limestones.

S.C.S. occurrence: Locality MO-1156, El Molino creek, Niquitao, Trujillo State, in Guayacan Member of Capacho Formation, of Late Turonian age.

Genus/Subgenus ***Isocyprina (Venericyprina)*** Casey, 1952.

This taxon with a Biochron extending from Late Jurassic (Kimmeridgian) to Early Cretaceous (Aptian) is considered European. Here, we describe it from S.C.S.

Isocyprina (Venericyprina) carinata (de Loriol, 1882)
Plate 43, fig. 16; plate 46, figure 6;

- 1882 *Anisocardia carinata* de LORIOL, Paleont. Suisse,#9: 67, pl. 8, figs. 11, 12;

Description: Cast of ovate shape, médium size, evenly inflated, cuneiform in the posterior area; the beaks are small, barely eminents, and contiguous. Anterior area short and rounded, escutcheon not well preserved, and no lunule is visible: posterior area slighjtly truncated, ventral margin widely arched; no sculpture was preserved. Adductor muscular scars are big, ovalate, the anterior ones are accentuated, the posterior ones, barely visible. The ligamentary area is bordered by an elongated depression, which is bordered on both valves by a sharp keel. Cosne, France, of Late Aptian age (de LORIOL, op. cit.).

Dimensions: Length: 34 mm, Height: 27,5 mm.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age (VIVAS, 1987). Three casts of articulated shells, of regular preservation.

Discussion: The nearest relative, *Isocyprina (Venericyprina) lurida* (Coquand)(MALLADA, 1887, Sinop. España, Cret. Inf.,#3:102, pl. 33C, figs. 4, 5)- is a more elongated shell, ornated with regular fine, growth lines, separated by wider interspaces.

Genus ***Proveniella*** Casey, 1952.

According to COX et alii. (1969: N648) *Proveniella* is a European genus, with a Biochron of Cretaceous. We have six species with a wide distribution, in S.C.S.

Proveniella argentina (Behrensen, 1893)
Plate 37, figure 13;

- 1892 *Cyprina (¿) argentina* BEHRENDSEN, Z. d. D.Geol.Ges. 44(2): 22, pl. 3, fig. 1:
- 1899 *Trigonia? decipiens* PHILIPPI, Foss. Sec. Chile: 90, pl. 38, fig. 2;
- 1931 *Cyprina argentina* B., WEAVER, U. Washington, Mem. 1:323-324, pl. 33, figs.185, 186;
- 1961 *Arctica sp.,* IMLAY, U.S.G.S., Prof. paper, 385:43, pl. 6, figs. 11-14, 16;

Diagnosis: Shell moderately small, convex, inequilateral and triangular-oval in outline. Umbones are prominent and strongly prosogyrous; lunule is deep, broad and moderately long. Surface with fine concentric lines, which can become heavier near the basal margin.

Dimensions: Length: 32 mm, Height: 17,5 mm; thickness of articulated specimen: 15,5 mm (WEAVER, op. cit.).

Occurrence: Is abundant everywhere in Northern Neuquen, in the very top of the marine Agrio

Formation,- Aptian age,- in the shallow water limestones which are intercalated with gypsum deposits. In Chile, is reported from the Portezuelo de Tinguiririca, of Hauterivian age. In Alaska, in Torok and Kukpowruk Formations, both of Albian age.

S.C.S. occurrence: Locality VG-139, Pico García, Monagas state, (DBG) of Late Aptian age.

Proveniella bernensis (Leymerie, 1842)
Plate 20, figure 12;

- 1842 *Cyprina bernensis* LEYMERIE, Mem. S. Geol. Franç. 5:5, pl. 5, fig. 6;
- 1866 *Cyprina bernensis* L., PICTET & CAMPICHE: 213, pl. 113, figs. 1, 2;
- 1921B *Cyprina bernensis* L., GILLET, B.S.S.H.n.Yonne,#75: 28, pl. 4, figs. 2-4 ;
- 1967 *Cyprina bernensis* L., BUSSON & ALBANESI : 621-622, pl. 52,figs. 4-6 ;
-

Occurrence : This taxon has a Biochron of Valanginian to Early Aptian, and is common in all the tropical subprovinces of Gondwana Province, and Balkanic Subprovince.

S.C.S. occurrence: Locality VG-565, road Rio Morocoto-Caituco-Ojo de Agua, upper Taguarumo Formation, (sDLP, DGC) Sucre State, of Early Aptian age. Common also in ElDantó Formation, of Hauterivian age.

Proveniella difficilis (Maillard, 1885)
Plate 7, figure 20;

- 1885 *Cyprina difficilis* MAILLARD Pal.Suisse, #12 : 18-19. Pl. 1, figs. 11, 12 ;

Occurrence : Studied originally from the Purbeckian facies of Jura mts., Switzerland,-of Ryazanian age.

S.C.S. occurrence: Locality PM-06-C, trail from El Pajaral to La Margarita, La Margarita mudstones, (sDLP) of Hauterivian age, Monagas state.

Dimensions: The better preserved cast measures, of Length: 18 mm; Height: 17 mm, Thickness: 11 mm.

Discussion: The presence of this otherwise rare species in the Purbeckian facies, and S.C.S. is an additional evidence of the presence of saline, evaporitic seas during the Eocretaceous of the Tethys Ocean.

Proveniella cf. meyeri (Woods, 1910)
Plate 47, figure 5;

- Cf. 1910 *Cyprina Meyeri* WOODS, Paleontogr. Soc., 2(7): 427, pl. 62, figs. 2, 3;

Occurrences: *Perna*-bed, Sundown, lower Greensand, England, of Late Aptian age. CASEY (1961: 606) found it in *fissicostatus Zone,* of Early Aptian age.

S.C.S. occurrence: Locality MC-372, shales south of Rio Grande, northeast of Cautaro, (DAGM), Garcia Formation, of Late Aptian age. This taxon has been found at six different localities of Garcia Formation.

Discussion: Our shells are quite like *P. meyeri,* but are consistently higher:Length: 30,2 mm; Height: 21,0 mm.

Proveniella roissii (Leymerie, 1842)
Plate 39, figure 21; plate 44, figures 8, 8a;

- 1845 *Venus Roissii,* d'ORBIGNY, Paleont. Franç. Cret. #3 :441-442, pl. 384, figs. 13-15 ;
- 1897 *Crassatella (Plionema) aequalis* GERHARDT, V.N.J.Miner. Geol. 11 :186, pl. 5, fig. 11(non Crassatella aequalis HOLZAPFEL, 1889, Paleontogr. :192-193, pl. 20, fig. 9)
- 1938 *Crassatella (Plionema) aequalis* G., DIETRICH : 101, PL. 20, FIGS. 8-9 ;
- 1985-c *Crassatella aequalis* G., ETAYO-SERNA, Proy. Cretacico, #25-3 ;
- 1987 *Crassatella aequalis* G., VIVAS, Bol. Geol., Caracas, 16(29) : 28, 32.

Description : Cast ovoidal-trigonal, almost as high as long, inequilateral, aequivalve, inflated; small rounded, umbones prosogyrous at 1/3 of total length; postero-dorsal and ventral margins, in uninterrupted curvature; antero-dorsal margin almost straight, anterior margin convex, short. Escutcheon long, well defined; lunule chordate, slightly depressed. Surface with fine, irregular growth lines.

Occurrence: In France, common in Marolles, Aube, of Aptian age.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age, associated to *Mesorbitolina texana-M. ovalis,* in marls. Locally frequent in Garcia Formation, of Late Aptian age. In western Venezuela, is present in Tibú Formation, Perijá area, of Early Aptian age. In Colombia, reported from Mesa de Barichara of Villeta Group, Aptian, associated to gastropods and ammonites; Fómeque and La Paja Formations, of Barremian age; also in Cordillera Central, from Aptian horizons.

Proveniella rosacea Casey, 1961.
Plate 42, figure 18;

- 1961 *Proveniella rosacea* CASEY, Paleontographica 3: 586, pl. 80, figs. 5ª, 5b; 606;

Diagnosis: Smaller, more rotund, and less elongate than *Proveniella meyeri* (Woods), -Aptian, England.

Occurrence: Characteristic of the Atherfield clay, of the *fissicostatus to forbesi Zones*, of Early Aptian age.

S.C.S. occurrence: Locality HA-4440, trail from Jabon to San Pedro, Trujillo state, lower carbonatic member of Peñas Altas Formation of Aptian age. It is associated with many well-preserved irregular echinoids.

Genus ***Tortartica*** Casey, 1961.

According to KAUFFMAN in HALLAM, (1973) it belongs to North Temperate Realm, where it is widespread endemic in the North European Province. In our files, there are species from all the tropical subprovinces of Gondwana Province, with a Biochron extended from Albian to Turonian; in Borneo, survived until Senonian times.

Tortarctica orientalis (Hamlin, 1884)

- 1884 *Cyprina orientalis* HAMLIN, M. M.c. Z. H.10(3): 44, pl. 5, fig. 3ª, 3b;
- 1960 *Cyprina sp.* DUSENBURY & FRAUNFELTER in C. KEY, 3º Congr. Geol. Venez., 2: 527;
- 1963 *Cyprina orientalis* H., FAWZI, Geol. Mus. Paleont. Mon. #2: 57;
- 1974 *Arctica orientalis* (H.) MORDVILKO, pl. 24, figs. 2ª, 2b;
-

Occurrence: Cardium-bed, in Beyruth distrct, Lebanon, of Cenomanian age. Widespread in Syrian, Maghrebian and Balkanic Subprovinces.

Dimensions: Length: 84 mm; Height: 69 mm, Thickness: 64 mm (Holotype, Lebanon).

S.C.S. occurrence: Locality MO-2333, Yasa River, Perijá, upper Maracas Formation, of Early Cenomanian age. Found mostly as casts of articulated shells in shale, alternating with limestones.

Discussion: *Tortarctica cordiformis* (d'0RBIGNY) – fossil-guide of the Albian stratotype in Aude, France,- is a much shorter and rounder shell, 1/3 of the size of *T. orientalis* (MONGIN, 1979A, pl. 2, fig. 9).

Tortarctica roemeri (Cragin, 1893)
Plate 56, figures 1, 3;

- 1893 *Cyprina roemeri* CRAGIN, Texas Geol. Surv., 4th Ann. Report: 179, pl. 37, figs. 1, 2;
- 1928 *Arctica roemeri* (C.), ADKINS, Univ. Texas Bull., #2938: 152;
- 1946 *Cyprina roemeri* C., LIDDLE, Geol. Venezuela and Trinidad: 220;

Occurrences: Glen Rose Formation, Texas, of Early Albian age, where it is abundant.

Diagnosis: Large cast, subequivalve, hinge line short, beaks small, incurved, close together; basal margin broadly rounded (ADKINS, op. cit.).

S.C.S. occurrences: Locality MO-3121, Quebrada La Gé, Perijá, Píche Member of Apón Formation, of Early Albian age. Also in Guácharo Member of El Cantil Formation, of Early Albian age.

Dimensions: Length: 117 mm, Height: 90 mm, Thickness: 70 mm (Holotype, a cast).

Genus ***Venilicardia*** Stoliczka, 1870.

According to KAUFFMAN in HALLAM et alii., (1973: N650), is of Cosmopolitan distribution, in "warm water" environments, mid-temperte to tropical belts. Its Biochron is Cretaceous.

Venilicardia inornata (d'ORBIGNY, 1844)
Plate 56, figure 19;

- 1844 *Cyprina inornata* d'ORBIGNY, Paleont. Franç.:99, pl. 272, figs. 1, 2;
- 1897 *Cyprina inornata* d'O. KARAKASH: 74, pl. 1, figs. 25, 26;
- 1954 *Epicyprina angulata* (J. Sowerby) COX, Jour. Paleont. 28(5): 633, pl. 66, fig. 4;(non J. Sowerby, 1818)
- 1963 *Cyprina inornata* d'O., FAWZI, Geol. Museum, Paleontology: 53-54;

Occurrence: *V. inornata* (d'O.) is one of the common species in the Argile à Plicatules, Wassy, the stratotype of the Aptian stage. Common in Western European, Balkanic, Maghrebian, Syrian Subprovinces, and North European Province. Its Biochron extends from Aptian to Cenomanian age.

S.C.S. occurrence: Locality MC-445-A, Cerro La Torre, on Campo Alegre-Buena Vista road, Guacharo Member of El Cantil Formation, (DGC) of Early Albian age. Also from the Albian of Colombia.

Venilicardia lineolata (J. Sowerby, 1829)
Plate 47, figure 15;

- 1904-13 *Cyprina (Venilicardia) lineolata* S., WOODS, Paleontogr. Soc. 2(4): 143-145, pl. 22, figs. 5-8; pl. 23, figs. 1, 2, 4;
- 1926 *Cyprina (Venilicardia) lineolata* S. BRUN & CHATELET, T.Labor. Geolog. Lyon, 9(8): 59-60, pl. 2, fig. 1;
- 1938 *Cyprina (Venilicardia) sp.* DIETRICH: 103, pl. 21, figs. 3, 4; non fig. 2;
- 1962 *Cyprina magharensis* ABBASS, Geol. Surv.M.R.D., Pal. Ser., Mon.#1: 131, pl. 18, fig. 1;

- ¿1852 *Venus Syriaca* CONRAD in LYNCH, Exped. Palestine: 218, pl. 9, fig. 52;

Diagnosis: Shell strong, big-sized, subquadrangular, inequilateral; anterior and ventral margins rounded, posterior clearly truncated; umbones prosogyrate, just above of cordiform lunule; escutcheon narrow, limited by a keel.

Dimensions: Length: 71 mm, Height: 61 mm from Blackdown, Upper Greensand, (WOODS, op.cit.); Length: 80 mm, Height: 70 mm (DIETRICH, op. cit.) Tablazo limestone, Late Aptian; Length: 40 mm, Height: 30 mm, Thickness: 15 mm (ABBASS, op. cit.) Sinai, Albian.

Occurrence: With a Biochron of Early Albian to Early Cenomanian, is wide-spread in all the tropical Subprovinces of the Gondwana Province: besides, in North European Province, and Western European Subprovince.

S.C.S. occurrence: Locality MC-445-A, Cerro La Torre, Campo Alegre-Buena Vista road, Teresen area, in Guácharo Member of El Cantil Formation, (DGC) of Early Albian age. In Western Venezuela, in the upper carbonatic member of the Peñas Altas Formation, of also Early Albian age.

Venilicardia olivensis (Vokes, 1946)
Plate 60, figure 18;

- 1946 *Venilicardia olivensis* VOKES, Amer. Mus. Nat. Hist., Null. 67(3): 173, pl. 6, figs. 12-15;

Occurrence: Olive locality, Abeih, Lebanon, of Late Aptian age.

Diagnosis: Shell of medium size, inflated, inequilateral, with relatively low, broad, swollen opithogyrous umbones whose anterior location are the most distinguishin features of this pecies.

Dimensions: Length: 39,5 mm, Height:30,5 mm, Diameter (RV) 14,2 mm (VOKES, op.cit.). Length: 32,3 mm, Height: 26,8 mm (plate 60, figure 18).

S.C.S. occurrnce: Locality MO-2403, Quebrada Santa Rosita, Lisure Formation, Perijá región, of Middle Albian age. Also in Upper Maraca Formation, of Cenomanian age.

Venilicardia protensa (Woods, 1907)
Plate 44, figure 7; plate 45, figure 7;

- 1907 *Cyprina (Venilicardia) protensa WOODS:* 137, pl. 21, figs. 4-7; text fig. 20, 21;
- 1930 *Cyprina (Venilicardia) protensa* W., STEINMANN, Geologie von Perú: 129, fig. 145;
- 1974 *Venilicardia protensa* W., DIMITROVA, Foss. Bulgaria #4-b: 111, pl. 13, fig. 2;

Occurrence: Lower Grensand, Perna-bed, England, of Aptian age. In Bulgaria, in Barremian and Aptian sediments. Cajamarca, Perú, of Aptian age, too.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, El Cantil Formation, (DBG) of Late Aptian age. Locality VG-376-D, Taguarumo Formation, (DAGM) of Barremian-Aptian age. In Colombia, in the Hauterivian: Moina Formation, and lower Villeta Group, Hauterivian, and Aptian: La Paja Formation (ROYO Y GOMEZ, 1941).

Venilicardia pseudoglobosa (de Loriol, 1882)
Plate 37, figure 4;

- 1882 *Venilia pseudoglobosa* DE LORIOL, Mat. Paleont. Suisse,#9: 89-90, pl. 11, figs. 1-3;

Description: Rounded shell, slightly longer than high, subinequilateral. There is no lunule, below the beaks, umbos big, prosogyrates; the valves are uniformly convexes, the test is thick. Surface marked by regular, uniform growth-lines.

Dimensions: Length: 71 mm, Height: 68 mm (de Loriol, op., cit.); our sample: Length (incomplete): 42,6 mm, Height: 38,7 mm (pl. 37, fig. 4).

Occurrence; Originally studied from Cosne, France, of Late Albian (Vraconnian) age.

S.C.S. occurrence: Locality VG-139, Rìo Aragua, north flank of Cerro Grande (DBG) lower Garcia Formation, of Early Aptian age.

Comparison: The nearest species seems to be *V. globosa* (Sharpe) – Portugal, Cenomanian age,- but our species lacks a lunule, the umbos are less inflated, and the general contour more rounded.

Family ***NEOMIODONTIDAE*** Casey, 1955.

COX et alii. (1969: N653) stated that the habitat of this family is "Fresh water, or seas of reduced salinity." Its Biochron extends from Early Jurassic to Late Cretaceous.

Genus ***Neomiodon*** Fischer, 1887. (=*Cyrena* auctt.)

According to HUCKRIEDE (1967) this genus is typical of Lacustrine and Brackish-water sediments. With an Eurasian distribution, its Biochron is Middle Jurassic (Bathonian) to Early Cretaceous (Wealdian). Its distribution in

Gondwana continent, is related to great mega-river systems, as Espino and Aguardiente.

Neomiodon acuta (Lisson, 1907)
Plate 15, figs. 6, 14;

- 1908 *Crassatella acuta* LISSON, 4º Congr. Cient. Latino-Americano, #1 : 29-30, pl. 2, figs. 3;

Occurrence: In Perú, black claystones with taphoflora near Lima and Isla San Lorenzo, of Berriasian-Valanginian age.

S.C.S. occurrence: Locality MC-448-A, Campo Claro road, near Teresén, La Margarita mudstones, of Late Valanginian-Hauterivian age: frequent. Also in MC-329-D, of El Cazón Formation, of Berriasian-Valanginian age, all disarticulated valves.

Discussion: It is near to *N. fasciatus* (Roemer, 1839), - middle and upper Wealdian of North Germany,- which has a lower umbo, in a more central position on the valve.

Neomiodon cf. brongniarti (Koch & Dunker, 1837)
Plate 15, figures 5, 22;

- Cf. 1967 *Neomiodon brongniarti* (Koch & Dunker) HUCKRIEDE: 126, pl. 8, fig. 2; pl. 12, figs. 1-18; pl. 13, figs. 1-6, 18;
- 1985c *Neomiodon cf. brongniarti* (K. & D.) ETAYO SERNA, Proy. Cretacico, 16: 25-3;

Occurrence: It is one of the commonest species in the Wealdien facies of Niedersachsen, Germany: Hilsthon and Salzgitter Formations, of Valanginian to Barremian age.

S.C.S. occurrence: Locality PM-09-D, road from Pajaral to La Margarita mt., Monagas state, in La Margarita mudstones, of Hauterivian age. Thirteen disarticulated valves, with some taphoflora. In Colombia, in Macanal mudstones, of Valanginian age.

Neomiodon latovatus caudatus (F. A. RÖMER, 1839)
Plate 15, figures 9, 23;

- 1915 *Cyrena caudata* R., FUCINI Paleontographica Ital. 21: 71, pl. 8, figs. 1-3;
- 1937 *Cyrena caudata* R., ARTHABER: 420, pl. 23, figs. 18, 19;
- 1967 *Neomiodon latoovatus caudatus* (R.) HUCKRIEDE: 135, pl. 10, figs. 1ª-17;

Occurrence: Wealdian facies of Germany; also in the Terminetto Formation, Apulian Subprovince of Italy, of Hauterivian age, where it is rare.

S.C.S. occurrence: Locality MC-448-A, road from Teresen to Campo Claro, Monagas state, La Margarita mudstones, of Hauterivian age.

Neomiodon sublaevis (F. A. RÖMER, 1839)
Plate 15, figure 4;

- 1915 *Cyrena sublaevis (R.)* FUCINI, Paleontographica Ital., 21: 82, pl. 9, figs. 15-21;
- 1937 *Cyrena sublaevis* (R.) ARTHABER: 424-425, pl. 24, figs. 1-6;
- 1967 *Neomiodon sublaevis* (R.) HUCKRIEDE: 145, pl. 14, figs. 5-23b, 26, 28, 29;

Occurrence: Wealdian facies, Zona Helvetica, Kieselkalk Formation,Southern Germany, of Hauterivian age. Also in Terminetto Formation, Apulian Subprovince, Italy.

S.C.S. occurrence: Locality PM-10-F, road from Pajaral to La Margarita mt., La Margarita mudstones, (sDLP, DGC), of Hauterivian age.

Genus ***Myrene*** Casey, 1955.

According to COX et alii., (1969: N655), *Myrene* has a Biochron of Late Jurassic (Oxfordian) to Early Cretaceous (Ryazanian), and a distribution in North European Province, and North-East Asia.

Myrene angulatiformis (ARTHABER, 1937)
Plate 15, figure 20;

- 1836 *Cyrena angulata* ROMER, Norddeutsche Oolithegeb: 117, pl. 9, fig. 12; (non Phillips, 1828)
- 1937 *Cyrena angulatiformis* ARTHABER: 416;
- 1967 *Myrene angulata angulata* (Romer) HUCKRIEDE: 112, pl. 4, figs. 14ª-22;

Occurrence: Common in Lower Wealdian,(Valanginian) but rare in the upper,(Hauterivian) in northern Germany. In Italy, in the Terminetto Formation, of Hauterivian age.

S.C.S. occurrence: Locality JFS-148, road to the west of Quebrada Grande, Monagas state, Bergantin Formation, (DBG) in micaceous shales, with taphoflora. Locality PM-08-C, trail from Pajaral to La Margarita, in La Margarita mudstones, of Hauterivian age, casts of RV.

Genus ***Musculiopsis*** MacNeil, 1939.

An Eocretaceous genus, supposedly restricted to Western Interior Endemic center (COX et alii.,

1969: N653-N654). In my files, I have species from Western European, Neuquen Subprovinces, North European Province and S.C.S. Some of them:

1. *Musculiopsis arkelli* (Casey) Wealdian, England
2. *Nusculiopsis bifaria* (de Loriol) Ryazanian, Yonne, France.
3. *Musculiopsis subtruncatus* (Sowerby in Fitton fide Maillard, 1884)
4. *Muculiopsis elongatus* (Von Alth) Ryazanian, Poland.
5. *Musculiopsis dutrae* (Maury), Albian ? Brazil.
6. *Musculiopsis jurassica* (Imlay), Kimmeridgian, Mexico.
7. *Musculiopsis nuculina* (Arthaber), Hauterivian, Italy.
8. *Musculiopis subtruncatus* (Sowerby in Fitton), Purbeckian, Jura.

Musculiopsis coycuarensis new name, Macsotay
Plate 23, figures 1, 13;

- 1912 *Crassatellites* sp. indet. MAURY, Acad. Nat. Sci. Philadelphia, Jour. #2(15): 54, pl. 9, fig.4;
- 1931 *Astarte elongata* Weaver, Univ. Washington Mem.1: 331-332, pl. 40, figs. 249, 250, 251; (non d'ORBIGNY, 1843, = *Seendia)*
- 1937 *Panopea gurgitis* B., ARTHABER: N. Jahrb. F. Min., Geol., Paleont.77(3): 443, pl. 25, fig. 18; (non BRONGNIART, 1822)

Description: Shell of small size, moderately elongate, rectangular-ovate in outline, and with umbones situated from 1/3 to 2/5s the length of the shell from the anterior end. Shells from the same locality and even from the same bed, exhibit considerable variations in outline, and strength of the umbono-posterior carina. The dorsal margin behind the umbones slopes downward at angles varying from 15º to 30º in a straight or slightly convex or slightly concave line. The anterior end is regularly but sharply rounded, passing into a broad arcuate base, wich in turn posteriorly merges into the rather sort, acutely rounded posterior margin. The surface is ornamented with strong raised concentric lines of gowth or ribs with interspaces of double or triple width. On mature specimens these ribs average 16-18.

Dimensions: Length: 14,8 m, Height: 8,8 mm (figure 13), Length: 14,4 mm, Height: 9,6 mm (figure 1); Length: 8 mm (MAURY, op. cit.), probably juvenile; Coll. UCVMG/IO-1945.

Etymology: This species is named after the first locality where it was collected "Parare-Coycuar trail, 6 miles south of Parare and 3 miles south of Caituco" in Monagas state, Venezuela. P.D.: Coycuar is the old Caribbean Indian name, now called Cocollar.

Occurrence: Top of lower third of the Agrio Formation, Argentina of Neuquén Subprovince, of Hauterivian age, where it was found in massive amounts, forming beds. In the Terminetto Formation, Italy, of wealdian facies of Hauterivian age.

S.C.S. occurrence: Locality MC-228-B, Río Quiriquire, sandy limestone on the top of Bergantín Formation, (DBG) of Barremian age. More than 20 disarticulated valves embedded in calcitized limestone. They represent a fresh-water facies on the top of the Bergantin Formation, mostly deposited as a delta of the Espino Megariver.

Discussion: *Musculiopsis bifaria* (de Loriol, 1868, pl. 12, figs. 13, 13a, 13b) –Portland beds, Yonne dept., France, of Ryazanian age,- bears a close similarity, and it is possible that this species is an ancestor of our taxon.

Subfamily ***EOMIODONTINAE*** Hayami, 1965b.
Genus ***Costocyrena*** Hayami, 1965.

Costocyrena is a brackish-water inhabitant. Its distribution area includes Japanese-East Asian, Neuquen Subprovinces, and S.C.S., with a Biochron extended from Ryazanian (=Berriasian) to Turonian stages.

Costocyrena cf. oreas (Philippi, 1899)
Plate 15, figure 19;

- Cf. 1899 *Trigonia oreas* Phjilippi, Fos. Secund. Chile: 91, pl. 38, fig. 4;

Diagnosis: Species based on external mold of a LV. The shape is ovate-cuadrangular; the beak is prominent, prosogyrate; surface with eight or nine nodulous concentric ribs, as wide as their interspaces. Length: 28 mm, Height: 22 mm and Thickness: 13 mm.

Occurrence: Tinguiririca, Chile, of probably Hauterivian age.

S.C.S. occurrence: Locality JFS-103, Casanay-Caripito road, Sucre state, La Margarita mudstones, (sDLP, DGC), of Hauterivian age. Two casts, deformed pelomorphically.

Costocyrena sp.indet.
Plate 40, figure 6;

- 1980-b *Pleuriocardia cottaldina* (d'Orbigny) MACSOTAY, Correlation Crétacé: 49; (non d'ORBIGNY, 1844)

Diagnosis: Shell small, of rounded shape, higher than long, with small, prosogyre umbones. Surface ornated with fine, radial rounded, low ribs, covered with fine, regular, concentric growth lines. Lunule small, slightly impressed.

Dimensions: Height: 8,8 mm; Length: (reconstructed) 8,0 mm.

S.C.S. occurrence: MC-329-D, Río Pajaral, Sucre State, El Cazón Formation, (sDLP, DGC), of Late Berriasian-Early Valanginian age. Found in a silty shale, with taphoflora, with many dwarf bivalvia.

Costocyrena cf. radiatostriata (Yabe & Nagao, 1926)
Plate 40, figures 5, 7;

- Cf. 1926 *Cyrena radiatostriata* YABE & NAGAO, in YABE, NAGAO & SHIMIZU: 51, pl. 12, figs. 29-35, pl. 13, fig. 45;
- Cf. 1965-b, *Costocyrena radiatostriata* Y. & N. HAYAMI: 135-137, pl. 19, figs. 1-7;
- 1995 *Costocyrena cf. hübneri* (Steinmann), VIVAS & MACSOTAY-B: 130;

Diagnosis: Shell small-sized for the genus, very inequilateral, trigonally ovate, higher than long, strongly inflated, test fairly thick; umbo prominent, prosogyrous, placed about 1/3 of the anterior extremity. Lunule shallow but wide, escutcheon broad, both quite smooth; surface ornated with 6-9 concentric cords, wider than the interspaces, covered by many radial riblets, barely seen.

Dimensions: Length: 8,2 mm, Height :7,2 mm (LV, figure 5) Length (incomplete): 10,3 mm, Height: 8 mm (RV, figure 7).

S.C.S. occurrences: Locality MC-119-A, west side of Cerro Piedra de Rayo, Garcia Formation, (DBG) of Early Aptian age. The fauna is all bivalvian, with *Filosina gregaria,* and other brackish, lagoonal fauna.

Comparisons: In shape and size is very alike to *Costocyrena radiatostriata* (Yabe & Nagao)- Aritan and Miyakoan Groups, Japan, of Late Neocomian to Aptian or Albian age,- but our taxon is higher than long, and is ornated with thick concentric cords covering all the external surface. *C. cranulicosta* (Whitfield, 1891) –Aptian or Albian of Abeih sandstones, Lebanon,- is also a small species, but its concentric cords are lamellar, and more alike to *Chione (Chione) cancellata* (L.) living in the Caribbean circalittoral areas (MACSOTAY & CAMPOS, 2001).

Genus ***Eomiodon*** Cox, 1935.

According to KAUFFMAN in HALLAM et alii., (1973: 359) this is a cosmopolitan genus that inhabits "warm-water" environments from mid-temperate to the tropical climatic belts. In S.C.S., the *Eomiodon* species, seem to prefer shallow, saline waters.

Eomiodon libanoticus (Fraas, 1878)
Plate 39, figures 2, 8;

- 1878 *Astarte libanotica* FRAAS, Geol. Beob.am Libanon: 130 pl. 5, fig. 1ª, 1b;
- 1884 *Cyprina (Venilicardia?) abeihensis* HAMLIN: 45, pl.4, figs. 2ª, b, c;
- 1913 *Cyprina sp. Ind.* HOFMANN & VADÁSZ, M. J. k. U.g. R.: 250-251, Fig. 5;
- 1956 *Protocyprina libanotica* (Fraas), VOKES, Amer. Mus. Nat. Hist. #87(3): 172, pl. 5, figs. 1-12;

Diagnosis: The range of variation of this species is very great, particularly as to the ratio between the height and length of the valves, and as to their relative diameter. Similar variation is also to be observed in the relative position of the umbones, and the degree of truncation observable at the posterior margin of the valve. The juveniles exhibit "6 to 8 strong *Astarte*-like wrinkles next to the umbones" (FRAAS, op. cit., VOKES op. cit.), which was fully described by NOETLING (1886: 869, pl. 28, figs. 1,1a,1b, 2, 3, 4).

Dimensions: Length: 77,6 mm, height: 69,8 mm; diameter (RV): 22,5 mm adult shell from Abeih, Lebanon. Length: 10,8 mm; Height: 9,6 mm juvenile from Garcia Formation.

Occurrence: Olive locality, Duccûn, Lebanon, of Late Aptian age, abundant.

S.C.S. occurrence: Locality MC-119-A, west side of Cerro Piedra de Rayo, Monagas state, Garcia Formation, (DBG) of Early Aptian age. Thirteen specimens collected, all of articulated juvenile specimens.

Discussion: From Magyaregregy of the Mecsek mts. of Hungary, HOFMANN & VADÁSZ (op. cit.) described a well-preserved but fragmentary RV exposing the whole cardinal area, suggesting a specimen alike to *Eomiodon libanoticus.* The sediments were considered Middle Neocomian (=Valanginian?). The great variability demonstrated in *E. libanoticus,* suggests a Bivalve species that lived in a stressful

environment – saline waters,- where had no predators (gastropods, fishes, ammonites) and could live until the senile stage.

Eomiodon cf. verrucana (Fucini, 1915)
Plate 15, figures 8, 12;

- 1915 *Corbula verrucana* FUCINI, Paleontogr. Ital., 21: 92, pl. 10, figs. 35-38;
- 1937 *Cyrena verrucana* (F.) ARTHABER: 416-417, pl. 23, figs. 8, 9, 10;

Occurrence: Terminetto Formation, Italy, Apulian Subprovince, of Hauterivian age.

S.C.S. occurrence: Locality PM-10-F, trail from Pajaral to La Margarita mt., Monagas state, La Margarita mudstones, (sDLP, DGC), of Hauterivian age. Only disarticulated valves were collected.

Discussion: Our valves, all have a consistently more inflated umbos, which could be *attributed to sexual dimorphisme.*

Family ***PTYCHOMYIDAE*** Keen, in COX et alii., (1969).
Genus/Subgenus ***Ptychomya (Ptychomya)*** Agassiz, 1842.

According to KAUFFMAN in HALLAM et alii., (1973:369) it belongs to the North Temperate Realm, being widespread endemic in the North European Province. Its Biochron extends from Late Jurassic? Early Cretaceous-Late Cretaceous, and is well represented in East African Province, Neuquen and Peruvian Subprovinces, and S.C.S. It is a genus specialized to thrive in saline waters.

Ptychomya (Ptychomya) germani *(Pictet & Campiche, 1866).*

- 1866 *Ptychomya Germani* PICTET & CAMPICHE, Paleont. Suisse,#3 : 354-355, pl. 127, figs. 7, 8 ;
- 1907 *Ptychomya Germani* P. & C., HAUPT, N.J.M.G.Paleont., #23 : 219-220 ;
- 1957 *Pholadomya n. sp.,* VON DER OSTEN, Jour. Paleont. 31(3) : 580, pl. 64, fig. 11 ;

Occurrence : Metabief sandstone Formation, Switzerland, of Valanginian age.

S.C.S. occurrence: Locality: MMH-Su-125, La Ceñidura de Caracas del Oeste, El Dantó Formation, (DAGM) of Hauterivian age. Also observed in Lope member of Taguarumo Formation, of Barremian-Early Aptian age.

Ptychomya (Ptychomya) cf. kitchini Lange, 1914.

- Cf. 1914 *Ptychomya kitchini* Lange, Archiv f. Biontologie, 3(4): 242-244, pl. 17, fig. 6 ;
- 1954 *Ptychomya* species A, COX, Jour. Paleont., 28(5) : 634, pl. 67, figs. 4, 6 ;

Description : The shell is ovate, with an oblique posterior truncation, and is less elongate than in most species of the genus (L: 60 mm) ; the ratio H :L being about 2 :3. The arched dorsal outline rises above the level of the umbo, which is placed at the anterior 1/6 th of the length, and reaches it highest point at about the middle of the shell length. The posterior slope is not carinate. The smaller specimen (L: 55 mm) shows thepresence of backward sloping, oblique, rounded ribs which increase in amplitude posteriorly; the part of the surface anterior to the umbo, has narrow, oblique ribs which slope in the opposite direction to, and form acute V's with the main series. The dorsal margin is coarsely crenulated, crenulations representing the ends of short, upward sloping dorsal ribs. The other margins are less coarsely denticulate internally.

Occurrence: Niongala, Likonde-Kitale and Narumbanga, Mozambique, from the *Trigonia schwarzi* –horizon, of Hauterivian age.

S.C.S. occurrence: Cuche Formation, of Trinidad, - Hauterivian age,- and reworked in the Nariva Formation, of Late Oligocene age.

Comparisons: Very closely comparable to *P. zitteli* Dames (1873: 380, pl. 12, figs. 1, 2) from Gosau Formation, Austria, of Turonian age.

Ptychomya (Ptychomya) solita (d'ORBIGNY, 1842)
Plate 32, figures 6, 10, 14;

- 1851 *Crassatella solita* d'ORBIGNY, Rev. Zoologie, 3^{e}. serie : 381, pl. 10, figs.3-4 ;
- 1858 *Crassatella buchiana* KARSTEN, Amt. Ber.Vers. DNn, Wien : 113, pl. 5, fig. 7 ;
- 1913 *Ptychomya lissoni* SOMMERMEIER : 383, pl.14, fig. 1 ;
- 1953 *Ptychomya robinaldina solita* (d'Orb.) ROYO Y GOMEZ, Acta Cient. Venez., 4(4) : 147-148, figuras 9-11 ;
- 1954 *Ptychomya robinaldina* d'O. BENAVIDES, Geol. Of N.Perú: 380;
- 1981 *Ptychomya solitae (sic)* d'O. FABRE: 4;
- 1985c *Ptychomya robinaldina solita* (d'O.) ETAYO SERNA, Proyecto Cretacico, Publ. Esp. 16:24-12; 24-15;
- 1998 *Ptychomya robinaldina solita* (d'O.) MACSOTAY & VIVAS: 72;

Description: Shell oblong, elongate, compressed, anterior area with diverging unequal radial ribs; posterior with oblique, ondulating, upward arching ribs, which near the posterior extreme, form a "V"

structure. Interior, all around the margin, marked with numerous, fine, Crassatellid-type denticles, perpendicular to the margin (figure 14). Its main difference with P. plana (Agassiz, 1842)(=P. robinaldina [d'O.]) – Valanginian to Albian, Western European Subprovince,- are the thick, corrugated radial cords in the posterior area, and a bigger size.

Dimensions: Length: 80 mm, Height: 40 mm, and apical angle 130º (d'ORBIGNY, op. cit.) Length: 120 mm, Height: 50 mm, Thickness: 24 mm (KARSTEN, op. cit.).

S.C.S. occurrences: Locality MC-402-T, Río Carinicuao, north flank of the Cardón anticline, of Taguarumo Formation, (DAGM) of Barremian age; collected in micaceous dark grey mudstone with plant debris. In the area between Mochima bay and Cumana city, is present in half of all the fossiliferous localities in El Dantó and Taguarumo Formations, of Hauterivian – Barremian age. Locality An-37 (=MO-2772) El Potrero, Anzoategui state, innodular yellow marls of Caripito member of Chimana Formation (VIVAS, 1987), of Middle Albian age. In Colombia, is abundant in Macanal mudstones, of Valanginian age; Rosablanca and Tambor Formations – Hauterivian,- La Paja and Yúruma Formations, - Barremian,- in Fómeque, Apón and Villeta Group, - Aptian age.

Occurrences: In Perú, in Calluan, of Aptian age, and Inca Formation, of Early Albian age (BEAVIDES, op. cit.).

Paleoenvironments: It is present and dominant among other Bivalvia, in all the sediments deposited in Hypersaline and saline waters. Usually is found with articulated valves, rarely are biodegraded. It is a Guide-fossil in the S.C.S., eocretaceous sediments.

Ptychomya (Ptychomya) cf. salvani *Palla, 1965*
Plate 60, figure 6;

- Cf. 1965 *Ptychomya salvani* PALLA, : 196, pl. 16, figs. 2ª-2c;
- Cf. 1972 *Ptychomya salvani* P., FRENEIX, N.m.S.geol. Maroc, #228 :159-168, pl. 16, figs. 3ª,b,c, 4ª,b,c, 5, 6; pl. 17, figs. 1, 2, 3ª-b, 4 a-b, et text-figs. 37, 38, 39;

Occurrences: In Morocco, in Oued Chebeika (*Dipoloceras cristatum* Zone) of Late Albian age; in Hammada Tassegdelt (*Calycoceras newboldi* Zone), of Mid-Cenomanioan age.

S.C.S. occurrences: Locality MO-3121, Quebrada La Gé, Perijá región, Píche member of Apón Formation, of Early Albian age; also in La Puya member of Peñas Altas Formation, Late Albian age.

Subgenus ***Pleuroconcha*** Conrad, 1872.

COX et alii., (1969: N655) stated it as a Late Cretaceous subgenus, restricted to Western European Subprovince.

Ptychomya (Pleuroconcha) cf. ***daedalea*** (Coquand, 1865)
Plate 43, figure 15;

- cf. 1865 *Crassatella daedalea* COQUAND, Mem. Soc. Emul. Prov., #3 :317, pl. 20, figs. 1-2 ;

Diagnosis : Shell oval, ovoidal, compressed, very inequilateral, anterior margin rounded, posterior more longated. Beaks barely seen. Lunule narrow and elongated. Flanks of the valves divided in two unequal areas, by an oblique keel that descends from the vertex to the posterior area. Surface ornated by a triple sytem of ribs.

Occurrence: Obón, Alcaine, Cabra, Oliete, Castel de Cabra in Calizas de Oliete, and Villaroya de los Pinares Formation, both of Gargasian (Late Aptian) age, Maestrazgo Basin, Spain (CANEROT, 1982).

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Bergantin area, Anzoategui state, El Cantil Formation (DBG) (VIVAS, 1987) of Late Aptian age. Only a fragmentary cast of an articulated shell was found, where only traces of one coarse system of ribs was preserved.

Family ***TRAPEZIIDAE*** Lamy, 1920.
Genus ***Tortucardia*** Olsson, 1944.

According to KAUFFMAN in HALLAM et alii. (1973: 367) is a Tethyan genus, of the "West Central American"Subprovince; this is an euphemism for fauna migrated from Izumi and Pacific Plates. Its Biochron extends from Berriasian to Maastrichtian stage. Few species are known previously:

T. barremica (Cossmann), Barremian, *T. caheni* (Darteville & Freneix), Senonian, *T. stephensoni* (Olsson), Maastrichtian.

Tortucardia cf. barremica (Cossmann, 1916)
Plate 7, figure 18;

- cf. 1916 *Coralliophaga (?) barremica* COSSMANN in BRUN, Paleontogr. #51: 31-32, pl. 4, fig. 22;

Diagnosis: Shell prosogyrate, umbono-posterior ridge bordered by a narrow furrow; escutcheon narrowly linear; very much alike to *T. barremica* (Cossmann)- Barremian of France,- but its beak is located at the anterior 1/3 of the shell, which is more rounded ventrally.

Dimensions: Length: 18,5 mm; Height: 11,3 mm; (Figure 18).

S.C.S. occurrence: Lovality VG-381, Ojo de Agua-Santa rosa trail, Sucre state, El Cazón Formation, (DGC, sDLP) of Berriasian-Valanginian age.

Family ***DICEROCARDIIDAE*** Kutassy, 1934.

Judging through the Cretaceous genera, the *Dicerocardiidae* are a thermophyllic family, with many species along the Tropical suprovinces of the Gondwana Province.

Genus ***Ambocardia*** Beringer, 1949.

This is a cosmopolitan genus, with a Biochron of Late Jurassic (Tithonian) to Late Cretaceous (Maastrichtian). Usually associated to brackish water assemblages, the 36 species in my files, are mostly shallow shelf inhabitants.

Ambocardia hermitei acuta (Choffat, 1902).

- 1902 *Anisocardia hermitei var. acuta* CHOFFAT, Sec. Trav. Geol. Portugal #4: 134, pl. 9, figs. 6, 7;
- 1930 *Anisocardia hermitei acuta* C. STEINMANN, Geol. Von Perú: 171, fig. 216;
- 1949 *Anisocardia hermitei acuta* C., TAVANI, Paleontogr. Ital., 46(16): 6-7;

Occurrence: The Biochron of this taxon, extends from Late Albian to Coniacian, in the Maghrebian, Syrian, Somalian Peruvian and S.C.S. Subprovinces of Gondwana Province.

Dimensions: Height: 35 mm, Length: 28 mm, Thickness: 33 mm.

S.C.S. occurrence: Locality MO-1156, Arroyo El Molino, Niquitao area, Trujillo state, Guayacán Member of Capacho Formation, of Late Turonian age.

Ambocardia neocomiensis (Agassiz, 1842)
Plate 18, figures 12ª, b, c;

- 1845 *Ceromya neocomiensis* AGASSIZ, Myes: 35, pl. 8, figs. 11-16;
- 1843 *Isocardia neocomiensis* (A.) d'ORBIGNY, Pal. Franç.: 44, pl. 250, fig. 9-11;
- 1854-58, *Isocardia neocomiensis* (A.) PICTET & CAMPICHE, Pal. Suisse: 235, pl. 116, figs. 1-3 ;
- 1882 *Isocardia galinieri* ROCHEBRUNE : 9-10 ;
- 1930 *Isocardia neocomiensis* d'O. STEINMANN, Geologie von Perú : 120, fig. 146 ;

Occurrence : With a Biochron extended from Valanginian to Aptian, this taxon is found in the Western European, Apulian, Somalian, Peruvian and Balkanic Subprovinces of the Gondwana Province.

S.C.S. occurrence: Locality MC-349-B, Cerro Garrapata, near Carinicuao River, (sDLP, DGC), El Cazón Formation, of Late Berriasian-Early Valanginian age. Also in PM-08-B, on trail of Pajaral-Margarita, La Margarita mudstones, of Hauterivian age.

Discussion: *Ambocardia milia* (Cossmann, 1918: 424, fig. 33) could be a dwarf morphotype of *A. neocomiensis*, related to a nutrient-poor oceanographic conditions.

Ambocardia praecisa (White, 1888)
Plate 59, figure 11;

- 1888 *Isocardia praecisa* WHITE, Arch. Mus. N. R. de Janeio, #7: 84-85, pl. 6, figs. 25, 26;
- 1936 *Isocardia praecisa* W., MAURY, Monogr. S.G.Miner. 11:69, pl. 9, figs. 8, 9;
- 1960 *Pharodina praecisa* (W.) DUSENBURY & FRAUNFELTER in KEY: 527;

Dimensions: Length: 34 mm, Height: 32 mm, Thickness: 25 mm.

Occurrence: Perto de Maroim, Sergipe, Ganhamaroba Group, Brazil, of Middle Albian age.

S.C.S. occurrence: Locality MO-2333, Río Yasa, Perijá area, Upper Maraca Formation, of Early Cenomanian age.

Genus ***Megalocardia*** Beringer, 1949.

According to KAUFFMAN in HALLAM et alii., (1973) it is a Tethyan genus, of the Syria-Lebanon endemic center, of the Eastern Mediterranean Subprovince.

Megalocardia medialis (Conrad, 1857)
Plate 42, figure 12;

- 1857 *Cardium mediale* CONRAD, Rept. U.S. Mex. Bound. Surv. #1(2): 149, pl. 4, fig. 4a, b;
- 1903 *Isocardia medialis* (C.) SHATTUCK: 27, pl. 14, figs. 4, 5; pl. 15, figs. 1, 2;

Diagnosis: Shell medium to very large, thick, very globose, subcircular, equivalved, inequilateral. Anterior and posterior margins subtruncate, ventral margin profoundly curved; umbos prominent, produced, curved downward and forward.

Dimensions: Length: 60 mm, Height: 60 mm (SHATTUCK, op. cit.). Length: (incomplete) 80 mm, Height: 70 mm, (Figure 12).

Occurrence: Frequent in Glen Rose Formation, Central Texas, of Early Albian age.

S.C.S. occurrence: MO-3110, Quebrada Santa Rosita, Píche Member of Apón Formation, Perijá, of Early Albian age. Also in Peñas Altas Formation, in upper carbonatic member, of the same age.

Genus ***Platycardia*** Beringer, 1949.

A rare genus, with Biochron extending from Late Jurassic (Tithonian) to Late Cretaceous (Maastrichtian).

Platycardia matris (Boehm, 1883)
Plate 19, figure 17;

- 1883 *Modiolaria matris* BOEHM, Paleontology, Mem. #4: 583, pl. 66, figs. 1, 2;

Occurrence: Stramberg, Austria, of Berriasian age.

S.C.S. occurrence: Locality MC-15-F, Trail from Pajaral to La Margarita, Monagas state, El Cazón Formation, (DGC) of Late Berriasian-Early Valanginian age.

Platycardia supermensa (White, 1888)
Plate 45, figure 10;

- 1888 *Isocardia supermensa* WHITE, Arch. Mus. Nac. Rio de Janeiro,#7: 80, pl. 6, figs. 1, 2;
- 1936 *Isocardia supermensa* (W.) MAURY, Mon. S. Geol. Min. #11: 71, pl. 9, fig. 16, 17;

Occurrence: Lastro, Maroim, Provincia Sergipe, Brazil, possible Ganhamaroba Group, of Middle Albian age.

Dimensions: Length, about 80 mm; Height: 55 mm; thickness, articulated: 62 mm (WHITE, op.cit.).

S.C.S. occurrence: MO-3121, Quebrada La Gé, Perijá, Píche Member of Apón Formation, of Early Albian age. Was not in situ. Also in An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age.

Observations: *"Homomya" ponderosa* (Gabb, 1877) – Cajamarca, Perú, of ¿Albian age,- has also a big size (Length: 112 mm, Height: 93 mm) has an umbo situated more posteriorly, and a more constricted posterior area.

Genus ***Rostrocardia*** Freneix, 1972.

The paleogeographic distribution of *Rostrocardia* is in the tropical subprovinces of Gondwana Province. Its Biochron extends from Barremian to Turonian stages. Species attributed to *Rostrocardia:*

R. boiti (Lisson), Barremian; *branneri* (White) Middle Albian; *R. guerangueri* (d'Orbigny), Cenomanian; *R. moevusi* (Coquand), Cenomanian; *R. papieri* (Coquand), Late Albian to Turonian; *R. spiralis* (Gabb), Albian?; *R. washita* (Marcou), Late Albian; *R. wiedeyi* (Olsson), Late Aptian to Early Albian.

Rostrocardia branneri (White, 1888)
Plate 40, figures 11, 12;

- *1888 Isocardia branneri* WHITE, Ann. Museum Rio de Janeiro#7: 81, pl. 6, figs. 18, 19, 20;
- 1934 *Anisocardia orientalis* C., BLANCKENHORN, Paleontogr. #81ª: 247-248, pl. 13, fig. 138;(non CONRAD, 1852).
- 1936 *Isocardia branneri* W., MAURY, Mem. Serv. Geol-Min. Brazil#11: 67-69, pl. 9, figs. 5, 6, 7, 10;
- 1955 *Anisocardia (Collignonicardia) simplex* MAHMOUD, P.I.D. Egypt: 121-122, pl. 10, figs. 5-8;
- 1961 *Anisocardia orientalis* (C.) ROSSI & ALBANESI, R.i.P.S. #67(3): 284, pl. 24, figs. 1-3;(non CONRAD, 1852).

Description: Shell subtrigonal, beaks, elevated, slender, incurved and prosogyrate; cardinal margin arched, frontal margin gently convex or slightly straightened below; basal margin gently convex; post-dorsal margin sloping strongly downward. The front below the beaks is broad and flattened; a distinct, a more or less angular posterior umbonal ridge extends from the beaks of each valve, to the postero-basal portion of the shell; and between that ridge and the posterior margin, there are two barely distinct radiating plications. With these exceptions, the surface is apparently smooth, or mrked only by the concentric lines of growth (WHITE, op. cit.).

Dimensions: Length: 30 mm, Height: 30 m, Thickness: 26 mm.

Occurrences: Coqueiro, Porto dos Barcos and Trapiche des Pedras Velho, Sergipe prov., Brasil, in Ganhamaroba Group, of Middle Albian age. In Sinai, Egypt, in Mid-Late Albian age, and in Libia, of Cenomanian age.

S.C.S. occurrences: Locality HA-4428, trail La Pastora-Jabón, upper carbonatic Member of Peñas Altas Formation, (ARNAUD et alii., 1999) of Early Albian age. Also Lisure Formation, Perijá area, of Middle Albian age.

Comparisons: *R. gaultina* (Pictet & Campiche, 1865, Pal. Suisse, 3 : 239, pl. 116, fig. 6a, 6b, 6c) – Col de Cheville, Albian,- is very much alike, having a more concave anterior area.

Rostrocardia cf. wiedeyi (Olsson, 1933).

- 1933 *Isocardia wiedeyi* OLSSON, Bull. Amer. Paleont., 20(69): 52-53, pl. 2, fig. 4, 5;
- 1946 *Isocardia sp.* LIDDLE, Geology of Venezuela and Trinidad: 220;

Occurrence: Pananga Formation, Perú, of Late Aptian-Early Albian age.

S.C.S. occurrence: Locality MO-2804, La Gé river, Perijá area, Píche Member of Apón Formation, of Early Albian age. Our casts are more elongated posteriorly, than the nominal species.

Rostrocardia? boiti (Lisson, 1930)
Plate 19, figure 1;

- 1930 *Trigonia Boiti* LISSON, B.M.I.C, Perú, #2, 20 : 12, pl. 5, fig. 1 ;

Occurrence : Quebrada de los Baños, al norte de Huarás (valle del Santa) Perú, of Barremian age.

S.C.S. occurrence: Locality VG-555, trail from Río Morocoto-Caituco-Ojo de Agua, Taguarumo Formation (sDLP, DGC) of Barremian age.

Family ***CORBICULIDAE*** Gray, 1847.

With a Biochron of ¿Early Jurassic, Middle Jurassic to Recent. COX et alii (1969: N665) stated that [Recent forms in brackish to fresh water ; fossil forms also in marine environments]. All the genera of *Corbiculidae* in S.C.S. in Cretaceous formations, are strictly brackish (oligohaline) or fluvial, lacustrine. Their presence in marine formations, is due to mechanical transportation.

Genus ***Dentonia*** Stephenson, 1953.

According to COX et alii., (1969: N666) this genus is distributed in North America and France, with a Biochron of Late Cretaceous to Eocene.

Dentonia peruviana (Steinmann, 1881)
Plate 58, figures 16, 17;

- 1881 *Cyrena (Leptesthes) peruviana* STEINMANN, N. Jarb. f. Miner., Geol., Paleont. 2: 148-149, pl. 8, fig. 1;

Occurrences: Pariatambo Formation, Perú, of Middle Albian age.

S.C.S. occurrences: Locality MO-1261, Quebrada Guaruríes, Uribante Hemigraben, Aguardiente Formation, of Middle Albian age. Monomictic assemblage, with all the valves disarticulated, in silt/sand flaser bedding.

Genus/Subgenus ***Eocallista/Eocallista*** Douvillé, 1921.

According to COX et alii., (1969: N666), it is an intra-Jurassic genus (Bathonian to Portlandian), in North European Province. Here we present several Cretaceous species. *E.(E.) cuneovata* (Cragin, 1905) from La Caja Formation, Coahuila, México, of Kimmeridgian-Tithonian age, is the oldest species in S.C.S.

Eocallista (Eocallista) huarazensis (Fritzsche, 1923)
Plate 19, figure 7;

- 1923 *Cyrena huarazensis* FRITZSCHE, N. Jb. F. Min., Geol. u. Paleont., Bg.#50: 45, pl.
- 1930 *Cyrena huarazensis F.* STEINMANN, Geol. Peru: 114, fig. 126;
- 1956 *Cyrena huarazensis* F. BENAVIDES, Geol. of Northern Peru: 369, 392;

Occurrence: In Perú, Carhuaz and Santa Formations, of Late Valanginian age; associated to non-marine fauna, alternating with *Ostrea*-beds and turtle fragments (STEINMANN, 1930). Associated molluska are: *Cassiope strombiformis, C. lujani and Idonearca gabrielis* (Leymerie).

S.C.S. occurrence: Locality PM-08-C, trail from Pajaral to La Margarita Mt., La Margarita mudstones (sDLP, DGC)of Hauterivian age. Also in Chururu Member of Rio Negro Formation, Uribante Hemigraben, of Hauterivian age. All are disarticulated, transported valves. RENZ (1960) reported it from Moina Formation, of Hauterivian age.

Eocallista (Eocallista) hübneri (Steinmann, 1881)
Plate 55, figures 3, 10;

- 1881 *Cyrena Hübneri* STEINMANN, N.J.Miner. Geol. Paleont. 2: 147, pl. 8, figs. 3, 4;

Occurrence: In Pariatambo Formation, Perú, of *Oxytropidoceras carbonarium* Zone, of Middle-Late Albian age.

S.C.S. occurrence: Locality MC-1261, Quebrada Guarurías, Aguardiente Formation, Mérida state, of Middle Albian age. It is associated to *Plesiosaurus* bones, in black shales intercalated between sandstones. The six shells were all articulated, proving that the reptiles actually penetrated fluvial channels and interdistributary lagoons, in order to feed.

Genus ***Filosina*** Casey, 1955.

According to KAUFFMAN in HALLAM et alii., (1973: 365) considered it from the Tethys: Western European and Syrian Subprovinces, with a Biochron of Wealdian to Aptian. Few species, with gregarious habits; *F. gregaria* Casey, forms monomictic shell-beds in the Weald-clay formations in England. Similar shell-lenses of *Pachydon hettenri* (Anderson, 1928) were studied in Chaguaramas Formation, of Early Miocene age in clays of the Proto-Orinoco delta complex (Wesselingh & Macsotay, 2006B, Jour. South Amer. Earth Sci. 21[2006]: 49-53).

Filosina hamlini (Whitfield, 1871)

- 1871 *Corbicula (Balissa?) hamlini* WHITFIELD: 386, pl. 6 figs. 17-22;
- 1946 *Eocallista? hamlini* (W.) VOKES, Amer. Mus. Nat. Hist. Bull.78: 193, pl. 8, figs. 20-23;
- 1957 *Epicyprina angulata* (S.) VON DER OSTEN, Jour. Paleont. 31(3): 581, pl. 64, fig. 6; (non Sowerby, 1814)

Occurrence : Abeih sandstones in Dukkun, Lebanon, of Aptian age. The dimensions of the shells varies: length: 23-29 mm, height: 22-29, Thickness: 12-17 mm (VOKES, op. cit.).

S.C.S. occurrence: Locality MMH, Su-177, Manare peninsula, Sucre State, Taguarumo Formation, of Late Barremian age. Also at CH-207, Cachimena inlet, Sucre State, in Lope Member of Taguarumo Formation, of Early Aptian age.

Genus ***Nemetia*** Casey, 1955.

According to KAUFFMAN in HALLAM et alii., (1973: 366) *Nemetia* is typical of the Syrian Subprovince, with a Biochron of Early Cretaceous (Aptian) stage.

Nemetia cf. triangularis (Whitfield, 1871)
Plate 48, figures 7, 12;

- Cf. 1891 *Platopis? triangularis* WHITFIELD, Bull. Amer.Mus.Nat. Hist.,#3: 401, pl. 5, figs. 16, 17;
- Cf. 1946 *Platopis triangularis* W., VOKES, Bull.Amer. Mus. Nat. Hist. 87(3): 196, pl. 9, figs. 6-9;

Occurrence: Olive locality, near Abeih, Lebanon, in brown clays and sandstones of Aptian age.

Dimensions: Length: 14,2 mm, Height: 12,7 mm, Thickness (articulated): 8,8 mm (Topotype, VOKES op. cit.). Length: 12,3 mm, Height: 11,5 mm, (cf. Hormiguera sandstones). Our specimens, carry a coarser concentric ornamentation, that the typical species.

S.C.S. occurrence: Locality MC-266-A, Eastern Río Caripe, Hormiguera member of El Cantil Formation, in black pyritiferous shales, of Late Aptian age. More than 14 disarticulated valves, associated to *Pholadomya pedernalis* (R.)

Genus ***Pharodina*** Stephenson, 1953.
(=*Cyprinella* Gabb, 1864, [non Girard, 1856])

Pharodina is an Amphiamerican and North European genus, whose Biochron is mainly Cretaceous extending from Berriasian to Maastrichtian. Judging by the associated Molluska, this taxon inhabits euhaline marine waters, so it is possible does not belong to the Corbiculidae, as was suspected by COX et alii. (1969: N668).

Pharodina cf. cuneata (J. de C. Sowerby, 1836)
Plate 56, figure 10;

- Cf. 1836 *Cyprina cuneata* J. de C. Sowerby, Trans. Geol. Soc., 2(4): 240, pl. 16, fig. 19;
- Cf. 1907 *Cyprina cuneata* S. WOODS, Paleontogr. Soc.2(4) :134, pl. 20, figs. 7-12;
- Cf. 1939 *Cyprina cuneata* S. MARLIÈRE, M.R.H.n., Belgique, 389 : 59-61, pl. 4, fig. 1a-c ;

Occurrence : Originally studied from Blackdown, Upper Greensand Formation, England, of Late Albian age. Also studied from Mans, France, and Hainaut, Belgium, from Cenomanian horizons, where it is abundant.

S.C.S. occurrence: Locality MO-1156, Quebrada El Molino, Niquitao area, Guayacan Member of Capacho Formation, Trujillo state, of Late Turonian age. Our three casts differ from *P. cuneata* sensu stricto, in the more extended posterior margin, and the less inflated umbo.

Dimensions: Length: 30 mm, Height: 24 mm, (plate 56, fig. 10) cast exposing the RV.

Family ***VENERIDAE*** Rafinesque, 1815.
Subfamily ***PITARINAE*** Stewart, 1930.

Genus/Subgenus ***Aphrodina (Aphrodina)*** Conrad, 1869.

Aphrodina (Aphrodina) cf. cretacea (d'Orbigny, 1842)
Plate 37, figure 7;

- Cf. 1842 *Venus cretacea* d'ORBIGNY, Paleont. Amer Mer. : 82 ; (not Aeora cretacea Conrad, 1870, Amer. Jour. Conch. 6:72, pl. 3, fig. 8; Matawan Formation, Maastrichtian)

Description : This species was based on a mold, showing the hinge-line, in a blackish limestone. Ovalated, compressed, anterior margin shorth, posterior angular (d'ORBIGNY, op. cit.). In collection, I have two well-preserved casts, which shows high similarity to the Colombian original. Cast medium-sized, subelliptical in outline; valves moderately convex, beaks small, situated anterior to the middle; anterior margin slightly concave, passing without interruption into the broadly rounded ventral margin; posterior margin long, gently convex; antero-cardinal margin inflected in front of the beak, to form a shallow and narrow lunule. Surface marked by more or less irregular concentric lines of growth. There is no escutcheon.

Dimensions: Length: 27 mm, Height: 22 mm (d'ORBIGNY, op. cit.). Length: 30 mm, Height (slightly damaged ventrally): 21 mm .

S.C.S. occurrence: Limestone from Tena, near Tocayma, Prov. Santa Fe de Bogotá, Colombia. In Venezuela, locality VG-139, Garcia Formation, (DBG) of Late Aptian age. Two well-preserved casts.

Comparisons: Alike to *A. magharensis* (Abbass) – Late Aptian to Late Albian- but *A. cf. cretacea* is more elongated, and with a more swollen umbo.

Aphrodina longa (Conrad, 1852)
Plate 48, figure 4;

- 1852 *Arca longa* CONRAD, Exped. Palestine, Appendix: 231, pl. 3, fig. 18;
- 1852 *Arca bhamdunensis* CONRAD, Exped. Palestine, Appendix: 232, pl. 3, fig. 19;
- 1934 *Cytherea longa* (C.) BLANCKENHORN: 253, pl. 13, fig.153a, b;

Occurrence: Bhamdun, Liban, and Sinai peninsula, Egypt, of Late Albian age.

S.C.S. occurrence: Locality MO-2313, Caño Cusare, Perijá area, Lisure Formation, of Middle Albian age. Also in El Cantil Formation, (DBG) of Early Albian age.

Aphrodina whitei (Böse, 1910)
Plate 45, figure 4;

- 1864 *Meretrix longa* GABB, Paleont. California, #1: 165, pl.25, fig. 147;(non Conrad, 1852).
- 1910 *Tapes whitei* BÖSE, :133, pl. 28, figs. 13-15;
- 1928 *Tapes whitei* B., ADKINS, Univ. Texas Bull. 2338: 165;
- 1962 *Meretrix magharensis* ABBASS, Paleont. Ser., Monogr. 1: 144-145, pl. 22, figs. 12-14;

Occurrence: Maghara mt., Sinai Peninsula, Egypt, of Late Albian age. Georgia, Caucasus mts., of Early Albian age. In Mexico, Chihuahua, from the *Oxytropìdoceras chihuahuense Zone,* of Middle Albian age; In Texas, Fredericksburg group, of Middle Albian age. In California in "Division A" of Albian? Age.

S.C.S. occurrence: Locality An-317-A, Santa Teresa-Los Monos road, Caripito Member of Chimana Formation, (DBG) of Early Albian age.

Genus ***Loxo*** Daily & Popenoe, 1966.

According to KAUFFMAN in HALLAM et alii., (1973: 679) *Loxo* is proper of the North Temperate Realm – Northeast Pacific Subprovince, endemic center, during Late Cretaceous times. It is associated to Molluska of mesohaline habits in S.C.S. According the literature, *Loxo* must have evolved in the Tethys Ocean shorelines, during Barremian-Aptian times, in saline seas, and migrated later to the temperate areas.

Loxo brongniarti (Leymerie, 1842)
Plate 42, figure 14;

- 1845 *Venus Brongniartina (Leymerie)* d'ORBIGNY, Pal. Franç. Terr. Cret.:432, pl. 382, fig. 3-6;
- 1916 *Meretrix (Flaventia) brongniarti* (L.) DOUVILLE: 151, pl. 19, figs. 11 ;
- 1961 *Pseudaphrodina brongniartiana* (L.) CASEY : 606 ;
- 1962 *Meretrix brongniartina* (L.) ABBASS, Paleont. Ser., Mon. 1 : 143, pl. 22, figs. 6, 7, 8, 10 ;

Occurrence : In the Western European, Apulian, Balkanic, and Syrian Subprovinces, and North European Province. Its Biochron extends from Barremian to Early Albian age.

S.C.S. occurrence: Locality HA-4436 Arbol Redondo section, Peñas Altas Formation, lower Carbonatic member of Late Barremian-Early Aptian

age. Also found in Lope Member of Taguarumo Formation, of the same age.

Loxo subbrongniarti (d'Orbigny, 1850)
Plate 43, figures 6, 7;

- 1850 *Venus subbrogniartina* d'ORBIGNY, Prodrome 2: 76;
- 1852 *Tellina obruta* CONRAD, Exped. Palestina: 210, pl. 10, fig. 57;
- 1852 *Tellina Syriaca* CONRAD, Exped. Palestina: 219, pl. 10, figs. 59-61;
- 1934 *Cytherea subbrongniartina* d'O. BLANCKENHORN, Paleontogr., #81ª: 253-254, pl. 14, figs. 156-157;

Occurrences: This taxón is known from the Late Neocomian to Early Cenomanian of the Western European, Syrian, and Maghrebian Subprovinces.

S.C.S. occurrences: Locality An-77, Cerro El Potrero, Anzoategui state, El Cantil Formation, (DBG, VIVAS, 1987) of Late Aptian age. Is associated to *Mesorbitolina texana/M. parva* horizon.

Genus ***Pseudaphrodina*** Casey, 1952.

According to KAUFFMAN in HALLAM et alii., (1973: 679) this genus is from the North Temperate Realm, widespread endemic in the North European Province.

Pseudaphrodina ricordeana (d'Orbigny, 1845)
Plate 60, figures 15, 17;

- 1845 *Venus ricordeana* d'ORBIGNY, Pal. Franç. #3, Bivalvia: 431-432,pl. 382, fig. 1, 2;
- 1908 *Clementia (Flaventia) ricordeana* (d'O.) WOODS, Paleontogr. Ser. 2(5): 189, pl. 29, figs. 16-18;

S.C.S. occurrence: Locality MO-3121, Quebrada La Gé, Perijá area, Píche member of Apón Formation, of Early Albian age. This is an evidence of southward migration, related to climatic changes.

Occurrence: Its first occurrence was in the Barremian of France; during Aptian times, became widespread in North European and Balkanic Subprovinces, between the *fissicostatus and nutfieldensis Zones* (CASEY, 1961).

Genus ***Trigonocallista*** Rennie, 1930. (=*Calva* Popenoe, 1937).

According to KAUFFMAN in HALLAM et alii., (1973: 374) this genus belongs to the South Temperate Realm, East African, North Pacific Provinces, and Western European Subprovince. With three species in S.C.S., we consider that *Trigonocallista* had preference for Saline Seas, independently of their dominant temperatures.

Trigonocallista cf. compacta (de Loriol)
Plate 39, figure 21;

- Cf. 1882 *Cytherea (Caryatis) compacta* de LORIOL, Mat. Paleont. Suisse, 9: 55-56, pl. 7, figs. 8,9;

Description: Shell of moderate size, nearly as highj as long; inflated, rather thick, beaks prominent, rather high, placed anterior to the mid-length of the shell, prosogyrous; anterior dorsal border strongly cncave, antyerior end rather sharply rounded. Ventral margin broadly arched; posteriuor end bluntly truncated; posterior dorsal border slightly arched. Externally, surface with irregular concentric striae.

Dimensions: Length: 31 mm; Height: 30 mm.
Occurrence: Nièvres, France, of Early Albian age.
S.C.S. occurrence: Locality VG-139, west side of Cerro Piedra de Rayo, Monagas state, Garcia Formation, (DGC) of Late Aptian age.
Comparison: It is very much alike to the nominal species, but the beaks are more swollen.

Trigonocallista cf. puella (de Loriol, 1882)
Plate 56, figure 12;

- Cf. 1882 *Cytherea? (Cariatis) puella DE LORIOL,* Mat. Paleont. Suisse 9: 57, pl. 7, figs. 10-13 ;

Diagnosis : The shell is only slightly higher than long; the greatest height is slightly in front of the center of the shell, an at the beaks. The anterior 1/3 of the LV exhibits irregular concentric growth threads. This character is different from *T. puella* (de Loriol),- Nièvres, France, of Middle Albian age,- whose concentric ornamentation is far more regular.

Dimensions: Length: 20,05 mm, Height: 20,1 mm Thickness: 10,1 mm(plate 56, fig. 12).
S.C.S. occurrence: Locality HA-4508, Cerro Los Platones, upper carbonate member of Peñas Altas Formation, of Early Albian age.

Trigonocallista curvirostris (Coquand, 1865).
Plate 53, figs. 8, 12 ;

- 1865 *Cyprina curvirostris* COQUAND, Mem. S.Emul. Provence #3 : 30, pl. 12, fig. 1-2 ; pl. 13, fig.2 ;
- 1887 *Cyprina curvirotris* C., MALLADA, Sinopsis, #3 :94, pl. 32ª, figs. 1-2;
- 1949 *Cyprina (Venilicardia) curvirostris* C., BATALLER, Sinopsis 8(1): 108-109;

Occurrence: Many localities cited in the Maestrazgo Basin, in Calizas de Oliete, and Villaroya de los Pinares Formations, of Gargasian age (CANEROT, 1982).

S.C.S. occurrence: Locality MO-3121, Quebrada La Gé, Perijá, Píche Member of Apón Formation, of Early Albian age.

Genus ***Nagaoella*** Hayami, 1965-b.

According to KAUFFMAN in HALLAM et alii., (1973: 371) this taxon has a wide distribution area: Japan-East Asian Subprovince, the tropical subprovinces of Gondwana Province, including Texas. The Biochron of this genus, extends from Aptian to Turonian. In my files are the following Taxa:

1. *N. corrugata (*Nagao), Aptian-Albian, Japan.
2. *N. crenulata* (Matsumoto), Cenomanian-Turonian, Japan
3. *N. delettrei* (Coquand), Albian – Turonian, Maghrebian, Syrian Subprovinces,
4. *N. euterpe* (Coquand), Aptian, Spain, Venezuela,
5. *N. forgemolli* (Coquand), Cenomanian, Maghrebian, Syrian Subprovinces,
6. *N. inflata* (Gabb), Cenomanian-Turonian, California.

The paleogeographic distribution of this genus, suggests the intense activity of the Equatorial counter-current, (GORDON, 1973) during the maximum transgressions of the Gallic times.

Nagaoella cf. delettrei (Coquand, 1862)
Plate 59, figure 10;

- Cf. 1862 *Venus Delettrei* COQUAND, Soc. Emul. Provence, Mem. 2 : 194, pl. 8, figs. 3, 4 ;
- Cf. 1917 *Dosinia Delettrei* (C.) GRECO, Paleont. Ital. 24 : 49, pl. 5, figs. 6-10 ;
- Cf. 1962 *Dosinia delettrei* (C.) ABBASS, Geol. S.M.R.D. Pal. Ser. Mon. 1 :151-152, pl. 23, figs. 8-9 ;

Occurrence : Its origination is at Late Albian in the Haut Atlas, Morocco ; during Cenomanian and Turonian times, it extended to the Maghrebian and Syrian Subprovinces, including Sicilia.

Dimensions: Length: 23 mm, Height: 25 mm, Thickness: 14 mm (ABBASS, op.cit.).

S-C.S. occurrence: Locality MO-1156, Quebrada El Molino, Niquitao area, Trujillo state, in Guayacan Member of Late Turonian age. Many casts, more inflated than the type illustrated by COQUAND (op. cit.).

Comparisons: *N. inflata* (Gabb, 1864: 168, pl. 23, fig. 149)- Chico Group, California, of Cenomanian-Turonian age,- differs from this specimen in having a less prominent umbo, as the result of which the outline is more rounded.

Nagaoella? euterpe (Coquand, 1865)
Plate 33, figures 15, 15a;

- 1865 *Dosinia euterpe* COQUAND, Mem. Soc. Emul. Prov.#3 : 297, pl. 23, figs. 1-2 ;
- 1949 *Venus (Dosinia) euterpe* C. BATALLER, Sinopsis, 8(1) : 110 ;
- 1952 *Meretrix wellsi* WHITNEY, Jour. Paleont. 26(5) : 705, pl. 89, figs. 6, 7 ;

Description : Small cast, subovate, equivalve, inequilateral ; beaks high, slightly subcentral, prosogyrate; general contour modified by pelomorphosis, (arrows on figure 15a). The margins are slightly gaping on our specimen; pallial line marked by short vertical ridges and grooves; the pallial sinus is deep, fairly wide, directed upward; the greatest height is at the beaks, and the greatest thickness is slightly above the center of the shell. No lunule observed, but the escutcheon is deep and narrow.

Dimensions: Height: 32,3 mm, Length: 26,0 mm (deformed specimen). Height: 33 mm, Length: 26,5 mm, Thickness: 14,5 mm; Holotype, (COQUAND op. cit.). Height: 39 mm, Length: 35 mm, Thickness: 25 mm (WHITNEY, op. cit.).

Occurrence: Collected from Cuatro Dineros, Forcall marl Formation, Teruel, Maestrazgo Basin, Spain, of late Early Aptian age. Glen Rose Formation, Texas, of Early Albian age.

S.C.S. occurrence: Locality MO-890, La Cueva Inlet, Borracha Island, Lower Borracha Formation, (DAGM), of Late Aptian age.

Nagaoella cf. forgemoli (Coquand, 1862)
Plate 62, figure 2;

- Cf. 1862 *Venus forgemoli* COQUAND, Mem. Soc. Emul. Provence,#2 : 194, pl. 8, figs. 7-8 ;
- 1897 *Cytherea (Caryatis) sp.* GERHARDT : 86, pl. 1, figs. 3, 3a;
- 1962 *Dosinia forgemoli* (C.) ABBASS, Paleont. Series, Mon. 1: 152-153, pl. 23,figs. 6, 7;

Occurrence: Frequent in all the tropical subdomains of the Gondwana Province, including Sicilia, Italy.

S.C.S. occurrence: Locality MO-1154, Quebrada Los Arillos, Niquitao, Trujillo state, Guayacan Member of Capacho Formation, of Late Turonian age, where it is frequent (GERHARDT, op. cit.). Our casts are identical to those illustrated by ABBASS (op cit.) – Cenomanian, Egypt,- but different from the ones of FOURTAU (1917: 87, pl. 7, fig. 8).

Dimensions: Length: 16 mm, Height: 19,5 mm, Thickness: 8 mm.

Comparisons; *Nagaoella deletteri* (Coq.) and *N. forgemoli* (Coq.) are minly separated on the basis of the form os the shell, which is orbicular in the former and higher than long in the latter. This distinction is probably due to sexual dimorphism, as both forms are found in the same bed (ABBASS, op. cit.).

Subfamily ***CYCLININAE*** Frizzel, 1936.
Genus ***Cyprimeria*** Conrad, 1864.

According to KAUFFMAN in HALLAM et alii., (1973) *Cyprimeria* belongs to the North Temperate realm – The Euramerican region, with a Biochron of Early Cretaceous to Eocene. The three species of this genus, are always sampled in biodetritical limestones, associated to Bivalvia of Mesohaline and/or Polyhaline habitats.

Cyprimeria meridionalis (Següenza, 1882)
Plate 56, figure 18;

- 1882 *Venus meridionalis* SEGUENZA, Atti r. Acad. Lincei, Mem. Ser.3(12): 71, pl. 2, fig. 6, 6ª;
- 1937 *Venus meridionalis* S. TREVISAN: 112, pl. 7, fig. 25, 16, 27;
- 1973 *Cyprimeria meridionalis* (S.) GORTANI: 67, pl. 14, figg. 4ª, 4b;

Occurrence: Thermophyllic species, common in Cenomanian algal limestones of Sicilia (Italy), Egypt and Ethiopia.

S.C.S.occurrence: Locality MO-1156, Quebrada El Molino, Niquitao area, Trujillo state, Guayacan Member of Capacho Formation, of Late Turonian age not common.

Cyprimeria neocomiensis (Weerth, 1884)
Plate 11, figure 5;

- 1884 *Venus neocomiensis* WEERTH, Paleont. Abh., 2(1): 41, plate 8, fig. 3;
- 1895 *Venus seveccensis* MAAS: 259, pl. 6, fig. 5-9 ;
- 1985-c, *Proveniella aff. rosacea* Casey, ETAYO SERNA, Proy. Cretacico, #16:24-21; pl. 1, fig. 15; (non CASEY, 1961).

Occurrence: Gersdorfer Burg limestones and Kannonenberg marls, from Hilsthon Formation, Northern Germany, of Hauterivian age.

S.C.S. occurrence: Locality MC-119-A, west of Piedra de Rayo, ferrugineous siltstone on the top of Bergantín Formation, Monagas state, (DBG) of Hauterivian age. Also in MC-448-A, trail from Pajaral to La Margarita mt., La Margarita mudstones, of Hauterivian age. The bivalve assemblage suggests proximity of coastal lagoons.

Cyprimeria texana (Roemer, 1852).
Plate 43, figures 4, 5;

- 1852 *Arcopagia texana* ROEMER: 46, pl. 6, figs. 8a, 8b;
- 1865 *Circe conspicua* COQUAND, Soc. Emul.Prov., Mem. 3: 298, pl. 11, figs. 1-2;
- 1891 *Arcopagia planissima* WHITFIELD: 409, pl. 7, figs. 8, 9;
- 1946 *Cyprimeria sp.,* LIDDLE, Geol. of Venezuela and Trinidad: 191;
- 1960 *Cyprimeria texana* (R.) PERKINS, Geol. Soc. Amer., Mem. 83: 76, pl. 22, figs. 1, 3;
- 1987 *Cyprimeria texana* (R.) VIVAS, Bol. Geologia (Caracas)#16(29): 29, 32, fig. 21;

Occurrence: *A. texana* originated in Oliete limestone Formation, Oliete Basin, Spain, of Late Aptian age. During Early Albian, was found in Abeih, Lebanon, Aurora limestone of Coahuila, Mexico, and Tablazos Formation, in Colombia. Finally, it proliferated in the Middle Albian Fredericksburg Group, Texas, and Upper Paja Formation of Colombia.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, lower El Cantil Formation, (DBG) of Late Aptian age, where it is associated to the *Mesorbitolina texana/M. parva* Zone. In quebrada Santa Rosita, in Apón medio Formation, was identified by DUSENBURY & 1842 & FRAUNFELTER, in KEY, 1960: 621.

Subfamily ***TAPETINAE*** Adams & Adams, 1857.
Genus ***Cyclorisma*** Dall, 1903.

According to KAUFFMAN in HALLAM et alii., (1973: 369) considered *Cyclorisma* as a genus of the North Temperate Realm, The North American Subprovince endemic of Eastern-Southeastern North America. Two well-known taxa counterdict these proposals: they are associated to hypersaline benthic molluska, in tropical seas.

Cyclorisma chia (d'Orbigny, 1842)
Plate 15, figure 18;

- 1842 *Venus chia* d'ORBIGNY, Coq. & Echinod. Foss. Colombie: 47, pl. 3, figs. 9, 10 ;

- 1964 *Cyprimeria (Cyclorisma) chia* (d'O.) ETAYO SERNA : 99 ;

S.C.S. occurrence: Based on a cast in a yellowish black limestone, collected between Tena and Tocayma prov. Santa Fe de Bogotá, Colombia (d'ORBIGNY, op. cit.). ROYO Y GOMEZ (1945b) collected it on the road to Utica, in Barremian sediments in the Caqueza Group. In Venezuela, locality MO-1322, quebrada Chururú, cut in Los Naranjos-La Fundación road, Uribante Hemigraben, Chururú Member of Rio Negro Formation, of Hauterivian age. Also in locality JFS-139-A, in Río El Danto, Bergantin Formation, (DBG) of Hauterivian? age; it was collected in slightly carbonatic mudstone, interbedded with massive sandstones.

Description: Cast of oval and oblong shape transverse, compressed, surface smooth, with fine growth lines, near the distal margin, and ondulated transverse ridges; anterior margin rounded, shorter than the posterior one: this last one, shows a tendence to angular form. Apical angle: 110º (d'ORBIGNY, op. cit.)

Dimensions: Height: 23 mm, Length: 29 mm, Thickness: 12 mm; (d'ORBIGNY, op. cit.) Height: 25 mm, Length: 33 mm (plate 15, fig. 18). In our casts, the concentric growth lines, are much stronger than on the type, suggesting older shells.

Cyclorisma parva (Sowerby, 1826)
Plate 59, figure 11;

- 1908 *Cyprimeria (Cyclorisma) parva* Sow., WOODS, Paleontogr. Soc. 2(5): 184-186, pl. 28, figs. 19-23; pl. 29, figs. 1-3;
- 1921ª *Cyprimeria (Cyclorisma) parva* S., GILLET, Bull. S. G. Françe: 4(21): 17;
- 1955 *Cyprimeria (Cyclorisma) parva* S., MAHMOUD, P.I.D. Egypt: 123-124, pl. 10, figs. 17-22;

Desscription: Small, oval, convex and slightly inequilateral casts; the ventral margin , very convex, is semi-lunar; prosogyre beaks, highly variable ; lunule large, variable, oval and well marked. The Egyptian shells are polymorphes, in their shapes.

Occurrence: Originated in the Late Barremian of France, emigrated during the Aptian times, to England (from *forbesi to nutfieldensis* Zone, fide CASEY, 1961), to become widespread during Early-Middle Albian in Egypt, where hundreds of exemplaires where collected from individual beds (MAHMOUD, op. cit.).

S.C.S. occurrence: Locality HA-4508, Cerro Los Platones, Trujillo state, upper carbonatic member of Peñas Altas Formation, of Early Albian age, in a sandy limestone, where it is a dominant form, as in Egypt.

Discussion: The almost monomictic population, and highly variable shells, inside one single bed, is a sign of fluvial, or oligomictic, lagoonal paleoenvironment.

Genus ***Flaventia*** Jukes-Browne, 1908;

KAUFFMAN in HALLAM et alii., (1973: 368) included this genus in the North Temperate Realm, in the Euramerican region. *Flaventia* has a Biochron of Hauterivian to Turonian age, in all the marginal seas of the Tethys Ocean. By shell morphology, *Flaventia* may have been a near-shore, lagoonal analogue of *Pitar* (MACSOTAY & CAMPOS, 2001).

Flaventia belviderensis (Cragin, 1894)
Plate 57, figures 15, 16;

- 1894 *Tapes belviderensis* CRAGIN, Amer. Geol., 14: 7, 8; pl. 1, figs. 12, 13;
- 1924 *Tapes belviderensis* C. TWENHOFEL: 84, pl. 19, figs. 4- 8;

Occurrences: Upper Kiowa Formation, Kansas, U.S.A., of Late Albian age.

S.C.S. occurrences: Locality HA-4508, Cerro Los Platones, Trujillo state, upper carbonatic member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, fig. 29). Collected in silty sandstones, mostly articulated shells.

Flaventia ovalis (Sowerby, 1827)
Plate 37, figure 6;

- 1908 *Clementia (Flaventia) ovalis* (S.) WOODS, Paleontogr. Soc., 2(6): 191-192, pl. 29, figs. 19-26;
- 1915 *Clementia (Flaventia) cf. ovalis* (S.) FISCHER: 258-259;

Description: Ovate-elongate shape, the prosogyrate beaks are located in the anterior 1/5; posterodorsal margin convex; anterodorsal margin weakly convex, ending in rounded margin; lunule ovate, small. Surface with fine concentric ribs. Test thin.

Occurrence: Common in the *Perna*-bed of the Lower Greensand, England, of Late Aptian age. Also in Iran, in the same horizon.

S.C.S. occurrence: Locality VG-139, Cerro los Encantados, Monagas state, Garcia Formation, of Late Aptian age. Articulated shells, with their test partially preserved.

Dimensions: Length: 29,3 (incomplete) mm, Height: 23 mm (plate 37, figure 6).

Comparisons: *Sinonia minor* (Ciofalo) – (TREVISAN, 1937, Monog. Igr. Univ. Padova, #12: 115, pl. 7, fig, 34a, b)- Cenomanian, Sicilia, Italia,- has a great resemblance, but it is more truncated posteriorly.

Flaventia cf. silvatica (Coquand, 1865)
Plate 44, figure 5;

- 1865 *Venus silvatica* COQUAND, Mem. Soc. Emul. Provence #3: 295, pl. 10, figs. 3-4;
- 1949 *Venus (Flaventia) silvatica* C., BATALLER, Sinopsis Fos. Cret. España #8(1): 115, 116;
- 1895-c *Cyprina? Sp.cf. "Venus" silvatica* (C.) ETAYO SERNA, Proy. Cretacico#16: 24-12;

Occurrence: Limestones of Villaroya de los Pinares Formation, Maestrazgo Basin, of Late Aptian age (CANEROT, 1982).

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age (VIVAS, 1987). Represented by 8 articulated casts, which differ from the nominal species in having the beaks even in more anterior position. Collected from the *Mesorbitolina texana/M. ovalis* Zone. In Colombia, from the Formations Apón and Mercedes, both of Aptian age.

Flaventia trita (Philippi, 1899)
Plate 15, figure 13;

- 1899 *Trigonia trita* PHILIPPI, Fos. Secundarios de Chile: 93-94, pl. 38, fig. 10;
- 1954 *"Cyprina" sp.,* COX, Jopur. Paleontology, 28(5): 634, pl. 67, fig. 8;

Occurrence: This taxon was based on a Chilean cast, but of unknown outcrop; we suppose it came from the Tinguiririca valley, and had an age of Neocomian.

S.C.S. occurrence: Locality PM-08-C, trail from Pajaral to La Margarita mt., La Margarita mudstones, (sDLP, DGC) of Hauterivian age. Also from Cuche Formation, of Trinidad, of the same age. In Colombia, was cited from Neocomian beds of Middle Magdalena valley (BÜRGL, 1952).

Genus ***Legumen*** Conrad, 1858.

According to KAUFFMAN in HALLAM et alii., (1973: 367) belongs to the North Temperate Realm: Eastern and Western North America, India, Northern European Province. Its presence in the Peruvian, Neuquen Subprovinces and S.C.S., suggests rather salinity preferences, and not thermic. Its Biochron extendes from Berriasian to Maastrichtian.

Legumen? cf. chapmani (Imlay, 1955)
Plate 11, figures 4, 4a;

- 1955 *Legumen chapmani* IMLAY, U.S.G.S. Prof. Paper 274-D: 82, pl. 11, figs. 1,1a;
- Cf. 1916 *Perissonata littlii* GARDNER in CLARK, et al., Maryland Upp. Cret.: 523-524, pl. 20, figs. 1, 2;
- 1985 *Legumen* sp. FIERRO & USECHE, VI Congr. Geol. Venez., T. 1:674;

S.C.S. occurrence: In Western Venezuela, locality MO-1305, quebrada on road from Naranjal to La Fundación, Táchira state, Uribante Hemigraben, Chururú Member of Río Negro Formation of Hauterivian age. Also locality PM-02-B, trail from Pajaral to La Margarita, La Margarita mudstones, Monagas state, (sDLP, DGC), of also Hauterivian age.

Dimensions: Our best cast measures, of Length: 33 mm, Height: 14 mm (LV).

Occurrence: In Alaska, in Hauterivian sediments. Our casts have the same proportions of *L. chapmani* but are the half of its size, and still preserve remain of concentric lines in the ventral margin´s proximity; two weak subumbonal radial ribs are observed, are not present on IMLAY´s illustrations.

Genus ***Paraesa*** Casey, 1952.

According to KAUFFMAN in HALLAM et alii., (1973: 369) *Paraesa* is widespread endemic genus, in the North Temperate Realm, mainly in North European Province. With a Biochron extended from Early Cretaceous (Berriasian) to Late Cretaceous (Senonian), this genus was well established in all the tropical Subprovinces of Gondwana Province.

Paraesa ceciliana (d'Orbigny, 1845)
Plate 47, figure 12;

- 1845 *Mactra ceciliana* d'ORBIGNY, Amer. Merid.: 126, pl. 15, figs. 5, 6;
- 1860 *Venus D'Orbignyanus* GABB, Proc. Acad. Nat. Sci. Phila., #12:198, pl. 3, fig. 2; (non FORBES, 1845)
- 1882 *Tapes Picteti* De LORIOL, Mat. Paleont. Suisse, 9 : 64, 65, pl. 8, fig. 20 ;

Occurrences : *P. ceciliana* was discovered in Peru and Chile, in Albian age sediments. In the limestone Cosne Formation, France, of Middle Albian age.

S.C.S. occurrences: In eastern Venezuela, locality MC-436-A, glauconitic marl west of Cautaro, Sucre state, Valle Grande Formation, (DGC) of Middle Albian age. Associated to Belemnites and medium-sized ammonites, it was considered of outer shelf facies.

Paraesa faba (Sowerby, 1827)
Plate 57, figure 12;

- 1844 *Venus faba* (Sow.) d'ORBIGNY, Pal. Franc. #3 : 444pl. 385, figs. 6-8 ;
- 1862 *Venus reynesi* COQUAND, Prov. Constantine : 193, pl. 8, figs. 11-12 ;
- 1962 *Meretrix faba* (Sow.) ABBASS, Geol. Mus., Paleont. Ser., Mon. 1: 146, pl. 22, fig. 21;
- 1952 *Tapes bakeri* WHITNEY, Jour. Paleont. 26(5): 705, pl. 88, figs. 6, 7;
- 1972 *Paraesa faba faba* (S.) FRENEIX, Not. M. Soc. Geol. Maroc, Monog. 228:178-179, pl. 18, figs. 10a-b, 11, 12; text fig. 46;

Occurrence: *Paraesa faba* originated in the Late Aptian of Lebanon, but proliferated in the tropical Subprovinces of Gondwana Province during Albian times, from Etiopia to Texas. Its acme was reached during Cenomanian-Turonian times in the same area.

Diagnosis: Shell small, oval, umbo at anterior ¼ of the length of the shell; ornament of concentric ridges.

S.C.S. occurrence: Locality MO-1156, quebrada Los Arillos, Niquitao area, Trujillo state, of Late Albian to Early Cenomanian age. From black, piritiferous shales, alternated with marls, 1 Km. of Colon, lower Capacho Formation, Tachira state, was cited by LIDDLE (1946: 270) as "Venus renesi"(sic).

Genus ***Sinonia*** Stephenson, 1953.

According to KAUFFMAN in HALLAM et alii., (1973: 369) considered it endemic of the Gulf and Atlantic Coastal Plain Subprovince, with a Biochron of Cretaceous (Berriasian to Santonian) age. My report of the S.C.S. presence of *Sinonia* is for the first time; it is part of the cryophyllic faunas arrived during upwelling phenomena of Hauterivian and Albian times.

Sinonia? fabrei new species, Macsotay.
Plate 12, figures 6, 12;

Description: Shell small, subelliptical, inequilateral, beals prosogyrate, prominent. Anterior slope concave, posterior slope convex; anterior extremity is regularly rounded; posterior end is more pointed; basal margin is broadly and regularly convex. The surface is marked by fine, regular, concentric ribs, with narrow, impressed lines between them, except in the anterior half, where they become faint, and are replaced by a series of rather coarser, moniliform, radiating ribs. Hinge and the pallial line, unknown. The concentric ribs tend to become coarser as they approach the ventral margin.

Etymology: I have the honor of dedicating this species to the Field Geologist Antoine Fabre, who in his PhD thesis realized in Central Colombia, described the Cundinamarca Aulacogen, where ten kilometers of marine sediments were deposited, the thickest Cretaceous continuous sequence in all the planet Earth. It was not a back-arch structure, as suggested PINDELL & TABBUTT (995).

Dimensions: The Holotype, measures, of Length: 31 mm, of Height: 24 mm; the Paratype, measures, of Length: 37 mm, of Height: 27 mm. Deposited under UCVMG/IO-1950.

S.C.S. occurrence: Locality MC-341 C, La Hacienda, Río Carinicuao, El Dantó dolostones, Sucre state, (sDLP, DGC), of Early Hauterivian age.

Discussion: *Sinonia? fabrei* is only slightly ventricose. On the surface of the Holotype, the radiating ribs are 12 – 14, but on the Paratype, only 8 – 10 could be counted. This character distinguishes it from all the known species of *Sinonia.*

Sinonia? hayamii new species, Macsotay.
Plate 46, figure 4; Plate 47, figure 8;

Description: Cast medium sized, oval, compressed, prosogyrate beaks in anterior 2/3-s, cardinal margin concave-convex anteriorly, widely convex posteriorly; a narrow and short escutcheon is observed on one of our samples; both extremities are regularly but narrowly rounded; basal margin widely convex, but more accentuated in the center. The casts did not preserve any ornamentation; all the samples are articulated , no dentition can be seen. Both extremes are damaged on all the samples; they must have been very thin-shelled.

Etymology: Dedicated to the famous Paleontologist Itaru Hayami – Kyushu University, Japan,- who published three monographies on Japanese Bivalvia (1965a, 1965b, 1966).

Dimensions: Length: 18,9 mm, Height: 15,3 mm. Holotype, UCVMG/IO-1951.

Occurrence: Locality An-77, Cerro Las Callecitas, El Cantil Formation, (DBG, VIVAS, 1987), of Late Aptian age. Eight casts were collected: all articulated.

Comparisons: Very much alike *Venus (Tapes) parallela* Coquand (1865) –Calizas de Alacón Formation, Oliete Basin, Spain, of Barremo-Bedoulian age; also in Perelló and Espartá island - but it is more rounded ventrally, and the umbonal-posterior angularity is less marked.

Family ***CORBULIDAE*** Lamarck, 1818.

The *Corbulidae* are infaunal siphon feeders (STANLEY, 1968). Many recent species of this family are shallow burrowing filter-feeders on a firm substrate. The majority of the corbulid genera evolved during the Cretaceous and Eocene; the remainder radiated during the Miocene and Recent times (SQUIRES & SAUL, 2004: 103). Corbulids are sluggish burrowers, the most of the species live in near-shore fine grained sediments, deposited in relatively low energy environments. Some species are euryhaline, and live in normal marine to brackish waters (COAN et al., 2000). Some fossil corbulidae are known to constitute monotypic shell beds, associated to brackish-water conditions (LEWY & SAMTLEBEN, 1979). The fine-grained sediments which the corbulids inhabit, tend to contain more organic matter than the coarse-grained ones. Its decomposition, mainly by microorganisms, is accompanied by comsumption of the free oxygen and the formation of oxygen-depleted environments which are enriched in H2S.

Subfamily ***CORBULINAE*** Gray, 1823.
Genus ***Caryocorbula*** Garner, 1926.

According to COX et alii. (1969: N693), this taxon was treated as Subgenus of *Corbula* Bruguiére, 1797, with a Biochron restricted to Eocene – Recent. The first *Caryocorbula* known to me, was collected in Portland beds of Yonne, France, of Ryazanian age: *Corbula autissiodorensis* BUVIGNIER (1868 De Loriol, plate 6, figs. 7a, b, c) and it fitted the description .."subquadrate, both valves acutely keeled posteriorly, concentrically rugose, pallial sinus short." and do so at last 48 species and subspecies of Cretaceous age. SQUIRES & SAUL (2004: 108, 110) supported the genus treatment of *Caryocorbula* and stated a Biochron from Middle Jurassic to Recent, and its distribution as Circumtropical.

Caryocorbula cf. elegantula (d'Orbigny, 1850)

- Cf. 1844 *Corbula elegans* d'ORBIGNY, Paleont. Franç, Terr. Cret.#3: 460, pl. 388, fig. 14-17 ;
- Cf. 1850 *Corbula elegantula* d'ORBIGNY, Prodr. Pal.: 118, nº 105;
- Cf. 1925 *Corbula elegantula* d'O. CORROY: 164, 301;

Description: Shell subtriangular in outline, inequivalve; the beaks slightly in front of the center, slightly prosogyrate. LV shorter, more equilateral, RV more elongated poteriorly. Both valves covered externally by fine, equal, concentric folds; on our shells, the beaks are devoid of ornamentation. Length: 7 mm.

Occurrence: The first origination of *C. elegantula* was at Leugny, France, in Hauterivian age sediments; common in Early Aptian of St. Dizier and the ferrolithic beds of Wassy, also France.

S.C.S. occurrence: Locality MO-896, west side of Patiño Inlet, cliffs west of Cumaná, Sucre state. Collected in silt-sand flaser just below the top of Taguarumo Formation, (DAGM), sixteen articulated shells, associated with rudists and a few small-sized colonial corals of Late Barremian age. Also locality MC-421-A, limestone with rudists, west side of the quebrada Paso Largo, Sucre state, Upper Taguarumo Formation, Late Barremian age.

Caryocorbula neocomiensis (d'ORBIGNY, 1850)
Plate 19, figures 10, 11;

- 1847 *Corbula carinata* d'ORBIGNY, Pal. Franc.: 457, pl. 388, figs. 3-5; (non DUJARDIN, 1837)
- 1850 *Corbula neocomiensis* d'ORBIGNY, Prodr. :761.
- 1912 *Corbula Neocomiensis* d'O., PERVINQUÈRE, Etudes de Paleont. Tunisienne, #2 : 294 ;
- 1985 *Corbula cf. convergens* Gerhardt, FIERRO & USECHE, VI Congr. Geol. Venez., Mem. #1: 674; (non GERHARDT, 1898)

Occurrence : *C. neocomiensis* (d'O.) is known from Valanginian to Barremian, in Western European, Maghrebian, and Neuquen Subprovinces.

S.C.S. occurrence: Locality MO-1305, road from Los Naranjos to La Fundación, Uribante Hemigraben, Chururú Member of Rio Negro Formation, of Hauterivian age. Also in El Dantó dolostones, only disarticulated valves, of the same age.

Dimension: Length: 10,5 mm, Height: 7,3 mm (mb. Chururú).

Caryocorbula cf. peruana (Gabb, 1877)
Plate 51, figures 4, 5;

- Cf. 1877 *Corbula peruana* GABB, J. A. Nat. Sci. Philad., 38 : 283-284, pl. 40, fig. 11;
- Cf. 1897 *Corbula peruana* G., GERHARDT, V. N. J. M. G., #11: 114-116, pl. 2, figs. 16 a, b, c;
- Cf. 1930 *Corbula peruana* G., STEINMANN, Geologie von Perú: 141, fig. 171;
- 1985c *Corbula peruana* G., juvenile? ETAYO SERNA, Proy. Cretacico, #24: 21;

Occurrence: Coal mines of Pariatambo, Junin Dept., Perú, of Turonian age (BENAVIDES, 1956). Also in the Turonian of Ecuador.

S.C.S. occurrence: Locality MO-1757, Corozo, on the road from San Cristobal to Santo Domingo, Tachira state Aguardiente Formation, of Middle Albian age; also locality MO-1261, quebrada Guaruríes, Merida state, Aguardiente Formation, of Middle Albian age, associated to *Ceratostreon maroimensis* in black shales. Also in Escandalosa Formation of Cenomanian-Turonian age.

Comparisons: The frequent disarticulated shells, have the shape illustrated by GERHARDT (1897, pl. 2, fig. 16, a, b, c) but with the strong concentric ribbing of GABB (1877, pl. 40, fig. 11). A big shell measures of Length, 13,5 mm, and Height: 10 mm.

Discussions: This whole goup of Gallic age, could be descendant of the "dwarf"fauna *Caryocorbula dammariensis* (Buvignier, 1852)(COX, 1929, : 192-193) – Portland beds, France and England, of Ryazanian age,- which is a lot smaller and aequilateral shell.

Genus ***Eoursivivas*** Ota, 1964.

Eoursivivas was discovered in the Early Neocomian of Japan, but later, its presence in all the tropical Subprovinces of the Gondwana Province, including Portugal and California, was evidenced. Its Biochron extends from Late Jurassic (Purbeckian) to Late Cretaceous (Turonian). OTA (1964) cited the tendency of this genus to forms limestones with abundant shells: articulated and disarticulated, attributing it to Oligohaline waters. My opinion is all the contrary: they inhabited saline/hypersaline waters.

Eoursivivas aligera (Hamlin, 1884).
Plate 42, figure 19;

- 1884 *Corbula aligera* HAMLIN, m.m.C.z.H.# 10(3): 38, pl. 4, figs. 6ª, b, c, d;
- 1934 *Corbula aligera* H., BLANCKENHORN, Paleontogr. 21-A: 263;

Diagnosis: Small shell, with a short rostrum a little less than one-half of the height of the shell, and situated only slightly above the base of the shell; ornamented with about 15-17 coarse concentric ribs, continuous from the anterior to the posterior ends of the shell, are wider than their interspaces. Length: 9,5 – 10,5 mm, Height: 6 – 7 mm, Thickness: 4 – 5 mm.

Occurrence: Sandy marls in Abeih, Liban, of Late Aptian age.

S.C.S. occurrences: Locality HA-4440, lower carbonatic member of Peñas Altas Formation,Trujillo state, of Early Aptian age. Five articulated shells in light grey marls, associated to irregular echinoida.

Comparison: The nearest taxon is *E. littoralis (*ADKINS) (1920: 133-134, pl. 10, fig. 5) – Weno Formation, Texas, of Late Albian age.- but our shell is less constricted posteriorly, and the surface is ornated with more concentric ribs, which are not so much elevated.

Eoursivivas mosensis (de Loriol, 1868)
Plate 11, figure 3;

- 1884 *Corbula Mosensis* de Loriol, MAILLARD, Mem. Soc. Paleont. Suisse,#11 : 81, pl. 2, figs. 46a, 46b ;
- 1898 *Corbula striatula* (Sow.) GERHARDT : 189 ;(non *Corulamella stratula* SOWERBY, 1827) ;
- 1929 *Corbula mosenis* (Buvignier) COX, Proc. Dorset, H. N., #50 :195 ;
- 1980 *Corbula sp. Indet.* GARCIA JARPA et alii. : 9 ;

Occurrence : The taxon originated in the Late Kimmeridgian of north Germany, and proliferated in all the Purbeckian and Ryazanian of Switzerland, England and Jura mts. of France. In wealdian beds of Hauterivian age, from Ördögvölgy, Transylvania, to Mirambell marl Formation, in Maestrazgo Basin, Spain (CANEROT, 1984).

S.C.S. occurrence: Locality MO-1805, road from Naranjal to La Fundación, in Chururú Member of Rio Negro Formation, Uribante Hemigraben of Hauterivian age. The strength and number of concentric growth lines, is variable in all the collected shells, which are of small size: Length: 7 mm, Height: 5 mm.

Eoursivivas martinae (Whitney, 1952)
Plate 51, figure 6;

- 1952 *Corbula martinae* WHITNEY, Jour. Paleont. 26(1): 66, 67, pl. 13, figures 8-11;

Occurrence: Edwards Formation, Texas, *Hoplites lautus* Zone, of Middle Albian age. *E. martinae* is very abundant in a constricted horizon 12 to 15 inches thick; it is an important horizon marker because it is so restricted; nearly the entire bed is often made up of this species (WHITNEY, 1952). Also in the Upper Glen Rose formation, in outcrops and in subsurface, of Early Albian age.

S.C.S. occurrence: Locality MO-2313, Caño Cusare, tributary of Maracas River, Perijá area, Lisure Formation, of Middle Albian age, where it is frequent in some limestone beds. Also in upper Píche member of Apón Formation, of Early? to Middle Albian age.

Comparisons: Closely resembles to *E. picteti* (CHOFFAT, 1886: 25, pl. 1, figs. 1-10), - Bellasian, Portugal,- but *E. martinae* is a lower and more compressed shell, with a strong, narrow, rounded ridge along the posterior cardinal margin.

Genus ***Excorbula*** Squires & Saul, 2004.

Genus based on a new species, *Excorbula parkyi,* S. & S., a late Cretaceous (Turonian-Santonian) species of California, of the North Pacific Province. *E. georgiana* (Stephenson, 1956) of the Gulf-Atlantic Coast Subprovince is also from Coniacian age. Its presence in Barremian-Aptian sediments in S.C.S., suggest a northward migration, during the Albian climatic optimum.

Excorbula? convergens (Gerhardt, 1898).
Plate 18, figures 2, 7, 8;

- 1898 *Neaera convergens* GERHARDT, V. N. J. Miner.,Geol. #11 :189, pl. 5, figs. 10 a, b, c ;
- 1924 *Neaera? convergens* G., GILLET, Soc. Geol. France, Mem. 3 :155 ;

S.C.S. occurrence : Between La Mesa and Anapoima (Cundinamarca, Colombia) in a Brown marl of Aptian age, of La Paja? Formation. ROYO Y GOMEZ (1941) identified it in the Pacho-Zipaquirá region, in the Lower Villeta Group, of Aptian-Albian age. In Venezuela, in Locality MO-892, northwest side of Puerto Escondido inlet, Sucre State, in Lope Member of Taguarumo Formation, of Early Aptian age. Is locally abundant, always associated to *Trochacteon (Neocylindrites)* spp., indicative of saline waters, in sideritic mudstones.

Dimensions: An average articulated shell measures, of Lenth: 9,2 mm, Height: 5,8 mm. Collection number UCVMG/IO-2142.

Comparisons: Its possible ancestor is *Corbula cf. bayani* de Loriol (COX, 1925: 152, pl. 1, figs. 18a, b) – Portland shell-bed, of Ryazanian age, England, and France,- which has the umbo more centrally located. It could be the first *Excorbula.*

Genus ***Panzacorbula*** Squires & Saul, 2004.

The genus *Panzacorbula* is a wide-spread taxon: North Pacific Province, and the Tropical subprovinces of Gondwana Province, including Cameroun and the S.C.S. The proposed Biochron was Late Cretaceous, but we have Aptian-Albian species in Venezuela and Colombia.

Discussion: Alike *Ursirivus* (Vokes, 1945), but differs because its elongated shape, discrepant inflattedness of the valves, discrepant sculpture, stronger sculpture on the RV, and the preence of a long, narrow pit posteriorly adjoining the chondrophore.

Pancorbula colombiana (d'Orbigny, 1842)
Plate 37, figure 16;

- 1842 *Corbula colombiana* d'ORBIGNY, Coq. & Echin. Foss Colombie: 49;

Description: One cast found in a blackish limestone, the same that contained *Anatina colombiana* [of d'ORBIGNY, 1842]; it is very inflated, ornated by thick concentric ribs, which become gradually thicker as they approach the ventral margin. Collected at Analayma, province of Santa Fe de Bogotá, no illustration was made (d'ORBIGNY, 1842). According to KARSTEN (1896) it was collected in the Fómeque Formation, of Aptian age. With the shells of Garcia Formation we can add: Shell small, with umbo slightly anterior to the middle; trigonal-rounded shape, umbono-lateral margins almost straight; posterior rostrum pointed, ventral margin widely rounded, curving anteriorly, where it passes to a rounded margin. Test thin, somewhat thicker distally, than proximally. No signs of pelomorphic deformation.

Dimensions: Length: 15,2 mm; Height: 10,2 mm, (plate 37, fig. 16).

S.C.S. occurrence: Locality VG-139, west of Cerro Piedra de Rayo, Monagas state, lower Garcia Formation, (DBG), of Early Aptian age. Seven casts of articulated specimens were collected, the best one is illustrated here. This horizon is considered a valley fill, where shallow marine and brackish water faunas are mixed up.

Comparisons: The nearest species seems to be *Corbula? fenti* Scott (1970, Univ. Kansas Contributions, 52: 77, pl. 5, figs. 1, 2) - Kiowa Formation, Kansas, USA, of Late Albian age,- where the concentric ribs are grouped in 2-3

sweelings extending from anterior extreme to posterior extreme.

Genus ***Ursirivus*** Vokes, 1945.

According to KAUFFMAN, in HALLAM et alii., (1973: 368) *Ursirivus* would belong to the North American Subprovince/Province, with Late Cretaceous biochron. Published evidence suggests the origination in Late Jurassic (Purbeckian) of North European Province, and Apulian Subprovince, where they proliferated in the Wealdian facies, of Neocomian age. Considered as oligohaline by most authors, the evaporitic remains in these units, suggest hypersaline/saline paleonvironment. They were important component of the "dwarf-molluskan" fauna, and is coincidental the survival in the Late Cretaceous Bear River Group, (SW Wyoming) of the Western Interior Endemic Center, where the *U. pyriformis* (Meek), the type species- attained great sizes, associated to a number of fresh-water faunal types.

Ursirivus cf. inflexus (Römer) Dunker, 1838.

- Cf. 1839 *Nucula inflexa* ROEMER, Nordeutsch. Oolithgeb., 100, pl. 6, figs. 16, 17;
- Cf. 1884 *Corbula inflexa* D., MAILLARD, Mem. Soc. Pal. Suisse, #11 :75,pl. 2, figs. 24-29;
- Cf. 1915 *Corbula inflexa* R. FUCINI, Paleontogr. Ital., #21: 92, pl. 10, figs. 40, 41;
- 1937 *Corbula cf. inflexa* (R.) ARTHABER, :440-441, pl. 25, figs.12, 13;

Occurrence: *U. inflexus* (R.) is a typical wealdian dwarf-bivalve, widely distributed in North European Province, and Apulian Subprovince, and Maestrazgo Basin, in Spain.

S.C.S. occurrence: Locality MC-329-D, Río Pajaral, Monagas state, La Margarita mudstones, (sDLP, DGC) of Hauterivian age. Also at locality MC-441-A, La Guanota-La Güiria trail, El Cazón Formation, (DGC) of Late Berriasian age.

Ursirivus sp. indet. Macsotay
Plate 16, figure 10;

Description: This taxon is represented by five casts of articulated shells, exposing the LV. This shell was relatively large for a member of the *Corbulidae* though smaller and less inflated than the genotype of *Ursirivus.* The shell is moderately elongate and subpyriform whith the blunt, rounded umbones situated at the anterior ¼ of the length; the ventral margin is widely rounded, and its greatest curvature is at the middle of the shell; it passés gradually to the anterior end. A well-defined, broad, impressed escutcheon marks the posterior dorsal area, and is set off by a narrow, raised ridge; lunular area is not observable. Surface of the cast, is smooth, but a small fragment of preserved shell, shows coarse, concentric lines.

S.C.S. occurrence: Locality MC-264-B, eastern part of Río Caripe, Monagas state, topmost El Cantil Formation, (DBG) of Early Albian age. Casts collected in a dark grey limestone bed, associated to *Costocyrena dürfeldi* and *Pachythaerus myophoroides,* and some polychaeta, of ill-circulated oligohaline marine waters.

Dimensions: Length: 12,5 mm, Height: 7,5 mm.
Discussion: VOKES (1946), stated "It may be that the greater convexity of *U. pyriformis "*can be attributed, to a response of that species, to the lesser salinity that must have "characterized the waters in the environment in which the Bear River Formation was "deposited." This could be used to explain why *Ursirivus sp. indet.,* is also an inflated shell.

Genus ***Vokesula*** Stenzel & Twinning in Krause & Twining, 1957.

According to COX et alii., (1969: N695-N696) this is a Paleogene genus (Early Eocene to Early Oligocene) of Eastern North America, a distribution. In the literature, there seem to be some Cretaceous species, too: *Corbula di stefanoi* Greco, Coniacian, Egypt; *C. parsura* Stoliczka, Turonian-Early Campanian, India; *C. paracrassa* Wade, Campanian, Gulf-Atlantic Coast Subprovince, and *C. raimondi* Gabb, Albian to Coniacian, Peruvian Subprovince.

Vokesula raimondi (Gabb, 1877)
Plate 56, figure 15;

- 1877 *Corbula Raimondi* GABB, Acad. Nat. Sci., Philadelphia, Jour.2º ser., 8:284, pl. 40, fig. 12;
- 1897 *Corbula raimondi* G., GERHARDT: 113, pl. 2, fig. 15 ;
- 1913 *Corbula raimondi* G., SCHLAGINTWEIT, N. J. f. Miner. B.#3 : 96 ;

Occurrences : Studied from Pariatambo coal mines, of Albian age (GABB, op. cit.).
S.C.S. occurrences: Locality JFS-002, Santa Rosa-Guaruta road, Sucre state, Valle Grande Formation, (DGC), of Late Albian age, in grey shales with small molluska and belemnites, articulated shells. In Chimana Grande Island, Boquerón

Formation, (DAGM) of Early Cenomanian age. In Barinas state, Navay Formation, of Turonian age. In Colombia, in San Pedro-Zipaquirá area, in the lower Villeta shales of Cenomanian age (ROYO Y GOMEZ, 1941).

Dimensions: Disarticulated RV, measures of Length: (incomplete) 9 mm, and of Height: 8 mm.

Subfamily ***CAESTOCORBULINAE*** Vokes, 1945.

Genus ***Parmicorbula*** Vokes, 1944.

Parmicorbula neaeroides (Blanckenhorn, 1890) Pate 32, figures 1, 2;

- 1890 *Corbula neaeroides* BLANCKENHORN, Kreidesyst. Mitt.-Nordsyrien : 96, pl. 7, fig. 3 ;
- 1946 *Parmicorbula neaeroides* (B.) VOKES, A.M.N. Hist. 87(3) : 209, pl. 10, figs. 25-29

Occurrence : Lower Trigonia sandstone, Abeih, Liban, of Aptian age.

S.C.S. occurrence: Locality MO-887, silty sideritic limestone northwest of Puerto Escondido, Lower Taguarumo Formation, (DAGM) Sucre state, west of Cumana. Associated to *Trochacteon (Neocylindrites)* spp., 16 articulated shells.

Discussion: The nearest species seems to be *Corbula chilmarkensis* (COX, 1929, Proc. Dorset Hist. Nat. 50: 194-195, pl. 10a, b, c,: 11a, b, c) – Portland beds, England, of Ryazanian age,- of bigger size, and the concentric sculpture, is more irregular.

Subfamily ***CORBULAMELLINAE*** Vokes, 1945.

Genus ***Corbulamella*** Meek & Hayden, 1857.

According to KAUFFMAN in HALLAM et alii., (1973: 369) is another Corbulid of the Western Interior Endemic Center of North America, of the North Temperate Realm. Its Biochron extends from Late Jurassic (Purbeckian) to Late Jurassic (Cenomanian). Considered brackish, it could be an opportunistic genus in the saline/hypersaline lagoonal evaporitic environments.

Corbulamella cf. forbesi (de Loriol, 1865) Plate 11, figs. 13, 14 ;

- Cf. 1865 *Corbula Forbesiana* de Loriol, in De LORIOL & JACCARD, Mem. S.P. H.n, Geneve #18 :38-39, pl.3, figs. 5, 6, 7 ;
- Cf. 1884 *Corbula Forbesiana* d.L., MAILLARD: 73, pl. 2, figs. 19-23;
- Cf. 1913 *Corbula Forbesiana* d.L., JOUKOWSKY & FAVRE: 313, 317;

Occurrences: *C. forbesiana* (de Loriol) is a very common species in Purbeckian horizons in Switzerland: Villers-le-Lac, Lignières, Mont Salève, in marls associated to evaporitic minerals (JOUKOWSKY & FAVRE, op. cit.).

S.C.S. occurrence: In locality MO-1305, road from El Naranjal to La Fundación, Chururú Member of Río Negro Formation, Uribante Hemigraben, of Hauterivian age.

Family ***HIATELLIDAE*** Gray, 1824.

Genus/Subgenus ***Panopea (Panopea)*** Ménard de la Groye, 1807.

According to KAUFFMAN in HALLAM et alii., (1973: 359) is a cosmopolitan taxon, whose Biochron goes from Triassic?, Early Cretaceous to Recent. They are trans-temperate Bivalves in Euramerica and Austral Province, during Cretaceous times, with about 100 taxa, from which we study 10 in the S.C.S. Probably was very well adapted to saline marine waters, specially when the influx of a big river, provided leptopel. According to CHARLES (1948, B.M.H.n.Mem., #6: 26) *Panopea* evolved from the genus *Pleuromya* and during the Cretaceous, the test is very thin, a lot more than in present times; this helps to explain the phenomena of Pelomorphosis (ROLLIER, 1917, Mém. Soc. Paleont. Suisse, #42).

Panopea (Panopea) brasiliensis (White, 1888) Plate 53, figure 9; plate 60, figure 8;

- 1888 *Glycymeris braziliensis* WHITE, Ar. Mus. Nac. Rio de Janeiro, #7: 111, pl. 7, figs. 1, 2;
- 1936 s*Panopea brasiliensis* (W.) MAURY, N. Soc. Geol. Min. Brasil, #11: 81-83, pl. 11, figs. 11, 12;
- 1933 *Panopea berryi* OLSSON, Bull. Amer. Paleont. 20(69): 58, pl. 7, fig. 3;

Description: Shell of médium size, elongate-ovate; umbos wide and rather prominent ending in the small beaks, situated approximately at the anterior one-third; ventral and dorsal margins nearly straight and parallel; the posterior extremity rounded and gaping; the anterior extremity produced and more narrowly rounded, closed; valves are moderately convex, the greatest inflation being located approximately in the middle; surface smooth or ornamented only by lines of growth.

Dimensions: Length: 75 mm, Height: 37 mm, (*P. brasiliensis),* Length: 96 mm, Height: 46 mm, Diameter: 35 mm, *(P. berryi).* Length (incomplete): 95 mm, Height: 51 mm (Píche member of Apón Formation).

Occurrence: Maroim, Sergipe, Brasil, Ganhamaroba Group, of Middle Albian age. In Perú, Pananga Formation, of Late Aptian-Early Albian age.

S.C.S. occurrence: Locality MO-3121, Quebrada La Gé, Perijá región, Píche Member of Apón Formation, of Early Albian age. Also in Arbol Redondo section, Upper carbonatic member of Peñas Altas Formation, also of Early Albian age. In Colombia, cited from upper Paja formation, of Albian age (CORYELL, 1935).

Panopea (Panopea) carteroni *(d'Orbigny, 1847)*

- 1847 *Panopea Carteroni* d'ORBIGNY, Pal. Franç. Terr. Cret. #3: 332, pl. 355, fig. 1;
- 1949 *Panopea Carteroni* d'O., COLLIGNON, (16): 24-25, pl. 3, figs. 8, 8ª;
- 1957 *Panope* sp. VON DER OSTEN, Jour. Pal., 31(3) : 582, pl. 64, figs. 3, 4 ;
- 1974 *Panopea carteroni* (dÓrb.) DIMITROVA, Foss. Bulgarie, Cretacé, #4-b: 115, pl. 56, fig. 2;

Occurrence: *P. carteroni* is known from the Valanginian of Paris Basin, France; Perù and Colombia; in Perú, in La Virgen Member of La Herradura Formation, of Early-Middle Valanginian age (ALLEMAN, 1985, cf.). In Somalia and Bulgaria, of Hauterivian age; Argentina and Bulgaria, of Barremian age.

S.C.S. occurrence: Locality Su-90, western coast of Picuda Grande Island, Taguarumo Formation, (DAGM), Sucre state, of Barremian age. In Colombia, Las Juntas sandstone Formation, of Hauterivian-Aptian?age, in the Cocuy Graben, and Macanal shale Formation, (cf.) ETAYO SERNA (1985-c).

Panopea (Panopea) gurgitis (Brongniart, in Cuvier, 1822)
Plate 53, figures 1, 2;

- 1909 *Panopea gurgitis* WOODS, Mon. Cret. Lamell. England, #2: 222, pl. 35, figs. 9-14; pl. 36, figs. 1-8;
- 1930 *Panopaea neocomiensis* (Leymerie) WEAVER, Univ. Washington, Mem.#1: 361, pl. 42, figs. 268-270;
- 1940 *Panope cf. gurgitis* (B.) IMLAY, Geol. Soc. Amer. Bull.,51: 154, pl. 6,figs. 7, 8;
- 1954 *Panopea gurgitis* W., COX Jour. Paleont. 28(5) : 634-635, pl. 67, fig. 9 ;
- 1985c *Panopea gurgitis* (B.) ETAYO SERNA, Proy. Cretacico, #24: 21;
- 1988 *Panopea gurgitis* (Br. In Cuvier) DHONDT & DIENI, Mem. S. Geol., #40 :55-58, pl. 13, figs. 9-12, text fig. 24 (Paleogeographic distribution)

Occurrence: Circum-Gondwanic Province Ditribution, including East African Province; also in Japanese-East Asian and Balkanic Subprovinces. Its Biochron begun during the early Valanginian and finished during Early Albian? of Madagascar (DHONDT & DIENI, op.cit.).

S.C.S. occurrence: Locality PM-10-F, trail from Pajaral to La Margarita mountain, Monagas state, in La Margarita mudstones, of Hauterivian age. It is also relatively common in Taguarumo Formation, (DAGM) of Barremian age (MACSOTAY & VIVAS, 1998: 72). In Trujillo state, small specimens were collected in Jabon, Trujillo state, in the Lower carbonatic member of Peñas Altas Formation, few specimens. In Perijá, western Venezuela, locality MO-3131, Caño Cusare, Piche Member of Apón Formation, of Early Albian age. All the casts present some degree of pelomorphosis.

Panopea (Panopea) inequivalvis (d'Orbigny, 1843)
Plate 54, figures 5,9;

- 1843 *Panopaea inaequivalvis* d'ORBIGNY, Paleont. Fr., Terr. Cret. 3:340, pl. 358, figures 5-7;
- 1949 *Panopaea inaequivalvis* d'O., COLLIGNON, A. g. S.M.Madagascar #16: 25, pl.4, figs. 1, 1a

Occurrence: Rare species, known from the Early Albian of Paris Basin, France, and the same horizon of Madagascar.

S.C.S. occurrence: Locality MO-3121, Quebrada La Gé, Perijá, Píche member of Apón Formation, of Early Albian age.

Panopea (Panopea) indifferens (Coquand, 1865)
Plate 53, figure 11;

- 1865 *Lavignon indifferens* COQUAND, Soc. Emul. Provence, Mem.#3: 1oo, pl. 9, figs. 7, 8;
- 1887 *Lavignon? Indifferens* C., MALLADA, Sinopsis, Cret. España, 33: 88;

Occurrence: Collected in Morella, Alcalá and Cinctorres, in Maestrazgo sandstone Formation, in Maestrazgo Basin, Spain, of Albian age, not Aptian (CANEROT, 1984).

S.C.S. occurrence: Locality MO-3121, Quebrada La Gé, Píche member of Apón Formation, of Early Albian age. Only two casts were found.

Panopea (Panopea) newberryi (?) Shumard, 1860
Plate 54, figure 1;

- 1860-a *Panope newberryi* SHUMARD, St. Louis Acad. Sci. Trans. 1: 605;
- 1928 *Panope newberryi* Sh., ADKINS, Univ. Texas Bull., 2883: 170;

Descriptions: Shell oblong, subovate, one-fourth to one-third longer than high, umbonal region gibbous; beaks small, strongly incurved, considerably anterior to the middle; surface with fine growth lines and concentric wrinkles. Length: 70 mm, Height: 45 mm, Thickness: 32 mm. (SHUMARD, op. cit.) never illustrated.

Occurrence: Collected in Parker County and at Comanche Peak, in the "Caprotina limestone" of Edwards Formation, Texas, of Middle Albian age.

Dimension: Length: 50,5 (incomplete) mm; Height: 39,5 mm, (Plate 54, fig. 1). S.C.S. occurrence: Locality MO-3121, Quebrada La Gé, Perijá mts., Piche Member of Apón Formation, of Early Albian age.

Panopea (Panopea) rathbuni (White, 1888)
Plate 51, fig. 15;

- 1888 *Glycymeria rathbuni* WHITE, Arch. Mus. Nac. Rio de Janeiro, 7:110, pl. 7, fig. 3, 4;
- 1936 *Panopea rathbuni* (W.) MAURY, Mem. Soc. Geol. Min. Brasil,#11: 83, pl. 9, figs. 12, 13;

Occurrence: Sergipe state, Brasil, Ganhamaroba Group, of Midddle Albian age.

S.C.S. occurrence: Locality MO-3121, Quebrada La Gé, Perijá mountains, Píche Member of Apón Formation, of Early Albian age. As in Brasil, *P. (P.) rathbuni* is found in the same limestone beds, as *P. (P.) brasiliensis.* Also reported from eastern Sabana de Bogotá, Une Formation, Albian horizons (ROYO Y GOMEZ, 1939).

Subgenus ***Myopsis*** Agassiz, 1840.

The utilization of *Panope (Myopsis)* was proposed by I. HAYAMI (1966) against the opinion of COX et alii. (1969: N700), who included it in the synonymy of *Panopea (Panopea).* Its definition: "Alike *Panopea (Panopea),* but are more inequilateral, more convex, with narrower and more "pointed umbones, and with a distinct furrow extending from the umbo, to the postero-ventral "margin. Anterior half of the shells, usually developing "concentric folds." The Biochron of this subgenus, is Eocretaceous (Valanginian) to Late Cretaceous (Maastrichtian).

Panopea (Myopsis?) nagaoi Hayami, 1966
Plate 60, figure 11;

- 1966 *Panopea (Myopsis) nagaoi* HAYAMI: 155, pl.12, fig. 8;
- 1975 *Panopea (Myopsis) nagaoi* H., HAYAMI, University M. U. Tokyo, Bull. 10: 147;

Occurrence: Yatsushiro Formation in Sakamoto area, and Arita Formation in Yuasa area, Japan, of Late Neocomian to Albian age.

S.C.S. occurrence: Locality HA-4337, La Aguada section, Trujillo state, La Puya Member of Peñas Altas Formation, of Late Albian age (ARNAUD et alii., 1999).

Panopea (Myopsis?) nana Coquand, 1865
Plate 59, figure 2;

- 1865 *Panopea nana* COQUAND, Mem. Soc. Emul. Provence #3: 279, pl. 7, figs. 7, 8;
- 1892 *Panopea nana* C. MALLADA, Catalogo: 136, nº 1744;
- 1949 *Panopea nana* C., BATALLER, Sinopsis Cret., 8(2): 124;

Occurrences: In Maestrazgo Basin, Spain, Utrillas (Teruel), Les Mesquites, Garraf, (Barcelona) in Mosqueruela Formation, of Middle-Late Albian age (CANEROT, 1982), and not Aptian.

S.C.S. occurrences: Locality MO-2310, Caño Lisure, Perijá, Lisure Formation, of Middle Albian age. The cast of this species usually are found in the limestone/shale interfase, and are not common. Also found in La Puya Member of Peñas Altas Formation, in La Urbina section. In Píche Member of Apón Formation, Perijá, of Early Albian age.

Dimensions: Length: 27,5 mm, Height: 22 mm, (plate 59, fig. 2)

Discussion: In California several taxa seem to be pelomorphic deformations of a *P. (M?) nana* : "*Pholadomya" clementina* ANDERSON (1938: 116, pl. 3, fig. 3) Upper Paskenta Group, and Lower Horsetown Group, of Neocomian age; and *"Pholadomya" distorta* ANDERSON (1938: 117, pl. 3, figs. 9, 10) of Paskenta Group. These taxa were inhabitants of slope environment in North Pacific Province during Neocomian times, and invaded the S.C.S. area during the retour of the "normal" salinities, during Albian times.

Panopea (Myopsis)? plicata (Sowerby, 1823)
Plate 47, figure 16;

- 1844 *Panopaea plicata* S. d'ORBIGNY, Paleont. Franç., Terr. Cret.,#3:337-338, pl. 357, figs. 4, 5 ;
- 1893 *Pleuromya henselli* HILL, #55 : 16, 31, pl. 4, figs.1-2 ;
- 1915 *Panopaea gurgitis B. var. plicata* FISCHER, Beitr. Pal. Österr.-Ungarn #27(4): 257;
- 1921-b *Panopea plicata* S., GILLET, Bull. Soc. S.H.n Yonne: 75: 39, pl. 4, fig. 5;
- 1946 *Panopea plicata* S., WINKLER in SUTTON, Amer. Assoc. Petrol. Bull. 30(1): pl. 4, figs. 5, 6;
- 1966 *Panopea (Myopsis) plicata* (S.) HAYAMI: 153, pl. 22, figs. 1-7;
- 1975 *Panopea (Myopsis) plicata* (S.) HAYAMI: Univ. M. U. Tokyo, Bull. #10: 146-147;

Occurrence: Wide-spread species in Western European, Apulian, Maghrebian, Balkanic S.C.S., and Japanese-East Asian Subprovinces, reaching Angola, in SW Africa. Its Biochron extends from Valanginian to Early Cenomanian in shelfal environments.

S.C.S. occurrence: Locality MO-1234, Río Apón, Perijá mountains, Tibú Formation, of Late Barremian-Early Aptian age (FRAUNFELTER in KEY: 519). Also in locality An-77, Cerro Las Callecitas, Anzoategui state, upper El Cantil Formation, of Lower Albian age.

Family ***MEGALODONTIDAE*** Morris & Lycett, 1853.

The Biochron of this family extends from Middle Silurian to Early Cretaceous.

Genus ***Pterocardia*** Bayan, 1874.

Typical big sized, and thick shelled genus. Posterior area differentiated by a well marked wing. Umbones prominent, almost orthogyrous; ornament of radial ribbing. With a Biochron of Middle Jurassic (Bathonian) – Eocretaceous (Aptian), distributed in Tropical Subprovinces of Gondwana Province.

Pterocardia isarae (Gras, 1852).
Plate 15, figures 24, 25;

- 1852 *Opis isarae* A. GRAS, Catal. Des corps foss. De l'Isere : 30, pl. 1, 2, 3 ;
- 1907 *Cardium (Pterocardia) brouzetensis* COSSMANN, Mem. Soc. Geol. Françe: 37: 29-30, pl. 5, figs. 1-3;
- 1916 *Pterocardia brouzetensis* COSSMANN in BRUN, Paleonogr. #51: 32, pl. 4, figs. 43-45;
- 1918 *Pterocardia brouzetensis* COSSMANN, Bull.Soc. Geol. Françe,16: 423, pl. 16, figs. 1-5;

Description: The genus *Pterocardia* was typical of the corallian facies during the Late Jurassic; *P. isarae* is an aberrant species: narrow wings, forms an angle over the palleal margin. The ornamentation consists of only concentric striae and the shell must have been thin, because of the scarcity of Calcium bicarbonate, in the saline waters of the Machiques Hemigraben.

Occurrence: Sassenage, Urgonian limestones, France, of Barremian age. Its frequence in these limestones, also deposited in saline waters, on extensive shelves.

S.C.S. occurrence: Locality MO-1322, Río Negro, Perijá area, Upper Río Negro Formation, 50 meters stratigraphically below the top, of early Barremian age, three casts of articulated specimens. Also in Tibú Formation, of Atarigua para-autochthonous, Lara state, of Barremian age.

Discussion: "*Opis" equalis* Conrad (1852: 231, pl. 2, fig. 9)- unknown locality of Lebanon, - is very near to *P. isarae,* but posteriorly is truncated, and not pointed. *P. subseptifera* (Gemmellaro, 1890)- San Cataldo, near Favarotta, province of Palermo, Sicilia, where it is associated to Nerineids of Late Tithonian-Berriasian age, is a large shell (Length: 77 mm, Height: 72 mm, Thickness: 56 mm) covered with only fine growth spirals. It is possibly the ancestor of the *P. isarae,* and are all related to the big-sized *P. septifera* (Buvignier), a common bivalve in the Corallian of Wimmis, Switzerland of Late Jurassic (Kimmeridgian) age.

Family ***MONOPLEURIDAE*** Munier-Chalmas, 1873.

Genus ***Monopleura*** Matheron, 1843.

Monopleura cf. votani Felix & Lenk, 1890
Plate 9, figure 1;

- Cf. 1890 *Monopleura Votani* FELIX & LENK, Paleontogr. #3: 166, pl. 25, fig. 4, 4ª;

Description: RV conical, spirally twisted, oval in section, outer surface marked by four coarse, rounded spiral ribs, with narrow interspaces; the ribs start at 1/3 of the distance from the umbo, and coarsen towards the edge. Only one RV collected, LV unknown.

Dimensions: Height: 34 mm, Width: 21 mm, (Plate 9, fig. 1).

S.C.S.occurrence: Locality MC-338-H, El Cordon-Rio Cariaco road, in El Dantó Dolostones, of Hauterivian age.

Occurrence: Puebla state, Southern Mexico, of Neocomian age.

Paleoecology: *M. cf. votani* originated in El Dantó dolostones, of Hauterivian age, deposited in saline/hypersaline waters, which also originated the famous *Requienia ammonia* (MACSOTAY & ALVAREZ, 1989).

Family ***CERATOMYIDAE*** Arkell, 1934.

The Biochron of the family extends from the Late Triassic to the Late Jurassic and ?Miocene (COX et alii., 1969: N838-N839), as a cosmopolitan taxon.

Genus ***Gresslya*** Agassiz, 1843.

Gresslya is a cosmopolitan Early to Late, Jurassic genus (COX et alii., 1969: N840). It had infaunal feeders inhabiting soft, clay or silt-rich sediments. In the paleontological literature, it survived during Berriasian-Valanginian times, mostly in carbonatic sediments.

Gresslya cf. aldouini (Fischer von Waldheim)
Plate 6, figure: 3;

- 1830-1837 *Donax aldouini* FISCHER von WALDHEIM, pl. 46, fig. 3;
- 1955 *Gresslya aldouini* (F. v. W.) GERASIMOV, T. B. R. G. M., 1060: 69-70, pl. 10, figs. 3-7;
- 1977 ¿*Gresslya sp.* ALENCASTER, Univ. Nac. Auton.Mexico, Inst.Geol.#1(2): 161;

Dignosis: A medium-sized LV, somewhat damaged, very inequilateral, the shell must have been thin. The cast is incrusted with microdolomite chrystals, specially on the postero-dorsl area. The umbo is prosogyrate, swollen and protuberant; remnants of a pallial sinus restricted to the posterior half of the cast. This taxon differs from the nominal species, in having a more swollen umbo.

Occurrence: A common species in Russia, in the Volgian (=Boreal Tithonian) stage.

Dimensions: Length: 31,5 mm, Height: 21,8 mm, (Plate 6, fig. 3).

S.C.S. occurrence: Locality VG-376, Ojo de Agua-Santa Rosa trail, between Rio Grande and Quebrada del Medio, into the lowest bed of El Cazón Formation, of Late Berriasian age, (DGC). In Mexico, was reported from San Ricardo Formation, of Berriasian age. In MC-346, shales in El Dantó dolostones, in outskirts of Cautaro, (DGC) of Hauterivian age, one cast was collected.

Comparisons: *"Astarte"? sp.* (YIN, 1931, Trav. Lab. G. Lyon, #18[14]: 107-108, pl. 13, fig. 2), described and illustrated from Tithonian-Berriasian of Bas Languedoc, France, - a *Gresslya* alike *G. cf. aldouini,* but with a small umbo, placed in almost terminal anterior position.

Gresslya? laventillensis (Waring, 1926)
Plate 13, figure 3;

- 1926 *Pteromya? laventillensis* WARING, Geology of the Island of Trinidad, B.W.I The Johns Hopkins Univ. Stud. Geol. #7: 90-91, pl. 17, fig. 1;

Description: Cast of medium size, oval-elongated; the shell is comparatively thin, however, and the cross sections through the hinge indicate something of a spoonshape process in either valve. Umbones situated near the anterior extreme, prosogyrate, umbono-posterior margin widely curved, just as the ventral margin; both converge in rather pointed anterior and posterior margins. The maximum height and thickness, are about the middle of the cast. Two shallow furrows are observable in the postero-dorsal area; the external one, is long, the internal one, short.

Occurrence: The Blue Limestone Series 4, shows traces in restricted layers of Lee Lum and Point Gourde, quarries of Laventille Formation, Northern Range of Trinidad.

S.C.S. occurrence: Locality VG-381, Ojo de Agua-Santa Rosa trail, between Río Grande and Quebrada del Medio, Sucre state, of Late Berriasian-Early Valanginian age.

Comparisons: *Gresslya gregaria* (F. A. Römer) (Tornquist, Paleont. Abhand. Bd., 4(2): 40, pl. 7, fig. 5) – Middle Jurassic, Callovian stage, of Chile,- is a related species, with the umbono-posterior and ventral margins widely rounded, converging in a rather pointed posterior margin. The presence of various species of the genus *Gresslya,* in the Jurassic of Neuquen Subprovince is evidence of Paleo-Pacific influence on the western coasts of Gondwana Continent.

Family ***MYOPHOLADIDAE*** Cox, 1964.

According to COX et ali., (1969: N841), the Biochron of *Myopholadidae* is Middle Jurassic (Bathonian) to Eocretaceous (Albian). These

infaunal siphon feeders proliferated in soft mud bottoms, as do most Pholadidae.

Genus ***Myopholas*** Douville, 1907.

According to KAUFFMAN in HALLAM et alii., (1973: 369) is an endemic taxon widespread in the North European Province, of the North Temperate Realm. Many species were reported from Japan, Russia, and Perú.

Myopholas cf. peruviana Olsson, 1934
Plate 18, figure 11;

- Cf. 1934 *Myopholas peruviana* OLSSON, Bull. Amer. Paleont. 20(69) :36-37,, pl. 5, fig. 7;
- Cf. 1954 *Myopholas peruviana* O., BENAVIDES, Geol. of North. Perú,: 369;
- 1946 *Pholadomya nodulifera* Münster, WINKLER in SUTTON,: 1644;
- 1980 *Myopholas cf. peruviana* O., GARCIA JARPA et alii.,:44;

Occurrence: Originally studied from Pananga Formation, Amotape region, Perú, of Late Aptian to Early Albian age.

S.C.S. occurrence: Locality MO-1782, road from San Pedro to Barbacoas, quarry on the turn of the road, lower Carbonatic Member of Peñas Altas Formation, of Early Albian age. Also collected in Guaimaros shale member of the same formation (MACSOTAY, 1980-b: 33). The Piche Member of Apón Formation, Perijá, of the same age: most of the casts are pelomorphically deformed. In Mendoza Fría, Trujillo state, in the lower shales of Peñas Altas Formation (SUTTON, 1946).

Family ***PLEUROMYIDAE*** Dall, 1900.

The Biochron of this family, extends from Triassic to Early Cretaceous. Infaunal siphon feeders, according to STANLEY (1967).

Genus ***Pleuromya*** Agassiz, 1842.

According to KAUFFMAN in HALLAM et alii., (1973: 359) *Pleuromya* is a cosmopolitan genus. Favoured by high salinities and soft substrates, where they reproduced with advantage.

Pleuromya borealis? Warren, 1947
Plate 42, figure 21;

- 1947 *Pleuromya borealis* WARREN, Jour. Paleont., 21(2): 119-120, pl. 29, figs. 1-4;

Occurrence: Mackenzie River valley, Canada, of Albian age.

Description: Shell elongated-oval, with opistogyrous umbo placed almost at the anterior margin. Superimposed to growth lines, there is a divergent spiral sculpture that remembers the one seen on the genus *Ceratomya* Sandberger 1864, (COX et alii., 1969: N839)- Early Jurassic to Late Jurassic,- but the general shape suggests a *Pleuromya.* This sculpture is present on both valves.

Dimensions: Length (reconstructed) 50 mm, Height: 28 mm; RV, pl. 42, fig. 21;

S.C.S. occurrences: Locality HA-4436, road from Jabón to San Pedro, Trujillo state, lower Carbonatic member of Peñas Altas Formation, of Early Aptian age (ARNAUD, et alii., 1999, fig. 18).

Discussion: This style of external ornamentation, is also present on *Machomya sinuata* Von ALTH, 1881, pl. 25, fig. 18; - of the Niznyow limestones, Poland, of Ryazanian age- is a smaller shell, with a small umbo placed at 1/5th anterior position.

Pleuromya colombiana (d'Orbigny, 1842).
Pate 48, figure 1;

- 1842 *Anatina colombiana* d'ORBIGNY, Coq. Echin. Foss., Colombie: 49-50, pl. 3, figs. 16-17;
- 1865 *Periploma Verneuili* COQUAND, Soc. Emul. Prov., Mem. 3 : 289, pl. 7, figs. 3-4 ;
- 1985-c, *Platymoidea aff. cornueliana (d'O.)* ETAYO SERNA, Proy. Cretacico, 16: 24-15, pl. 2, fig. 3; (not d'Orbigny, 1844)

Occurrence: In Colombia, illustrated from the Macanal shale, of Valanginian age. In Spain, collected from Teruel, in Mirambell marls, of Hauterivian age, and not Aptian (CANEROT, 1982). Associated to *Tessarolax americana and Cucullaea tocaymensis* from Analayma, Santa Fe de Bogotá, Colombia, (KARSTEN, 1858) and ROYO Y GOMEZ (1939) cited it from Une Formation, of Albian age, .

Dimensions: Height: 37 mm, Length: 50 mm, Thickness: 16 mm, Apical angle: 130º.

S.C.S. occurrence: Locality MC-448-A, Campo Claro road, off Teresén, Monagas state, La Margarita mudstones, (sDLP, DGC) of Hauterivian age. It was associated to small *Corbulidae.*

Discussion: The *Pleuromya* found in the albian-age sediments in Colombia, should be compared to *Myacites bisinuosus* WHITE (1888, Ar. Mus. Nac. R.-J. #7: 104, pl. 7, figs. 6, 7) –Maroim,

Sergipe, Brazil, from Ganhamaroba Group, of Middle Albian age- a well-preserved articulated shell, somewhat bigger than *P. colombiana,* and a lot more dilated posteriorly.

P. colombiana is more related to the wide-spread *P. tellina* Agassiz (GERASIMOV, 1955: 66-67, pl. 9, figs. 3-4) – Middle Callovian to Ryazanian (=Berriasian) in Boreal and Austral Realms, including Mexico, - but the ventral curvature of the former, shows a flexure, just below the umbos.

Pleuromya hedbergi new species, Macsotay.
Plate 48, figures 2, 3, 8;

Diagnosis: Oval-elongated cast, with a pointed posterior constriction, that gives a pyriform shape to the shell.

Description: Big sized cast, inflated, inequilateral and inequivalve; RV slightly higher than LV, with moderately rounded orthogyrous umbones, situated in the middle of the shell. The maximum inflation of the valves, is about 1/5 anterior to the umbones. The umbono-anterior margin is first convex, then later concave, merging gradually to the curved anterior extreme; the umbono-posterior is slightly convex, ending in a truncated posterior gape. The ventral margin is weakly curved, increasing its convexity towards the well-rounded anterior edge. External surface without any concentric ornamentation, visible on the casts, nor any trace of pallial sinus.

Dimensions: The Holotype, measures of Length: 70 mm, of Height: 40 mm, Thickness: 40,5 mm. UCVMG/IO-1951, seven articulated casts.

Etymology: Dedicated to the famous Stratigrapher, The German descendant American Hollis D. HEDBERG, (1903-1988) successful explorer of Eastern Venezuela's Cretaceous sequence.

S.C.S. occurrence: Locality MO-6307, Cerro Las Callecitas, Bergantin area, Anzoategui state, (DBG), El Cantil Formation, of Late Aptian (Gargasian) age. Collected in a marl interbed, associated with *Mesorbitolina texana/M. parva*, and irregular echinoids, with good preservation.

Discussion: It is probably descendant of *P. colombiana* (d'ORBIGNY), - Valanginian-Hauterivian age, in S.C.S.- from which it differs in the constricted profile of posterior extremity, anteriorly is more rounded.

Pleuromya? inconstans Castillo & Aguilera, 1895
Plate 7, figure 8;

- 1895 *Pleuromya inconstans* CASTILLO & AGUILERA, Bol. C.G. Mexico, #1: 10;
- 1905 *Pleuromya inconstans* C. & A., CRAGIN, U.S. Geol. Surv. #266: 82-83, pl. 17, figs. 1-5;
- 1937 *Pleuromya sp.* IMLAY, Jour. Paleont. 11(7): 567, pl. 74, figs. 2, 3;
- 1940a *Pleuromya? inconstans* C. & A., IMLAY Geol. Soc.Am.Bull. 51(1): 409, pl. 55, fig. 1;
- 1980-b *Pleuromya inconstans* C. & A., MACSOTAY, Unpubl. Thesis : 26 ;

Occurrence: In Mexico, in the Lower Taraises Formation, of Hauterivian age; also in the upper Malone Formation, (Texas) of Berriasian age.

S.C.S. occurrence: Locality VG-384-A, Ojo de Agua-Santa Rosa trail, between Río Grande and Quebrada del Medio, (DGC), El Cazón Formation, of Late Berriasian-Early Valanginian age. Collected in yellowish white dolomitic claystone, on the top of the sequence. Also found in El Dantó dolostones, and Chururú Member of Rio Negro Formation, of Hauterivian age.

Pleuromya pleuromyaeformis (Choffat, 1888)
Plate 54, figures 2, 4;

- 1888 *Pholadomya pleuromyaeformis* CHOFFAT : 84, pl. 5, figs. 1 – 3 ;
- 1893 *Pholadomya ? knowltoni* HILL, 55 : 30, pl. 2, figs. 1, 2;
- 1956 *Pholadomya cf. pedernalis* R., ALENCASTER de CSERNA : 21, pl. 3, fig. 8;

Occurrence: Originated in Dombe Grande, Angola, in Aptian and in Spanish Guinea, in Albian sediments. Frequent in Glen Rose Formation, Texas, of Early Albian age.

S.C.S. occurrence: In locality MO-2804, Quebrada La Gé, Perijá area, Píche member of Apón Formation, of Early Albian age. Also in Upper carbonatic Member of Peñas Altas Formation, of the same age.

Comparisons: *P. autissiodorensis* Cotteau (de Loriol, 1868, pl. 6, figs. 11, 11a)- Ryazanian of Yonne, France,- is a very related species, but *P. pleuromyaeformis* has a more widely rounded ventral margin.

Family ***PHOLADOMYIDAE*** Gray, 1847.

According to STANLEY (1968) the *Pholadomyidae* were infaunal siphon feeders. Frequent in S.C.S., it preferred pelitic, rather carbonatic substrates. Most shells are found articulated, in life position, so we infer that their burrowing strategy was efficient.

Genus/Subgenus ***Pholadomya (Pholadomya)*** G. B. Sowerby, 1823.

According to KAUFFMAN in HALLAM et alii., (1973: 359), this taxon was cosmopolitan; with a Biochron extended from Late Triassic to Recent, it reached its acme during Jurassic-Cretaceous times. The type species, *P. (P.) candida,* G.B. still survives in the Southern Caribbean Sea, in pelletal-rich, organic muds in less than 10 meters of depth (Gibson Smith & Gibson Smith, 1898).

Pholadomya (Pholadomya) cf. agrioensis *Weaver, 1930*
Plate 11, figure 7;

- Cf. 1931 *Pholadomya agrioensis* Weaver, U. Washington Mem.#1: 316-317, pl. 36, figs. 205, 206;
- 1985 *Pholadomya aff. papyracea* M. & H., FIERRO & USECHE: 674;(non MEEK & HALL, 1862).

Occurrence: *P. agrioensis* is characteristic of the Upper Quintuco Formation, of Berriasian and Early-Middle Valanginian age, of Neuquen Basin, Argentina (WEAVER op. cit.). Also from the Rosablanca Formation, middle Magdalena Valley, Colombia, of Late Valanginian-Hauterivian age.

S.C.S. occurrence: Locality MO-1305, road from Naranjal to La Fundación, Uribante Hemigraben, Chururú Member of Río Negro Formation, of Hauterivian age.

Comparison: *P. agrioensis* never attain a greater length than 60 mm, and whose costae vary between 10 or 12; the anterior and posterior ends are free from costal ornamentation, and the anterior four ribs are always separated by wide interspaces (WEAVER, op. cit.). The Rio Negro specimens have less radial costae: only 8, otherwise have all the characters.

Pholadomya aff. gigantea Sowerby in Fitton, 1836
Plate 51, figure 10;

- 1938 *Pholadomya cf. gigantea* S., DIETRICH: 105-106;
- 1940 *Pholadomya cf. gigantea* S., IMLAY, Geol. Soc. Amer., Bull, 51(1): 155, pl. 18, fig. 5;

Occurrence: Originally described from the Barril Viejo shale, Coahuila, Mexico, of Early Hauterivian age. DIETRICH (op. cit.) cited them from La Mesa and Zapatoca, Colombia from the "youngest Neocomian" horizons.

S.C.S. occurrence: Locality ED-14-B, quebrada El Dantó, Monagas state, (DGC) Mapurite member of El Cantil Formation, of Late Aptian age. The host rock was a sandy, micaceous black limestone, with several articulated specimens. Also in the lower Tibú Formation, of Uribante Hemigraben, of Barremian age.

Pholadomya (Pholadomya) gigantea Sowerby in Fitton, 1836
Plate 33, figures 10, 12;

- 1909 *Pholadomya gigantea* (Sow.) WOODS, Paleontogr. Soc., 2(6): 246-248, pl. 40, fig. 14; pl. 41,fig. 1;
- 1887 *Pholadomya gigantea* S. MALLADA, Sinopsi. Cretacico España, #3: 84;
- 1900 *Pholadomya elongata* M. WOLLEMAN, Neoc. Holl., Deut.: 133-134;
- 1931 *Pholadomya gigantea* (S.) WEAVER, U. Wash., Mem. 1:313-315, pl. 36, fig. 209, 210 y 211;
- 1988 *Pholadomya gigantea* (S.) DHONDT & DIENI, Mem. Sci. Geol.U. Padova, 40: 59-60, pl. 13, fig. 20; text-fig. 25;

Occurrence: The first origination of *P. gigantea,* was in the Tithonian sediments of Chile, (CORVALAN & PEREZ, 1956) but its major diffusion occurred during Neocomian times: in all the Subprovinces of Gondwana Province, but reaching North European Province, Western European, Apulian and Balkanic Subprovinces (DHONDT & DIENI, op. cit., text-fig. 25). It profited from the saline seas, its distribution was not thermally influenced. Still frequent in Aptian sediments, became extinct in Earliest Albian times.

S.C.S. occurrence: Locality HA-4447, Cerro de Agua Dulce, Trujillo state, lower carbonatic Member of Peñas Altas Formation, of Early Aptian age.

Discussion: This is a highly variable species, and are numerous transitions between the different varieties: 1) The type of the species, or the elongated variety (*P. elongata* sensu stricto) is straight, almost cylindrical, the height not bigger than the thickness. The cardinal margin is almost straight and the pallial border is barely curved (it is dominant in the Hauterivian stage type section, in Switzerland). 2) The big size variety (*P. scheuchzeri)* is still straight, of bigger size than the former, without becoming thicker. Cardinal border is straight (dominant in the Valanginian of St. Croix, Switzerland). 3) Scaphoid variety: very arched

shell, with cardinal margin strongly curved, in size is intermediate between the two former ones: also of Valanginian. 4) Very short variety: Almost as long as high, slightly arched, uncommon in the Valanginian of Switzerland (PICTET & CAMPICHE, 1864: 74).

Paleoenvironment: It is evident the effort of adaptation to substrate firmness, food availability, and nearness of the pycnocline, where the leptopel abundance reached its acme. So, it was inhabitant of middle or outer shelf, and not sublitoral, as was suggested.

Pholadomya (Pholadomya) pedernalis Römer, 1852. Plate 52, figure 1;

- 1852 *Pholadomya pedernalis* RÖMER, Kreide von Texas: 45, pl. 6, fig. 4;
- 1854-1858 *Pholadomya pedernalis* R., PICTET & RENEVIER:60, pl. 6, fig. 7;
- 1875 *Pholadomya pedernalis* R., MOESCH: 93, pl. 32, figs. 7-9, pl. 33, fig. 2;
- 1887 *Pholadomya pedernalis* R., MALLADA, Sinops. Esp., Cret. #3: 84-85;
- 1947 *Pholadomya silinensis* RICHARDS, Johns Hopkins U. S. G. #15: 65-66, pl. 8, figs. 6, 7;
- 1974 *Pholadomya (Pholadomya) pedernalis* R., DIMITROVA, Foss. Bulgarie: 116-117, pl. 59, fig. 7;

Occurrence: Biochron of the species, Early Aptian to Cenomanian, in the Western European, Apulian and Balkanic Subprovinces and the tropical Subprovinces of Gondwanan Province, including Texas. In Peruvian Subprovince, in Aptian-age sediments.

S.C.S. occurrence: Locality HA-4367, Arbol Redondo Section, Trujillo state, in lower Carbonatic Member of Peñas Altas Formation, of Aptian age. In Mapurite Member of El Cantil Formation, (sDLP, DGC) of the same age. Also Corral Viejo Member of Chimana Formation, (DAGM) of Late Albian age (ROD & MAYNC, 1954: 276).

Discussion: *Pholadomya rustica* Phillips (COX, 1929, Mem., S.N.S. Dorset, 50: 172, pl. 5, fig. 1) – Oxfordian to Ryazanian (Portland beds, England and France),- is ornated by about twelve equidistant radial ribs, which become much sharper near the ventral margin. It could be the ancestor of the group of *P. pedernalis.*

Pholadomya (Pholadomya) syriaca Conrad, 1852. Plate 61, figure 15;

- 1852 *Pholadomya Syriaca* CONRAD in LYNCH, Palestine Expedition, App.: 231, pl. 2, fig. 17;
- 1880 *Pholadomya vignesi* LARTET, Mer Morte: 126, pl. 11, fig. 9 ;
- 1886 *Pholadomya fontannesi C*HOFFAT, Faun. Cret. Portugal : 27, pl. 1, figs. 18-22 ;
- 1941 *Pholadomya syriaca* C., VOKES, Ame. Mus. Novit. #1145 ; 8-9 ;
- 1962 *Pholadomya vignesi* L., ABBASS, G.S.M.R.D., Pal. Ser, Mon#1 : 157-158, pl. 24, figs. 7, 8, 8a ;

Occurrence : In all the tropical subprovinces of Gondwana Province, and Western European Subprovince, with a Biochron of Late Albian to Early Cenomanian.

S.C.S. occurrence: Locality MO-2333, Yasa river, Perijá region, upper Maraca Formation, of Early Cenomanian age (DUSENBURY in KEY, 1960: 527, as *Liopistha cornueliana* [d'Orbigny]), not common.

Pholadomya (Pholadomya) ex group texana Conrad, 1857 Plate 17, figure 11;

- 1857 *Pholadomya texana* CONRAD, #18: 152, pl. 19, fig. 3;
- 1931 *Pholadomya gigantea* S., WEAVER, U. Washington, Mem. 1: 313-315, pl. 36, figs. 209, 210, 211; (non Sowerby, in FITTON, 1836)
- 1988 *Pholadomya gigantea* S., DHONDT & DIENI, Mem. S. Geol., U. de Padova, 40: 59-60, pl. 13, fig. 20; text fig. 25; (non Sowerby in FITTON, 1836).

Description: Cast with a fragment of shell, attached; ornated with 13-14, distant, narrow, prominently elevated, undulated or irregular ribs with wide, concave interspaces; coarse, irregular growth lines, some prominent ones at rather regular, widely spaced intervals (ADKINS, 1928, U.Texas Bull. 2338: 139).

Occurrence: Turkey Creek, Leon and Eagle Pass roads, Fredericksburg Group, Texas, of Late Middle-Early Late Albian age (*Pholadomya texana* s.s.).

S.C.S. occurrence: Locality MO-1334, eastward curve of Río Negro, Perijá area, lower Tibú Formations, of Late Barremian age; in marls, all disarticulated and fragmentary valves. The specimens of Tibú Formation are alike to *P. (P.) gigantea,* but the radial ribs are stronger and separated by wider interspaces. The elongate form and numerous sharp ribs in the anterior-medial area, with the posterior smooth area, distinguish this taxon from the nominal species. The maximum thickness is located in the subumbonal area. Fragments of the

shell were observed in various beds of the lower carbonatic Member of Peñas Altas Formation, of Late Barremian-Early Aptian age.

Dimensions: The reconstructed shell, measures, of Length: 120 mm, and Height: 44 mm, lower Tibu Formation.

Discussion: FERUGLIO (1937, Mem. I. Geol. Univ. Padova, #11: 18, pl. 1, fig. 10), illustrated a big-sized fragment of a LV, as *Pholadomya* sp. ind., -Patagonian Subprovince, of Tithonian-Berriasian age,- where the unusual ornamentation is present.

Genus/Subgenus ***Pholadomya (Bucardiomya)*** Rollier in Cossmann, 1912.

This taxon is cosmopolitan, with a Biochron extending from Early Jurassic (Toarcian) to Cenozoic (Paleogene) (COX et alii., 1969: N828).

Pholadomya (Bucardiomya) picteti Mayer-Eymar, 1893
Plate 59, figures 4, 5;

- 1893 *Pholadomya picteti* MAYER-EYMAR, Viert. Zür.naturf. Ges. 38(3) :15, pl. 2, fig. 1;
- 1905 *Pholadomya picteti* M.-E., DACQUE, :17: 17, pl. 2, fig. 10, 11 ;
- 1938 *Pholadomya picteti* M.-E., DIETRICH: 106, pl. 22, fig. 4;
- 1951 *Pholadomya picteti* M.-E. MONGIN & GLAÇON, :435, pl. 15, fig. 11;

Occurrence: Restricted to the tropical subprovinces of Gondwanan Province. The earliest documented occurrence is in Kref Krakmat, Tunisia, of Middle Berriasian age to Middle Albian, in South Graua, Etiopia.

Dimensions: Length: 32 mm, Height: 32 mm, Thickness: 30 mm.

S.C.S. occurrence: Locality MO-2804, Quebrada La Gé, Perijá area, Píche Member of Apón Formation, of Early Albian age. In Apón Formation, Cocuy Graben, Colombia, of Late Aptian age.

Pholadomya (Bucardiomya) cf. picteti Mayer-Eymar, 1893.
Plate 56, figure 13;

S.C.S. occurrence: Locality HA-4337, La Aguada section, La Puya Member of Peñas Altas Formation, Trujillo state, (ARNAUD et alii., 1999, fig. 32), of Late Albian age.

Discussion: This cast has a great similarity with *P. (B.) picteti* Mayer-Eymar (1983: 15-16, pl. 2, fig. 1) – originally reported from the Barremian-Aptian of Switzerland, but our cast has a rounded contour, and the concentric ribs are restricted to the anterior half of the shell. Its measurements are, Height: 24,9 mm, and Width: 26,7 mm. It is probably related to *P. (B.) cf. paucicosta* Roemer, (BUITRON, 1984: 95, pl. 2, figs. 5-6) – Malone and Las Casitas Formations, of Kimmeridgian-Tithonian age of Mexico.

Pholadomya (Bucardiomya) sanctaecrucis Pictet & Campiche, 1864.
Plate 8, figure 14;

- 1864 *Pholdomya sanctae-crucis* PICTET & CAMPICHE, Foss. Cret. Sainte-Croix, #3: 82, pl. 105, figs. 6a, 6b ; 7a, 7b ;
- 1864 *Pholadomya valangiensis* PICTET & CAMPICHE, Foss. Cret. Sainte-Croix, #3 : 83, pl. 106, figs. 1a, 1b, 2, 2a, 2b, 3a, 3b ;
- 1931 *Pholadomya sanctae-crucis* P. & C., WEAVER. U. Washington, Mem. #1: 317-318, pl. 36, figs. 202, 203;
- 1985-c *Pholadomya cf. valangiensis* P. & C., ETAYO-SERNA, Proy. Cret., #16: 24-22;
- 1985-c *Iotrigoni aff. lorenti* (Dana), ETAYO SERNA, Proy. Cret., #16:24-21, pl. 1, fig. 20;

Occurrences: Originally studied from the Calcaire Roux Formation, of Cinquetral, Switzerland, of Valanginian age. Also in Arzier, France, of the same age. In the carbonatic Klippe in Csáklya, Pécs, Hungary (HERBICH, 1886) of Valanginian age. In Lower Quintuco Formation, Neuquén Basin, Argentina, of Berriasian age, where it is abundant. Also Agrio Formation, of Valanginian age.

S.C.S. occurrence: Locality VG-384, Ojo de Agua-Santa Rosa trail, Sucre State, El Cazón Formation (DGC) of Late Berriasian-Early Valanginian age. In Colombia, in the Macanal shale Formation, of Valanginian-Hauterivian age.

Genus/Subgenus ***Pholadomya (Procardia)*** Meek, 1871.

According to KAUFFMAN in HALLAM et alii., (1973: 359), this is a cosmopolitan taxon, with a Biochron extended from Late Jurassic (Callovian) to Late Cretaceous (Senonian).

Pholadomya (Procardia) malbosi Pictet, 1867.
Plate 3, figs. 2, 3;

- 1867 *Pholadomya Malbosi* PICTET, Mat. Paleont. Suisse, #2: 92-93, pl. 19, fig. 3;

- 1874 *Pholadomya malbosi* P., MOESCH, Mem. Soc. Paleont Suisse. 1 :88, pl. 30, fig. 5; pl. 35, fig. 1;
- 1964 *Pholadomya cf. malbosi* P., FÜLÖP, Geologica Hungarica #13 :37, pl. 18, figs. 3ª, 3b;

Occurrence: *P. (P.) malbosi* P., originated during Berriasian times : France, Switzerland, and in Vallivana limestone Formation, Maestrazgo Basin, Spain (CANEROT, 1982). Still present in Mirambell marls Formation, of Hauterivian age; its youngest report is from the Bakony mountains, Hungary, of Barremian age.

S.C.S. occurrence: Locality MO-5115, nameless Quarry, southeast of Cumana, old road to Barranquin town, El Cazón Formation, of Late Berriasian age (DAGM). Two articulated shells and one fragment.

Pholadomya (Procardia) roebberae Wolleman, 1906.
Plate 39, figs. 19, 19-A;

- 1906 *Pholadomya Roebberae* WOLLEMAN Jahrb. K.Preus G.L., Bergakad.#27: 278, pl. 7, figs. 1-2;
- 1974 *Pholadomya (Procardia) malbosi* P., DIMITROVA, Foss. Cret., Bulgaria 34-b: 118-119.(non Pictet, 1867).
- 1879 *Pholadomya barremensis* MATHERON, pl. 18-c, fig. 5; (nomen nudum).

Occurrences: Originally described from Alt-Warmbüchen, (*nolani*-Zone) of Middle Albian age, and Flammenmegrel Grünsand Formation, of Late Albian age. In Bakony mountains, Hungary, of Early Barremian age (FÜLÖP, 1964); in Délul Sasulul, Transylvania, of the same age.

S.C.S. occurrence: Locality : quebrada Zanjon del Muerto, trail to Ira, Lara state, lower Carbonatic member of Peñas Altas Formation, of Aptian age.

Genus ***Goniomya*** Agassiz, 1841.

According to KAUFFMAN in HALLAM et alii., (1973: 359), it is a cosmopolitan genus, with a Biochron of Early Jurassic to Late Cretaceous (Turonian).

Goniomya mailleana (d'Orbigny, 1845)
Plate 18, figure 9;

- 1845 *Pholadomya Mailleana* d'ORBIGNY, Pal. Franç., Terr. Cret. #3: 355, pl. 364, figs. 1, 2 ;
- 1891 *Goniomya Mailleana* d'O., PERON, Explor. S. Tunisie, #1: 327;
- 1909 *Goniomya Mailleana* d'O., WOODS, Paleontogr. Soc. 2(6): 255-256, pl. 52, figs. 6, 7;
- 1986 *Goniomya (Gonimya) mailleana* (d'O.) ABDEL-GAWAD, A. g. Pol., #36(3):182, pl.47, fig. 2;
- 1996 *Goniomya mailleana* (d'O.) MACSOTAY et al.: 7138;

Occurrence: Originally studied from Perte-du-Rhône, France, Aptian age; later reported from Crackers, Lower Greensand, England, of the same age. Wery extended in the Northern European Province, from Albian to latest Maastrichtian (ABDEL-GAWAD, op. cit.).

S.C.S. occurrence: Locality MO-888, Promontory to the west of Patiño Point, (DAGM) of Lope Member of the Taguarumo Formation, of Early Aptian age.

Genus ***Homomya*** Agassiz, 1843.

According to KAUFFMAN in HALLAM, (1973: 359), *Homomya* is a cosmopolitan genus, whose Biochron extends from Middle Triassic to Late Jurassic (Ryazanian). In S.C.S. this genus persists until Albian times. SCOTT (1970: 77) supposed it was a shallow-burrowing filter-feeder most common in firm, sandy substrates. In Venezuela, its preference was towards calcarenite/calcisiltite bottoms (LIDDLE, 1946).

Homomya brasiliensis (White, 1888
Plate 52, figures 11, 14;

- 1888 *Glycymeris brasiliensis* WHITE, Arch. Mus. Rio de Janeiro, 7: 111, pl. 7, figs. 1, 2;
- 1943 *Panopea brasilienis* (W.) OLIVEIRA & LEONARDOS, Geol. Brasil: 566, pl. 26, fig. 16;

Occurrences: Maroim, Sergipe, Brasil, Ganhamaroba Group, of Middle Albian age.
Dimensions: Measurements are, Length: 57,5mm, Height: 30mm.
S.C.S. occurrences: Locality HA-4343, La Urbina north section, lower La Puya Member of Peñas Altas Formation, of late Middle Albian age.

Homomya cf. bravoensis Böse, 1910.
Plate 42, figures 4, 6; plate 46, figure 9;

- Cf. 1910 *Homomya bravoensis* BÖSE, 8: 136-137, pl. 29, figs. 5-6;
- Cf. 1928 *Homomya bravoensis* B., ADKINS, Univ. Texas Bull.# 2938: 141-142;

Occurrence: Originally studied from Cerro de Muleros, El Paso, Texas of Late Albian age; also is present in Fredericksburg Group, of Early Albian age, and Edwards Formation, of Middle Albian.

S.C.S. occurrence: Locality An-77, Cerro La Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age. It is frequent, and associated to *Mesorbitolina texana/M. ovalis,* in Bivalve-dominated grey limestones.

Discussion: Our casts are alike to *H. bravoensis* Böse, in their general shape, and degree of inflation, but the umbos are more centrally located, and is more elongate posteriorly. The wide and rounded concentric ondulations at the anterior half, and the distal area, are also distinctive.

Homomya scaphoides (Agassiz, 1842).
Plate 11, figures 8, 10;

- 1842 *Myopsis scaphoides* AGASSIZ: 261, pl. 32, figs. 4, 5;
- 1865 *Pholadomya scaphoides* (A.) PICTET & CAMPICHE, Paleont. Suisse 33: 80-81, pl. 103, fig. 3-5 ;
- 1985 *Pholadomya* sp. indet., FIERRO & USECHE, 6º Congr. Geol. Venez., Mem.31: 674;

Occurrences : With a Biochron of Valanginian to Barremian times, in all the tropical subprovinces of the Gondwanan Province. In Switzerland, is frequent in the Marnes Bleus Formation, of Hauterivian age.

S.C.S. occurrence: Locality MO-1305, quebrada on the Naranjal-La Fundación road, Uribante Hemigraben, in Chururú Member of Rio Negro Formation, of Hauterivian age.

Homomya cf. scaphoides (Agassiz, 1842)
Plate 33, figs. 8, 9;

- 1949 *Pholadomya scaphoides* (A.) TAVANI, Paleont. Ital, 46(16) : 9-10 ;(non Agassiz, 1842)

Occurrences : Aissemó transect, near Antara, Somalia, of Aptian age ; it is associated to big sized *Exogyrae and Pholadomyae*.

S.C.S. occurrence: Locality MO-1234, Río Apón, Perijá area, Tibú Formation of Late Barremian-Early Aptian age.

Observations: *Homomya cf. scaphoides* (A.) is of smaller size than the nominal species, less inflated valves, and less elongated posteriorly. It lacks the anterior concavity of *H. scaphoides,* and the coarse ondulations developed on the postero-dorsal area.

Homomya solida (Cragin, 1893)
Plate 44, figures 10, 11;

- 1893 *Homomya solida* CRAGIN,Texas Geol. Surv., 4º Ann. Rept: 171, pl. 39, figs. 3-4;
- 1946 *Homomya sp.*? LIDDLE, Geology of Venezuela and Trinidad: 190, 191;

Occurrence: In the Glen Rose Formation, Texas, of Early Albian age.

Diagnosis: Somewhat trapezoidal in outline, thick. Length, height and thickness in proportion 11:9:8. Umbonal region elevated, narrow, proyecting from the rest of the shell, beaks subterminal (ADKINS, 1928, Univ. Texas Bull.# 2838: 141).

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, of Late Aptian age. Only casts were found, the biggest of all the bivalves in the locality.

Genus/Subgenus: ***Pachymya (Pachymya)*** J. de C. Sowerby, 1826, (=*Cratomya* Rollier, 1913)

According to COX et alii., (1969: N834) this taxon is Cosmopolitan, with a Biochron extended from Middle Triassic to Late Cretaceous. Definitely is holomarine, with its first appearance in S.C.S. during the Albian, with the normalization of the sea salinity.

Pachymya (Pahymya) cf. austinensis *SHUMARD, 1860.*
Plate 59, figure 11;

- 1839 *Arca rostellata* VON BUCH, Ges. Sch. #4: 522(14)-523 (15), fig. 16; (non Morton, 1834: 64, pl. 3, fig.11).
- Cf. 1860 *Pachymya austinenis* SHUMARD, Acad. Sci. St. Louis, Trans.#1: 604;
- Cf. 1928 *Pachymya austinensis* S., ADKINS: 150, pl. 15, fig. 3 ;
- Cf. 1947 *Pachymya austinensis* S., STANTON, U.S.G.S. Prof.paper #211 : 51, pl. 45, fig. 1 ; pl. 46, fig. 1 ;
- Cf. 1948 *Arca cyrenaica* NALDINI, Paleontogr. Ital. 15: 95, pl. 1, fig. 5;

Diagnosis: It differs from *P. (P.) austinensis* S., in having a more centrally located and less prominent umbo. All these bivalves were based on casts, and only a well-preserved shell, with the external ornamentation, could solve this dilemma. The cast measured, of Length: 145 mm, Height: 100 mm, and Thickness: 115 mm.

Occurrence: In Texas, in Main Street limestone of Early Albian age; in Weno clay and Grayson marl, of Middle Albian; Buda and Georgetown limestones, of Late Albian age. In

Libya, Sidi-as-Sid Formation, Ain Tobi Member, from the Hammadah Basin, of Early to Middle Cenomanian age.

S.C.S. occurrence: Locality HA-4245, Fila San Francisco, (San Pedro, Trujillo state), Upper Carbonatic Member of the Peñas Altas Formation, of Middle Albian age. Also in locality MO-2804, Río Negro, Perijá area, Píche member of Apón Formation, of Early Albian age. In Colombia, in Socotá Formation of Villeta Group, of Late Albian-Early Cenomanian age (KARSTEN, 1886).

Genus/Subgenus ***Pachymya (Arcomya)*** Roemer, 1839.

According to KAUFFMAN in HALLAM et alii., (1973) is a Cosmopolitan taxa, with a Biochron extended from Triassic to Late Cretaceous (Turonian). It seems to be Euryhaline: mostly is associated to other bivalves in brackish Early Cretaceous sediments. In the Terminetto Formation of Italy (Apulian Subprovince) there is a bivalvian fauna of Wealdian facies, found also in Switzerland and in Niedersachsen, Germany: *Pachymya (Arcomya) excavata* ARTHABER, *P. (A.) helvetica* (Roemer), *P. (A.) cf. sinistra* (Agassiz), and *P. (A.) ferruginea* (De Loriol), in two different climatic belts.

Pachymya (Arcomya) declivis (Conrad, 1852)
Plate 48, figure 16;

- 1852 *Arca declivis* CONRAD in LYNCH, Palestine Expedition: 216, pl. 5, fig. 32;
- 1937 *Arcomya helvetica* Agassiz, ARTHABER, :441, pl. 25, fig. 14;
- 1938 *Cucullaea* n. sp.? DIETRICH: 90-91, (pro partim), pl. 17, fig. 4; non figs. 5, 6; (=*Trigonarca consobrina* d'Orbigny)

Description: Ovate-oblong; side somewhat flattened; beaks situated about one-third of the shell´s length from the anterior margin; posterior hinge margin declining, subrectilinear; posterior end obliquely truncated; basal margin straight; within entire; beaks approximate; lunule lanceolate (CONRAD, 1852, op. cit.).

Dimensions: Length: (incomplete) 31 mm, Height: 15,5 mm. Length: 26,2 mm; Height: 13,0 mm, (plate 48, figure 16).

Occurrence: Aklim el-Jurd, Liban, in marls of Aptian age. In Italy, Mt. Terminetto, of Hauterivian age, dwarf individual (?).

S.C.S. occurrence: Locality MO-1334, Uribante river, Tachira state, Tibú Formation, of Aptian age. In Colombia, Paja shales of Villeta Group, of Aptian age.

Pachymya (Archomya) cf. gigas *(Sowerby, 1826)*
Plate 56, figure 8;

- Cf. 1826 *Pachymya gigas* Sowerby, Min. Conchology, #6: 1, pl. 504-505;
- Cf. 1845 *Pholadomya gigas* (d'ORBIGNY) Paleont. Franç. Terr. Cret. #3: 359-360, pl. 366;

Description: Three fragments of this cast, suggest a *P. (A.)* alike to *P. (A.) gigas* Sow., -Cenomanian, in Mans, France, and Lyme Regis, England, Length: 160 mm, a thick-shelled species- but its size is lot smaller, and the whole shell is less inflated.

Dimensions: The measurements are, of Length (incomplete): 38,5 mm and Height: 18,3 mm (pl. 56, fig. 8).

S.C.S. occurrence: Locality MO-3110, Quebrda Santa Rosita, Perijá, Píche Member of Apón Formation, of Early Albian age.

Comparisons: Superficially, these casts are alike to *Panopea (P.) indifferens* (Coquand, 1865)- Morella clay Formation, maestrazgo Basin, Spain, of Late Barremian age, - whose umbones are more centrally located, and does not have any constriction in the ventral area.

Pachymya (Archomya) icaunensis (Cotteau, 1853)
Plate 10, figure 16;

- 1855 *Pholadomya icaunensis* COTTEAU, Moll. Foss. De l'Yonne : 55, pl. 4, fig. 6 ;
- 1921B *Arcomya icaunensis* C., GILLET, Bull. S.S.H.n. Yonne: 75: 36.

Occurrence: Calcaire à Spatangues, Paris Basin, France, of Hauterivian age.

S.C.S. occurrence: Locality MO-3213, Lope inlet, Chimana Grande Island, lower Taguarumo Formation, (DAGM), of Late Hauterivian age. Green clayey limestone, only casts were recovered.

Discussion: *Cyrena ferruginea* De Loriol, (ARTHABER, 1937: 427, PL. 24, FIG. 10) – Upper Portland beds, Ryazanian age to Mt. Terminetto, Italy, of Hauterivian age,- is a dwarf *Pachymya (Arcomya)* which is distinguisehed from *P.(A.) icaunensis ,* by a prominent umbo, located at anterior 1/3 of the total length of the shell.

Pachymya (Arcomya) pectorosa (Conrad, 1852)

Plate 47, figure 14;

- 1852 *Panopaea pectorosa* CONRAD in LYNCH, Exped. Palestine,: 217, pl. 7, fig. 46;
- ¿1865 *Panopaea aptiensis* COQUAND, Soc. d'E. Provence, Mem.#3: 90, pl. 8, figs.1, 2;
- 1877 *Homomya incurva* GABB, Jour. A.N.S. Philad. #8 : 285-286, pl. 40, figs. 13, 13a ;
- 1893 *Homomya jurafacies* CRAGIN, Texas Geol. Surv., 4th Ann. Rept.#21:191, pl. 39, figs. 1-2;
- 1985c *Panopea aff. aptiensis* C., ETAYO SERNA, Proy. Cretacico, 16:24: 21, 9;
- 1987 *Pholadomya decisa* C., VIVAS, Bol. Geol., Caracas, 16(29): 28, 32, fig. 21; (non Conrd, 1852)

Diagnosis: Oblong-ovate, inflated; anterior side very short, margin obliquely truncated, obtusely subrostrated; extremity subangulated; beaks subterminal, small, strongly incurved but not touching. Casts only. Length, height and thickness in proportion 1,5:1:1; anterior basal margin obliquely truncated. Basal margin widely rounded, or partly convex and partly flat, due to pelomorphosis (CONRAD, op. cit., CRAGIN, op. cit.). Some casts measure more than 120 mm. Numerous small rounded concentric ribs (COQUAND, op. cit., GABB op. cit.), covering the external surface.

Occurrence: First reference from Bhamdûn, Liban, of Aptian-Albian age. In Spain, was very abundant in Benasal limestone and Utrillas sandstone Formation, of Late Aptian to Albian age (CANEROT, 1982), not only Aptian. In Texas, is a common fossil in Glen Rose Formation, of Early Albian age. In Perú, cited from Ollon, of probable Early Albian age.

S.C.S. occurrence: An-77, Cerro Las Callecitas, Anzoategui state, lower El Cantil Formation (DBG) of Late Aptian age. It is associated to *Mesorbitolina texana-M. ovalis* Zone. LIDDLE (1946: 220) cited it from Río La Gé, of Píche member of Apón Formation, of Early Albian age. In Colombia, cited fro Apón Formation, Cocuy Graben, of Late Aptian age.

Family ***LATERNULIDAE*** Hedley, 1918.
(=*Anatinidae* Gray, 1840)

The Biochron of this family extends from Late Triassic to Recent. As infaunal siphon feeders, (STANLEY, 1968) they inhabited unconsolidated sediments, they must have been deep burrowers.

Genus ***Laternula*** Röding, 1798.

With a Biochron of Late Cretaceous to Recent, this genus is known from North America, Europe, and Pacific to Indian Oceans (COX et alii., (1969: N845).

Laternula shattucki (Adkins, 1928)
Plate 53, figures 3, 4;

- 1903 *Anatina texana* SHATTUCK: 30, pl. 18, fig. 3; (not CRAGIN, 1893)
- 1928 *Anatina shattucki* new name ADKINS: 143;

Diagnosis: Length: 100 mm, Height: 55 mm, Cast of rather oval form, compressed; length nearly twice than height; rather quadrate in outline; surface of cast with eight or more unequal, rounded, concentric placations (SHATTUCK, 1903). Ventral margin, very convex; anterior extreme, rather angular; posterior extreme, rather pointed.

Occurrence: Collected in Buda limestone Formation, Texas.

S.C.S. occurrence: Locality MO-3131, Caño Cusare, Perijá area, Píche member of Apón Formation, of Early Albian age.

Genus ***Cercomya*** Agassiz, 1842.

According to KAUFFMAN in HALLAM et alii., (1973: 359) this genus is cosmopolitan in distribution. Its Biochron extends from Late Triassic to Cretaceous.

Cercomya cf. gurgitis (Pictet & Campiche, 1855)
Plate 39, figure 22 ;

- Cf. 1855 *Anatina Robinaldina* PICTET & RENEVIER, Matér. Pal. Suisse, s. 1 :63, pl. 6, fig. 1 ;(non d'ORBIGNY, 1845)
- Cf. 1865 *Anatina gurgitis* PICTET & CAMPICHE, Matér. Pal. Suisse, s.4 : 105, pl. 107, figs. 6-8 ;
- Cf. 1909 *Anatina (Cercomya) gurgitis* P. & C., WOODS, Paleontogr. Soc. 2(6) : 239, pl. 39, figs, 2-4 ;
- Cf. 1966 *Cercomya gurgitis* (P. & C.) HAYAMI, M.Fac. Sci. Kyushu Univ., 17(3) :166, pl. 14, figs, 8-10;

Occurrence: Originally studied from the Perte-du-Rhône, Switzerland, and the Lower Greensand (Crackers) of England, both of Aptian age. Also in the Albian of Angola. In Japan, is frequent in the Miyako Group, (Hiraiga and Aketo Formations) and Lower Monogebawa Group, with a Biochron of Aptian and Albian.

S.C.S. occurrence: Locality MC-260-B, Cerro Los Encantados, Monagas state, Upper Garcia Formation, (sDLP, DGC) of Late Aptian age. Gray

marls with many bivalves and ammonites of the Zones *deshayesi & bowerbanki*, fide BULOT (1994).

Observations: The casts collected, are ornated in the anterior area, with six concentric folds, assymetrical towards the umbo. These concentric folds become evanescent along a vertical line below the umbos.

Genus ***Periplomya*** Conrad, 1870.

STEWART (1930: 297-298) reviewed the genus *Periplomya* and included it in Anatinidae (=Laternulidae). ANDERSON (1938: 117-118) included "*Periploma*" *robinaldina, P. neocomiensis and P. simplex* (d'ORBIGNY) and other related European to forms from the Early Cretaceous of California. Even so, COX et alii (1969: N845) restricted it to Late Cretaceous, and Eastern North America as distribution area. In the literature, we find also Eastern Asia, Japan, and South America (Brazil), and a Biochron from Early Cretaceous (Hauterivian) to Late Cretaceous (Maastrichtian).

Periplomya colombiana (d'Orbigny, 1842).

- 1842 *Anatina colombiana* d'ORBIGNY, Voy. Amér. Meridionale: 84-85, pl. 18, figs. 16, 17;
- 1850 *Thracia columbiana* d'ORBIGNY, Prodrome, #2: 104;

Description: Oval shell, oblong, compressed, smooth of with very fine growth times; anteriorly rounded, shorter and postriorly subquadrate; hinge with one lamellar anterior cardinal tooth in each valve. (d'ORBIGNY, 1842). Shell of medium size, compressed, subelliptical in shape, subequivalve, closed; valves thin; umbones low, rounded, obtuse, umbonal angle about 130º. Beaks low, not prominent, orthogyrates, located behind the mid-line of the shell. Posterior margin nearly straight and vertically aligned, subtruncate; ventral border evenly convex, blending smoothly into anterior and posterior margins; nterior border is very slightly convex, short; sculpture nearly obliterated preserved only on the distal surface of the RV, consisting in concentric grooves, no radials are observed. Pallial line not preserved, but anterior and posterior muscle scars are oval and elongated.

Dimensions: Length: 50 mm, Height: 37 mm, Thickness: 16 mm,

S.C.S. occurrence: In Colombia, prov. Santa Fe de Bogotá, Une Formation, of Late Aptian to Albian age. Found in the same limestone bed as *Paralellodon tocaymensis and Tessarolax americana.* In Venezuela, at locality MC-426-B, shaly depression 1 km. before reaching Güiria, Sucre state, in Lower Valle Grande Formation, of ?Albian age.

Comparisons: Very alike to *P. nagaoi nagaoi* Ichikawa & Maeda (1958), - Hakobuchi group, Campanian-Maastrichtian of Japan,- and to *"Thracia" Gaudini* RENEVIER (1867: 144, pl. 7, fig. 6)- Ervy, France of Albian age,- but it is proporcionately longer. The dwarf *Anatina verrucana* FUCINI (1915: 90, pl. 10, figs. 26, 27) – Terminetto beds, Italy, of Hauterivian age, is still more elongated. *Periplomya whitneyi* (Gabb, 1864, Cret. California: 160, pl. 30, figs. 242) – from the "lower division of California Cretaceous": probably Albian age, is more inequilateral and its umbos are smaller and more posterior position than in *P. colombiana.*

Genus ***Platymyoidea*** Cox, 1964.

According to KAUFFMAN in HALLAM et alii. (1973: 369) considered *Platymyoidea* as from the North Atlantic Province, with endemic species of Western Europe. This genus was favoured by saline/hypersaline paleoenvironments and oxygen-poor bottom waters. All the samples found, were articulated shells, without any biodegradation.

Platymyoidea cf. marullensis (d'Orbigny, 1845)
Plate 19, figure 3;

- Cf. 1844 *Anatina marullensis* d'ORBIGNY, Pal.franç., Terr. Crét. #3: 376, pl. 371, figs. 3, 4;
- Cf. 1853 *Anatina Rhodani* PICTET & ROUX, Grés verts: 410, pl. 29, fig. 4;
  1865 *Anatina marullensis* d'O., PICTET & CAMPICHE, Pal. Suisse #3:101-102, pl. 107, figs. 2, 3;
- Cf. 1869 *Anatina marullensis* d'Orb., de LORIOL & GILLIERON, M.S.H.s.N. #23: 12, pl. 1, fig. 11;
- Cf. 1887 *Anatina marullensis* d'O., MALLADA, Sinops. España, Cret. Inf.,#3: 87;
- Cf. 1974 *Platymyoidea marullensis* (d'O.) DIMITROVA, Foss. Bulgarie, Cretacé, 4b: 120, pl. 59, fig. 10;
- Non 1985c *Platymyoidea cf. marullensis* (d'O.) ETAYO SERNA, Proy. Cret. 16:24:22, pl. 2, fig. 8;

Description: Oval-elongated cast, with subcentrally situated umbones, and a radial depression extended from the umbones to the ventral margin; the area anterior to the depression, is marked by strong ribs, which start at the dorsal margin, and descend obliquely towards the ventral margin, but evanescing before reaching it. Posterior area, only with concentric growth lines. This is a highly variable

species, and the ornamentation of the anterior area varies between numerous and few strong ribs (compare PICTET & CAMPICHE, op. cit., pl. 107, figs. 2 and 3), all collected from the Hauterivian-Barremian beds of Switzerland. The radial depression in the middle, is always present.

Occurrence: *P. marullensis* (d'ORBIGNY) is widely distributed during Neocomian to Aptian, in Western European, Apulian, Balkanic and Maghrebian Subprovinces.

S.C.S. occurrence: Locality VG-384-A, Ojo de Agua-Santa Rosa trail, between Rio Grande and Quebrada del Medio, Sucre State, Upper El Cazón Formation, (sDLP, DGC) of Late Berriasian-Early Valanginian age. Only casts were collected.

Platymyoidea aff. rostrata (Agassiz, 1842)
Plate 19, figure 6;

- 1842 *Platymya rostrata* AGASSIZ, Monogr. des Myes : 182, pl. 10, figs. 11, 12;
- 1948 *Platymya Agassizi* (d'O.) TAVANI, :142, pl. 10, fig. 7 ;
- 1957 *Anatina agassizi* d'O., REYMENT, 48, pl. 7, fig. 16;
- 1985c *Platymioidea aff. rostrata* (A.) ETAYO SERNA, Proy. Cretacico, #24:22;
- 1988 *Platymoidea rostrata* (A.) DHNODT & DIENI, Mem.s.Geol., U. Padova # 40 : 60-61, pl.13, fig. 21, text-fig. 25;

Occurrence : With a Biochron of Valanginian to Barremian, in Western European, Apulian, Balkanic, Somalian Subprovinces, and East African Province. During Albian times, survived in Nigeria and Cameroun.

S.C.S. occurrence: Locality PM-12-A, trail from Pajaral to La Margarita mountain, in La Margarita mudstones, (sDLP, DGC), of Hauterivian age. Siltstone bioturbated by *Chondrites imbricatus.* In Colombia, cited from Las Juntas Formation, of Hauterivian-Barremian age.

Comparisons: It is ptobably a descendant of "*Anatina" obliquiplicata* CRAGIN (1905, U.S. geol. Surv, Bull, #266: 85, pl. 16, figs. 7-8)- Malone Formation, Berriasian, Texas, - but it is more elongated posteriorly.

Genus ***Plectomya*** de Loriol, 1868;

According to COX et alii., (1969: N845), has a Biochron of Late Jurassic (Kimmeridgian) to Early Cretaceous (Aptian). Its distribution includes the Eurasian area, but also Asia (Japan), Africa and South America.

Plectomya silinensis (Richards, 1947)
Plate 33, figure 4;

- 1947 *Anatina silinensis* RICHARDS, John Hopkins U. S. Geol. 15: 66-67, pl. 8, figs. 10, 11;
- 1956 *Anatina silinensis* (R.) BENAVIDES, Geol. North. Peru: 375;

Description: Only casts are available; medium size, inequilateral, evenly inflated throughout umbonal and dorsal area, attaining greatest convexity across the posterior side of the beaks; depressed ventrally, and having a constriction which is faint and narrow on the anterior protion of the umbonal area, but which becomes broader under the beaks toward the venter. Inequivalve, RV slightly more inflated than the LV; outline oblong, subelliptical. Beaks small, flattened, incurved; surface ornamented by numerous, fairly strong, rounded, irregularly developed concentric ridges, bearing fine concentric lines which are exposed on the ventral portion of the cast.

Dimensions: Length (Incomplete): 55 mm, Height: 35 mm, Thickness: 23 mm (RICHARDS, op. cit.).

Occurrence: In Chulec Formation, of Early-Middle Albian age, of Perú. RICHARDS (op. cit.) considered it as Aptian age.

Comparison: *P. rugosa* (Roemer), (MAILLARD, 1884, : 83, pl. 2, figs. 2-5)- Kimmeridgian to Ryazanian age Purbeck and Portland beds, in the North European Province, - is a very related species, with a well marked ornamentation, but is ventral margin is straight, and not convex. This species is also related to *P. aritagawana* HAYAMI (1975: 152) – Arita and Yatsushiro Formations of Japan, of Neocomian to Albian age,- but the coarse concentric cords in the anterior area, are less regular than on that species. None of these show any fissure in the area posterior to the beaks, which must have been a result of pelomorphic deformation, without any taxonomic value.

S.C.S. occurrence: Locality MC-346-C, Catuaro, Sucre state, of Upper Taguarumo Formation, of Early Aptian age. The casts were collected in a dark yellow marl, with many molluskan shell detritus.

Family ***THRACIIDAE*** Stoliczka, 1870.
Genus ***Thracia*** Sowerby, 1823.

According to KAUFFMAN in HALLAM et alii., (1973: 367) this genus is proper of the North Temperate Realm: North America, North Europe and North-Central Asia, with a Biochron of Jurassic to

Recent. This family has infaunal siphon feeders, soft mud dwellers in slope and apron (bathyal) environments.

Thracia cf. phillipsi (Römer, 1841)
Plate 12, figure 10;

- Cf. 1841 *Thracia Phillipsi* RÖMER, Verstein. Nord-deutsch Kreidegeb.: 74, pl. 10, fig. 1 ;
- Cf. 1884 *Thracia striata* WEERTH, Neocomsandstein : 40, pl. 8, fig. 10;
- cf. 1909 *Thracia Phillipsi* RÖMER, WOODS, Paleontogr. Soc. 2(6): 240-241, pl. 39, figs. 7-9;

Occurrence: *T. phillipsi* (.) is a common fossil in the Hilsthon Formation of Valanginian-Hauterivian age, of Niedersachsen, Germany. Is common also in Speeton clay Formation, England, of Valanginian to Aptian age.

Discussion: It is alike to *T. phillipsi* (R.) – a typical fossil of the North European Province, of temperate affinities, - but the general outline of our cast is subquadrate, with the posterior area truncated in place of being acuminated.

Dimensions: Length: 20,5 mm, Height: 15,3 mm RV, pl. 12, fig. 10;

S.C.S. occurrence: Locality VG-555, trail from Río Morocoto-Caituco-ojo de Agua, Sucre state, El Dantó dolostones, (DGC), of Latest Valanginian – Early Hauterivian age.

Comparisons: *Thracia? neversensis* (de Loriol, 1882, Mem. Pal., Suisse, #9:48-49, pl. 6, fig.6) – Albian age, France, - is a small species with a more restricted postero-dorsal area, and a less rounded ventral margin.

Thracia rotundata (Sowerby, 1836).
Plate 54, figure 7;

- 1836 *Panopea rotundata* J. de C. Sowerby, Trans. Geol. Soc. 2(4): 129, 337, pl. 13, fig. 2;
- 1909 *Thracia rotundata* (S.) WOODS, Paleontogr. Soc., 2(6): 241-242, pl. 39, fig. 10ª, 10b;

Occurrence: Hythe beds of Lympne and Court-at-street, England, Lower Greensand, of Early Albian age. Also at Atherfield clay, of Late Aptian age.

Description: Cast with few fragments of the original thin shell, preserved in the postero-dorsal area. Regularly convex, oval, slightly inequivalve, and inequilateral; anterior and ventral margins, forming a regular curve. Dorsal part of posterior margin oblique, forming an angle with the ventral part. The umbones are broad, in contact, with a narrow, sharp curved carina, extending to the posterior angle, and limiting a triangular, concave, postero-dorsal area.

Dimensions: Length (incomplete): 84 mm, Height: 72 mm.

S.C.S. occurrence: Locality MO-2790, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age. Associated with *Mesorbitolina texana-M. ovalis.*

Family ***POROMYIDAE*** Dall, 1886.
Genus ***Poromya*** Forbes, 1844;

KAUFFMAN (1976: 508-509) furnished valuable information on the genus *Poromya's* living species: most are carnivorous on microorganisms (e.g., ostracodes, foraminifers) in deep, food-poor habitats they prefer. KEEN & COAN (1974) in KAUFFMAN (op. cit.) report a depth range of 75 – 2930 meters for seven species. Average bottom temperatures preferred are around 2.4ºC, and preferred substrates range from globigerinid ooze to dark, organic mud, and silty mud. Its Biochron extends from Cretaceous to Recent, with a cosmopolitan distribution.

Poromya (Poromya) sp. indet.
Plate 30, figure 7;

- 1899 *Anomia sp.* WOODS, Paleontograph. Soc., 1(1): 28-29, pl. 5, figs. 4, 5a, 5b;
- 1971 *Anomia sp.,* MONGIN, Geol. Alpine, 47:83;

Occurrence: Crackers of Atherfield, England, of Late Aptian age.

S.C.S. occurrence: Upper Carorita Formation, Lara Nappe, of Hauterivian-Barremian age (MACSOTAY et al., 1987).

Genus ***Psilomya*** White, 1874.

According to KAUFFMAN in HALLAM et alii., (1973: 367) *Psilomya* belongs to the North Temperate Realm: North America, Northern Europe, North-Central Asia, during Late Cretaceous times. All six species found in Venezuela, were collected in algal carbonates, deposied in estuarine paleoenvironments, where usually are prolific in individuals.

Psilomya? banderaensis (Whitney, 1952).
Plate 47, figure 11;

- 1952 *Liopistha (Psilomya) banderaensis* WHITNEY, Jour. Paleont. 26(1): 67, 68, pl.- 16, figs. 1, 2;

Occurrence: Upper Glen Rose Formation, Texas, in the *Salenia texana* horizon, of Early Albian age.

S.C.S. occurrence: Locality MC-243-E, Río Azagua, Monagas state, El Cantil Formation, of Early

Albian age. Its casts are among the biggest among all the Bivalves in El Cantil Formation.

Psilomya cornueliana (d'Orbigny, 1844)
Plate 33, figures 14, 20, 20A;

- 1844 *Cardium Cornuelianum* d'ORBIGNY, Paleont. Franc. Cretacé, #3: 23-23, pl. 256, figs. 1, 2;
- 1887 *Pholadomya Cornueliana* (d'O.) MALLADA, Sinopsis España, Cret. Inf. #3:86, pl. 36, figs. 8-10;
- 1909 *Pholadomya cornueliana* (d'O.) WOODS, Paleontogr. Soc., 2(6): 245-246, pl. 41, figs. 2ª, 3;
- 1921ª *Liopistha? Cornueliana (d'O.)* GILLET, Bull. Soc. Geol. Françe, 2(21): 19-20;
- 1954 *Liopistha cf. L. cornueliana* (d'0.) RUTSCH & SALVADOR, Jour. Paleont. 28(4): 424-425, pl. 40, fig. 3;

Occurrence: With a Biochron of Barremian to Cenomanian, *P. cornueliana* attained a wide distribution: North European Province, Western European, Apulian, Somalian, Peruvian and S.C.S.

S.C.S. occurrence: Locality HA-4414, La Pastora-Jabón road, of Trujillo state, upper Carbonate Member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999). Collected from a limestone bed, below the *Mesorbitolina texana-M. parva* marls. Also collected from Lope member of Taguarumo Formation, of Early Aptian age.

Psilomya? fletcheri (Whitney, 1952)
Plate 47, figure 9;

- 1952 *Liopistha (Psilomya) fletcheri* WHITNEY, Jour. Paleont. 26(1): 68, pl. 16, figs. 3, 4;
- 1973 *Liopistha (?) hararina* GORTANI, Ann. N. d. Lincei, 4: 45, pl. 11, figs. 1-4;

Occurrence: Originally studied from upper Glen Rose Formation, Texas, of Early Albian age; from the *Salenia texana* horizon. In Ethiopia was collected in Graua Nord and Graua South, and Monte Falti, from Albian age.

S.C.S. occurrence: Locality MC-444, La Hacienda, west of Catuaro town, Sucre state, from Valle Grande Formation, of Middle Albian age. In Corral Viejo member of Chimana Formation, of Middle Albian age (ROD & MAYNC, 1954: 276). Also found in Guacharo Member of El Cantil Formation, (DGC) of Early Albian age.

Psilomya gigantea (Sowerby, 1818)
Plate 45, figure 3; Plate 46, figure 7;

- 1909 *Liopistha (Psilomya) gigantea* (S.) WOODS, Palentograph. Soc. 2(6): 257-258, pl. 43, figs. 3, 4; pl. 44, figs. 1, 2;
- 1912 *Liopitha (Psilomya) gigantea* (S.) PERVINQUIÈRE, Cret. Tunisie: 242, pl. 20, figs. 21ª-21b;
- 1913 *Liopistha (Psilomya) gigantea* (S.) SOMMERMEIER, N.J. B.#36: 374;
- • 1960 *Psilomya gigantea* (S.) DUSENBURY & FRAUNFELTER in KEY,: 52;
- 1987 *Liopistha (Psilomya) gigantea* (S.) VIVAS, Bol. Geol. (Caracas) 16(29): 28, 32, fig. 21;
- ¿1852 *Inoceramus Lynchii* CONRAD, in Lynch, Palestine Exped. :218, pl. 8, fig. 47;

Occurrence: *L. gigantea* has a Biochron of Aptian to Cenomanian in North European Province, and Western European, Maghrebian, Peruvian and Southern Caribbean Subprovinces.

S.C.S. occurrences: Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age. Associated with *Mesorbitolina texana-M. ovalis* Zone (VIVAS, 1987). Cited from Maraca Formation, Late Albian-Early Cenomanian age, (KEY, op. cit.).

Psilomya ligeriensis (d'Orbigny, 1845).
Plate 45, figures 8, 9;

- 1845 *Pholadomya ligeriensis* d'ORBIGNY, Paleont. Franç, Terr. Cretacé: 395, pl. 363, figs. 8, 9;
- 1884 *Liopistha libanotica* HAMLIN M. M. c.Z.H. #10(6): 39, pl. 6, fig. 7;
- 1936 *Homomya profunda* (White) MAURY, Bull. Serv. Geol., M. Brasil, 11: 77, pl. 10, fig.13;
- 1954 *Liopistha (Psilomya)* sp., VON DER OSTEN, Bol. Geol.: 148;
- 1987 *Liopistha (Psilomya) ligeriensis* (d'O.) VIVAS, Bol. Geol. (Caracas):16(29): 28, 32, fig. 21;

Occurrences: *P. ligeriensis* (d'O.) has a Biochron of Late Aptian to Early Coniacian, distributed in all the tropical Subprovinces of Gondwana Province, including Perú, Bolivia, Brasil Texas and México.

S.C.S. occurrences: Locality MC-271-F, east of Punceres Anticline, Monagas state, upper El Cantil Formation, (DBG) of Early Albian age. Also in Chimana Formation (DAGM) of Middle Albian age. In Píche member of Apón Formation, Perijá, of Early Albian age, rare.

Psilomya walkeri (Whitney, 1952)
Plate 49, figures 7, 8;

- 1952 *Liopistha (Psilomya) walkeri* WHITNEY, Jour. Paleont. 26(1): 68, pl. 16, figs. 7, 8;

Diagnosis: Cast large, ventricose, wedge-shaped, equivalve, inequilateral; umbones prosogyrate, large, inflated, near the anterior extreme of the cast.

Occurrences: Glen Rose Formation, Texas, of Early Albian age.

S.C.S. occurrences: Locality MO-2876, Cerro Las Callecitas, Anzoategui state, upper El Cantil Formation, of Early Albian age (DBG). 14 casts of articulated specimens. In Corral Viejo member of Chimana Formation, DBG, of Middle Abian age (ROD & MAYNC, 1954: 276).

Genus ***Cymella*** Meek, 1864.

Shell small, ovate, with many regular, concentric undulations, crossed midway by some radial lines, impressed on the crests of the concentric waves. There are many species in the Late Cretaceous of North America (COX et alii., 1969: N852).

Cymella altumbonata (Anderson, 1938)
Plate 15, figure 16;

- 1938 *Pholadomya altumbonata* ANDERSON, Geol. Soc. Amer, Spec. Pap. 16: 116, pl. 5, figs. 5, 6;

Description: Cast subovate in outline, very thin, equivalve, inequilteral, moderately convex becoming somewhat posteriuorly. Beaks are prominent, strongly incurved, approximate, slightly in advance of the mid-line. Dorsal margins are sloping from the summit, at an angle of 90º, anterior area convex, posterior concave. Surface marked by 15-16 prominent, regularly placed, concentric plications which terminate at the margin of the lunule and the escutcheon-like areas. Very fine radial striations cross the concentric ribs. Ventrally is convex. Posterior area damaged. The maximum convexity of the cast, is located in the middle (ANDERSON, op. cit.).

Dimensions: Length: 9,6 mm, Height: 8,2 mm, Convexity: 7 mm. A flattened cast measures 10,6 mm of length.

S.C.S. occurrences: Locality MC -338-H, El, Cordón –Rio Cariaco road, Sucre State, El Dantó dolostones (DGC) of Hauterivian age. Also in PM-08-B, trail from Río Pajaral to La Margarita mt., La Margarita mudstones (sDLP, DGC), mostly deformed casts, also of Hauterivian age.

Discussion: *Liopistha sp.* (MONGIN, 1980, Notes Serv. Geol. Tunisie, 45: 138, pl. 5, fig. 4)- Kef Khouadja, Early Berriasian du Djebel Naras, and late Tithonian of Kef Krakmat, Tunisie,- is a small-sized *Cymella*, alike to our specimens, and extends the Biochron of the genus to the top of the Jurassic. *Thracia rotunda* PICTET & ROUX (1852, Moll. Fossils des Gres verts: 114, pl. 29, fig. 6) – Perte-du Rhone, Switzerland, of Aptian age, is also a *Cymella. Pholadomya crassesulcata* SEGUENZA, (1884: 127, pl. 6, figs. 8, 8a) Cenomanian of Calabria, Italy, is presumably also a *Cymella.*

Family ***CUSPIDARIIDAE*** Dall, 1886.
Genus ***Cuspidaria*** Nardo, 1840.

Cuspidaria is a carnivorous Bivalve, with a Biochron of Late Cretaceous to Recent. Is distribution area includes Europe and North America. Infaunal siphon feeders, their bathymetric range always have been outer shelf, slope and apron.

Cuspidaria neocomica (Somogyi, 1916)
Plate 20, fig. 16;

- 1916 *Neaera neocomica* SOMOGYI, Mitt. Jahrb. Kgl.Ung. Geol. Reichsamt 22(5):308(14)-309(15), pl. 11, fig. 1;
- 1887 *Cuspidaria? cometa Coquand,* MALLADA, Sinops. España, Cretacico Inferior, #3: 80-81; pl. 36, fig. 5;
- 1942c *Corbula sp. nov.?* ROYO Y GOMEZ, Comp. Est. Of.Col., Serv. Geol. Nac., #5 :343;

Diagnosis: Small shells, gibbous, ending in a fine tube in the anal region, with maximum length of 6 mm, and 3 mm of height, ornated by very fine concentric striae.

Occurrence: Nyagdagraben, Transylvania, fine grained sandstones of Hauterivian age. Limestones and marls of Chert Formation, of early Bedoulian (=Earliest Aptian) age, in Maestrazgo Basin, Spain (CANEROT, 1982).

S.C.S. occurrence: Locality PM-09-D, trail from El Pajaral to La Margarita Mt., Monagas state, La Margarita mudstones, (sDLP, DGC), of Hauterivian age. In Colombia, in ferrugineous clay concretions, in reddish-brown slates on the road to Tibirita, 1 Km of Guateque, in Paja Formation, of Villeta Group. Its age is Barremian, usually associated to *Haustator colombiana.*

CHAPTER V.

Class GASTEROPODA

INTRODUCTION.

Widespread and Cosmopolitan Gasteropoda.
The Class Gasteropoda is present in the planet's oceans, since the Cambrian-Ordovician Periods, when the salinity of the Oceans, was barely Oligohaline. In the Southern Caribbean Subprovince, the Class Gastropoda has a lot less representation than in the Cenozoic Period, as much in taxonomical diversity as individual frequency. A total of **296 taxa** are studied here, of which 15 are new species for science. Surprisingly low, considering that the area remained in the Tropical belt during the whole Cretaceous Period (PINDELL & TABBUTT, 195).

SYSTEMATIC WORK.

For the general taxonomical arrangement, I have followed TAYLOR & SOHL's (1960) classification. Unfortunately, the volumes 2 and 3 of TREATISE ON IVERTEBRATE PALEONTOLOGY (Mollusca, Gastropods) were stolen from my library.

Family ***EUOMPHALIDAE*** De Koninck, 1881.

With a Biochron of Early Ordovician to Triassic, and ?Late Cretaceous, includes mostly discoidal shells with wide umbilicus, but varying in form through wide range. The spire, usually slightly prominent, forms a dissymmetric shell. External sculpture composed of growth lamellae, forming axial ribs, and keels or spiral cords, which limit the external margin of the last whorl. Members of this family, in S.C.S. usually are found associated to the gastropod genus *Cassiope,* in organic rich, reductor muds, in saline waters (DELPEY, 1941).

Genus ***Nummocalcar*** Cossmann, 1896.

According to KNIGHT et alii., (1960: *I195*): the Biochron of *Nummocalcar* extends from Middle Jurassic (Bajocian) to Late Cretaceous (Senonian). Its distribution includes Western European, Maghrebian Subprovinces, and is also Amphiamerican of "trans-temperate" according to KAUFFMAN (1973). Inhabits eutrophic environments, mostly muds rich in organic matter.

Nummocalcar dentatum (Deshayes, in Leymerie, 1842)

- 1843 *Solarium dentatum* d'ORBIGNY, Paleont. Franç. Terr.Cret.#2: 201-202, pl. 180, figs. 5-8;
- 1849 *Solarium dentatum* PICTET & ROUX, Foss. Grès verts.,:76, pl. 20, fig. 4;
- 1962 *Nummocalcar cf. dentatum* (D.) BENKÖ-CZABALAY, G. Hung., Paleont #31: 242;
- 1971 *Nummocalcar dentatum* (D.) MONGIN, Notes Serv. Geol. Tunisie, 334: 29-30, pl. 1, fig. 8;
- 1974 *Solarium dentatum* (D.) DIMITROVA, Foss. Bulgarie, #4b: 27, pl. 6, figs. 3, 4;

Occurrences: This taxon is quite common in Western European, Apulian Maghrebian and Balkanic Subprovinces, with a Biochron extended from Barremian to Albian and Cenomanian?

S.C.S. occurrences: Locality VG-432, Km 6,3 on the road Agua Fría Arriba-Campo Alegre, Sucre state, Valle Grande Formation (DGC), of Middle Albian age. Shales with belemnites, ammonites and bivalves. In Yúruma Formation, cf., in the Atarigua para-autochthone, associated to Barremian fossils (MACSOTAY, 1980-b: 36).

Genus ***Semisolarium*** Cossmann, 1915.

Semisolarium moniliferum (Michelin, 1834)
Plate 34, figures 15, 23;

- 1842-43 *Solarium moniliferum* M., d'ORBIGNY, Pal. Fr. Terr. Crét. #2: 197, pl. 179, fig. 11;
- 1862 *Solarium vattoni* COQUAND, Mem. Soc. Emul. Provence #1: 182, pl. 4, figs. 7, 8, 9 ;
- 1912 *Solarium moniliferum* M., PERVINQUIÈRE: Et. Paleont., Tunisie. Gast: 57, pl. 3, figs. 22-24;
- 1948 *Semisolarium moniliferum* (M.) DELPEY, A. Geol. Serv. M., Madagascar #15: 14-15, pl. 3, fig. 4;
- ?1962 *Semisolarium moniliferum* (M.) BENKÖ-CZABALAY, Geol. Hung., Paleont.331:243-244, pl. 2, figs. 22-24;

- 1971 *Semisolarium moniliferum* (M.) MONGIN, N. S. Geol. Tunis.#34: 24-27, pl. 1, figs. 1 – 5;

Occurrence: *S. moniliferum* (M.) was widely distributed: Western Europe, Apulian, Balkanic, Maghrebian and Somalian? Subprovinces, and East African Province. Its Biochron extends from Albian to Cenomanian, always in shales, in outer shelf environment. Is one of the more characteristic gastropoda of the Albian stratotype, in Aube, France.

S.C.S. occurrence: Locality MC-426-D, Tonoro depression, just before reaching La Güiria, Sucre state, Valle Grande Formation, of Early? to Middle Albian age. Also in Locality ED-08, in shelly limestone in Quebrada El Dantó, of Mapurite Member of El Cantil Formation, (sDLP, DGC), of earliest Albian age.

Genus ***Delpeya*** Collignon, 1949.

Diagnosis: The early whorls are flat, to expand later to give the shell a helicoidal shape. The base is concave, the umbilicus deep, and conical. The ornamentation of the shell, has axial ribs, varices and spines, but no keels. The growth striae are axial.

Comparisons: It differs from *Discohelix* Dunker and *Nummocalcar* Cossmann, and their subgenera, by the absence of peripheral keels, and axial growth striations. Of *Semisolarium* Cossmann, by its low spire, and the rounded umbilicus without crenulations, and the varices and spines on its surface.

Delpeya cottreaui Collignon, 1949.
Plate 34, figure 27;

- 1949 *Delpeya cottreaui* COLLIGNON, Ann. Geol. Serv. Mines, Madagascar 26: 32, pl. 5, figs. 10, 10a, 10b, 11, 11a, 11b, 12, 12a, 12b;
- 1971 *Nummocalcar dentatum memmiae* MONGIN, Notes Serv. Géol. Tunisie, #34: 30-31, pl.1, figs. 7-8;

Occurrence: Djebel ech Chenanuafa, Tunisie, (Maghrebian Subprovince) in calcareous shales, of the Zone *Globigerinelloides ferreolensis,* Subzone *Schackoina postulans,* Gargasian, Late Aptian age (MONGIN, op. cit.). The material from Madagascar was collected from Early-Middle Albian horizons.

S.C.S. occurrence: Locality MC-426-C, Tonoro depression, just before La Güiria, Sucre State, Valle Grande Formation, of Early to Middle age. *D. cottreaui* (C.) is found in the thin glauconitic sandstone beds.

Comparisons: *Solarium ornatum FITTON,* (1836:336, pl. 11, fig. 13) – Middle to Late Albian, in North European Province, Western European, Balkanic and Apulian Subprovinces,- has a lower apical angle, 128º to 140º, the base has 14 spines with a different shape, and is a *Nummocalcar.*

Family ***WEEKSIIDAE*** Sohl, 1960.
Genus ***Weeksia*** Stephenson, 1941.

According to SOHL (1960: U.S.G.S. Prof. p. 331-A: 51) this genus is unknown outside of the *Exogyra costata* Zone of the Gulf Coast area, U.S.A. DELPEY (1939: Gastr. Mesoz. :30-31, Figs. 5-6) published from Abeih area, Lebanon, in claystones at Baouerté , of Aptian or Albian age, small gastropods called *Nummocalcar rugosum* (Whitfield, 1891) which is a typical *Weeksia.* It is a thermophyllic genus.

Genus ***Discohelix*** Dunker, 1848.

According to KNIGHT et alii., (1960: I195) this taxon has a Biochron of Middle Triassic to Late Cretaceous (Senonian), with a cosmopolitan distribution.

Discohelix brouzetensis Cossmann, 1916.
Plate 25, figures 6, 7, 8, 9;

- 1916 *Discohelix brouzetensis* COSSMANN in BRUN, Paleontologie #51: 20-21, pl. 2, figs. 14-16;
- 1918 *Discohelix brouzetensis* C., COSSMANN, Bull. Soc. Geol. France #16: 376-377, pl. 11, figs. 17-19;

Occurrences: Frequent in Orgon limestone Formation, France, of Barrmian age. Also in Schrattenkalk limestones in Switzerland, the same age.

S.C.S. occurrences: Locality MO-888, Promontory to the west of Punta La Peña, Sucre state, inLope Member of the Taguarumo Formation (DAGM) of Late Barremian age. Also in Yúruma Formation, Lara state, in Atarigua para-autochton, of Hauterivian-Barremian age.

Discussion: *Straparollus portlandicus* de Loriol, 1868, - Portland beds, Yonne, France, of Ryazanian age, is a *Discohelix,* and a possible ancestor of the various species of the Western European, Maghrebian and South Caribbean Subprovinces, favoured by the saline seas of the Eocretaceous.

Family ***PLEUROTOMARIIDAE*** Swainson, 1840.

Genus ***Bathrotomaria*** Cox, 1956.

According to KNIGHT et alii., (1969: I219) it is a cosmopolitan genus, with a marine habitat, mostly on outer shelf.

Bathrotomaria cf. chouberti Collignon, 1972.
Plate 57, figure 8;

- 1972 *Bathrotomaria chouberti* COLLIGNON, Notes M..Serv. geol. Maroc,#228 : 12-13, pl. 2, figs. 1, 2, 3 ;
- 1946 *Pleurotomaria sp.* LIDDLE, Geology of Venezuela and Trinidad : 195 ;

Occurrence: Originally studied from Oued Chebeika, SW of Foum Chebeika, Marocco, of Late Albian age.

S.C.S. occurrence: Río Liboa, Monagas state, in Corral Viejo member of Chimana Formation, (sDLP, DGC), of Late Albian age. Collected in black, splintery shale with small ammonites, 10 meters above the contact with the top of El Cantil Formation's Guácharo member, of Middle Albian age (LIDDLE, op.cit.).

Genus ***Leptomaria*** E. Eudes-Deslongchamps, 1864.

According to KNIGHT et alii., (1960: I219), *Leptomaria* is a cosmopolitan genus, whose Biochron extends from Middle Jurassic (Bajocian) to Paleocene (Danian). Restricted to the aphotic zone, in most of the Oceans.

Leptomaria gibbsi (Sowerby, 1821)
Plate 28, figures 11;

- 1821 *Trochus Gibbsi* Sowerby, Min. Conch. Pl. 278, figs. 1, 2;
- 1842-43, *Pleurotomaria gurgitis* d'ORBIGNY, Pal. Franc. Terr. Cret. #2: 249, pl. 192, figs. 4-6;
- 1867 *Pleurotomaria Gibbsi* (S.) RENEVIER, Soc. Vaud. S. Nat.,#9: 137;

Occurrence: Originally collected from the Upper Greensand of Cambridge, and most of the localities in France, are all of Albian age; In Switzerland, only found in Aptian age sediments.

S.C.S. occurrence: Locality MO-6048, Cautaro, Sucre state, (DGC) Valle Grande Formation, of middle Albian age. Over 100 casts have been collected from eight localities of Valle Grande localities, by the geologists of Aguasuelos field party.

Family ***TROCHOTOMIDAE*** Cox, new family in KNIGHT et alii., 1960.

The Biochron of this family, extends from Late Triassic (Rhaetian) to Late Jurassic.

Genus/Subgenus ***Trochotoma (Trochotoma)*** Deslongchamps, 1840.

The Biochron of this taxon, extends from Late Triassic (Rhaetian) to Early Cretaceous (Albian).

Trochotoma (Trochotoma) increbescens (Stanton, 1947).

- Cf. 1947 *Pleurotomaria (s.l.) increbescens* STANTON, U.S.G.S., P.p. 211: 53, pl. 47, figs. 9-11, 17, 18 ;
- 1980 *Pleurotomaria cf. increbescens* (S.) GARCIA JARPA et alii.: 44;

Occurrence : Edwards limestone in Travis County, Texas, of Late Middle Albian age.

S.C.S. occurrence: Upper carbonatic member of Peñas Altas Formation, of early Albian age. Collected on the top of the *Caprinuloidea perfecta* (Palmer) limestone (ARNAUD et alii., 1999, fig. 27).

Family ***TROCHIDAE*** Rafinesque, 1815.

The genera of this family are carnivorous, predators on sessile Bivalvia.

Subfamily ***PROCONULINAE*** Cox in KNIGHT et alii, 1960.

Genus ***Discotectus*** Favre, 1913.

Biochron of Middle Jurassic (Bathonian) to Late Cretaceous (Senonian), with a distribution in Europe and South America. Normally found in limestones, associated to rudists (COSSMANN, 1918).

Discotectus cf. crispus (Blanckenhorn, 1890).
Plate 34, figure 19;

- Cf. 1890 *Trochus (Turcica?) crispus* BLANCKENHORN, Kreidesyst. In Mitt.-NordSyriens: 98, pl. 7, fig. 6;
- Cf. 1900 *Trochus (Tectus) crispus* J. BÖHM: 190;
- Cf. 1939 *Trochus crispus* B., DELPEY, Gasterop. Mesozoiques: 54-55, fig. 31.

S.C.S. occurrences. Locality MO-896, west side of Patiño Inlet, Sucre state, Lope Member of

Taguarumo Formation, (DAGM) of Late Barremian age. It was associated to the rudists *Amphitriscoelus waringi,* and *Praecaprina varians,* and small colonies of hermatypic corals. Also in Yúruma Formation, Lara state, (Atarigua para-autochthone), also of Barremian age.

Occurrences: Originally studied from Abeih, - Aptian, - and Gurzúz, Liban, of Albian age.

Subfamily ***CHILODONTINAE*** Wenz, 1938.

According to KNIGHT et alii., (1960: *I*249) its Biochron extends from Late Jurassic (Oxfordian) to Late Cretaceous (Maastrichtian). Restricted to Western European Subprovince.

Chilodonta elegans (Deshayes in Leymerie, 1842)
Plate 23, figure 10;

- 1842 *Triton? elegans* Deshayes in LEYMERIE, Mem. Soc. Geol. Fr. 1(5): 14, pl. 17, fig. 13;
- 1874 *Olivia Cotteaui* BAYAN Bull. Soc. Geol. France, 3º sér., #2: 336, pl. 10, fig. 2;
- 1900 *Chilodonta Cotteaui* B., PERON Bull. Soc. S.h.n. Yonne, #53: 77-79, pl. 3, fig. 3 ;

Occurrence : Ferruginous coralligene limestones, Gy-l'Evèque, Paris Basin, France, of Hauterivian age. Height : 11 mm, Width : 7,5 mm (LEYMERIE, op. cit.). It reaches a height of 27 mm (PERON, op. cit.).

S.C.S. occurrence : Locality MO-881, cliff east of Puerto Escondido, East of Cumana, Sucre state, (DAGM) Lower Taguarumo Formation, of Early Barremian age.

Subfamily ***ANGARIINAE*** Thiele, 1924
(=*Delphinulidae* Stoliczka, 1868).

With a Biochron of Triassic to Recent, widespread mostly in tropical and Subtropical belts.

Genus ***Angaria*** Röding, 1798.

Angaria has a Biochron of Middle Jurassic to Recent, and is known from Europe, Africa, Australasia and Indo-Pacific Ocean.

Angaria keenae Von der Osten, 1957.
Pl. 26, figure 1;

- 1954 *Petropoma peruanum* Gabb, VON DER OSTEN, Bol. Geol. (Caracas) 3(8): 172, pl. 10, fig. 4; (non GABB, 1877)
- 1957 *Angaria keenae* VON DER OSTEN, Jour. Paleont. 31(3) : 583, pl. 65, fig. 1 ;

S.C.S. occurrence : Locality MMH, Su-132, Punta Fuera, isla Caracas del Oeste, Taguarumo Formation, (DAGM), of Barremian-Early Aptian age. Also at MO-896, west side of Patiño inlet, Upper Taguarumo Formation, of Late Barremian age. Also at PM-50-B, Cantera de El Yaque, Sucre state, Taguarumo Formation, of Late Barremian-early Aptian age, collected in a dark yellow clayey limestones, associated to rudists.

Comparisons: It is nearby to *"Delphinula" leoncei* DONCIEUX, - Early and Middle Albian, endemic in all the Albian stratotype of Aube, France (MONGIN & PEYBERNES, 1981: 233) also an *Angaria* but with only 13 evenly spaced spiral rows with hollow spines on the last whorl, in place of the 17 of *A. keenae.*

Subfamily ***CALLIOSTOMATINAE*** Thiele, 1924, (=*Conulinae* Cossmann, 1916 [partim])
Genus ***Calliostoma*** Swainson, 1840.

Biochron extended from Early Cretaceous to Recent (*Calliostoma* sensu lato).

Calliostoma gaudini (Pictet & Campiche, 1861).
Plate 25, figure 22;

- 1861/64 *Trochus gaudini* PICTET & CAMPICHE, Mat. Paléont. Suisse, : 513, pl. 86, figs. 2, 3 ;
- 1962 *Calliostoma cf. sociale* (C.) BENKÖ-CZABALAY, S. Hung. Paleont. #31: 247, pl. 5, fig. 1-2;
- 1974 *Calliostoma gaudini* (P. & C.) DIMITROVA, Foss. Cret. Bulgarie : 21, pl. 12, fig. 4 ;
- 1980-b, *Calliostoma sociale* (C.) MACSOTAY: 39, pl. 11, fig. 12; (non COSMANN, 1918);

Occurrence: White urgonian limestones in Châtillon de Michaille Switzerland, and Orgon, South France, of Late Barremian-Early Aptian age. Also in Bulgaria, in Aptian age beds, and in *Munieria* marls and claystones in Zirc, Hungary, of Late Aptian age.

S.C.S. occurrence: Locality MO-1718, trail from San Pedro to Jabón, Trujillo state, lower carbonatic member of Peñas Altas Formation, of Late Barremian-Early Aptian age. Also reworked as olistolith in Guayamure Formation, of Late Albian age (MACSOTAY & VIVAS, 2011).

Calliostoma substriatulus (d'Orbigny, 1850)

- 1842 *Trochus striatulus* Deshayes in LEYMERIE, Mem. Soc. Geol. Françe, #5: 13, pl. 17, fig. 1; (non Deshayes, 1824)
- 1850 *Trochus substriatulus* d'ORBIGNY, Prodrome, #2 : 69, ètage 17, nº 119 ;
- 1900 *Trochus substriatulus* PERON, Bull. S.S.h.n., Yonne 353 :70-72 ;
- 1925 *Tectus striatulus* Desh., CORROY, :91 ;
- 1957 *Calliostoma* n. sp., Von Der OSTEN, Jour. Paleont., 31(3) : 583, pl. 65, fig. 9 ;

Description : Shell small, stout, conical, not umbilicated, consisting of five whorls; sutures slightly impressed; whorls almost straight sided, plain or slightly concave, except for a very weak narrow sutural band below the sutures; body worl of about same size as last spiral whorl, anterior border subcarinate; Apical angle about 60º. Aberture of triangular shape, with a strong tooth in the internal margin of the columellar wall (PERON, op. cit.).

Dimensions: Height: 10 mm, Width: 9,5 mm;(Marolles, France) Height: 7, width: 6,5 mm. (Picuda Formation).

Occurrences: Bryozoan marls of Hauterivian age above Calcaire Roux of Valanginien age Switzerland; ferrugineous clay deposits of Saint-Dizier, Paris Basin, France of the same age.

S.C.S. occurrence: Locality SU-90, west coast of Picuda Grande Island, (DAGM), in Picuda Formation, (VON DER OSTEN, 1954: 171), of Hauterivian age.

Family ***ATAPHRIDAE*** Cossmann, 1918.

The Biochron of *Ataphridae* extends from Triassic to Late Cretaceous.

Genus ***Ataphrus*** Gabb, 1869.

The Biochron of *Ataphrus* goes from Middle Jurassic(Bajocian) to Late Cretaceous (Maastrichtian). Its distribution is cosmopolitan.

Ataphrus sp.indet. Macsotay.
Plate 55, figure 15;

- 1998 *Ataphrus cf. crassus* Gabb, VIVAS & MACSOTAY, 14TH Caribb.Geol. Conf. #2: 133;

S.C.S. occurrence : This small taxon is characterized by its medium-sized, globose, turbiniform shell, flattened adpressed whorl, prosocline growth lines, weakly convex base, and elliptical aperture. The presence of a tubercle on the inner lip can not be determined because of a thick covering of glauconite in the aperture. This taxon has much in common in shell form with some Jurassic and Eocretaceous forms, such as *Ataphrus acmon* (d'Orbigny, 1847), from the Bajocian of England, *A. yocoyamai* Nagao, 1934, -Aptian of Japan,- and *Ataphrus (Ataphrus) sp. A* KASE, 1990, Jour. Paleont. 64(4): 565, Figures 2.1 and 2.2) – Late Campanian to Maastrichtian of Japan.

S.C.S. occurrences: JFS-04, road from Santa Rosa to Guaruta, Sucre state, of Valle Grande Formation, (sDLP, DGC), of Middle Albian age. It is associated to small Bivalvia (*Freiastarte, Nuculana, Thracia) and* belemnites embedded in fine grained glauconitic sandstone.

Family ***STOMATELLIDAE*** Gray, 1840.

Genus ***Praestomatia?*** Kutassy, 1940, nom. nud., emend COX n. gen., in KNIGHT et alii., (1960, *I*263).

Small, with rapidly expending whorls having flattened upper surface separated by carina from almost vertical, moderately high outer face, which may carry 2 spiral angulations; ornament collabral ridges. Its Biochron extends from Late Triassic (Norian) to Late Jurassic, and seemed to be endemic to Europe.

Praestomatia? chimanaensis new species, Macsotay.
Plate 28, figs. 3, 7;

Description: Cast of medium size, not umbilicated, spire slightly elevated, whorls 3 or 4, rapidly expanding, with angular shoulder and a subsutural ramp on the penultimate worls; broadly rounded on the sides on the last whorl; protoconch not preserved. Aperture rounded-semilunar, obtusely angular in front. Outer lip thin, simple; shell partially preserved, on the external surface of the last whorl smooth, with regular, low, radial ribs extending from a medial line, upwards and downwards, symmetrically distributed. These radial ribs, for an angle of about 22º near the medial line, curving away from it, and increasing to 32º.

Dimensions: The Holotype, UCVMG/IO-1955, measures, of Length: 23,3 mm, and Height: 14,6 mm.

S.C.S. occurrence: Locality MO-3213, Lope inlet of Chimana Grande island, Sucre State, (DAGM), Lower Taguarumo Formation, of Late Hauterivian age.

Comparisons: This unusual gastropod, is superficially alike to *Pterocera wimmisensis* Ooster, (1869, Corallian of Wimmis: 23, pl.9, fig. 7) – Simmenfluh Formation, Switzerland, of Late Jurassic, Kimmeridgian age,- whose spiral ornamentation is not bifurcate, as on *P. chimanaensis,* but is continuous on the subsutural ramp, too. *Natica? Rutimeyeri* VILANOVA, (1863, Mem. Geol. Teruel, pl.4a, figs. 3, 5) – Mirambell marl Formation, Maestrazgo Basin, Spain, (CANEROT, 1982) of Hauterivian age, not Aptian a three-whorled shell, which on the last whorl, carries 8 – 10 denticulated spiral ribs, which are not divaricate. *Natica cf. hugardiana* d'Orb., IMLAY, (1940 Geol. Soc. Amer. Bull. 51(1): 157, pl. 14, figs. 7, 8) – Barril Viejo Shales, Mexico, of Early Hauterivian age,- was figured as an inflated cast, with an expanded apertural poroyection, preserved on the cast.

Recommendation: *Praestomatia?* should be investigated, as probably is a new genus.

Family ***TURBINIDAE*** Rafinesque, 1815.

According to KNIGHT et alii, (1960: *I*264) inhabits in warm seas, mainly. Its Biochron extends from Middle Triassic to Recent.

Subfamily ***ASTRAEINAE*** Davies, 1933.
Genus ***Astralium*** Link, 1807.

According to KNIGHT et alii., (1960: *I*265) the Biochron of this genus extends from Eocene to Recent, with a distribution in Europe, East Indies, West Indies, and South America. There are many Late Cretaceous species published:

- *A. aculeata* Zekeli, 1852, Santonian,
- *A. basiconcavum* Cossmann, 1918, Barremian,
- *A. acuta* Zekeli, 1852, Santonian,
- *A. arbenzi* Böhm & Heim, 1909, Senonian,
- *A. bellavistensis* Delpey, 1938, Turonian,
- *A. carnaticum* Stoliczka, 1868, Cenomanian
- *A. densiporcatum* Pethö, 1906, Senonian,
- *A. fimbriatum* Repelin, 1907, Senonian,
- *A. granulatum* Zekeli, 1852, Campanian,
- *A. hofmanni* Pethö, 1906, Senonian,
- *A. provinciale* Repelin, 1907, Senonian
- *A. undato-coronatum* Pethö, 1906, Senonian

Astralium wesselinghi new species, Macsotay.
Plate 25, figure 1;

Description: Shell small, thin, suborbicular, with a short spire. Four whorls were preserved, ornated with rounded, irregular radial ribs, which start at the suture, but do not reach completely the external margin; they are traversed by 8 – 10 spiral cords, irregular and of variable thickness. The whorls are regularly convex, with the mayor convexity nearby the external margin. External margin with 8 flattened spines, of which four were damaged, during cleaning of the sample.

Dimensions: The Holotype (UVCMG/IO-1256) measures, of Width (without spines): 17 mm, Height: 7 mm, Length of the longest spine: 6 mm.

Etymology: I dedicate this new species to the Dutch Paleobiologist, Dr. F. P. Wesselingh, of the National Museum of natural History, - for publishing [Scripta Geologica, Nº 133, 2006] the most complete study of the Molluska of the Pebas Lake of Early to Middle Miocene in the Subandean Basins of South America.

S.C.S. occurrence: Locality MO-883, east side of Patiño inlet, Sucre state, (DAGM) Lope Member of Taguarumo Formation, of Early Aptian age.

Comparison: *Astralium bellavistensis* DELPEY (1942, Bull. Soc. Hist. nat. Toulouse, #77: 187-188, fig. 22) - Turonian limestones, Bellevue, France,- was studied originally from a natural mold, where the dorsal part was preserved. The spire is short, whorls above are flattened and ornamented with a lower set of tubercles, followed by 3 – 4 series of scaly granulations; bordering the suture, a crown of fourteen flattened spines, which constitute the essential criteria for the generic identification (DELPEY, 1942). It is the nearest species to *A. wesselinghi,* but the dominantly spiral ornamentation, and more spines per whorl, distinguish both species.

Paleoecology: *A. bellavistensis* was collected from a limestone banc with ammonites (DELPEY, op. cit.). *A. wesselinghi* was found in a sideritic siltstone, associated to *Aetostreon, Pileolus, Boltenella and Aphanoptyxis,* all representative of outer shelf sedimentation. These are evidences of a deep shelfal origin of the genus *Astralium.*

Subfamily ***LIOTIINAE*** Adams & Adams, 1854.

Biochron of the subfamily, Triassic to Recent, mostly found in carbonatic sediments.

Genus ***Eucycloscala*** Cossmann, 1895 (=*Urceolabrum* Wade, 1916).

Biochron of Middle Triassic (Ladinian) to Early Paleocene (Danian), and its distribution area includes Europe and North America.

Eucycloscala cf. pyrene (White, 1887).
Plate 34, figures 1, 4, 12;

- Cf. 1887 *Scalaria pyrene* WHITE, Ar. Mus.N. Rio de Janeiro, #7: 194, pl. 13, fig. 17;
- Cf. 1936 *Epitonium pyrene* W., MAURY, Mem.Soc. Geol.Min. Brasil, 11:203, pl. 12, fig. 7;
- Cf. 1943 *Epìtonium pyrene* W., OLIVEIRA & LEONARDOS, pl. 25, fig. 13;

Occurrence: Originally studied from Jacaranha, Sergipe, Brazil, from the Ganhamaroba Group, of Middle? Albian age. It is rare.

S.C.S. occurrence: Locality MC-446-A, Campo Alegre-Buena Vista road, (near Teresén, Monagas state), in El Guacharo Member of El Cantil Formation, of Early Albian age. All the fossils Goethite pseuomorphs. The axial ribs are restricted to the maximum convexity, without touching any of the sustures. The base of the last whorl, is ornted with 5-6 spirl threads.

Comparisons: Resembles to *E. philippi* (WEINZETTEL, 1910: 19, pl. 3, fig. 25-26, non REUSS, 1846), - Cenomanian, Czech Republic, - but our apical angle is smaller.

Subfamily ***HELICOCRYPTINAE*** COX, in KNIGHT et alii., (1960: *I*267).

Biochron extends from Middle Jurassic (Bathonian) to Late Cretaceous (Cenomanian).

Genus ***Helicocryptus*** d'Orbigny, 1850.

Helicocryptus cf. mexicanus (Böse, 1910).
Plate 25, figures 25, 26;

- Cf. 1910 *Helicocryptus mexicanus* BÖSE, Inst. Geol. Méx., Bol. 25: 140, pl. 46, figs. 1-5; 9-12; pl. 47, fig. 1;
- 1957 *Architectonica planorbis* (Roemer) VON DER OSTEN, Jour. Pal., 31(3): 584, pl. 65, figs. 6, 10;(non ROEMER, 1888).

Occurrences: In Texas, common in Weno and Pawpaw Formations, of Late Albian age.

S.C.S. occurrence: Locality Su-90, (MMH), west coast of Picuda Grande Island, basal limestones of Taguarumo Formation, (DAGM) of Late Hauterivian age. Many of these shells are present along the limestone/shale contact.

Dimensions: This small shell measures, of Height: 10,2 mm, and Width: 4,2 mm.

Comparisons: *H. fittoni* (Roemer, 1841)- species common in the Albian Flammenmergel, Grünsand Formation, Germany, and Gault clay Formation, England,- is less involute than *H. mexicanus.*

Family ***NERITOPSIDAE*** Gray, 1847.
Subfamily ***NERITOPSINAE*** Gray, 1847.
Genus ***Neritopsis*** Grateloup, 1832.

With a Biochron from Triassic to Recent, this genus attained cosmopolitan distribution during Mesozoic times, becoming more restricted during the Cenozoic.

Neritopsis cf. gaultina (Pictet & Campiche, 1863)
Plate 30, figure 16;

- Cf. 1847 *Stomatia gaultina* PICTET & ROUX, Grés Verts, :245, pl. 24, fig. 3; Cf. 1863 *Stomatia gaultina* PICTET & CMPICHE, Paleont. Suisse, 32: 409;
- Cf. 1942 *Neritopsis gaultina* P. & R., DELPEY, Bull. Soc. Hist. nat. Toulouse,#77: 84, pl. 1, fig. 2;
- Cf. 1962 *Neritopsis sp. II,* BENKÖ-CZABALAY, Geol. Hung., Paleontologia #31: 246, pl.3, figs. 11-13;

Occurrence: Originally studied from the Grès Verts of Perte du Rhône, Switzerland, and Saxonet, d'Escragnolles, France, of Albian age. Later, from glauconitic limestones of Wielka, Rówien, Poland, of the same age (PASSENDORFER, 1929). Also in glauconitic marls in North Bakony mountains, Hungary, of Early Cenomanian age (BENKÖ-CZABALAY, 1962).

S.C.S. occurrence: Locality VG-411-C, Río Macarapana, Sucre state, Valle Grande Formation, (DGC) of Middle Albian age. With Ammonites and Belemnites associated, the clay-shales are considered from bathyal facies.

Family ***NERITIDAE*** Rafinesque, 1815.
Subfamily ***NERITINAE*** Rafinesque, 1815.

According to KNIGHT et alii., (1960: *I*279) its Biochron extends from Middle Triassic to Recent. It is a thick-shelled operculate taxon, that since its origination, always lived in the highly competitive, littoral belt.

Genus ***Neritoma*** Morris, 1849.
Sub-genus ***Neridomus*** Morris & Lycett, 1851.

Its Biochron extends from Middle Jurassic to Late Cretaceous (Senonian).

Neritoma (Neridomus) fluctuoides (Whitfield, 1891)
Plate 34, fig. 11;

- 1891 *Natica (Ampullina) fluctuoides* WHITFIELD, Bull. Ann. Mus. Nat. Hist.#3: 147, pl. 8, figs. 8, 10; pl. 9, fig. 1;
- 1927 *Neridomus fluctuoides* (W.) BLANCKENHORN, Palaeontogr., #69: 127, pl. 1, fig. 12;
- 1939 *Neritina (Neritodomus) fluctuoides* (W.) DELPEY, Gast. Mesoz.: 38-39, figs. 13, 14;

Occurrence: Originally studied from the "Olive locality" Abeih, Liban, of Early Aptian age; also from Mont Gazelle, Liban, of Cenomanian age. The oldest horizons were those of the Urgonian limestone in Brouzet-les-Alés, France, and Baskuntschak, Turkmenistan, of Barremian age.

S.C.S. occurrence: Locality JFS-174, Quebrada Sotera, Sucre State, (DAGM) in Chimana Formation, of Middle-Late Albian age; small sized Gastropoda and Bivalvia, all pseudomorphs in microchrystallin marcasite. Belemnites are unaltered. Also in several Valle Grande Formation localities, of Middle Albian age.

Genus ***Pileolus*** G. B. Sowerby, 1823.

According to KNIGHT et alii., (1960: *I*280) it is cosmopolitan, with a Biochron extending from Early Jurassic to Late Cretaceous (Turonian).

Pileolus urgonensis Pictet & Campiche, 1863.
Plate 27, figures 4, 11;

- 1863 *Pileolus urgonensis* PICTET & CAMPICHE, Matér. Paléont. Suisse, #2: 412, pl. 76, fig. 7 ;
- 1900 *Pileolus urgonensis* P. & C., COSSMANN : 11, pl. 2, figs. 1-3;
- 1918 *Pileolus urgonensis* P. & C. COSMANN: Mem. Soc. Geol. France, Paleontologie,#15: 385-386, pl. 11, figs. 40-41 ;

Occurrences : Urgonian Blank Formation, de Chatillon de Michaille (Switzerland) and Brouzet-les-Alais, (France) of Barremian age.

S.C.S. occurrence : Locality MO-888, west side of Punta La Peña, east of Patiño inlet, Sucre state, (DAGM) Lope Member of Taguarumo Formation, of Late Barremian age. In calcareous shale, associated to *Palorbitolina discoidea/P. conoidea.*

Dimensions: UCVMG-IO2115. It measures, of height: 6,3 mm, of width: 6,7 mm;
Discussion: R.A. LIDDLE (1946: 191) cited *P. cf. plicatus* Sowerby, from El Cantil Formation (DBG) from outcrops of north and northeast of El Cantil-Punceres anticline, of Monagas state. It could have been *P. septangularis* Stanton, (1947, USGS, Prof. paper 211: 62, pl. 35, figs. 4-9) - Edwards limestone Formation, Texas, of Middle Albian age, - but this taxon was collected from Caripito Member of Chimana Formation(DBG) of the same age, and the same facies.

Genus ***Trochonerita*** Cossmann, 1907;

Trochonerita mammaeformis (Renaux, 1837).
Plate 33, figure 2 ;

- 1837 *Trochus mammaeformis* Renaux, Congrès de Nimes.
- 1850 *Nerita mammaeformis* d'ORBIGNY, Prodrome, #2 : 104, nº 675, 17ᵉ étage.
- 1907 *Nerita (Trochonerita) mammaeformis* (R.) COSSMANN, Mem.Soc. Geol., France, 37: 23-24, pl. 4, figs. 2-4;
- 1918 *Nerita (Trochonerita) mammaeformis* (R.) COSSMANN, Bull. Soc. Geol. France #16: 384-385, pl. 17, figs. 3, 4;
- 1974 *Trochonerita mammaeformis* (R.) DIMITROVA, Foss. Bulgarie: 19, pl. 1, fig. 7;

Occurrence: Orgon limestone, (Bouches-du-Rhône), and Brouzet-les-Alais, France, both of Barremian age. In Bulgaria is common in Aptian sediments, where it is associated to *Requienia ammonia.*

Dimensions: Height: 85 mm, maximum width: 80 mm, (COSMANN, 1907, op. cit.).
S.C.S. occurrence: Locality VG-276, Cruz Verde, Caserío La Paloma, Sucre state, Chuparipal Formation, (DEP) of Barremian age. Associated to *Requienia ammonia.* Also Tibú Formation, Atarigua unit (STEPHAN, 1985), of Late Barremian-Early Aptian age.

Discussion: "*Turbo gigas"* Verneuil & Lorière, (1868, Mem. p. Pal. España, 37 : 27, pl. 3, fig. 1), - Obón, Teruel, calizas de Alacon Formation, Maestrazgo Basin, Spain, of Barremian-Early Aptian age – is a *Trochonerita, and* only differs in the presence of a row of rounded nodules on the shoulder of the last whorl. Its maximum height is 111 mm.

Comparisons: The species of *Trochonerita*, all of decimetric sizes, are very different from most of the Gasteropoda of the Urgonian limestones, mostly thin shelled and elongated outlines as *Eunerinea and Aptyxiella.* A comparable species is the algophagous *Cittarium pica* (Linneo, 1758)(MACSOTAY & CAMPOS, 2001: 33, map nº 10)- living on hard bottoms, between SE Florida and Trinidad & Tobago, - in the saline Caribbean sea, at depths of 0 to 40 meters.

Genus ***Lissochilus*** Pethö, 1882, non Zittel.

According to KNIGHT et alii., (1960: *I*281-*I*282) the Biochron of this genus extends from Middle Jurassic (Bathonian) to Late Cretaceous (Senonian), and a cosmopolitan distribution.

Lissochilus cf. asper Blanckenhorn, 1927.
Plate 33, figures 18, 22;

- 1927 Cf. *Lissochilus asper* BLANCKENHORN, Palaeontographica 69: 127, pl. 1, figs. 10a, b, c;

Diagnosis: Shell thick, composed of 2,1/2 to 3 whorls, loosely coiled and making only about arevolution and half; body whorl obtusely angulated above the middle, somewhat concave above the angulation and again convex above the concave zone; spire very small; aperture semilunar; peristome considerable thickened below; columellar area bradly flattened and overspread with a callus; whorls marked with close and abruptly elevated transverse lines, and bearing tubercular or noded ribs; last whorl ornated with 5 spiral cords, with narrow interspaces; there is a 6th one, coarser and separated from the others. Subsutural area with 7-8 protruding nodes on the shoulder, hiding partially the suture line.

Occurrence: *Trigonia* sandstone, in Liban, of Aptian age.

Dimensions: Height, 40 mm, and width: 29,5 mm (pl. 33, figs. 18, 22).

S.C.S. occurrence: Locality MC-235-C, road towards the Antenna, Monagas state, Lower El Cantil Formation, of Clansayesian (Late Aptian) age, (DBG): bioturbated calcareous marls, with two gerontic shells, and three juveniles, ill preserved. Associated, small casts of bivalves and gastropoda, of brackish-water environment.

Comparisons: In ornamentation and size, our shells are alike *Lissochilus asper,* but the last whorl of our gerontic shells, only has spiral cords, not tangential ribs.

Lissochilus squamosa (White, 1888).
Plate 25, figure 16; pl. 27, figure 10;

- 1888 *Lyosoma squamosa* White, Arch. Mus. Nac. Rio de Janeiro,#7: 179, pl. 10, figs. 25-27;
- 1936 *Lyosoma squamosa* W., MAURY, Mem.Soc.g.m. Brasil, #11: 187, 189, pl. 14, figs. 10, 12;

Occurrence: Porto dos Barcos, Maroim, Sergipe, in Ganhamaroba Group, Brazil, of Middle Albian age.

S.C.S. occurrence: Locality MO-892, Cachimena inlet, Taguarumo Formation, (DAGM) of Barremian age, in dark red siltstones, associated to *Trigonia* shells.

Comparisons: Very near to *Nerita (Otostoma) antonii* CHOFFAT (1902, D.t. Geol.#4: 130-131, pl. 4, figs. 4 to 10) - Vraconian and Early Cenomanian of Portugal, – but *L. squamosa* WHITE is similar, but with coarser and more separated axial ribs.

Paleoecology: *Lissochilus* is alike *Nerita* in its faunistic associations, as a littoral-sublittoral dweller in Caribbean mangroves and littoral lagoons (FLORES, 1964, Mem. Soc. Cienc. Nat. La Salle, 24(67): 78-90) with strong salinity anomalies.

Family ***PARATURBINIDAE*** Cossmann, 1916.

The Biochron of *Paraturbinidae* extends from Triassic to Late Cretaceous (KNIGHT et alii., 1960: *I* 302), a family belonging to Taxa Group One, (SOHL, 1987: 1102).

Genus ***Chartronella*** Cossmann, 1902.

According to KNIGHT et alii., (1960: *I*302), the Biochron of *Chartronella* extends from Triassic to Late Jurassic (Portlandian), distributed in Europe, and both Americas. There are species until Late Cretaceous (Cenomanian):

1. *Cyclonema (Chartroniella) ambikyensis* Delpey, 1946, Late Valanginian,

2. *"Turbo" atherstoni* Sharpe, 1856, Hauterivian
3. *"Turbo" bitropistus* ASHER, 1906, Valanginian,
4. *"Turbo" cureti* REPELIN, 1902, Cenomanian,
5. *"Turbo" durui* de LORIOL, 1868, (V. ALTH, 1882) Ryazanian-Valanginian.
6. "*Turbo" festivus* ANDERSON, 1938, Valanginian,
7. "*Turbo?"gouldi* STANTON, 1947, Cenomanian,
8. "*Turbo" gradatus* WOLLEMANN, 1908, Hauterivian,
9. *Chartroniella infundibulata* COSSMANN, 1918, Barremian,
10. "*Turbo" portentus* WHITE, 1888, Albian,
11. *Paraturbo reticulatus (*PHILLIPS, 1829) Neocomian,
12. *Chartronella saxorum* (COX, 1954) Earl Albian,
13. "*Turbo" valangiensis* PICTET & CAMPICHE, 1863. Valanginian.

Chartronella infundibulata (Cossmann, 1918)
Plate 28, figures 5, 17 ;

- 1918 *Chartroniella (sic) infundibulata* COSSMANN, Bull. Soc. Geol. France, #10(6): 373-374, pl. 11, figs. 10-11;

Diagnosis: Shell turbiniforme, small, width almost equal to height (5 mm), spire short, last whorl bicarinated at periphery; base is convex, covered by fine spiral threads, also present in the subsutural ramp. Aperture subpentagonal, slightly inclined on the axis, with a thick peristome. Umbilicus semilunar, bordered by a finely beaded spiral rib.

Occurrence: Strongly compacted oolithic limestone, from Orgon, France, of Barremian age.

S.C.S. occurrence: Locality MO-5623, Cantera de El Yaque, on the road from Casanay, Sucre state, Lower Borracha Formation, of Early Aptian age, in dark grey limetones, associated to Caprinid rudists.

Chartronella saxorum (Cox, 1954)

- 1954 *Chartroniella (sic) saxorum,* COX, Jour. Paleont. 328(5) : 625, pl. 67, figs. 2a, b, 3a,b ;

S.C.S. occurrence: Unknown Cretaceous limestone olistoliths, reworked in Nariva Formation Trinidad, of Early Miocene age. In Venezuela, in locality MC-447-C, Cerro La Torre, on the Campo Alegre-Teresen road, Monagas state, of Guacharo member of El Cantil Formation, of Early Albian age.

Dimensions: Height: 31,5 mm, and maximum width: 26 mm.

Comparisons: The most similar described species is "*Turbo" faucignyanus* PICTET & ROUX, (1849: 195, pl. 9, figs. 3a-c),-from the Greensand, Genève, Switzerland, of Albian age,- on which the upper of the two spiral bands, is feebly nodose, and the outline of the base is not so strongly convex as in *Chartroniella saxorum* COX. Both are six times the size, of the *C. infundibulata* formerly cited.

Family ***AMBERLEYIDAE*** Wenz, 1938.
Genus ***Amberleya*** Morris & Lycett, 1851.
Subgenus ***Eucyclus*** J. A. Eudes-Deslongchamps, 1860.

According to KNIGHT et alii., (1960: *I* 306) its Biochron extended from Triassic to Oligocene, with a distribution in Europe and South America.

Amberleya (Eucyclus) saxoneti (Pictet & Roux, 1849).
Plate 33, figures 2, 14;

- 1849 *Trochus Saxoneti* PICTET & ROUX, Mollus. Gres Verts, :197, pl. 19, fig. 5 ;
- 1863 *Turbo Saxoneti* P. & R., PICTET & CAMPICHE, Mat. Pal. Suisse : 495 ;

Occurrence : Species quite common in the Glauconitic sandstones of Aptian age in France and Switzerland. Complete specimens measured 38 mm of height, and 28 mm of width. Spiral angle 36º.

S.C.S. occurrence: Locality MC-260-D, Cerro los Encantados, Monagas state, Garcia Formation, (DBG) of Late Aptian age; collected in grey marls, between glauconitic sandstones, with many small cryophyllic bivalves, whose suggested paleodepth was **90 – 160 meters.**

Comparisons: MONGIN & PEYBERNES (1981: 233) reported *Eucyclus octavius* (d'Orbigny) forma *doncieuxi*, as abundant in the Fontfroid Formation, France, of Early-Middle Albian age.

Family ***NODODELPHINULIDAE*** Cox in KNIGHT et alii., (1960).

According to KNIGHT et alii. (1960: *I* 308) its Biochron extends from Late Triassic to Late Cretaceous (Senonian) age. They also belong to the Taxa Group one, of SOHL (1987), and suggests a trans-temperate distribution.

Genus ***Metriomphalus*** Cossmann, 1916.

According to KNIGHT et alii. (1960: *I* 308), it has a Biochron of Late Triassic to Late Cretaceous (Senonian) age. The distribution area is Europe and Asia.

Metriomphalus schwarki Von der Osten, 1957.
Plate 26, figure 2 ;

- 1954 *Turbo sp. 1,* VON DER OSTEN, Bol. Geologia, (Caracas) 3(8): 141;
- 1957 *Metriomphalus schwarki* VON DER OSTEN, Jour. Paleont., 31(3) : 583, pl. 65, fig. 20 ;

Description : Shell of medium size, stout, conical, consisting offour convex worls ; sculpture of 19 spiral lines, nine being visible on the spire ; of the lines visible on the spire, firt fpour moderately weak, expanding in size, fifth and seventh strongest, giving the whorl shouldered appearence, sixth and eight weakest, ninth strong ; twelfth, seventeenth and eighteenth moderately strong, all others weak; spiral lines always narrower than interspaces. On base, growth-lines forming moderately strong costae, diminishing in strength upwards, causing serrations on stronger spiral line; umbilicus small, aperture unawailable on holotype; pleural angle 75º (VON DER OSTEN, 1957).

Dimensions: Height of body whorl, 11 mm, Width: 19 mm, Total height: 18 mm;

S.C.S. occurrence: MMH locality Su 90, western coast of Picuda Grande Island, basal limestones of Taguarumo Formation, (DAGM) of Late Hauterivian age. Also in locality MO-907, Punta Bordones, west from Cumana city, Sucre State, in the base of basal limestone of Taguarumo Formation, of Late Hauterivian age.

Comparisons: Bears some resemblance to "*Turbo?" belviderensis* STANTON (1947: 54-55, pl. 49, figs. 1, 2) – Kiowa shale Formation, Kansas, of Late Albian age,- but *M. schwarki* has a more complex spiral ornamentation. *Metriomphalus grasianus rotundata* (MONGIN, 1980: 111-112, pl. 1, fig. 6)- Frequent in Late Berriasian to Barremian age, Tunisia, - has whorls of rounded profile, and has no angularity developed. The French equivalent is *M. mantelli* (Leymerie, 1842, pl. 17, fig. 4) – Late Valanginian to Hauterivian of Western European Subprovince, and also Mexico,- is of smaller size, and more numerous spiral ribs, and lower pleural angle.

Metriomphalus taguarumensis (Von der Osten, 1957)
Plate 26, figure 4;

- 1954 *Turbo sp. 2,* VON DER OSTEN, Bol. Geol. (Caracas) 3(8): 170, pl. 10, fig. 2;
- 1957 *Metriomphalus taguarumensis* VON DER OSTEN, Jour. Paleont. 31(3) : 583-584, pl. 65, fig. 22 ;

Description : Shell small, stout, conical, consisting of four whorls; sutures slightly impressed; whorls almost rectangular, straight sided; sculpture of 14 serrate spiral lines, of which only six are visible on spire; strong third and sixth lines giving whorls a rectangular shape, first two and fourth and fifth lines moderately weak; other lines, visible on convex base of the shell, moderately strong; spiral lines and intercostal areas equal in width; serrations almost twice as wide as spiral lines, those on third and sixth lines almost spinose; umbilicus small, aperture ovate; inner lip thick, reflexed over umbilicus. Pleural angle, 70º (VON DER OSTEN, 1957, op. cit.).

Dimension: Total height: 12 mm, Width: 10 mm, Height of body whorl: 6 mm.

S.C.S. occurrences: Locality MMH Su-130, Punta Afuera, Caracas del Oeste Island, Lower Taguarumo Formation (DAGM) of Late Hauterivian age.

Comparisons: Similar to *M. chihuahuensis* (Böse, 1910: 139, pl. 30, figs. 2-4) - Cerro de Muleros, upper Fredericksburg Group, of the *Oxytropidoceras chihuahuense* Zone, of Late Albian age,- which has three prominent, revolving ridges and the whorls are squarish in section.

Genus ***Helicacanthus*** Dacqué, in Wenz, 1938.

According to KNIGHT et alii., (1960 *I* 308) with a distribution inside Europe, has a Biochron of Late Jurassic to Early Cretaceous. Here we add citations from Maghrebian and South Caribbean Subprovinces.

Helicacanthus maestrei (Verneuil-Lorière, 1868)
Plate 34, figure 26;

- 1868 *Trochus Maestrei* VERNEUIL-LORIERE, Mon. P.P. L. Espagne, #7 :23, pl. 2, fig. 9 ;
- 1949 *Trochus Maestrei* V.-L. BATALLER, Sinopsis, #8(2) : 22 ;
- 1953 *Trochus cf. maestrei* V.-L. ROYO Y GOMEZ: Acta Cient. Venez.,4: 150;

Occurrences: Collected from Utrillas (Teruel, Maestrazgo Basin, Spain) in the Alacon limestone

Formation of Late Barremian-Early Aptian age (CANEROT, 1982).

S.C.S. occurrences: ROYO & GOMEZ (1953, op. cit.) collected it in the sideritic red marls, typical of Taguarumo Formation, of Eastern Venezuela, of Barremian age. It was associated to *Mediterraneotrigonia, Rutitrigonia and Pterotrigonia* and many encrusting serpulids, indicating a saline environment with abundant leptopel in the sea water.

Helicacanthus pellicoi (Verneuil-Lorière, 1868).

- 1868 *Trochus pellicoi* VERNEUIL-LORIÈRE, Mon. P. P. L. Espagne, #7 : 24, pl. 2, fig. 10 ;

Diagnosis : Shell with the same height as width (8 mm), stout, and 4-5 convex whorls. Each whorl is ornated with 3 spiral cords, 4 on the last one; growth striae very fine; aperture is rounded, slightly quadrangular, apical angle, 74º.

Occurrence: Utrillas, in Alacon limestone formation, Maestrazgo Basin, Spain, of Late Barremian –Early Bedoulian age (CANEROT, 1982).

S.C.S. occurrence: Locality MO-896, west of Patiño inlet, top of Taguarumo Formation, Sucre state, (DAGM), of Late Barremian age. Other localities in the same area, are: MO-905, MO-884, MO-888, MO-883, all belonging to Lope member of Taguarumo Formation, of Late Barremian-Early Aptian age.

Paleoecology: In all the cited localities, *H. pellicoi* was a common species: many disarticulated bivalvia, in the same sample, suggests the predator activity.

Genus ***Nododelphinula*** Cossmann, 1916.

With a Biochron extended from Middle Jurassic (Bajocian) to Late Cretaceous (Maastrichtian), this genus had a fair distribution in tropical subprovinces of Gondwana Province. Its migration to West European, Apulian and Balkanic Subprovinces, is related to saline water presence.

Nododelphinula munita (Forbes, 1845)
Plate 28, figure 4;

- 1845 *Turbo munitus* FORBES: 348, pl. 4, fig. 2;
- 1858 *Turbo munitus* F., PICTET & RENEVIER, Mat. Paleont. Suisse: 38, pl. 4, figs. 1, 2 ;
- 1893 *Delphinula munita* (F.) MAYER-EYMAR : 16, 17, pl. 2, fig. 2;
- 1912 *Turbo? munitus* F., PERVINQUIÈRE, Pal. Tunisienne, : 5 ;
- 1972 *Nododelphinula munita (F.)* TAVANI : 20-21, Pl. 2, figs. 13, 14;
- 1974 *Paraturbo munitus* (F.) DIMITROVA, Foss. Cret. Bulgaria: 17, pl. 1, fig. 8;

Occurrence: The origination of this species was in the Hauterivian of Somalia, and migrating later to the West European Subprovince, and all the Tropical subprovinces of Gondwana Province, until its extinction, during Aptian times.

S.C.S. occurrence: Locality MO-905, cliff northwest of Puerto Escondido inlet, Sucre State, Lope Member of Taguarumo Formation, (DAGM) of Late Barremian age.

Family ***Ampullariidae*** Gray, 1847.
Subfamily ***Ampullariinae*** Gray, 1847.

This taxon became very favored in the brackish-water shallow shelf environments, where the algae (calcareous and non-calcareous) dominated the sessile flora. Unfortunately, the brackish waters contributed to the dissolution of the fragile and thin aragonitic shells, so most of our species are insecure determinations, because the apertural and sutural features are not preserved. I consider them carnivorous predators of Bivalvia-banks.

Genus ***Ampullospira*** Harris, 1897.
(=*?Prisconatica* Gabb, 1877).

According to PCHELINTSEV (1953: 44), has a Biochron of Triassic to Neogene (Miocene).

Ampullospira bulimoides (Deshayes. 1842).
Plate 34, figures 8, 9;

- 1842 *Ampullaria? bulimoides* DESHAYES in LEYMERIE, Mém. Soc. Geol. Fr. 1(5): 12, pl. 16, fig. 9;
- 1842-43 *Natica bulimoides* (D.) d'ORBIGNY: 153, pl. 172, figs. 2-3;
- 1878 *Natica allaudiensis* MATHERON, Rech. Paleont. 2º partie, pl. B-17, fig. 1;
- 1946 *Natica bulimoides* (D- in L.) CHARLES, Bull. Mus.H.n. Marseille, 6(3-4): 119-120;
- 1948 *Ampullina bulimoides* (d'O.) TAVANI, Palñeont.Italica, 45 : 20 ;
- 1974 *Ampullospira bulimoides* (D.) DIMITROVA, Foss. Cret. Bulgaria 4b: 42, pl. 16, fig. 1;

Occurrence: *A. bulimoides* (D.) has a Biochron extended from Valanginian to Early Aptian, distributed in Western European, Apulian and Balkanic Subprovinces.

S.C.S. occurrence: Locality VG-552-A, road Río Morocoto-Ojo de Agua-Caituco, Sucre state, (DGC) Taguarumo Formation, of Barremian age. It was associated to many echinoids and bivalves, in a fossiliferous limestone.

Ampullospira indurata (Conrad, 1852).

Plate 27, figures 2, 3;

- 1852 *Chenopus induratus* CONRAD in LYNCH, Palestine expedition: 220, pl. 11, fig. 69;
- 1884 ¿*Tylostoma depressum* P. & C., HAMLIN, M.M.c. Z.H.#10(3): 21, plate 1, figure 7;(not Pictet & Campiche, 1862)
- 1938 *Tylostoma indurata* (C.) BLANCKENHORN: 113;
- 1939 *Ampullina? Indurata* (C.) DELPEY, Gasteropoda Mésozoiques, :91;

Diagnosis: Fusiform; whorls 5 or 6, those of the spire somewhat flattened laterlly; spire conical; body whorl ventricose, very large in proportion to the spire, regularly rounded inferiorly (CONRAD op.cit.).

Dimensions: Height: 63 mm (originally about 70 mm); width: 53 mm.

Occurrence: Collected originally in Aleih, Bhamdûn, Liban, in Albian sediments. Also in the Early Cenomanian of Transjordania and Syria.

S.C.S. occurrence: Locality MO-896, La Cueva Inlet, Borracha Island, (DAGM) upper Borracha Formation, of Early Albian age. Not scarce.

Ampullospira sharpei (Landerer, 1872)
Plate 25, figure 26;

- 1872 *Natica Sharpei* LANDERER, Piso Aptico…:18, pl. 1, figs. 3, 4;
- 1872 *Natica Coll Albae* LANDERER, Piso Aptico….:23, pl. 4, figs. 16, 17;
- 1872 *Natica Fitae* LANDERER, Piso Aptico….:23, pl. 4, fig. 15;
- 1872 *Natica Larteti* LANDERER, Piso Aptico….24, pl. 4, fig. 18; (pelomorphic deformation)
- 1872 *Natica pii noni* LANDERER, Piso Aptico….19, pl. 2, fig. 7;
- 1872 *Natica Pyriformis* LANDERER, Piso Aptico….22, pl. 3, figs. 13, 14;(ditto)
- 1949 *Natica Sharpei* (L.) BATALLER, Sinopsis Fos. Cret., #8(2): 55-56;
- 1979 *Ampullina sharpei* L., S. CALZADA, :447;

Occurrence: Arena de Utrillas Formation, Maestrazgo Basin, Spain of Middle-Late Albian age, (CANEROT, 1982), and not Aptian, as was supposed by LANDERER (op. cit.). It is very common in the brackish-water facies, where the pelomorphically deformed casts were considered different species.

S.C.S. occurrence: Locality MC-327-A, Río Caripe, Monagas state, (DBG) in the Caripito member of the Chimana Formation, of Early-Middle Albian age. In western Venezuela, it was cited from the Píche member of the Apón Formation, Perijá, of Early Albian age (DUSNBURY in KEY, 1960: 523). Locally present in upper carbonatic member of Peñas Altas Formation, of Early Albian age (HA-4511, Cerro Los Platones, Trujillo state) in a limestone with many *Gervilleia.*

Ampullospira syriaca (Conrad, 1852).
Plate 27, figure 17;

- 1852 *Natica Syriaca* CONRAD, in LYNCH, Palestine Expedition…:220, pl. 12, fig. 70;
- 1939 *Ampullina syriaca* (C.) DELPEY, Gasteropoda of Mesoz.,: 90;

Occurrence: Originally collected from Mukhtârah, Jezzin, el-Judeideh, esh-Shûf and Mount Lebanon, Lebanon, in Late Albian limestones.

Diagnosis: Cast ovate, ventricose, whorls four to five, rapidly diminishing towards the apex; spire very short; base umbilicated? Aperture is acutely subovate. A number of this large species occurs, often so deformed, as it is hard to be recongnised (CONRAD, op. cit.).

Dimensions: Height: (incomplete) 72,6 mm, Width: 61 mm (plate 12, fig. 70).

S.C.S. occurrence: Locality MO-890, Punta Manare, Sucre State, Lower Borracha Formation, (DAGM), of Late Aptian age. It is common in the marl interbeds of the massive rudist-limestones, with many disarticulated bivalvia.

Subfamily ***Ampullininae*** ?
Genus ***Pictavia*** Cossmann, 1925.

According to WENZ (1938), the Biochron of this genus extends from Late Triassic (Rhaetian) to Late Jurassic (Portlandian), and was reported from Europe, India, and the Sunda islands.

Pictavia pungens (Sowerby, 1836).
Plate 27, figures 2, 5;

- 1957 *Lunatia cragini* S., VON DER OSTEN, Jour. Paleont. 31(3) :585, pl. 65, fig. 13 ; (non STANTON, 1947 : 65, pl. 52, figs. 1-3)
-

Occurrence : *P. pungens* (Sow.) originated in the Valanginian-Hauterivian of Paris Basin, France, and

extended to all West European, Apulian, Balkanic Subrovinces by Aptian times: and the tropical subprovinces of Gondwana Province including Gulf-Atlantic coast subprovince during Albian times. It became extinct during Cenomanian, having reached South India.

S.C.S. occurrence: MMH locality Su-90, west coast of Picuda Grande Island, (DAGM) base of Taguarumo Formation, of Hauterivian age (VON DER OSTEN, op. cit.). Also found at MO-890, lower Borracha Formation, of Late Aptian age. At locality MO-884, west side of Patiño inlet, Sucre state, in Lope Member of Taguarumo Formation, of Early Aptian age, habitally in Bivalvia-rich sideritic siltstones.

Genus ***Ampullinopsis*** Conrad, 1865.

The Biochron of *Ampullinopsis* extends from Late Jurassic (Kimmeridgian) to Late Cretaceous (Senonian). This genus of predator habits, evolved as an adaptation to the salinization/hypersalinization of the marginal seas of Western Tethys Ocean; it belongs to the Taxa Group One, as was proposed by SOHL (1987: 1102).

Ampullinopsis hemisphaerica (Roemer, 1836)

- 1836 *Nerita hemisphaerica* ROEMER, Nord. Oolith.: 156, pl. 10, fig. 7;
- 1850 *Natica hemisphaerica* (R.) d'ORBIGNY, Prodrome Paleont. #2: 6, etage 14ª n.93;
- 1869 *Natica hemiphaerica* R., GEMMELLARO, Geol. G., pt. 2: 55, pl. 10, figs. 1, 2;
- 1861-64 *Natica hemisphaerica* R., THURMANN & ETALLON, Lethaea Bruntr. 118, pl. 10, fig. 75;
- 1977 *¿"Natica" sp. Cf. N. hemisphaerica* R., ALENCASTER, U.N.A.Mex., IG31(2): 162, fig. 17;

Occurrence: Originally reported from Vendhausen, Germany, of Ryazanian age, from the North European Province. Many shells collected at Billiemi, Palermo, Sicilia, named *Natica subhemisphaerica* GEMMELLARO (1968-76: 92) were considered as Tithonian age, but they are associated to Berriasian Nerineidae. The Sicilian shells,had a somewhat more prominent spire. Also collected in the San Ricardo Formation, Chiapas, Mexico, of Berriasian age.

Ampullinopsis claveli new species, MACSOTAY.
Plate 42, figure 11;

Description: Globular shell, with a very short spire, the last whorl well developed. Penultimate whorl convexe, well separated by deep suture. Surface ornated by growth lines, weakly marked. Last whorl wide, aperture open anteriorly and sinuose posteriorly.

Dimensions: The Holotype, UCVMG/IO-1956, Height (incomplete): 45,9 mm, Width: 43,8 mm; besides, four additional shells, with pelomorphic deformation.

Etymology: I have the honor of dedicating this species to a condecorated parachutiste de la *Légion Etrangère,* and Paleontologist Bernard CLAVEL, whose PhD thesis on Eocretaceous Echinoida of Western European Subprovince, contributed enormously to the comprehension de la Biostratigraphy of the Tethys Ocean.

S.C.S. occurrence: Locality HA-4440, Jabón, trail to San Pedro, Trujillo state, lower carbonatic member of Peñas Altas Formation, of Early Aptian age (ARNAUD et alii., 1999, fig. 18). Associated to many spatangid echinoida.

Comparisons: By the size of the last whorl, this species resembles *Ampullinopsis bruguierii* (Matheron, 1842, Cath. Meth.,: 302, pl. 39, fig. 1)- Hauterivian d'Allauch, France, and Bulgaria,- and *A. helvetica* (PICTET & CAMPICHE, 1863, Paleont. Suisse, #2: 378-379, pl. 75, fig. 3) – Valanginian, Calcaire Roux Formation, Switzerland,- but these shells exhibit a well-defined umbilicus. *A. claveli* is alike, but more constricted dorso-ventrally than *A. cureti* (Cossmann, 1916), a Barremian-Aptian species.

Ampullinopsis cureti (Cossmann, 1916)
Plate 34, figures 10, 13;

- 1916 *Ampullina cureti* COSSMANN in BRUN, Paleont. #51: 22, pl. 5, figs. 15, 16;
- 1918 *Ampullina Cureti* COSSMANN, Bull. Soc. Geol. France, 10(6): 380-381, pl. 11, figs. 32-33;
- 1980-b *Tylostoma cureti* (C.) MACSOTAY: 38;
- 1974 *Tylostoma cureti* (C.) DIMITROVA, Foss. Bulgarie, 4b : 39-40, pl. 13, fig. 1 ;
- 1878 *Natica patulaeformis* FRAAS, W. n. Jahrb., # 34: 322, pl. 8, fig. 7;

Diagnosis : *A. cureti* (C.) is a globulous, robust, thick shelled gastropod, with a short, conoidal spire, and whose columellar callosity is well spread all along the base, covering completely all possible umbilicus.

Dimensions: The type from Orgon, France, measured of height: 40 mm, width: 38 mm, and thickness: 28 – 30 mm. Gerontic individuals from the same locality, reached 60 or 70 mm of height (COSSMANN, 1918).

Occurrence: *A. cureti* (C.) has a Biochron of Barremian to Aptian, in Western Europan, Balkanic and Syrian Subprovinces. In 'Abeih, Liban, in the upper gastropod-zone, of the Trigonia-sandstone, of Aptian age.

S.C.S. occurrence: Locality MO-2127, road from Carora to Curarigua, in Tibú Formation, in Atarigua para-autochthon, of Late Barremian-Early Aptian age. It is common in *Toucasia* beds, where it would be a predator species.

Ampullinopsis desectus (Kollmann, 1978)
Plate 48, figure 9;

- 1978 *Ampullinopsis desectus* KOLLMANN, A. N. M. Wien, #81: 176-177, pl. 3, figs. 24-27;

Occurrences: Lösensteiner Formation, Holleiten graben, Austria, (Apulian Subprovince) of Middle Albian age.

S.C.S.occurrence: Locality MC-273-E, north of Cerro Piedra de Rayo, Monagas state, El cantil Formation, (DBG) of Late Aptian to Early Albian age. Common at several limestone horizons.

Dimensions: It measures, of height: 35 mm, of width: 25 mm (pl. 48, fig. 9).

Ampullinopsis cf. gardonensis (Cossmann, 1916).
Plate 23, figure 15;

- Cf. 1916 *Ampullospira gardonensis* COSSMANN in BRUN, Paleontogr. #51: 21-22, pl. 2, fig. 11;

Description: Casts presenting high resemblance to *A. gardonensis* (C.), - Angustines, Urgonian limestone, France, of Barremian age. Globular-ovoidal shape, higher than wide, spire not preserved in our sample; last whorl ventricose, equals 6/7 of the total height; sutures linear, devoid of any shelf; outer lip is regularly ovate, until the imperforatyed base; aperture semi-lunar, labre thin, slightly inclined; columella excavated, smooth and callous. Our difference with the nominal species, is the presence of a flat varix , extended from the suture to the columelar callus. It is present in both of the collected casts.

Dimensions: Height: 57 mm, Width:40 mm and Thickness: 32 mm (COSSMANN, op. cit.). Height: 57,4 (incomplete) mm, Width: 49,0 mm (plate 23, fig. 5).

Occurrence: Angustines, Urgonian limestone Formation, France, of Barremian age.

S.C.S. occurrence: Locality MO-892, northwest of Puerto Escondido inlet, Sucre state, in Taguarumo Formation, of Barremian age. Collected in a sideritic limestone, together with *Trochaceton (Neocylindrites) spp.*

Comparisons: *A. cf. gardonensis* (C.) is very much alike "*Ampullina" cf. prophetica* Zittel, (YIN, 1931, Travaux Lab. Geol. Lyon #18(14): 73, pl. 7, figs. 16, 17) – Bois de Valène, Bas Languedoc, France, of Berriasian age,- which is a true *Ampullinopsis,* but is also devoid of any varix.

Genus/Subgenus ***Tylostoma (Tylostoma)*** Sharpe, 1849; (=*Varigera* d'Orbigny, 1850 = *Pseudotylostoma*

Von Ihering, 1907). According to DELPEY, (1939: Gastr. Mesoz: 76-77) has a Biochron extended from Late Jurassic (Kimmeridgian) to Late Cretaceous (Senonian). Its distribution includes all the Tropical subprovinces of Gondwana Province, Western European, Apulian, Balkanic, Japanese-East Asian Subprovinces, all South American subprovinces (see PCELINTSEV, 1953, FIG. 3). Teoretically, this thermophyllic genus, showed its dominant preference for Saline Marine waters in the Syrian and Maghrebian Subprovinces, as ended up migrating to Patagonian Subprovince, during Senonian times, just before extinction. *Tylostoma* developed very thin shells, which rarerly are preserved. During Albian times, - at the climatic optimum,- attained big sizes, of 100 mm of height, or more. In my files, they are well represented:

1. *T. aguilerai* Alencaster, Barremian
2. *T. allaudiensis* (Coquand) Matheron Barremian,
3. *T. brasilianum* Maury, Albian, Turonian,
4. *T. chihuahuense* Böse, Albian
5. *T. cf. chihuahuense* Böse, Albian, middle-late,
6. *T. czabalayae* n. sp., Macsotay Barremian
7. *T. depressum* Pictet & Campiche, Barremian-middle Albian,
8. *T. intermedium* Choffat, Albian,
9. *T. jaworskii* Weaver, Neocomian,
10. *T. kentense* Stanton, Albian-Cenomanian,
11. *T. magharensis* Abbass, Barremian,
12. *T. materinum* White, Aptian, late,
13. *T. matheroni* (Charles), Barremian,
14. *T. mutabilis* White, Albian
15. *T. regina* Cragin, Albian, early,
16. *T. ricardi* (Morrison & De la Torre) Albian, early,

17. *T. syriacum* (Conrad) Albian, early,
18. *T. torrubiae* Coquand (type of genus) Turonian,
19. *T. triplica* (Whitfield) Albian, early,
20. *T. tumidum* Shumard Albian, early
21. *T. whitei* Von Ihering Albian

According to DELPEY (1942) the *Tylostoma* are very variable shells, whose characteristics are difficult to establish. The elongation of the whorl, the number of varices, the extension of columellar margin, the subsutural shelf, can be variable in most species. The peristome at the base, and the dimensions are the most reliable specifical characters. I add the fact of the pelomorphically deformed shells (See Pl. 52, fig. 4).

Tylostoma (Tylostoma) allaudiensis (Coquand) Matheron, 1878;
Plate 26, figure 6;

- 1878 *Varigera allaudiensis* Coquand in coll. MATHERON, pl. B-17;
- 1957 *Tylostoma* sp. n., VON DER OSTEN, Jour. Paleont. 31(3) : 585, pl. 65, fig. 3 ;

Description : Shell of moderate size, globose, consisting of four whorls ; sutures deeply impressed ; whorls smooth, convex, with strong varices at interval about 190º ; spire compressed only 1/7th of the height of the shell; body whorl strawberry-shaped, with wide, rounded, posterior shoulder; varices well marked; umbilicus moderately large; outer lip greatly expanded; aperture pear-shaped, narrow posteriorly; apical angle, 125º (VON DER OSTEN, op. cit.).

Dimensions: Height: 21 mm, width: 17 mm, Height of body whorl: 18 mm.

Occurrence: Sampled at Orgon, South France, of Barremian age.

S.C.S. occurrence: MMH locality Su-92, west coast of Picuda Grande Island, basal limestone of Taguarumo Formation (DAGM), of Late Hauterivian age. Also found in Lower Borracha Formation, of Aptian age, several casts, not in place.

Tylostoma (Tylostoma) brasilianum (Maury, 1936)
Plate 50, figures 5, 6;

- 1887 *Tylostoma globosum* White, Archives Mus. Nac. Rio de Janeiro, #7:190, pl. 17, fig. 10; (not SHARPE, 1849)
- 1887 *Natica gabonensis* MEUNIER, Bol. Soc. Geol. France, 3º ser., #16: 63, pl. 1, fig. 7;
- 1935 *Tylostoma brasilianum* MAURY, Mon. Soc. Geol. Min. Brasil, #4: 533, pl. 23,fig. 5;

Occurrence: Collected originally at Lastro, near Maroim, Sergipe, Algodoes Formation, Brazil, of Early Albian age; and Gabon, East Africa, of Albian age. Apodí Formation, Brazil, of Turonian age.

Diagnosis: Cast measuring 147 mm of height (incomplete), and 123 mm of maximum diameter; ovoidal and ventricose; spire high, preserved whorls with strong and flat shoulder; body whorl is big, globular, with convex shape anteriorly (MEUNIER, op. cit.). The Brazilian cast, with 6 whorls preserved, measures, 88 mm of height.

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Mochima area, Sucre State, upper Borracha Formation, (DAGM) of Early Albian age.

Tylostoma (Tylostoma) chihuahuense Böse, 1910.

- 1910 *Tylostoma Chihuahuense* Böse, Inst. Geol. Mex., Bol. 25: 144, pl. 30, fig. 13, pl. 31, figs. 1, 2;
- 1912 *Amauropsis? guariquenensis* MAURY, Acad. Nat. Sci. Philad. Jour. 2(15): 102, pl. 13, fig. 10;
- 1960 *Tylostoma chihuahuense* B., PERKINS, Geol. Soc. Amer. 83: 88, pl. 28, figs. 13, 14;
- 1995 *Tylostoma chihuahuense* B., VIVAS & MACSOTAY: 136;
-

Occurrences: El Paso, Cerro de Muleros, Chihuahua, upper Aurora limestone, Coahuila, México, and Goodland limestone in Texas, of Middle Albian age.

S.C.S. occurrence: Locality VG-465, Pico García, Monagas state, (DGC) Guácharo Member of El Cantil Formation, of Early Albian age. Two casts, with portions of the shell replaced by black sparite. The incomplete cast illustrated by MAURY (op. cit.) measured 50 mm of height, alike to aur casts from the Guácharo limestones.

Tylostoma (Tylostoma) cf. chihuahuense Böse, 1910.
Plate 52, figure 4;

S.C.S. occurrence: Locality HA-4348, La Urbina norte section, Trujillo State, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 33), of Late Albian age. It is associated to *Neithea aethiopica,* and other thick-shelled bivalvia. The pelomorphic deformation affected all three casts of this taxon.

Tylostoma (Tylostoma) czabalayae **new species,** Macsotay.
Plate 23, figures 1, 2, 5*;*

Description: Casts of a globular shell, with a low spire, composed of 2 or 3 whorls, of smooth, inflated

profiles; narrow, low varices present in antepenultimate whorls only; suture incised but not canaliculated. Body whorl, seems to have been formed obliquely to the main axis of the shell, so it hides completely the former whorls (plate 23, fig. 2). The aperture is regular, alike the *T. globosum* SHARPE, 1849, the type species of *Tylostoma.* No peristome is observed on any of the eight casts.

Dimensions: Height: 85 mm, Width: 85 mm, Holotype, (pl. 23, fig. 2)UCVMG/IO-1949; Height: 83,5 mm, width: 80,4 mm(incomplete).

Etymology: I have the honor of dedicating this new species, to Paleontologist Dr. Lenke Benkö-Czabalay, - of Eötvös-Lóránt University, Departement of Paleontology, Természet Tudományi Múzeum, Budapest, Hungary, for her most valuable contributions in Cretaceous Molluska.

S.C.S. occurrence: Locality MO-5623, hill south of Nueva Colombia, Sucre State, Taguarumo Formation, (DAGM) of Barremian age. Collected in soft, grey marls, associated to *Palorbitolina lenticularis,* and *Amphitriscoelus waringi* (H. & H.)(ARNAUD et alii., 2000).

Paleoecology: The phenomena observable in all the specimens of *T. czabalayae* n. sp., is the decoiling angle of the last whorl, with respect to the vertical axis of the former whorls of the shell. This is observable in many specimens of *Tylostoma globosum:* (MALLADA, 1887, pl. 18, fig. 5) – Alacon Formation, Barremo-Aptian of Spain,- (NEWTON, 1916, pl. 1, fig. 19) – gypsum beds by Catumbella, Angola, of Late Albian age. *T. ovale* Pcelintsev (1953, pl. 4, figs. 5a, 5b) – Transcaucasia, Early Turonian. *T. ovatum* Sharpe (MALLADA, 1887, pl. 18, fig. 6) – Gargallo? Utrillas sandstone Formation, Late Albian, Spain. *T. pedernalis* HILL (not Roemer) (1893, pl. 6, fig. 2), -Glen Rose Formation, Texas, of Early Albian age, - but also cited from the "Neocomian of Mexico, Venezuela, Bogotá (?) on the central Pacific coat of South America." >>>My personal opinion on these anomalous decoiling angle, is the result of the elevation of the pycnocline with hypersaline waters on the shelf, during the growth of the gastropod.

Tylostoma (Tylostoma) depressum Pictet & Campiche, 1863.
Plate 24, figure 6;

- 1863 *Tylostoma depressum* PICTET & CAMPICHE, Paleont. Suisse #2: 355, pl. 73, figs. 10, 11 ;
- 1872 *Natica Lamberti* LANDERER, Monogr. Paleont. Aptico : 20, pl. 3, fig.9 ;
- 1939 *Tylostoma depressum* P. & C., DELPEY, Gastrop. Mesozoique: 80, fig. 54;
- 1974 *Tylostoma depressum* (P. & C.) DIMITROVA, Foss. Mesoz. Bulgarie, 4b: 39, pl. 13, fig. 2;
- 1980-a *Tylostoma aff. depressum* P. & C., MACSOTAY: 254;

Occurrence: Originally reported from the Calcaire jaune Urgonien, Switzerland, of Barremian age; also in the Hauterivian of jura mts. In Mirambell marl Formation, in Maestrazgo Basin, Spain, of Hauterivian-Early Barremian age (CANEROT, 1982). In Liban, Etiopia and Bulgaria, collected in pre-Aptian horizons.

S.C.S. occurrence: Locality MC-346-A, north of Catuaro town, Sucre State, Taguarumo Formation, and Tibú Formation, Perijá of Barremian age both. One cast with affinity has been collected from Píche Member of Apón Formation, Perijá, of Early Albian age.

Tylostoma (Tylostoma) intermedium Choffat, 1906.
Plate 50, figure 7, 9;

- 1839 *Rostellaria sp.* VON BUCH, Ges. Schriften #4 :529-531, pl. 31, fig. 27 ;
- 1906 *Tylostoma intermedium* CHOFFAT, Jour. Conchyliologie, 54(8): 39, pl. 2, figs. 5, 6;

Occurrence: Estoril, Lisboa, frequent in limestones with *Ammonites uhligi,* Vraconian, Late Albian age. Also in the limestones with *Polyconites subverneuili,* Cenomanian, also in Portugal.

S.C.S. occurrence: Locality HA-4428, La Pastora-Jabon road, Trujillo state, upper carbonatic member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, fig. 26). This is the first gastropod-rich bed, above the *Mesorbitolina texana-M. ovalis-M. pervia* horizon. VON BUCH (op. cit.) illustrated a cast of a ventricose gastropod, which seems to be the only *Tylostoma* cited from the Cretaceous of that country. It could have been collected in the Tablazo limestone of the Villeta Group, of Albian? age.

Tylostoma (Tylostoma) kentense (Stanton, 1947).
Plate 60,figure 9;

- 1947 *Tylostoma kentense* STANTON, U.S.Geol. Surv., Prof. p. 211: 69, pl. 52, figs. 4, 5, 10;

Description: Shell large, rather slender, consisting of 7 or 8 slightly convex worls; apical angle about 45º; suture inconspicuous on shell, channeled on molds, but not so prominent as in *T. tumidum* Shumard; last whorl constituting about half of th height of the

shell; surface smooth. Internal varices indicated by small and inconspicuous grooves; aperture somewhat oblique, rather narrow auriform, acute above, broader and rpounded below; inner lip with a moderately heavy callus.

Dimensions: Height: (incomplete) 77 mm, width:50 mm, height of the aperture: 43 mm, breadth of aperture: 20 mm (STANTON, op. cit.). Height (only last and penultimate whorl) 70 mm, width: 44 mm (plate 60, fig. 9). Complete shell could have reached 85 mm of height.

Ocurrence: Washita Group, common at various localities in Texas, of Late Albian age.

S.C.S. occurrence: Locality MO-2478, Rio Yasa, Perijá area, Maraca Formation, of Late Albian to Early Cenomanian age.

Tylostoma (Tylostoma) magharensis Abbass, 1962. Plate 24, figure 4;

- 1963 *Tylostoma magharensis* ABBASS, Geol. Surv. M.R.D., Pal. Ser. Mon.#2: 90-91, pl. 10, figs. 1, 6-9, 9a ;

Description : Cast of small to medium size and is turbinate ; apical angle of 70 – 90º, three preserved whorls the outline of which is slightly convex, with a narrow posterior shoulder; the suture is furrowed; the body whorl forms the greater part of the shell. Its posterior side is continuous with the outline of the spire, and its base is evenly rounded. Aperture is semilunar with a broadly rounded anterior margin which joins the columellar lip in an even curve. The shell (partially preserved) surface has fine prosocline growth-threads, crossed by fine spiral threads. Marked varices appear at intervals of half a whorl, thus forming two continuous axial ridges descending from the apex.

Occurrences: Maghara area, Sinai Peninsula, Egypt, of Aptian age.

S.C.S. occurrences: Locality VG-276, Cruz Verde, caserío La Paloma, Edo. Sucre, Chuparipal Formation, (DEP) of Late Barremian age, common; also in Taguarumo Formation, Eastern outcrops, associated to *Amphitriscoelus waringi* (Harris & Hodson).

Tylostoma (Tylostoma) materinum White, 1887. Plate 38, figure 4;

- 1887 *Tylostoma materinum* WHITE, Arch. M. N. Rio de Janeiro, #7: 189, pl. 17, fig. 1;
- 1930 *Tylostoma cf. materinum* W., MAURY, Monog. S.G. Min. Brasil,#8: 201, pl. 10, fig. 5;
- 1936 *Tylostoma materinum* W., MAURY, Monog. Serv.Geol. Min. Brasil, #11: 197, pl. 15, fig. 2; pl. 16, fig. 1;
- 1955 *Tylostoma (T.) cf. T. (T.) materinum* W., ALLISON, J. Paleont. 29(3): 428, pl. 44, fig. 16;

Diagnosis: Cast very large, spire elevated, whorls broadly convex; at maturity the aperture extends upwards fully half way across the adjacent whorl. Height: 150 mm, width of the last whorl, 80 mm.

Occurrence: Pedreiras de Gambaroba, Joao Pereira, and Aroeira, Maroim, Brazil, Algodoes Fomation of Middle Albian age. Also in Alisitos Formation, Baja California, of Albian age. It survives until Gramame Formation, of north Paraiba, Brazil, of Maastrichtian age.

S.C.S. occurrence: Locality FA-58-A, quebrada Agua Blanca, Monagas state, lower El Cantil Formation, (DBG) of Late Aptian age.

Comparisons: This *Tylostoma* resembles large specimens of *T. chihuahuensis* Böse, and *T. elevatum* Shumard, from the Albian of Mexico and Texas, respectively, but differs in apertural details.

Tylostoma (Tylostoma) mutabilis Gabb, 1869.

- 1869 *Tylostoma mutabilis* GABB, Geol. Surv. Calif., Paleont. #2: 261-262, pl. 35, figs. 6a-c;
- 1877 *Tylostoma mutabilis* G., GABB, Acad. Nat. Sci. Philadelphia, Jour. #8: 280, pl. 40, fig. 4, 4a;
- 1955 *Tylostoma (Tylostoma) mutabilis* G., ALLISON, Jour. Paleont. 29(3): 428, pl. 44, fig. 8 ;

Diagnosis : Globose cast, spire high, whorls six or seven ; body whorl most convex above the middle; varices oblique, large; aperture elongate-ovate; surface unknown.

Occurrence: Arivechi, Sonora, Mexico, of Middle Albian age; also in Walnut Formation and Fredericksburg Group, Texas, of Middle Albian age. In Baja California, Mexico, in Alisitos Formation, of Albian age. In Perú, reported abundant from Hacienda de Uchupata, Huari Province, associated to *Echinus bolivari* Gabb, in Chulec Formation, of Middle Albian age (BENAVIDES, 1956)

S.C.S. occurrence: Locality MC-66-A, Quebrada La Zumbadora, Monagas state, upper El Cantil Formation, of Early Albian age.

Discussion: *T. miyakoensis* NAGAO (1934, :247-248, pl. 34, figs. 1-3, 6, 7, pl. 39, fig. 3) – from the

Mesorbitolina sandstone, Hiraiga and Moshi Formation, Japan, of Aptian-Albian age,- is very similar to *T. mutabilis.*

Tylostoma (Tylostoma) regina *(Cragin, 1895)*

- 1893 *Buccinatrix regina* CRAGIN, Texas Geol. Survey, 4th Ann.Rept.: 220, pl. 43;
- 1936 Gastropoda genus and species indet. JAWORSKI, B. S. N. J. M. B.#76: 537;
- 1947 *Tylostoma regina* (Cr.) STANTON, U.S.Geol. Surv.,Prof. paper 211: 69, pl. 54, figs. 1-4;

Diagnosis: Cast large, elongate, consisting of 6 or 7 rather rapidly increasing whorls; apical angle varying from 50º to 60º; spire elevated, about equal height of the body whorl; sutures deeply channeled; whorls regularly rounded, rather convex; well-preseved casts usually show 2 irregular, opposite rows of depressions formed by the internal varices.

Dimensions: Height: 98 mm, maximum width: 64 mm, height of aperture: 52 mm, width of the aperture: 27 mm.

Occurrence: Glen Rose Formation, Texas, Of Early Albian age: widespread and frequent. In Mexico, reported from Aurora Formation, of Late Aptian-Early Albian age.

S.C.S. occurrence: Locality VG-465, Pico Garcia, Monagas state, El Cantil Formation, (DBG), of Late Aptian-early Albian age. In Colombia, in dept. Sur de Santander, in El Tablazo Formation, of Late Albian to Early Albian age (JAWORSKI, 1936: 537).

Comparisons: The most closely related Albian form, is *T. tumidum* Shumard but our species is of larger size, generally more slender form, and different shape of the aperture.

Tylostoma (Tylostoma) ricardi (Morrison & De La Torre, 1983).
Plate 47, figure 6; plate 49, fig. 25 ;

- 1983 *Bursa (Bufonaria) ricardi* MORRISON & DE LA TORRE, Contrib. Geol. Cuba oriental: 263-265, pl. 9, figs. 1,2, 3;
- 1973 *Tylostoma cfr. depressum P.& C.* GORTANI, A. N. d.Lincei, #4: 72-73, pl. 14, figs. 10, 11;(non PICTET & CAMPICHE, 1863).
- ?1927a *Tylostoma subnaticoide* PCELINTSEV, pl. 7, fig. 10;

Description: Shell of big size, globular, conical and dorso-ventrally compressed; matrix-filled aperture with fragmented peristome; whorls with a well marked shoulder, biserial varices are present in most whorls, separated by 180º. Apical angle: about 90º.

Dimensions: Height: 64,2 mm; Width: 53,7 mm; Thickness: 41,1 mm. Aperture, Lenght: 38,4 mm, Width: 29,5 mm.

Occurrence: Originally collected in Cobre Formation, Cuba, and it was considered of Eocene age. The matrix that fills the shell, is "polimitic vulcanoclastic sandstone, calcite-cemented" which was accepted as lithology of Cobre Formation. My opinion is that it is an olistolith, reworked from the Tuff Series, a decakilometric sequence of volcanoclastic sequence of Cretaceous age (Neocomian-Turonian), outcropping in Cuba (BUTTERLIN, 1956: 34-35) which became locally exposed to erosion during Eocene times.

S.C.S. occurrence: Locality HA-5402, Cerro Los Platones, Trujillo state, Upper carbonatic member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, fig. 29). Medium-sized, tumid casts, with or without weak varices, have been cited from Albian sediments of Ethiopia, Georgia and Tunisia.

Tylostoma (Tylostoma) syriacum (Conrad, 1852)
Plate 50, figure 5;

- 1852 *Chenopus Syriacus* CONRAD, in LYNCH, Palestine Expedition, Off. Report: 220, pl. 12, fig.77;
- 1862 *Natica elatior* COQUAND, Géol. & Paleont. Constantine: 179, pl. 3, fig. 5;
- 1877 *Pterodonta elongata* LARTET, :124; (non d'ORBIGNY, 1845)
- 1878 *Phasianella supracretacea* FRAAS: 325; (non d'ORBIGNY, 1845)
- 1884 *Tylostoma induratum* (C.) HAMLIN, M.M.c.Z.H #19(10)3: 22, PL. 1, Fig. 8
- 1927 *Tylostoma syriacum* BLANCKENHORN, Paleontographica, 69: 139, pl. 2, fig. 29;
- 1907 *Tylostoma taurica* KARAKASCH, Crimea …:171, pl. 17, fig. 2;
- 1939 *Tylostoma syriacum* C. DELPEY, Gastr. Mesoz.:83, fig. 58;
- 1952 *Tylostoma travisensis* WHITNEY, Jour. Paleont. 26(1): 72, 73, pl. 13, figs. 1-3;

Occurrence: *T. syriacum* (C.) has a Biochron of Late Aptian to Early Cenomanian, with a distribution area of Syrian, Maghrebian, Balkanic,and Gulf-Atlantic Coast Subprovinces, of the Gondwanan Province.

S.C.S. occurrence: Locality FA-58-A, Pico García, Monagas state, El Cantil Formation, (DBG) of Late Aptian-Early Albian age.

Tylostoma (Tylostoma) torrubiae Sharpe, 1849.

- 1849 *Tylostoma Torrubiae* SHARPE, Quart. Jour. Geol. Soc.,#5: 378, pl. 9, figs. 1, 2;
- 1887 *Tylostoma Torrubiae* S., MALLADA, Sinop. España, Cret. Inf., #3: 58, pl. 18, fig. 7;
- 1910 *Tylostoma torrubiae* S. BÖSE, Bol. Inst. Geologico #25: 143, pl. 30, figs. 11, 12;
- 1973 *Tylostoma cf. torrubiae* S., GORTANI, Acta N. di Lincei, #4: 73-74, pl. 14, figs. 13ª, 13b;

Occurrences: Cited originally from Portugal, Spain, Utrillas sandstone Formation, Mexico and Texas, always from Albian sediments, (CANEROT, 1982) never from the "Urgo-Aptiense" as was stated in old studies.

S.C.S. occurrences: Locality M0-4254, Cerro El Portachuelo, Anzoategui state, El Cantil Formation (DBG), of Early Albian age. Also in locality MC-15-F, sector cerro Piedra de Rayo-Caserío Quiriquire, Monagas state, (DBG) also of Early Albian age.

Tylostoma (Tylostoma) triplica Whitfield, 1891.
Plate 50, figure 3;

- 1891 *Globiconcha triplica* WHITFIELD, :440, pl. 10, figs. 20-22;
- 1939 *Tylostoma triplica* W., DELPEY: 82-83, fig. 57;

Occurrences: Originally collected from the cherts of Gazelle Hollow, near Abeih, Liban, of Late Apian age. Also in the *Cardium* beds, in Asfouriyé, between the route to Damascus, and the big outcrop in Aïn Sofar, Aley, Djezzine, Bhamdoun, Medjel Chems of ?Albian age.

Diagnosis: Length: 69 mm, Width: 57,5 mm; five or six whorls. Apical angle: 80º. (DELPEY, 1939).

S.C.S. occurrence: Locality MO-890, La Cueva Inlet, Borracha Island, Anzoategui state, (DAGM) Upper Borracha Formation, of Early-Middle Albian age.

Tylostoma (Tylostoma) tumidum (Shumard, 1853).
Plate 42, figures 15, 17;

- 1853 *Globiconcha (Tylostoma) tumida* Shumard, in R.B. Marcy, U.S. 32d Congr,:54: 208, pl. 5,fig. 3;
- 1947 *Tylotsoma tumidum* (Shumard), STANTON, U.S. Geol. Surv.Prof. P# 211: 70, pl. 53, figs. 6-9;

Diagnosis: Casts, ovate-globose; pyramidal spire apical angle about 55º; whorls about 6, whorls moderately onvex; width of body whorl about one-half of the total length of the shell.

Occurrence: Comanche Peak limestone and Goodland limestone Formations, of Fredericksburg Group, of Middle Albian age.

S.C.S. occurrence: Locality HA-4416, section La Pastora-Jabon, Trujillo state, Upper carbonatic Member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, fig. 26); it is associated in grey marls to Mesorbitolina pervia-M. texana- M. ovalis Zone of GÖRÖG, (1994).

Subgenus ***Odostomopsis*** Whitfield, 1891, emend. Delpey, 1939.

Shell equivalve, naticoid in form, axis perforate, peristome interrupted, columella with a single strong fold or plication at the upper end near the body whorl; surface smooth, substance thick. Type *Amauropsis abeihensis* Hamlin, 1884, fide BLANCKENHORN, 1927 (WHITFIELD, 1891).

***Tylostoma (Odostomopsis) enayi,* new species,**
Macsotay.
Plate 24, figures 1, 5;

Description: Cast of medium size, higher than wide, with no traces of the shell that could present an ornamentation; vaguely hexagonal in shape, only with 4 – 5 whorls preserved; worls are shouldered, sutures well marked in the cast. The strongest varix is the one that defines the labre. There is a weak trace of varix 120º behind the labre. Aperture wide anteriorly, narrow posteriorly; the columellar fold is not visible on the holotype, but was well exposed in a fractured specimen.

Dimensions: The measurements of the Holotype, (UCVMG/IO-1957), are: Height: 40,3 mm, Width: 30,3 mm, (plate 24, figures 1, 5).

Etymology: Species dedicated to Prof. Dr. Raymond Enay, - Departement des Sciences de la Terre, Université Lyon-I, Villeurbanne, Lyon, France, whose studies in Late Jurassic Ammonite evolution, contributed to the Paleoceanographic reconstruction of the Tethys Ocean.

Occurrence: Locality VG-382-B, Quebrada El Imposible, Serrania de La Paloma, Sucre state, Chuparipal Formation, (DGC), of Barremian age. Also in HA-4446, cerro Agua Dulce section, (San Pedro), lower Carbonatic Member of Peñas Altas Formation, of Late Barremian age. Also in Tibú Formation, Lara state, of Barremian age, in Atarigua para-autochthone, associated to *Toucasia carinata* in massive limestones.

Discussion: *Tylostoma (Odostomopsis)* is a taxon whose Biochron goes from ?Late Aptian, Albian to Maastrichtian, always in the tropical subprovinces of Gondwana Province. In Venezuela, *T. (O.) enayi* is a reasonably common in Barremian carbonatic sediments, deposited in saline marine waters. It is the oldest species known of *Odostomopsis,* probably descendant from an ancestor like *T. (T.) syriacum.*

Family ***VALVATIDAE*** *Gray,*

According to Von Zittel (1937, Text-book of Paleontology, vol. 1: 544) this family has a Biochron from Late Jurassic to Recent. Shell composed of few worls, conical or discoidal, umbilicate. The aperture is rounded, with continuous peristome. Operculum horny, circular, multispiral.

Genus ***Valvata*** *Müller,*

Description: Is a small shell, and varies from turbinate to discoidal. It comprises about twenty-five recent species, inhabiting the fresh waters of Europe and North America. Originated in the Purbeck Formation (Volgian-Ryazanian), but does not become at all abundant until Cenozoic times.

Valvatidae gen. nov., sp. nov., Macsotay.
Plate 34, figures 8, 9;

- 1938 *Ampullina cf. bulimoides* d'O., JAWORSKI: Min. de Industrias y Trabajo, #3: 530-533, figs. 1ª, 1b;(non D'Orbigny, 1843, nec Deshayes, 1842)
- 1985 *Ampullina cf. bulimoides* d'O. BALLESTEROS & NIVIA, Proyecto Cretacico, K-16: xiv-4;
- 1987 *Ampullina cf. bulimoides* d'O., VIVAS, Bol. Geol. (Caracas) 16(29): 28, 32, fig. 21;

Description: Cast medium size, anomphalous, rounded-trigonal; height considerably exceeding diameter. Whorls convex, more or les convex at suture, the earlier ones low and feebly convex; forming a slightly ortoconoid top of spire, with an apical angle of about 90º; last whorl broadly rounded at the periphery most of it is broken at the best sample we dispose of. Outer lip and growth lines strongly prosocline, slightly sigmoidal, shell wall thin. A small juvenile, shows a deep umbilicus, and the aperture is kidney-shaped.

Dimensions: The measurements are: Height: 20,2 mm, Width: 15,5 mm (both incomplete). Restitution: Height: 27,35 mm, Width: 21,2 mm. The juvenile cast, measures, of Height: 10,0 mm, Width: 8,5 mm.

S.C.S. occurrence: Locality MC-324-B, Río Pajaral, Monagas state, lower El Cantil Formation, of Late Aptian age; locality MC-243-E, Río azagua, lower El Cantil Formation (DBG) of the same age. Locality An-77, Cerro Las Callecitas, Anzoategui state, lower El Cantil Formation, of Late Aptian age, few transported juveniles, associated to *Mesorbitolina texana-M. ovalis* Zone. Also locality MO-892, northwest of Purto Escondido inlet, Middle Taguarumo Formation, in sideritic limestone, of Early Barremian age. In Quetepe valley, in sideritic bed of Taguarumo Formation, (B. LOPEZ, 1987: 134). In Colombia, reported from Ritoque Formation, of Early Hauterivian age.

Paleoecology: This globular species, preserved always as casts, is quite common in more or less carbonatic siltstone, with traces of gypsum, suggesting saline or hypersaline episodes associated to *Trochaceton (Neocylindrites)* and *Nerinella spp.* In over 30 casts examined, there were no traces of depredation, usually common on another Eocretaceous gastropods of inflated, thin shells, as *Tylostoma* or *Pseudomelania.* The presence of saline horizons in Lower El Cantil Formation, suggests important salinity changes vertically, which were not sensed in many of the micropaleontological studies (GUILLAUME et al., 1971; FURRER in YORIS, 1985) realized on these samples.

Comparisons: The only comparable taxon, is *Valvata helicoides* (Forbes)(1913, JOUKOWSKY & FAVRE: 316) – Purbeckian facies beds in England and Switzerland, Middle to Late Volgian age,- a turbinate species too, but whose size is subcentimetric.

Subfamily ***PSEUDOMELANIIDAE*** Fischer, 1885.

Genus ***Pseudomelania*** Pictet & Campiche, 1862.

Pseudomelania is one of the most typical of Mesozoic genera. It originated during Late Trissic (Skythian) and became extinct by Late Cretaceous (Cenomanian) times. It belongs to the Taxa Group One of Mesozoic Gastropods (SOHL, 1987: 1102), becoming widely distributed during Jurassic Period in all the Tethys Ocean, including Japan. DELPEY (1941) considered this genus as brackish and even non-marine habitat. By the fauna associated in S.C.S. occurrences, as Bivalvia and Irregular Echinoida, we consider it rather hypersaline-saline.

Pseudomelania albensis (d'Orbigny, 1844)
Plate 38, figures 6, 13;

- 1842-43 *Eulima albensis* d'ORBIGNY, Paleont. Franç. Terr. Cret.#2: 64-65, pl. 155, figs. 14-15;
- 1900 *Pseudomelania albensis* (d'O.) PERON, Bull. S. S. hist. Nat. Yonne, 53:30-32, pl. 1, fig. 11;
- 1980-b *Pseudomelania albensis* (d'O) MACSOTAY, Thèse, Lyon-I: 46;

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Occurrence: Small species, relatively wide-spread in the Parisian Basin, and Vocontian trough in France, always in Hauterivian shales.

S.C.S. occurrence: Locality HA-4427, Section on the La Pastora-Jabón road, Trujillo state, Upper carbonatic member of Peñas Altas Formation, of Early Albian age. It is associated to echinoids and other gasteropoda (ARNAUD, 1999, fig. 26). Also in El Cantil Formation, together with paracerithiidae gastropoda.

Pseudomelania benahensis (Böhm, 1900).
Plate 53, figure 7;

- 1900 *Melania benahensis* BÖHM, Z. D. G. G., # 52: 201, pl. 6, fig.3;
- 1936 *Nerinea riachuelana* MAURY, Mon. S. G. M. Brasil, #11: 214-215, pl. 12, fig.14;
- 1939 *Pseudomelania benahensis* (B.) DELPEY, Gastr. Mesoz.: 67-68, fig. 41, 42;

Occurrence: Porto do Pedrinho, Riachuelo, Sergipe, Brazil, Ganhamaroba Group, of Middle Albian age. Bekfaya, Bneit Chebab, Liban in Early Aptian age sediments; also in Wadi Modjib, west coast of Dead Sea, Palestina, of Cenomanian age.

S.C.S. occurrence: Locality MO-3110, Quebrada Santa Rosita, Píche member of Apón Formation, of Early Albian age. One well-preserved cast, of 5 whorls, and six fragments of different individuals were collected.

Observations: *P. benahensis* (Böhm) with an apical angle of 17º, and a maximum height of 26,0 mm, is very alike to "*Nerinea" riachuelana* Maury (op. cit.) which only differs by its asymmetric inflation of the whorls, a feature that seems to be transitional in the fragmentary material.

Pseudomelania elegantula Nagao, 1934.
Plate 38, figures 14, 15;

- 1934 *Pseudomelania elegantula* NAGAO: 238, pl. 37, figs. 1, 2, 3, 4, 9, 10;
- 1936 *Turritella carregozica* MAURY, M. S. Geol. M. Brasil, #11: 205, pl. 12, fig. 15;
- 1948 *Pseudomelania sp.* TAVANI, Paleont. Italica 45: pl. 4, fig. 6;
- 1952 *Strombus beckleyi* WHITNEY, Jour. Paleont. 26(1): 72, pl. 13, figs. 6, 7;
- 1977 *Pseudomelania (Pseudomelania) elegantula* N., HAYAMI & ITARU, Univ. Tokio Bull., 13: 44, pl. 5, figs. 7, 8;

Occurrences: Originally published from Hiraiga and Aketo Formations of the Miyako Group, Japan, of Aptian-Albian age, where is common. Also in Sergipe, Brazil, in Ganhamaroba Group, of Middle Albian age. In Glen Rose Formation, the *Salenia texana* horizon, Texas, of Early Albian age. In Bur Tilal, Libia, of Late Albian age.

S.C.S. occurrences: Locality MC-86, Cerro Piedra de Rayo area, Monagas state, Garcia Formation, DBG, of Late Aptian age. Also in locality HA-4347, La Urbina north section, Trujillo state, La Puya Member of Peñas Altas Formation, of Late Albian age. Also at MC-271-A, east of Punceres anticline, Monagas state, El Cantil Formation, of Early Albian age, in marls with gastropoda and bivalvia.

Pseudomelania germani Pictet & Campiche, 1862.
Plate 28, figs. 1;

- 1862 *Pseudo-melania Germani* PICTET & CAMPICHE, Mat. Paleont. Suisse, s.#3 :269, pl. 70, figs. 6-8 ;
- 1879 *Pseudomelania Germani* P. & C., VACEK, J.d.K. K. geol. R. # 29(4): 742;
- 1907 *Pseudomelania Germani* P. & C., KARAKASCH : 174, pl. 17, fig. 21;

Occurrence: With a Biochron of Hauterivian-Barremian, this species is frequent in the Apulian and Balkanic Subprovinces of European Province.

S.C.S. occurrence: Locality MO-3213, Lope inlet, Chimana Grande Island, (DAGM), Lower limestones of Taguarumo Formation, Late Hauterivian age. Also Tibú Formation, Lara state, of Late Barremian age.

Pseudomelania gresslyi Pictet & Campiche, 1862.
Plate 28, figure 9; plate 38, fig. 3;

- 1862 *Pseudo-melania Gresslyi* Pictet & Campiche, Mat. Paleont. Suisse, #2: 267, pl. 70, figs. 1, 2 ;
- 1868 *Pseudo-melania Gresslyi* P. & C., DE LORIOL, Mat. Paleont. Suisse, #4: 10-11, pl. 1, fig. 6a, 6b ;
- 1918 *Pseudomelania Gresslyi* P. & C., COSSMANN, Bul. Soc. Geol. Franç. 10(6): 370, pl. 11, fig. 12;

Description: *P. gresslyi* P. & C., was proposed as type of the Genus *Pseudomelania* by Pictet & Campiche (1862), but all the samples from Switzerland, were casts only. COSSMANN (op. cit.) collected relatively well preserved shells from the Calcaire crayeux of Orgon, South France. His description follows: "Big sized shell (probable

height: 70 mm, width: 23 mm), of pupoid form; spire mediocrement elongated, apical angle 30º; whorls smooth, slightly convexes, whose height reaches the half of the width, seprated by linear sutures. Last whorl reaches less than the half of the total height, ovalate until the base, which is imperforate. The aperture is short, oval, columella curved."

Dimensions: The type measured 60 mm of height, with 30º of apical angle (cast from marnes à bryozoans, of Valanginian of Swiss Jura).

Occurrence: This species seems to be restricted to Calcaire Roux and Bryozoa-marls, Switzerland, of Valanginian age. Also present in Urgonian limestones in France, of Barremian age.

S.C.S. occurrence: MC-329-D, Río Pajaral, DGC, Monagas state, El Cazón Formation, of Late Berriasian-early Valanginian age.

Pseudomelania magna (Karakasch, 1907).
Plate 60, figure 12;

- 1907 *Turritella magna* KARAKASCH, T.S.I.N.Paleont. 32(5): 172-173, pl. 17, fig. 26;

Diagnosis: Taxon based on casts, with an unusual size for Cretaceous Gasteropoda. The type, a cast composed of 3 ½ whorls, including the body whorl, measures: 125 mm of height, and 50 mm of width. With an apical angle of 16º, the adult shell must have measured, 150 mm of height. The profile of the whorls is less rounded than *P. gresslyi*, the type of the genus.

Occurrence: Originally described from Crimea peninsula, Ukrania, and from the Caucasus mountains, in Late Albian-Early Cenomanian limestones.

S.C.S. occurrence: Locality HA-4347, La Urbina north section, La Puya member of Peñas Altas Formation, of Late Albian age, (ARNAUD et alii., 1999, fig. 33). Also in VG-669, El Soro in Majagual Formation of Late Albian-Early Cenomanian age, (ROD & MAYNC, 1954) in limestones associated to algae, stromatoporids and the rudist *Mexicaprina sp.*.

Pseudomelania cf. verneuilli (Vilanova, 1863)
Plate 33, figure 11;

- Cf. 1863 *Pyramidella Verneuilli* VILANOVA, Descr. Foss. Teruel, España, pl. 4, fig. 8 ;
- Cf. 1887 *Chemnitzia var., Verneuilli* (V.) MALLADA, Sinopsis Foss. España, Cret. Inf., #3 : 47-48, pl. 27ª, figs. 1, 2;

Occurrence: Originally collected from Aliaga, Teruel, Maestrazgo Basin, locality that belongs to Mirambell marl Formation, of Hauterivian age (CANEROT, 1982) and is not Urgo-Aptian, as was stated.

S.C.S. occurrence: Locality MC-86-G, Cerro Piedra de Rayo, Monagas state, (DBG), in Lower García Formation, of Early Aptian age. It was collected in ferrugineous limestone/marl alternations.

Genus/Subgenus ***Microschiza (Microschiza)*** Gemmellaro, 1878.

According to DELPEY (1939 ; 69-70) its Biochron extends from Middle Triassic (Ladinian) to Late Cretaceous, with a cosmopolitan distribution, in the Tethys Ocean, where it originated many species. It could be included in Taxa Group One (SOHL, 1987: 1102). DELPEY (op. cit.) – after revision of most of the Mesozoic taxa, - considerait that *Microschiza, Cloughtonia and Coronatica* form a coherent assemblage, including transitional forms among them. I compare their relationship with the Caribbean Sea: the Genus *Thais* Röding, 1798, - which has 12 known species living in high energy, euhaline waters, but the subgenus *Thaisella* is restricted to the brackish and sluggish, saline waters of Gulf of Paria, and the Bahia del Tablazo, Venezuela. This relationship persists along the coasts of Brazil (CARVALHO RIOS, 1970).

Subgenus ***Cloughtonia*** Hudleston, 1882.

According to WENZ (1938, Handbuch Paleozoologie 1(1): 376-377, fig. 894) is a genus, whose Biochron extends from Middle Jurassic (Bajocian) to Late Jurassic (Portlandian). But DELPEY (1939) extends this Biochron to Late Cretaceous (Turonian), and designated *Cerithium belgicum* Münster in Goldfuss (1841/44 : 74, pl. 25, fig. 3) (DENINGER, 1905: 20, pl. 4, fig. 6)- North European Province, of Cenomanian age- as the type of the subgenus *Cloughtonia.* It should be included among Taxa Group One of SOHL (1987: 1102).

Microschiza (Cloughtonia) aptiensis (Landerer, 1872)
Plate 26, figure 3;

- 1872 *Chemnitzia aptiensis* LANDERER, Monogr. Paleont. Piso Apt. :26, pl. 2, fig. 20; pl. 8, fig. 20;
- 1949 *Pseudomelania aptiensis* L., BATALLER, Sinopsis, Cret., 8(2): 77-78;
- 1954 *Purpuroidea Pachecoi* MENENDEZ AMOR, R. Soc. Esp. Hist. Nat.: 473, pl. 24;

- 1957 *Pseudamaura cf. bulbiformis* (S.) VON DER OSTEN, Jour. Paleont. 31(3) : 585, pl. 65, fig. 2 ;
- (non *Natica bulbiformis* (Sowerby, 1835), Tr. Geol. Soc. London, 2(3) : 418, pl.38, fig. 13)
- 1974 *Microschiza aptiensis (L.)* DIMITROVA, Foss. Bulgarie, 4-b: 22-23, pl. 5, fig. 1; pl. 8, fig. 4;

Occurrence: Originally studied from Coll d'Alba, Tortosa, from the Forcall marl Formation, Spain, of Early Aptian age; In Liban, it was collected from El Bnayé,- Early Aptian,- Meirouba and Bekfaya of probably Aptian age.

Diagnosis: The height of the shell is of 60 mm, and the diameter is about 33 mm; the apical angle was appropriately 80º, before deformation. Strong radial ribs, about 12 per whorl, are present on penultimate whorl; on the body whorl, they are restricted to the shoulder of the subsutural area.

S.C.S. occurrence: Locality MMH, Su-190, western coast of Picuda Grande Island, Sucre state, Lope Member of Taguarumo Formation, of Early Aptian age (DAGM).

Microschiza (Cloughtonia) scalaris (Conrad, 1852). Plate 33, figs. 17, 20;

- 1852 *Natica? scalaris* CONRAD, in LYNCH, Palestine Exped., App. 234, pl. 7, fig. 50;
- 1927 *Coronatica purpuroidea* BLANCKENHORN, Paleontographica, 69: 135, pl. 2, fig. 26a, b, c;
- 1939 *Microschiza (Cloughtonia) scalaris* C., DELPEY, Gastr. Mesoz.: 70-71, figs. 44-45;
- 1955 *Microschioza (Cloughtonia) scalaris (C.)* ALLISON, Jour. Paleont. 29(3): 413, pl. 41, figs. 1, 2;
- 1974 *Leviathania mickovciensis* (V.) DIMITROVA, Foss. Bulgarie, 4b: 28, pl. 9, figs. 2a,2b; 3a, 3b; 4a, 4b; (not VANKOV, 1892).

Occurrence: Species with a Biochron extended from Early Aptian (Bedoulian) to Early Cenomanian in Western European, Syrian, Balkanic Subprovinces and Baja California.

S.C.S. occurrences: Locality MC-86-G, Cerro Piedra de Rayo, Monagas state, in limestone/marl alternations, Garcia Formation, (DBG) of Aptian age. Also in Quebrada Aponcito Seco, Tibú Formation, northern Perijá, of Early Aptian age.

Comparisons: *Turbo Michaelensis* BUVIGNIER, (1852 pl. 26, figs. 9, 10) – Meuse, France, from Kimmeridgian – Ryazanian age beds,- sems to be clearly the ancestor of *M. (S.) scalaris* (C.) with less escalonated whorls, which developed axial nodules along the subsutural band.

Subgenus ***Coronatica*** Blanckenhorn, 1927.

Microschiza (Coronatica) is a short-lived Cretaceous taxon (Aptian-Cenomanian), of thermophyllic brackish-water habitat.

Microschiza (Coronatica) ornata (Fraas, 1878). Plate 27, figs. 7, 8; plate 33, fig. 20;

- 1878 *Neritopsis ornata* FRAAS, J. Ver. Väterland Naturk. Württemberg, #34: 66, pl. 6, fig. 6;
- 1900 *Natica ornata* (F.) J. BÖHM,:197, figs. 7-9;
- 1927 *Microschiza (Coronatica) ornata* (F.) BLANCKENHORN, Paleontograph. 69: 134-135, pl. 6, fig. 27;
- 1939 *Microschiza (Cloughtonia-Coronatica) ornata* (F.) DELPEY, Gastr. Mesoz.: 73-74,, figs. 48-49;

Occurrences: Widely distributed in Syrian and Balkanic Subprovinces, during Aptian times.

S.C.S. occurrences: Locality MO-890, Punta La Cruz, Manare peninsula, (plate V-07), Lower Borracha Formation, (DAGM) of Late Aptian age. Common in the shaly interbeds, where casts of adult and juvenile shells, are found together. Also in Lower El Cantil Formation, east of Punceres anticline, Monagas state, DBG, of Late Aptian age.

Microschiza (Coronatica) pellati Cossmann, 1907 Plate 27, figure 6;

- 1907 *Microschiza pellati* COSSMANN, Mem. Soc. Geol. France, 37: 18, pl. 4, figs. 12-13;
- 1916 *Microschiza pellati* C., COSSMANN: 19, pl. 5, figs. 10, 11;
- 1951 *Natica cf. sautieri* Coquand, MAKSIMOVIÇ: 197, pl. 2, fig. 3; (non COQUAND, 1862);
- 1956 *Tylostoma aguilerai* ALENCASTER DE CSERNA, Paleont. Mexicana : 24-25 (pro parte) pl. 4, fig. 9: (not figs. 5, 6, 7)

Occurrence : Originally collected at Brouzet-les-Alés, Urgonian limestones, France in the Western European Subprovince of Barremian-Early Aptian age. Later, found in contemporary limestones of Serbia, of Balkanic Subprovince.

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Manare peninsula, Sucre state, in Lower Borracha

Formation, (DAGM) of Late Aptian age. Few specimens collected.

Microschiza (Coronatica) sautieri (Coquand, 1856).
Plate 33, figure 4;

- 1856 *Strombus Sautieri* COQUAND, Soc. Emul. Doubs., 2e. serie, 7 : 45, pl. 5, fig. 2 ;
- 1886 *Natica leviathan* CHOFFAT, :18, pl. 1, figs. 1-2, pl. 3, figs. 1-3;(not Pictet & Campiche, 1861-64)
- 1906 *Purpuroidea Sautieri* (C.) COSSMANN : 215 ;
- 1939 *Purpuroidea Sautieri* (C.) DELPEY Gastr. Mesoz: 130-131, fig. 91;

Occurrence: With a long Biochron, this taxon is known from Late Portlandian to Late Aptian of Western European and Balkanic Subprovinces, with a maximum of abundance during Valanginian times, in sediments of evaporitic origin.

S.C.S. occurrence: Locality MC-95-A, Cerro los Encantados, Monagas state, Lower El Cantil Formation, of Late Aptian age (DBG).

Genus ***Oonia*** Gemmellaro, 1878.

According to WENZ (1938) and PCHELINTSEV (1953), *Oonia* has a Biochron of Middle Triassic (Ladinian) to Late Cretaceous (Maastrichtian). With many species, they are mostly found in peri-Gondwanan Province areas, but in Western European Subprovince, too. It shows no thermal preference, but preferred saline waters, too.

Oonia cf. capduri (Cossmann, 1907)
Plate 33, figure 19;

- Cf. 1907 *Pseudomelania capduri* COSSMANN, 1907, M. S. G. France, #37: 18-19, pl. 2, figs. 13-14;
- 1980-b *Oonia cf. capduri* (Cossmann) MACSOTAY, Univ. Lyon-I, Thèse:37, pl. 11, fig. 4;
-

Occurrence: Discovered and described from Brouzet-les-Alais, France, of Late Barremian age.

S.C.S. occurrence: Locality MO-1322, Río Negro, Perijá area, upper Río Negro Formation, of Early Barremian age. Also in locality HA-5451, Cerro Agua Dulce section, Trujillo state lower Carbonatic member of Peñas Altas Formation, of Late Barremian age (ARNAUD et alii., 1999, fig. 17). Collected from the marls above the tempestite many shells.

Oonia trinidadensis Cox, 1954.
Plate 38, figure 9;

- 1954 *Oonia trinidadensis* COX, Jour. Paleont., 28(5): 626, pl. 65, figs. 3, 6:

Diagnosis: Shell large, ovate-conical, smooth, without umbilicus, with a conoidal spire, whose surface is continuous with the convex body whorl; aperture narrowly pyriform; outer lip closely adpresssed posteriorly to the penultimate whorl.

Dimensions: Height: 88 mm, maximum diameter: 59 mm (COX, op.cit.); Height: (incomplete) 35 mm, width: 24,5 mm (incomplete, too)(figure 9, juvenile specimen)

S.C.S. occurrence: Locality MC-70-A, Quebrada La Lisboa, Monagas state, Lower El Cantil Formation, of Late Aptian age; associated to other gastropods, in marls of *Mesorbitolina texana-M. ovalis* Zone. Also in locality VG-556-A, in upper Tahuarumo Formation, Sucre state, of Late Barremian-Early Aptian age. In Trinidad, reworked from Cuche Formation, of Barremian age.

Comparisons: It resembles to *Acteonina colusaensis* Anderson, (1958, Mem. Geol. Soc. Amer., 71: 158, pl. 21, fig. 14)- Early Cenomanian, California,- but its whorls are more blunt. Most of the Eocretaceous species of Europe: *O. allardi (*Cossmann, 1907) *y O. peroni* (Choffat, 1886) are smaller in size, and their whorls are more convex.

***Oonia* (?) sp. indet.** Macsotay.
Plate 57, figure 1;

Diagnosis: This unusual gastropod was drawn from the weathered surface of a 3 meter thick massive limestone outcrop. Its measurements, are: of height: 38 mm; of width: 29 mm, and was not pelomorphically deformed. The outstanding feature is, the presence of a canaliculated suture, at last on the three last whorls. The shell had no umbilicus, and the early whorls are all sparitized.

S.C.S. occurrence: Locality MO-2794, Cerro los Encantados, Monagas state, lower El Cantil Formation, (DBG) of Late Aptian age.

Comparisons: This taxon seems to be related to to the PaleoPacific fauna: *"Phasianella" garzana* ANDERSON (1958, Amer. Geol. Soc., Mem. 71: 162, pl. 73, fig. 5),-lower part of the Moreno Formation of Campanian age, and *"Phasianella"incerta* (FORBES)-Senonian, SE India,- all belong to the genus *Oonia.*

Subfamily ***TRAJANELLINAE*** Pcelintsev, 1953.
Genus ***Trajanella*** Popovici-Hatzeg, 1899.

According to WENZ (1938, Handbuch Paleozoologie, 1(1): 375-376, fig. 892) *Trajanella* has a Biochron of Early Cretaceous (Aptian) to Late Cretaceous (Senonian), and belongs to the Taxa Group Two, SOHL (1987: 1104). The palaeogeographic distribution, is mostly Mesogean, but it is present in all the Subprovinces of Gondwana Province. PCHELINSTEV (1953, fig. 5) published the Late Cretaceous distribution, including India and Japan. DELPEY (1939: 68) indicated its presence in subrecifal units, mostly in sandstone formations. It could be a thermophyllic genus.

Trajanella cf. japonica Nagao, 1934.
Plate 25, figure 27;

- Cf. 1934 *Trajanella japonica* NAGAO, Jour. Fac. Sci. Hokkaido Imper. Univ.(4), 2 (3): 239, pl. 39, figs. 1, 1ª, 2, 4, 5, 5ª, b;
- Cf. 1977 *Trajanella japonica* N., HAYAMI & ITARU, Univ. Tokio, Bull. 13: 44-45, pl. 6, fig. 1;
- ¿ 1927ª, *Trajanella conoidea* PCHELINSTEV, Mem. Com. Geol. Leningrad, n. ser.#172: 69, pl. 9, fig. 7;

Occurrence: Abundant in Miyako Group, Iwate Prefecture, Japan, of Aptian-Albian age. Also (?) in Caucasus mountains, in Aptian horizons.

S.C.S. occurrence: Locality MC-370-D, Trail to La Acequia, Carinicuao river, Sucre state, Taguarumo Formation, (DGC) of Barremain-Early Aptian age.

Trajanella komarensis Pcelinstev, 1927a.
Plate 42, figures 4, 6;

- 1927ª *Trajanella komarensis* Pcelintsev, Mem. Com. Geol. Leningrad, n. ser. #172: 168, pl. 4, fig. 25;
- 1958 *Cerithium clarki* ANDERSON, Geol. Soc. Amer., Mem. 71: 163, pl. 59, figs. 3, 3a;

Diagnosis: Shell of unusual size, exposing the base of a body whorl, the second whorl, and a small portion of a third whorl. A medial constriction of the body whorl, is characteristic of the species, is seen also in *"Cerithium" clarki* ANDERSON (op. cit.) – collected Mustang Gulch, Gualala in Merced County, California, U.S.A. in undefined Cretaceous horizon. No external ornament is preserved on our casts, but *C. clarki* exposed 3 – 4 spiral cords on the anterior extreme of the last whorl.

Dimensions: Maximum Diameter of the cast: 39 mm; Height of 2,1/2 whorls: 64 mm. Apical angle: 30º; sutural slope: 12º.

Occurrence: Originally collected from the Crimean peninsula, Ukraine, in Early Albian horizon. The horizon of the Californian shell is not known.

S.C.S. occurrence: HA-4538, Cerro El Cocuy, in Depositional Sequence # 4, lower Carbonatic Member of Peñas Altas Formation (ARNAUD et alii., 1999, fig. 22), of Late Aptian age. The horizon corresponds to the *Melathrokerion* Zone.

Family ***PURPURINIDAE*** Zittel, 1895.

According to DELPEY, (1939: 46, 48, pl. 18), the *Purpurinidae* have a Biochron extended from Triassic (Ladinian) to Late Cretaceous, (Turonian), conforming well the Taxa Group One, of SOHL (1987: 1102). DELPEY (op. cit.) considerait that the holostomous species after the Cenomanian inhabited "marine-brackish" facies. In S.C.S. they seem to have been adapted to saline environments.

Genus ***Purpuroidea*** Lycett, 1848.

This genus has the same Biochron as the Family; its paleogeographical distribution is in the subprovinces of Gondwanan Province.

Purpuroidea borrachensis nom. nov. Macsotay
Plate 35, figures 15, 16;

- 1948 *Purpuroidea gigas* TAVANI, Paleontogr. Italica# 45: 16-17, pl. 3, fig. 2; (non *P. gigas* ETALLON, in THURMANN & ETALLON, 1859)

Occurrence: Originally collected from Bur Talel, Bur Bitale, Lybia in nodular White limestone with *Mesorbitolina,* of Ain Tobi Member of Sidi as Sid Formation, of Early Cenomanian age (MEGERISI & MAMGAIN, 1980).

S.C.S. occurrence: Locality MO-888, Borracha Island, La Cueva Inlet, (DAGM) lower Borracha Formation, of Late Aptian age. Collected in a forminifera-rich light grey wackestone. Also in Tibú Formation, of Northern Perijá, of Early Aptian age.

Description: Cast subglobose, spire moderately elevated, with 3 – 4 whorls preserved; whorls of the spire marked by rather broad low nodes weakly marked on the shoulders, and separated by about equally broad depressions; sutures well marked, bordered by a narrow convex shoulder; body whorl shows no traces of any node. The shell substance must have been thin. The aperture is semi-lunar, and does not show any trace of umbilicus. Apical angle, 70 – 80º.

Dimensions: Height: 62 mm, Width: 55 mm; (plate 35, figs. 15, 16).

Observations: *P. borrachensis* nom. nov., is more alike to *P. gigas* Étallon (SCHLOSSER, 1881, Paleontogr. 48(2): 68-69, pl. 10, figs. 4, 4a) – Tithonian (Volgian) to Berriasian (Ryazanian), North European Province, and its Apulian Subprovince – but our species has more rounded whorl profiles, and has less nodes on the shoulder, which do not persist to the body whorl. The Lybian specimen (TAVANI, 1948, op. cit.) has a higher spire, and is generally less inflated.

Purpuroidea aff. striata Zittel, 1873.
Pl. 10, fig. 11;

- Aff. 1873 *Purpuroidea striata* ZITTEL, Pal. M. Museum, B. S., #2: 315, pl. 43, figs. 6, 7, 8;
- Cf. 1897 *Purpuroïda,* nov. sp., ROMAN, Ann. Univ. Lyon, #34: 289, pl. 2, fig. 7;

Diagnosis: One cast of dolostone, relatively well preserved, but lacking the distal right side of the aperture has a *Purpuroidea*-type spire, with subsutural depression, bordered by nodules on the shoulder, and a medial constriction on the body whorl. Some fragments found with the sample, showed a short, anterior channel, alike the illustrated in ZITTEL (1873, pl. 43, fig. 7).

Dimensions: Height (incomplete) 72 mm, Width: 63 mm.

S.C.S. occurrence: One cast and three fragments collected by B. LOPEZ (1987: 91-92), in Quebrada Quetepe, Sucre state, Morro Blanco Formation, (DAGM) of Late Berriasian-Early Valanginian age (Text-fig. V-07).

Comparisons: *Purpuroidea aff. striata* Z., is probably a new species, but better samples are needed in order to do so. The nominal species, sampled in Stramberg and Koniakau Formations, (Austria) of Late Tithonian to Berriasian age, - does not show any medial constriction in the body whorl. *Purpuroïda* nov. sp., (ROMAN op. cit. pl. 2, fig. 7) from Bois de Moinier, of Bas- Languedoc, France, of Late Tithonian age,- also lacks th medial constriction.

Genus ***Leviathania*** Pchelintsev, 1927.

With a Biochron of Early Cretaceous (Berriasian to Late Albian) this genus belongs to Taxa Group Two (SOHL, 1987: 1103) a clade evolved in saline-hypersaline marine waters, in the tropical subprovinces of Gondwana Province. It is a carnivorous genus, predator on Bivalvia, rudists included. According to WENZ (1937) only few species are known. The up-dated list would be:

1. *Leviathania? galeotti* (Aguilera, 1906) Barremian,
2. *Leviathania gasullae* (Coquand, 1865) Hauterivian,
3. *Leviathania hector* (Coquand, 1865) Barremian
4. *Leviathania kelleri* (Delpey, 1939) Aptian?
5. *Leviathania leviathan* (Pictet & Campiche, 1864) Berriasian-Early Valang.,
6. *Leviathania pseudoconoidea* (Von ALTH, 1881) Ryazanian
7. *Leviathania pseudoleviathan* (Choffat, 1886) Barremian-Aptian,
8. *Leviathania vilanovae* (Landerer, 1872) Albian.

Leviathania gasullae (Coquand, 1865)
Plate 25, fig. 29;

- 1865 *Natica Gasullae* COQUAND, Mém. Soc. Emul. De Provence, #3: 73, pl. 6, figs. 1-2 ;
- 1872 *Natica Calix* LANDERER: 20, pl. 2, fig. 8;
- 1863 *Natica aragonensis* VILANOVA: pl. 8, fig. 1;
- 1886 *Natica Gasullae* C., CHOFFAT, Dir. T. G.-I: 22, pl. 2, figs. 7,8?;
- 1887 *Natica gasullae* C., MALLADA, Sinops. Cret. Inf., #3: 63;
- 1931 *Natica cf. N. bulimoides* (D.) d'O., WEAVER, U. Wash., Mem.#1: 374, pl. 43, figs. 289, 290;
- 1962 *"Natica" sp. aff. gasullae C.,* BENKÖ-CZABALAY, Geol. Hung., Paleont. #31: 253, pl. 3, figs. 28-29;
- 1972 *cf. Ampullina gasullae* (C.) MACSOTAY in SEIJAS, Bol. Geol.,(Caracas) Publ. Esp 5(3): 1905;
- 1979 *Ampullina gasullae* (C.) CALZADA, Estudios Geol., 35: 447-448, fig. 2;(Synonyms).

Diagnosis: Cast large, inflated, higher than wide, thick, usually with 5 escalonated whorls, with a deep suture between them; body whorl is the biggest of all the shell. The whorls of the spire have a very narrow sutural platform, and have steep slopes. The spiral angle averages 72º. The body whorl is very large, and is slightly excavated in the central part; aperture wide, suboval in outline. Umbilic hiddened by columellar callosity.

Dimensions: Height: 130 mm, Width:100 mm; (Serra da Cintra, Potugal, Hauterivian), Height: 72 mm (type of *L. gasullae* [Coquand], Barranco del Abad, Teruel, of Mirambell marl Formation, Maestrazgo Basin, Spain, of Hauterivian age). Between Morella and Cati, casts with sizes up to 150

– 200 mm of height were collected in marls and limestones of Blesa Formation (CANEROT, 1982) in the Oliete Basin. Casts of juveniles in the Mirambell Formation, of only 3-4 whorls, were named "*Natica" peredae* Vilanova, 1863. The cast from the Agrio Formation, Argentina, measured of height: 103 mm, and width: 72 mm.

Occurrence: Originally studied from the Maestrazgo and Oliete Basins of Spain, where it abunds in all the Hauterivian-Early Barremian Formations: Blesa, Camarillas, Mirambell and Mas de Querol, and not Aptian or Albian, as was stated originally. In Portugal, in Almargen beds, of Hauterivian age (CHOFFAT, 1886). In Hungary the *Munieria* marls, of north Bakony, of Late Aptian age, only contained one doubtful specimen. In Argentina, in the upper Agrio Formation, of Hauterivian-Barremian age of the Neuquen Subprovince.

S.C.S. occurrence: Locality FA-58-A, Pico García, Monagas state, lower El Cantil Formation, of Late Aptian age. Also in PM-50-B, Taguarumo Formation, of Barremian age. In massive limestones of Cantera Bertonzini, associated to Hauterivian-Barremian age fossils, reworked in the Guinimita Formation, of Late Cretaceous age. Also in MO-904, in limestones at the east side of Puerto Escondido, (DAGM) of Lower Taguarumno Formation, of Hauterivian age.

Leviathania leviathan (Pictet & Campiche, 1864).
Plate 3, figs. 5, 5a;

- 1864 *Natica Leviathan* PICTET & CAMPICHE, Mat. Paleont. Suisse #2: 564-566, pl. 89, figs. 1, 2;
- 1886 *Natica Leviathan* P. & C., CHOFFAT: D. t. Geologia#1: 18-20, pl. 1, figs. 1-2; pl. 3, figs.1-3;
- 1950 *Natica leviathan* P. & C., ROCH: 319;
- 1957 *Ampullina leviathan* P. & C., MARIE & MONGIN: 414, text fig. 4C;
- 1977 *Leviathania leviathan* (P.& C.) NEAGU et al., :138;
- 1987 *Leviathania leviathan* P. & C., B. LOPEZ: 91-92;

Diagnosis: The distinctive characters of this taxon are: the exceptional size of the casts, measuring 300 mm of height in Provence, South France, 250 mm in the Jura mountains, in Switzerland; the very scalariforme spire, and the presence of a weak constriction in the area near the shoulder of the body whorl, called "chicken´s neck" by H. Coquand. The calcitic shell preserved, is thick. Umbilicus wide, but concealed.

Occurrence: Of wide distribution in carbonatic and dolomitic formations of France, Switzerland, Portugal, Transylvania, Rumania, Spain, the Haut Atlas mountains of Morocco and Algeria, of Berriasian-Early Valanginian age. The most typical unit is the Marbre Batard Formation, - Berriasian age, evaporitic unit, of the French Jura mountains.

S.C.S. occurrence: Locality MO-5700, Quebrada Quetepe, Sucre state, in Morro Blanco Formation, (DAGM) of Late Berriasian-Early Valanginian age.

Comparisons: *"Purpura" pseudoconoidea* Von ALTH, (1882, Beitr. Paleont. Österr.-Ungarn, I: 130, pl. 19: 1, 2) – Nizniow limestone Formation, southern Poland, of Ryazanian age, - is a very related big-sized species, but lacking the constriction besides the shoulder.

Paleoecology: *L. leviathan* normally is found in impure, dolomitic, gypsiferous, and sandy limestones, sometimes oolithical, associated to oysters, and abundant characids, as an additional evidence of the hypersaline paleoenvironment. The big size attained by this taxon, is attributed to the lack of natural predators, which allowed these gastropods, to live to an advanced age.

Leviathania vilanovae (Landerer, 1868)
Plate 35, figure 21; plate 43, figure 6;

- 1863 *Natica hispanica* VILANOVA, pl. 2, fig.3;(non d'ORBIGNY, 1850)
- 1872 *Natica vilanovae* LANDERER, Monogr. Pal. Piso Aptico: 17, pl. 8, figs. 33, 34;
- ¿1886 *Natica Vilanovae* L., CHOFFAT: 21;
- 1887 *Natica Vilanovae* L., MALLADA, Sinops. España, Cret. Inf., #3: 63-64;
- 1979 *Natica Vilanovae* L., S. CALZADA: 446-447;

Occurrence: Originalmente colectado de Mas de la Creu (Chert) of sandstones of Maestrazgo Formation, western Maestrazgo Basin, Spain, of Albian age, and not Aptian, as was stated by LANDERER (op. cit.).

S.C.S. occurrence: MC-273-C, Caripito Member of Chimana Formation, (DBG) of Middle Albian age, about 12 casts. Also at MC-271-D, Upper El Cantil Formation, (DBG) Bivalvia-rich marl outcrops in Río Caripe, where only few casts were recovered, of early Albian age. Observations: S. CALZADA (1979: op. cit.) considered that *L. vilanovae* (based on a cast) and *L. gasullae* (based on a shell) are synonymous, because the morphological details are related with these differences. In the casts collected in Venezuela, those of *L. vilanovae* never reach 50 mm of height, and never show the posterior constriction near the shoulder. The associated molluskan fauna suggests an euhaline marine Bivalvia fauna.

Leviathania vonderosteni new species, Macsotay.
Plate 24, figures 2, 3, 7;

- 1966 *Leviathania aff. munieri* CHOFFAT, DVALI, A. S. R. S. S. G., Trans. N.s.#10: 39, pl. 9, fig. 1; (non *Natica munieri* CHOFFAT, 1886: 23, pl. 1, fig. 5 : =*Ampullospira* fide DIMITROVA, 1974).

Description : Cast of big size, rounded, of trigonal shape ; with about three whorls, moderately elevated; suture canaliculate with a wide and deep, subrounded depression. Outer whorls gibbous above, with slightly convex sides until it reaches the umbilicus. The surface of cast is smooth; umbilicus narrow, deep, and sediment-filed in most of the casts. Aperture ovoidal, originally must have been holostomous.

Dimensions: The Height, 150 mm, Width: 140 mm, (DVALI, 1966); Holotype, UCVMG-IO-2113, measures, of Height: 81,3 (incomplete) mm, Width: 61,5 mm; a juvenile, measures, of Height: (incomplete) 38,8 mm, Width: 33,5 mm.

Etymology: This new species of *Leviathania* is dedicated to the Geologist Erimar Von Der Osten, a german-descendent South African, who realized the second serious study on Eocretaceous benthic Molluska of Venezuela, which costed him his Oil-Exploration Geologist career, and his health.

S.C.S. occurrence: Locality VG-495-B, Pica El Algarrobo-Cerro El Pato-Río Santa Ana, Sucre state, (sDLP, DGC), in Taguarumo Formation, of Early Barremian age, where it was associated with rudists and nerineans. *L. aff. munieri* fide DVALI (1966), was sampled from limestones of Barremian-Early Aptian age in Georgia, Caucasus Mountains.

Paleoecology: The associated molluska, as *Teleoptyxis, Plesioplocus, Cossmannea, Trochacteon (Neocylindrites)* and rudists, suggest a paleodepth of **60 – 120 meters.**

Family ***RISSOIDAE*** Adams & Adams, 1854.
Genus ***Keilostoma*** Deshayes, 1848.
(=*Paryphostoma* Bayan, 1873)

Keilostoma is an exotic genus, - too big-sized for the family,- whose Biochron extends from Early Cretaceous (Albian) to Paleogene (Oligocene), and it should be included in Taxa Group Three (SOHL, 1987). Distributed in Europe, Asia and both Americas.

Keilostoma cf. pupoides (Cragin, 1893).
Plate 33, figure 13;

- Cf. 1893 *Rostellites pupoides* CRAGIN, Texas Geol. Survey, 4th. Ann. Rept.:228;
- Cf. 1947 *Pseudomelania? Pupoides* (C.) STANTON, U.S.Geol. Surv., 211: 63, pl. 55, figs. 28, 30, 31;

Occurrences: Glen Rose Formation, Texas, of Early Albian age; it is relatively common.

S.C.S. occurrence: Locality MC-445-C, Vía Campo Alegre a Buena Vista, Cerro La Torre, Teresen, Monagas state, of Guácharo Member of El Cantil Formation, of Early Abian age.

Observations: Only one fragment of 6 whorls of this pupoid shell, could be extracted from the compact limestone bed. Most part of the body whorl is missing, this is why I used the “confer”.

Keilostoma cf. sergipensis (Maury, 1936).
Plate 52, figure 10;

- Cf. 1936 *Amauropsis sergipensis* MAURY, Mem. Serv. Geol. Min., Brasil #11: 199, pl. 14, fig. 18;

Diagnosis: Only the last whorl is preserved, with a fragment of the penultimate whorl. The body whorl retains traces of an ornamentation of rather distant, low, vertical folds, giving a fluted aspect. Our cast differs from the *K. sergipense* (Maury) sensu stricto, in having more convex body whorl, where the vertical folds are restricted to the posterior 1/5th of the exposed surface. Not cited by MAURY (op. cit.) is a weak sulcus at a middle position of the last whorl; there are traces of a peristome, which encircled the whole aperture, preserved mostly at the parietal area.

Dimensions: When entire, this shell was approximately 38 mm in Height, and 22 mm in greatest width (MAURY, op. cit.). Our cast, measures, in Height (incomplete), 34,5 mm, and of width: 23,5 mm.

Occurrence: Porto do Pedrinho, Sergipe, Brasil, of the Ganhamaroba Group, Brazil, of Middle Albian age.

S.C.S. occurrence: Locality HA-4336, La Aguada de los Chivos section, Trujillo state, La Puya Member of Peñas Altas Formation, of Late Albian age (ARNAUD et alii., 1999, fig. 32). Also in Caripito Member of Chimana Formation, of Middle Albian age: several external molds.

Family ***TRUNCATELLIDAE*** Troschel,

Genus ***Truncatella*** Risso, 1826.

In my files, I dispose of little information about Eocretaceous representatives of this genus. They are:

1. *T. incerta* (d'Orbigny) Middle Albian
2. *T. primaeva* Maillard Ryazanian
3. *T. renevieri* (de Loriol) Maillard Ryazanian
4. *T. requieniana* (d'Orbigny) Albian
5. *T. shurae* (Shalem) Aptian-Albian
6. *T. villersense* (de Loriol) Ryazanian
7. *T. zumoffeni* (Shalem) Aptian-Albian

Truncatella shurae (Shalem, 1937)
Plate 37, figure 11;

- 1937 *Chemnitzia Shurae* SHALEM, Paleont. Ital.# 37: 21, pl. 1, fig. 20;

Diagnosis: Elongated, cylindrical small shell, with 7-8 worls. It is not umbilicated, and aperture is oval, wide adaperturally, marrow in the other extreme; the body whorl not different of the others, exhibiting an apical angle of about 10º.

Dimensions: Maximum height: 3,7 mm, Height of body whorl: 1,0 mm, width of body whorl: 0,7 mm.

Occurrence: Sediments of Aptian-Albian age in Liban.

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Manare peninsula, (DAGM) lower Borracha Formation, of Late Aptian (Gargasian) age. Also in the basal limestones of Borracha Formation, in Borracha Island, La Cueva inlet. Found reworked frequently in Río Chavez member of Mucaria Formation, of Campanian-Maastrichtian age. In all cases, the casts are psudomorphs of black chert, easy to distinguish from the grey background.

Paleoecology: Usually found frequently in bioclastic limestones (packstone) associated to many Echinoid debris, so we suspect that *T. shurae* was an ectoparasite of the urchins, in a high energy-environment.

Family ***TURRITELLIDAE*** Lovén, 1847.

According to DELPEY (1941, pl. 17) the *Turritellidae* were included in the Cassiopidae Family, too. With a Biochron of Triassic to Recent, this has been a successful family, as filter-feeders that burrow just beneath the sediment-water interface. Detritivores, burrowing in organic-rich sediments of shelfal setting; these habits explain their high diversity and abundance in the Molassic Basins of the Cenozoic. Siliciclastic bottoms are preferred (ALLMON, 1988). During Eocretaceous times, in the S.C.S. the *Turritellidae* are rather rare, in individuals as much as in species.

Genus ***Turritella*** Lamarck, 1799.

According to WENZ (1938) the typical *Turritella* originated during Aptian times, and evolved in many species. Its distribution includes Europe, Africa, Lesser Asia, India, Formosa, Japan, both Americas and the Caribbean, Australia and New Zealand. Inhabits terrigenous sediments, frequently ferrolithic, in marine waters at depths of 0-92 meters. Uncommon in S.C.S. Eocretaceous (Gallic) sediments (JAWORSKI, 1938; ROYO Y GOMEZ, 1941-b; VON DER OSTEN, 1957; and FRAUNFELTER in KEY, 1960).

Turritella orbignyana Cotteau, 1855.
Plate 34, figure 14; plate 48, figure 20;

- 1855 *Turritella orbignyna* COTTEAU, Bull. Soc. des Sciences de l'Yonne :#9 : 18 ;
- 1900 *Turritella orbignyana* (C.) PERON, Bull. S. S. hn. Yonne#53: 22, pl. 1, fig. 3;
- 1934 *Turritella Robineausa* d'O., COTTREAU, Ann. Paleont. #23: 52-53;

Occurrence: Collected at Leugny and Gy-l'Evêque, Paris Basin, France, in the Ferrolithes of Hauterivian age. Also reported in La Bedoule, France, of Late Barremian age.

S.C.S. occurrence: Locality MO-890, La Cueva Inlet, Borracha Island, (DAGM) lower Borracha Formation, of Late Aptian age; collected in the soft, marly interbeds between the massive limestones, where it is not common.

Turritella pelusae Von der Osten, 1957
Plate 26, figure 12;

- 1954 *Turritella sp. 1,* VON DER OSTEN, Bol. Geol. (Caracas) 3(8): 173, pl. 12, fig. 1;
- 1957 *Turritella pelusae* VON DER OSTEN, Jour. Paleont. 31(3) : 586, pl.65, fig. 15 ;
- 1985 *Turritella aff. pelusae* V.D.O., ETAYO-SERNA, Proy. Cret., Publ. Esp. 16#24: 26;

Description: Shell elongate, concave, sustures deeply impressed; spire with 7 or 8 whorls, three or four lacking in the holotype; height of whorl ½ of width; sculpture of five serrate spiral ribs on each whorl, equal in size, about 1/3 as wide as intercostal areas; body whorl twice the height of the last spire-whorl, with oneadditional rib; base somewhat flattened, with several spiral lines; aperture not preserved; apical angle 13º.

S.C.S. occurrence: Collected at MMH locality Su-110, west coast of Picuda Grande Island lower limestone member of Taguarumo Formation, (DAGM) of Late Hauterivian age. Also at MO-3213, Lope inlet of Chimana Grande island, the same stratigraphic horizon.

Types: The types are lost; the neotypes are catalogued as UCVMG/IO-2138.

Observations: Associated to *Columbellina* and *Panopea* spp. in ill-sorted bioclastic limestones. Related to *T. pseudodupiniana* PERON, (1900, 53: 25-26, pl. 1, fig. 7) – Paris Basin in Yonne, France, of Hauterivian age – which also has five spiral cords, but equals to the interspaces, and whose whorls are strongly convex.

Subgenus ***Torquesia*** Douvillé, 1929.

Torquesia seems to have originated in the Apulian Subprovince, during Tithonian-Berriasian times, with *T. tithonica* Gemmellaro (1864, Geol. G., 2: 51, pl. 8, figs. 25, 26). It is *Nerinea*-like, with low whorls, separated by a smooth subsutural cord. Found in the *Terebratula janitor*-beds in Sicily, and in Tithonian limestones in Vidlic, Croatia (VESELINOVIC, 1965). In S.C.S. the species of *Torquesia,* are found in carbonatic sediments, associated to holomarine fauna.

Turritella (Torquesia) raimondi Gabb, 1877.
Plate 42, figure 17;

- 1877 *Turritella raimondii* GABB, Jour. Acand. Nat. Sci. Philadelphia, 8 :279-280, pl. 40, fig. 2;
- 1918 *Turritella planilateralis* ELLISOR, Univ. Texas Bull., 16: 18, pl. 4, fig. 7;
- 1960 *Turritella (Haustator) cf. scheibei* J., DUSENBURY & FRAUNFELTER in KEY, Bol. Geol. Publ. Esp. 3(2): 521;

Occurrences: Originally collected in the Pariatambo coal mine, of Pariatambo Formation, of Late Middle Albian age (BENAVIDES, 1956). Also from Georgetown Formation, Texas, of Late Albian age.

S.C.S. occurrence: MO-2519, Quebrada Santa Rosita, Perijá area, Píche Member of Apón Formation, of Early Albian age. Also HA-4336, in upper carbonatic member of Peñas Altas Formation, of Late-Middle Albian age.

Turritella (Torquesia) vibrayeana *(d'Orbigny, 1842)*

- 1842 *Turritella Vibrayeana* d'ORBIGNY, Paleont. Franç. Terr. Cret., 2, Gast.:37-38, pl. 161, figs. 10-12;
- 1862 *Turritella Vibrayeana* d'O., PICTET & CAMPICHE, Mat. Paleont. Suisse, 2 : 315-317, pl. 72, figs. 5-7 ;
- 1903 *Turritella vibrayeana d'O.,* DONCIEUX, Ann. Univ. Lyon, ns. 2 : 301-302, pl. 1, fig. 1 ;
- 1954 *Turritella vibrayi* d'O., VON DER OSTEN Bol. Geol. (Caracas), 3(8) : 148 ;
- 1962 *Turritella (Torquesia) vibrayena* d'O. ABBASS, Brit. Mus. Nat. Hist. Bull. 7(6): 185-187, pl. 31, figs. 17-22; Text-fig. 11;
- 1962 *Haustator vibrayeanus* (d'O.) BENKÖ-CZABALAY, Geol. Hung., Paleont. 31: 254, pl. 5, figs. 10-12;
- 1979 *Torquesia vibrayeana* (d'O.) KOLLMANN, II, Ann. Nat. Mus. Wien, #82: 30-32, pl. 5, figs. 46-51;

Occurrence: One of the most wide-spread Gastropoda species in Western European, Maghrebian, Somalian and Balkanic Subprovinces in all the stages of Albian.

S.C.S. occurrence: Locality MC-271-D, eastern coast of Chimana Grande Island, Chimana Formation, (DAGM), of Middle Albian age. Formerly cited from Colombia, in Paja Formation, of Albian age.

Genus ***Haustator*** Montfort, 1810.

According to WENZ (1938) the Biochron of this genus extends from Eocretaceous (Neocomian) to Recent. Its habitat is in warm oceans, in siliciclastic sediments. In Central Asia and Transcaucasia, the genus flourished from Albian to Senonian times (PCHELINTSEV, 1953, fig. 6). During Cretaceous Period, the *Haustator* was common in the Tethys Ocean, Indonesia, Japan and Australia. It would belong to Taxa Group Three, (SOHL, 1987).

Haustator columbiana (Jaworski emend. ROYO Y GOMEZ, 1942c)
Plate 25, figure 11;

- 1936 *Turritella (Haustator) columbiana* JAWORSKY N. J. f. Miner. B. 76: 513-518, pl. 30, figs. 1ª, 1d;
- 1942c *Turritella (Haustator) columbiana* J., ROYO Y GOMEZ, Comp. Est. Geol. Of. Col., S.G.N., #5: 344-345;
- 1957 *Turritella seriatim-granulata* R., VON DER OSTEN, Jour. Paleont. 31(3): 586, pl. 65, fig. 7 ;(not Römer, 1852, Kreideb., v. Texas ; 39, pl. 4, figs. 12ª, 12b)

Description: J. ROYO Y GOMEZ (op. cit.) had the opportunity of rewieving *H. columbiana* , based on 45 fragmentary material, from which JAWORSKY thougth were all of Albian age. With additional 330

specimens, whose most frequent height, is of 15 mm, but some shells reached 20 and 25 mm. Turriculated shell, with whorls nearly flat, and excavated suture. On the young shells, the apical angle is about 20º, but on the mature shell, it decreases to 14º. The whorls are slightly wider than high, almost flat, with a subsutural cord. The body whorl in the older shells, has a convex base, being 1/3 higher than the penultimate whorl. The sculpture is formed by five spiral ribs, finely nodulated; all the ribs are uniformly separated, except the first two ones. In the four lower ones, one or two fine riblest get intercalated. The base of the body whorl are four spiral ribs. The growth striae are falcated.

Dimensions: The height: 25 mm, width of the last whorl: 14 mm, 14 whorls preserved. Deposited at UCVMG/IO-2139.

S.C.S. occurrence: Most of the shells collected in Colombia, are from Barremian-age beds, probably extended to Late Hauterivian and to Early Aptian, and are definitely not of Albian age, as was supposed by JAWORSKY (op. cit.). Collected in La Paja Formation, of the Lower Villeta Group. In Venezuela, at M.M.H. locality Su 109, western coast of Picuda Grande Island, (DAGM) in Lower Taguarumo Formation, of Hauterivian age. Also at VG-381, in Upper Taguarumo Formation, of Late Barremian age.

Haustator cf. scheibei (Jaworsky, 1938)
Plate 35, figure 11;

- Cf. 1936 *Turritella (Haustator) scheibei* JAWORSKI, Beitr. S. N.J. f. M. B.# 76: 518-520. Pl. 30, figs. 2a-c;
- Cf. 1942c *Turritella (Hautator) scheibei* J. ROYO y GOMEZ : 345 ;
- CF. 1985[a] *Turritella (Haustator) scheibei* J., ETAYO SERNA, Proy. Cret., Publ. Esp. 16:24: 26;

S.C.S. occurrences: Localidad MC-260-D, Cerro Los Encantados, García Formation, Monagas state, (DBG) of Late Aptian age; associated to low temperature Bivalvia, and the predator gastropod, *Drepanochilus.* All the *T. scheibei* are replaced by ferrolite (goethite) and the surface ornamentation is weakly represented. In Colombia, is known from Fomeque Formation (Barremian) and Tablazo limestone Formation, of Late Aptian age (ETAYO SERNA, op. cit.).

Haustator marahuana (Maury, 1925)

- 1925 *Turritella marahuana* MAURY, Mon. Serv. Geol.-Min., Brail#4: 573, 575, pl. 22, fig. 11;
- 1980 *Haustator vibrayeanus quadricostata* MONGIN & PEYBERNES, Paleogeogr., Paleoecol., Paleoclimat., 32(1980/81): 233, pl. 2 fig. 3;(not vibrayeanus ´d'ORBIGNY, var.) ?1985[a] *Turritella aff. seriatimgranulata* R. ETAYO SERNA, Publ. Esp. 16:#24: 21, 26, pl. 1, fig. 21(not RÖMER, 1849);

Occurrence: Originally collected from Algodoes, Bahia, Brazil, in Algodoes Formation, of Abian age. Also in Fontcouverte, France, of Early-Middle Albian age.

S.C.S. occurrence: Locality MO-1375, Road from Santa Teresa-Los Monos, Anzoategui state, (DBG) Caripito Member of Chimana Formation, of Middle Albian age. In Colombia, Sierra Nevada del Cocuy, in Late Aptian sediments.

Genus ***Arcotia*** Stoliczka, 1868, (=*Craginia* Stephenson, 1952).

Arcotia has a Biochron extended from Eocretaceous (Valanginian) to Late Cretaceous (Turonian). Our thermophylic species all were found in holomarine high-energy sediments, usually in High Stand Tract sequences. They should be included in Taxa Group Two, of SOHL (1987: 1103).

Arcotia peralveata (Conrad, 1852)
Plate 59, figure 6;

- 1852 *Turritella peralveata* CONRAD in LYNCH, Exped. To Palestine: 221, l. 20, fig. 120;

Diagnosis: Shell turriculated, composed of 9-10 convex whorls, with three equal, and equidistant prominent revolving carinae on each; space above and below the carinae equal in width and concave. Aperture unknown.

Dimensions: Height: 34,5 mm, Width of last whorl, 16,5 mm. (CONRAD's type, op. cit.).

Occurrences: Bhamdûn, Liban, of Late Albian age.

S.C.S. occurrences: Locality HA-4343, La Urbina north section, Trujillo state, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 33), of Middle Albian age.

Comparions: *Vicarya (Turritella) studeri* VILANOVA (1863, pl. 4, fig. 16; pl. 5, fig.22; pl. 8, fig. 14 [non 25]), treated as a *Glauconia (=Cassiope)* by MONGIN in COMBES-MONGIN (1970) – Hauterivian and Barremo-Aptian of Spain and south France, but also Valanginian of Perú (BENAVIDES, 1956),- has all the characteristics of *Arcotia,* and I consider it the Mesogean ancestor of *A. alveata.*

Arcotia studeri peruana (Fritzsche, 1923).
Plate 25, figures 4, 5;

- 1923 *Pseudoglauconia Studeri var. peruana* FRITZSCHE, N. Jahrb. F. Miner., Geol. u. Paleont. Bd 50: 44-46, pl. 2, figs. 10 a-c;
- 1923 *Pseudoglauconia strombiformis S.,* FRITZSCHE, N. J. M. G., Pal. Bd. 50 : 41-43, text fig. 7 ; (*non* SCHLOTHEIM, 1820)
- 1956 *Craginia floresi* ALENCASTER DE CSERNA, Paleont. Mexicana, 2 : 33, pl. 5, figs. 9-11;

Occurrences: Collected originally in Carhuaz and Santal Formations of northern Perú, and San Juan Raya, Mexico, all of Barremian age.

S.C.S. occurrences: Locality PM-87-B, Cerro Garrapatero, Casanay, Sucre State, in Chuparipal Formation, (DEP) of Barremian age, in the silty interbeds of the massive limestones. Also in Lope member of Taguarumo Formation, of Barremian-Early Aptian age. In Colombia, it was found in Fómeque Formation, (ROYO Y GOMEZ, 1954-B: 490) of Barremian age. Las Cinco Ceibas corallian locality, of El Dantó Formation, of Late Hauterivian age.

Genus ***Trobus*** Stephenson, 1955.

Trobus has a Cretaceous Biochron: (Hauterivian to Maastrichtian) and a distribution in both Americas, and Lesser Asia.

Trobus damesi (Blanckenhorn, 1896)
Plate 26, figures 9, 24;

- 1890 *Turritella Damesi* BLANCKENHORN, Beitr. Zur Geologie des Syriens : 99, pl.7, figs. 8-10 ;
- 1891 *Cerithium Conradi* WITHFIELD, Bull. Ann. Mus. Nat. Hist 33 : 428, PL. 9, FIGS. 11, 12;
- 1927 *Turritella sp.* BLANCKENHORN, Paleontogr. #69: 140, pl. 3, fig. 36; pl. 4, fig. 74b;
- 1939 *Turritella-Glauconia Damesi* B. DELPEY, Gastr. Mesoz.: 99-101, figs. 70, 71, 72;
- 1957 *Turritella ministeri* VON DER OSTEN, Jour. Paleont. 31(3) : 586, pl. 65, fig. 27 ;

Description : Shell moderately large, conical, whorls straight, sutures incised ; spire with at last five whorls; height of whorl, almost ½ of width, side almost flat, with slight undulations and a strong sutural band just below the suture, growth lines occasionally well marked; shell thick, which forms a subcircular aperture; apical angle: 30º. This fragment measures, of Height: 35 mm, greatest width: 12 mm (VON DER OSTEN, op. cit.), and it represents an adult *Trobus damesi,* which resembles to some *Cassiope.* The juvenile part was published as *Cerithium conradi*: the first whorls (until 7 or 8) are almost flat, ornated by two or three spiral cords, equals or unequals, where the middle one is the weakest; there is a weak subsutural cord, separated from the others by a slight depression. The sutures are weak, the shell is thin. At fifth and sixth worls, the cords become granular, the aboral one changes to a whorl forming tubercles; the base, not umbilicated, resembles the outlook of a *Cassiope,* resembling *C. lujani* Verneuil & Loriére. The juvenile, barely reaches 10 mm of width, and 27 mm of height. DELPEY (op. cit.) illustrated complete shells, where the two stages are transitional.

Occurrence: In Liban, this species was collected in Mechta-Helou of the Nahr Ibrahim valley, where the facies was evaporitic. At Beit Chébab, Bekfaya (Mar Boutrosse) in the first two fossiliferous horizons, both of Early Aptian age.

S.C.S. occurrence: Locality MMH, Su-110, west coast of Picuda Grande Island, lower Taguarumo Formation, (DAGM) of Late Hauterivian age.

Observations: DELPEY (op. cit.) asked herself about this dimorphisme on the *Trobus* shell? One answer would be gerontisme, but the pearly-nodulated phase persisted on 3 or 4 successive whorls. She suggested that some paleoenvironmental cause would be involved. The Venezuelan sample came from the green basal limestones of Taguarumo Formation, deposited during the Faraoni OAE, of Late Hauterivian age. The Lebanese shells came from the Early Aptian, during the Selli OAE. Strong salinity changes during these events, could be related to this dimorphism.

Genus ***Mesalia*** Gray, 1847.

Mesalia has a Biochron extended from Eocretaceous (Albian) to Recent, so it should be ranged among Taxa Group Three of SOHL (1987). Its distribution extended in all the Tethys Ocean, Indonesia, New Zealand and both Americas during Cretaceous times, decreasing during the Cenozoic, just the opposite of the genus *Turritella* sensu lato.

Mesalia hebe White, 1888.

- 1888 *Mesalia hebe* WHITE, Arch. Mus. Nac. Rio de Janeiro #7: 165, pl. 18, fig. 5;
- 1936 *Mesalia hebe* W., MAURY, Monog. Serv. Geol. Min. Brasil, # 11: 205, pl. 12, fig. 8;

- • ?1903 *Mesalia Fontcouvertensis* DONCIEUX, Ann. Univ. Lyon, n.ser. 2 : 303, pl. 1, fig. 4 ;
- 1980 *Mesalia hebe* W., GARCIA JARPA et alii., Bol. Geol. (Caracas) 14(26): 44;

Diagnosis: Shell rather small, aoical angle 20º, whorls ten or more in number, regularly convex. Suture impressed. The whorls are sculptured with five sharply raised, nearly uniform, spiral lines, separated by interspaces that are a little wider than the spirals. The base has also revolving lines, but somewhat coarser.

Dimensions: Height of the type: 19 mm, width of last whorl: 7 mm.

Occurrence: Sao Gonçalo, near Estancia, Brazil, of probably Middle Albian age.

S.C.S. occurrence: Locality MC-235-C, Road to La Antena, near Teresén, Monagas State, El Cantil Formation, (DBG) of Late Aptian age. The associated mall molluscan fauna, suggests an inner shelf environment, with saline waters.

Discussion: *Mesalia fontcouvertensis* DONCIEUX, (op. cit.) – Late Albian, Pyrenean mts., south France),- have more convex whorls, with 10 unequal spiral cords, of which 4 are coarser than the others, and the sutures are canaliculated.

Mesalia cf. planicostata (Peron, 1900)
Plate 25, figures 28, 28ª;

- 1900 *Turritella planicostata* PERON, Bull. S. Sc.H.n. Yonne, 53: 26-27, pl. 1, fig. 8;
- 1925 *Turritella planicostata* P. CORROY, Neoc. Du Bassin du Paris: 178;

Occurrence: Originally collected at Auxerre, France, in the Paris Basin, of Hauterivian age.

Diagnosis: Small shell, preserving about 5,1/2 convex whorls, which are twice as wide as high; surface covered with fine, regular spiral threads, giving an appearance of Nerinean genus of *Aphanoptyxis.* The labral profile is parasigmoid, very asymmetric, the adapertural half of the labrum forming a proyecting hood, while the abapertural half is embayed, consequently *Mesalia* is the only genus of the Family *Turritellidae* in which the growth-lines seen on the spire-whorls, meet the lower suture more to the left than the upper suture (DAVIES, 1935, p. 251, fig. 307). It would be an oblique prosocyrt labral profile (fig. 28A). *Aphanoptyxis* has an orthocline labral profile, so is necessary to accept *Mesalia cf. planicostata* a the oldest known of this genus. The apical angle is about 14º, lower than in most of *Mesalia.*

S.C.S. occurrence: Locality MO-905, cliff at east side of Cachimena inlet, lower Lope member of Taguarumo Formation, (text-fig. V-08) of Late Barremian age. Collected in the coral-rich bed, above the basal sandstone of the member.

Dimensions; Height: 15 mm, Width of body whorl: 7 mm.

Family ***CASSIOPIDAE*** Kollmann, 1979.
(=*Glauconiidae* Pcelintsev, 1953).
Genus ***Cassiope*** Coquand, 1865.

According to COSSMANN (1909: 167-168) and WENZ (1939: 694) it had a Biochron of Eocretaceous (Valanginian) to Late Cretaceous (Maastrichtian), widespread in the Tethys Ocean, including Japan. Is one of the most important Genera in the Taxa Group Two of SOHL (1987) having originated in saline or hypersaline shallow seas, as a thermophyllic taxon, where it was usually abundant. According to MONGIN in COMBES & MONGIN (1970: 142-143) the first species were big-sized shells, well ornamented, mainly with nodes and tubercles on the spiral cords; during Middle Cretaceous, the size decreased (25 mm of height), and the ornamentation consisted mostly of more or less pearly spiral cords. During Senonian times, *Cassiope* evolves to many species, with several varieties, frequently developing strongly tuberculated cords. ROMAN & MAZERAN (1913: 53-54) considerd this as an euryhaline genus, inhabiting normal marine seas, (Cenomanian and Turonian) to go back to brackish during Senonian times. C. J. MAURY (1936), G. DELPEY (1940: 250) and S. FABRE (1942: 12) considered *Cassiope* as a lagoonal fauna. The size increased again during Cenomanian and Turonian times, the shells became more inflated and developed a stronger ornamentation (FABRE, 1942). MORTER in WORSSAM (1978: 21) cited the frequency of *Cassiope* in the Wealdian clays, in England, where they are mostly crushed.

Paleoenvironment: The increase in size, the degree of inflation and nodular/pearly ornamentation, in some Gasteropoda, Molluska, as in *Cassiopidae* suggests a saline/hypersaline paleoenvironment, where only algae, stromatoporids and hydrozoans subsisted upon the usually muddly bottom. The nodular ornamentation has the purpose of substrate for fixating epibionts which constituted a camouflage against vagrant predators. The Bivalves of the Subfamily *Carditesinae* present these same phenomena.

Cassiope lujani (Verneuil, 1853).
Plate 25, figure 23;

- 1853 *Cerithium Lujani* VERNEUIL, Bull. Soc. Geol. France, 2e. ser., #10: 165, pl. 3, fig. 17;
- 1858 *Cerithium heeri* PICTET & CAMPICHE, Mat. Paleont. Suisse ser. 3: 51, pl. 5, fig. 4 ;
- 1866 *Cassiope lujani COQUAND* :Soc. Emul. Provence, Mem. 3 : 250, pl. 4, fig. 3, 4, 5 ;
- 1947 *Cassiope branneri* (Hill) STANTON, U.S. Geol. Surv.,Prof. p. 211: 77, pl. 57, figs. 1-6;
- 1974 *Paraglauconia lujani* (V.) DIMITROVA, Cret. Foss., Bularie : 25-26, pl. 6, fig. 1a, 1b ;
- 1987 *Cassiope picteti* B. LOPEZ, Thèse, UCV, 134, fig. 35 ;

Occurrence : This taxon had a Biochron extended from Barremian to Late Albian, distributed in all the tropical subprovinces of Gondwana Province, including Texas, Balkanic and the Neuquén Subprovince. In Spain, is frequent in Alacon limestone Formation, of Barremian-Early Aptian age (CANEROT, 1982).

S.C.S. occurrence: Locality MO-1502, Arbol Redondo Section, lower carbonatic member of Peñas Altas Formation, of Late Barremian age; many shells in a reddish ferrugineous limestone. In Taguarumo formation, Quebrada Quetepe, Sucre state, of Barremian age, many sparitized shells.

Cassiope strombiformis (Schlotheim, 1820)
Plate 26, figures 14, 15, 21;

- 1820 *Muricites strombiformis* SCHLOTHEIM, Petrefaktenkunde: 144;
- 1836 *Potamides carbonarius* ROEMER, Norddeut. Oolithengebirges: 140, pl.11, fig. 17;
- 1863 *Turritella Lorieri* VILANOVA, Descr. Geogn. Teruel, pl. 8, fig. 15;
- 1882 *Melania Laginensis* STRUCKMANN, Neue Beitr. Wealdenb. 1: 28, pl. 4, fig. 24-26;
- 1902 *Glauconia strombiformis* S., REHBINDER, C. g. S. P.M., #16 : 122-134, pl. 1, figs. 13-24 ; pl. 2, figs. 1-7 ;
- 1931 *Cerithium cf. heeri* (P. & R.,) WEAVER, Univ. Washington, Mem. #1: 385, pl. 42., fig. 284;
- 1956 *Paraglauconia strombiformis* (S.) BENAVIDES, Pal. Northern Perú: 367, 369, 392;
- 1974 *Paraglauconia strombiformis (S.)* DIMITROVA, Foss. Bulgarie, 4b : 26, pl. 7, fig. 2 ;

s

Occurrences : The earliest occurrence of this taxon, is in the Santa and Carhuaz Formations, in Peruvian Subprovince, of Valanginian age, precisely in the Ammonite Zone *Valanginites broggi* (BENAVIDES, op. cit.). During Hauterivian stage, the species invades North European Province, Western European Subprovince, S.C.S., and during Barremian, Neuquen and Balkanic Subprovinces. During Early Aptian, survives in Switzerland and Bulgarie, until extinction.

S.C.S. occurrence: Locality Las Cinco Ceibas, Sucre state, (WELLS, 1944, Jour. Paleont. 18: 429) of upper El Dantó dolostones, of Late Hauterivian age; where 26 well preserved shells, associated to small coral colonies, were collected.

Genus ***Pseudomesalia*** H. Douvillé, 1917.

According to PCHELINTSEV (1954), the Biochron of this genus, is also intra-Cretaceous, (Albian to Senonian) as its sister-genus, *Cassiope,* belonging to SOHL's (1987) Taxa Group Two. Its paleogeographical distribution includes Syrian, Balkanic Subprovinces, and S.C.S.

Pseudomesalia deserti Douville, 1916.
Plate 50, figure 10;

- 1916 *Pseudomesalia deserti* DOUVILLE, Moghara : 141-142, pl. 1º8, figs. 18-25 ;
- 1963 *Vermicularia (Pseuomesalia) deserti* (D.) ABBASS, Geol. Surv. M. R.D., Paleont. Serv., Mon. 2 : 45, pl.2, fig. 23-25 ;
- 1979 *Pseudomesalia deserti* D., KOLLMANN, II, a. n.m.Wien, #82: 32-33, pl. 5, figs. 52, 53;

Occurrence: Originally studied from Djebel Manzour, Sinai Peninsula, Egypt, in yellow oolithic ferrugineous limestones, of Albian age. In Hölleitengraben, Austria, of the same age.

S.C.S. occurrence: Locality PM-87-B, Cerro Garrapatero, Rio Carinicuao area, Sucre state, in Borracha Formation, of Early Albian age. Also in La Cueva Inlet, Borracha Island, (DAGM) in Lower Borracha Formation, of Early Albian age. Uncommon.

Pseudomesalia manzourenis (Abbass, 1963).
Plate 25, figure 30;

- 1963 *Vermicularia (Pseudomesalia) manzourensis* ABBASS, Geol. Surv. M. R. D., Paleont. Ser.Mon. #2: 45-46, pl. 2, figs. 10-13;

S.C.S.occurrence: Locality MO-905, Cliff to the northeast of Cachimena Inlet, Sucre state, Lope member of Taguarumo Formation, of Late Barremian-Early Aptian age (Text-fig. V-08). Sideritic limestone with many bivalves, found biodegraded.

Occurrence: Collected at Rishat Manzour, Maghara, Sinai Peninsula, Egypt, in Early Albian age.

Genus ***Coninoda*** Kollmann, 1979.

KOLLMANN (1971: 42-43) described this genus, as follows: "Turriculate shell; distinct coniform "nodes in the upper portion of the whorls, delicate threads below, inner lip concave, reflected." Its Biochron extends from Late Jurassic (Ryazanian) to Late Cretaceous (Cenomanian), fitting well into Taxa Group One of SOHL (1987). It inhabited sandy bottoms, in high energy shallow marine waters. Species in my files:

1. *Coninoda arigoi* (Vilanova, 1863) (=*C. tourneforti* Coquand, 1865) Hauterivian,
2. *Coninoda bosquense* (Schumard, 1860) Albian
3. *Coninoda eleanorae* (Allison, 1955) Albian
4. *Coninoda excavatum* (Brongniart, 1828) Albian
5. *Coninoda lamanonis* (Coquand, 1856) Aptian-Barremian
6. *Coninoda mammata* Kollmann, 1979, *type of *Coninoda* Albian
7. *Coninoda miyakoense* (Nagao, 1934) Aptian-Albian
8. *Coninoda miyakoense v. tomásenis* (Allison, 1955) Albian
9. *Coninoda portlandica* (Fitton, 1836) Ryazanian
10. *Coninoda ríograndense* (Stanton, 1947) Albian

Coninoda mammata KOLLMANN, 1979.
Plate 62, figures 6, 7;

- 1979 *Coninoda mammata* KOLLMANN, A. N. Mus., Wien, #82: 43, pl. 5, figs. 69-71;

Occurrence: Losensteiner Schichten, Holleitegraben, Austria, of Middle Albian age.

S.C.S. occurrence: HA-4576, Santo Domingo River´s gorge, Barinas state, Aguardiente Formation, of Late Albian age (ARNAUD et alii., 1999, fig. 37). It was collected in a calcite-cimented coarse sandstone bed.

Coninoda sp. aff. arigoi (Vilanova, 1863)
Plate 23, figure 4;

- 1863 *Cerithium Arigoi* VILANOVA, Descr. Geognostica …de Teruel, pl. 8, fig. 12;
- 1970 *Cimolithium cf. tourneforti* (Coquand) MONGIN: 140-141, pl. 8A, fig. 3; Text-figs. 3c and 4;
- 1985 *Cerithium sp. aff. Tourneforti* Coq., ETAYO SERNA, Proy. Cretacico #16: 24-9;

S.C.S. occurrence: Locality MO-1375, La Cueva Inlet, Borracha Island, (DAGM) Lower Borracha Formation, of Late Aptian age. Collected on the top of a massive limestone, many biodegraded shells. In Colombia, in the Apón Formation, Cocuy Hemigraben, of Aptian age.

Occurrence: In south France, in calcareous-clay intercalations, in the bauxite deposit of Lescalé (Ariège) of Barremian-Aptian age.

Comparisons: *Coninoda arigoi (Vilanova) (=C. tourneforti* [Coquand, 1865]) – Mirambell marl and Blesa marl/limestone Formations, Maestrazgo Basin, Spain, of Hauterivian-Early Barremian age, not Aptian as was stated originally – were of bigger size, and with the subsutural nodules almost fused in a subsutural belt.

Family ***ABYSSOCHRISIDAE?***
Genus ***Humptulipsia*** Kiel, 2008.

According to KIEL et al., (2010) the Genus *Humptulipsia* has a Biochron extended from Eocretaceous (Hauterivian) to Paleogene (Eocene). It is a marine, Bathyal gastropoda, proper of chemosynthetic paleoenvironments.

Humptulipsia macsotayi Kiel, Campbell & Gaillard, 2010.
Plate 30, figures 3, 6, 9;

- 1972 Mesogasteropoda genus indet. THIELUOY, Geobios : 19, pl. 1, figs. 3-9;
- 2010 *Humptulipsia macsotayi* KIEL, CAMPBELL & GAILLARD, Zootaxa, 2390: 31-32, fig. 3;

Diagnosis: Shape, size and sculpture typical for genus, whorls with subsutural constriction and ridge, upper sinus below thatridge; lower slit narrow, at or below basal margin, with sinuous growth lines below slit.

Dimensions: The Holotype measures of Height (only the last 3 whorls) 52 mm, Width: 31 mm, (in Collections of Grenoble University, France).

Occurrence: Originally collected near Rottier, (DRÔME), Pre-Alpes of France, in a carbonatic lens in deep-sea shales of Zone of *Crioceratites Loryi* of Early Hauterivian age (THIELUOY, op. cit.) in the Vocontian Basin. According to KIEL et al., (op. cit.) the carbonatic lens was a presumed Seep Carbonate.

Discussion: In Venezuela, there is one lithostratigraphic unit, Carorita Formation, deposited

in Bathyal paleoenvironment (MACSOTAY, et al., 1987: 6-7) comparable to the Vocontian Basin. The presence of bathyal Bivalvia as genera *Propeamussium, Entolium, Poromya* and the big-sized *McLearnia and Prohinnites*, suggests the presence of Eocretaceous methane-seeps in this unit, in Venezuela. See Text-Figure I-02-b, for paleo-position of Carorita Formation. It will be possible to find also big-sized Gasteropoda as *Humptulipsia,* too.

Family ***PROCERITHIIDAE*** Haas, 1953.
Subfamily ***PROCERITHIINAE*** Haas, 1953.
Genus ***Gymnocerithium*** Cossmann, 1906.

With a Biochron extended from Middle Jurassic (Bathonian) to Eocretaceous (Aptian) of Late Cretaceous (Cenomanian?). With an extension of West European and Balkanic Subprovinces, this genus originated few species.

Gymnocerithium cf. collegiale (Zittel, 1873)
Plate 9, figure 5;

- 1873 *Cerithium collegiale* ZITTEL, Pal. Mus. Bs. #2: 383, pl. 45, fig. 5;
- 1906 *Gymnocerithium collegiale* (Z.) COSSMANN: Paleont. Comp., #7: 36, pl. 7, fig. 17;
- 1931 *Gymnocerithium collegiale* (Z.) YIN TSAN hsun, Trav. Lab. Geol. Lyon #18(14): 39, pl. 3, fig. 7;

Occurrence: Originally collected at Stramberg, actually in Czeh Republik, of Tithonian-Berriasian age (ZITTEL, op. cit.), and reported from Croatia, and Bas Languedoc, south France, from the same stratigraphic horizon. Also in Murles, France, of Valanginian age.

S.C.S. occurrence: Locality MO-3131, Cantera Los Andes, La Rosa Hill, south of Cumana, Sucre State, (DAGM) in Morro Blanco Formation, of Late Berriasian-Early Valanginian age. About eight shell profiles were observed, in massive dolostones.

Family ***PARACERITHIINAE*** Cossmann, 1906.
Genus ***Rhabdocolpus*** Cossmann, 1906.

With a Biochron of Early Jurassic (Sinemurian) – Early Cretaceous (Albian), this is a common genus in the Wealdian Facies, in North European Province, and Southern Caribbean Subprovince. Represented by many species, its frequency in our saline formations, suggests: A) Taxon favored by saline environments, or B) The great volume of algal material favored the algophagous gastropoda, as *Rhabdocolpus.* WENZ (1938) treated it as a subgenus of *Procerithium,* but it was seprated as an independent taxon by ABBASS (1973). *R. sp. cf. rugosum* (Dunker) was cited from the Valanginian of the evaporitic Río Batá series of Colombia. It should be included in Taxa Group One of SOHL (1987: 1102).

Rhabdocolpus forbesi (d'Orbigny, 1850).
Plate 26, figure 27;

- 1845 *Cerithium phillipsi* Leym. FORBES, Quart. Jour. Geol., 31 :352, pl. 4, fig. 12 ;
- 1850 *Cerithium Forbesianum* d'ORBIGNY, Prodrome #2 :116 ;
- 1865 *Cerithium Forbesianum* d'O., COQUAND, Mem. Soc. Emul. Provence, #3: 85-86;
- 1868 *Cerithium forbesianum* (d'O.) VERNEUIL & LORIERE, M. P.p.l. España, #7 :15-16, pl. 2, fig. 7 ;
- 1973 ?*Rhabdocolpus forbesianum,* ABBASS, Bull. B. M.N.Hist. #23(2): 143-144, pl. 5, fig. 1-5;

Occurrences: Collected originally in the Wealdian facies of England and Hannover, northern Germany, where it is widespread. Also common in the limestone and marl Formation of Chert, Maestrazgo Basin, Spain, of Early Bedoulian (Aptian) age. Rare in Perte-dû-Rhone, Switzerland, in Early Aptian sediments.

S.C.S. occurrence: Locality MO-5622, El Yaque quarry, (DAGM) Upper Taguarumo Formation, of Late Barremian age. Found in dark grey limestones, weathering yellowish grey, associated to pharetronid sponges, calcareous algae and *Palorbitolina lenticularis,* (H. ARNAUD et alii., 2000).

Rhabdocolpus hausmanni (Dunker, 1846)
Plate 15, figure 11;

- 1846 *Cerithium Hausmanni,* DUNKER, Monogr. Nordd. Wealdenbild. Pl. 10, fig. 21;
- 1868 *Cerithium Hausmanni* (D.) VERNEUIL & LORIÈRE, M. p.p.l. España, #7 : 14-15, pl. 2, fig. 6 ;
- 1967 *Procerithium (Rhabdocolpus) hausmanni* (D.) HUCKRIEDE : 193, pl. 2, fig. 6;

Occurrences: Originally, collected from the Wealdian facies of northern Germany; in Utrillas, Spain, studied from marls interbedded with lignites, of De Blesa Formation, of Oliete Basin, of Hauterivian-Early Barremian age (CANEROT, 1982).

S.C.S. occurrence: Locality PM-09-D, trail from El Pajaral to La Margarita mountain, (Monagas state) in La Margarita mudstones of Hauterivian age. Several pelomorphically defomed casts, with the characteristic sculpture.

Rhabdocolpus krauskopfi (Von der Osten, 1957)
Plate 26, figure 11;

- 1957 *Cerithium krauskopfi* VON DER OSTEN, Jour. Paleont. 31(3) : 588, pl. 65, fig. 14 ;

Description : Shell small, conical, whorls slightly conve, sutures impressed : spire with six whorls ; height of whorl about 1/3 of width ; ornamentation of seven strong radial ribs per whorl, anteriorly inclind downwards ; rib on each whorl located more anteriorly than those on preceding whorl, giving spire a twisted appearance; interspaces four or five times as wide as ribs, crossed by 6-7 spiral threads; body whorl about four times height of last spiral whorl, with strong spiral thjreads; anterior border rounded; two spiral lamellae on bottom; perture not vailable in holotype; apical angle 40º(VON DER OSTEN, op. cit.).

Dimension: Height: 12 mm, Width: 4,5 mm.
S.C.S. occurrence: Locality MMH, Su-90, west coast of Picuda Grande island, (DAGM) base of Taguarumo Formation, of Late Hauterivian age.
Comparisons: It is very similar to *Procerithium (Rhabdocolpus) manselli* (de Loriol)(COX, 1925: 159-160, pl. 5, figs. 14, 15) – Lower Spilsby Formation, England, of Ryazanian age,- but the whorls embrace one another very anteriorly, well below the periphery, consequently, the body whorl is very high.

Subfamily ***PARACERITHIINAE*** Cossmann, 1906;
Genus ***Diatrypesis*** Tomlin, 1929. (=*Terebrella* Andreae, 1877, non Maltzan, 1886)

This unusual genus originated in Early Jurassic (Toarcian) – Early Cretaceous (Aptian), and formed many species during Jurassc times, in Western European and Maghrebian Subprovinces.

Diatrypesis viteli (Pictet & Campiche, 1862)

- 1862 *Cerithium viteli* PICTET & CAMPICHE, Mat. Pal. Suisse, #2 : 278-279, pl. 70, figs.9, 11 ;
- 1900 *Cerithium sp.,* PERON, B. S. S. hist. nat. Yonne, 53: 137;
- 1987 *Cimolithium* sp.indet. MACSOTAY & ALVAREZ, fig. 6-g;

Occurrence: Discovered in Calcaire Jaune Formation, in the Urgonian limestones of Switzerland; later was located in Auxerre, Calcaire gris à *Spatangues*, France, of Hauterivian age.

Diagnosis: Several natural sections on the limestone surface: Regularly conical shell; whorls low, convexes, marked locally by depressions, which correspond to weak marks of the varices. Aperture ovale, as high as wide; labrum simple, columella with a weak fold in medial position. The apical angle is about 18º, and the height is 25 mm.

S.C.S. occurrence: Locality MO-3163, Cerro La Pica, El Pilar area, Sucre state, Chuparipal Formation of Late Barremian age (see Text-Figure V-04), (DEP). Associated to the *Amphitriscoelus waringi* rudist assemblage, in a four-meter thick massive packstone.

Genus ***Cirsocerithium*** Cossmann, 1906.

According to WENZ (1938) it is an intra-Cretaceous genus: Albian to Cenomanian. Its distribution includes North European Province, Western European, Apulian, Maghrebian, Japanese – East Asian Subprovince, as a typical Tethyan Genus. As a main difference with Subfamily *Procerithiinae, Cirsocerithium* is not only holomarine genus, but showing preference for outer shelf paleoenvironments (**120 – 360 meters**) of paleodepth.

Cirsocerithium harborti (Wolleman, 1908).
Plate 35, figures 6, 12;

- 1908 *Cerithium Harborti* WOLLEMAN, Jahrb. K. Preuss. G. Landes: 179, pl. 13, figs. 5 – 7;
- 1978 *Cirsocerithium (?) harborti* W., MONGIN,Not. Serv. Geol. Tunisie :34, pl. 1, figs. 10-11;

Occurrence: Originally studied from Hildesheim, in the Trümmererze von Salzgitter Formation, in Lower Saxony, Germany, of Barremian and ?Hauterivian age. In Tunis, collected from glauconitic shales of Aptian age.

S.C.S. occurrence: Locality MC-105-B, Cerro Piedra de Rayo, east side, Monagas state, Garcia Formation, (DGC) of Late Aptian age.

Paleoecology: The southward migration of *C. harborti* (W.), from temperate seas of northern Germany, to tropical ones in Tunis and Venezuela, is facilitated by the fact of the saline character of both marine seas, more than a temperature anomaly.

Cirsocerithium subspinosum (Deshayes, 1842).

- *1842 Cerithium subspinosum* DESHAYES in LEYMERIE, Mém. Soc. Geol. France, 5(1): 14, pl. 17, fig. 12;
- 1906 *Cirocerithium subspinosum* D. COSSMANN: 51, PL. 7,FIGS. 1-3;
- 1949 *Cirsocerithium subspinosum* D.,COLLIGNON: 36, pl. 4, figs. 14, 15;

- 1973 *Cirsocerithium subspinosum* (D.) ABBASS, Bul. Brit. Mus. Nac. H. #23(2): 114-120, pl. 2, fig. 182;

Occurrence: Widely distributed gastropod, in North European Province, Western European, Apulian and Somalian Subprovinces, always in Late Aptian-Albian – age sediments.

S.C.S. occurrence: Locality MC-382-A, Cerro de Piedra, Monagas state, Garcia Formation, (DGC) of Late Aptian age; eighteen goetite pseudomorphs in marls, with good preservation. It is frequent in localities PM-13-A, JFS-152, JFS-151, MC-446-A, to E, all belonging to Garcia Formation. Also in locality JFS-174, Caripito Member of Chimana Formation, Sucre state of Middle Albian age (DBG); only two shells were found.

Cirsocerithium tirolense Rahman, 1967.
Plate 30, figures 2, 3;

- 1967 *Cirsocerithium tirolense* RAHMAN, M.B.S.Ph.G.#7: 50-51, pl. 6, figs. 9-10;

Diagnosis: Conical, small shell, with about 7 fragmentary whorls arepreserved; another whorl, with only 4 whorls. Convex whorl outline, with no subsutural ramp. The preserved whorls with 5 spiral cords, which form nodes on the intersection with axial ribs, which are prosoclyne. Height: 13 mm, Width of last whorl: 9 mm; apical angle, 50º.

Occurrence: Discovered in Tirol, Austria, in sediments of Cenomanian age.

S.C.S. occurrence: Locality MO-1659, Guayamure creek two well preserved shells, in the Guayamure Formation, of the Atarigua Para-autochthone, of Middle to Late Albian age (MACSOTAY & VIVAS, 2011). These shells are bigger than the Austrian shells: Heigth: 15,5 mm, Width: 12,6 mm (plate 30, fig. 3).

Genus ***Rhynchocerithium*** Cossmann, 1906.

This genus has a Biochron of Middle Jurassic (Bathonian) – Early Cretaceous (Albian), known until now only from Europa, having few species, and we have to include it in Taxa Group One of SOHL (1987).

Rhynchocerithium ex gr. lallieri (d'Orbigny, 1843)

- Cf. 1843 *Cerithium lallierianum* d'ORBIGNY, Pal. Franc., Terr. Cret.,#2: 365, pl. 229, figs. 7-9 ;
- Cf. 1868 *Turbo fittoni* BRIART &CORNET, 4 : 34, pl. 3, figs. 34-36;

Cf. 1939 *Cerithium lallieri* d'Orb., MARLIÈRE, M. R. H.n. Belgique, 89: 130-131, pl. 7, fig. 11 ;

Occurrence : Paris Basin, France, Meule de Bracquegnies Belgium, of Middle Albian age. Also known from California, and Oregon (var. *suciense* Whiteaves, 1879), U.S.A., always from Albian horizons.

S.C.S. occurrence : Locality JFS-144, road near the bridge, on the Río Cristalino, Sucre state, Garcia Formation, of Late aptian age.

Subfamily ***METACERITHIINAE*** Cossmann, 1906.

The genera of this subfamily, seem to be holomarine, but preferring carbonatic bottoms.

Genus ***Metacerithium*** Cossmann, 1906.

The Biochron of *Metacerithium* extends from Eocretaceous (Neocomian) to Paleocene (Danian), with many species WENZ, (1939) and ABBASS (1973: 131). Its paleogeographical extension includes Western European, Maghrebian, East Indies and Japanese – East Asian Subprovince. In North America is doubtful. In S.C.S., is frequent in glauconitic limestones and sandstones.

Metacerithium ornatissimum tatricum
(Passendorfer, 1929).
Plate 61, figure 9;

- 1930 *Metacerithium mosense tatrica* PASSENDORFER, Trav. Serv. Geol. Pologne, 2(4): 606-607, pl. 2, figs. 24a, b, c ;
- 1949 *Metacerithium sp. aff. trimonile* (M.) COLLIGNON, Mem. Serv. Geol. Madagascar: 37, pl. 4, fig. 16, 17, 18; 19, 20, 21; (not MICHELIN, 1938).

Occurrence: Originally collected at Wielka Rowien, Poland, of Middle Albian age. Also in Ambarimaninga, Madagascar, in glauconitic sandstones, of the same age.

S.C.S. occurrence: Locality MC-95-A, north of Cerro Piedra del Rayo, Monagas state, (DBG), Caripito Member of Chimana Formation, of Middle Albian age.

Metacerithium trimonile (Michelin, 1838).

- 1906 *Metacerithium trimonile* (MICHELIN), COSSMANN, Paleoconch. Comp., 7: 54-55, pl. 6,figs. 29-31;

- 1930 *Metacerithium aff. trimonile* (M.) PASSENDORFER: 605, pl. 2, fig. 23;
- 1962 *Metacerithium trimonile* (M.) BENKÖ-CZABALAY, Geol. Hung., Paleont. #31: 257, pl. 5, fig. 26;
- 1973 *Metacerithium trimonile* (M.) ABBASS, Paleont. Series, Monograph 2: 133, pl. 4, figs. 1, 2, 7, 8, 10;
- 1979 *Metacerithium trimonile* (M.), KOLLMANN, A.N.M. Wien, #82: 18-20;
- 2005 *Cerithium cf. heeri* MYCZYNSKI & ITURRALDE-VINENT, Car. Jour. Sci., 41(4) : 794-795, fig. 5 :7 ; (not PICTET & RNEVIER, 1854).

Occurrence : Middle to Late Albian, Gault, Folkestone, Kent, England; All Albian of both Germany, Switzerland and France, including the stratotype (DESTOMBES & MONGIN, 1975). Úrkút, south Bakony, in the *Munieria* clays and marls, Hungary. Also in the Albian of Angola, Gabon, Baja California, Madagascar and Egypt, attaining a circum-Gondwanic distribution. In Poland, in the Wielka Rowien valley, in glauconitic limestones, Poland.

Diagnosis: Small to medium-sized *Metacerithium* slightly coeloconoid; spire orned by three nodulated cords separated by deep, nrrow interspaces; aperture cuadrangular, with short channel. Whorls increase very gradually in height and width, but are three or four times broader than high.

S.C.S. occurrence: In Río Hatillo Formation, Puerto Rico, overlaying the thick Lava Formation of Neocomian age (MYCZYNSKI & ITURRALDE-VINENT, 2005), of Middle Albian age. Also in locality HA-4511, Cerro Los Platones Section, Trujillo state, Upper carbonatic member of the Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, fig. 29). It is associated to a *Gervillaria*-banc, below a rudist horizon.

Observations: *Metacerithium trimonile* is one of the several fossil Molluska, that suggests that the Lava formation in Puerto Rico, - Greater Antilles Terrane,- was formed in situ in the S.C.S. carrying a Tethys-affinity fauna of Albian age, and is not of Pacific origin.

Family ***POTAMIDIDAE*** Troschel, 1857.

According to auctt. the genera of this family, inhabit warm Brackish waters, with muddy bottoms, being detritivores. Usually habits in groups. Its Biochron extends Late Cretaceous to Recent (DAVIES, 1935).

Genus ***Potamides*** Brongniart, 1810.

According to DELPEY (1939: 133-134) gasteropoda with the characteristic ornamentation of *Potamides* are found since the Early Jurassic, until the Pliocene. The *Potamides,* known from the Late Cretaceous to Pliocene, carries a short siphonal channel, slightly oblique, forming a fold at the base of the columella. The shape of the aperture, and the siphonal channel, seem to be related to the paleoenvironment; this is also true for the varices, pointing to a stop of the growth of the shell.

Potamides peregrinorsa (d'Orbigny, 1842)
Plate 59, figure 8;

- 1842 *Cerithium peregrinorsum* d'ORBIGNY, Pal. Francaise, Terr. Cret: 1: 374, pl. 231, figs. 3, 4;
- 1906 *Uchauxia peregrinorsa* (d'O.) COSSMANN, Malac. Comparée: 56, pl. 6, figs. 37, 40;
- 1890 *Cerithium sp. cf. peregrinorsum* (d'O.) BLANCKENHORN, Beitr. Geol. Syriens : 114;
- 1939 *Potamides peregrinorsa* (d'O.) DELPEY: 136, fig. 94;

Occurrences: With a Biochron of Albian to Turonian, is known from France, Transylvania, Liban, and the *Nerinea* – limestones of Palestina, of Albian-Cenomanian age.

S.C.S. occurrences: Locality VG-139, Monagas state, Caripito member of Chimana Fomation, (DBG) of Middle Albian age. The only specimen, shows in abapertural view, the uncoiling of the last whorl, alike *Haustator plana* (Binkhorst), collected in the Maastrichtian of Warsawa, Poland.

Genus ***Cedrosia*** Saul & Squires, 2003;

SAUL & SQUIRES (2003, Jour. Paleont., 77(3): 444), proposed the new genus *Cedrosia*, for *C. pacifica* – Pinos Formation, Valle Group, of Turonian age Baja California,- a very distinct *Potamididae* of the Cretaceous. In my files, I recognize the following species belonging to *Cedrosia:*

1. *Cerithium aubersonense* Pictet & Campiche, 186Late Valanginian to Hauterivian age,
2. *Cerithium (Pyrazus) acuticostatum* Blanckenhorn, 1890, - Late Aptian to Early Cenomanian,
3. *Cerithium buddha* Noetling, 1887-b, - Maastrichtian,

4. *Cerithium cuauhtemoci* Böse, 1906, - Santonian,
5. *Cerithium michaillense* Pictet & Campiche, 1862, -Barremian,
6. *Cedrosia pacifica* Saul & Squires, 2003, *type of genus, -Turonian,
7. *Pyrasus? quadrangularis* Sayn, 1932, - Barremian,
8. *Cerithium rehbinderi* Choffat, 1906, - Aptian-Albian,
9. *Cerithium (Pyrazus) rustemi* Fraas, 1878, - Barremian-Aptian
10. *Pyrazus? steuri* Cossmann, 1906, - Coniacian-Senonian
11. *Cerithium vicinum* Verneuil & Lorière, 1868, - Barremian-Aptian,

Cedrosia is similar to *Terebralia* Swainson, 1840 but it differs by having only a single fold on the columellar lip; also has a quadrate aperture rather than an ovate one, narrower and more raised spiral cords, a projecting anterior canal, and a more flared outer lip. According to SAUL & SQUIRES (op. cit.) *Cedrosia* originated on the Pacific Slope of North America, it might have inmigrated into the Old World region, but this is counterdicted by the evidence: the oldest species was found in the Late Valanginian of Switzerland, of the Western European Subprovince (CORROY, 1925), so the opposite is true.

Cedrosia michaillense (Pictet & Campiche, 1862)
Plate 28, figure 13;

- 1862 *Cerithium michaillense* PICTET & CAMPICHE, Paleont. Suisse, #2: 281, pl. 71, figs. 1, 2 ;
- 1931 *Pyrazus cf. michaillense* (P. & C.) SAYN, Tr. L. G., 318 : 41-43, pl. 3, fig. 18, 18a ;

Occurrence : Originally collected from the white Urgonian limestone quarries, Switzerland, of Late Barremian-Early Aptian age. Also in the same horizon in South France, frequently associated to *Trochaceton (Neocylindrites)* spp.

S.C.S. occurrence: MO-892, east of Puerto Escondido, Sucre state, (DAGM) Taguarumo Formation, of Barremian age.

Genus ***Terebralia*** Swainson, 1840.
Subgenus ***Pyrazisinus*** Heilprin, 1887.

The Biochron of *Pyrazisinus* is a subgenus of Oligocene – Pliocene age distributed only in North and South America. Few species were attributed to this taxon in North Africa and South America, collected in the Cretaceous (Barremian to Turonian), coincidentally starting with the salinity crises, and ending with it. This would include it in the Taxa Group Two, of SOHL (1987) and we think that it is an ecophenotype, specialized for highly variable salinity environments and disposing of quality specimens of Cretaceous age, it should receive a new name.

Terebralia (Pyrazisinus?) orientalis *(Conrad, 1852)*
Plate 34, figure 7;

- 1852 *Nerinea orientalis* CONRAD in LYNCH: Palestine expedition...:223, pl. 5, fig. 52;
- 1906 *Tympanotomus orientalis* COSSMANN: 112, pl. 10, figs. 18-20;
- 1927 *Cerithium (Tympanotomus) orientale* BLANCKENHORN, Paläeontogr. 69: 157, pl. 2, figs. 118-119;
- 1939 *Terebralia (Pyrazisinus) orientalis* Conrad sp., DELPEY, Gastr. Mesoz.: 141-143, figs. 98-99;

Occurrences: Collected at many localities in Liban and Syria, from sediments of Aptian age (DELPEY, op. cit.). COSSMANN (op. cit.) considered it as Turonian.

S.C.S. occurrence: Locality MC-125, Punceres Anticline, north flank, Monagas state, El Cantil Formation, (DBG) of Late Aptian-Early Albian age. Only casts were collected.

Family/Subfamily
CERITHIIDAE/CERITHIINAE Fleming, 1828.
Genus ***Hemicerithium*** Cossmann, 1893.

Hemicerithium Cossmann, 1893, sems to have a Biochron of Early Cretaceous (Albian) to Recent. It evolved in many species in Europe, North America, Indonesia, - along the Tethys Ocean margins. It survives in the Pacific Ocean, and Australia, with only few species, in the Cretaceous Period:

1. *H. binodosum* (Römer, 1839) - Senonian,
2. *H. coxi* (Collignon, 1949) - Early Albian,
3. *H. interlineatum* (Cragin, 1893) - Cenomanian
4. *H. insigne* Stephenson, 1952, - Conamanian.
5. *H. mosense* (Buvignier, 1852) - Albian

Hemicerithium? coxi (Collignon, 1949)
Plate 35, figures 5, 8;

- 1949 *Cerithium coxi* COLLIGNON, Ann. Geol. Surv. Min., Madagascar,# 16: 35-36, pl. 5, fig. 8;
- 1987 *Cerithium coxi* C., VIVAS, Bol. Geol., (Caracas): 16(29): 27;

- 1995 *Cerithium coxi* C., VIVAS & MACSOTAY: 14TH Carib. Geol. Conf. #2: 136;

Occurrence: Locality MC-260-D, Cerro Los Encantados, Monagas state, Garcia Formation (DBG) of Late Aptian age. Associated to many small bivalves as *Freiastarte.*

Family ***CERITHIOPSIDAE*** H. & A. Adams, 1854.

Genus ***Cerithiella*** Verrill, 1882.

Cerithiella phillipsi (Leymerie, 1842)
Plate 11, figures 6, 6A;

- 1842 *Cerithium (?) Phillipsi* LEYMERIE, Mem. Soc. Geol. France, (1)5: 14, pl. 17, fig. 17;
- 1842 *Cerithium Phillipsi* d'ORBIGNY, Paleont. Franç., Cret., #2:356, pl. 227, figs. 7-8;
- 1854 *Turritella Charpentieri* PICTET & RENEVIER, :29, pl. 3, figs.. 3A, 3B ;
- 1868 *Cerithium Forbesianum* d'O., VERNEUIL & LORIÈRE, Fos. Neoc. Utrillas : 15, pl. 2, fig. 7 ;
- 1902 *Cerithium Phillipsi* L., REHBINDER, C.G. S. P. M.#16:149-153, pl. 3, figs.. 17-19;
- 1939 *Potamides Phillipsi* L., DELPEY: 134-135, fig. 92;
- 1974 *Uchauxia phillipsi* (L.) DIMITROVA, Foss. Mesoz. Bulgaria. : 32-33, pl. 12, fig. 11 ;

Diagnosis : Small shell, elongated, with convex whorls ornated by four granular spiral ribs, and some varices ; this is an extremely variable shell. First whorls with apical angle of 28º-32º; last whorls with 16º-20º; dimension of average shell: Height: 32 mm, Width: 7 mm.

Occurrence: Originated during Valanginian it became extinct by Late Aptian, attaining a distribution in Western European, Balkanic, and Syrian Subprovinces.

S.C.S. occurrence: Locality HA-4451, Cerro Agua Dulce section, Trujillo state, lower Carbonatic member of Peñas Altas Formation, of Late Barremian age (ARNAUD et alii., 1999, fig. 17), where it was abundant.

Observations: Usually found in oligomictic assemblages, in bioclastic clayey limestones, where it can be the dominant species. The successive variable ornamentation, and the change of apical angle, during the growth of the shell, commented by PERON (1900: 124-126) suggests to me a variable salinity/hypersalinty conditions, related to the tropical two-season alternations.

Family ***CAMPANILIDAE*** H. Douville, 1904.

Genus ***Diozoptyxis*** Cossmann, 1896 (emend. DELPEY, 1941, and KOLLMANN, 1987).

Diozoptyxis cf. lamanonis (Coquand, 1865)
Plate 25, fig. 19;

- Cf. 1865 *Cerithium lamanonis* COQUAND, M. S. Emul. Prov. 3: 86, pl. 5, fig. 9;
- 1954 *?Cerithium potosianum* B., VON DER OSTEN, Bol. Geol. (Caracas) 3(8): 175, pl. 13, fig. 5;(not Böse, 1906).
- 1957 *Turritella seriatim-granulata* R., VON DER OSTEN, Jour. Paleont. 31(3) : 586, pl.65, fig. 7; (non ROEMER, 1852)

Occurrences: Collected at the "upper layers of the Aptian stage" in Utrillas, in the marl and limestones of Blesa Formation, Oliete Basin, Spain, of Hauterivian-Early Barremian age (CANEROT, 1982), and not Aptian.

S.C.S. occurrences: At MMH locality Su-109, west coast of Picuda Grande island, Taguarumo Formation (DAGM) of Barremian age. At locality JFS-144, road and bridge on Río Cristalino, to Toma de Agua Sucre State, (DGC) García Formation, Early Aptian age, three reworked fragments.

Diozoptyxis sanctae-crucis (Pictet & Campiche)

- 1862 *Cerithium Sanctae-Crucis* PICTET & CAMPICHE, Paleont. Suisse, #2: 283, pl. 70, fig. 14 ;
- 1974 *Terebrella sanctaecrucis* (Pictet & Campiche), DIMITROVA, Foss. Bulgarie, 4-b : 30, pl. 12, figs. 6, 7 ;

Occurrence : Originally studied from Early Aptian sediments of Sinte-Croix, Switzerland. Later in the Grodischter sandstones, Austria of Valanginian age, and in the Aptian beds of Bulgaria, it showed a reasonable distribution in the northern margins of the Tethys Ocean.

S.C.S. occurrence: MO-3165, Cerro La Pica, El Pilar, Sucre state, (DEP) upper El Dantó dolostones, of Late Hauterivian age (see text-fig. V- 07).

Family, Subfamily ***APORRHAIDAE/APORRHAINAE*** Philippi, 1836.

Recent Aporrhaids are marine, shallow water detritus-feeders living at or just below the sediment-water interface. One of the most successful Families of Gastropoda in the Eocreatecous of S.C.S. my personal opinion is that many (or all) the genera, were carnivorous predators, and this is why they could penetrate the saline shelf waters.

Genus ***Aporrhais*** da Costa, 1778.

According to WENZ (1938) its Biochron extends from Eocretaceous (Neocomian) to Recent, and its Paleogeographical distribution includes Europa, Lesser Asia, India, Both Americas, originating many species.

Aporrhais cf. affinis *Coquand, 1865.*

- Cf. 1865 *Aporrhais affinis* COQUAND, Mem. Soc. Emul. Prov.,#3 : 270, pl. 5, fig. 2 ;
- Cf. 1887 *Aporrhais affinis* C., MALLADA, Sinops. Eapaña, Cret., #3 : 77, pl.22, fig. 5 ;
- 1954 *Aporrhais* sp. COX, Jour. Paleont. 28(5) : 626, pl. 65, figs. 2, 4 ;
-

Occurrence : Originally studied from Morella and Cinctorres, Maestrazgo Basin, Spain, of the Morella clay Formation, of Late Barremian age, not Aptian, as was stated originally (CANEROT, 1982).

S.C.S. occurrence: MC-372-B, south of Cerro Grande, northeast of Cautaro, Sucre State, Garcia Formation, of Late Aptian age, (sDLP, DGC), where six shells replaced by siderite, were collected. Ammonites and belemnites were common in the glauconitic shales. In Trinidad, the gastropods were collected as olistoliths in the Paleocene Chaudiere Formation (COX, op. cit.).

Aporrhais? nodifera (Koch & Dunker, 1837)
Plate 23, figure 11;

- 1837 *Rostellaria nodifera* KOCH & DUNKER, Nordd. Oolith.: 47, pl. 5, fig. 9;

Occurrence: Collected in the Hilston clay Fomation, of Niedersachsen, Gemany, of Neocomian age.

S.C.S. occurrence: Locality VG-382-B, Quebrada El Imposible, Serrania de La Paloma, (DGC), El Dantó dolostones, of Hauterivian age. Several shells, not fully grown, with the nodes on the shoulder, of smaller size, and more numerous than the nominal species.

Aporrhais cf. picteti (de Loriol, 1861).
Plate 26, figure 16 ;

- Cf. 1861 *Rostellaria Pictetiana* DE LORIOL, Descr. Anim. Invert. Mont Salève: 43, pl. 4, figs. 5-7;
- Cf. 1864 *Aporrhais pictetiana d. L.,* PICTET & CAMPICHE, Mat. Paleont. Suisse, 3:600-601;
- 1957 *Anchura sucrensis* VON DER OSTEN, Jour. Paleont. 31(3) : 589, pl. 65, fig. 26 ;

Diagnosis : Cast of medium size, fusiform, whorls convex, sutures incised ; spire of 3-4 whorls ; height of whorls about 2/3-s of width ; sculpture of strong radial ribs, concave towards the aperture, center thickened almost into nodes, about eight to the whorl, crossed by approximately 25 fine spiral threads; growth-lines forming fine radial threads; slightly weaker than spiralsculpture; body whorl at least twice height of last spiral whorl (anterior channel missing) posterior portion of outer lip thickened, extending outwards and upwards, forming undulating wing-like process (broken off) reaching as high as top of last spiral whorl, with strong fold in line with nodes on ribs; aperture elongated, broken off, too. Apical angle about 40 º (VON DER OSTEN, op. cit.).

Dimensions: Height of broken cast: 21 mm, Width: 10 mm, probable original height: 27 mm. (VON DER OSTEN, op. cit.). The shells of Mt. Salève, measured of height: 40 mm, and had an apical angle of 25 º.

Occurrence : Originally collected from the marls of Sainte-Croix and Mt. Salève, Switzerland, of Hauterivian age. Also at Escragnolles, Var, South France, of the same age.

S.C.S. occurrence: Locality VG-556-A, trail to Río Morocoto-Caituco-Ojo de Agua, (sDLP, DGC) Sucre state, of El Dantó dolostones, of Hauterivian age. VON DER OSTEN (1954: 176) collected it in MMH locality Su-92, at western coast of Picuda Grande Island, the green limestones at the base of Taguarumo Formation, of Late Hauterivian age.

Aporrhais? subfusiformis (Shumard, 1853)
Plate 38, figures 8, 12;

- 1853 *Eulima subfusiformis* SHUMARD, U. S., 32d. Cong., Senate E.Doc. 54 : 208, pl. 4, fig. 3 ;
- 1857 *Rostellaria (?) texana* CONRAD: 158, pl. 13, figs. 4ª-b;
- 1872 *?Aporrhais Benifazae* LANDERER : 29, pl. 4, fig. 26 ;
- 1973 *Alaria faltensis* GORTANI, A. N. d. Lincei, #4:77-78, pl.16, figs. 6ª-d;
- 1947 *Aporrhais? subfusiformis* (S.) STANTON, U.S. Geol. Surv. Prof. p. 211: 106, pl. 65, figs. 20-21;

Occurrences: Originally studied from Comanche Peak Formation, Fredericksburg Group,Texas, of Middle Albian age. Also in the Washita Group, Texas, of Late Albian age. In Spain, reported from Benasal limestone Formation, of Late Aptian (Clansayesian) age (CANEROT, 1982). In Ethiopia, at Monte Falti, of Albian age (GORTANI, op. cit.).

S.C.S. occurrences: Locality FA-58-A, Quebrada Agua Blanca, Monagas state, (DBG) lower El Cantil Formation, of Late Aptian age. Three well-preserved casts were collected, two with pelomorphic

deformation; many epibionts were observable, of polychaeta tubes, and juveniles of bivalvia.

Observations: The molluskan assemblage suggests a well-oxygenated, agitated, sediment-free marine waters, at **20 – 40 meters** of paleodepth, entoured with abundant calcareous and non-calcareous algae, fixed on hard bottom.

Genus ***Tessarolax*** Gabb, 1864.

According to WENZ (1938) its Biochron is intra-Cretaceous (Neocomian – Senonian) and its distribution area includes Europa, India, Japan and the Sachalin islands, North America, with few species. It should be included in SOHL's (1987) Taxa Group Two, which evolved during the salinization cycle.

Tessarolax americana (d'Orbigny, 1854)
Plate 38, figure 11;

- 1854 *Rostellaria americana* d'ORBIGNY, Amer. Merid: 80, pl. 18, fig. 5;

Occurrence: Originally collected as a mould on a black limestone in Analayma, Prov. Santa Fe de Bogotá, Colombia. According to BÜRGL (1956B) this locality would belong to Une Formation, Villate Group, of Barremian age. PICTET & CAMPICHE (1864) also was collected from Escragnolles and Saint-Julien, France, of the same age.

S.C.S. occurrence: Locality MC-426, in Tonoro, near La Güiria, Sucre state, Lower Chimana Formation (sDLP, DGC) of Middle Albian age. Collected in a glauconitic sandstone, associated to *Plicatula inflata* and *Neohibolites minimus.*

Tessarolax bicarinata evolutior (Jaworski, 1938).

- 1938 *Chenopus (Tessarolax) bicarinata evolutior* JAWORSKI, Bol. S. N. J. f. MB #76: 522-525, pl. 30, figs. 3a-c;

S.C.S. occurrence: Mesa de Barichara, upper part of the descent of the road to Sube (Jordán), South Santander department, Colombia, of La Paja Formation, of Aptian age. It is associated to the ammonites *Cheloniceras sp., Acanthoplites sp.* and the Bivalvia *Proveniella roissyi* (d'Orb.) and *Callucina (C.) plicatocostata* (d'Orb.)- corrected terminology,- confirming the age. RENZ (1960) found it in Yúruma Formation, La Guajira Domain, but here it is associated to the ammonites *Heinzia and Phylloceras* indicating Barremian age.

In Venezuela, locality MC-446-C, Cerro La Torre, road from Campo Alegre-Buena Vista (Teresén), Garcia Formation, of Late Aptian age. Associated to many small bivalvia, in shales interbedded with white sandstones.

Tessarolax rouxii (Pictet & Renevier, 1854)
Plate 35, figure 8;

- 1854 *Rostellaria Rouxii* PICTET & RENEVIER, Paleont. Suisse, Terr. Aptien : 47, pl. 4, fig. 9 ;
- 1864 *Aporrhais rouxii* P. & R., PICTET & CAMPICHE, Paleont. Suisse, #2 :603 ;
- 1921 *Chenopus Rouxii* P. & R., GILLET, Bull. Soc. Geol. France,#4(21): 27-28;

Occurrence: Originally studied from Perte du Rhône, and Sainte Croix, Switzerland, of Aptian age; in Spain, limestones and marls of Chert Formation, Mora de Rubielos Basin, of Early Bedoulian age (CANEROT, 1982). At Wassy, France, of Late Barremian age.

S.C.S. occurrence: Locality MC-446-B, Cerro La Torre, (DGC) road from Campo Alegre-Buena Vista, (Teresén), Monagas state, García Formation, of Late Aptian age. Uncommon.

Genus ***Perissoptera*** Tate, 1865.

Perissoptera ha a Biochron extended from Eocretaceous (Neocomian) to Paleocene (Danian), belonging to the Taxa Group Two, of SOHL (1987). Originated during the salinity Crisis, eviolved in many species. Its distribution includes Europe, Africa, India, North and South America and New Zealand.

Perissoptera maxima (Price, 1875).
Plate 55, figure 12;

- 1836 *Rostellaria marginata* J. de C., Sowerby in FITTON, Geol. Trans. 4:114, pl. 11, fig. 18;
- 1864 *Aporrhais marginata* S., PICTET & CAMPICHE, Pal. Suisse, #2 : 614-615, pl. 154, figs. 2, 3 ;
- 1875 *Aporrhais máxima* PRICE in GARDNER: 127, pl. 5, fig. 4;
- 1962 *Dicroloma (Anchura) aff. Maxima* (Price) BENKÖ-CZABALAY, Paleont. 31 : 266, pl. 5, figs. 29-30 ;

Description : Spire elongated, composed of eight or more convex whorls, forming a regular angle of about 30º, finely striated spirally, and ornamented transversely by about twelve axial ribs, to each whorl, which extend from suture to suture; these ribs disappear on the last whorl, and are replced by a single prominent and angular keel. The wing and anterior canal resemble those of *Dicroloma carinata* (Mantell, 1822).

Occurrence: *P. maxima* is widely distributed in West European Subdomain, during all the Albian stage: early to late. In Hungary, it was reported from the *Munieria*- marls, of the north Bakony mountains, of Late Aptian age. In Switzerland, also in Late Aptian of Sainte-Croix.

S.C.S. occurrence: Locality VG-452, Km. 22 on the Ojo de Agua-Guariquén road, Sucre state, Valle Grande Formation, (DGC) of Early-Middle Albian age. Scarce in three ifferent localities of the same formation.

Perissoptera orbignyana (Pictet & Roux, 1849).
Plate 42, figure 3;

- 1849 *Rostellaria orbignyana* PICTET & ROUX, Grès verts, Genève: 249, pl. 24, fig. 4;
- 1864 *Aporrhais orbignyana* P. & R., PICTET & CAMPICHE, Paleont. Suisse #2 : 608-609, pl. 153, figs. 5 – 8 ;
- 1896 *Dimorphosoma orbignyana* P. & R. PARONA & BONARELLI: 71, 72;
- 1930 *Aporrhais Orbignyna* P. & R., ROCH, Notes M. S. m. Cg., Maroc #9: 346;

Occurrence: Its origination was in western Morocco, in Aïn Abit, of Barremian age. By Albian times, it was extended in all Western European, Balkanic (reaching Daghestan) and Maghrebian Subprovinces.

S.C.S. occurrence: Locality HA-4471, trail from Jabon to San Pedro, (Trujillo state), in Lower Carbonatic member of Peñas Altas Formation, of Late Aptian age (ARNAUD et alii., 1999, fig. 18). Several casts, somewhat deformed pelomorphically.

Perissoptera ex gr. parkinsoni (Mantell, 1822).
Plate 23, figure 12 ;

- 1822 *Rostellaria Parkinsoni* Mantell, South Downs, : 108, pl. 18, figs. 1, 4, 5, 10;
- 1875 *Aporrhais Parkinsoni* M., GARDNER, Gault Aporrhaidae: 200, pl. 6, figs. 6, 7 (non 4, 5).
- 1939 *Alaria (Perissoptera) parkinsoni* (M.) MARLIÈRE, M. R. H. n. Belgique, 89 :131-132, pl. 8, fig. 12a, b ;
- 1948 *Perissoptera parkinsoni* (M) DELPEY, A. g. s. m. Madagascar, 15: 20;
- 1970 *Anchura (Peissoptera) reussi* (Geinitz) WOLFF, Oberalb Tennboden: 114, pl. 5, fig. 10;
- 1970 *Anchura (Perissoptera) robinaldina* (d'Orbigny), WOLFF, Oberalb Tennboden: 114, pl. 5, fig. 10;
- 1978 *Perissoptera parkinsoni* (M.) KOLLMANN, A. N. M. Wien, #81: 190-192, pl. 5, fig. 52;

Description: Cast massive, elongate and biconical; only 4 or 5 whorls are preserved; they seem to become filled out by growth with a solid mass of aragonite, inasmuch as they disappear altogether on the cast of the shell. The last whorl including the anterior canal is about 1/4th longer than the spire. As regards the wing, in our specimens there is one flat alation diverging 30º- 34º from the central axis. One of the casts shows on the penultimate whorl, weak axial ribs extended from suture to suture, alike *p. parkinsoni* (Mantell).

Dimensions: Height (incomplete): 75,5 mm, Width (with alation included): 56 mm. Sample catalogued as UCVMG/IO-2141. Its size is definitely bigger than any of the nominal species and varieties of *P. parkinsoni.*

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Manare Peninsula, Sucre state, Upper Borracha Formation (DAGM, text-figure V – 08) of Early Albian age. Six casts were collected, unfortunately without the original shell. Also Píche member of Apón Formation, Perijá area, in limestone/marl interfase, of Early Albian age: only one cast. In Colombia, it has been cited between Tena and Tocayma, and also Zapatoca, Santander, but never illustrated.

Observations: Definitely, this is a new species, that have evolved from a stock of *Perissoptera* of the group of *parkinsoni* (M.) which has ben a dominating gastropod in the Albian-Cenomanian sediments of Western European Subprovince, and even North European Province.

Perissoptera vilanovae (Coquand, 1865)
Plate 28, figure 14;

- 1865 *Aporrhais Vilanovae* COQUAND, Mem. Soc. Emul. Provence, #3 : 79, pl. 5, fig. 13 ;
- 1949 *Aporrhais Vilanovae* C. BATALLER, Synopsis Fos. Cret. #8(2) : 120 ;

Occurrence : Collected in Xert, Ballestar and Aliaga, Spain, in the Morella and Chert Formations, of Barremian-Early Aptian age (CANEROT, 1982).

S.C.S. occurrence: Locality MO-892, El Peñón, Sucre state, Taguarumo Formation, (DAGM) of Barremian age (text fig. V-08). Catalog number: UCVMG-IO2118.

Comparisons: *Anchura infortunata* White (1888: 173, pl. 11, fig. 20) – Ganhamaroba Grouyp, Sergipe, Brazil, of Middle Albian age,- is also a *Perissoptera* but has a more rounded body whorl profile.

Genus ***Dicroloma*** Gabb, 1868. (=*Alaria* Morris & Lycett, 1850 non Schranck, 1788)

With a Biochron of Jurassic (Charmoutian) to Late Cretaceous (Maastrichtian), having originated many species during the Jurassic Period, a lot less during the Cretaceous.

Dicroloma carinata (Mantell, 1822).
Plate 33, fig. 16;

- 1822 *Rostellaria carinata* Mantell, Fossils of the South Downs: 86, pl. 19, figs. 11-14;
- 1842-43 *Rostellaria carinata* M., d'ORBIGNY, Foss.Terr. Cret., Gasteropoda 2: 284-285, pl. 207, fig. 2;
- 1875 *Aporrhais carinata* M., GARDNER. Geol. Magazine, n. s., 2(2): 125-126, pl. 5, fig. 1 ;
- 1948 *Dicroloma carinata* M., DELPEY, A. g. s.m. Madagascar #15: 19-20;

Occurrence: Widely distributed in England and France, in all the stages of the Albian, but not in Switzerland. Also located in Middle Albian of Madagascar, where it is rare.

Diagnosis: Elongated small species, with nodular ribs which originally were spiny varices; body whorl two spiral keels, forming a single bifurcated digitation. All the shell is cowered by fine spiral striae; Apical angle: 22º.

S.C.S. occurrence: Locality HA-4249, Fila San Francisco section, Trujillo state, Upper Carbonatic member of Peñas Altas Formation, of Early Albian age (ARNAUD et alii., 1999, fig. 28). In Eastern Venezuela, it was found in MC-382-D, and PM-29-A, on the Casanay-Santa Rosa road, in Valle Grande Formation (DGC) of Middle Albian age. JAWORSKI (1936: 521-522) reported *Dicroloma n. sp. cf. carinata* Mantell, based on plastilin molds colleted from black shales, presumably from the Lower Gachatá Formation, of Albian age. Its apical angle reaches 30º in place of 22º, and the maximum height of the molds is 11 mm. The locality is 1000 meters southwest from Cuatro Esquinas, on the Paipa-Iza road, Boyaca Department, Colombia. Associated to *Haustator sp.,* of also small size.

Dicroloma aff. longiscata (Buvignier, 1852).
Plate 16, figure 3;

- 1852 *Anchura longiscata* BUVIGNIER, Statist. Meuse, Atlas: 44, pl. 28, figs. 28-30 ;
- 1864 *Aporrhais acuta* d'O., PICTET & CAMPICHE, Mat. Paleont. Suisse, 2 : 597-598, pl. 93, fig. 1 ;
- 1900 *Alaria longiscata* (B.) PERON, B.S.S.h.n.Yonne, #53 :117-121, pl. 4, fig. 4 ;
- 1921 *Alaria (Dicroloma) longiscata* (B.) GILLET : 30,pl. 3, figs. 7-9;
- 1953 *Alaria (Dicroloma) aff. Longiscata* (B.) BERTRAND: 265, pl. 6-B, fig. 8;

Occurrence: *Dicroloma longiscata* (Buvignier) is a wide-spread taxon in North European Province, and its Western European Subprovince during Valanginian-Hauterivian stages.

S.C.S. occurrence: Locality MO-3213, Chimana Grande island, Lope inlet, basal limestones of Taguarumo Formation, (DAGM) of Late Hauterivian age. Also in several localities of El Dantó dolostones, as in MO-3154, Cerro La Pica, El Pilar area, (text-figure V-04).

Subfamily ***GONIOCHEILINAE,***
Genus ***Cultrigera*** J. Böhm, 1885 (=*Tridactylus* Gardner, 1875)

According to WENZ (1938) this genus had an intra-Cretaceous Biochron (Aptian-Coniacian), and evolved in few species, all restricted to Europe. But the recognized species tell otherwise:

1. *Cultrigera acuta* Holzapfel, 1888. Maastrichtian
2. *Cultrigera aracnoides* (Müller, 1850) Maastrichtian
3. *Tridactylus cingulatus* (Pictet & Roux, 1853) Albian
4. *Pteroceras Fittoni* Forbes, 1845, Aptian,
5. *Pteroceras moreausiana* d'Orbigny, 1842-43 Hauterivian- Aptian,
6. *?Pterocera Mosensis* Buvignier, 1852. Tithonian
7. *Cultrigera(?) nagorzanyensis* (Favre, 1869) Senonian-Maastrichtian
8. *Cultrigera Nilssoni* (Müller, 1851) Maastrichtian,

Cultrigera Rauffi (Böhm, 1891) Senonian, bathyal

9. *Pterocera polypoda* Buvignier, 1852, Tithonian,
10. *Rostellaria retusa* J. Sowerby, in Fitton, 1836. Albian,
11. *Cultrigera turriformis* Abdel-Gawad, 1986. Maastrichtian.
12. *Tridactylus Walkeri* J. S. Gardner, 1875, Hauterivian.

This up-dated list tells a quite different story: *Cultrigera* was a deep-water gastropod, which evolved during Tithonian times, from a *Pterocera.* With little success during the Eocretacous faunal

crises, it succeded in temperate shelfal environments by the end of the Cretaceous. Definitely, is a cryophyllic genus.

Cultrigera moreausi (d'Orbigny, 1842)
Plate 28, figure 15;

- 1842 *Pterocera Moreausiana* d'ORBIGNY, Paleont. Franç., Cretacé, 1: 301-302, pl. 211, figs. 1, 2;
- 1884 *Pterocera moreausiana* d'O., WEERTH: 30-31, pl. 7, figs. 9-10;
- 1900 *Aporrhais moreausiana* d'O., PERON: 105, 106;

Occurrences: This unusual gastropod originated in Valanginian sediments in France and Switzerland, and by Gargasian (Late Aptian) times, reached Libia, in the Maghrebian Subprovince.

S.C.S. occurrence: Locality MO-1278, Caserío de La Peña, on main road from Humocaro Bajo to Barbacoas (Trujillo state). Collected by Geology student, Grant SKERLEC, in a dark grey, laminated claystone/sandstone rhytmite, which weathers to cream color; associated to *Hoploparia colombiana,* and various fossil remains of a *Clupeidae* fish, of pluridecimetric size. This horizon belongs to the Lower Carbonatic member of Peñas Altas Formation, of Late Aptian age.

Genus (Subgenus) ***Goniocheila (Goniocheila)*** Gabb, 1868.

This taxon has a Biochron extending from Eocretaceous to Eocene, coincidental with the Taxa Group Two (SOHL, 1987). Its palaeodistribution area includes North America, Europe, Madagascar and India, with relatively few species.

Goniocheila (Goniocheila) tarrantensis (Stanton, 1947)
Plate 38, figure 7;

- 1947 *Aporrhais tarrantensis* STANTON, U.S. Geol. Surv., Prof. paper 211: 107-198, pl. 66, figs. 4-6, 8;

Occurrence: Goodland and Comanche Peak limestones, of Fredericksburg Group, Texas, of Middle Albian age.

S.C.S. occurrence: Locality FA-58-A, Quebrada Agua Blanca, Monagas state, lower El Cantil Formation, (DBG) of Late Aptian age. Also in Upper carbonatic member of Peñas Altas Formation, Trujillo state.

Goniocheila (Goniocheila) travisensis (Stanton, 1947)
Plate 60, figure 3;

- 1947 *Aporrhais travisensis* STANTON, U.S. Geol. Surv., Prof. paper 211: 108, pl. 65, figures 12, 13, 16;

Occurrence: Originally collected in Travis Peak Formation, Texas, of Aptian age.

S.C.S. occurrence: Locality HA-4336, La Aguada section, near Barbacoas, Trujillo state, of Late Albian age (ARNAUD et alii., 1999, Figure 32).

Genus ***MONOCUPHUS*** Piette, 1876
(=*Monocyphus* Fischer, 1884).

According to WENZ (1938) it has a Biochron extended from Middle Jurassic (Bathonian) to Eocretaceous (Neocomian), and an European palaeodistribution.

Monocuphus brittsi (Stanton, 1947) Plate 51, figure 18;

- 1947 *Aporrhais brittsi* STANTON, U.S.Geol. Surv., Prof. paper 211: 104-105, pl. 65, figs. 22, 23;

Occurrence: Originally studied from Edwards and Goodland Formations, of Fredericksburg Group, Texas, of Middle Albian age.

S.C.S. occurrence: Locality MC-426, Tonoro village, near La Güiria, Sucre state, lower Valle Grande Formation, of Early-Middle Albian age. Yellowish grey phosphatic limestone in the transitional beds with underlaying Taguarumo Formation. It was interpreted as a condensed bed.

Genus ***Drepanocheilus*** Meek, 1864
(=*Dimorphosoma* J. Gardner, 1875).

According to WENZ (1938) *Drepanocheilus* has a Biochron of Early Cretaceous (Aptian) to Eocene, having originated many species. Its palaeodistribution area includes Europe, West Africa, Indonesia, Japan. Also present in Balkanic Subprovince (PCHELINSTEV, 1953). Very abundant in the Western Interior and Gulf Coast areas of North America's Late Cretaceous (ERICKSON, 1974) but it is absent from the Atlantic coast correlative sediments. In the latter province it was replaced by *Anchura and Graciliala.*

Drepanocheilus coquandi (Cossmann, 1904).
Plate 38, figure 1;

- 1865 *Aporrhais simplex* COQUAND, Mem. Soc. Emul. Provence, 33 : 272, pl. 6, figs. 6, 7 ; (non *Rostellaria simplex* d'ORBIGNY, 1843).
  1904 *Arrhoges (Drepanochilus) coquandi* Cossmnn, E. Paleoconch. Comparée, #6: 76;
  1905 1912 *Aporrhais (Drepànochilus) coquandi* Cossmann, PERVINQUIÈRE, Gast. Tunis: 23-24;

Occurrence: Collected originally at Chert and Obon, Maestrazgo Basin, Spain, in the Chert Formation, of Early Aptian age (CANEROT, 1982). Mrhila, Tunisia, in limestones of Late Aptian age.

S.C.S. occurrences: Locality MO-1375, La Cueva Inlet, Borracha Island, lower Borracha Formation, (DAGM) of Early Aptian age. Also locality MO-881, Patiño Inlet, upper Taguarumo Formation, of the same age (Text fig. V-08). Locality MO-1143, in limestone boulder, reworked in Bobare Formation, Lara Nappe, of Albian? age.

Comparison: *Anchura infortunata* White, 1887 (MAURY, 1936: 221, 223, pl. 14, fig. 5) – Porto dos Barcos, Sergipe, Brazil, Ganhamaroba Group, of Middle Albian age, - is a less inflated shell, otherwise it is alike to *D. coquandi.*

Drepnocheilus cf. magharensis *Abbass, 1963.*

- Cf. 1963 *Drepanocheilus (D.) magharensis* ABBASS, Geol. Surv.M. R. D. Pal. Ser. Monography #2: 78-79, pl. 6, figs. 6, 7;
- 1978 *Drepanocheilus cf. muleti* (d'O.) KOLLMANN, II, A. N. M. Wien #31: 183-184, pl. 4, figs. 34-35;

Description: The Shell is small and fusiform; the spire is long and consists of 5-6 whorls; the whorl outline is convex and the sutures are deeply furrowed; the ornament consists of 24-26 fine, opisthocline and opisthocyrt axial cords on each whorl. They are separated by interspaces of the same or slightly greater width, and are crossed by finer spiral cords with interspaces of the same width; the intersections form fine tubercles (ABBASS, 1963). The differences of our shell: the spire is shorter, with an apical angle of 50º instead of 30º, where the body whorl occupies the 3/5 of the total height. Aperture concealed.

Dimensions: The measurements of 3 specimens are: height: 7, 66 mm; width: 4,83 mm

Occurrence: Maghara area, Sinai Peninsula, Egypt, Middle Albian (ABBASS, op. cit.).

S.C.S. occurrence: Locality ED-08, La Hacienda, west of Catuaro, Sucre State, (DGC) in Valle Grande glauconitic shales, of Early Albian age.

Comparisons: *D. cf. magharensis* ABBASS (op. cit.) has the general aspect of a *Nassariidae,* but with the typical ornamentation of *Drepanocheilus.*

Drepanocheilus muleti (d'Orbigny, 1850) Plate 55, figure 17;

- 1850 *Rostellaria Muleti* d'ORBIGNY, Prodrome, #2: 132;
- 1864 *Aporrhais Muleti* d'O., PICTET & CAMPICHE, Paleont. Suisse, #2 : 612-613, pl. 94, fig. 1 ;
- 1882 *Dimorphosoma Muleti* De LORIOL, Mem. Soc. Pal. Suisse, 9: 28, figs. 1-6;
- 1955 *Drepanochilus Muleti* (d'O.) De LORIOL, MAHMOUD, P.I.D.Egypte: 148-149, pl. 17, figs. 1, 2;
- 1972 *Drepanochilus muleti* (de Loriol) COLLIGNON, N.M.S.g. Maroc, #229 : 15, pl. 3, fig. 2-5 ;

Occurrence : *D. muleti* (d'O.) is one of the commonest *Drepanocheilus* in Western European, Balkanic and Syrian Subprovinces, during Albian times (MONGIN & PEYBERNES, 1980: 233).

S.C.S. occurrence: Locality VG-432, Agua Fría Arriba-Campo Alegre road, Sucre state, Valle Grande Formation, (DGC) of Middle Albian age. Four relatively well preserved shells, associated to Belemnites, in dark grey shales.

Genus ***Protohemichenopus*** Camacho, 1953;

This small-sized genus has a Biochron extending from Late Jurassic (Tithonian)-Early Cretaceous (Albian) stages, in deep-water facies in South America and Europe. Well adapted to the saline seas, are represented by few species:

1.- *Protohemichenopus baratense* new name Macsotay, Valanginian
2.- *Protohemichenopus angulosa* (d'Orbigny, 1842) Albian
3.- *Protohemichenopus neuquensis* Camacho, 1953 * Hauterivian,
4.- *"Aporrhais?"* sp., Harbort, 1909, Neocomian

Protohemichenopus baratensis new name Macsotay.

- 1892 *Alaria acuta* BEHRENDSEN, Z. Dtsch. Geol. Ges., #44: 19, pl. 4, figs. 3ª-b;
- (non 1842 *Rostellaria acuta* d'ORBIGNY, Terr. Crétacé, 2: 298)
- (non 1864 *Aporrhais acuta* PICTET & CAMPICHE, Mat. Paleont. Suisse : 597, 616, pl. 93, fig. 4)
- (non 1895 *Aporrhais acuta* MAAS, Z. Deut. Geol. Gesell. 47(2) : 255-256)

S.C.S. occurrence : Collected in pyrite-carrying black shales, in Río Barát, Colombia, of Late Jurassic, Tithonian age (BÜRGL, 1960a: 182).

Occurrence: The taxon published by BEHRENDSEN (1982, op. cit.) was originally collected in black shales of supposedly Tithonian age, in Neuquen Basin, Argentina. Review studies of CAMACHO & RICCARDI (1978, Cuadro 5) indicate a Valanginian-Hauterivian age for this taxon.

Protohemichenopus angulosus (d´Orbigny, 1842).
Plate 50, figure 8;

- 1842 *Rostellaria angulosa* d'ORBIGNY, Coquilles et Echinod. Foss. Colombie : 45, pl. 3, fig. 4 ;
- 1998 *Drepanocheilus cf. carinella* (d'Orbigny) MACSOTAY & VIVAS, figure 3 ;

Description : Very elongated shell, the high spire is composed by five angular whorls, developing a strong keel, accompanied by fine spiral striae on both surfaces of the keel. The last whorl keeps the medial keel. Aperture unknown, the molds are smooth, without additional ornament (d'ORBIGNY, op. cit.). Its apical angle is 25º.

Dimension: Height (incomplete) 20 mm, Diameter of the last whorl: 9 mm.

S.C.S. occurrence: Collected in Coyal Anapoyma, Santa Fe de Bogota province, in a yellowish-grey limestone, in which only casts and molds were preserved (d'ORBIGNY, op. cit.). Possibly sampled from the Ubaque (=Une) Formation, of Albian age. In Venezuela, in locality MC-426-B, Tonoro, before La Güiria, Sucre State, Valle Grande Formation (DGC)of Middle Albian age. This taxon is not common, but widespread: MC-430, MC-431, VG-432, VG-453, MC-382, MC-431, MC-440 and JFS-06, in the same unit.

Comparisons: *Aporrhais?* n. sp. HARBORT (1905, A. K. P. G. L. B.n.f.#43 : 91-92, pl. 10, figs. 13a-b),- Neocomian of Hannover, Germany,- is also a small shell, with apical angle of 20º, and a height of 12 mm, distinguished by a weaker keel just below the main one, observable in all the whorls.

Genus ***Eustoma*** Piette, 1855, (=*Diatinostoma* Cossmann, 1905)

According to WENZ (1938) *Eustoma* has a Biochron of Middle Jurassic (Bathonian) to Late Cretaceous (Turonian), and it should be included in SOHL (1987) Taxa Group One. With a palaeogeographical distribution of North European Province and its West European Subprovince; for first time, reported from S.C.S.

Eustoma pellati (Cossmann, 1907)
Plate 25, figures 19;

- 1907 *Diatinostoma? pellati* COSSMANN, Mem. Soc. Geol. France #37:16-18, pl. 3, figs. 5-8;
- 1932 *Diatinostoma pellati* C., SAYN, Tr. L. G.#18: 34-35, fig. 6;
- Not 1974, *Diatinostoma? pellati* C., DIMITROVA, Foss. Bulgarie, 4b: 33, pl. 10, fig. 2;

Occurrence: Collected at Brouzet-les-Alais, South France, in the Urgonian limestones of Barremian age.

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Manare Peninsula, Sucre state, Lower Borracha Formation, of Late Aptian age. It is found in massive limestones, associated to *Adiozoptyxis coquandi* (d'Orbigny), also of big size.

Genus ***Harpagodes*** Gill, 1870.

According to WENZ (1938) *Harpagodes* has a Biochron of Middle Jurassic (Bathonian) to Late Cretaceous (Turonian) and a wide palaeogeographic distribution in the tropical subprovinces of Gondwana Province, and Western European Subprovince. In Japan, survived until Coniacian-Santonian times, favoured by the tropical conditions on the Izanagi Plate. Often, has been found on carbonatic bottoms, associated to *Mesorbitolina*-beds, suggesting a habitat alike *Melongena melongena* (Linné, 1758) in the present Caribbean sea (MACSOTAY & CAMPOS, 2001).

Harpagodes beaumonti (d'Orbigny, 1845)
Plate 23, fig. 18;

- 1842-43 *Pterocera Beaumontiana* d'ORBIGNY, Paleont. Franç. Terr. Cret. 2, Gast.:305, pl. 213;
- 1878 *Pterocera Beaumontiana* d'O., FRAAS, W. Jour. #34:334;
- 1887 *Pterocera Beaumontiana* d'O., MALLADA, Sinopsis España, Cretacico #3: 75;
- 1899 *Harpagodes Beaumontianus* d'O., COSSMANN, A.F.A.S.,#3: 4-5, pl. 2,fig. 2;
- 1919 *Harpagodes Beaumontianus* d'O., ROLLIER, Mat. S.Pal. Suisse, #44: 98;
- 1980-a *Harpagodes beaumontianus (d'O.)* MACSOTAY : 254 ;

Occurrence : *H. beaumonti* (d'O.) has a Biochron extended from Hauterivian to Aptian, in Western European, Maghrebian, Syrian and Southern Caribbean Subprovinces. In Egypt, it is common in limestones with *Mesorbitolina conoidea/M. discoidea* fauna, of Aptian age.

S.C.S. occurrence: Locality MO-3163, Cerro La Pica, El Pilar, estado Sucre, Chuparipal Formation, of Barremian age (text-figure IV-04). Also in Tibú Formation, northern Perijá of Late Barremian-Early Aptian age. Only one specimen in each locality.

Harpagodes desori (Pictet & Campiche, 1861-1864)
Plate 35, figs. 3, 7;

- 1861-64 *Pteroceras desori* PICTET & CAMPICHE, Mat. Paleont. Suisse, #3 : 575, pl. 50, figs. 3, 4 ;
- 1919 *Harpagodes desori* P. & C., ROLLIER, Mat. S. Paleont. Suisse, #44 : 95 ;
- 1934 *Pterocera tricarinata* d'Orb., COTTREAU, Annal. Paleont. 23 : 63-64 ;
- 1956 *Harpagodes cf. desori* (P. & C.) ALENCASTER, Paleont. Mexicana, 2 : 26, pl. 5, fig. 6;

Occurrences: This species has a Biochron extended from Berriasian to Aptian, in all the tropical Subprovinces of Gondwana Province: Somalian, Syrian, Maghrebian, and Mexico. In Western European Subprovince, from France to Transylvania.

S.C.S. occurrence: In Eastern Venezuela, locality MC-260-D, Cerro Los Encantados, Monagas state, (DBG) Lower García Formation, of Early Aptian age. An oligomictic benthic fauna of casts of three bivalves and this gastropod, showing filling of contractional cracks, suggesting high salinity (plate 35, figs. 3, 7). Better preserved casts were collected from upper Morro Blanco Formation, of Early Valanginian age, in nodular mudstones. As an olistolith reworked in Trinidad´s Chaudière Formation, of Paleocene age (COX, 1954, Jour. Paleont., 28(5): 626, pl. 65, fig. 1). It was attributed to Cuche Formation of Hauterivian age.

Harpagodes espinosi (Landerer, 1872)
Plate 43, figure 3;

- 1872 *Pterocera Spinosa* LANDERER, Monogr. Piso Aptico de Tortosa, etc.:28, pl. 8, figs. 25-26;
- 1887 *Pterocera Espinosi* L., MALLADA, Sinopsis, #3: 75, nº 246;
- 1949 *Pterocera Espinosi* L., BATALLER, Sinopsis: 38(2): 124-125;
- 1987 *Aporrhais cf. tarrantensis* S., VIVAS, Bol. Geol. (Caracas) 16(29): fig. 21;
- ¿ 1852 *Chenopus* -------, CONRAD in LYNCH, Foss. Expedit. Palestine, App. 235, pl. 8, figs.51, 52;

Occurrence: Originally collected in Tortosa, Tarragona and Teruel, Maestrazgo Basin, Spain, in Benasal limestone Formation, of Latest Aptian (Clansayesian) age (CANEROT, 1982). Possibly also in Abeih, Lebanon, of Late Aptian-Early Albian age.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui State, El Cantil Formation, of Late Aptian age; it is associated to *Mesorbitolina texana, M. ovalis,* and many species of Bivalvia.

Harpagodes jaccardi (Pictet & Campiche, 1864).

- 1864 *Pterocera jaccardi* PICTET & CAMPICHE, Mat. Paleont. Suissse, 2(2) : 577, pl. 151, figs. 3, 4 ;
- 1869 *Pterocera Oceani* GEMMELLARO : 84, pl. 14, figs. 18, 19, (non BRONGNIART, 1822).
- 1939 *Harpagodes jaccardi* P. & C., DELPEY, Gastr. Mesozique: 111-112, fig. 80;

Occurrence: The Biochron of *H. jaccardi* (P. & C.) extends from Late Tithonian and Berriasian to Early Aptian, in all the tropical subprovinces of Gondwana Province (DELPEY, op. cit.). Uncommon.

S.C.S. occurrence: Locality MO-777, La Ceñidura, Venados Island, (DAGM), Morro Blanco Formation, of Late Berriasian age; one cast collected between the corallum masses, found overturned in situ.

Family ***COLOMBELLINIDAE*** Fischer, 1884.

According to WENZ (1938, Handb. Paleozool., #1(1): 926), this family has a Biochron extending from Early Jurassic (Sinemurian) to Late Cretaceous. The ornate of these shells, seems to be intermediate between the *Aporrhaidae* and the *Cerithiidae:* the long siphonal channel, is shorter than the one in the *Cerithiidae,* but longer than a rostrum. The stratigraphic distribution, also seems to have evolved with these families (DELPEY, 1939). Most of the Jurassic species have a latticed ornamentation, but during Early Cretaceous, the transversal ornamentation seems to be frequent.

Genus ***Colombellina*** d'Orbigny, 1842.

The genus *Colombellina* has an intra-Cretaceous Biochron (Neocomian to Cenomanian), having developed many species (WENZ, 1938). It reached a Tethyan distribution, extended to Japan and North America, paralelling the extension of

the saline seas: it belongs to Taxa Group Two, of SOHL (1987: 1103).

Colombellina catedralis (Von der Osten, 1957)
Plate 26, figures 10, 13;

- 1953 *Anchura sp.* VON DER OSTEN, Bol. Geol. (Caracas) 3(8): 178, pl. 14, fig. 4ª, 4b;
- 1957 *Anchura catedralis* VON DER OSTEN, Jour. Paleont. 31(3) : 589, pl. 65, figs. 11, 12 ;
- 1939 *Columbellina petrosa var.monodactyla* DELPEY, Gast. Mesoz: 123-124, fig. 87; (non *monodactyla* HAMLIN, 1884).
- 1985 *Anchura catedralis* V. d. O., ETAYO SERNA, Proy. Cret, # 24: 26;

Description: Shell large, fusiform, whorls slightly convex, sutures incised; spire of four or five whorls, height of whorl almost ½ of width; sculpture of strong, wide, radial ribs, anteriorly inclined downwards, nodose posteriorly, becoming strong nodes in body whorl,about 11 to the whorl, crossed by approximately 44 fine spiral threads, arranged in dands of one stronger thread followed by three weaker; growth lines faintly marked; body whorls about three times height of last spiral whorl; posterior portion of outer lip thickened, extending upwards and outwards, forming a thick, almost rectangular process, possibly alate downwards (not present), reaching to about center of the preceding whorl; inner lip thickened; aperture long, extending into anterior canal, unavailable in holotype; Apical angle, 35º (VON DER OSTEN, op. cit.).

Dimensions: Height (incomplete): 60 mm, Width: 23 mm, probable original height: 70 mm (VON DER OSTEN, op. cit.). Height: 28 mm, Width: 11 mm, Height of the aperture: 15 mm, apical angle: 25º (DELPEY, op. cit.).

Occurrence: Collected at Mar Hanna, Beit Chebab, Antélias, Liban; in the first two beds, of Early Aptian age. Also in Moghara, Sinai Peninsula, Egypt, in Albian-Early Vraconnian sediments.

S.C.S. occurrence: In the MMH locality Su-90, west coast of Picuda Grande Island, parallel green limestone beds at the Base of Taguarumo Formation, (DAGM) of Late Hauterivian age. Also at MO-905, Cachimena inlet, Sucre state, Lope member of Taguarumo Formation, of Early Aptian age.

Observations: In the samples from Liban, "one can find enough stages of transition "between our shell and *C. petrosa* sensu stricto, from which it differs by its less elevated "base, and the ribs which are clearly spiny on the last whorl."(DELPEY, op. cit.).

Colombellina fulviae new species, Macsotay.
Plate 26, figure 25; plate 27;

- ?1896c *Anchura catedralis* V.-d.O., ETAYO-SERNA, Proyecto Cretacico, #24:26;(non Von Der Osten, 1957)

Diagnosis: Medium-sized turreted shell, where the lat whorl constitutes the half of the shell´s height. Sculpture of 14 vertical axial ribs, crossed by fine spiral threads; shoulder visible in all the last five whorls.

Description: The shell is of medium size and fusiform, in outline. The spire is long and consists of six whorls. The outline of the earlier whorls is convex, but a well-marked posterior shoulder is present on the later ones. The sutures are deeply furrowed. The ornament of the spire consists of 10 – 14 convex axial ribs, which are inflated on the shoulder and taper towards both sutures. They are separated by interspaces with spiral cords. Apical angle: 40º, (plate 27, fig. 16) which is increased by pelomorphic deformation: originally should be 32º - 34º.

Dimensions: The Holotype, UCVMG/IO-2112, measure, of Height: 48,5 mm, and width: 24 mm.

Etymology: Dedicated to Micro-Biologist, Mrs. Fulvia SCARPARI de MACSOTAY, for all the support she gave to the author, during the preparation of this ms.

S.C.S. occurrence: Locality MO-892, Cachimena inlet, west of Cumaná (DAGM) Taguarumo Formation, concretion bed, of Barremian age nine well-preserved adult shells, four juveniles. Also in MO-896, west of Patiño inlet, upper Taguarumo Formation, of Late Barremian age. Also in VG-384-A, south of Nueva Colombia, (DAGM) eastern outcrops of Taguarumo Formation, of Late Barremian age; as possible predator of rudists. ETAYO SERNA (1985-c, Proyecto Cretacico #24:26) cited *C. catedralis* Von der Osten from the horizon IGM-185657, of Lower Apón Formation, El Cocuy Hemigraben, of Late Barremian-Early Aptian age. Not illustrated, this Colombian taxon was associated to *Prohinnites favrinus* (P. & R.), *Eryphila cf. obovata* (Sow.), *Scittila nasuta radiata* Casey? confirming the age determination.

Discussion: It resembles *C. verneuili* Cossmann (1904, Essais de Paleoconch. Comp. VI : 118 pl. 3, figs. 25-26) – Maestrazgo Basin, Spain, in the Morella clay Formation, of Late Barremian age, (CANEROT, 1982),- which has a lower whorl, and the eight axial ribs are shorter.

Colombellina priamus (Coquand, 1865).
Plate 28, figure 19;

- 1865 *Aporrhais priamus* COQUAND, Mem. S. Emul. Prov., 3 : 78-79, pl. 6, fig. 9 ;
- 1885 *Aporrhais priamus* C., MALLADA, Synops. Cret. España, #3 : 77, pl. 22, fig. 6;
- Non 1985-c, *"Aporrhais" priamus* C., ETAYO SERNA, Proy. Cretacico, #24 : 26, pl. 1, fig. 11;(= *Strombus [Dilatilabrum]* sp. Indet. Macsotay)

Diagnosis: Fusiform shell, composed of 6 convex whorls, ornated by about 10 oblique axial ribs obtuse at the center and sharp at the extremities. Body whorl also has 10 ribs, but attenuated towards the vertex.

Dimensions: Height(incomplete): 32,5 mm, Width: 14,0 mm (pl. 28, fig. 19).

Occurrences: Originally collected between Cabra and Montalban, Oliete Basin, Spain, in Alacon limestone Formation, of Late Barremian-Early Bedoulian age (CANEROT, 1982).

S.C.S. occurrences: Locality VG-384-A, Ojo de Agua-Santa Rosa road, (DGC) between Rio Grande and Quebrada del Medio, in El Cazón Formation, of Early Valanginian age. Also in MO-881, west of Patiño inlet, Sucre state, Taguarumo Formation, of Barremian age (DAGM, see Text fig. V-08).

Genus ***Pterodonta*** d'Orbigny, 1842.

According to WENZ (1938), the Biochron of this genus in intra-Cretaceous (Neocomian to Senonian), belonging to Taxa Group Two of SOHL (1987). Two species extend this genus into the Late Jurassic: *Pt. corallina* Etallon (Ooster, 1869) and *Pt. simmenenis* Ooster, 1869, from the Corallian (?Early Kimmeridgian) of Switzerland. By association, seems to be a Thermophyllic, euhaline genus an active predator in agitated marine waters.

Pterodonta aubouini new species, Macsotay.
Plate 23, figure 7; plate 27, figures 13, 14;

Diagnosis: Shell large, thick, elongatedly oval; spire high, with 4-5 conical, whorls weakly convex, separated by deep sutures, surface smooth; body whorl large, bulging, forming 2/3-s of total height; outer lip is semicircular,with a marked convexity near the anterior channel; thick external anal channel, upturned and attached to the penultimate whorl (plate 27, fig. 14). Aperture is wide, and the inner lip is concave, with a low fold bordering the umbilicus; it has a short anterior channel or notch; columella concave posteriorly, smooth; columellar lip callous. Judging from the shell substance left between the whorls of the casts, the shell must have been very thin and fragile. Surface unknown, but apparently smooth.

Dimensions: The holotype, UCVMG/IO-2113, measures, oh Height (incomplete adult): 96,4 mm, and Width(incomplete): 68,2 mm (Plate 23, fig. 7). A juvenile, with an apical angle of 60º, measures of Height: 56,5 mm, and Width: 34 mm (Plate 27, fig. 14).

Etymology: This species is dedicated to Prof. Dr. Jean AUBOUIN, - Université Pierre et Marie Curie, Paris, France, - who directed the Exchange Program of French-Venezuelan Cooperation, during the Oil Crises of the seventies. His many PhD students working with the Ministry of Mines and Energy, (Venezuela), advanced the local knowledge of Allochthonous/Para-autochthonous Ranges to international levels.

S.C.S. occurrence: MO-890, Punta La Cruz, Manare Peninsula, Sucre state, of Lower Borracha Formation, (DAGM) of Late Aptian (Gargasian) age (Text Figure V-08). Eight adult shells, and two juveniles collected.

Comparisons: Alike to *P. altispira* (Whitfield) (1891: 440, pl. 11, figs. 4-5) – at Ain Kisûr, near Abeih, Lebanon, in the upper layers of a brown clay-limestone of Vraconnian (Late Albian) age, overlaying Bewerty clays, - but the body whorl of *P. aubouini* is less swollen. *P. deffisi* THOMAS & PERON, (TAVANI, 1948, Paleontographica Italica, 45: 13-14; ROSSI RONCHETTI, 1959, Riv. Ital. Paleont., 65(2): 61, pl. 1, figs. 13, 14) – Cenomanian of Tunisia, Egypt and Somalia,- is a probable descendant of *P. aubouini,* of bigger size, a biconic, ovoidal shell, of only 80º of apical angle.

Pterodonta? bhamdunensis (Blanckenhorn, 1890)
Plate 50, figure 1;

- 1890 *Fusus Bhamdunensis* BLANCKENHORN, Kreidesystem in Mittel un Nord-Syrien: 117, pl. 6, fig. 1;
- 1927 *Fusus Bhamdunensis* B., BLANCKENHORN, Palaeontogr. 69: 173, pl. 4, fig. 83c;
- 1939 *Pterodonta? bhamdunensis* B., DELPEY, Gast. Mesoz.: 126, fig. 88;

Occurrence: Found abundantly in form of casts, in Bhamdûn, Lebanon, of Albian age marls, associated to other gasteropoda.

S.C.S. occurrence: Locality HA-4343, La Urbina north section, in La Puya Member of Peñas Altas Formation, of Middle Albian age (ARNAUD et alii., 1999, Fig. 33).

Pterodonta gaultina Pictet & Roux, 1849

Plate 35, figure 17;

- 1849 *Pterodonta gaultina* PICTET & ROUX, Moll. Grès verts Geneve : 266, pl. 26, fig. 1 ;
- 1962 *Pterodonta gaultina* P. & R., BENKÖ-CZABALAY, Hung. Paleont. #31: 267, pl. 6, figs. 28-35;

Diagnosis: Smooth cast, without varix or any other ornate; apical angle, 24º; elongated siphonal channel.

Occurrence: Perte-du-Rhône, Saxonet and the Reposoir, Switzerland, of Albian age. From Tés, Hungary, north Bakony mountains, in glauconitic marls of Early Cenomanian age.

S.C.S. occurrence: MC-119-A, north of Punceres Anticline, Monagas state, of Guacharo member of El Cantil Formation, (DGC) of Early Albian age. Also in VG-139, of Garcia Formation, of Late Aptian age.

Pterodonta cf. globulus Coquand, 1865.
Plate 32, figure 16;

- Cf. 1865 *Strombus globulus* COQUAND, Soc. Emul. Prov. Mem. : 267, pl. 6, fig. 5 ;
- Cf. 1887 *Strombus globulus* c. MALLADA, Sinops., España, Cret., #3: 73, pl. 13, fig. 6;

Occurrence: Found near Morella, Maestrazgo Basin, (Castellon, Spain) in Benasal limestone Formation, of Clansayesian (Latest Aptian) age, associated to *Mesorbitolina*-beds (CANEROT, 1982).

S.C.S. occurrence: Locality MC-66-A, Quebrada La Zumbadora, right side, Monagas state, upper El Cantil Formation, (DBG) of Early Albian age.

Pterodonta aff. homarensis Blanckenhorn, 1927.
Plate 28, figure 12;

- Aff. 1872 *Pterodonta sp.,* LARTET, La Mer Morte : 125, pl. 8, fig. 15 ;
- Aff. 1927 *Pterodonta homarensis* BLANCKENHORN, Palaeontographica, 69 : 169, pl. 5, fig. 94 ;

Occurrence : Collected westward of 'Ain Homâr, Wadi Àjun Mûsâ, Jordania, of Early Cenomanian age. Also in the *Buchiceras*-beds of Nebi Safi, Hasbéja in the Liban-limestone Formation, of Late Albian age (BLANCKENHORN, op. cit.).

S.C.S. occurrence: MO-890, Punta La Cruz, Manare peninsula, Sucre state, Uppermost bed of Borracha Formation, of Middle Albian age (DAGM, see text-fig. V-08).

Pterodonta cf. marticenis Matheron, 1879.
Plate 27, figure 10;

- Cf. 1879 *Pterodonta marticensis* Ph. MATHERON, Rech. Paleont. Midi de la France, #1, plate C-16, figure 3a, 3b;

Occurrence : *P. marticensis* Ph. MATHERON, collected in an undetermined place of the Urgonian limestones of South France, of Barremian-?Early Aptian age (COTILLON et alii, 1979).

S.C.S. occurrence: MO-905, Cachimena inlet, Sucre state, (DAGM) lower Borracha Formation, of Late Aptian age. Four casts were collected in the calcareous silt between the first two massive limestones of the unit.

Discussion: This small cast, measures of height: 17,8 mm, recalls very much the form of a *Bulimus or Achatina* (DAVIES, 1935). It preserves 4 whorls, of which the last one measures the 70% of the total height. The apex is obtuse, the whorls convex, with sutures strongly impressed, no sculpture is preserved on any of the casts. The columella is solid, the aperture is oval, pointed on both ends and anteriorly slightly notched. They represent possibly young shell, but the angularity developed on the body whorl, distinguishes it from *P. aff. homariensis* and definitely is not related to *P. aubouini,* collected in the same stratigraphic horizon.

Family ***STROMBIDAE*** Swainson, 1840.

In the adult shell, the anal sinus is net, the rostrum short, and labrum not digitated. The parieto-labial callus is big, and is more or less welded to the penultimate whorls. According to DELPEY (1939) the family has a Biochron of Eocretaceous (Albian) to Recent, mostly in warm seas, so it could be included in Taxa Group Three of SOHL (1987).

Genus ***Strombus*** Linné, 1758.

According to DELPEY (1939) this taxon has a Biochron of Eocretaceous (Berriasian) to Recent, having developed a thick shell, characteristic to subreefal habitat. About 30 Cretaceous species are known, mostly represented by casts and molds of uneasy identification.

Subgenus ***Dilatilabrum*** Cossmann, 1904.

COSSMANN (1904, Essais de Paleoconchologie Comparée, 6º livraison, pl. 1, fig. 7) proposed based on *Strombus fortisi* (Brongniart), - Paris Basin, Lutetian, of Middle Eocene age, - the subgenus *Dilatilabrum.* It includes large, thick shells, spire low, slightly concave; whorl with keel, tuberculate or not; body whorl very large, with sharp smooth or tuberculate keel; aperture narrow, with short rostrum, feebly notched; outer lip wing-shaped, scarcly with anterior sinu; dilated posteriorly; colmella straight;

oblique; columellar lip thin, expanded (ABBASS, 1963: 84). Most of the Cretaceous species, seem to belong to this subgenus.

Strombus (Dilatilabrum) navarrii *(Landerer, 1872).*

- 1872 *Strombus? Navarrii* LANDERER, Monogr. Pal. Piso Aptico de Tortosa, etc. : 27, pl. 5, figs. 21, 22;
- 1946 *Harpagodes Matheroni* CHARLES, Bull. Mus. Hist. nat. Marseille, 6(3-4): 127, illustr.;

Description : Cast of big size, higher than wide, the surface completement devoid of ornamentation. The spire was low, and escalonated, less of ¼ of the total height. A shell fragment preserved on the illustrated cast (LANDERER, op. cit., pl. 5, fig. 21) shows a spiral rib ornamentation, composed of at last, three alternating ribs. Anterior siphon twisted in the sens opposed to labrum, which is quite expanded, and suggests the existence of four digitations, of which the posterior one was extended of part of the penultimate whorl.

Dimensions: The measurements are, of Height: 132 mm, Width in the dorso-ventral sense, 57 mm; Width including alation: 88 mm. Apical angle, 76º (CHARLES op. cit.). Height: 72 mm, Width including alation: 59 mm (LANDERER, op. cit.).

Occurrence: Collected at Rastro de Tortosa, Palomar, Villar del Cabo, Utrillas, in marls and limestones of Blesa Formation, Oliete Basin, Spain of Hauterivian-Early Barremian age, not Late Aptian, as was stated originally. In France, was collected in Allauch, of Hauterivian age.

S.C.S. occurrence: Locality MO-3213, Lope inlet, Chimana Grande (Puinare) Island, (DAGM), lowermost Taguarumo Formation, of Late Hauterivian age. Two fragmentary casts were collected, exhibiting the shape and the size of this species.

Strombus (Dilatilabrum) sp. indet., *Macsotay, Plate 29, figure 15; plate 34, figure 2;*

- 1985 "*Aporrhais" priamus* C., ETAYO SERNA, Proy. Cretacico, Publ. Esp. 16, #24: 26, pl. 1, fig. 11; (non COQUAND, 1865)

Description: Shell of medium size, rather stout, consisting of 4-5 convex whorls, of which the last on approaching the aperture becomes carinate above the posterior margin. This sharp carina is separated from the suture by a concave ramp. The penultimate whorl shows rounded tubercules (more or less 5 per whorl, seen on pl. 34, fig. 2). The last whorl is convex, showing sharp growth lines, which suggest a sinuosity developing an extension of the subsutural carina, broken off on all the samples. This description is based on four fragmentary casts, collected from three localities, besides the illustration of ETAYO SERNA (1985-C, pl. 1, fig. 11).

Dimensions: It measures, of Height (incomplete): 51,5 mm, of Width: 38 mm (ETAYO SERNA, op. cit.).

S.C.S. occurrences: Locality MC-90-A, Quebrada El Pulvio, Monagas state, basal García Formation, (DBG) of Early Aptian age: several casts, mostly juveniles were collected. Localities VG-382-B, and VG-556-A, Quebrada El Imposible, Sucre state, Upper Taguarumo Formation, (DAGM) of Early Aptian age. In Colombia, it was collected at the base of Apón Formation of El Cocuy Hemigraben, of Aptian age.

Paleoenvironment: The locality MC-90-A, is one of the basal sequences of the unit, which, due to its content of calcareous green algae and ostracods was considered by FALCON (1989-b) as the top of the underlaying Barranquin (=Bergantin) Formation. As a matter of fact, was the base of the TST of the Aptian transgression, where the first sediments filled the erosional surfaces of the Hauterivian age Bergantín sandstones, already well cemented, as was predicted by POTIE (1989) and ERICKSON (1994). Related to the OAE "Selli" which produced climatic perturbances, including heavy tropical rains with the consequent erosion, which reached its peak during *Globigerinelloides blowi* Zone (BRALOWER et alii., 1993). At MC-90-A, it is associated to shallow-water brackish-habit Bivalvia, suggesting active mixing of fresh and marine waters, with abundant prey for the poredator.

Family ***VANIKOROIDAE*** Gray, 1840.
Genus ***Vanikoro*** Quoy & Gaimard, 1823.
(=*Narica* Recluz, 1841).

According to WENZ (1938: 885) The shell is ovate, globose, consisting of a few rapidly increasing whorls; the surface usually ornamented with spiral and transverse striae or ribbings, rarely smooth; aperture roundish, large, with the outer lip entire, and the inner lip more or less thickened. Its Biochron extends from Late Jurassic (Volgian) to Late Cretaceous (Maastrichtian), along all the shores of Tethys Ocean, including Japan and Australia. During Cenozoic to Recent, proliferated in warm seas. DELPEY (1942) observed that the absence of callous formations permets the umbilicus to stay open, while the apical angle allows it. The columellar bordure is oblique and straight, while the

shell is thin. Never cited previously from the Cretaceous of the S.C.S. area.

Vanikoro aff. pricei (Passendorfer, 1929)
Plate 52, figsures 2, 3;

- 1929 *Natica aff. pricei* (d.L.) PASSENDORFER, Trans. Serv. Geol. Pologne, 2(4): 601, pl. 2, fig. 36, (non de LORIOL, 1882);

Occurrence: Collected from glauconitic limestone of Wielka Ravien, Poland, of Middle Albian age.

S.C.S. occurrence: Locality HA-4336, La Aguada Section, Trujillo state, La Puya Member of Peñas Altas Formation, of Late Albian age (ARNAUD et alii., 1999, fig. 32). Frequent.

Paleoecology: The presence of *V. aff. pricei* in La Puya member,- associated with other gastropoda as *Keilostoma* and *Goniocheila*,- is the best confirmation on the euhaline marine waters, suggested already by the biodiverse Ammonite-fauna (RENZ, 1982; ARNAUD et alii., 1999).

Vanikoro cf. genevensis (Pictet & Roux, 1847-1853).

- Cf. 1847-1853 *Narica genevensis* PICTET & ROUX, Moll. Foss. Grès verts des env. de Genève : 188, pl. 18, fig. 5 ;
- Cf. 1887 *Narica genevensis* P. & R., MALLADA, Synops. España, Cret. Inf.#3: 67;

Occurrence: Originally collected in Saxonet, and Perte du Rhône, Switzerland, of Aptian age. In Spain, it was reported from Gargallo? of the Alacon limestone Formation, Oliete Basin, of Late Barremian-Early Bedoulian age (CANEROT, 1982).

S.C.S. occurrence: Locality MC-119-A, west of Cerro Piedra de Rayo, Monagas state, (DBG) of Lower Garcia Formation, of Early Aptian age. This bivalve-carrying marl is one of the valley-fill sediments, which was part of the TST, and deposited during the OAS "Selli" event. One shell collected, preserving part of the original shell, with an open umbilicus and the fine spiral striae. Its apical angle varies between 125º and 130º, and the height reaches 28 mm.

Family ***NATICIDAE*** Forbes, 1838.

SOHL (1960, U.S.G.S. Prof. paper 331-A) pointed out the many difficulties in working with the fossil naticids and ampullinids of the Cenozoic, and the same is valid for the Cretaceous, where only rarely are available well preserved shells for their study. With a Biochron of Triassic to Recent, these carnivorous gastropods are known as predators of Bivalvia and other invertebrates.

Subfamily ***GYRODINAE*** Wenz, 1941.
Genus ***Ampullospira*** Harris, 1897.

With a Biochron of Triassic to Neogene (Miocene), *Ampullospira* has been traditionally considered as a shallow, brackish water inhabitant.

Ampullospira simillima (Choffat, 1885).
Plate 3, figure 7 ;

- 1885 *Natica simillimus* CHOFFAT, Direct. Travaux Geolog.#1 : 22, pl. 1, fig. 4a, 4b ;
- 1887 *Natica simillimus* C., MALLADA, Sinopsis Fos. España, Cret. Inf., #3:65;
- 1931 *Natica cf. bulimoides* (D.) WEAVER, Mem. Univ. Washington, 1:374, pl. 43, figs. 289, 290;
- 1957 *Natica bulimoides* (D.) VON DER OSTEN, Jour. Paleont. 31(3) : 584, pl. 65, fig. 24 ;(non DESHAYES, 1842).

Occurrences : Originally collected in Serra de Cintra, and around Bellas, Portugal, of the Urgonian limestone Formation, of Barremian age. In Spain, collected in Coll de Alba Tortosa and Alcalá de Chisvert, of Chert Formation, Maestrazgo Basin, of Early Bedoulian age (CANEROT, 1982). In Argentina, found in Upper Agrio Formation, of Hauterivian-Barremian age.

S.C.S. occurrences: At MMH locality Su-216, West coast of La Ceñidura, Los Venados Island, in Morro Blanco Formation, (DAGM) of Late Berriasian-Early Valanginian age.

Ampullospira drumensis (Sayn, 1932).
Plate 28, figure 16;

- 1932 *Ampullospira drumensis* SAYN, Urgonian de Barcelonne: 61-62, pl. 4, figs. 16, 16a;
- 1863 *Natica Perezi* VILANOVA, Ensayo descripc. Geognostica Prov. Teruel, pl. 5, fig. 5; (non VON BUCH, 1838).
- 1927ª *Natica acuta* PCHELINTSEV, Mem. Comité Geol., Leningrad, #172 : 164, pl. 4, fig. 15; (non acuta Lamarck, 1818)
- 1987 *Tylostoma praelonga* (D.) LOPEZ, Tesis: 91-92, fig. 19; (non Deshayes, 1842).
- 1980-B *Prisconatica cf. perezi* (Vilanova) MACSOTAY, Thèse U. Lyon-I: 49;

Occurrences: Collected in Spain, in Mirambell marl, and De Blesa marl and limestone, Formations, in Maestrazgo and Oliete Basins, of Hauterivian-Early Barremian age (CANEROT, 1982) not Aptian, as was stated. In Southern France, sampled at Barcelonne, in Urgonian limestones, of Barremian age (COTILLON et alii., 1979). In Hauterivian sediments in Crimea (Ukraine) and in Tunisia.

S.C.S. occurrence: Locality MO-905, Cachimena inlet, Sucre state, in Lope Member of Taguarumo Formation (DAGM) of Barremian age (plate 28, fig. 16). Also in quebrada Quetepe, in El Dantó dolostones, of Hauterivian age.

Dimensions: Our sample UCVMG-IO2114, measures, of Height: 22 mm, of Width: 20 mm, incomplete. In Lope member of Taguarumo Formation, most shells are well preserved, but elsewhere usually casts are found only.

Ampullospira whitei (Von Ihering, 1907)
Plate 38, figure 2;

- 1887 *Tylostoma torrubiae* WHITE, Ar. Mus. Nat. Rio de Janeiro,#7: 187, pl. 17, figs. 2, 3; (not SHARPE, 1849).
- 1907 *Tylostoma whitei* VON IHERING, Ann. Mus. Nat. Buenos Aires, ser 3(7): 41;
- 1936 *Tylostoma whitei* V. I. MAURY, Mem. Serv. Geol. Min. Brasil, 11: 198, pl. 14, fig. 19, 20, 21;

Description: Cast of medium size, sub-ovate, with convex volutions, and a prominent spire; outer portion of the last whorl considerably expanded. Aperture extended forward and rounded anteriorly, posterior narrowes and, upon maturity, upwards more than half way across the preceding volution.

Dimensions: Height when entire about 70 mm; width: 40 mm.

Occurrence: Porto dos Barcos and Trapiche das Pedras Velho, near Maroim, Sergipe, Brazil, of Middle Albian age.

S.C.S. occurrence: Locality VG-465, Pico García, Monagas state, (DBG) upper El Cantil Formation, of Early Albian age. Also collected in MO-883, cliff west of Puerto Escondido, upper Borracha Formation, (DAGM) of the same age.

Discussion: The description of *Ampullospira whitei* as was reproduced by MAURY (op. cit.), fits perfectly the many casts we have collected in Eastern Venezuela. There is no mention or trace of any varix on any of the whorls. Adult shells and juveniles are common in biodetritic algal limestones deposited in brackish (or saline) waters. MACSOTAY & VIVAS (1995: 136) reansferred this species to *Ampullospira.* Is alike to *Ampullospira hispanica* (d'Orbigny, 1850) – limestone and marl of Mosqueruela Formation, of Maestrazgo and Rubielos basins, Spain, of Cenomanian age - which was distinguished by a non-channeled suture.

Genus ***Gyrodes*** Conrad, 1860.

According to DELPEY (1942) the Biochron of *Gyrodes* was intra-Cretaceous extended from Hauterivian to Maastrichtian, so it fits well in the Taxa Group Two of SOHL (1987). During this time-span, it became cosmopolitan, with many species, and usually common in individuals, so the lack of preservation of the rather thin aragonitic shell, is compensated.

Gyrodes cf. contracta Gabb, 1877.
Plate 28, figure 6;

- Cf. 1877 *Gyrodes contracta* GABB, Jour. Ann. Nat. Sci. Philadephia, 8 :276-277, pl. 39, figs. 5, 5a ;
- Cf. 1974 *Cyrodes (sic) contracta* G., RIVERA & ALLEMAN : 96 ;

Diagnosis : While possessing every character essential to the genus, it differs from its congeners in having the characteristic umbilicus, but usually narrow (GABB, op. cit.).

Occurrence: Collected in Pariatambo, province of Yaulí, Junin Department, Perú, Pariatambo Formation, of late Middle Albian age (BENAVIDES, 1956: 375-376), and not Liassic, as was stated originally.

S.C.S. occurrence: Locality MO-3213, Lope inlet, Chimana Grande Island, (DAGM), lower Taguarumo Formation, of Late Hauterivian age. Several cvasts were collected in the siltstones between the green limestones, and all are pelomorphically deformed.

Observations: Somewhat smaller than *G. contracta* Gabb, and it lacks the subsutural channeling observable in the figure 5a.

Gyrodes ervyna (d'Orbigny, 1842)

- 1842 *Natica ervyna* d'ORBIGNY, Pal. Franc. Terr. Cret.,, #2: 159, pl. 173, fig. 7;
- 1849 *Natica ervyna* d'O., PICTET & ROUX, Gres verts env. Genève: 180, pl. 17,, fig. 2;
- 1906 *Natica ervyna* d'O., WOLLEMANN, J. k. P. G. L. B.#27: 287-288, pl. 9, figs. 4, 5;

Occurrence: Common species in the North European Province, and the Western European Subprovince, in Early to Middle Albian times.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, Lower El Cantil Formation, (DBG) of Late Aptian (Clansayesian) age. In Colombia, it was reported (cf.) from Une Formation, near Villeta, of Albian age (COLLET in EUGSTER, 1922, Eclog. Geol. Helv.: 251).

Gyrodes excavata (Michelin, 1836).
Plate 34, figure 3;

- 1836 *Natica excavata* MICHELIN, Mem. Soc. Geol. France#3: pl. 12, fig. 4;
- 1843 *Natica excavata* M., d'ORBIGNY, Paleont. Franc., Terr. Cret.: 155, pl. 173, figs. 1-2 ;
- 1879 *Gyrodes excavata* M., WHITEAVES, Geol. S. Canada, Mesoz. Fossils, #2 :124-125, pl. 16, figs.2, 2a ;
- 1912 *Natica (Gyrodes) excavata* M., PERVINQUIÈRE, Paleont. Tunisienne : 48 ;
- 1962 *Gyrodes cf. excavata* (M.) BENKÖ-CZABALAY, Hung. Paleont.#31: 252, pl. 3, figs. 22-23;

Occurrences: The Biochron of this species extends from Hauterivian to Cenomanian, in Western European, Maghrebian, Balkanic and Northeast Pacific subprovinces.

S.C.S. occurrences: Locality VG-465, Pico García, Monagas state, upper El Cantil Formation (DBG) of Early Albian age. Also in locality MC-273-E, Caripito member of Chimana Formation, Monagas state, of Middle Albian age, frequent. In western Venezuela, in MO-2519, Quebrada El Mene, Perijá region, Piche Member of Apón Formation of Early Albian age, only one cast.

Gyrodes gaultinus (d'Orbigny, 1842).
Plate 51, figure 11;

- 1842 *Natica gaultina* d'ORBIGNY, Paleont. Franç., Terr. Cret.#2: 156-158, pl. 173, figs. 3-4;
- 1849 *Natica Rauliniana* d'O. PICTET & ROUX, Foss. Du Gres verts: 47, pl. 17, figs. 5-6 ;
- 1882 *Natica gaultina* d'O. De LORIOL, Gault de Cosne (Nièvre): 86, pl. 10, fig. 16;
- 1956 *Gyrodes gaultina* d'O., DARTEVILLE & PREBION, AMRC, Belg. Soc. Geol. 15: 76;
- 1978 *Gyrodes gaultinus* (d'O.) KOLLMANN, A.N.M..Wien, #81; 174-175, pl. 1, figs- 1-6 ;

Occurrence : Frequent species with a Biochron of Late Aptian to Late Albian, in all the tropical Subprovinces of Gondwana Province down to Angola and Madagascar, and all the North European Province, and its subprovinces, too. Its distribution seems to have been controlled by salinity anomalies, than surface temperature.

S.C.S. occurrence: Locality HA-4343, La Urbina north section, La Puya member of Peñas Altas Formation, of Late Middle Albian age, where it is reasonably frequent.

Gyrodes manueli (Choffat, 1885)
Plate 24, figures 9, 10;

- 1886 *Natica Manueli* CHOFFAT, D. trav. Geol. #1: 16-17, pl. 2, fig. 9;
- 1942 *Gyrodes Manueli* Ch. DELPEY, Gasterop. Mesozoique: 34, figs. 8-9;
- 1978 *Pterodonta sp.* KOLLMANN, II A. Naturh. Mus. Wien, #81:181, pl. 2, fig. 23;
- ?1877 *Prisconatica ampla* GABB, Jour. Acad. Nat. Sci. Philadelphia, 2º ser.,8: 279, pl. 40, fig. 1; (not *Natica [Gyrodes] ampla* BINKHORST, 1861).

Diagnosis: Shell large, unusually short and broad, spire very short, aperture very oblique in relation with the axis; the whorls are convex, the cast exhibits a weak ramp. The base is open, with a large ombilic, whose margins are ornated with longitudinal folds. In our samples the ombilic is closed by young shells of *Acutostreea cf. leymeriei* (Deshayes), but fragmentary shells allow to see the presence of a wide ombilic.

Dimensions: Illustrated casts measure of Height: 70 mm, Width: 72 mm (fig. 10); and of Height: 50 mm, Width: 60 mm, (fig. 9) all incomplete.

Occurrence: Originally collected at Casaes da Camara, Sabugo, Portugal, in facies de Carregueira, of Hauterivian age. In the *Mesorbitolina* beds of Mezarié, (road to Damascus), and the *Cardium*-beds in Asfouriyé, of Albian age, Syria. Also in the Albian sediments in Aley and Bhamdoun, Lebanon. In France, in the Albian of Padern (Corbières). In Perú, between the Chonta River and the village of Baños in the Carhuaz Formation, of Hauterivian-Barremian age (BENAVIDES, 1956).

S.C.S. occurrence: Locality MO-5613: La Hacienda quarry, south of La Acequia, Sucre state, (DAGM) in Taguarumo Formation, associated to *Palorbitolina lenticularis* of Late Barremian age.

Subfamily ***POLINICINAE*** Gray, 1847.
Genus ***Euspira*** Agassiz, 1839 (=*Lunatia* Gray, 1847).

According to WENZ (1938) has a Biochron of Late Cretaceous (Cenomanian) to Recent, having developed many species and extended to all the tropical and temperate seas in the Amphiamericas, Europe, Australia, New Zealand, Japan, India and north and west coasts of Africa. COX (1925: 160-161) reported a small-sized (18 mm of Height) *Euspira ceres* (de Loriol), as abundant in the shell-bed of Lower Spilsby Formation, of Ryazanian age; this report extends the Biochron to Late Jurassic. I assume a rol of opportunistic genus, as an active predator.

Generic diagnosis: Medium to large-sized globose shell, with abutting to impressed sutures; umbilicus open and small to medium-sized, and lacks a funicle (SOHL, 1960: 122). This diagnosis was based on

Natica glaucinoides J. Sowerby, 1812, not Deshayes, - of the Eocene of England. According to ADKINS (1928:177) it is rather like *Natica*: shell subspherical, smooth, thin, spire low; umbilicus wide or narrow, without callous filling; aperture oval-crescentic, occasionally somewhat oblique, inner lip thickened above. In the Upper Cretaceous series of the Gulf Coast species of *Euspira* are not numerous but are found at all levels (SOHL, 1960) and the same can be stated of Gosau species of Austria (BÖHM, 1900). The Woodbine Formation species assigned by STEPHENSON (1953: 150-151) to *Natica* lack the funicle of that genus, and probably belong to *Euspira.*

Euspira jaworskii (Weaver, 1931)
Plate 34, figure 20;

- 1931 *Tylostoma jaworskii* WEAVER, Univ. Washington, Mem.#1: 379-380, pl. 41, figure 273; pl. 43, figs. 287, 288;
- 1954 *Tylostoma jaworskii* W., VON DER OSTEN, Bol. Geol. (Caracas), 3(8): 172-173, pl. 11º, fig. 2;
- 1957 *Prisconatica praelonga* (Leym.) VON DER OSTEN, Jour. Paleont., 31(3): 355, pl. 65, fig. 8; (non Leymerie, 1842).
- 1958 *Tylostoma jaworskii* W., CORVALAN & PEREZ: 47;
- 1978 *Tylostoma jaworskii* W., CAMACHO & RICCARDI, cuadro nº 5;

Occurrence: Collected in the lower horizons of the upper member of the Agrio Formation, Neuquen Basin, Argentina of Late Hauterivian age, where it is frequent. Associated to *Crioceras andinum* Gerth, and many outer shelf Bivalvia. Found in Valanginian-Hauterivian sediments in Chile.

Diagnosis: Casts of large size, moderately elongated spire, elongate and only moderately convex body whorl, straight columella and large and narrow aperture.

Dimensions: Height: 90 mm, height of body whorl: 24 mm, heigjht of spire, 66 mm, height of aperture: 57 mm; maximum diametr of the cast, 49 mm; apical angle, 65º.

S.C.S. occurrence: Locality MO-3213, Lope inlet, Chimana Grande Island, lower Taguarumo Formation, of Late Hauterivian age. Also in MO-1305, black shales of Chururú member of Rio Negro Formation, Uribante Hemigraben, of Hauterivian age. Also in VG-556-A, on Rio Morocoto-Caituco-Ojo de Agua road, Sucre state, in El Dantó Formation (DGC) of Hauterivian age; collected in light grey shales, intensely bioturbated by *Chondrites cf. arbuscula* Brongniart. At locality MC-324-B, of Cerro Garrapata, Casanay, of Lower Borracha Formation (DAGM) of Late Aptian age.

Comparisons: WEAVER (op. cit.) compared these casts to *Tylostoma,* six species of the Neocomian and two of Aptian age of Western European Subprovince. The specimens of Punta Fuera, Caracas del Oeste Island, (DAGM) are smaller than those of the Neuquén basin, and were collected in the basal green limestones of Taguarumo Formation, by VON DER OSTEN, (op. cit.) of Hauterivian age.

Euspira sergipensis (Maury, 1936).
Plate 50, figure 2;

- 1887 *Euspira pagoda* WHITE: Arch. Mus. Nac. Río de Janeiro #7: 185, pl. 17, figs. 11, 12; (not *Natica pagoda* FORBES, 1846).
- 1936 *Euspira sergipensis* MAURY, Mem. Serv. Geol.-min. Brasil, #11: 191, pl. 14, figs. 3-4;
- ¿1958 *Polinices gainesanus* ANDERSON, Geol. Soc. Amer., Mem. 71: 151, pl. 30, figs. 1, 1a;

Occurrence: Originally studied from Poro dos Barcos, Maroim, Sergipe, Brazil, of Ganhamaroba Group, of Middle Albian age.

S.C.S. occurrence: Locality MO-878, west of Patiño Inlet, Sucre state, (DAGM) upper Borracha Formation, of Early Albian age. The dimension of our best cast, measures of Height (incomplete): 14,5 mm and Width: 11,6 mm; when complete the cast measured 17,5 mm of height. The Brazilian originals measured 17 x 12 mm.

Discussion: *Polinices gainesanus* ANDERSON (1958, Geol. Soc. Amer., Mem. 71: 151, pl. 30, figs. 1, 1a) – North fork of Cottonwood Creek, Shasta County, Califorbnia, of Late Albian to Early Cenomanian age,- is somewhat a somewhat bigger *Euspira* shell, which developed an angularity on the posterior area of the labrum.

Observations: The Genus *Euspira,* present abundantly in the Ryazanian beds of England, seem to have invaded the western Tethys Ocean from the Proto-Pacific Ocean, during the Neocomian high-salinity episodes (OAE event Faraoni). Its presence during the Albian times, is more related to abundant biomass related to high-energy marine waters.

Genus ***Amaurellina*** [Bayle] P. Fischer, 1885.

According to WENZ (1938), the Biochron of this genus extends from Late Cretaceous (Cenomanian) to Paleogene (Oligocene). Its palaeogeographic distribution includes Europe, Africa, Levante (Syria), Pakistán, North and Central South America, Antilles and New Zealand. It should be included in Taxa

Group Three of SOHL (1987). An up-dated rewiev was published by SOHL (1960: 125).

Amaurellina rhodani (Pictet & Roux, 1849)
Plate 50, figure 1;

- 1849 *Natica rhodani* PICTET & ROUX, Grès verts, Geneve: 182, pl. 17, figs. 3a-c;
- 1978 *Amaurellina rhodani* (P. & R.) KOLLMANN: 178-179, pl. 1, figs. 12-14;

Occurrence: Originally studied from Perte du Rhône, Switzerland, of Albian age. Later found in Hölleitengraben, Austria, of Middle Albian age.

S.C.S. occurrence: Locality MO-1375, La Cueva Inlet, Borracha Island, DAGM, Upper Borracha Formation, of Early Albian age. Associated to many thick-shelled gasteropoda, as *Pseudomesalia and Tylostoma.*

Family ***MURICIDAE*** Gray, 1857.

According to STOLICZKA (1867-1868: 128-129) the Biochron of this family extends from Early Cretaceous (Albian) to Recent, so it is well adapted to Taxa Group Three of SOHL (1987). Very active carnivorous predators.

Subfamily ***RAPANINAE*** Wenz, 1938
(=*Sarganidae* Stephenson, 1923).
Genus ***Blackdownia*** Kollmann, 1976.

According to KOLLMANN (1976, A. Naturh. Mus. Wien, #80: 196-197) this genus has an intra-Cretaceous Biochron, and an intra-Tethyan distribution. Based on the type-species, *Murex quadratus* J. Sowerby, - Albian of England, - it includes six species which were identified as *Fusus, Pyropsis, Tudicla* and *Rapa, but* they constitute a well-differentated genus.

Blackdownia ex group quadrata (Sowerby, 1836).
Plate 34, figure 5;

- 1836 *Fusus quadratus* J. de C. Sowerby in FITTON, Trans. Geol. Soc. Great Brit., ser. 2, #4:343, pl. 18, fig. 17;
- 1868 *Fusus Dejaerii* BRIART & CORNET, :23, pl. 2,, figs. 13-14;
- 1939 *Tudicla quadrata* (S.) MARLIÈRE, Transgr. Albienne: 139, pl. 8, figs. 3a, 3b;
- 1953 *Pyropsis? Sp.* VON DER OSTEN, fide ROYO & GOMEZ: 136;
- 1976 *Blackdownia quadrata* (Sowerby) KOLLMANN, A. N. Museum Wien, #80: 197-198, pl. 1, figs. 3-4; pl. 2, figs. 10-12;

Diagnosis: Fusiform, rhomboidal, with a short conical spire, transversely striated and obscurely bicarinated; base produced, conical; whorls about five; aperture sub-rhomboidal. (FITTON, 1836)

Description: One small cast, preserving part of the shell, which was relatively thick. Biconical in shape, spire moderately high, with 4-5 concave whorls preserved. Apical angle: 80-84º. Sutures appressed, followed by a smooth rampe. Body whorl smooth too, obscurely monocarinated with no tendency to become nodular, moderately concave until its base which is not preserved.

Dimensions: Height(incomplete): 21,5 mm; Width (incomplete): 13,3 mm.

S.C.S. occurrence: Locality MO-1375, Chimana Grande island, Sucre state, (DAGM) Lower Borracha Formation, of Late Aptian age. Two fragmentary juveniles from MC-446-E, Campo Alegre-Buena Vista (Teresén) Monagas state, (DBG) transition beds between Garcia and overlaying El Cantil Formation, of also Late Aptian age.

Discussion: This enigmatic shells, were collected at stratigraphically lower horizons than any *Blackdownia.* The monocarinated body whorl seems to relate it to *Pterocera coquandi* Thomas & Peron, (PERON, 1890, Explor. Tunisie, #1: 78-79, pl. 20, fig. 10)- Santonian stage, Tunisia,- in shape and general form, measuring 38 mm in height, but its spire is lower, the carina is sharper, and the whole shell is ornated by spiral striae. Unfortunately, also lacks the anterior area of the shell, with the eventual channel.

Family ***MELONGENIDAE*** *(=GALEODIDAE auctt.)*

The name *Melongenidae* is prefereable to *Galeodidae,* because *Galeodes* Röding, 1798 is a junior synonym (SOHL, 1960: 16). These are also Predatory gastropods.

Genus ***Mayeria*** Bellardi, 1872.

According to WENZ (1938; I/2: 1216), the Biochron of this Genus is Early Cretaceous (Valanginian) to Neogene (Pliocene). Its palaeogeographical distribution included Japan, Sachalin, New Zealand, India, Madagascar, South Africa and Europe. Relatively few species, among which the Cretaceous ones are the following:

1. *M. africanus* (Woods, 1911) Late Cretaceous
2. *M. oxycrepis* (Mayer-Eymar, 1887) Late Berriasian.
3. *M. secans* (Stoliczka, 1867-68) Campanian-Maastrichtian.

4. *M. umzambiensis* (Rennie, 1929-32) Turonian-Campanian
5. *M. valdensis* (Pictet & Renevier, 1854) Barremian-Early Aptian
6. *M. villersensis* (Pictet & Campiche, 1864) Valanginian
7. *M. sp.* (Woods, 1906)Turonian

Mayeria valdensis (Pictet & Renevier, 1854)
Plate 25, figure 15;

- 1854 *Pyrula valdensis* PICTET & RENEVIER, Matér. Paleont. Suisse,#1: 50, pl. 5, fig. 3 ;
- 1860 *Pleurotoma arata* GABB, Proc. A. Nat. Sci. Phila., 12 : 198, pl. 3, fig. 9 ;
- 1864 *Fusus valdensis* P. & R., PICTET & CAMPICHE, Mat. Paleont. Suisse : 630 ;
- 1867-68 *Pleurotoma arata* G., STOLICZKA : 168 ;
- ?1951 *Pyrula valdensis* MAKSIMOVICH : 197, pl. 2, fig. 1;

Occurrence: Originally collected in the yellow marls of Sainte Croix and Perte-du-Rhone, Switzerland of Early Aptian age. Also in Mt. Tumbia, Serbia, in Urgonian limestones. Also in the "Early Cretaceous" of Perú.

Description: Shell scalariform, spire elevated, apical angle, 85º - 95º, whorls three or four, subangular above, and marked by a shallow revolving groove immediately below the angle; surface marked by numerous revolving striae, crossed by faint growth lines. One peripheral chord, thin but prominent, at the angle of the shoulder of the shell, was depicted on *M. arata* Gabb, but not on *M. valdensis* which was based on a cast.

Dimensions: The height of *M. valdensis* was, without the channel, 31 mm, and the width: 22 mm, (PICTET & RENEVIER, op. cit.). Height: 15,3 mm, width: 10,7 mm, UCVMG/I0-2128.

S.C.S. occurrence: Locality MO-888, Promontory to the west of Punta La Peña, Sucre state, (DAGM) of Lope member of Taguarumo Formation, of Early Aptian age. Attached to a shell of *Aetostreon couloni.*

Mayeria villersensis (Pictet & Campiche, 1864).
Plate 3, figure 4;

- 1864 *Fusus villersensis* PICTET & CAMPICHE, Mat. Paleont. Suisse, #2 : 637-638, pl. 95, fig. 2 ;
- 1906 *Semifusus ? (Mayeria ?) sp.,* WOODS, Ann. South African Museum, #4 : 324-325, pl. 40, fig. 5;
- 2003 *Fusus villersensis* P. & C. SNYDER, Catalogue of the Marine Gastropod Family Fasciolariidae : 218, 289 ;

Occurrence: Originally collected in the marls overlaying the Calcaire Roux Formation, of Valanginian age; also in Villers-le-Lac, Switzerland, of the same age. Possibly in sedimentary rocks at the estuary of the Umzamba river, Mozambique, of Neocomian age.

S.C.S. occurrence: Locality HA-4605, Los Andes Quarry, cut in La Rosa Hill, Sucre State, south of Cumana city, in Morro Blanco Formation, of Late Berriasian-Early Valanginian age. (ARNAUD et alii., 2000).

Family ***FASCIOLARIIDAE*** Gray, 1853.
Subfamily ***FASCIOLARIINAE*** Gray, 1853.
Genus ***Boltenella*** Wade, 1917.

Proposed originally by WADE (1917) a monotypic genus placed as a subgenus of *Euthriofusus* Cossmann (1925) part of the Subfamily *Fusininae.* The genus, however, has a higher spire, a proportionately longer siphonal canal, and lacks the strongly constricted subsutural collar of *Boltenella;* so SOHL (1964, U.S.Geol. Surv., Prof. p. 331-B: 225-226) gave it a full generic rank. Finally, SNYDER (2003: 18) placed it in the Subfamily *Fasciolariinae* Gray, 1853.

Generic diagnosis: Fusiform medium-sized shells having a spire of less than 1/3 total shell length. Whorls posteriorly constricted to a subsutural collar, shoulder strong and noded by transverse ribs, that die out on the lower part of the periphery. Spiral lirae cover shell surface. Aperture posteriorly notched, anterior canal elongate; outer lip elongated at shoulder; inner lip with callus well defined but tapering on columellar lip. With its type-species, *Boltenella coronata* (Roemer) known in Germany, The Biochron of *Boltenella* is supposed to be restricted to Late Cretaceous (Turonian-Maastrichtian.) Few species were reported from Tennessee, North America whose ancestors migrated from tropical areas, as S.C.S.

Boltenella? steffenkieli new species, Macsotay.

Plate 28, figure 10;

Description: Small-sized, tulip-flower shaped shell. There are preserved, the body whorl, part of a constricted but open anterior canal, and one and 1/3 convex whorls. The penultimate whorl is posteriorly constricted, ornated by about 9 swollen axial ribs, separated by wide interspaces; they are covered by spiral lirae well marked in the interspaces and weakened on the top of the axial ribs. Sutures well impressed. Body whorl with 14 swollen axial ribs, well developed at the shoulder, but which fade about the middle of the whorl; the spiral lirae, very

regularly spaced, cover the rest of the whorl. Aperture semilunar, elongated, narrow; posterior notch not observable; inner lip is covered by thin callus which suggests that part of the outer lip was broken off. The shell itself is moderately thick. Apical angle: 64º to 68º.

Etymology: I have the satisfaction to dedicate this new species to the young but innovative Paleobiologist, Dr. Steffen KIEL, - Christian Albrechts Universität, Institut für Geowissenschaften of Kiel, Germany – whose discoveries in Cretaceous-Cenozoic Bathyal Molluska, opened a new insight in Palaeoecology.

Dimensions: The Holotype nº UCVMG/IO-2114, measures, of Height(incomplete): 26,0 mm, and Width: 16,5 mm. When complete, the shell might have measured, of Height: 35 mm.

S.C.S. occurrence: Locality MO-892, Puerto Escondido, Sucre State, (DAGM) Taguarumo Formation, of Early Barremian age. Two incomplete specimens, that were labelled "*Latirus sp."* in the collections.

Comparisons: Surprisingly, *Purpurina San-Claudi* Guirand & Ogèrien, (1865), while PIETTE (1882) ranged this species to *Fusus,* - Corallian (=Kimmeridgian) of France, - had the same general shape, and sculpture as *Boltenella steffenkieli;* it only differs by having a stronger and sharper spiral cord, marking the shoulder of the last whorl, and should be the oldest known species of *Boltenella.* A small shell of 10 mm of height, having a swollen body whorl and a thin anterior channel, was called *Murex* sp. indet., (WEERTH, 1884, Paleont. Abhandl., 2(1): 31, pl. 7, fig. 11) – of Tönsberg, of Hilsthon Formation, of Valanginian-Hauterivian age,- should beincluded in *Boltenella.* In Mora de Rubielos Basin, Morella Formation, Spain, of Late Barremian age, "*Fusus" absconditus* COQUAND (1865, Mem. S. Emul. Prov., #3: 82-83, pl. 5, fig- 15) is a short, oval, but smooth shell, terminating in thin anterior canal, is very near to *Boltenella.*

Boltenella? sp. indet. *Macsotay.*
Plate 26, figure 5;

Description: Shell short, spire formed of very convex whorls, ornated by nodular ribs, axially arranged, 12 to 14 in number; body whorl also exhibiting the axial ribbing, but evanescing before it reaches the ¼ of the height of this whorl. Anterior channel narrow, and seemingly open. Aperture semilunar, outer lip moderately thin.

Dimensions: Height (incomplete): 25 mm, Width: 18,2 mm.

S.C.S. occurrence: Locality MO-905, Cachimena inlet, Sucre State, Lope member of Taguarumo Formation, (DAGM) of Late Barremian-Early Aptian age.

Comparisons: "*Fusus" incomptus* COQUAND (1862), collected at Tenoukla, Tunisia, in shales of Carentonian (=Coniacian) age – is a *Boltenella* very near to *B.* sp. indet., but with the axial ribs more extended on the body whorl.

Subfamily ***FUSININAE*** Wrigley, 1927.
Genus ***Serrifusus*** Meek, 1876.

According to SOHL (1967, U.S.Geol. Surv. Prof. Pap.#393/B: 29) the genus *Serrifusus* does not exist outside of north America, and inside, is restricted to the Campanian and the Maastrichtian stages of the west coast, with few species represented.

Serrifusus cf. rusticus (Briart & Cornet, 1868).
Plate 50, figure 15;

- 1868 *Fasciolaria rustica* BRIART & CORNET, Mèm. Acad. R. Belg. Cl. Sci. #34: 20, pl. 2, figs. 7, 8;
- 1939 *Fasciolaria rustica* B. & C., MARLIÈRE M.R.H. nat. Belg., #89: 137, pl. 7, figs. 15a, 15b;

Occurrence: *S. rusticus* was originally collected in the Meule de Bracquegnies, Belgium, of Early Cenomanian age. It is common in the glauconitic sandstones of Blackdown, in the Early Albian horizons. Also reported from Hungary, in Late Albian sediments.

S.C.S. occurrence: Locality VG-424-A, Pica Las Minas-La Chorrera, margen derecha del río Coicual, (DGC) Valle Grande Formation, of Middle Albian age; mostly are goetite pseudomorphs in glauconitic sandstones. Our samples are identical to the original shells of Northern European Province, but our shells exhibit 5 – 11 peripheral nodes in place of 12 – 14; the apical angle is wider: 90º in place of 76º. It was found also reworked in the allochthonous Bobare Formation – Aptian to Late Albian age, in the Lara Nappe of Western Venezuela.

Comparisons: The Valle Grande Formation specimens, are more alike to the *Fusus rusticus* J. de C. SOWERBY in FITTON, (1836, Trans. Geol. Soc. G. B., ser 2(4): 344, pl. 18, figs. 18), where the ribs, are arranged into two knobs, as to give a squareness to the whorls.

Serrifusus stinnesbecki new species, Macsotay.
Plate 28, figure 18;

Description: Turreted shell, spire angular, of moderate height, possessing five or six whorls; the whorls are slightly convex, on the upper surface, moreconvex below; whorls bordered near the middle by a prominent nodose keel. Upper surface sloping outwardly is faintly ribbed by oblique undulations crossed by faint revolving threads; whorl sutures sharply defined, bordered below by a narrow collar-like zone. Aperture ovate, angulate at its outer border; is rounded below, base of body whorl sloping downward to an apparent short canal, which is not preserved.

Dimensions: The Holotype, UCVMG/IO2131, measures of height: 17,3 mm, and the greatest width:13,9 mm.

Etymology: Dedicated to the young Palaeontologist, Dr. Wolfgang STINNESBECK,-Institut für Geowissenschaften, Ruprecht-Karls-Universität, Heidelberg, Germany, - who has been analyzing the molluskan fauna of stratigraphic outcrops of Maastrichtian/Paleocene sequences in Mexico, with great success.

S.C.S. occurrence: Locality MO-892, east of Puerto Escondido inlet, Sucre State, Lope member of the Taguarumo Formation, (DAGM) of Early Aptian age. It is associated to a Bivalvia fauna, of Bedoulian affinities.

Comparisons: *S. stinnesbecki n. sp.* shows a resemblance to *S. joaquinensis* ANDERSON (1958, Geol. Soc. Amer., Mem. 71: 171-172, pl. 49, fig. 3) – upper part of Panoche Formation, California, North America, of Late Campanian age, - whose whorls are bordered by the middle by a prominent nodose keel, but the nodes are flattened and sharp. *S. stinnesbecki* seems to be the oldest species of the genus, whose Biochron extends from Aptian to Maastrichtian.

Family ***PERISSITYDAE*** Popenoe & Saul, 1987.
Genus ***Perissolax*** Gabb, 1861.
(=*Pseudoperissolax* Clark, 1918)

The Genus *Perissolax* has a Biochron extended from Early Cretaceous (Aptian) to Paleogene (Eocene), conforming to the Taxa Group Three of SOHL (1987). Its distribution includes North, South America and Europe. Among the Cretacous species, we know:

1. *P. brighti* (J. de Sowerby, 1836) Aptian,
2. *P. cornuelianus* (Stephenson, 1953), Cenomanian
3. *P. dubia* (Gabb) Coniacian
4. *P. durvillei* (d'Orbigny, 1847) Maastrichtian,
5. *P. filamentosus* (Binkhorst, 1853) Maastrichtian,
6. *P. hombroniana* (d'Orbigny, 1847) Maastrichtian
7. *P. longirostris* (d'Orbigny, 1847), *type species. Maastrichtian
8. *P. sowerbyi* (Seeley, 1861) Albian-Cenomanian.
9. *P. whitfieldi* (Weller, 1926) Maastrichtian

Perissolax sowerbyi (Seeley, 1861)
Plate 56, figure 2;

- 1861a Pyrula (Myristica) Sowerbyi SEELEY: 283;
- 1903 *Fusus sp.* SHATTUCK, U. S. Geol. Surv. Bull. 205 :34, pl. 19, figs. 10-11;

Description: A worn cast with only the last and penultimate whorls preserved. Inflated, ovately fusiform, striated; spire 1/3 of the height of the shell; body whorls inflated, aperture concealed. Las whorl composed of a shoulder, with a concave ramp extended from the suture, with smooth surface. Below the shoulder, convex surface ornated with 7-8 spiral grooves, followed by three weak ones. No growth line is visible.

Occurrence: Originally studied from Folkstone, Kent, England, of Albian age sediments. In Texas, collected from Buda and Austin Formations, of Early Cenomanian and Coniacian age.

S.C.S. occurrence: Locality MO-ll56, arroyo El Molino Niquitao area, Trujillo state, Guayacan Member of Capacho Formation, of Late Turonian age.

Comparisons: "*Fusinus" cornuelianus* STEPHENSON (1952, U.S.Geol. Survey, Prof. Pap. 242: 183, pl. 41, figs. 2, 3) – Woodbine Formation, of Cenomanian age, Gulf-Atlantic Coast Subprovince,- is a small *Perissolax,* but with the peripheral cord has several spirals on both sides.

Perissolax trochoides Gabb, 1877.
Plate 50, figure 13;

- 1877 *Perissolax trochoides* GABB, Jour. A. Nat. Sci. Phila., #8 : 276, pl. 39, fig. 4 ;

Occurrence : Many casts collected at Hacienda Macanga, Dept. La Libertad, Perú, in Collarisquisga? Formation, of Aptian age (BENAVIDES, 1956).

S.C.S. occurrence: Locality MO-3110, Quebrada Santa Rosita, Perijá región, in Piche Member of Apón Formation, of Early Albian age.

Observations: Various species of *Perissolax* were studied from California, *P. brevirostris,* -from Cenomanian,- and *P. blakei* ,- from *Maastrichtian* sediments containing coal seams, which have preserved their well ornamented shells.

Family ***NASSARIIDAE***
Genus ***Alamirifica*** Saul & Squires, 2003.

SAUL & SQUIRES (Jour. Paleont., 77[3]: 444-445, 447) successfully included high-spired cerithiform shells of intraCretaceous (Albian-Early Campanian) *Nassariidae* as some of the oldest representatives of the family. Originally considererd as belonging to the Pacific slope of North American plate, it is present in Western European, Maghrebian and Syrian Subprovinces, suggesting a thermophyllic genus, probably to be included in the Taxa Group Three of SOHL (1987).

Alamirifica magnicostata (Conrad, 1852).

Plate 28, figure 13;

- 1852 *Turritella magnicostata* CONRAD in Lynch: Palestine expedition.,:34, pl. 10, figs. 63, 64;
- 1891 *Potamides? distorta* WHITFIELD: Bull. Amer. Mus. Nat. Hist.#3: 429-430, pl. 9, figs. 19, 21;
- 1927 *Cerithium (Pyrazus?) magnicostatum* (C.) BLANCKENHORN, Palaeontographica #69: 161, pl. 4, fig. 75;
- 1939 *Cerithium (Pyrazus) magnicostatum* (C.) DELPEY, Gaster. Mesoz.: 137-138, pl. 5, fig. 6;

Diagnosis: Shell turriform, whorls rounded, axially ribbed; ribs large, distant, rounded; revolving spiral lines prominent, some large and distant, with generally three finer, unequal intermediate lines.

Dimensions: Height, (incomplete):60 mm, Width: 23 mm , apical angle: 20º-23º (BLANCKENHORN, 1927); Height (incomplete): 52,7 mm, Width: 16 mm, apical angle 28º-30º (pl. 28, fig. 13).

Occurrences: Originally collected at Bhamdoun, Djezzine and the yellow marls of Bekfaya, Lebanon, in Aptian horizons. In western Morocco, collected at Djebel Tissakatine, of probable Albian age (ROCH, 1930: 395).

S.C.S. occurrence: At Locality MO-892, east side of Puerto Escondido inlet, Sucre state, in Lope Member of Taguarumo Formation, of Early Aptian age. Also at locality MC-382-C, *A. cf. magnicostata* of mid-Garcia Formation, of Late Aptian age; the glauconitic incrustations make the identification, rather tentative.

Family ***OLIVIDAE***

Subfamily ***PSEUDOLIVINAE*** Cossmann, 1901.
Genus ***Calorebama*** Squires, 1989.

Based on the *Pseudoliva inornata* Dickerson, 1915, -Eocene, California,- forms a group of species in the Paleogene of the Pacific coasts of both Americas. During the Cretaceous, it was common in the Senonian of Japan, and the Maastrichtian of India.

Calorebama sp. indet. Macsotay.
Plate 57, figure 13;

Diagnosis: Pyriform, stout *Calorebama* with a smooth shell, with a pseudolive-groove constituting a fasciolar band, well marked on the body whorl. Apical angle about 90º.

S.C.S. occurrence: Locality MO-1156, is frequent at El Molino creek, Niquitao area, Trujillo state, Guayacan Member of Capacho Formation, of Late Turonian age. Also locality Beli-4, where it is rare, quebrada La Bellaca, Barinas, Escandalosa Formation, of Cenomanian-Turonian age.

Dimensions: Height(incomplete): 52 mm, and Width: 43 mm.

Observations: The Guayacan Member specimens are the oldest pseudolivine of the Genus *Calorebama,* older than *C. cretacea* KASE (1990, Jour. Paleont. 64(4): 572-573, Figure 3.8, 3.9) – Middle Campanian to Maastrichtian of Japan.

Comparisons: *Calorebama parinasensis* (WOODS, 1922: 93-94, pl. 12, figs. 4-6)- Parinas, Salinas and Negritos Formations, northwestern Perú, of Early Eocene age,- is the taxon that bears more resemblance to *Calorebama* sp. indet. *C. soldadoensis (*Van Winkle, 1919: 22, pl. 3, fig. l0) – from Soldado Rock, bed 2, and Marac Quarry, Trinidad, of Paleocene age,- has the penultimate whorl more inflated. *"Pseudoliva" mutabilis* (Woods, 1922) and *"Pseudoliva"mutabilis douvillei* (Olsson, 1928) both of Early Eocene of Perú, and *"Pseudoliva" mutabilis woods* (Olsson, 1928) of Paleocene of Perú, all are distinguished by possessing heavy tubercles on the shoulder of the last whorl. *C. cretacea* (Kase, 1990)- Campanian-Mastrichtian of Japan,- is more pyriforme and smaller than *Calorebama sp. indet.*

Superfamily ***NERINEACEA*** Zittel, 1873.
Family ***CERITELLIDAE*** (=*Tubiferidae* aucct.)

According to WENZ (1938) this family has a Biochron extended from Early Jurassic (Sinemurian) to Late Cretaceous (Cenomanian). Its palaeogeographical distribution is restricted to Western European and Syrian Subprovinces.

Genus ***Fibulella*** WENZ, 1938, (n.nom. pro *Fibula* Piette, 1859, non LESKE, 1778).

According to WENZ (1938) its Biochron extends from Middle Jurassic (Bajocian) to Early Cretaceous (Barremian), in West European, tropical subprovinces of Gondwana Province, including Madagascar. In the Apulian Subprovince survived until Cenomanian times.

Fibulella bekfayensis (Delpey, 1939)
Plate 29, figs. 15, 20;

- 1939 *Cerithiella (Fibula) bekfayensis* DELPEY, Gaster. Mesozoiques: 214, pl. 5, fig. 10;
- 1957 *Eulima albensis* d'O., VON DER OSTEN, Jour. Paleont. 31(3): 584, pl. 65, fig. 23 ;

Occurrences : Originally collected from Bekfaya, Beit Chébab (Mar Boutros, Lebanon) of Early Aptian age.

S.C.S.occurrence: West coast of Picuda Grande Island, (DAGM) Sucre State, upper Taguarumo Formation, of Early Aptian age (VON DER OSTEN, 1954).

Fibulella jaccardi (Pictet & Campiche, 1862).
Plate 28, figures 2, 8 ;

- 1862 *Pseudo-melania jaccardi* PICTET & CAMPICHE, Paleont. Suisse, #2 : 268, pl. 70, figs. 3-5 ;
- 1907 *Pseudomelania jaccardi* P. & C., KARAKASCH, T.S.I.N.P, #32(5) : 174, PL. 17, FIGS. 23, 24 ;
- 1957 *Pseudomelania cf. jaccardi* P. & C., MARIE & MONGIN : 414, text-fig. 4 B.

Description : All previous records were based on casts collected in pelitic rocks. Our samples from El Cazón Formation dolostones, have preserved part of the original shell. Elongated shell, with whorls near the apex ornamented with rather strong, rounded, convex, transverse ribs with very fine spirals between them; the remaining whorls are ornamented with very fine spirals between them; the remaining whorls are ornamented with growth-ridges or lines with a fasciole in medial position. Sutures impressed, with a small spiral cord bordering it. Aperture unknown; apical angle, 20 º.

Dimensions: The height (incomplete) of the type specimen was: 45 mm. Our best shell, measures of Height (incomplete): 32,5 mm, Maximum width: 14 mm (Plate 28, fig. 2).

Occurrence: Originally collected at Villers-Le-Lac, Jura mountains, Switzerland, in Pierre Jaune Formation, of Valanginian age. Also in Biassala & Sably in Crimean Peninsula of Neocomian age. At Mont-Rose, France, in Calcair Blanc inferieur, of "Infra-Valanginian" age.

S.C.S. occurrence: Locality MO-3213, Lope inlet in Chimana Grande Island, (DAGM), in lower Taguarumo Formation, of Late Hauterivian age. Not rare. Also in MC-441-A, La Guanota-La Güiria, in Hacienda with funicular, (DGC) in El Cazón Formation, of Late Berriasian-Early Valanginian age, associated with many small-sized bivalves.

Genus ***Sequania*** Cossmann, 1895.

According to Wenz (1938), *Sequania* has an intra-Jurassic (Rauracian-Sequanian) biochron and is restricted to Europe, having few species. GEMMELLARO (1909) collected *S. diblasii* (G.) in Carini, near Palermo, Sicilia in *Dyphia janitor* limestones, associated to a gastropoda-rich Late Tithonian-Berriasian *Nerineacean* fauna, proving its extension into Cretaceous times.

Sequania? sp. indet. *Macsotay*
Plate 34, figure 6.

Description: Cast medium-sized, (Height of 3 ½ whorls, 21,5 mm, and a width of 12,3 mm), with a fairly rapid taper and a sculpture formed by strong, fold-like ribs. The suture appears to have been deep and excavated by the ends of the ribs. There are 11 - 12 sinusoidal fold-like ribs which start at the edge of the subsutural ramp, which is sculptureless, and evanesce approaching the anterior canal which is short ond flexuous. No spiral sculpture is observed. Aperture concealed on all the samples.

S.C.S. occurrence: Locality MC-119, Cerro Piedra de Rayo, Monagas state, Basal Garcia Formation, of Early Aptian age (Text-figure V-06). Several ill-preserved casts, associated to abundant disarticulated shells of *Filosina gregaria*, of estuarine habitat.

Comparisons: The only gastropod of the South American Cretaceous fauna, comparable to ours, is *Cerithium* sp., (OLSSON, 1934, Bull. Amer. Paleont. 20(69): 66, pl. 10, fig. 4) – Monte Grande Formation, northwestern Perú of Maastrichtian age,- but the axial folds are subvertical, and not sinusoidal as in *Sequania sp.,indet.*

Family ***Nerineidae*** Zittel, 1878.
Subfamily ***Nerineinae*** Zittel, 1878.
Genus/Subgenus ***Eunerinea (Eunerinea)*** Cox, 1949.

According to COX (1949, Proc. Malac. Soc. London, v. 27 {6}: 250) the biochron of *Eunerinea* extends from Middle Jurassic (Bajocian) to Late Cretaceous

(Senonian), belonging to the Taxa Group One, of SOHL (1987). Originated many species, and its distribution, is cosmopolitan. In this group we include the most common and long-ranged group, the *Nerineinae* with three simple folds: 1 labral, 1 parietal and 1 columellar, **1,1,1,0.** The ombilic is narrow or absent. Generally, the whorls are excavated and a nodular collar ornates the border of the sutures (BERTHOU & TERMIER, 1972). Its type species is *Nerinea castor* d'Orbigny (1850), -Early Rauracian (=Oxfordian), Late Jurassic, Saulces-aux-Bois, Ardennes, Belgium,- but also in France and Switzerland,- (COSSMANN, 1898).

Eunerinea (Eunerinea) aptiensis (Pictet & Campiche, 1861-64)
Plate 29, figures 10, 11 ;

- 1861-64, *Nerinea aptiensis* PICTET & CAMPICHE, Mat. Paleont. Suisse, #2 : 3435, pl. 69, fig. 3 ;
- 1959 *Nerinea cf. aptiensis* P. & C., CZABALAY, M.A.F.I.E. Jelentés : 163, pl. 1, fig. 3 ;

Occurrence : Located in Switzerland, France, Hungary and Lebanon, always in Aptian-age sediments.

S.C.S. occurrence: Locality HA-4452, Cerro Agua Dulce section, Trujillo state, in Lower carbonatic member of Peñas Altas Formation, of Early Aptian age (ARNAUD et alii., 1999, fig. 17). It is found in bioclastic carbonate beds, in *Choffatella*-marls, associated to *Teleopetyxis galatea* (Coquand). Also in MO-1461, in Arbol Redondo section, Trujillo state, in Lower carbonatic member of Peñas Altas Formation.

Eunerinea (Eunerinea) chamousseti (d'Orbigny, 1842-43).
Plate 29, figure 26 ;

- 1842-43 *Nerinea chamousseti* d'ORBIGNY, Terr. Cret., #2, Gaster. : 79-80, pl. 159, figs. 1-2 ;
- 1925 *Nerinea (s.s.) Chamousseti* d'O. DIETRICH, Foss. Cat., Nerineidae: 117;
- 1980-b *Nereinea chamousseti* d'O. MACSOTAY Thèse: 38, pl. 11, figs. 5, 14 ;

Occurrence : Originally collected as casts in Chambéry (Savoie, France) in Urgonian limestones of Barremian age.

S.C.S. occurrence: Locality MO-1502, Arbol Redondo section, Trujillo state, Lower carbonatic member of Peñas Altas Formation, of Early Aptian age (=HA-4369 of ARNAUD et alii., 1999, fig. 14). Also in Tibú Formation, Perija region, of Late Barremian-Early Aptian age. Also in Chuparipal Formation, (DEP) Sucre State, of Late Barremian age (MACSOTAY & ALVAREZ, 1987). Rare in all localities.

Eunerinea (Eunerinea) hicoriensis (Cragin, 1893)
Plate 28, figure 20;

- 1893 *Nereinea hicoriensis* CRAGIN, Texas Geol. Surv., 4th Ann. Report: 225, pl. 42, fig. 6 (not 7);
- 1902 *Nerinea sp.* BROILI: A.B.A.W.M.P.C., 21: 608, pl. 1, fig. 1;
- 1925 *Nereinea hicoriensis* C., DIETRICH, Foss. Catalogus, 31: 115;
- 1947 *Nerinea hicoriensis* C., STANTON, U.S.Geol. Surv., Prof. Pap. 211 : 83, p'l. 58, figs. 2-4 ;
- 1956 *Cossmannea (Eunerinea) hicoriensis* (C.) ALENCASTER DE CSERNA, Paleont. Mex. 2: 38, pl. 6, fig. 7;
- 1957 *Nerinea trishae* VON DER OSTEN, Jour. Paleont. 31(3) : 387, pl. 65, fig. 17 ;

Occurrence : Originally collected in Hickory creek, Travis County, Texas, in Travis Peak Formation, of Late Aptian age. In limestone with *Palorbitolina*, Crimea Peninsula, of Barremian-?Aptian age. In Estado de Puebla, Mexico, in San Juan Raya Formation, of Barremian-Aptian age.

S.C.S. occurrence: Locality MO-905, Cliff in Cachimena inlet, Sucre State, Lope member of Taguarumo Formation, of Late Barremian-Early Aptian age.

Eunerinea (Eunerinea) schotti (Conrad, 1857)
Plate 50, fig. 22;

- 1857 *Nerinea schotti* Conrad, U. S. & Mexico Border.S.R. #1(2): 158, pl. 14, figs. 3a, 3b;
- 1947 *Nerinea schotti* C., STANTON, U. S. Geol. Surv., Prof. pap. 211: 90, pl. 60, fig, 4, 15;

Occurrence: Originally collected "near mouth of Puercos River (not Pecos River) " Texas, in Devils River Formation, Fredericksbur group, of Middle Albian age.

S.C.S. occurrence: Locality HA-4427, La Pastora-Jabón road, Trujillo state, upper Carbonatic member of Peñas Altas Formation, of Middle Albian age (ARNAUD et alii., 1999, fig. 26). This gastropoda-rich bed is above the *Mesorbitolina*-marl. Also at MO-1659, on the old Curazaito-Curarigua road, in Guayamure Formation, (MACSOTAY & VIVAS, 2011) in the Atarigua unit, Lara State.

Eunerinea (Eunerinea) syriaca (Conrad, emend. Blanckenhorn, 1927).

Plate 50, figure 12;

- 1852 *Nerinea Syriaca* CONRAD in LYNCH, Palestine Expedition: 221, pl. 12, fig. 72 (non pl. 11, fig. 67, non p. 233, App. pl. 5, fig. 33-38).
- 1852 *Nerinea sp.* F. ROEMER, Kreideb. Von Tyexas: 41, pl. 4, fig. 8;
- 1862 *Nerinea Pauli* COQUAND, Constantine, : 177, pl. 4, fig. 3 ;
- 1912 *Nerinea Pauli* C., PERVINQUIÈRE, Paleont. Tyunis. : 33, pl. 2, figs. 25-26 ;
- 1927 *Nerinea syriaca* C. emend. BLANCKENHORN : 27 ;
- 1942 *Nerinea Pauli* C., DELPEY: Bull. Soc. Hist. Nat. Toulouse,#77: 178-179, pl. 5, figs. 1-2;
- 1948 *Nerinea aff. Pauli* C., TAVANI, Paleontogr. Ital., 43:5, fig. 140;

Occurrence: Originally collected at the Greek Church of Bhamdùn, in the Antelias, Liban, of Aptian age. In Bhamdûn and Ruassât in Vraconnian sediments. In all the Maghrebian Subprovince, is common in Aptian liumestones. Also in the Somalian Subprovince, at the same horizon.

S.C.S. occurrence: MO-5621, east side of Rio Carinicuao, (DEP, Sucre state) in white limestones of Lower Majagual Formation, of Late Albian age. Associated to other Nerineids, and *Pseudotoucasia.*

Observations: In Nehr el Kelb, Liban, was found associated to hermatypic corals. In Tunisia, is usually found in urgonian-type limestones, with mostly algal and hydroanzs associated.

Subgenus ***Acrostylus*** Cossmann, 1896.

The Biochron of *Eunernea (Acrostylus)* extends from the Jurassic (Oxfordian) to Eocretaceous (Hauterivian). *Acrostylus* was supposed to be restricted to the Western European Subprovince, was proposed, as a genus by COSSMANN (1896) but treated as a subgenus of Nerinea by WENZ (1938). The formula of the folds is the same as *Eunerinea:* **1,1,1,0**., but the inner space of the whorls is more elongated axially, than *Eunerinea.* With more than 40 taxa developed, mostly on the carbonatic shelves of the Tethys Ocean from Texas to Japan, reaching its acme on the Apulian Subprovince, it can be considered as a thermophyllic genus. It should be included in the Taxa Group One of SOHL (1987).

Eunerinea (Acrostylus) cazorlensis (Foucault et al., 1975).

- 1975 *Nerinea (Eunerinea) cazorlensis* FOUCAULT et al., Bol. Geologico-Minero (España) 86(3) : 248, pl. 1, figs. 3-5; pl. 2, fig. 1;

Occurrence: Sierra de Cazorla, Maestrazgo Basin, Spain, in Vallivana Formation, of Berriasian-Valanginian age (CANEROT, 1982).

S.C.S. occurrence: Locality MO-881, Cliff to the east side of Patiño inlet, Sucre state, (DAGM), of Lower Taguarumo Formation, of Barremian age (text-fig. V-05). Also in the lower Taguarumo Formation's green limestones of Late Hauterivian age. In the lower limestones of Chuparipal Formation, of Barremian age (DEP).

Eunerinea (Acrostylus) hoheneggeri (Peters, 1855).
Plate 3, figures 8, 8a;

- 1855 *Nerinea Hoheneggeri* PETERS, Nerin. Ob. Jura Österr.: 24, pl. 3, figs.1-2;
- 1869 *Nerinea Hoheneggeri* P. GEMMELLARO: 30, pl. 5, figs. 6, 7;
- 1886 *Nerinea Hoheneggeri* P. HERBICH: 21, pl. 8, figs. 19, 20;
- 1913 *Nerinea Hoheneggeri* P. FAVRE, Monog. Pal. Salève: 444, pl. 29, figs. 1-5;
- 1931 *Nerinea Hoheneggeri* P. YIN, Trav. Lab. G. Lyon, #18(14): 52-53, pl. 4, figs. 12-17;
- 1971 *Nerinea cf. hoheneggeri* P., CHARVET & TERMIER: 188, pl. 30, figs. 1-5;
- 1974 *Nerinea hoheneggei* P., KRIVIC, R. G.Porocila #17: 197-199, pl. 12, figs. 12a, 12b;
- 1997 *Eunerinea hoheneggeri* (Peters) MACSOTAY & PERAZA, 11, 12, Figure 2A-3;

Occurrence: With a Biochron extended from Late Jurassic (Kimmeridgian) to Eocretaceous (Hauterivian), reached its acme along the Tithonian/Berriasian boundary. Its Palaeodistribution includes Western European, Apulian, S.C.S. and Maghrebian Subprovinces.

S.C.S. occurrence: Locality M0-2850, eastern inlet of Venados island, (DAGM), 30 meters above coral horizon, in nodular limestones in Morro Blanco Formation, of Late Berriasian-Early Valanginian age. Also was found in the olistolithes of La Lagunita, of Tithonian-Berriasian mollusks reworked in Late Cretaceous Mucaria Formation.

Genus ***Cossmannea*** Pchelintsev, 1927.

Cossmannea has a Biochron extended from Middle Jurassic to Late Cretaceous (Turonian), which suggests its affinity with Taxa Group One of SOHL (1987). This thin, tall shell is characterized by one columellar and one –usually small - labral folds, whose formula is **1,0,1,0**, as it is seen in *Nerinea desvoidyi* d'Orbigny, the type species of *Cossmannea.* Its palaeodistribution includes Western

European, Balkanic, Apulian Subprovinces of European Province and Somalian, Syrian Subprovinces of Gondwanan Province.

Cossmannea opposita (Costa, 1866).
Plate 29, figure 13;

- 1866 *Nerinea opposita* COSTA, A. R. I. Napoli, #2(3): 26-27, pl. 3, figs. 11, 12, pl. 4, figs. 13, 14 ; (non pl. 2, figs. 11, 16).

Diagnosis : Of medium size and moderate acuteness, anomphalous ; whorls relatively low, their height about one-half of their maximum diameter, strongly concave. A moderately acute labral fold is present, has its counterpart of slightly stronger columellar fold. The average shell has an apical angle of 26º-28º. All specimens are axially sectioned specimens, exposed by erosion on massive limestone beds.

Dimensions: The best section measures of incomplete Length: 19 mm, maximum width: 16 mm (fig. 13); among the specimens illustrated by COSTA (op. cit.), Height: 22 mm , 5 whorls of pl. 3, fig. 12; Height: 35 mm, about 4 whorls, pl. 4, 1ig. 14;

Occurrence: Appennine mountains, Campania State, Italy, of ¿Early Cretaceous age. This locality belongs to the Apulian Subprovince.

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Manare Peninsula, Sucre state, (DAGM) in lower Borracha Formation, of Late Aptian age. Also in locality MO-905, La Cueva inlet of Borracha island, the same horizon and the same age. Also found in (MO-1635) an olistolith reworked in La Osa member of Barquisimeto Formation, of Turonian age (MACSOTAY, 1980-B, pl. 12, fig. 14).

Discussion: *Cossmannea* is very well represented in the Middle Jurassic of Argentina (*Nerinea [Aptyxis] stelzneri* Gottsche, 1878) and Perú (*Cosmannea peruviana* Cox, 1956), so its presence in the Eocretaceous of S.C.S. is not a surprise.

Cossmannea royogomezi new species, Macsotay.
Plate 28, figures 1, 7;

1953 *Nerinella utrillasi* (Verneuil & Lorière) ROYO Y GOMEZ, Acta Cient. Venez., 4(4): 149-150, figs. 12-14:

- 1972 *Nerinella utrillasi* (V. & L.) MACSOTAY in SEIJAS, Bol. Geol. (Caracas) Pub. Esp. #5: 1908;
- 1980-a *Nerinoides utrillasensis* (V. & L.) MACSOTAY, 26º Internat. Geol. Congress, Paris: 254;
- Not 1957 *Nerinea roemeri* Von Der OSTEN, Jour. Paleont. 31(3): 587-588, pl. 66, fig. 21 ;(non Philippi, 1837).

Diagnosis : A turreted, tall shell, with a low columellar fold, and a higher parietal one.

Description: Shell of medium size, very acute, anomphalous; whorls strongly concave, wit a bulging suturtal region; their height is only slightly less than their diameter. Surface of whorls ornated with 3-4 smooth or granular cords, equally spaced, with 2-3 fine spiral lines, intercalated (see ROYO Y GOMEZ, op. cit. fig. 14). Two internal folds are present, of which the columellar is prominent, angular, and about 1/3 of whorl height, the parietal is angular and slightly less prominent, slightly above the middle.

Etymology: I have the honor of dedicating this gastropod to Prof. Dr. Jose ROYO Y GOMEZ, the first Paleontologist who correlated correctly the Barremian-Aptian molluska of Venezuela, with the European stratotypes.

Dimensions: The measurements are: of Height (8, ½ whorls): 56,44 mm; maximum Width:11.35 mm.

S.C.S. occurrence: Picuda Grande Island, Sucre State, Upper Taguarumo Formation, of Barremian age. Locality PM-50-D, El Yaque Quarry, near Casanare, Sucre state, Upper Taguarumo Formation, of Late Barremian age, in a dark yellow clayey limestone. Also in MC-370-C, Via La Acequia, Sucre state, DAGM, upper Taguarumo Formation, of Early Aptian age. Usually common in each locality, as in the Lope Member of Taguarumo Formation, Borracha Island, where it is associated to *Mediterraneotrigonia hondaana* (Lea). In western Venezuela, is common in Tibú Formation, northern Perijá, of Late Barremian-Early Aptian age. In the mega-olistolith of Cantera Bertonzini, in Güinimita Formation, of Late Cretaceous age.

Comparisons: Externally it resembles to *Nerinella utrillasi* (Verneuil & Loriere, 1868: 16, pl. 2, figs. 1-2) – common species from Spain to Liban, - which is a true *Nerinella* with the formula **1,1,1,0**, as illustrated on plate 28, fig. 2.

Cosmannea aff. desvoidyi (d'Orbigny, 1850)
Plate 46, figure 9;

- 1850 *Nerinea Desvoidyi* d'ORBIGNY, Prodrome #2: 4, nº 55;
- 1850 (1854) *Nerinea Desvoidyi* d'Orbigny, Paleont. Franc. Terr. Jurass.32: 107, pl. 261, figs. 1-3;
- 1866 *Nerinea Desvoidyi* d'O., COSTA, A.R.I.l. Napoli, #2(3): 19-20;

Diagnosis: Shell medium-sized, turriculate. I dispose of 14 natural axial sections, exposed on massive limestone, where the thickness of the shell, almost equals the central columella. Whorls distinctly concave in the central part of the shell, somewhat more flat at both the early and late stages. Suture at a distinct sutural roll, symmetrical at the early whorls, asymmetrical at the late ones. Shell base slightly convex, separated clearly from the flank of the last whorl. Axial hole very narrow. At the late whorls, labral wall developes one assymetrical fold, approximating 1.5 – 2.0 mm in height, while columella remains flat.

Dimensions: Height of three last whorls: 44 mm, width: 22.6 mm.

Occurrence: *Cossmannea desvoidyi* (d'Orbigny), according to DELPEY (1942) and WIECZOREK (1979) is a taxon with a Biochron from Late Jurassic (Late Oxfordian) to Eocretaceous (Early Berriasian). Its distribution area includes North European Province, Western European and Balkanic Subprovinces of European Province, Syrian and Somalian Subprovinces of Gondwanan Province.

S.C.S. occurrence: Cerro La Amanita, Sucre state, (DGC) (ROSSI, 1985, ARNAUD et alii., 2000), in Upper Taguarumo Formation, of Barremian age, where it is associated to *Adiozoptyxis coquandi* (d'ORBIGNY), *Neoptyxis galatea (*COQUAND) and many gasteropoda. In Trujillo state, it was observed in the Lower Peñas Altas Formation, on the Arbol Redondo exposures in Barremian-Aptian levels.

Discussion: *C. desvoidyi* and its subspecies *C.d. baltovenis* WIECZOREK 1979, *C. d. karczewskii* WIECZOREK, 1979, coexisted during Oxfordian and Kimmeridgian times in Poland. In my opinion, they are not subspecies, but ecophenotypes, developed during the early salinization in a shallow-water sea, alike the present Caribbean Sea with *Crassostrea rhizophorae* (PERAZA & MACSOTAY, 2011). Descendants of *C. desvoidyi*, seem to be present in the Valanginian of Caucasus mountains, as *Nerinea cryptoptyxis* Pchelintsev, (1927, pl. 7, figs. 6-7), an elongated form, with barely any fold present. COSTA (op. cit.) cited a "*Nerinea" desvoidyi* d'O., collected at Majella, Campania Province, Italy, (Apulian Subprovince) in a strongly weathered limestone, where it is associated with big sized *Adiozoptyxis coquandi* (d'ORBIGNY). The cast is composed of two mature shell whorls, measuring 72 mm of height, and 47 mm of width. By the associated gastropods, we suggest a Barremian-¿Early Aptian age.

Comparison: *Cossmannea aff. desvoidyi* , differs from the nominal species (DELPEY, 1942: 165-167, fig. 128, pl. 2, fig. 1-2) in having no fold or swelling at all on the columella, no trace of axial hole; otherwise, the apical angle of 10º-12º is coincident. Stratigraphically, they are well separated. A new name will be needed, with better samples, of this *aff. desvoidyi* non d'Orbigny.

Genus ***Carinia*** Cox, 1954.

Diagnosis: The Genus *Carinia* was proposed for moderately stout, slightly cyrtoconoidal (=conoidal with convex sides, fide COX op. cit.), slightly gradate at sutures, without umbilicus. Whorls, very low and numerous, smooth, almost flat. Last whorl broadly convex at periphery, but strongly contracted and with a well.marked neck below. Details of aperture unknown. Folds, **1, 1, 1, 0**. The biochron extends from Late Jurassic (Tithonian) to Late Cretaceous (Turonian). Shallow marine, calcareous bottoms.

Type species: *Nerinea seguenzae* Gemmellaro, (1869: 10, pl. 2, figs. 18, 19), Tithonian, Sicily, Italy.

Carinia laraense new species Macsotay, Plate 59, figure 13;

- 1980-b *Carinia sp. indet.* MACSOTAY, Thèse de Doctorat : 42, pl. 12, fig. 27 ;

Description: Stout, cyrtoconoidal medium-sized shell, whorls with weakly curved flat sides and sutures unseen. The height of the whorls are 1/3 of their width. No umbilicus, central axis thick. Folds **1, 1, 1, 0,** the inner folds are flat, proportional, sharp-edged, and with their axis oriented perpendicular to the central axis. The decription isbased on 9 natural sections.

Dimensions: Height (incomplete, three whorls preserved): 28 mm; Width: 26,5 mm.

Etymology: Named after Lara state, of west-central Venezuela, area where the epimetamorphic sediments of allochthonous Lara Nappe are thrusted above the Autochthonous Mérida Andes; caught in between are the highly fossiliferous Cretaceous rocks of the Atarigua unit (STEPHAN, 1985; MACSOTAY & VIVAS, 2011).

S.C.S. occurrence: Locality MO-1679, Carorita Arriba, Lara state, in limestone conglomerate of La Osa Member of Barquisimeto Formation (MACSOTAY et al., 1987), of Turonian age. Many shells were observed in at last 9 different limestone blocks. The shell is located in limestone boulders of very fossiliferous

bioclastics mostly wackestone and packstone, which were reworked from unknown outcrops of western Venezuela.

Age: A probable Early Cretaceous (Albian?) age is attributed to these fossils.

Carinia aff. multilamellosa (Delpey, 1942)
Plate 50, figure 17;

- 1942 *Nerinea multilamellosa* DELPEY, Gasterop. Mesozoiques: 179-180, fig. 143, pl. 6, fig. 4;

Occurrence: This species was based on one sample collected in Lebanon by ZUMOFFEN, in supposedly Aptian beds.

Description: Shell probably elongated, pupoïde, with whorls weakly convexes, where the suture is not observable. The shell is very thick, exteriorly ill preserved. Interiorly, there are three folds: a strong columellar and parietal folds, and an obtus labral fold. Basal wall convex, with no folds. The Venezuelan shell differs from the nominal species, that the labral fold is confronted by the parietal one. This feature is constant on all the eight natural sections, we have observed.

Dimensions: The the better preserved axial section, measures, of Height (Two whorls and half):66 mm, Maximum diameter: 29 mm.

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Peninsula de Manare, Sucre State, Upper Borracha Formation, (DAGM) of Early Albian age. In massive, hard limestone beds. Also in locality MO-1324, 1 Km. south of Guarico Town, Portuguesa state, in La Osa member of Barquisimeto Formation, of Turonian age, in a limestone olistolith.

Comparisons: DELPEY (op. cit.) compared this species with *Carinia valdesiensis* (Cox) (=*Nerinea annulata* Gemmellaro, 1865, non SHARPE, 1850), in the Ciaca superior, Sicilia, of Turonian age, - which has a second lower labral fold, and the infiling of early whorls is not so important.

Carinia valdesiensis (Cox, 1954).
Plate 48, figure 10;

- 1865 *Nerinea annulata* GEMMELLARO, Nerin. Ciaca Palermo: 33, pl. 4, figs. 1, 2;(non SHARPE, 1850).
- 1938 *Nerinea annulata* G., VOORWIJK: 47, pl. 1, fig. 5;
- 1954 *Cossmannea valdesiensis* COX, Proc. Malac. Soc. London, 31(1): 16;
- 1971 *Cosmannea annulata* (Gemmellaro) CARBONE et al., Geologia Romana 10: 150-151, fig. 20;

Diagnosis: Cyrtoconoidal, elongated, solid, with apical angle about 19º. From the axial section it is possible to deduce that the most marked folds are the parieto-columellar and the columellar ones. The first is rather strong, sickle-shaped and turned obliquely towards the labrum; the second is alo strong, but is smaller than the foregoing one. Besides, there is a third fold localized at the base of the whorl; it is not well developed, and has the trend of a simple swelling.

Dimensions: Height (incomplete): 902 mm, Width: 29 mm. (GEMMELLARO op. cit., pl. 4, fig. 2).

Occurrence: Originally collected in Valdesi, Palermo, Sicilia, where it is associated to *Ichthyosarcolites bicarinatus*, which indicates Cenomanian limestones. Later found in Rocca di Cave, Apennines mountains, Italy, in also Cenomanian rocks. But in Dalmatia, Croatia, is found in Turonian horizons.

S.C.S. occurrences: Locality JFS-516-B, Cerro La Funcia, to the west of Cerro Garrapatero, north side of the road, (DEP) Upper Majagual Formation, of Early Cenomanian age.

Genus ***Coxella gen. nov.*** , Macsotay.

(Gender, feminine named after Paleontologist Leslie Reginald COX, coordinator of the authors of the Bivalvia Volumes 1, 2 of the Treatise on Invertebrate Palkeontology, Mollusca 6, 1969).

Type species: *Nerinea clava* GEMMELLARO, 1865.

Diagnosis: Medium-sized to big, fusiform, moderately acute, without umbilicus. Spire with relatively few, high, smooth, feebly convex worls, adpressed at the sutures. The last or body whorl is broadly convex at periphery ; peristome without distinct siphonal outlets. The internal folds are **1, 1, 1, 1,** where the columellar fold is the widest and strongest, pointed to the concavity between labral and basal folds. The parietal fold is also swollen, and weakly bent upwards, but is the half of the size of the columellar one. The labral fold is symmetrical, and pointed to the space between the columellar and parietal folds. The basal fold is the smallest of all, weak and assymetrical, located in the distal corner of the base.

Palaeoecology: This is a typically thermophyllic genus, restricted to carbonatic bottoms, mostly calcareous algae, stromatoporids and sponges, whose evolution was related to hypersaline or saline waters.

Biochron: Late Jurassic (Tithonian) to Late Cretaceous (Turonian), belonging to the Taxa Group One of SOHL (1987). It has developed few species:

1. *Coxella clava* (Gemmellaro, 1865) Tithonian-Berriasian.
2. *Coxella somalica* (Tavani, 1948) Cenomanian.
3. *Coxella majagualensis* n. sp. Macsotay Late Albian-Cenomanian.

Coxella majagualensis new species, Macsotay.
Plate 50, figure 23;

Diagnosis : Big heavy shell, cylindrical, with a narrow umbilicus. With only three whorls preserved, including the body whorl; the whorls are flat, only the body whorl shows some convexity; base rounded, convex. Siphonal channel short. Internally, has four folds, as *Coxella clava* (Gemmellaro), but the folds are subequal, the parietal the only pointed one.

Dimensions: The natural axial section composed of body whorl and the two penultimate whorls, measures of Height: 40 mm, and Width of last whorl: 28,5 mm. The profile of the preserved whorls, suggest also an apical angle of 8º.

Etymology: This species is named after the Majagual Formation, a *Nerinea* and rudist-dominated massive limestone of the offshore sequence (DEP) of Serrania del Interior Oriental.

S.C.S. occurrence: Locality MO-5597, Fila Victor Marín, Sucre state, (DEP) Majagual Formation (ROD & MAYNC, 1954: 252) of Late Albian to early Cenomanian age. In massive white medium-chrystalline limestone, associated to many nerineids and rudists. Also in MO-5597, Rio Carinicuao, Puerto Majagual, type section of Majagual Formation, of the same age, where the *C. majagualensis* are more rechrystallized.

Palaeoecology: The association of *C. majagualensis* to many rudists, mostly biodegraded, suggests that it is a carnivorous, predator genus.

Comparisons: *Nerinea (Ptygmatis) somalica* Tavani, (1948, Paleontographica Italica # 45 :5-6) – Sanga Funga, sulla pista Bulo Burti, Giglei, a 30 Km. Of Bulo Burti, Somalia, of Cenomanian age, - is a *Coxella* near *C. majagualensis*, but with the parietal fold the strongest of all.

Family ***DIPTYXIDAE*** Pchelintsev, 1960 emend. Djalilov, M.R., 1975: 27;

Genus ***Diptyxis*** Oppenheim, 1889, Z.D.G.G. #41: 460;

The type of *Diptyxis* is **Nerinea (Diptyxis) biplicata* OPPENHEIM: 460, pl. 20, figs. 4, 5; (non Quenstedt, 1858: 529, pl. 205, figs. 76-77) re-named *Diptyxis oppenheimi* COX, (1954: 16). The Biochron of *Diptyxis* extends from Late Jurassic (Kimmeridgian) to Late Cretaceous (Cenomanian), and is a typical genus to be included in Taxa Group One of SOHL (1987), a predator carnivorous gastropod, well adapted to saline palaeoenvironment.

Diagnosis: Shells of medium to large size, cyrtoconical and conical-turretiform in outline. Whorls low or moderately high, concave or flattened. Aperture tetragonal or rhombic, with two plicae, 1 on the columella and 1 on the parietal part. Siphonal canal short. Umbilicus absent or very narrow.

Composition: DJALILOV (1975: 27) included four genera: *Diptyxis* Oppenheim, 1889; *Cylindroptyxis* Pchelintsev, 1965; *Oligoptyxis* Pchelintsev, 1953; and *Nerineoptyxis* Djalilov, 1975. I added *Julesia* Cox, 1954. Its paleodistribution area includes Western European, Balkanic, Apulian Subprovinces, extended to Central Asia.

Diptyxis euphyes (Felix, 1891)
Plate 29, figures 20, 21;

- 1891 *Nerinea (s. str.) euphyes* FELIX in FELIX & LENK, Palaeontogr. 37: 170(54), pl. 26, fig. 11;
- 1956 *Nerinea euphyes* F., ALENCASTER DE CSERNA, Paleontol. Mexicana, 2: 36, pl. 7, fig. 3;
- 1957 *Nerinea riverae* VON DER OSTEN, Jour. Paleont. 31(3) : 587, pl. 65, fig. 25 ;
- 1980 *Nerinea euphyes* F., GARCIA JARPA et alii., Bol. Geol. (Caracas) 16(26): 44;
- 1987 *Nerinea riveroae* (sic) LOPEZ, B,, Thesis: 91-92, fig. 20;

Description: Shell medium size, cyrtoconical, elongate, whorls slightly concave, sutures impressed; 11-12 whorls preserved (FELIX, op. cit.); height of whorls 2/3-s of width, gently concave posteriorly, flat to weakly convex anteriorly, forming expansion above the suture; sculpture of very weak spiral lines; anterior border of body whorl sub-carinate. Interior with one high narrow fold in parietal area, and one low, short fold on the columella. Apical angle about 10º.

Dimensions: Height about 60 mm, width of body whorl: 20 mm. (FELIX, op. cit. Pl. 26, fig. 11). Height of broken shell, 58 mm, Diameter 19 mm,

probable original height 110 mm (VON DER OSTEN, op. cit.).

Occurrences: Originally collected at Tehuacan, very near Zapotitlan, Puebla State, Mexico, of "Neocomian" age. Later, collected in Zapotitlan Formation, of Barremian age.

S.C.S. occurrences: Locality MMH, Su-109, Picuda Grande island, (DAGM) Taguarumo Formation, of Barremian age. Also in MC-441 La Guanota-La Güiria, (DAGM) Sucre State, of El Dantó dolostones, (DGC) of Early Hauterivian age. Collected in PM-58-D, and MO-1617, Casanay-Maturín road, in upper Taguarumo Formation, (sDLP) of Late Barremian age. Common in Qebrada Quetepe, in Taguarumo Formation. In Western Venezuela, reported from Arbol Redondo section, lower carbonatic Member of Peñas Altas Formation, of Late Barremian age. In MO-1853, olistolith reworked in Bobare Formation, Lara Nappe, in Albian horizons.

Diptyxis hottingeri (Collignon, 1972).
Plate 50, figure 19;

- 1972 *Nerinea (Ptygmatis) hottingeri* COLLIGNON, Not. Mem. Serv. Geol. Maroc#228: 17-18, pl. 4, figs. 1 – 6;

Occurrence: Collected at Hammada Tassagdelt, Morocco, where it was associated with the ammonites *Hypengonoceras and Hysteroceras,* of Late Albian age.

S.C.S. occurrence: Locality 1324, in an olistolith reworked in Bobare Formation Lara Nappe, of Albian-Cenomanian age. In Colombia was cited, but not illustrated from Upper Cogollo Formation, of La Guajira.

Observations: Probably this taxon was the last one, before evolving into *Oligoptyxis* Pchelintsev, (1953, fig. 21) evolving to 14 species during Late Cenomanian – Early Turonian in Transcaucasia, southern Russia. This group did not reach S.C.S.

Diptyxis luttickei (Blanckenhorn, 1890).
Plate 29, figure 15;

- 1890 *Nerinea Lüttickei* BLANCKENHORN, Kreidesystems Mittel- Nord-Syrien: 106, pl. 8, fig. 4;
- 1925 *Nerinea (s.s.) Lüttickei* B., DIETRICH: 127;
- 1942 *Nerinea lüttickei* B., DELPEY, Bull. Soc. Hist. nat. Toulouse #77: 176, pl. 3, fgs. 1-2, fig. 137;
- 1956 *Nerinea sp.,* ALENCASTER, Paleont. Mex., 2: 37, pl. 6, figs. 10, 12;

Occurrences: Originally collected in Schteidi and Brummâna, near Beirut, Liban, in limestones of Aptian age; also in Mâr Abda and Niha at Nahn ed-Djôz, not Cenomanian-Turonian, as was stated by DIETRICH (op. cit.). Also in Zapotitlan, Mexico, of Late Barremian age.

S.C.S. occurrences: Locality MO-888, East of Puerto Escondido, Sucre state, of lower limestone of Taguarumo Formation, of Hauterivian age. Also in MC-441, La Guanota-La Güiria, in Hacienda with funicular, El Dantó dolostones, of Hauterivian age. Not common.

Subfamily ***PTYGMATISINAE*** Pchelintsev, 1960.

According to WENZ (1938) this subfamily has a Biochron extended from Middle Jurassic (Bathonian) to Late Cretaceous (Senonian). The review of *Ptygmatisinae* by Pchelintsev (1960) restricted the *Ptygmatis* (s.s. in COSSMANN, 1898, Mat. Paleont.# 19: 67-68) whose type is *P. bruntrutana* Thurmann, to Middle Jurassic (Bathonian) to Late Jurassic (Ryazanian). The post-Jurassic genera of *Ptygmatisinae*, would be ranged in *Heteroptygmatis, Teleoptyxis (=Plesioptyxis), Plesioptygmatis (Simploptyxis), Polyptyxis* and *Laevinerinea (=Plesioplocus)* and would extend its Biochron to Late Cretaceous (Santonian).

Genus ***Heteroptygmatis*** Shikama & Yui, 1973.

The Biochron of *Heteroptygmatis* extends from Late Jurassic (Kimmeridgian) to Eocretaceous (Albian). It seems to be a group well adapted to saline paleoenvironments, on carbonatic bottoms: it coincides well into Taxa Group One, of SOHL (1987).

Diagnosis: Shell large to moderate size, slender conical to high-turreted. Umbilicus not present. Five eminent folds interiorly, two on columellar lip, two on labral and one on parietal lip, without basal fold. All folds expanded and complicated with two or four keels, except in the last whorl and in juvenile stage. Some Cretaceous species belong in this genus:

1. *Heteroptygmatis hyaccarina* (Gemmellaro, 1869) Tithonian- Early Berriasian
2. *H. meneghinii* (Gemmellaro, 1865) Tithonian-Early Berriasian.
3. *H. pseudobruntrutana* (Gemmellaro, 1865) Kimmeridgian-Valanginian,
4. *H. pseudoconvexa* (Stanton, 1947) Hauterivian-Middle Albian

Heteroptygmatis cf. pseudoconvexa (Stanton, 1947)
Plate 23, figure 6;

- Non 1947 *Nerinea pseudoconvexa* STANTON, U.S.G.S., Prof. paper, 211: 87, pl. 60, figs. 8, 10-12;
- Cf. 1957 *Nerinea pseudoconvexa* VON DER OSTEN, Jour. Paleont. 31(3) : 587, pl. 65, fig. 16 ;

Occurrence : *Nerinea pseudoconvexa* STANTON (1947 : 87, pl. 60, figs. 8, 10-12) – Edwards limestone and the Fredricksburg Group of Texas, of Early to Middle Albian age,- has in its interior, 3 rather prominent, subequal, simple columellar folds, and a thicker fold with its free margin expanded in th middle of the labrum, in some specimens threre is a second faint fold higher on the labrum. This small shell is also reported from Alisitos Formation, - Early Albian of Baja California,- related to the Texas forms.

S.C.S. occurrence: Locality MO-1461, Arbol Redondo section, Trujillo-Bocono main road, Trujillo state, Lower Carbonatic Member of Peñas Altas Formation, of Late Barremian age (=HA-4366, H. ARNAUD et alii., 1999, fig. 14). VON DER OSTEN (op. cit.) identified a small (8,8 mm of height) *Nerinea* from locality MMH, Su-90, of the base of Taguarumo Formation, in the green limestones of Late Hauterivian age, which he attributed to *N. pseudoconcava. At* eastern Venezuela, in locality MO-888, promontory to the west of Punta La Peña, in Lope member of Taguarumo Formation, (DAGM) of Early Aptian age. It was this the taxon reported from the Macanal shale Formation, Colombia, of Valanginian age by ETAYO SERNA (1985-c, Proy. Cret., #24-26) and not the gastropod from Texas.

Description: Two natural axial sections of a cyrtoconoidal *Nerineidae* (MACSOTAY, 1980-B, pl. 12, fig. 30), where the last three worls measure, of Height: 21 mm, and of maximum diameter: 12 mm. The whorls have flat sides, with a subsutural belt, attached to it. Internally, the formula is **3: 1: 1: 0,** where the columella has three sharp folds, the middle one the highest; the parietal one is pointed outside; the labral one is medial, ending with a perpendicular plug. This formula is very much alike to the figure 8 of plate 60 (STANTON, op. cit.) specially the thickened labral fold.

Observations: *H. cf. pseudoconvexa* (Stanton) could be a dwarfed *Heteroptygmatis* fighting for survival in the saline and calcium-poor marine waters of S.C.S.

Genus ***Teleoptyxis*** Olsson, 1933, (=*Plesioptyxis* Pchelintsev, 1953).

The Biochron of *Teleoptyxis* extends from Eocretaceous (Berriasian) to Late Cretaceous (Coniacian). Proposed originally as a section of the Subgenus *Ptygmatis* Sharpe, it is a well-established genus, originated in Peruvian and Southern Caribbean Subprovinces, during Gallic times, and invading eastward to the Balkanic (Armenia-Adzerbaijan) and northward to Gulf-Atlantic Coast Subprovinces, during Senonian times (see YOUNG, 1952; and PCHELINTSEV, 1954, fig. 18). Barely cited, it is common in the tropical subprovinces of Gondwanan Province, during the Albian-Cenomanian. Its formula is 2: 1: 1:1.

Teleoptyxis cedrorum (Blanckenhorn, 1890)
Plate 50, figure 18;

- 1890 *Nerinea cedrorum* BLANCKENHORN, Kreide von Mittel- und Nord-syrien: 105, pl. 8, fig. 1;
- 1925 *Nerinea (s.s.) cedrorum* B., DIETRICH, Foss. Catalog., Nerineidae: 124;
- 1942 *Nerinea cedrorum* B. DELPEY, Gastropod. Mesoz.: 195-196, fig. 152, pl. 8, figs. 1-8;

Diagnosis: Big-sized shells, cyrtoconoidal, with concavewhorls and weak sutural swellings. Axial cut shows a weak umbilicus; internally shows a long, medial columellar fold, followed by a weak one; parietal fold strong, hook-shaped, and one labral fold, weak and short, opposed to the medial columellar fold. Apical angle of the juvenile whorls, 43º to 50º. Maximum width: 48 mm.

Occurrence: Collected in many localities of Lebanon and alaouite Syria, in limestones of Cenomanian age, not Turonian, as was supposed originally. Also cited from Egypt, and Mexico, from the same horizons.

S.C.S. occurrence: Locality MO-5620, Cerro El Pato, north flank, Sucre state, (DEP) in upper Majagual Formation, of Early Cenomanian age.

Teleoptyxis micromorpha (Cossmann, 1907)
Plate 29, fig. 18;

- 1907 *Nerinea (Ptygmatis) micromorpha* COSSMANN, Mem. Soc. geol. France, 15(37): 14, pl. 2, figs. 5-8;
- 1932 *Nerinea (Ptygmatis) micromorpha* C., SAYN: 22-23, pl. 2, fig. 4;
- 1959 *Nerinea (Ptygmatis) micromorpha* C., CZABALAY: 164-165, pl. 1, fig. 1;

Occurrence: Collected in Brouzet-les-Alais, Gard, France, in Urgonian limestones, of Barremian age, where it is quite common. Also in Barremian limestones in Serbia and in the Aptian of Zirc,

Hungary, where it is associated to Oysters in *Orbitolina* marls.

S.C.S. occurrence: Locality JFS-102, Casanay-Caripito road, Sucre state, (DAGM) in Upper Taguarumo Formation, of Late Barremian age. Quite common in in Lope member of Taguarumo Formation, of Late Barremian-Aptian age: MC-338-F, JFS-48-A, VG-461. Locality PM-87-B, VG-459, in Chuparipal Formation of Late Barremian age; here, they are concentrated in the intercalary marls between massive limestones.

Teleoptyxis pellucida (Cragin, 1893).

- 1893 *Nerinea pellucida* CRAGIN, Geol. Surv. Texas, 4º Ann. Rept.: 226, pl. 42, fig. 5;
- 1947 *Nerinea pellucida* C., STANTON, U. S. Geol. Surv., Prof. P. 211: 86, pl. 62, figs. 9, 10, 12-16;
- 1952 *Nerinea pellucida* C., YOUNG, Jour. Paleont. 26(5): 823-828, pl. 121, figs. 1-11;
- 1998 *Teleoptyxis sp.* VIVAS & MACSOTAY, 14º Caribb. Geol. Conf., #2: 134;

Occurrences: Common in Deep Eddy Bluff, Texas, Edwards Formation, of Middle Albian age. Also common in Upper Glen Rose Formation, Texas, of early Middle Albian age.

S.C.S. occurrences: Locality JFS-524, El Soro, estado Sucre, (sDLP, DGC), Majagual Formation, of Late Albian-Early Cenomanian age. Quite common species, distinguished from other *Nerineans,* by its variable apical angle of 14º to 26º. Also in locality HA-4502, Cerro Los Platones, Trujillo state, Upper carbonatic member of Peñas Altas Formation, of Early Albian age: uncommon (ARNAUD et alii., 1999, fig. 29).

Teleoptyxis peruvianus (Olsson, 1934).
Plate 50, figure 14;

- 1934 *Nerinea (Teleoptyxis) peruviana* OLSSON, Bull. Amer. Paleont. 20(69) :65, pl. 10, fig. 1, 3;
- 1928 *Nerinea cf. incavata* B., GERTH, Leidsche Geol. Meded. 11(4): 233; (not BRONN, 1836)
- 1955 *Cossmannea (Eunerinea) pauli* ALLISON, Jour. Paleont. 29(3): 426; (non Coquand, 1862)
- 1959 *Nerinea prefleuriai rengarteni* CZABALAY, Magyar A.F.I. Evi Jeletés 7 : 162, pl. 2, fig. 3 ;

Description: Shell slender, turriculate with numerous slowly tapering whorls; each whorl is approximately three times as wide as high, excavated in the middle. Internal structure with four folds, two on the columella, and oneeach in the parietal and labral walls **2:1:1: 0,** the posterior columellar fold is very small. The shell is not umbilicated; the pillar is enlarged just anterior of the middle of each whorl, or in the zone of the anterior columellar fold, and a section of the pillar shows the presence of an internal cavity in this region. (OLSSON, op. cit.) It is the type of *Teleoptyxis.*

Dimensions: Height: 115,0 mm, Diameter: 30,5 mm, (Holotype).

Occurrence: Originally found at Pan de Azúcar, Muerto, Quebrada Culebra, Peru, in Pananga Formation, of Late Aptian-early Albian age. In the same horizon in Provincial limestones, Cuba. In Punta Baja, Alisitos Formation, Baja California, of Middle Albian age. Also in Úrkút, Hungary, in limestones with *Requienia* of Albian age.

S.C.S. occurrence: Locality VG-02, Río Caripe, lower course, in Caripito Member of Chimana Formation, of Middle Albian age. Also in HA-4436, Cerro Los Platones, of the Upper carbonatic member of Peñas Altas Formation, of Albian age, where it is abundant (ARNAUD et alii., 1999, fig. 18). Also collected at La Cueva inlet, Borracha island (DAGM) in lower Borracha Formation, of Late Aptian age.

Teleoptyxis cf. subnodulosa (Futterer, 1892)
Plate 5, figure 24;

- CF. 1892 *Nerinea subnodulosa* FUTTERER, Paleont. Abh., 6: 115, pl. 10, figs. 6, 6a;
- Cf. 1900 *Nerinea subnodulosa* F. FITTIPALDI, Atti Roy. Acad.Sci. Napoli, 10, 2(5): 6-7, figs. 12, 12a;

Occurrence: Originally studied from the Venecian Alps, Col of Schiosi, in limestones of Late Cenomanian-Early Turonian age.

S.C.S. occurrence: Locality JFS-524, Hill besides the town of Soro, Sucre state, (DEP), Majagual Formation, of Late Albian-early Cenomanian age. Four different limestone slabs, exposing natural axial sections.

Genus ***Polyptyxis*** Pchelintsev, 1924.

Polyptyxis was proposed as a genus, based on *Nerinea nodosa* Voltz, - Oxfordian to Valanginian of Western Europe, Apulian and Balkanic (Transcaucasia) Subprovinces – but the genus extends to Late Cretaceous (Turonian) age. PCHELINTSEV (1953: 233-234) observed the "important increase in size and thickness of the shells belonging to *Polyptyxis* compared "with most of the Nerineans of Late Jurassic." An important point of evidence, that during the Tithonian-

Berriasian times, increased the number of species, coincident with the salinization of the Tethys Ocean (HERBICH, 1886; PIRONA, 1878; SIRNA, 1968; KRIVIC, 1974; TERMIER & TERMIER in FOUCAULT et al., 1975). *Polyptyxis* must be included into Taxa Group One, of SOHL (1987).

Polyptyxis dayi (Blanckenhorn, 1927).
Plate 36, figure 10;

- 1927 *Nerinea Dayi* BLANCKENHORN, Kreidesyst. Mittel-u.nordsyriens: 154, pl. 4, figs. 63-64 ;
- 1942 *Nerinella Dayi* B. DELPEY, Gastropoda Mesozoïques: 159,pl. 1, figs. 5-14; fig. 118;
- 1952 *Nerinella Dayi* B., AWAD, Bull. F. d. Desert, 2(2): 24, pl. 1, fig. 1;

Occurrence: Collected originally in Bekfaya, Beit Chebab, Lebanon, in Early Aptian limetones; later also from Ras-el-Ahmar, Egypt, in Urgo-Aptian beds.

S.C.S. occurrence: Locality HA-4446, Cerro Agua Dulce setion, (San Pedro, Trujillo state) of Late Barremian age, (H. ARNAUD et alii., 1999, fig. 17). Also at HA-4293, La Loma section, where is the dominant species amoing other Nerineids, (Trujillo state) of Early Aptian age. Also found in olistoliths in Bobare Formation, of Albian-Cenomanian age.

Genus ***Laevinearinea*** Dietrich, 1938
(=*Plesioplocus* Pchelintsev, 1953).

Diagnosis: Turriculated, nerineiform shells of big size, with many weakly concave whorls; sutures marqued by a low band, the surface are not ornated; umbilicus narrow, sometimes fisiforme; the aperture is quadrangular, with rhombic profiles. Interiorly, with four folds, and a fifth one rudimentary, located in the lower area. The formula would be the following: **2:1:1:1**. The folds are all simple, not bifurcated; the strongest ones, are the lower columellar and the parietal.

Types: *Laevinerinea* Dietrich, was based on *Nerinea (Laevinerinea) bauga* d'Orbigny, fron Charente, France, of Cenomanian age. *Plesioplocus* Pchelintsev, was based on *Plesioplocus grandis* Pchelintsev, collected in Early Turonian of Armenia, Caucase mountains.

Occurrence: In Western European, S.C.S., Apulian, Balkanic, Maghrebian and Syrian Subprovinces. Its extension to Gulf-Atlantic coast Subprovince was signaled by Pchelintsev (op. cit., fig. 10). In the Cretaceous, I acknowledge the following species:

1. *Laevinerinea aiguebellensis* (Cox, 1954) Purbeckian, Berriasian.
2. *L. baconica* (Czabalay, 1959) Aptian,
3. *L. bauga* (d'Orbigny, 1842) * type species Cenomanian.
4. *L. bauga trinidadensis* (Dietrich, 1939) Late Aptian not Cenomanian
5. *L. elongata* (Abbass, 1963) Turonian
6. *L. erycina* (Gemmellaro, 1865) Berriasian
7. *L. forojuliensis* (Pirona, 1884) Albian? Cenomanian
8. *L. futtereri (*Pchelinstev, 1953) Cenomanian
9. *L. grandis* (Pchelintsev, 1953) * type species Turonian.
10. *L. incavata* (Bronn, 1836) Cenomanian to Coniacian
11. *L. karabakhensis* (Pchelintsev, 1953) Cenomanian,
12. *L. kentensis* (Stanton, 1947) Cenomanian,
13. *L. kerrvillensis* (Stanton, 1947) Albian
14. *L. mutabilis* (Delpey, 1942) Aptian,
15. *L. paeligna* (Fossa-Mancini, 1918) Cenomanian-Turonian,
16. *L. stoppanii* (Gemmellaro, 1865) Cenomanian-Turonian,
17. *L. subincavata* (Pchelintsev, 1954) Late Turonian
18. *L. subbauga* (Pchelintsev, 1954) Cenomanian
19. *L. texana* (Roemer, 1852) Middle Albian
20. *L. uchauxiana* (d'Orbigny, 1842) Late Turonian

Laevinerinea trinidadensis (Dietrich, 1939)
Plate 25, figure 10;

- 1939 *Nerinea (Laevinerinea) bauga trinidadensis* DIETRICH, Paleont. Zeitschr., Band: 21, figs. 1-7;
- 1946 *Nerinea (Laevinerinea) bauga trinidadensis* D., LIDDLE, Geology of Venezuela and Trinidad: 717;
- 1966 *Nerinea pseudobella* DVALI, A. S. R. S. S. Georgia, Trans. N.ser.#10: 17-18, pl. 3, fig. 8;

Description: Shell moderately large of cyrtoconical shape and fairly stout, consisting of numerous rapidly increasing whorls with slightly concave sides; apical angle 18º to 20º; suture inconspicuous; whorls weakly convex, convexity increases on last whorl; interior with only two prominent folds, one is parietal and one on the columella.

Dimensions: An incomplete shell of 11-13 whorls, measures, of Height: 100 mm, and width: 27 mm (DIETRICH, 1939, fig. 1).

S.C.S. occurrences: The type of *L. trinidadensis,* colleted by Dr. R. Rutsch, was a partially sparitized limestone olistolith sampled in Bon Accord, Point-a-Pierre, Trinidad, from Late Paleocene-age shales.

Associated to them were two rudists, *Texicaprina kugleri* (Bouwman) and *Kugleria macgillawryi* Bouwman (1937). MACSOTAY & VIVAS, (1995), published the stratigraphy of Chuparipal Formation, (DEP) of Barremian-early Aptian age; this is the unit of Eastern Venezuela, that originated most of the *Amphitriscoelus-Kipia* assemblage rudist-carrying olistostromes of Central Range of Trinidad (Text-fig. V-04). But the *Texicaprina-Kugleria* assemblage seem to represent a younger fauna, of Late Albian-Cenomanian age, eroded from Majagual Formation outcrops, (DEP) of the northern extreme of Serrania del Interior Oriental. Locality MC-375, Cerro Grande-Las Pozas Afuera, Sucre State, Upper Taguarumo Formation, of Early Aptian age. Also in locality MO-1386, eastern coast of Monos Island, in the core of the Anticline, lower exposed limestones of Borracha Formation, of Late Aptian age. *L. trinidadensis* is definitely of Aptian age, not Cenomanian, as was stated.

Occurrences: *Nerinea pseudobella* DVALI, 1966, -Barremian-Aptian? of Georgia, Caucasus mountains,- is identical in its interior fold arrangement, and other shell characteristics to *Laevinerinea trinidadensis,* so we included it in the synonymy.

Laevinerinea mutabilis (Delpey, 1942).
Plate 35, figure 17;

- 1942 *Nerinea mutabilis* DELPEY, Gaster. Mesozoiques: 186, figs. 144-145;
- 1963 *Nerinea (Plesioptygmatis) magharensis* ABBASS, G.S.M.R.D., Paleont., ser. Mon. #2: 71-72, pl. 5, figs. 7-9;

Occurrence: Found at the top of the *Mesorbitolina* beds of Late Aptian age, above the *Cardium*-beds to the west of Abey, Lebanon. Also in the Maghara area, Sinai Peninsula, Egypt of the same age (ABBASS, op. cit.).

S.C.S. occurrence: Locality HA-4371, Arbol Redondo section, Trujillo state, lower carbonatic member of Peñas Altas Formation, of Late Barremian age (ARNAUD et alii., 1999, fig. 14). Also in MO-1386, western coast of isla de Monos, (DAGM) core of the anticline, Lower Borracha Formation, of Late Aptian age.

Subfamily ***CRYPTOPLOCINAE*** Pchelintsev, 1960.

Genus ***Cryptoplocus*** Pictet & Campiche, 1862.

The *Cryptoplocus* are characterized by having one fold in parietal position, and are different of *Trochalia* Sharpe, by the absence of any fold (YIN, 1931). According to WENZ (1938, fig. 2411-a, -b) this conical and umbilicated gastropod has a Biochron extended from Late Jurassic (Rauracian=Middle Oxfordian) to Early Cretaceous (Aptian) – ?Late Cretaceous (Turonian). It would belong to the Taxa Group One of SOHL (1987), which reached their acme during Kimmeridgian-Tithonian time. Its saline affinities, would explain its almost extinction during Albian-Cenomanian times. Originated many species, in Western European, Apulian, Balkanic, Maghrebian and Japanese-East Asian Subprovinces. Synonimous of *Trochalia* SHARPE, 1849 for many authors. DIETRICH (1925:98), PCHELINTSEV (1960), HAYAMI & ITARU (1977), WIECZOREK (1979) consider it a different genus; the convexity of the base, the character of the spire and of the umbilicus, place this genus as near to *Tubiferidae* as to *Nerineidae* (DELPEY, 1942: 201). The preferred paleoenvironment was "subreefal" in heterolithic sediments (DELPEY, op. cit.).

Cryptoplocus libanensis (Hamlin, 1884)
Plate 38, figure 18;

- 1884 *Cryptoplocus libanensis* HAMLIN, Syrian moll. Fossils: 26, pl. 2, fig. 8;
- 1900 *Endiaplocus libanensis* (H.) J. BÖHM, Zeitschr. Deutsch. G. G. : 52 : 208, textfigs. 11, 12 ;
- 1925 *Trochalia (Endiaplocus) libanensis* (H.) DIETRICH, Foss. Catalog. : 144 ;
- 1942 *Trochalia libanensis* (H.) DELPEY, Mesoz. Gastrop.: 201-202, fig. 153;
- 1957 *Gymnocerithium lisum* VON DER OSTEN, Jour. Paleont. 31(3) : 588-589, pl. 65, fig. 18 ;

Description : Shell small, cyrtoconical, whorls straight, sutures impressed ; height of whorl about one-third width; sculpture smooth, a suggestion of fine spiral lines, eroded from the holotype; body whorl about twice the size of the last whorl, anterior border rounded, produced into narrow anterior canal, faint growth lines visible on bottom; aperture ovulate; apical angle: 30º- 40º (VON DER OSTEN, op. cit.).

Dimensions: Height of incomplete shell, 30 mm; diameter 12,5 mm, probable originala height, 35 mm. (Von der Osten, op. cit.). Height, of incomplete specimen of 8 whorls: 86 mm, Width: 52 mm (Type of *C. libanensis*).

Occurrence: Originally collected at Aïn Drafil, Beit-Meri and Mar Abda, Lebanon, of Aptian limestones, not Turonian, as was supposed by BLANCKENHORN (1890). Also at El Bnayé and Beit Chébab (Mar Boutros, Lebanon) of Early Aptian age.

S.C.S. occurrence: Locality MMH/Su-130, west coast of Picuda Grande island, (DAGM) Taguarumo Formation, of Late Barremian age. A nearly complete shell, slightly deformed by shearing parallel to longitudinal axis (pelomorphosis) in siltstones. Also in MO-896, in silty limestones, of the same unit and age: here it is associated to *Columbellina catedralis* (Von der Osten), without any *Naticidae* present. The rounded biohoradation observable on the penultimate whorl of the fig. 18, is attributed to *Columbellina.*

Cryptoplocus picteti (Gemmellaro, 1864).

- 1864 *Cryptoplocus Picteti* GEMMELLARO, Stud. Pal. Calc. Nord Sicil., #2: pl. 11, figs. 3-8;
- 1897 *Trochalia picteti* G., ROMAN, Tithon corall. Gard: 294, pl. 3, fig. 2;
- 1898 *Cryptoplocus picteti* G., COSSMANN, Nerin. Jur.: 160, pl. 13, fig. 9;
- 1968 *Trochalia picteti* (G.) SIRNA, Geologia Romana #7: 167, pl. 2, figs. 5, 6;
- 1974 *Cryptoplocus picteti* G., KRIVIC, R. G. Porocila #17: 190, fig. 6a, 6b, 6c;
- 1997 *Trochalia picteti* (G.) MACSOTAY & PERAZA, Mem. 8º Congr. Geol. Venez., SVG, t. 2: 9-15;

Description: This determination is based on the natural section exposed on a light grey limestone, exposing the last three worls of an adult *Cryptoplocus.* Observable is a solitary parietal fold, in the interior of the whorls, and an open umbilicus. The height measures 20,0 mm, the width: 21,7 mm, with an aplical angle of 20º.

Occurrence: Originally collected in Rotula, near Palermo, and Carini, island of Sicilia, Italy, where it was associated to a rich *Nerineacean* fauna, of Early Tithonian age (GEMMELLARO, op. cit.). Reported from many limestone outcrops in Apulian, Balkanic and Western European Subprovinces, from Tithonian-Early Berriasian age.

S.C.S. occurrence: Locality MO-1460, Campo Claro farm, near Altagracia de Orituco, Guarico state, north-central Venezuela. *C. picteti* was found in a micritic packstone olistolith, reworked in Late Eocene-Early Oligocene Tememure Formation (VIVAS & MACSOTAY, 1995-a) along the Frontal thrust of Piemontine Nappe (Text-figure II-04).

Genus ***Aphanoptyxis*** Cossmann, 1896.
(=*Trochalia {Endiaplocus}* Cossmann, 1896).

The Biochron of *Aphanoptyxis* extends from Middle Jurassic (Bathonian) to Late Cretaceous (Turonian)(SAUL & SQUIRES, 1998), suggesting affinity with the Taxa Group One of SOHL (1987). Few species. Quite frequent in hypersaline marine waters, in the Purbeckian of Western Europe Subprovince (JOUKOWSKY & FAVRE, 1913). Relatively frequent in the Urgonian, a diachronous, white-limestone facies of Southern Europe – predominantly Barremian to Early Aptian, but in places, ranges into the Early Albian (RAT & PASCAL, 1979).

Aphanoptyxis böhmi (Blanckenhorn, 1927)
Plate 25, figures 13, 14;

- 1927 *Nerinea (Aptyxiella) Böhmi* BLANCKENHORN, Palaeontogr. 69: 147, pl. 3, fig. 50;
- 1937 *Cerithium excavatum? cf. var. syriaca* B. SHALEM, Paleontogr. Ital. 37: 28, pl. 1, fig. 30;
- 1942 *Nerinella Böhmi* B. DELPEY, Bull. Soc. Hist. nat. Toulouse: 155-156, fig. 110-111;

Occurrence: Collected originally in Abey and Djamûr, Lebanon; very well preserved shell were collected at El Bnayé, also in Lebanon, of Early Aptian age (HEYBROEK in DELPEY, op. cit.). Also in Palestina in Aptian-Albian sediments.

S.C.S. occurrence: Locality MO-905, Cachimena Inlet, Sucre state, Lope member of Tguarumo Formation, (DAGM) of Late Barremian-Early Aptian age. Also in MC-382-B, Cerro de Piedra, Monagas state, Lower Garcia Formation, of Early Aptian (Bedoulian) age. Fossils replaced by goethite. Uncommon.

Aphanoptyxis buloti new species, Macsotay.
Plate 35, figures 9, 10;

- 1929 *Nerineopsis sp. n.,* PASSENDORFER, T. S. p. Pologne, 2(4): 603, pl. 2, fig. 26;
- 1973 *Cerithium sp.* GORTANI, A. N. d. Lincei, #4: 77, pl. 16, fig. 4;

Diagnosis: An *Aphanoptyxis* with convex whorls whose width is four times wider than their height; umbilical area filled with sparite; no folds are observable in the interior of the whorls. Whorls covered by fine spiral lines.

Description: Shell of small size (Height: 18 mm, Width: 11,8 mm, last 4, ½ last whorls preserved), turreted-conical, multi-whorled, with an elongate and narrow upper spire; Apical angle variable between 16º and 20º; whorls about 4 times wider than high; spire whorls regularly convex, ornated with fine spiral striae; body whorl slightly wider and slightly more convex than the penultimate whorls. Suture impressed, whithout any cord or ornamentation; aperture small, wider than high; whorls without interior plaits. Umbilicus filled with sparite chrystals.

Anterior canal and aperture not preserved on any of the samples. Shell substance thin, replaced by black calcite.

Types: The holotype (pl. 35, fig. 10) is catalogued as UCVMG/IO-1961, and the paratype (pl. 35, fig. 9), a shell cut axially with a diamond saw, as UCVMG/IO-1962.

Etymology: This species is dedicated to French Paleontologist, Dr. Luc Bulot, who collected and studied the Eocretaceous Ammonites of Serranía del Interior Oriental, during the last stage of Aguasuelos Proyect (1992/93).

S.C.S. occurrence: Locality MO-3188, La Cueva inlet, Borracha island, Upper Borracha Formation, of Early-Middle Albian age. Eight fragmentary specimens collected in the calcareous siltstone interbedded with the last two massive limestone beds, on the top of the unit.

Occurrence: Studied from a glauconitic limestone, of the Wielka Rowien valley, in Poland, of Albian age. GORTANI (op. cit.) reported a small shell collected at Graua Sud, Ethiopia, in limestones of Albian age, calling it *Cerithium* sp., comparing it with *Nerinea subaequalis* (d'ORBIGNY, 1842) (fide BLANCKENHORN, 1927: 149, pl. 3, figs. 52-54) – Cenomanian of Jerusalem, Palestine, and Late Cenomanian of Sinai Peninsula, Egypt – an unrelated *Cossmannea* with three small unequal folds inside the axially elongated whorl (COSSMANN, 1899, pl. 4, fig. 1).

Aphanoptyxis excavata (Brongniart, 1922)
Plate 50, figure 16;

- 1822 *Cerithium excavatum* BRONGNIART in CUVIER, Ossements fossils, pl. 9, fig. 10;
- 1842 *Cerithium excavatum* B., d'ORBIGNY, Paleont. Franç., Terr. Cret.: 371 pl. 230, fig. 12 ;
- 1865 *Cerithium Gassendi* COQUAND, Soc. Emul. Prov., Mem. 3: 83-84, pl. 4, figs. 14, 15;
- 1930 *Nerineopsis excavata* (B.) PASSENDORFER, T. Sp.Pologne, 2(4): 252, pl. 1, fig. 20a-g ;
- 1976 *Aphanoptyxis excavata* (B.) KOLLMANN, A. M. N. Wien, 80 : 173-174, pl. 2, figs. 13-16 ; pl. 3, figs. 17-19 ;

Occurrences : Studied from the Tatra mountains, Poland, in Middle Albian glauconic limestones. Very abundant in the Perte du Rhône, Switzerland, in Late Albian sediments; in Blackdown, England, and Austria, at the same horizon.

S.C.S. occurrence: Locality HA-4343, La Urbina north section, Trujillo state (ARNAUD et alii., 1999, fig. 33), in La Puya member of Peñas Altas Formation, of Middle Albian age. Also in JFS-171, Casanay-Caripito road, Sucre state Valle Grande Formation, (DGC), of Middle Albian age. It is associated to Belemnites and many Bivalves.

Subfamily ***ADIOZOPTYXISINAE*** Pchelintsev, 1931.
Genus ***Adiozoptyxis*** Dietrich (1914) 1925.

Description: COX (1954, P. M. S. London, 31[1] : 12) defined the Genus *Adiozoptyxis* as follows: Shell moderately stout, often large, with broad umbilicus; whorls low, strongly concave to flat, smooth or tuberculate, with an angular adaxial projection forming a helix within the umbilicus. Details of aperture unknown. Three internal folds present (**2, 0, 1, 0** or **1, 1, 1, 0).** The genus has a Biochron extending from Late Jurassic (Tithonian) to Late Cretaceous (Senonian), belonging to the Taxa Group One of SOHL (1987). Is cosmopolitan in the Tethys Ocean, where frequently is associated to rudist banks. The type species is *Nerinea polymorpha* Gemmellaro 1865, confirmed by DIETRICH (1925: 108), - Tithonian to early Berriasian of Palermo, Sicilia, Italy.

Adiozoptyxis coquandi (d'Orbigny, 1842).
Plate 29, figure 25;

- 1842 *Nerinea Coquandiana* d'ORBIGNY, Paleont. Franç. Terr. Cretacé: 75, pl. 156, fig. 3-4;
- 1887 *Nerinea Renauxiana* d'O. MALLADA, Sinopsis Cret. España: 42-43, pl. 31, fig. 4;
- 1916 *Nerinea (Diozoptyxis) Coquandiana* d'O., BRUN, CHATELET & COSSMANN: 14, pl. 1, figs. 27, 28;
- 1927 *Nerinea renauxiana* d'O., DAGUIN: 240, pl. 31, fig.4;
- 1939 *Nerinea Coquandi* d'O., DELPEY, Gastrop. Mesoz.: 180-182, pl. 4, figs. 1-5;
- 1959 *Nerinea (Diozoptyxis) coquandi* d'O., CZABALAY, Magyar A.F.I. E. J. 5(7): 158-160, t. 1, figs. 6-8;
- 1960 *Nerinea coquandi* d'O., GLAÇON & GLAÇON: 30-31, pl.text, fig. 1 ;
- 1976 *Diozoptyxis renauxiana* (d'O), KAUFFMAN & SOHL, Mid-Cretaceous events, XXIX-5, fig. 1;
- 1980-b *Adiozoptyxis coquandi* d'O., MACSOTAY, Thèse, Univ. Lyon-I, :38, pl. 12, fig. 26;
- Diagnosis: Big-sized shell, turriculated, conical, umbilicated, of 150 mm of height or more; the height of the whorls is less than ½ of the width. Apical angle: 15º; whorls ornated by nine to eleven tubercles.

Occurrence: *A. coquandi* (d'O.) is one of the most wide-spread Nerinean in the Eocretaceous: with a

Biochron of Barremian to Late Aptian in Western European, Apulian, Balkanic, Maghrebian, Syrian and Somalian Subprovinces reaching the Kashmir mountains, in Pakistan, Central Asia. In Spain, it was collected in Alacon limestone Formation, Oliete Basin, of Barremian-Bedoulian age (CANEROT, 1982), and in Gulf-Atlantic Coast in equivalent horizons. In Tendaguru, Mozambique, East African Province, was found associated to corals in limestones of Barremian age (DIETRICH, 1914). In Transylvania, it was reported as *Nerinea (Diozoptyxis) titan* SHARPE from Cserges, in the Maros River basin (LUPU, 1966, pl. 1, fig. 6). SHIBA (1994:468, fig. 8-a) illustrated it from Daiichi-Kashima Seamount, -east of Japan,- from sediments of Hauterivian-Barremian age limestones.

S.C.S. occurrence: Cited from the Late Aptian of Jamaica, and the middle Albian of Cuba (KAUFFMAN & SOHL, 1976: XXIX: 5, fig. 1) under the term *Archimedia gigantea* (d'Ombre-Firmas). KNIPSCHEER (1938: 676, fig. 12, not fig. 13, *=Plesioplocus*) reported it from San Cristóbal, south of Seibabo, Santa Clara prov., Cuba, of Provincial limestone Formation, of Albian-Cenomanian age. SOHL in KHUDOLEY & MEYERHOFF (1971, Geol. Soc. Amer., Mem. 129: 113) cited *Diozoptyxis n. sp.? ex gr. coquandi-renauxi* (d'O.) from Benbow limestone Formation, Jamaica.

In Venezuela, locality MO-890, Punta La Cruz, Manare peninsula, Sucre state, in Lower Borracha Formation, (DAGM) of Early Aptian age, where it was associated to *Requienia ammonia* and *Amphitriscoelus waringi*, in massive limestones. In other localities of Borracha Formation, MO-1386, MO-1375, usually associated to *Neoptyxis astrachanica* (see text-fig. VIII-08-E). In Lara state, western Venezuela, it is rare in the Tibú Formation, Atarigua para-autochthon, of Barremian-Early Aptian age (STEPHAN, 1977). ETAYO SERNA (1964: 90) cited *N. aff. renauxiana* from a locality called Toro, Colombia of unknown age.

Observations: DELPEY (1942: 182) observed that the disntinction between *A. coquandi and A. renauxi* proposed originally by d'Orbigny, - absence of external umbilicus, and the variability of the size and number of tubercles added to the apical angle,- but these taxa are found associated in the same beds in Lebanon, with intermediary stages. DOUVILLE considered them varieties, but the ecophenotype of two sympatric forms, is normal in saline/hypersaline seas.

Adiozoptyxis traversensis (Pictet & Campiche, 1862)

- 1862 *Nerinea traversensis* PICTET & CAMPICHE, Sainte Croix #2: 238, pl. 67, figs. 4a-c ;
- 1952 *Nerinea traversensis* P. & C., CIRIC, B. M. H. N. Serbe, ser A,#5: 266, pl. 10, fig. 3;

Diagnosis: *Adiozoptyxis* of the same type as *A. coquandi-A. renauxi* in all their characteristics, but not developing any tubercular structure on a smooth shell. The umbilicus is quite large, the margins of the inner cavities, are less regular and more rounded. Internally, the labral fold is low and obtuse, not pointed (PICTET & CAMPICHE, op. cit.).

Occurrence: Originally collected in Val Travers, Neuchâtel, Switzerland, in saccaroid Urgonian limestone, of Barremian age. Also in Silistria, Croatia and in Serbia, of Apulian Subprovince from the Urgonian limestones.

S.C.S. occurrence: Locality MO-1716, road from Carora to Curimagua, Lara state, Tibú Formation, (Atarigua para-autochton) of Late Barremian-Early Aptian age; where it is more common than *A. coquandi* (d'Orbigny).

Adiozoptyxis valdensis (Pictet & Campiche, 1862).

- 1862 *Nerinea valdensis* PICTET & CAMPICHE, Mat. Paleont. Suisse, 2: 228, pl. 65, fig. 8 ;
- 1945[a] *Nerinea* sp.nov ? ROYO Y GOMEZ : 223-224, fig. 2;
- 1948 *Nerinea valdensis* P. & C., TAVANI, Paleont. Italica, 45 : 5 ;
- 1977 *Nerinea gachupinae* ALENCASTER, U. N. A. México, I.G. #1(2): 164, Figura 20 a-g;
- 1980b *Adiozoptyxis valdensis* (P. & C.), MACSOTAY, Thèse Doct.U. Claude Bernard: 37;

Occurrence: Originally studied the bryozoa-bed above the Calcaire Roux Formation, Sainte-Cloud, Switzerland. LORIOL (1868: 10) collected it from Arzier marl Formation, beds A and B, dated Berriasian by MOUTY & LOMBARD in Colloque sur le Crétacé Inferieur, Lyon, (1965: 39-48). Here it is associated to *Nerinea blancheti* (P. & C.) trebebratules and echinoida. In Mexico, it was reported as *Nerinea gachupinae* ALENCASTER, (op. cit.) of San Ricardo Formation, of Berriasian age.

S.C.S. occurrence: Locality MO-778, Venados Island, (DAGM), Sucre state, Upper Morro Blanco limestones, of Late Berriasian-early Valanginian age. In Colombia, it was reported from a calcareous sandstone in Upper Caquezá Group, of Valanginian-Hauterivian age (ROYO Y GOMEZ, op. cit.).

Genus ***Neoptyxis*** Pchelintsev, 1934.

Pchelintsev (1934) proposed this term for *Nerinea astrachanica* REHBINDER (1902), from the Eocretaceous sediments of Astrachan, Transcaucasia. These are strong, narrowly umbilicated shells, with quadrangular aperture, having 1-2 palatal folds, 2 columellar folds, 1-2 labral folds, and sometimes with a basal one (ABBASS, 1963: 74). Its Biochron is Barremian (Early) to Cenomanian-(Late) Cretaceous. Its distribution is restricted to Balkanic, Apulian, Syrian and Western European Subprovinces. Its preferred lithotype are the white (Urgonian-type) limestones, in agitated, saline marine waters. *Neoptyxis prefleuriaui* (Delpey) and *N. fleuriaui* (d'Orbigny), were cited by SHIBA (1994: 468, fig. 8-b, 8-c) from the Daichii-Kashima Seamount, in limestones with *Mesorbitolina parva* (Douglass), of Late Aptian-Early Albian age.

Neoptyxis astrachanica (Rehbinder, 1900)
Plate 29, figs. 24, 29;

- 1900 *Nerinea astrachanica Rehbinder,* N. Jb. F. Min., 1: 217;
- 1902 *Nerinea astrachanica* REHBINDER, Mem. Com. Géol. St. Petersbourg 17(1): 142-145, pl. 2, figs. 18-19, pl. 3, figs. 1-10;
- 1904 *Ptygmatis astrachanicus* R. CHOFFAT, Crét. dans l'Arrabida, etc. :13, 14, 15 ;
- 1953 *Cerithium sp. 2,* VON DER OSTEN, Bol. Geol. (Caracas) 3(8): 175, pl. 14, fig. 2;
- 1976 *Neoptyxis astrachanica* R., KOLLMANN, A. N.M. Wien, #80 : 178-179, pl. 5, figs. 38-40 ;

Occurrence : Originally collected from a sandstone in the Astrachanic steppe, Kazajstan, in Late Aptian (or Albian) age. In Almagrem, Portugal, also in Late Aptian- Early Albian beds. In Holleitengraben, Austria, of Albian age, and frequent in the Cenomanian of Abruzzo mts., Italy.

S.C.S. occurrence: Locality MO-888, La Cueva inlet, Borracha Island, (DAGM), Lope Member of Taguarumo Formation, of Early Aptian age. Also at MO-890, Punta La Cruz, Manare Peninsula, (DAGM) in Lower Borracha Formation, of Late Aptian age.

Neoptyxis essertensis (Pictet & Campiche, 1862).
Plate 29, fig. 12 ;

- 1862 *Nerinea essertensis* PICTET & CAMPICHE, Mem. Paleont. Suisse #2 : 242, pl. 69, fig. 1 ;
- 1959 *Nerinea sp. (aff. essertensis* P. & C.) CZABALAY, Magyar A. F. I. Evi Jel: 165, pl. 2, figs. 1-2;
- 1980b *Plesioplocus esertensis* (P. & C.) MACSOTAY, Thèse: 37, pl. 12, figs. 5, 28;
- 1987 *Plesioplocus essertensis* (P. & C.) MACSOTAY & ALVAREZ, Bol. Soc. Venez. Geol., #29: 21, fig. 13;

Occurrence: Originally collected in the Urgonian limestone outcropping in Mount Salève, near the town called Essert, Switzerland, of Barremian age. Also in the Urgonian limestones of Lókút, Hungary, and in Czech Republik, in the same horizon.

S.C.S. occurrence: Locality MO-1461, Arbol Redondo section, Trujillo state, lower carbonatic member of Peñas Altas Formation, of Late Barremian age. In Chuparipal Formation, Eastern Venezuela, (DEP) two lensatic limestones of bioclastic limestone, they constitute the dominant fauna. Also in localities MC-338-H, PM-87-A,-B, MO-3162, MC-380-H, all of the Chuparipal Formation, Sucre State.

Neoptyxis galatea (Coquand, 1865)
Plate 29, figs. 5, 6;

- 1865 *Nerinea Galatea* COQUAND, Soc. Emul. Provence, #3: 255, pl.5, fig. 3;
- 1887 *Nerinea galatea* C., MALLADA, Sinopsis, Cretacio: 42, no. 124;
- 1953 *Cerithium sp. 1,* VON DER OSTEN, Bol. Geol. (Caracas) 3(8): 175, pl. 14, fig. 1;
- 1956 *Nerinea (Nerinea) galatea* C., ALENCASTER, Paleont. Mexicana, 1: 35; (pars?)
- 1957 *Nerinea trishae* VON DER OSTEN, Jour. Paleont., 31(3) : 588, pl. 65, figs. 4, 5 ;
- 1970 *Nerinea galatea* C., MONGIN in COMBES & MONGIN, Mollus. Infracret, pl. 8a, fig. 5;
- 1976 *Nerinea (Ptygmatis) galatea* C., CALZADA BADIA, Bol. R. S. E. Hist. Nat.(Geol.), 74: 31-33;

Occurrence: Originally collected at Puerto de Querol, and many other localities, of the Mirambell marl Formation, Maestrazgo Basin, Spain, of Hauterivian age, not Aptian, as was stated originally (CALZADA BADIA, op cit., CANEROT, 1982). In Lescalé, Bauxite deposits, France, and finally, in Lebanon, in Early Aptian sediments.

Diagnosis: Shell moderately small, cyrtoconical, whorls concave, sutures inconspicuous; spire with nine whorls; height of the whorl about 1, ½ times the width. Ornamentation of seven spiral ribs, the first and the last, the strongest. Interior with two weak folds on the columella, two moderately strong parietal folds, pointed outward; two moderately extended folds on the labrum, the anterior, the stronger. Apical angle, 28º.

S.C.S. occurrence: Locality MO-888, Cachimena inlet, (DAGM), Sucre state, Upper Lope member of the Taguarumo Formation, of Early Aptian age. In locality HA-4523, Cerro El Cocuy, Curarigua, Trujillo state, in Lower carbonatic member of Peñas Altas Formation, of Early Aptian age (ARNAUD, et alii., 1999: 29, fig. 22). Locally common in Chuparipal Formation, MC-380-H, PM-87-A, -B of Barremian-Early Aptian age. One fragment was recowered from Tibú Formation, in Atarigua para-autochthonous unit, of Barremian-Early Aptian age.

Family ***NERINELLIDAE*** Pchelintsev, 1960.

(=*Nerinoides* WENZ, 1940; non *Nerinella* Nardo, 1847 [ICZN Opinion 316, 1954]).

According my personal observations, there is a correlation between the frequency of *Nerinella* shells and the organic-rich terrigenous sedimentation, just alike the behavior of *Turritella* sensu lato in Neogene times in the Caribbean Province (ALLMON, 1992).

Genus ***Nerinella*** Sharpe, 1850;

The type spcies is *Nerinea dupiniana* d'Orbigny, 1842, - Hauterivian, France, - by original designation. The Biochron of this genus is extended from the earliest Jurassic (Hettangian) to latest Cretaceous (Maastrichtian) according to WENZ (1940). *Nerinella* is, in general, longer and more slender than *Nerinea.* According to ABBASS (1963) on some specimens of *Nerinella,* the columellar and parietal folds virtually disappear. Interior with one labral fold, one or two columellar folds, and a weak or absent parietal fold, **1 – 2; 0; 1.** It does not belong to any of the SOHL's (1987) group. It represents an adaptantion to terrigenous (silt) sediment, poor in carbonates and rich in organic matter, in dysoxic marine waters. Its palaeogographical distribution includes all European Province, Maghrebian and Syrian Subprovinces, East African Province, and both Americas.

Nerinella bruni Cossmann, 1916.
Plate 29, figures 27, 28;

- 1916 *Nerinella bruni* COSSMANN, Mem. Soc. Geol. France, Pal. 51: 15, pl. 1 figs. 13-14;
- 1925 *Nerinella bruni* C., DIETRICH, Foss. Catal., :138 ;

Diagnosis : Small sized, very narrow baculiform fragments, composed of slightly convex whorls which are higher than wide; ornamentation composed of six or seven spiral cords, which are granular;

Dimensions: A fragment of 3 ½ whorls, measures, of Height: 16,5 mm, and of width: 11 mm, (pl. 29, fig. 28), it only differs from the type specimen, in having one granular spiral cord less.

Occurrence: Espeiras, and in the oolithic limestone of Orgon, both in South France, of Barremian age.

S.C.S. occurrence: Locality MO-888, Cachimena inlet, Sucre state, Lope Member of Taguarumo Formation, (DAGM) of Early Aptian age. Sixteen shells were recovered from a sideritic limestone of reddish-violet color, with many bivalve fragments.

Comparisons: *Turritella cesticulosa* Matheron, (1842: 312, pl. 39, fig. 17) – *Hippurites*-limestone, from port de Figuières, Marseille, France, of Campanian age,- differs from our *Nerinella bruni* in having a strong and nodular subsutural cord, and a concave whorl profile. Also was cited from the brackish-water Turonian of south France.

Nerinella dupini (d'Orbigny, 1842).
Plate 29, figures 8, 9;

- 1842 *Nerinea Dupiniana* d'ORBIGNY, Pal. Franç. Terr. Cret. 2:81-82, pl. 159, figs. 5-8;
- 1863 *Nerinella Dupiniana* d'O., PICTET & CAMPICHE, Mat. Paleont. Suisse : 249 ;
- ¿1887 *Nerinea Dupiniana* d'O. MALLADA, Sinops. Cretaceo inf.#3: 44, pl. 20, fig. 7;
- 1900 *Nerinella Dupiniana* d'O. PERON, B.S.S. hist. Nat. Yonne, 53: 36-38, pl. 2, fig.1;
- 1918 *Nerinella cf. dupiniana* (d'O.) COSSMANN: 352, pl. 10, fig. 17;
- 1953 *Nerinella utrillasi* (V. & L.) ROYO Y GOMEZ, Acta Cient. Venez., 4(4): 149-150, figs. 12-14; (non VERNEUIL & LORIÈRE, 1868);
- 1957 *Nerinea pseudoconvexa* S. VONDER OSTEN, Jour. Paleont., 31(3): 587, pl. 65, fig. 16 ;(non STANTON, 1947).

Occurrences : Originally collected in Marolles, Aube, France, in Early Neocomian sediments. Later, was located in most of the Hauterivian localities of France, including the Jura mts. In Crimea Peninsula, Ukraine, also in Hauterivian sediments (PCHELINTSEV, 1927-a, pl. 4, figs. 11-12). In Sierra Mariola, Mas de Querol Formation, Spain, of Hauterivian age. Reported from the Barremian of South France, considered as a variety by COSSMANN (1918).

S.C.S. occurrences: Locality MMH, Su 90, west side of Picuda Grande Island, lower Taguarumo Formation, (DAGM) of Late Hauterivian age. Also collected at several localities of lower Lope member of Taguarumo Formation, along the cliffs between

Mochima bay and Cumaná. In locality 3076, isla Chimana segunda, in shelly brecchia of Taguarumo Formation, associated to *Pterotrigonia tocaymaana,* (ROYO GOMEZ, op. cit.). In western Venezuela, only collected at the top of the Rio Negro Formation, in Perijá, associated to Barremian fossils.

Nerinella itaporangica (Maury, 1936)
Plate 56, fig. 4;

- 1936 *Nerinella itaporangica* MAURY, Mem. S. Geol. Min., Brasil,#11: 215, 217, pl. 12, fig. 10, 12;
- 1980 *Nerinella sp. Cf. itaporangica* M., GARCIA JARPA et alii., Bol. Geol (Caracas), 14(26): 44;

Occurrence: Originally collected at the east end of Maude Island, Queen Charlotte Islands, western British Columbia, Canada, in Haida Formation, of Albian age. Later collected at Itaporanga, Sergipe, Brazil, in ?Ganhamaroba Group, of probable Middle Albian age. It is on the same limestone block, as the *Rostrocardia branneri* (White), which was originally located at Maroim, Brazil.

S.C.S. occurrence: Locality in Arbol Redondo section, Trujillo State, in upper carbonatic member of Peñas Altas Formation, of Early Albian age.

Genus ***Aptyxiella*** P. Fischer, 1885.

According to PCHELINSTEV (1953) *Aptyxiella* has a Biochron extending from Late Jurassic (Rauracian) to Eocretaceous (Aptian) age, having evolved to many species in Europe and North America.

Subgenus ***Acroptyxis*** Tiedt, 1958.

TIEDT (1958: 487-488) proposed the taxon *Acroptyxis* as a subgenus of *Aptyxiella*, with the formula 1: 1: 1: 0, in which the labral fold is in central position, opposing the wide concavity, between the smaller and more acute columellar and parietal ones. With *Aptyxiella gracilis (*Zekeli, 1852) – of Gosau group, Austria, Santonian age,- as the type species, this subgenus has a Biochron extended from Late Jurassic (Kimmeridgian) to Late Cretaceous (Santonian). Its palaeodistribution includes Western European, Apulian, Balkanic, Japanese-East Asian Subprovinces, extending to East African Province.

Aptyxiella (Acroptyxis) banderaensis, **nom. nov.**
Macsotay Plate 50, figure 19;

- 1852 *Nerinea* sp. indt., ROEMER, The Kreidebildungen von Texas: 41,pl. 4, fig. 8;
- 1952 *Nerinea roemeri* WHITNEY, Jour. Paleont. 26: 71, pl. 14, figs. 1, 2;
- Non 1837 *Nerinea Roemeri* PHILIPPI, Neues Jahrbuch : 294, pl. 3, fig. 12 ; Oxfordian, Corallian ;
- Non 1861 *Nerinea Roemeri* THURMANN & ETALLON, Lethaea Bruntrutana : 106, pl. 8, fig. 54 ; Kimmeridgian.

Description : Cast elongated, turreted, slender ; the whorls of the cast consist of two parts separated in the middle, in which two almost equally sloping surfaces come together. On the axial cross-section, the labral fold is the most prominent, blunt; in the columella there is one thin and sharp fold; in the parietal area, there are two folds, the first smaller than the second.

Dimensions: Width: 35 mm, apical angle, 5º; sutural angle: 15º. The longest cast measured over 200 mm.

Occurrence: The type locality is at 2, ½ miles south of Lone Man Mt., Glen Rose Formation, Texas of Early Albian age, at *Salenia texana* horizon (WHITNEY, op. cit.).

Etymology: Named after the Texan locality of Bandera, Smithson valley.

S.C.S. occurrence: Locality MO-892, El Peñon, Los Bordones, Sucre state, (DAGM) Upper Borracha Formation, of Early Albian age. Only casts are available of this remarkable species, one of the greatest size of an *Aptyxiella (Acroptyxis).*

Comparisons: WHITNEY (op. cit.) compared this taxon to *Nerinea espaillaciana* d'Orbigny (1842), which whorls are broader in proportion to their height, and internally, has one fold on the labrum, much more prominent than the other two, being sharply truncated. In *espaillaciana* the posterior lobe is larger than the anterior one, reversed condition with respect of *A. (A.) banderaensis.*

Aptyxiella (Acroptyxis) favrei Pictet & Campiche, 1862, emend. Dietrich, 1925.

- 1862 *Nerinea Favrina* PICTET & CAMPICHE, Mat. Paleont. Suisse, #3 : 229, pl. 65, figs. 1-3 ;
- 1866 *Nerinea Favrina* P. & C., DE LORIOL en FAVRE :52-53, PL. a, FIGS. 4, 5;
- 1925 *Nerinea (s.s.) Favrei* DIETRICH, Fos. Catal., Nerineidae: 115;
- 1957 *Nerinaea roemeri* W., VON DER OSTEN, Jour. Paleont. 31(3) : 587-588, pl. 65, fig. 21 ; (non *Nerinella roemeri* PHILIPPI ; nec *Nerinea roemeri* THURMANN & ETALLON, 1861).
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Occurrences : Collected in Le Locle, Villers-le-Lac (Doubs), Mt. Salève (Savoia) in Switzerland, in Late Berriasian-Valanginian age sediments, where it is

usually abundant. Also in the Vallivana limestone Formation, Eastern Maestrazgo Basin, of Berriasian-Valanginian age (CANEROT, 1982).

S.C.S. occurrences: Locality MMH, Su-92, western coast of Picuda Grande island, (DAGM), in the basal limestones of Taguarumo Formation, of Late Hauerivian age.

Observations: In Switzerland, usually is associated to *Adiozoptyxis marcoui* (d'Orbigny)(De LORIOL, op. cit.) suggesting saline environment, coincident with the Taguarumo Formation's siderite-rich sediments.

Aptyxiella (Acroptyxis) rigida (Nagao, 1934).
Plate 25, figure 17;

- 1934 *Nerinea rigida* NAGAO, Jour. Fac. Sci. Hokkaido Imp. Univ.,(4) 2 (3) :250, pl. 38, figs. 1, 1ª, 1b, 2;
- 1977 *Nerinea rigida* N., HAYAMI & ITARU, Univ. Tokio. B., 13: 69;
- 1980 *Aptyxiella (Acroptyxis) circumvoluta* (Cragin) MACSOTAY, Thèse Univ., U.Lyon-I, pl. 11, fig.9; (non CRAGIN, 1905).

Occurrences: Originally collected in Hiraiga Formation of the Miyako Group, Iwate Prefecrture, Japan, of Aptian age.

S.C.S. occurrences: Locality HA-4469, Jabon-San Pedro section, Trujillo state, lower carbonatic Member of Peñas Altas Formation, of Early Aptian age (ARNAUD, et alii., 1999, Fig. 18). Also in locality MO-1716, Cerro Los Curaríes, near Curarigua, of Late Aptian age. In eastern Venezuela, in locality MO-4710, northern part of Isla Venados, (DAGM) in Lope Member of Taguarumo Formation, of Early Aptian age.

Comparisons: NAGAO (op. cit.) fully discussed the resemblances of *A. (A.) rigida* N. with *A. (A.) vogti* (de Mortillet), *A.(A.) vogti archimedi* (d'Orbigny) and *A. (A.) guinchoensis* (Choffat), from the Barremian, Aptian an Valanginian, respectively of Western European Subprovince, but is distinguished from them by the whorl profile and by the shape of columellar folds.

Aptyxiella (Acroptyxis) vogti vogti (de Mortillet, 1856).
Plate 25, figure 24 ; plate 29, figure 19 ;

- 1856 *Nerinea Vogtiana* de Mortillet. Bull. Ass. Florimont.d'Annecey: 71;
- 1861 *Nerinea Vogtiana* d. M., PICTET & CAMPICHE, Mater. Paleont. Suisse: 240, pl. 68,figs. 1-2;
- 1887 *Nerinea Vogtiana* M., MALLADA, Sinopsis España, Cretacico inf., #3: 41, 42;
- 1907 *Nerinea Vogtiana* d. M., COSSMANN, Mem. Soc. Géol. Fr., 15(37): 10, pl. 3, figs. 1-4;
- 1914 *Nerinea (s. str.) sp.,* DIETRICH, Gastropoden der Tendaguruschichten, etc.,: 136, pl.13, fig. 7;
- 1925 *Nerinea (s. s.) Vogti* de M., DIETRICH, Foss. Catalogus, *Nerineidae* : 121 ;
- 1973 *Nerinea Martiniana* d'Orb., COTTREAU, Ann. Paleont. 26: 76;

Occurrence: Originally studied from Annecy, Savoya, France, in Urgonian limestones of Barremian-Early Aptian age. Also collected in Switzerland, Southern Spain, and other localities of France, of the same horizon. In Apulian and Balkanic Subpovinces, but also in East African Province, always in Barremian or Aptian stages. KRIVIC (1974: 119) reported a related taxon (cf.) from the Hauterivian of Croatia.

S.C.S. occurrence: Locality HA-4269, Cerro Los Curaries section, near Curarigua, Trujillo state, in lower carbonatic member of Peñas Altas Formation, of Early to Late Aptian age (ARNAUD et alii., 1999: 31, Fig. 23). Also in upper Chuparipal Formation, (MACSOTAY & ALVAREZ, 1987: 21) of Late Barremian-Early Aptian age. In western Venezuela, cited from Tibú Formation, of the Atarigua para-autochthone, of Lara state (MACSOTAY, 1980-A).

Observations: It is important to observe, that *Aptyxiella (Acroptyxis)* species in Spain are not found in the Maestrazgo or Oliete Basins, where other *Nerinacea* are relatively common, in saline, shallow waters. Cazorla and Quesada are tectonically displaced exotic terrains, whose paleo-position was more basinward in the Tethys Ocean. In Venezuela, the situation is alike: *Aptyxiella (Acroptyxis)* are associated to deeper water localities, which were more distally situated from the palaeo-shoreline, as the Chuparipal Formation´s limestones of eastern Venezuela (DEP), dominated by dasycladacean algae, stromatoporids and sponges, but not corals. This confirms the RAT & PASCAL (1983) hypothesis of a deep shelfal and distally deposited carbonates constituting the Urgonian limestones.

Aptyxiella (Acroptyxis) vogti archimedi (d'Orbigny, 1842-43).
Plate 29, figures 3, 4;

- 1842-43 *Nerinea archimedi* d'ORBIGNY, Paleont. Franç. Terr. Cret, 2.: 78-79, pl. 158, figs. 3-4;
- 1907 *Nerinea vogtiana* d. Mortillet in COSSMANN, Mem. Soc. Geol. France 37: 10, pl. 3, figs. 1-2;

- 1954 *Nerinea vogti* d. M. var. *archimedi* d'Orb. ANDJELKOVIC: Ann. Geol. Penins. Balk, 23: 58, pl. 1, f. 2;
- 1957 *Nerinea dianae* VON DER OSTEN, Jour. Paleont. 31(3) : 587, pl. 65, fig. 19 ;
- 1959 *Nerinea vogti var. archimedi* d'Orb., CZABALAY: 164, pl. 3, figs. 3-4;
- 1980 *Aptyxiella (Acroptyxis) vogti archimedi* ('Orb.) MACSOTAY, Thèse, U. Lyon, pl. 11, fig. 1;

Description : Shell of medium size, elongate, conical, with apical angle of 14º, whorls concave, suture conspicuous ; height of whorls ½ of width, gently concave in middle, elevated posteriorly to form a narrow subangular just below the suture. Anterior elevation not forming a ridge not forming a ridge in spiral whorls. Sculpture of 10 generally weak spiral lines, some of them stronger than the rest. Anterior border of the body whorl carinate, produced into a prominent, deflected anterior canal. Interior with one strong blunt fold on the labrum; one high narrow parietal fold, and a small fold at the base of the columella (VON DER OSTEN, op. cit.).

Dimensions: Height of last five whorls: 32 mm, width: 13 mm, probably original height: 58 mm (pl. 29, fig. 3).

Occurrences: Originally located in Orgon, Var, south France, in Urgonian limestones of Barremian-Early Aptian age; there it is associated to *Caprotina ammonia.* In Spain, in Alacon limestone Formation, in Oliete Basin, of the same age. In Algeria and Croatia, in limestones from Valanginian to Aptian age. In Zirc, Hungary, in Early Albian limestones, associated to *Mesorbitolina.*

S.C.S. occurrence: Locality MO-902, cliff west of Cachimena inlet, (DAGM) Taguarumo Formation, of Barremian age (MACSOTAY, 1980-b, pl. 11, fig. 1); also in locality Su-110, west coast of Picuda Grande Island, in the same age and horizon. Locality MO-3160, thin ferrugineous limestone on top of Chuparipal Formation, of Early Aptian age, common.

Aptyxiella (Acroptyxis) subflexuosa *(Cossmann, 1896).*

- 1887 *Nerinea flexuosa* Sow., MALLADA, Synopsis Cretacico españa: 43, pl. 27, fig. 2;(non SOWERBY, 1831, Geol. Trans. 2 (3): 38, fig. 16 ;
- 1868 *Nerinea flexuosa* Sow., VERNEUIL & LORIÈRE, M. p.p. l. España, 37 :17-18, pl. 2, fig. 17 ;
- 1896 *Nerinella subflexuosa* COSSMANN, Essais 2 : 39 ;

Occurrence : Utrillas, in Limestone and marl Mosqueruela Formation, Oliete and Mora de Rubielos Basins, Spain, of Late Aptian-Cenomanian age, not Urgo-Aptian age, as was stated originally.

S.C.S.occurrence: Locality MO-5606, klippe south of El Zorro thrust (DEP) of Majagual Formation, of Late Albian-Early Cenomanian age. It is associated to *Mexicaprina cf. cornuta* (Coogan) and *Texicaprina kugleri* (Bouwman).

Genus ***Contortella*** Pchelintsev, 1965.

PCHELINTSEV (1965) proposed this term for a *Nereinellidae* family member, whose Biochron extended from the Late Jurassic (Kimmeridgian) to Eocretaceous (Albian). This unusual, small *Nerinellidae* is an extreme adaptation to calcium-poor saline seas, inhabiting soft, muddy bottoms, where it fed on marine worms. It should be included in SOHL (1987) Taxa Group One, as a genetically regressive form to the family *Ceritellidae.*

Contortella has developed few species, among which I include:

1. *Contortella labriplicata* (Schlosser, 1881) Tithonian-Berriasian
2. *Contortella maudensis* (Whiteaves, 1884) Albian
3. *Contortella ornata* Pchelintsev, 1965, Valanginian,
4. *Contortella sp.* Wieczorek, 1979, Early Kimmeridgian

The palaeogeographic distribution of the genus *Contortella* included the Western European, the Apulian, the Balkanic Subprovinces, and the North Pacific Province.

Contortella cf. ornata Pchelintsev, 1965.
Plate 25, figure 21;

- Cf. 1965 *Contortella ornata* PCHELINTSEV, Izv-vo Akad. Nauk. SSSR : 94, pl. 24, fig. 10;

Description: Natural axial section, representing a turriculate thin shell, with low, concave whorls on the spire; body whorl only concave near the suture; the rest is convex, and terminates into an extension of the central pillar. Sutural roll conspicuous, symmetrical. Central pillar solid, narrow; interiorly there is only one blunt, rounded, columellar fold, in central position.

Dimensions: An axial section of slightly more than 2 whorls, measures in Height: 42 mm, and of width: 23 mm (fig. 21).

Occurrence: Crimea Peninsula, Ukraine, from Valanginian horizons.

S.C.S. occurrence: Locality MO-890, Punta La Cruz, Manare Peninsula, (DAGM) lower Borracha Formation, of Late Aptian age. Two sections, on the top of the massive limestone. Also at MO-1386, Isla de Monos, at the core of the anticline, lower Borracha Formation, of Late Aptian age, in a mudstone-textured limestone.

Comparisons: It resembles to *C. ornata* Pchelintsev, (op. cit.) – the type of the genus, of Valanginian age, - but the columellar fold is more centrally located, and the body whorl has more the shape of a *Phaneroptyxis.*

Contortella sp. indet. Macsotay
Plate 42, figure 9;

Description: One natural axial section of a thin, turriculate shell, with low, concave whorls; interiorly, constricted by a labral fold, blunt, assymetrical, situated about the middle of the wall. Columella solid, and narrow.

Dimensions: A profile of three whorls measures of Height: 30,2 mm, and of width: 16,3 mm.

S.C.S. occurrence: Locality HA-4436, Jabón-San Pedro track section, Trujillo state, in lower carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 18), of early Aptian age. Our shell resembles *Nerinea labriplicata* Schlosser, (1881, Paleontographica 8(2): 76, pl. 10, figs. 16, 16a), - *Diceras* limestone, of Kelheim, Southern Germany, of Late Tithonian-Berriasian age,- which also had a labral fold interiorly.

Family/Subfamily ***ITIERIIDAE/ITIERIINAE*** Cossmann, 1895.

According to WENZ (1938) and PCHELINTSEV (1953, 1954), the Biochron of the family *Itieriidae* extends from Late Jurassic (Lusitanian) to Late Cretaceous (Senonian). PCHELINTSEV (1954, fig. 25) and RAHMAN (1967, fig. 15) gave a good representation of the evolution of the *Itieriidae,* with its more important genera, *Phaneroptyxis, Itieria, Brouzetia, Campichia and Itruvia.* The maximum of the development of this family was reached during Tithonian-Eocretaceous**,** coincident with the maximum salinity anomalies of the Tethys Ocean; its migration to India and the Borneo Island, during Senonian times, could be explained by the extension to the east of the cited salinity conditions.

Genus/Subgenus ***Itieria (Itieria)*** Matheron, 1842.

According to WENZ (1938) and DIETRICH (1925: 103) THE Biochron of this genus extends from Late Jurassic (Oxfordian) to Middle Cretaceous (Cenomanian), having developed few species. The type, *Acteon cabanetianus* (d'Orbigny, 1841), - Kimmeridgian, of Oyonnax, Nantua, dept. of Ain, France, but has been reported from Western European, Balkanic Apulian and East Asian-Japanese Subprovinces (COSSMANN, 1898).

Itieria (Itieria) rugifera Zittel, 1873.
Plate 26, figure 23;

- 1873 *Itieria rugifera* ZITTEL, Gastrop. Stramberg Sch.: 340-341, pl. 41, figs. 1-3;
- 1913 *Itieria rugifera Z.,* FAVRE, Mém. Soc. phys. & Hist. Nat. Genève 37 : 450-451, pl. 30, fig. 1 ; textfig. 36;
- 1925 *Phaneroptyxis rugifera Z.,* DIETRICH, Foss. Catalogus, Nerineidae: 109;
- 1931 *Phaneroptyxis rugifera* Z., YIN, Trav. Labor. Geolog. Lyon #18(14): 69-70, pl. 6, fig. 14;
- 1965 *Itieria rugifera* Z., VESELINOVIC, A. G. Y. A., #5: 255-256, pl. 2, figs. 5;

Occurrence: Originally studied from the Stramberg Formation Chech Republik of Tithonian-Berriasian age; in Csáklya, Pozsony, Hungary (HERBICH, 1886); in Mt. Salève, Switzerland, and Languedoc, southern France, (YIN, 1931) from the same horizons, all in Western European Subprovince. Also in Balkanic and Apulian Subprovinces. In Crimean peninsula, was collected from the lower *Palorbitolina* limestones (BROILI, 1902).

S.C.S. occurrence: Locality PM-87-B, Cerro El Pato, Sucre state, (DEP) in Chuparipal Formation, where it was found associated to the *Amphitriscoelus-Kipia-Offneria* fauna, of Late Barremian age. Also in the Cerro Garrapatero, Casanay, in the same unit.

Subgenus ***Campichia*** Cossmann, 1896
(=*Campicheia* Dietrich, 1925).

Itieria (Campichia) is a small gastropoda, with a Biochron restricted to the Early Cretaceous Neocomian to Cenomanian, mostly in Urgonian facies. Its palaeogeographic distribution includes the Western European, Maghrebian Subprovinces, and East African Province. Few species according to WENZ (1938). I aknowledge these:

1. *Itieria (Campichia) pellati* Cossmann, 1900. Late Barremian,
2. *Itieria (Campichia) subtruncata* Brun & Chatelet, 1926 Cenomanian
3. *Itieria (Campichia) truncata* Pictet & Campiche, 1861 Hauterivian-Early Aptian
4. *Itieria (Campichia) umbonata* Pictet & Cmpiche, 1861 Barremian-Early Aptian
5. *Itieria (Campichia) zwierzyckii* Dietrich, 1914. Aptian

6. *Itieria sp.* Moesch, 1878. Neocomian?

Itieria (Campichia) truncata (Pictet & Campiche, 1861).
Plate 25, figures 12, 17;

- 1861 *Itieria truncata* PICTET & CAMPICHE, Mat. Paleont. Suisse #2:218, pl. 63, figs. 1-4 ;
- 1887 *Itieria truncata* P. & C., MALLADA, Synopsis Cret. Inf., #3: 39-40. Pl. 21, figs. 3-5, 10, 11 ;

1918 *Itieria (Campichia) truncata* P. & C., COSSMANN, Bull. Soc. Geol. Fr. 10(6):347-348, pl. 10, figs. 10-12.

- 1932 *Itieria (Campichia) truncata* P. & C., SAYN, Trav. Lb. Lyon, Geol. #18: 14-17, pl. 1, figs. 13, 14, 15, 15ª, 16, 17, 18, 18ª, 18b;
- 1971 *Itieria* n. sp., SOHL in KHUDOLEY & MEYERHOFF, Geol. Soc. Amer., Mem.129: 113;
- 1979 *Campichia truncata* CHERNOV & YANIN in Geobios, Mem. Spec. #3: 173, 174;

Occurrence: Originally studied from the trail to Châtillon de Michaille, Ain, Bellegarde, France, in Calcaire Blanc Formation, of Barremian age. Reported later in many other localities of France (Orgon Formation) and Switzerland (Schrattenkalk Formation) of the same age (SAYN, 1932). In Mirambell and Mas de Querol Formations, Maestrazgo Basin, Spain of Hauterivian-Barremian age, (CALZADA BADIA, 1979: 63) and not Aptian, as was stated originally. Also in the Máramaros klippe, in northeastern Carpatians, of Barremian-Aptian age.

S.C.S. occurrence: Locality PM-87-B, quarry on Cerro Garrapatero, Sucre strate (DEP) in Chuparipal Formation, of Late Barremian age (Text-figure V-04). Also in MO-881, Patiño inlet, Sucre state, in sideritic limestones of Taguarumo Formation, of Barremian age. They are associated to *Amphitriscoelus waringi* H. & H. and other thick-shelled bivalvia.

Dimensions: The illustrated specimen measures, of Height: 13,75 mm, of width: 12,85 mm, pl. 25, fig. 12, Ucvmp/IO-2117. Four specimens were collected together in MO-881. Also collected in Tibú Formation, Atarigua para-autochthone, associated to *Toucasia carinata* in massive limestone bed, of Late Barremian-Early Aptian age.

Genus ***Endoplocus*** Cox, 1954. (=*Itieroptygmatis* CHARVET & TERMIER, 1971).

The Biochron of the genus *Endoplocus* extends from the Late Jurassic (Kimmeridgian) to the Eocretaceous (Valanginian) age. It was considered as characteristic of the Mesogean Suprovince, where it evolved in many species. *Itieria (Itieroptygmatis) ellipticata,* proposed by CHARVET & TERMIER (1971, Ann. Soc. Geol. du Nord, T. 91[3] 189-190, pl. 32) is a junior synonym of *Endoplocus nanus* (Gemmellaro, 1865), of Costa Cervera, Palermo, Sicilia, grey limestones of Tithonian-Berriasian age. This unusual nerineid has numerous, strong, and complicated inner folds (**2, 1, 2, 0** or **2, 1, 1, 0)**(COX, 1954).

Endoplocus nanus (Gemmellaro, 1865).

- 1997 *Itieroptygmatis ellipticata* (Charvet & Termier), MACSOTAY & PERAZA, Mem. VIII Congr. Geol., Venez., t. 2: 11, fig. 2ª- 8;

Occurrence: *Endoplocus nanus* (Gemmellaro) is a widely distributed taxón on the carbonatic sediments of Apulian, Balkanic Subprovinces, associated always to Tithonian-Berriasian molluska and brachiopoda.

S.C.S. occurrence: Near Quebrada Tuira, in white sandy and subconglomeratic calcarenite olistoliths, with more than 12 *Endoplocus nanus* shells, collected in olistostrome at the base of Tememure Formation, of Late Eocene-Early Oligocene Tememure Formation, in the Guárico Mountain front (VIVAS & MACSOTAY, 1995-a, figures 8, 10). Among these same olistoliths, BECK & FURRER (1977) have identified *Calpionellids* and benthic foraminifera of Berriasian-Valanginian age (BECK, 1986: 93).

Endoplocus renevieri (de Loriol, 1866).

- 1866 *Nerinea (Itieria) Renevieri* de Loriol: 13, pl. A, figs. 11, 12;
- 1886 *Itieria renevieri* (de L.) HERBICH, Mitt. a. d. Jahrb. K. Ungar. Geol. Anst. #8 :36, pl. 2, figs. 11-14;
- 1931 *Phaneroptyxis renevieri* (de L.) YIN TSAN HSUN Trav. Lab. Geol. Lyon, 18(14): 72, pl. 7, figs. 65-8;
- 1965b *Phaneroptyxis renevieri* (de L.) VESELINOVIC, Bol. Geol. #4: 99, pl. 4, figs. 3-12;
- 1980-b *Endoplocus renevieri* (de L.) MACSOTAY, Thèse, Univ. Lyon-I : pl. 12, fig. 13;

Occurrence: *E. renevieri* was a wide-spread taxon during Late Jurassic (Tithonian)- Eocretaceous (Berriasian) shallow shelves of the Tethys Ocean (DIETRICH, 1925); Western European, Balkanic, and Apulian Subprovinces.

S.C.S. occurrence: Locality MO-1451-a dirt road from El Tocuyo to Ira, Lara State, aphanitic limestone olistolith reworked into conglomerates of

Guayamure Formation, of Middle-Late Albian age (MACSOTAY & VIVAS, 2011). The most frequent fossil in the olistoliths in this locality, is *Trichites picteti*, of Berriasian-Early Valanginian age.

Subfamily ***PHANEROPTYXISINAE*** Pchelintsev, 1965.

Genus ***Phaneroptyxis*** Cossmann, 1896, emend. Pchelintsev, 1965.

The Biochron of *Phaneroptyxis* extends ftom Middle Jurassic (Bathonian) to Eocretaceous (Barremian) age. It evolved in many species, distributed in tropical subprovinces of Gondwana Province: Western European, Apulian, Balkanic, Syrian Japanese-East Asian and Somalian; also in East African Province. From S.C.S. has been cited only from Mexico. RAHMAN (1967: 119) considererd the genus *Ituvia* Stoliczka, 1867, -Cenomanian to Campanian, in the Mesogean Tetrhys Ocean- as a descendant of *Phaneroptyxis.*

Phaneroptyxis anguillina (Castillo & Barcena)
Plate 26, fig. 23; plate 29, fig. 17;

- 1877/78 *Nerinea anguillina* Bárcena, Ann. Mus. Nac. Mexico 1:201, figs. 25, 26;
- 1879 *Nerinea arnaudi* MATHERON, pl. C-16, figs. 2, 26; (no description)
- 1897 *Nerinea (Itieria) anguillina* CASTILLO & BARCENA, Bol. Inst. geol. Mexico, 4-6: 380, figs. 13, 14;
- 1916 *Phaneroptyxis cureti* COSSMANN, Mem. Soc. Geol. Franç. 21(51): 12-13, pl. 54, fig. 25;
- 1918 *Phaneroptyxis arnaudi* (M.) COSSMANN: 348, pl. 10, fig. 18;
- 1956 *Phaneroptyxis anguillina* (C. & B.) ALENCASTER DE CSERNA, Paleont. Mexicana 2:40-41, pl. 7, figs. 11, 12;

Occurrences: *Ph. anguillina* (C. & B.) is a big sized gastropod, collected originally from Huétamo, Michoacan state, Mexico, from Early Aptian Zapotitlán limestones and not Cenomanian, as was stated by DIETRICH (1925: 146). Both species named by Cossmann were collected fom the Urgonian limestones, France, of Barremian-Early Aptian age, but also were collected in Switzerland, Italy, Argelia, Syria, Lebanon, Iran Saoudi Arabia and Croatia, in the same horizon.

S.C.S. occurrences: Locality MO-1653, in sparitic limestone olistolith, collected in La Osa Member of Barquisimeto Formation, of Turonian age (MACSOTAY, 1980-B, pl. 12, fig. 15). Also found in situ in MO-1324, on Carora-Curimagua road, Lara state, in Tibú Formation, of Late Barremian-Early Aptian age (MACSOTAY, 1980-a). Also in MO-3162, in Lower Borracha Formation, of Late Aptian age.

Discussion: *P. bjelishensis* (CHARTVET & TERMIER, 1971, A. S. G. N. #91: 189, pl. 31, figs. 1-4) – Tithonian-Berriasian species of Bosnia, Balkanic Subprovince,- which differs from P. aguilerae in having two small columellar folds, in place of one. It could have been the ancestor of *P. anguillina.*

Family ***TROCHACTEONIDAE*** Sohl & Kollmann, 1985.

Genus /Subgenus ***Trochacteon (Trochacteon)*** Meek, 1863.

With a Biochron of Eocretaceous (Barremian) to Early Paleocene (Danian) age, it evolved in many species. Their distribution followed the saline shelfal seas in tropical but also in temperate climatic zones. Subjective synonyms include: *Spiracteon* Meek, 1863; *Mesotrochacteon* Hacobjan, 1972; *Neotrochacteon* Hacobjan, 1972; *Purpuracteon* Hacobjan, 1963, detailedly discussed by SOHL & KOLLMANN (1985, Us. S. G. Surv., Prof. paper 1304: 47-48).

Subgenus ***Neocylindrites*** Sayn, 1932.
(=*Palaeotrochacteon,* Hacobjan, 1972).

With a Biochron extended from Eocretaceous (Barremian) to Late Cretaceous (Maastrichtian) it coincides with the Taxa Group two of SOHL (1987). It has a thermophyllic distribution, favored by hypersaline marine habitats, in all the shallow seas of the Tethys Ocean.

Description: Cylindrical shell, of medium size, thin, high, with a low spire. Internally, with 2-3 columellar folds (KOLLMANN, 1963).

Trochacteon (Neocylindrites) abbreviata (Conrad, 1852).
Plate 26, figure 28;

- 1852 *Nerinea abbreviata* CONRAD in LYNCH, Palestine Expedition, App. 233, pl. 5, fig. 36;
- 1878 *Actaeonell Absalonis* FRAAS: 65, pl. 6, fig.9;
- 1890 *Actaeonella Absalonis* (F.) BLANCKENHORN, Beitr. Geol. Syriens :117 (ex parte) pl. 9, fig. 4;
- 1932 *Trochacteon barremicus cylindrica* SAYN, Trav. Lab. Geol. Lyon, Mem. 15 :8-9, pl. 1, fig. 6;
- 1939 *Actaeonella abbreviata* C., DELPEY, Gastr. Mesozoique: 229-230, fig. 174;

Occurrences: Originally collected in the *Trigonia* sandstone of Abeih, and Antelias, in Lebanon; in the

second fossiliferous horizon of Beit Chèbab, of Early Aptian age. Is relatively common in the Orgon Formation, France, of Late Barremian-Early Aptian age. Its occurrence in the *Nerinea* marbles of Beit Méri and Ouadi el Djoz, near Jeruslem, in Palestine is not proved yet.

S.C.S. occurrence: Locality MO-892, in the ferrolithic limestones in the cliff northwest of Puerto Escondido inlet, Taguarumo Formation, (DAGM) of Late Barremian age. Many well-preserved shells in a bed rich in disarticulated bivalvia.

Palaeoecology: In the Near East, it was found associated to *Buchotrigonia (Syriotrigonia) syriaca* in Abeih, Lebanon, and to *Cerithiella bilineata,* all fossils known to be of saline marine environment. In the Urgonian facies units in Western European, the Balkanic and Maghrebian Subprovinces, there is also a saline assemblage (RAT & PASCAL, 1979). The same situation was observed in the Aptian beds of Mozambique (DIETRICH, 1914).

Trochacteon (Neocylindrites) boutillieri (Cossmann, 1895)

- 1895 *Trochacteon Boutillieri* COSSMANN, Paleoconch. Comparé #1 :149, pl. 6, figs.. 18, 19;
- 1918 *Trochacteon Boutillieri* C., COSSMANN, Bull. Soc. Geol. Franç. 10(6):341;
- 1932 *Trochacteon boutillieri* C., SAYN, Trav. Lab. Geol. Lyon, 18 :10 ;

Occurrence : Collected at various localities, as Brouzet, Barcelonne, Bogaris and in many places of Orgon Formation, France, of Late Barremian age. Frequently is associated with *Campichia* in the Zone *Palorbitolina discoidea-P. conoidea.*

S.C.S. occurrence: Locality VG-459, Pica de El Algarrobo-Cerro El Pato, río Santa Ana, Sucre state, Lower Chuparipal Formation, (DEP) of Early Barremian age. Also in VG-672, behing the Church at Nueva Colombia village, Sucre State, in carbonatic Taguarumo Formation (DAGM), of Late Barremian age. Here it is associated to *Amphitriscoelus waringi* and *Praecaprina varians.*

Family ***ACTAEONELLIDAE*** Zilch, 1959-1960.

The Biochron of the *Actaeonellidae* is intra-Cretaceous (Barremian-Maastrichtian). According to SOHL (1987: 1101), it shows only modest diversity, through the Albian, but then diversify rapidly during Cenomanian to Coniacian: see PCHELINTSEV (1953, fig. 45). They maintain high level of diversity until Maastrichtian times, mainly in the western hemisphere. Present in Venezuela, they were never cited from Colombia.

Paleoecology: The anomalies of distribution of the shells of this family suggest necrophagous habits: they became dominant taxa in the borderlands of the anoxic Oceans. A habit comparable to the living *Marginellidae* of the tropical oceans in present times. I add the fact of high salinity, something that was not considered by KOLLMANN (1965, A.N.M.W. 68: 257-259) in his speculations about the paleoenvironment of the genus *Actaeonella* in the Late Cretaceous Gosau Group, studied intensely in Austria.

Genus ***Actaeonella*** d'Orbigny, 1842.
Subgenus ***Pchelincevella*** Djalilov, 1972.

Pchelincevella subgenus, was proposed for *Acteonellid* shells ranging from small to large, filiform, amygdaloid, with narrow apex and slightly rounded lower end. Aperture narrow, of practically uniform width throughout its length (DJALILOV, 1972, Paleont. Jour. 6[1]: 17); Fourteen species were originally included in this subgenus from the Albian-Campanian of Western European subprovince, Transcaucasia and Central Asia. In my files, there are many more Cretaceous taxa:

1. *Actaeonella (Pchelincevella) caucasica* (Zekeli, 1852) Vraconnian – Cenomanian,
2. *A. (P.) caucasica grossouvrei* (Cosmmann, 1902) Albian - Coniacian
3. *A. (P.) caucasica schiosiensis* (Böhm, 1894) Santonian
4. *A. (P.) crassa* (d'Orbigny, 1842) Turonian,
5. *A. (P.) cubensis* Sohl & Kollmann, 1985 Late Campanian-Maastrichtian
6. *A. (P.) elongata* KOLLMANN, 1965 Santonian?
7. *A. (P.) gracilis* (Douville, 1916) Late Albian
8. *A. (P.) gracilis* (Pchelincev, 1954, non Douville) Coniacian
9. *A. (P.) grandis* (Pchelincev, 1954) Cenomanian
10. *A. (P.) involuta* (Coquand, 1862) Santonian
11. *A. (P.) jicarensis* Sohl & Kollmann, 1985 Middle Maastrichtian
12. *A. (P.) laevis laevis* (Sowerby, 1835 Santonian-Campanian
13. *A. (P.) marchmontensis* Sohl & Kollmann, 1985. Middle Maastrichtian
14. *A. (P.) obtusa* (Zekeli, 1852) Cenomanian
15. *A. (P.) peruviana* (Olsson, 1938) Aptian-Albian
16. *A. (P.) roashensis* (Abbass, 1963) Santonian

17. *A. (P.) robinsoni* Sohl & Kollmann, 1985 Maastrichtian
18. *A. (P.) sinaiensis* (Abbass, 1963) Santonian
19. *A. (P.) sublaevis* (Briart & Cornet, 1868) Albian – Cenomanian
20. *A. (P.) syriaca* (Conrad, 1852) Cenomanian-Santonian
21. *A. (P.) zouparriensis* (Choffat, 1902) Late Turonian

Actaeonella (Pchelincevella) baconica (Benkö-Czabalay, 1962).
Plate 23, figures 9, 10;

- 1962 *Actaeonella baconica* BENKÖ-CZABALAY, Geol. Hungarica, Paleont. 31: 270, pl. 7, figs. 6-16;
- 1954 *Cyraea riachuelana* Maury?, VON DER OSTEN, Bol. Geol. Caracas, 3(8): 176, pl. 15, fig-3; (non MAURY, 1936, Mem. Serv. Geol. Min. Brazil, 9:222, pl. 14, fig. 13).

Occurrence: Originally collected in *Munieria* marls, at Lókút, Ajka and Csingervölgy, Zirc area, north Bakony mountains, Hungary of Late Aptian age. Also in marl-limestone alternations with Radiolithids of Albian age.

S.C.S. occurrence: Punta Fuera, Caraca del Oeste island, Sucre state, in Upper Taguarumo Formation, of Late Barremian age (VON DER OSTEN, op. cit.). Also in MO-896, Puerto Escondido inlet, Sucre state, in sideritic limestone, of Upper Taguarumo Formation, of Late Barremian age (Text-figure V-05): two shells, lacking both extremes.

Actaeonella (Pchelincevella) gracilis (Douville, 1916).
Plate 50, figures 20, 21;

- 1916 *Acteonnella (sic) gracilis* DOUVILLE, M. Acad. Sci. Inst. Fr.,ser 2 #54 :147, pl. 18, fig. 34 ;
- 1939 *Acteonella sp. Indet.* DELPEY, Notes et M.S.E.Geol. Haut-Comissariat R.Fr. en Syrie et Liban #3 :231, fig. 182 ;
- 1955 *Acteonella gracilis* D., MAHMOUD, P. I. D. Egypte: 155-156, pl. 17, figs.29-31;

Occurrence: Collcted originally at Djebel Manzur, Sinai peninsula, Egypt, in Late Albian age limestones. At the same horizon in Syria.

S.C.S. occurrence: Locality VG-02, Quebrada Los Hoyos, southeast of Cerro Grande, Monagas state, Caripito Member of Chimana Formation, (DBG) of Middle Albian age, where it is abundant.

Genus ***Peruviella*** Olsson, 1944. (=*Peruvia* Olsson, 1934 non Mallock, 1929; =*Ovacteonella* Djalilov, 1972).

The Biochron of *Peruviella* Olsson, 1944, is intra-Cretaceous: Aptian to Coniacian which seems to coincide with the presence of toxic sediments along the borderline of the Anoxic Oceans (See Text-Figure VII-07). This is one more evidence of the necrophagous habits of these gastropoda.

Diagnosis: Shell ranging from moderately large to large, dilated-oval, pyriform, tumid. Spiral sculpture only in early growth stages. Aperture narrow, widening downward. Umbilicus of varying width, sinuate. Columella completely involute. The pillar and anterior portion of each whorl is strongly thickened with callus deposit; columellar folds are absent at maturity or they are reduced to a single small plait situated at the upper edge of the parietal callus.

Observations: The main difference of *Peruviella* with the Genus *Volvulina* Stoliczka, 1865 – Cenomanian to Campanian age, in all the Tethys Ocean extending fom Mexico and Perú to Tibet, in central Asia,- is the lack of three columellar folds in the mature whorls. *Peruviella* could be the ancestral form of *Volvulina,* as they share the same biochoremas.

Peruviella gerthi (Olsson, 1934).

- 1934 *Peruvia gerthi* OLSSON, Bull. Amer. Paleont. 20(69): 73, pl. 9, figs. 1, 2, 3;
- 1944 *Peruviella gerthi* (O.) OLSSON, Bull. Amer. Paleont. 20(69):37;
- 1979 *Peruvia gerthi* O., CAMPOS, GUEDEZ & OSUNA, Bol. Geol.(Caracas), 13(25):47, fig. 2;

Description: Shell of medium size, ovate, globose, spire completely enveloped by the last whorl, but with the apical portion of the shell somewhat produced and pointed; the sides of the whorls in the posterior region are noticeably impressed, while just below the whorl appears slightly shouldered; the base of the body whorl is rounded, ending in a small, proyecting beak; surface smooth except for lines of growth; characters of complete aperture unknown; columella solid without folds; internal characters as described above. (OLSSON, 1934: 73).

Dimensions: Height: 50,0 mm, Diameter: 34,0 mm (Pananga Formation, Peru).

Occurrence: Pan de Azúcar, Pananga Formation, northwest Perú, of Late Aptian-Early Albian age, where it is abundant.

S.C.S. occurrence: Locality MO-1145, road to Guarico town, Portuguesa state, Bobare Formation, Lara Nappe of Albian (?) age. All shells are sparitized, but natural sections reveal the internal structure.

Peruviella sergipensis (Maury, 1936).
Plate 62, figure 7;

- 1936 *Trochacteon sergipensis* MAURY, Mem. Serv. Geol. Miner. Brasil #11 :225, 227, pl. 13, figs. 2, 5, 6, 8 ;
- 1979 *Trochacteon sergipensis* M., CAMPOS et al., Bol. Geologia (Caracas) : 13(25) :47 ;

Diagnosis: Cast of a shell involute, globose, broad and short. Internally has three very sharp, strongly marked plications. The shell measured approximately 50 mm in height and 40 cm in width (MAURY, op. cit.).

Occurrence: Porto do Pedrinho, and at Riachuelo, Sergipe, Brazil, of Middle Albian age.

S.C.S. occurrence: Locality MO-1659, road from Carora to Curimagua, Guayamure Formation, Atarigua Unit, of Albian age (MACSOTAY & VIVAS, 2011).

Family ***ACTEONIDAE*** H. & A. Adams, 1880.
Genus ***Acteon*** Montfort, 1810.

Acteon marullensis d'Orbigny, 1842. Plate 27, fig. 18;

- 1842 *Acteon affinis* d'ORBIGNY, Paleont. Française, Terr. Cret. #2 :117, pl. 167, figs. 4-4b ; (non *Tornatellea affinis* FITTON, 1836)
- 1850 *Actaeon marullensis* d'ORBIGNY, Prodrome, 67, nº 98 ;
- 1900 *Actaeon marullensis* d'O. WOLLEMANN, Abh. K. Preuss. Geol. Landes., Berlin, 31 :176 ;
- 1995-a *Acteon marullensis* d'O., VIVAS & MACSOTAY , 14TH Carib. Geol. Conf., Port of Spain:131;

Occurrence: Very common in the Paris Basin, in Hauterivian sediments. Also in Niedersachsen, Hils Formation, of Valanginian-Hauterivian age, in northern Germany and Holland.

S.C.S. occurrence: Locality MO-881, Puerto Escondido inlet, Sucre state, in Upper Taguarumo Formation, (DAGM) of Late Barremian age; 6 shells in a sideritic limestone. Also in VG-479-A, dirt road from Guariquén-Querepe de Tierra (DGC) in glauconitic shales of Valle Grande Formation, of Middle Albian age. The four well-preserved shells, were not distinguishable from the taxon oh Hauterivian age, of the Paris Basin.

Subfamily ***CYLIBDROBULLININAE*** Wenz, 1938.
Genus ***Globiconcha*** d'Orbigny, 1843.

Globiconcha has a Biochron of Eocretaceous (Aptian) to Late Cretaceous (Senonian) age. They fit into the Taxa Group Two, evolving into the saline seas, under stressful conditions in deep shelfal environment, on carbonatic bottoms. According to WENZ (1938) its few species, were distributed in Europe, North and South America. D'ORBIGNY (1842-43) wrote: "je réunis, sous ce nom, quatre espèces de coquilles qui ne peuvent rentrer dans « aucun des autres genres de cette famille. Je n'en connais que le moule ; mais il suffit « pour bien fixer sur les caractères de ce groupe, dont toutes les espèces sont propres à « l'étage de la craie chloritée. » In my files, there are more species of different horizons of Cretaceous:

1. *Globiconcha avellanaeformis* (CHOFFAT, 1902) Middle-Late Turonian;
2. *G. baconica* HANTKEN, 1871. Albian
3. *G. coniformis* ROEMER, 1852, Cenomanian?
4. *G. fleuriausa* d'ORBIGNY, 1842, Late Cenomanian
5. *G. incerta* THOMAS & PERON, 1890, Coniacian-Santonian
6. *G. marrotiana* d'ORBIGNY, 1842, Late Cenomanian
7. *G. maxima* VILANOVA, 1863, Aptian
8. *G. montsecana* VIDAL, 1921, Santonian,
9. *G?. nodosum* (SOWERBY, 1825) Cenomanian
10. *G. nuciformis* MATHERON, 1881, Santonian,
11. *G. ponderosa* (COQUAND, 1862) Cenomanian
12. *G. remondi* GABB, 1864, Cenomanian
13. *G. rotundata* d'ORBIGNY, 1842, * type of *Globiconcha* Cenomanian.
14. *G. utriculus* COQUAND, 1865, Aptian,
15. *G. weinzettli* RAHMAN, 1867 Cenomanian,

Globiconcha maxima (Vilanova, 1863)
Plate 34, figures 24, 25;

- 1863 *Acteonina (Globiconcha) maxima* VILANOVA, Prov. De Teruel, pl. 4, fig. 7;
- 1887 *Globiconcha máxima* Vilanova, MALLADA, Sinops. #3: Cretaceo inferior, : 59, nº 182.

1949 *Globiconcha máxima* V., BATALLER, Sinops. Paleont. Esp.,8(2): 135-136;

Occurrence: Originally collected at Aliaga (Teruel), Masarbonés (Tarragona) in Maestrazgo Basin, Spain, in Forcall marl Formation, of Early Aptian age (CANEROT, 1982).

S.C.S. occurrence: Locality MC-382-A, Cerro de Piedra, Monagas state, (DBG) of Lower Garcia Formation, of Early Aptian age. Two pseudomorphs of goethite, hardly embedded associated to bivalvia and gasteropoda.

Globiconcha cf. ponderosa (Coquand, 1862)
Plate 34, figure 22;

- Cf. 1862 *Globiconcha ponderosa* Coquand, Soc. Emul. Provence, Mem. 2: 168-169, pl. 3, fig. 8;
- Cf. 1890 *Globiconcha ponderosa* C., PERON, Exploration S. Tunisie #1: 59-60;
- Cf. 1904 *Globiconcha ponderosa* C., FOURTAU, B. I. Egyptien 4(4): 270;

Description: Cast of a globular shell, resembling to a whipping-top, almost as high as wide; 348perture moon-shaped, wide anteriorly and narrowing posteriorly. Diameter: 65 mm (COQUAND, 1862: 178-179). Our casts, of about the same size, but wider than high: Height: 63 mm, Width: 77 mm (restitution of an incomplete cast).

Occurrence: Originally studied from Saint-Trojan, Charente, France, of Cenomanian age. Later, discovered in Tenoukla, Tunisia, Tanger, Morocco, Aïn Araïdah, Egypt, always in Cenomanian sediments. In Maghrebian Subprovince, is usually associated to *Cameleolopha syphax* (Coq.) and *C. nicaisei* (C.).

S.C.S. occurrence: Locality MO-892, Borracha Island, La Cueva inlet, (DAGM), Upper Borracha Formation, of Early Albian age; many specimens. Also in MO-2772, Quebrada La Previsora, Monagas State, Upper Guacharo Member of El Cantil Formation, of Early Albian age. Our cast differs from *G. ponderosa* (C.) in having a lower spire, but otherwise has the same proportions: it could be the ancestor of the nominal species.

Globiconcha utriculus (Coquand, 1865)
Plate 38, figure 10 ;

- 1865 *Globiconcha utriculus* COQUAND, Mem. Soc. Emul. Prov., #3 :260, pl. 13, fig. 1 ;
- ?1863 *Natica Cavanillesi* VILANOVA, Teruel… :pl. 4, fig. 1 ;
- 1949 *Globiconcha utriculus* C., BATALLER, Sinops. Cret. España, 8(2) : 137 ;
-

Occurrence : Originally collected at Cuatro Dineros, de Cabra a Montalbán, Teruel, Maestrazgo Basin, in Benasal Formation, of Latest Aptian (=Clansayesian) age. *N. cavanillesi* Vilanova, collected in Mirambel, is a juvenile shell, of the same unit.

S.C.S. occurrence: Locality An-77, Cerro Las Callecitas, Anzoategui state, (DBG) El Cantil Formation, of Late Aptian (Gargasian age). Also in the lowest calcareous sandstone bed, in the road Zea-Las Cocuizas, Merida state, basal Aguardiente Formation, of Middle Albian age (GHOSH & GARCIA JARPA, 1980: 109, fig. 2).

Globiconcha sp. indet., Macsotay
Plate 52, figure 13;

- 1903 *Cypraea sp.,* SHATTUCK, U.S. Geol. Surv., Bull. 205: 86, pl. 22-1, 2;
- 1888 *Tylostoma globosum* Sharpe? WHITE, Mus. Nac. Rio de Janeiro, Arch. 7: 190, pl. 17, fig. 10;(non SHARPE, 1849, Quart. Jour. Geol. Soc. London, #5:379, pl. 19, fig. 5).
- 1928 *Cyprea sp.* Shattuck, ADKINS, Univ. Texas Bull. 2838: 192;

Occurrence: In Lastro, Maroim, Sergipe Province, Brazil, two fragmentary natural casts of a shell were obtained in the Ganhamaroba Group, of Middle Albian age (WHITE, op. cit.). Also located in Shoal Creek, Austin, Buda Formation, Texas, of Early Cenomanian age.

S.C.S. occurrence: Locality MC-431-A, on road west of Catuaro, Hacienda, Sucre state, (sDLP, DGC) in Valle Grande Formation of Middle Albian age; four casts of juvenile shells, in clay-shale sequence, with a glauconitic hard-ground where the fossils are pseudomorphs of goethite. Also found in MO-1659, western Venezuela, on Carora-Curarigua road Lara state, in Guayamure Formation, of Middle to Late Albian age (MACSOTAY & VIVAS, 2011).

Palaeoecology: Coincidentally, both Venezuelan localities of Albian age, where *Globiconcha* sp. indet. was collected, had bathyal molluskan assemblages, proposed as **600 – 800 meters of palaeodepth.**

Family ***RINGICULIDAE*** Philippi, 1853.
Genus ***Eriptycha*** Meek, 1876.

The Biochron of *Eriptycha* extends from Eocretaceous (Neocomian) to Late Cretaceous (Maastrichtian)(POPENOE, 1954). It coincides with Taxa Group Two of SOHL (1987), having originated in saline seas in subprovinces all around Gondwana Province, and the Paleo-Pacific, too.

Eriptycha busnardoi new species, Macsotay
Plate 24, figure 10;

- Cf. 1918 *Eriptycha granum* COSSMANN, Bull. Soc. geol. France, 10(6): 345, fig. 7;
- 1980-a *Eriptycha aff. lachryma* (Michelin) MACSOTAY: 46;

Description: Subspherical, globular shape, barely higher than wide; spire very short; three rapidly growing whorls, separated by very fine sutures; body whorl regularly ovoidal, ornamentation of spiral cords, regulars and weakly punctuated present until the non-perforated umbilical region; our specimens show an ornamentation of fine cords in the upper 2/3s, which become gradually thicker on the lower 1/3. Aperture narrow, widening gradually in the anterior area; labrum widely rounded, and regularly thickened all along. Columella is biplicated, with the posterior fold stronger.

Dimensions: It measures of Height: 7,5 mm, and width: 5,75 mm. The HOLOTYPE (Ucvmp/IO-2222), was the best preserved specimen among eight.

Etymology: This species is dedicated to Prof. Dr. Robert BUSNARDO, -Université de Lyon-I, Lyon, France, - one of the most active Eocretaceous ammonite researcher of his time, and who was my field-guide on Eocretaceous outcrops of France.

S.C.S. occurrence: Locality MO-896, west side of the Patiño inlet, Sucre state, (DAGM) in upper Taguarumo Formation, of Late Barremian age. Collected in a sideritic marl bed, or reddish-violet color.

Discussion: This new species is related by its general outline to *E. granum* Cossmann – Calcaire dur et oolithique, Orgon Formation, France, of Barremian age, - but it is of three times bigger size, and in having two columellar folds. *E. ringens* (d'Orbigny)(PERON, 1900) - Paris Basin and Jura region, France, and Switzerland, of Hauterivian age,- is about the same size, but it is more elongated axially, and the spiral sculpture has a reverse distribution.

Genus ***Ringinella*** d'Orbigny, 1842.
(=*Stomatodon* Seeley, 1861)

Diagnosis: Elongate-ovoid ringiculids with extended spire, ordinarily with two columellar folds of which the anterior is bifid, labrum smooth within. Biochron Cretaceous (Neocomian-Turonian). Relatively few species known from both Americas and Lesser Asia. The genus *Ringinella* should be included in the Taxa Group One of SOHL (1987) as a typical evolution in saline seas. *Ringinella lacryma* (Michelin) is an important index fossil in the Aube, France, the Albian stratotype (MONGIN, 1979-a, pl. 1, fig. 14).

Ringinella inflata (Fitton, 1836)
Plate 26, figure 19;

- 1836 *Auricula inflata* FITTON, Trans. Geol. Soc. #4: pl. 11, fig. 11;
- 1842 *Ringinella inflata* d'Orbigny, Palont. Franç. Terr. Cret. #2: 128-129, pl. 168, figs. 1-4;
- 1862 *Avellna inflata* F., PICTET & CAMPICHE, Mat. Paleont. Suisse, 2 :210 ;
- 1980-b *Ringinella inflata* (F.) MACSOTAY, pl. 17, fig. 1 ;

Occurrence : Originally collected in Folkestone, England, in Zone *mammillatum*, of Early Albian age (CASEY, 1961: 607). Later collected in Cosne, and Ervy, France, also in Albian sediments.

S.C.S. occurrence: Locality MO-896, northwest of Puerto Escondido inlet, (DAGM) Taguarumo Formation, of Late Barremian age. Also in upper Borracha Formation, MO-892, Punta La Cruz, Manare Peninsula, (DAGM) Of Early Albian age.

Family ***EPITONIIDAE*** Suter, 1913.
Subfamily ***ACIRSINAE***
Genus ***Proscala*** Cossmann, 1912.

The Biochron of *Proscala* Cossmann, is Cretaceous (Neocomian-Senonian), with a palaeogeographic distribution in Europe and North America.

Proscala dubisiensis (Pictet & Campiche, 1862)
Plate 16, figure 4;

- 1862 *Turritella dubisiensis* PICTET & CAMPICHE, Mat. Paleont. Suisse, 2 : 314-315, pl.72, fig, 14 ;
- 1987 *Acirsa sp. Indet.* LOPEZ, Thesis, :134 ;

Occurrence: Originally found in Pierre Jaune, Neuchatel, Switzerland, of Hauterivian age.

S.C.S. occurrence: Locality BL-034, Quebrada Quetepe, Sucre state, (DAGM) in El Dantó dolostones, of Hauterivian age.

Subfamily ***OPALIINAE*** Cossmann & De Boury, 1912.
Genus ***Confusiscala*** De Boury, 1909.

Confusiscala De Boury has a Biochron restricted to the Cretaceous Period (Neocomian-Maastrichtian). It should be included in the Taxa Group Two of SOHL (1987), and probably evolved in the saline, stressful shelfal seas. Attained wide distribution: Both Americas, South Africa, Indonesia, Lesser Asia and Europe. CALZADA (1973) gave a good review of the most common species.

Confusiscala dupini (d'Orbigny, 1842)

- 1861-64 *Scalaria dupiniana* d'Orbigny, PICTET & CAMPICHE, Mat. Paleont. Suisse, #1:332;
- 1915 *Confusiscala dupiniana* (d'O.), COSSMANN,): 73-74, pl. 3, figs. 27, 28, 37, pl. 4, fig. 41;
- 1916 *Confusiscala cf. dupini* (d'O.) DOUVILLE, Moghara, : 143, pl. 18, fig. 29;
- 1938 *Epitonium (Confusiscala) dupiniana* (d'O.) JAWORSKI: 528-529;
- 1962 *Confusiscala dupiniana* (d'O.) BENKÖ-CZABALAY, Geol. Hung., Paleontology #31:261-262, pl. 1-3;
- 1949 *Scala Franciscae* COLLIGNON, Ann. Geol. S. Min., Madagascar, 16:29-30, pl. 5, figs. 1, 2, 3;
- 1980 *Confusiscala dupiniana* (d'O.) MONGIN & PEYBERNES, P.-P.-P. 32(1980/81): 233;
- 1995-b *Confusiscala dupiniana* (d'O.) VIVAS & MACSOTAY, Bol. Geol. (Caracas) Publ. Esp. 11:136;

Occurrence: Originally collected at Ervy, Gérodot, Courcelle (Aube), Novion, Clansayes, and elsewhere in France, in Albian age sediments. In Perte-du-Rhone, Saxonet, Switzerland; also in Poland, England and northern Germany in the same horizon. In Magrebian Subprovince it is found already in Gargasian-Clansayesian stages (Late Aptian) and continues up to Late Albian times. In Bakonynána, Tilos Erdö, Hungary, in glauconitic marls of Early Cenomanian age.

S.C.S. occurrence: JAWORSKI (1938, B. S. N. Jb. Min. B, #76 : 528-529) cited *Epitonium (Confusiscala) dupiniana* (d'O.) from Alto Paramillo, Río Tarra, along the San Pedro-La Cruz road, (North Santander dept.) Colombia, in Tablazo Formation, of Late Albian age. VIVAS (1987) reported several pelomorphically deformed casts from Caripito Member of Chimana Formation (DBG) of Middle Albian age.

Confusiscala infulata (Wollemann, 1900)
Plate 26, figure 22;

- 1900 *Scalaria infulata* WOLLEMANN, Jb. K. preuss.geol. Landesanst,#27: 164-165, pl. 8, fig. 5;

Occurrence: Originally studied from Moorhütte, Braunschweig, Niedersachsen, Germany in Hilston Formation, of Hauterivian age. Cited also from Barranco del Abad, Maestrazgo Basin, Spain, from Mirambell marl Formation, of Early Hauterivian age.

S.C.S. occurrences: Locality MO-3213, Lope inlet of Chimana Grande Island, (DAGM) from Lowermost Taguarumo Formation, of Late Hauterivian age.

Family ***RETUSIDAE***

In Neocomian sediments, *Retusidae* were silty-bottom dwellers, associated with high salinity of the waters. Its morphotypic equivalents, living species of *Scaphander* in Santa Fe baylet, northeastern Venezuela, proliferated in soft bottoms, between 50 and 150 meters of depth (MACSOTAY, 1975: 471).

Subfamily ***CYLICHNINAE*** (=*Aceridae* Cossmann, 1895)
Genus ***Acera*** O. F. Müller, 1776

According to DELPEY (1939) the Biochron of *Acera* extends from Middle Jurassic (Bathonian) to Late Cretaceous (Maastrichtian) times. The known Cretaceous species are:

1. *Acera barremiensis* GILLET, 1921a. Late Barremian
2. *A. brownii* (WHITE, 1887) Middle Albian
3. *A. choffati* (RENNIE, 1945) Late Campanian-Maastrichtian
4. *A. constricta* (STEPHENSON, 1941) Campanian
5. *A. depressa* TAVANI, 1948. Maastrichtian
6. *A. eliai* SHALEM, 1928. Early Cenomanian
7. *A. fourtaui* GRECO, 1916. Cenomanian
8. *A. gregoryi* BULLEN-NEWTON, 1916 Maastrichtian
9. *A. neocomiensis* COSSMANN, 1895. Hauterivian-Barremian
10. *A. orbignyi (*GUERANGER, 1867) Cenomanian
11. *A. ovata* (BRIART & CORNET, 1868) Cenomanian
12. *A. perstriata* TAVANI, 1948. Campanian
13. *A. phoenicia* SHALEM, 1937. Aptian-Albian
14. *A. reperta* COQUAND, 1865. Aptian
15. *A. siliciosa (*WHITFIELD, 1891) Cenomanian
16. *A. thevestensis* (Coquand, 1862) Cenomanian.

Acera cf. neocomiensis (Cossmann, 1895)
Plate 25, figures 2, 3;

- Cf. 1895 *Acera neocomiensis* COSSMANN, Paleoconch. Comp. #1: 153, pl. 6, figs. 23-24;
- Cf. 1900 *Acera neocomiensis* C., PERON, Bull. S. S. H. n. Yonne, 53: 48-50, pl. 2, fig. 6;
- Cf. 1921-a *Acera neocomiensis* C., GILLET, B.Soc. Geol. France, 4(21): 40;
- 1980-b *Acera neocomiensis* C., MACSOTAY, Thèse, U. Lyon-I: 49;

Diagnosis: Our Shell belongs to the same group of *A. necomiensis* C., with the main difference of the labrum is convex, not parallel to the opposite side of the body whorl, and developing an angularity with the lower part of the peristome.

Dimensions: Our best preserved shell measures, of height: 14,5 mm and of width: 11,5 mm. The nominal species measured, 16 mm X 14 mm.

Occurrence: Originally studied from Gy-l'Evêque, Marolles, France, of Hauterivien age. It is relatively common in the Paris Basin, France, and in Switzerland, in Hauterivian-Late Barremian horizons.

S.C.S. occurrence: Locality MO-892, Cachimena inlet, Sucre state, (DAGM) Lower Taguarumo Formation, of Hauterivian-Early Barremian age. Associated to *Trochacteon (Neocylindrites),* amd many molluska of hypersaline affinities.

Palaeoenvironments: PERON (op. cit.) wrote: We have to consider, that living *Acera,* have extremely thin, flexible and fragile shells. These are nektonic animals whose body did not fit inside their shells, and lived on marine algae at **depths of 25 to 100 meters.** It is surprising to find the shells of these animals at Saints and at Gy-l'Evêque among a corallian fauna, surrounded by corallophylic gastropods of thick and resistant shells that lived near the shoreline, in shallow waters. In present times, along the shorelines of Venezuela and Trinidad, most of the patch-reefs and offshore islands, are inhabited by thick-shelled gastropoda during daylight, and many nektonic molluska enter during the night (MACSOTAY & CAMPOS, 2001). Thick-shelled carnivorous gastropoda as *Fusinus (Fusinus)* and *Strombus (Strombus)* live and thrive, down to depths of 120 meters.

Comparisons: A related species, "*Bulla" reperta* Coquand (1865, Mem. S. Emul. Prov., #3: 83, pl. 3, figs. 11, 12, 13) – Chert, prov. Castellón de la Plana, Maestrazgo Basin, Spain, in Chert Formation, of Early Aptian age,- only differs from *A. cf. neocomiensis* (Cossmann) in having a well-rounded peristome, and a more cylindrical body whorl. *Acera orbignyi* Gueranger (1867:12, pl. 14, fig. 35) – of Sarthe, France, in Baalbeck-Ain Arous, Lebanon and Ouadi Modjib, Palestine always in Cenomanian age sediments, - is a somewhat bigger species, having developed weak wrinkles in the subsutural area.

Genus and Subgenus ***Cylichna (Cylichna)*** Lovén, 1846.

According to WENZ (1938) its Biochron extends from Late Cretaceous (Senonian) to Recent, virtually cosmopolitan including Arctic seas and Australia. *Cylichna*-like shells are known from Late Jurassic (Kimmeridgian?) and Early Cretaceous (Berriasian-Valanginian?).

Cylichna (Cylichna) tombecki (Pictet & Renevier, 1858)
Plate 45, figure 8;

- 1858 *Acteonina Tombeckiana* PICTET & RENEVIER, Paleont. Suisse, Terr. Apt. :172;
- 1862 *Bulla (Cylichna) Tombeckiana* P. & R., PICTET & CAMPICHE, Mat. Paleont. Suisse, #2:173, pl. 60, figs. 3, 4 ;
- 1921-a *Tornatina (Retusa) tombecki* P. & C., GILLET, Bull. Soc. Geol. France, 4(21): 40, pl. 3, fig. 22;

Occurrence: Originally collected from the Marne Jaune Formation, of Perte-du-Rhône, Switzerland, of Early Aptian age. In the Paris Basin, France, is common in the Late Barremien age beds at Wassy.

Diagnosis: Shell elongate-ovate, height twice the width, aperture with subparallel sides, narrow above the middle, wider below; anteriorly, only 4-5 smooth, spiral grooves. Maximum height of the shell: 22,9 mm, Width, incomplete: 13 mm. The type measured 17 mm of height.

S.C.S. occurrence: Locality HA-4437, trail from Jabon to San Pedro, Trujillo state, lower carbonatic member of Peñas Altas Formation, of Late Barremian-Early Aptian age (ARNAUD et alii., 1999, fig. 18).

Family ***SIPHONARIIDAE***
Genus ***Brunonia*** Müller, 1898

The Biochron of *Brunonia* Müller, extends from Eocretaceous (Barremian) to Late Cretaceous (Coniacian). Formerly placed among the *Patellidae,* the Genus *Brunonia* exhibits a main difference in habitat: they are solitary animals, which preferred the outer shelf carbonatic bottoms. This genus necessarily must be included in Taxa Group Two of SOHL (1987), and its evolution is related to the general salinization of shelfal seas during Gallic times.

Brunonia pervinquieri Dimitrova, 1974.
Plate 30, figure 15;

- 1912 *Acmaea sp. indet.* PERVINQUIÈRE, Carte Géol. Tunisie, :9, pl. 1, figs. 19 a-b ;
- 1974 *Brunonia perviquieri* DIMITROVA, A. Bulg. Sc., Foss. of Bulgaria, IVB: 14, pl. 1, fig. 5;

Occurrence: Originally collected at Djebel Serdj and D. Djaoudda, Tunisia, in Aptian age sediments. In

Béléné, it was collected in clayey limestones of Late Aptian age, and in Vratza district, Bulgaria in Early Albian marls.

S.C.S. occurrence: Locality MC-445-C, road from Campo Alegre to Teresén, Monagas state, Guácharo member of El Cantil Formation, (sDLP, DGC) of Early Albian age. Two well-preserved casts in marl interbed among massive limestones.

Dimensions: This fossil, originally identified as *Helcion* and later, as *Acmaea sp. indet.* by PERVINQUIERE (op. cit.), was a big-sized cast: Maximum diameter: 75 mm, minimum diameter: 62 mm, and Height: 20 mm. The Bulgarian samples are smaller: Max. diameter: 44 mm, Min. diameter: 30 mm, and height: 8 mm. Our cast, measures of Max. diameter: 49 mm, and of Min. diameter: 39 mm.

Palaeoecology: I propose as a living equivalent *Umbraculum cf. U. plicatulum* (Von Martens) – MACSOTAY & CAMPOS, (2001: 118, pl. 9, figs. 13, 14, 16, 17) who reported capturing 3 living animals between 30 and 40 meters of depth on Margarita Shelf, offshore Venezuela,- and down to 175 meters, in Barbados Island, on soft bottoms. These parameters are coincident with the ones proposed for the distal Guácharo member limestones, in this study.

APTYCHI

Lamellaptychus Arkell, Treatise on Invert. Paleontology, Pt. L: 439;

Lamellaptychus Macsotay, Plate 13, figure 1;

S.C.S. occurrence: Locality MC-341-C, La Hacienda on Rio Carinicuao, Sucre state, El Dantó dolostones, (DGC) of Hauterivian age. This fossil is included in this study, for being the first time that an *Aptychi* is cited from Venezuela or Colombia.

Occurrence: In West-central Cuba, there is a stratigraphic unit called *Aptychus* limestone, (BUTTERLIN, 1956: 35) of aphanitic brown limestones, containing *Aptychi,* molds of ammonites, scarce molluskan shells, and abundant radiolarites reaching to 400 meters of thickness. In Camagüey province, there are thick beds of gypsum in the upper part of the unit. Because of the resemblance of the *Aptychi*, to European forms, they were dated of Neocomian age. This unit is of bathyal origin, (VAN WESSEN, 1943, RUTTEN, 1936 in BUTTERLIN op. cit.) and underlays the Tuff Series of 8 Km of thickness, which in Cuba is the best evidence for the in situ formation of the Greater Antilles Terrain (see Text-figure I- 02).

Palaeoeology: Unfortunately, the "scarce molluskan fossils"of the *Aptychus*-limestones (=Palenque Formation, fide MEYERHOFF & HATTEN, 1974, which reach 400 meters of thickness) were not published yet: their study would help to establish the palaeogeographical relationship with the Southern Caribbean Subprovince, including the salinity of the seas

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CLASS SCAPHOPODA
Family DENTALIIDAE

Genus ***Dentalium*** Linné, 1758.

GARDNER in CLARK et al., (1916: 509) wrote: "This genus is one of the most ancient of all "the Molluskan Phylum. There is evidence of it early in the mid-Paleozoic, and in the Late "Mesozoic it was abundantly represented. The recent species number about one hundred "and fifty. The larger forms are many of them bathyal and abyssal. The animal lives, for "the most part, buried head downward in unconsolidated sand or mud, with the mantle "spread to function as a gill, and the posterior end of the test extending obliquely upward "into the clear water." According to updated literature, there is no evidence of the presence of *Dentaliidae* in the Cretaceous sediments of the Southern Caribbean Subprovince, or the neighboring ones. This could be attributed to the high salinity in the bottom waters, because the organic-rich "black shales"were relatively common in that time and place. The frequency of carbonaceous shales with abundant *Chondrites, Teichichnus and Palaeophycus* are withnesses of the great volume of organic carbon in these sediments.

Dentalium cf. cylindricum (Sowerby J. & J. de C. Sowerby, 1812)
Plate 35, figure 19;

- 1823 *Dentalium cylindricum* SOWERBY & SOWERBY, Mineral Conchology #1: 179, pl. 79, figure 2;
- 1877 *Dentalium cylindricum* S., GARDNER, Quart. Jour. Geol. Soc. London #34 :61, pl. 3, figs. 21-25;
- 1925 *Dentalium cylindricum* S., CORROY, Bassin de Paris: 251, 307;

Occurrence: Originally collected at Emsworth, England, in Blackdown Formation, of Aptian age, where it is abundantly found (GARDNER, op. cit.). In the Paris Basin, it is collected in Wassy, Late Barremian and Gurgy, of Early Aptian age.

Description: Shell cylindrical or elliptical, slender, elongated, alike *D. cylindricum* (S. & S.) , but it is somewhat less curved. The surface is rugose with irregular varices and lines of growth; the aperture is circular, the margin thin. Length: 23,7 mm.

S.C.S. occurrence: Locality VG-280-A, trail from Santa Rosa to El Zancudo, Sucre state, Garcia Formation, (sDLP, DGC) of Late Aptian age. Also at PM-029-A, trail to La Margarita mountain, Monagas state, (DGC) Upper Taguarumo Formation, of Late Barremian age. The scarcity of *Dentaliidae* in the Eocretaceous sediments of S.C.S. could be explained by the salinity of the marine waters, but the toxicity of the mud bottoms, (ERLICH et alii., 1999, 2000), would be a reason for the absence of these molluska.

Class CIRRIPEDIA
Family SCALPELLIDAE

Genus ***Cretiscalpellum*** Withers, 1913.

According to BROOKS et alii. (1969: R277), the genus *Cretiscalpellum* is an European taxon, with intra-Cretaceous (Aptian – Maastrichtian) biochron. Its type, *C. unguis* (J. de C. Sowerby), was collected in the Albian of England.

Cretiscalpellum hausmanni (Koch & Dunker, 1837)
Plate 9, figure 18;

- 1837 *Pollicipes Hausmanni,* KOCH & DUNKER, Norddeutschland Oolitische: 52-53, pl. 6, fig. 6a-6u;

Occurrence: Originally collected from the Ellsiger Thon Formation, of Niedersachsen, Northern Germany, of Hauterivian age.

S.C.S. occurrence: Locality PM-08-B, trail from Pajareal to La Margarita Mt., Monagas state, in La Margarita mudstones, of Hauterivian age.

Dimensions: Lenght: 29,5 mm, Width: 9,1 mm. (plate 9, figure 18).

Palaeoecology: The associated fauna in sample PM-08-B, consisted in: *Limatula tombecki* (d'Orbigny), *Platymyoidea aff. rostrata* (Agassiz), *Nuculana (Rollieria) valangiensis* (Pictet & Campiche), *Parmicorbula neaeroides* (Blanckenhorn), and *Linearia multilineata* (Coquand), a fauna of endobenthic detritus-feeders, in aphotic waters, at more than **160 meters** of paleo-depth. The sample included many biodegraded fragments of scutum, with only one preserved. This is evidence, that some predators lived in the saline oxygen-poor waters.

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Plates

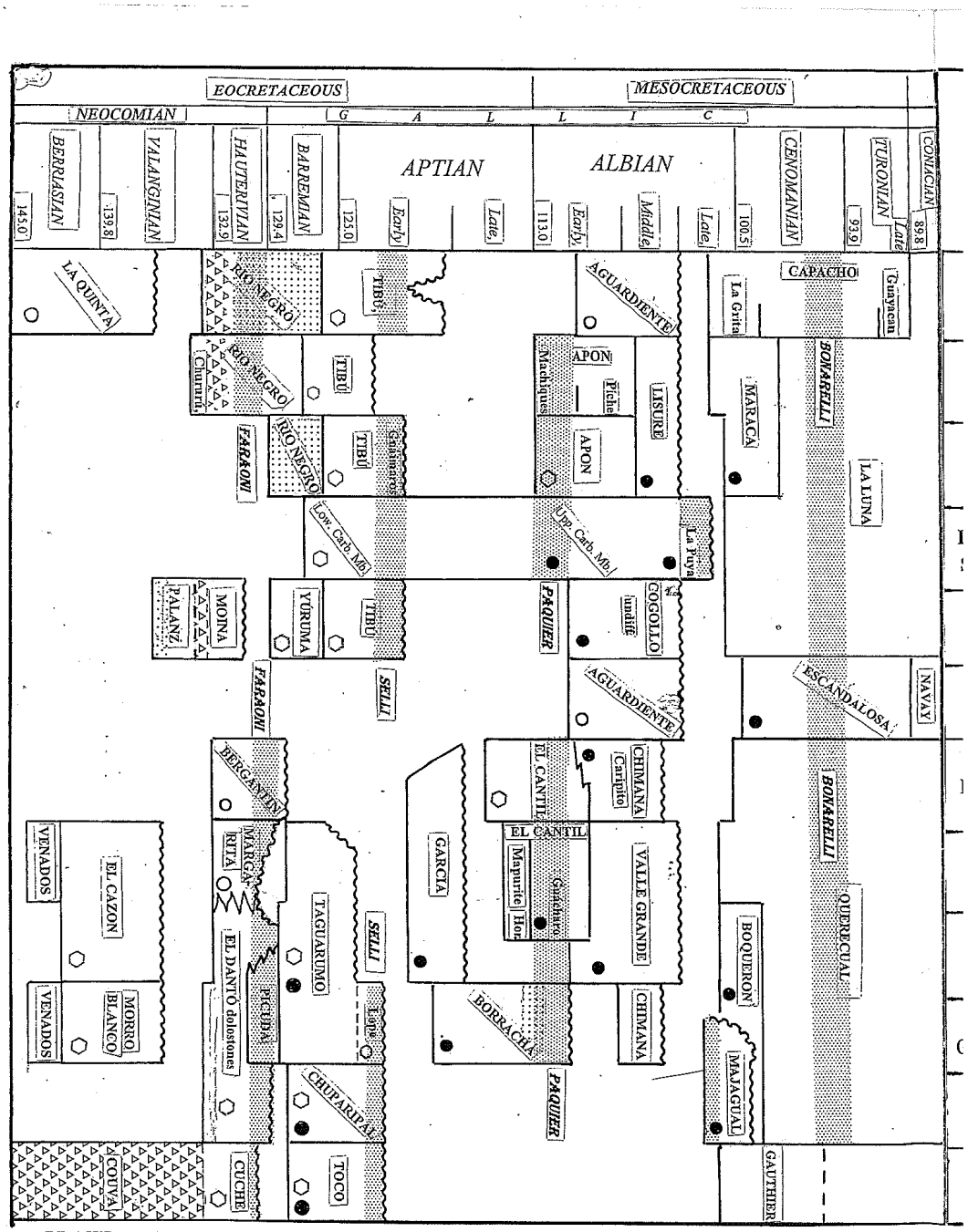

PLATE 1.- SOUTH CARIBBEAN SUBPROVINCE OF GONDWANAN PROVINCE. (S.C.S.) The ages of FORMATIONS and Members are corrected with the Molluskan Biochron ranges. Black dots: Marine mollusks; white dots: Brackish or Fresh-water; hexagons: Hypersaline/Saline mollusks. Gray bands: Oceanic Anoxic/Disoxic Events (OAE). Minute numbers taken from International Chronostratigraphic Chart v. 2013/01. GRADSTEIN, OGG & SCHMITZ et al., (1912). Black numbers represent the Domains, proposed for Venezuela by MACSOTAY (1980-B). See Text-Figure IV-01.

Plate 2

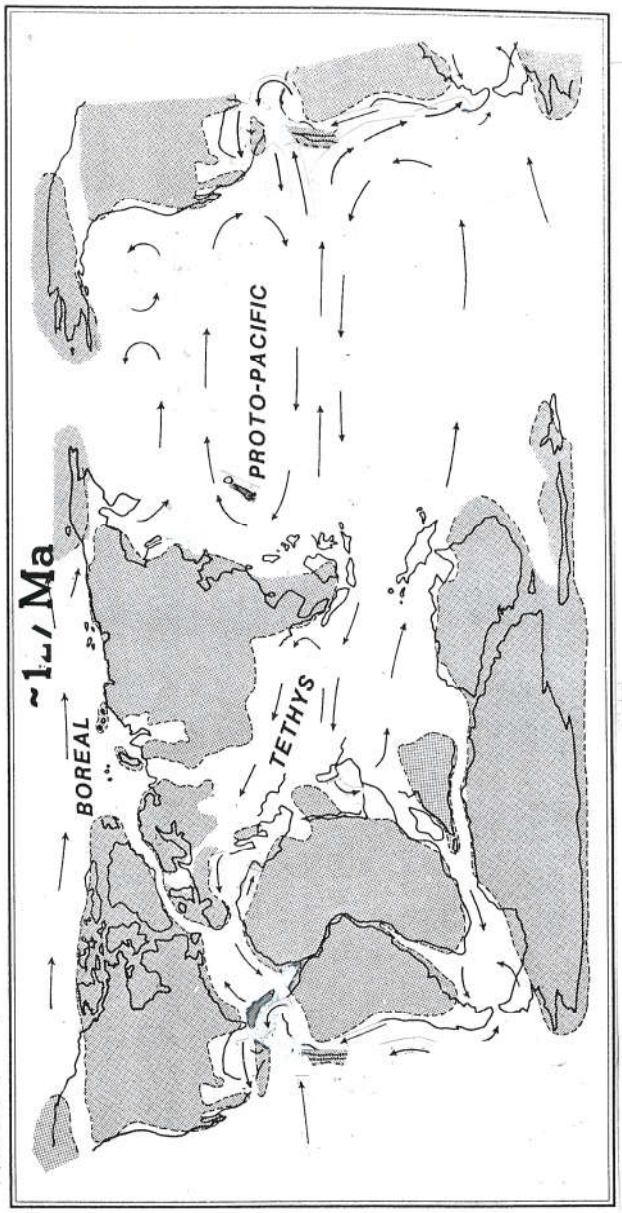

PLATE 2.- Palaeogeographic map of Barremian stage, showing the Realms: *Proto-Pacific, Tethys and Boreal,* according to SMITH et al., (1994). All Choremas are parts of these Realms. Modifications in their current systems are introduced with Japan, the Neuquén and Patagonian Subprovinces; the Caribbean area, was a basin closed to the east by the Blake-Bahamas Ridge, and to the west, by Tahamí-Calima Terrane. The Urgonian Facies reaches Japan only by Late Aptian times (SANO, 1992).

PLATE 3

Morro Blanco and Cazón Formations of Late Berriasian-Early Valanginian age.

Figure 3-1.- ***Freiastarte marcouana*** (Pictet & Campiche). X 3. Locality VG-376-B, El Cazón Formation.. -1: LV, external view.

Figures 3-2, 3.- ***Pholadomya (Procardia) malbosi*** Pictet. X 1. Locality MO-5115, Morro Blanco Formation. -2: anterior view, -3: RV, external view.

Figure 3-4.- ***Mayeria villersensis*** (Pictet & Campiche). X 2. Locality HA-4605, Morro Blanco Formation. -4: apertural view.

Figures 3-5, 5a.- ***Leviathania leviathan*** (Pictet & Campiche). X 1. Locality MO-5700, Morro Blanco Formation. -5: apertural view; -5a: details of aperture.

Figures 3-6, 6a.- ***Isoarca cf. cordiformis*** (Zieten). X 1. Locality HA-6405, Morro Blanco Formation.. -6; frontal view, articulated specimen; -6a: RV, external view.

Figure 3-7.- ***Ampullospira simillima*** (Choffat). X 1. Locality MEM, Su-216, Morro Blanco Formation, -7: apertural view.

Figures 3-8, 8a.- ***Eunerinea (Acrostylus) hoheneggeri*** (Peters). X 1. Locality HA-6405, Morro Blanco Formation, -8: apertural view of an adult shell; -8a: axial cut.

Figure 3-9.- ***Entolium angustum*** (Philippi). X 2. Locality MC-349-C, El Cazón Formation, -9: RV, external view.

Plate 3

PLATE 4

Morro Blanco and El Cazón Formations of Late Berriasian-Early Valanginian age.

Figures 4-1, 2, 5.- ***Trichites seebachi*** Boehm. X 0,5. Locality MO-3131, Morro Blanco Formation, -1, -8: RV, external and internal views. -2: posterior view of an articulated specimen; -5: LV, external view.

Figure 4-3.- ***Trichites saussuri*** (Thurmann). X 0,5. Locality M0-777, Morro Blanco Formation, -3;LV, external view of articulated specimen.

Figure 4-4.- ***Spondylus cf. texanus*** Whitney. X 1,5. Locality MC-349-D, El Cazón Formation, -4: RV, external view.

Figure 4-6.- ***Trichites picteti*** Campiche. X 1. Locality MO-3131, upper Morro Blanco Formation. -6:LV, cast.

Figure 4-7.- ***Neithea (Neithella) valangiensis*** (Pictet & Campiche). X 3. Localty MC-349-D, El Cazón Formation. -7: RV, external view.

Plate 4

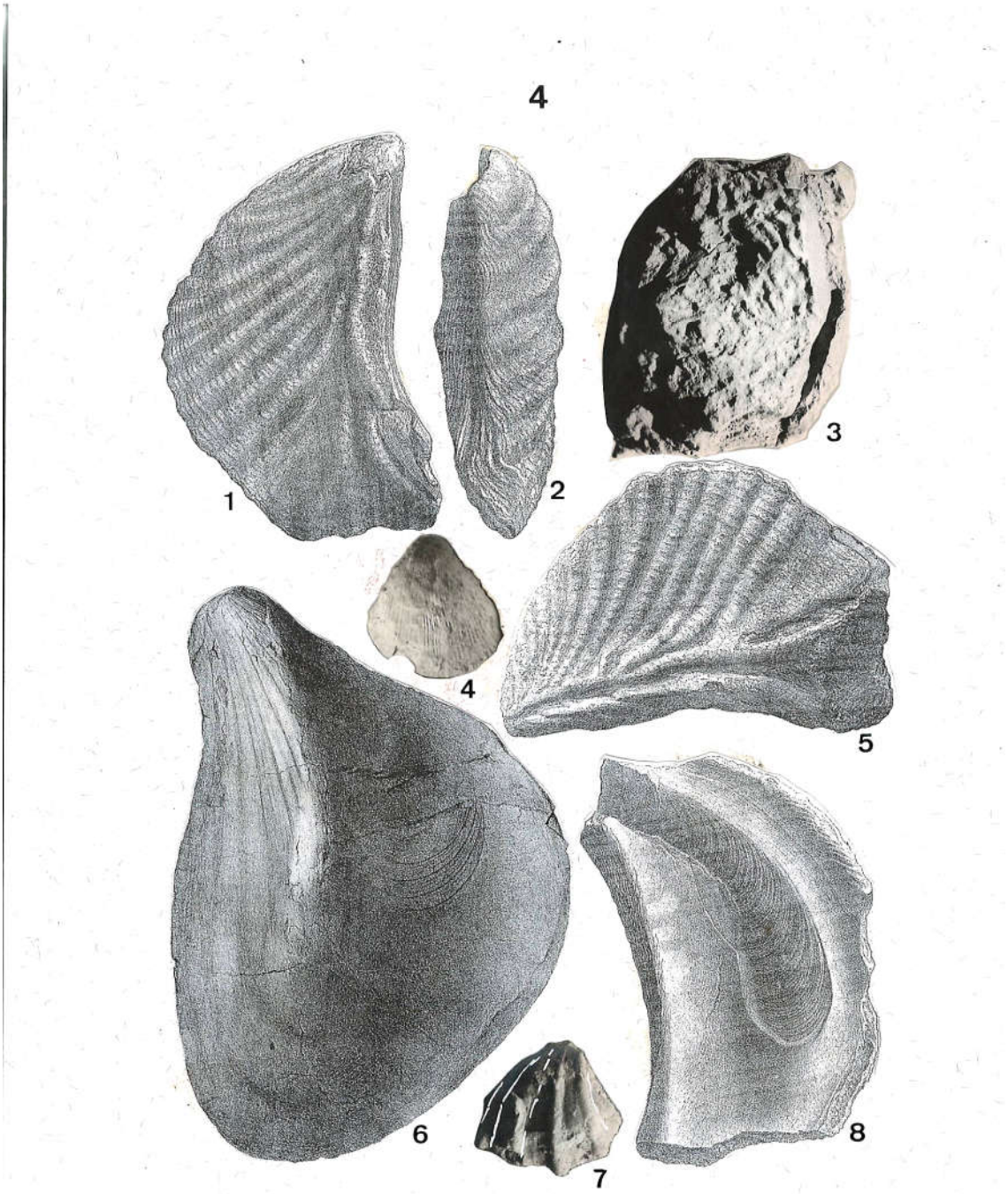

PLATE 5

El Cazón Formation, of Late Berriasian-Early Valanginian age, and El Dantó dolostones of Early Hauterivian age (Plate 1.)

Figure 5-1, 11.- ***Ceratostreon boussingaulti*** (d'Orbigny). X 2. Locality VG-376-D, El Cazón Formation, -1:LV,inner view; -11: LV, external view.

Figures 5-2, 3, 5, 7, 12, 14.- ***Catinula pulligera*** (Goldfuss). X 2. Locality VG-383, Lower El Cazón Formation. -2, 3, 7, 8: RV, external view; -5, 12, 14: LV, external view.

Figures 5- 4, 10.- ***Ceratostreon tuberculiferum*** (Koch & Dunker) X 2. Locality PM-29-A, El Cazón Formation, -4: RV, internal view; -10, LV, internal view.

Figure 5-6.- ***Ludbrookia valdensis*** (Pictet & Campiche) X 2. Locality VG-382, El Cazón Formation, -6: LV, external view.

Figure 5-9.- ***Placunopsis iskodoubouki*** (Rochebrune). X 2. Locality VG-376, El Cazón Formation, -9: flat but presumed LV, external view.

Figure 5-13.- ***Pycnodonte (Phygraea) scaphidium?*** (Philippi). X 2. Locality MC-349-B, El Cazón Formation, -13; LV, goethite pseudomorph.

Figure 5-15.- ***Catinula (sg?) refulgens*** (Coquand). X 2. Locality MC-349-D, upper El Cazón Formation, -15: LV? external view.

Figure 5-16.- ***Gyrostrea (Pseudogyra) germaini*** (Coquand) X 2. Locality MC-376-A, El Cazón Formation, -16:LV, strongly incrusted by dolomite and goethite, externalview.

Figure 5-17, 19, 20.- ***Catinula eos*** (Coquand). X 2. Locality VG-381, El Cazón Formation, -17:RV, -19, 20:LV, external views.

Figure 5-18.- ***Catinula loryi*** (Mayer-Eymar). X 2. Locality MC-341-C, El Dantó dolostones, -18:RV, external view.

Figure 5-21.- ***Palaeonucula spitiensis*** (Holdhaus). X 2. Locality VG-376, El Cazón Formation, -21:RV, external view.

Figure 5-22.- ***Meekia (Meekia) cf. exotica*** Saul & Popenoe. X 2. Locality VG-381, El Cazón Formation. -22:RV, external view.

Plate 5

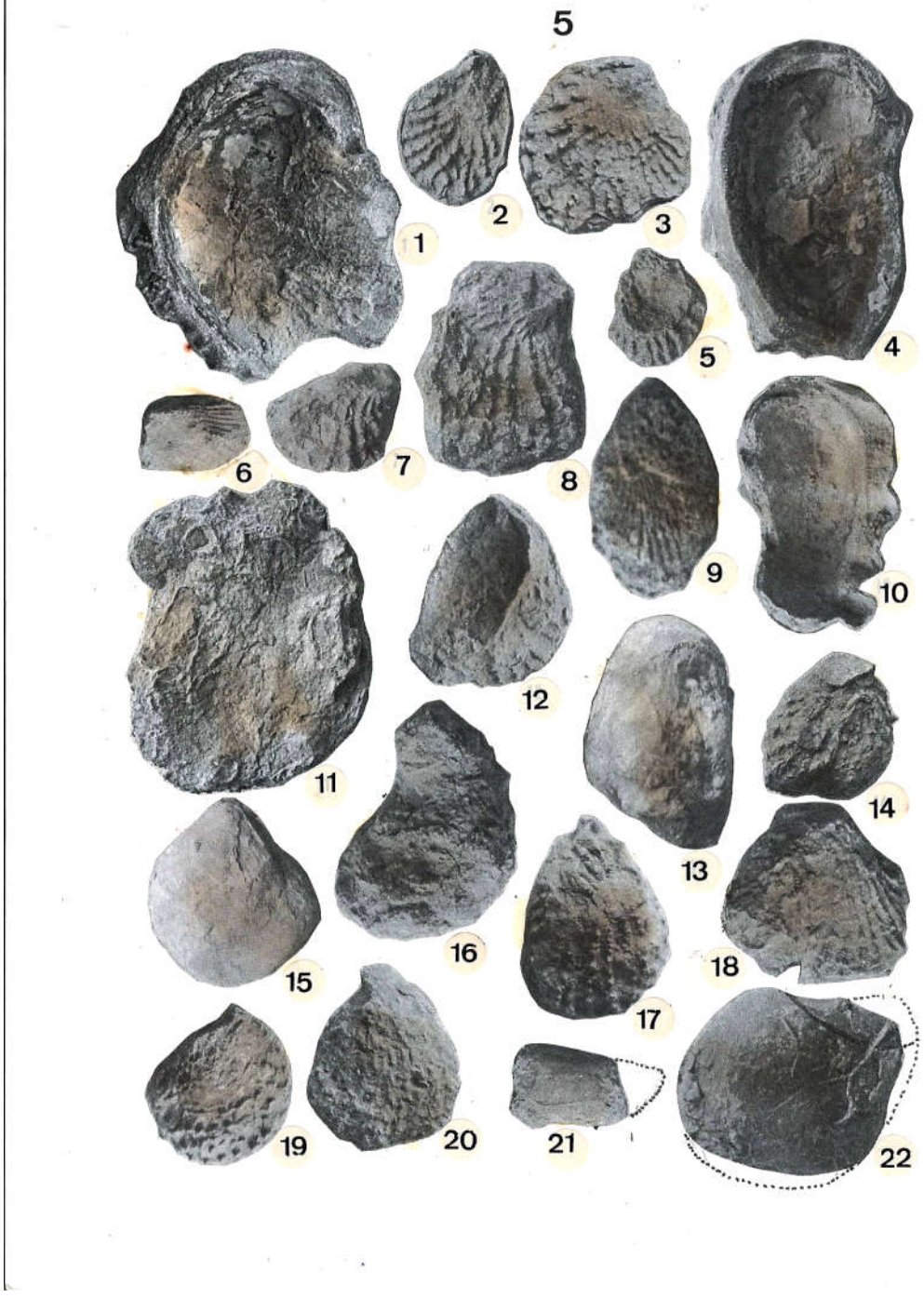

PLATE 6

El Cazón Formation, of Late Berriasian-Early Valanginian age (Plate 1.)

Figures 6-1, 2.- ***Ceratostreon boussingaulti*** (d'Orbigny) X 3. Locality VG-376, El Cazón Formation, -1:RV, and -2:LV, external views.

Figure 6-1A.- ***Glomerula gordialis*** (Schlotheim). X 3. Polychaeta tube, attached to ***Ceratostreon boussingaulti*** (d'O.), El Cazón Formation.

Figure 6-3.- ***Gresslya cf. aldouini*** (Fischer de Waldheim), X 3. Locality VG-376, El Cazón Formation, -3:LV, external view.

Figure 6-4, 5.- ***Cretyocardia cf. yaffarensis*** (Rochebrune). X 1. Locality VG-376, El Cazón Formation, -4:RV, -5:LV, external views.

Figure 6-6.- ***Ceratostreon tuberculifera*** (Koch & Dunker). X 2. Locality VG-376, El Cazón Formation. -6:RV, internal view.

Figures 6-7, 7A.- ***Parsimonia cf. subscissa*** Regenhardt. X 3. Locality VG-376, El Cazón Formation, -7:lateral view, -7A: curved portion, external view. Polychaeta.

Plate 6

PLATE 7

El Cazón Formation, (sDLP, DGC), of Late Berriasian-Early Valanginian age, Yúruma Formation, of Hauterivian age (Plate 1).

Figures 7-1, 3, 5, 7, 12.- ***Anthonya cornueli*** (d'Orbigny). X 2,5. Locality VG-381, El Cazón Formation, -1, -3 :LV, external views, -5, -7, -12 :RV, external views.

Figures 7-2.- ***Nuculoma lamplughi*** (Woods). X 2. Locality MC-329-D, El Cazón Formation, -2 :RV, external view.

Figures 7-4, 9, 10, 17.- ***Ludbrookia villersensis*** (Pictet & Campiche). X 2. Locality VG-381, El Cazón Formation. -4, 10, 17 :RV, external views, -9 :LV. external view.

Figures 7-6, 15.- ***Anisocardia (Anisocardia) valangiensis*** (Pictet & Campiche). X 1. Locality MC-392-D, El Cazón Formation, -6:LV, -15:RV, external views.

Figure 7 – 8.-***Pleuromya? inconstans*** Castillo & Aguilera. X 1. Locality VG-384-A, upper Cazón Formation, -8:LV, external view.

Figure 7 – 11.- ***Sowerby? cf. crassa*** d'Orbigny. X 2. Locality VG-386, El Cazón Formation. -11:LV, external view.

Figure 7 – 13.- ***Magrebella cf. bisculpta*** (Gerhardt). X 1. Locality VG-381, El Cazón Formation. -13:LV, external view.

Figure 7 - 14.- ***Anisocardia (Anisocardia) cf. paquieri*** Rollier. X 1. Locality VG-381, El Cazón Formation, -14;LV, external view.

Figure 7 - 16.- ***Eodonax cf. unioniformis*** (Philippi). X 2. Locality VG-381, El Cazón Formation, -16:LV, external view.

Figure 7- 18.- ***Tortucardia cf. barremica*** (Cossmann). X 1. Locality VG-381, El Cazón Formation, -1º8:RV, external view.

Figure 7 - 19.- ***Tancredia (Isotancredia) alpina*** (d'Orbigny). X 2. Locality VG-384, El Cazón Formation, -19:RV, external view.

Figure 7 -20.- ***Proveniella difficilis*** (Maillard). X 1,5. Locality VG-381, El Cazón Formation, -20:RV, external view.

Figure 7 -21.- ***Prorocardia (Protocardia) peregrina*** (d'Orbigny). X 2. Locality MO-1724, Yúruma Formation, Lara State. – 21:LV, external view.(MACSOTAY, 1980-b).

Figure 7 -22.- ***Tancredia (Isotancredia) cf. tellina*** Lange. X 1,5. Locality MC-329-D, El Cazón Formation, -22:LV, external view.

Plate 7

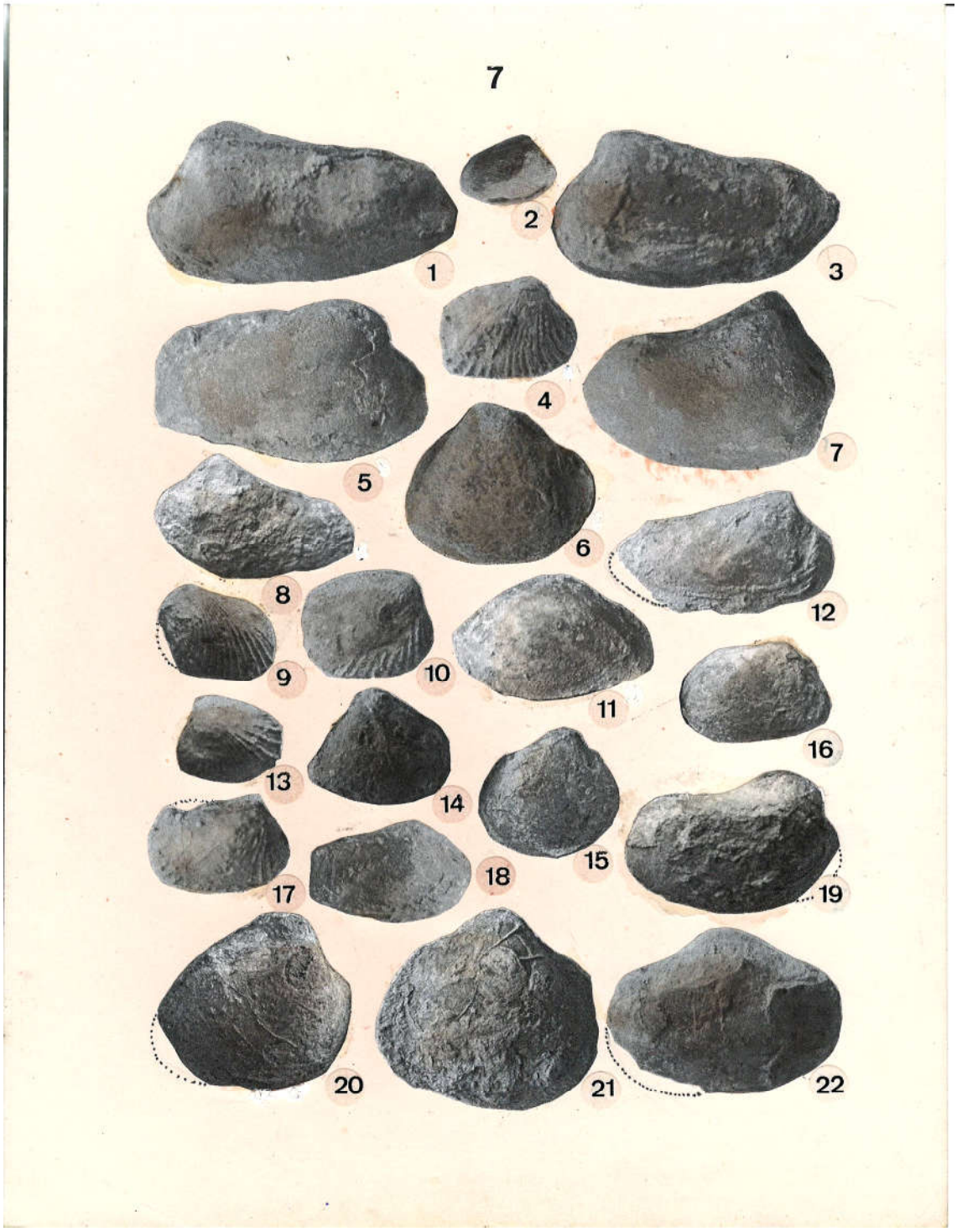

PLATE 8

El Cazón Formation, (sDLP, DGC) of Late Berriasian-Early Valanginian age (See plate 1).

Figures 8 - 1, 3, 7, 6, 13.- ***Xenocardita enayi new species.,*** Macsotay. X 2. Locality VG-381, Ojo de Agua-Santa Rosa road, (DGC), Sucre state, El Cazón Formation, -1, 8:RV, external view. -7:LV, decorticated, -13:posterior view. -3:RV, distal fragment showing the sculpture.

Figures 8-2, 9, 12.- ***Vepicardium (Vepricardium) cazonensis new species.,*** Macsotay. X 3. Locality VG-381, Ojo de Agua-Sant Rosa road, (DGC) El Cazón Formation, -2, 12:RV, external view. -9:LV, external view. See also fig. 9-10.

Figures 8-4, 6, 11.- ***Cretocardia monginae new species.,*** Macsotay. X 2. Locality VG-381, Ojo de Agua-Santa Rosa road, (DGC) El Cazón Formation, -4, 6:LV, external view, -11:RV, external view.

Figures 8-5, 10.- ***Vepricardium (Vepricardium) sp. indet.*** Macsotay, X 2. Locality VG-381, El Cazón Formation, -5:LV, external view. -10:RV, internal view.

Figure 8-14.- ***Pholadomya (Bucardiomya) cf. valangiensis*** (Pictet & Campiche), X 0,5. Locality VG-384, El Cazón Formation, -14: LV,external view. Reproduction of PICTET & CAMPICHE, (1865, pl. 106, fig. 2a).

Plate 8

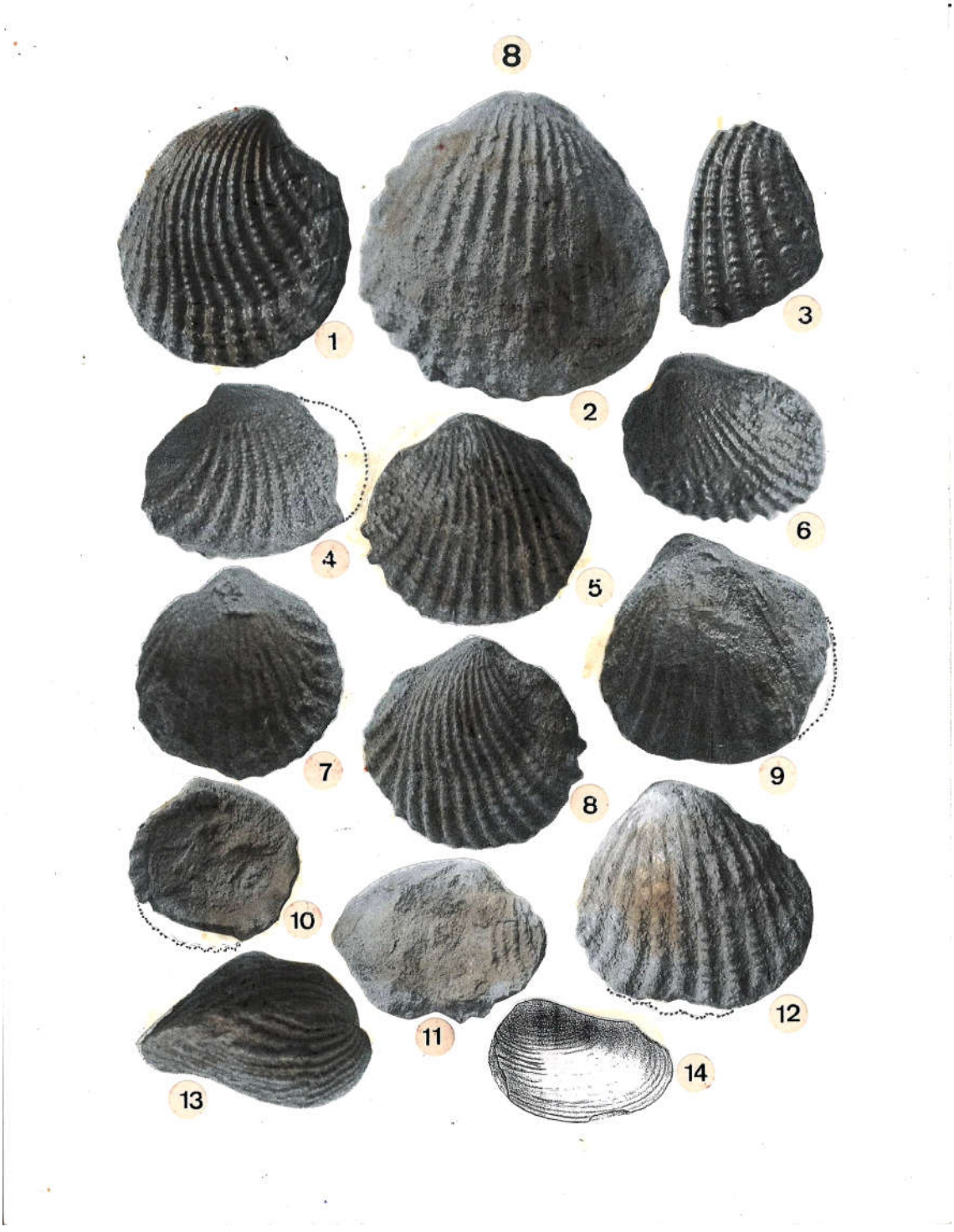

PLATE 9

El Cazón and Morro Blanco Formations, of Late Berriasian-Early Valanginian age, El Dantó dolostones, La Margarita mudstones, Lower Taguarumo Formation, of Hauterivian age (See plate 1).

Figure 9-1.- ***Monopleura cf. votani*** Felix & Lenk. X 1. Locality MC-338-H, El Dantó dolostones, -1 :LV external view.

Figure 9-2.- ***Priscomactra bussoni*** (Busson & Albanesi), X 2. Locality MO-3213, lower Taguarumo Formation, -2 :LV, external view.

Figure 9-3.- ***Anulostrea urgonensis*** (d'Orbigny). X 1. Locality VG-556-A, El Dantó dolostones. -3:articulated specimen. See also pl. 10, fig. 5.

Figure 9-4.- ***Megacuculaea moreana*** (dÓrbigny). X 1,5. Locality MC-338-H, El Dantó dolostones, -4:LV, external view of articulated specimen, with umbonal area fractured.

Figure 9-5.- ***Gymnocerithium cf. collegiale*** Zittel. X 0,5. Locality MO-1313, Morro Blanco Formation, -6: axial section.

Figure 9-6.- ***Ludbrookia valdensis*** (Pictet & Campiche). X 1. Locality VG-382, El Cazón Formation,

Figure 9-7.- ***Cretocardia monginae n. sp.,*** Macsotay, X 2. Locality VG-381, El Cazón Formation, -7:RV, external view.

Figure 9-8.- ***Corbicellopsis claxbyensis*** (Woods). X 2. Locality VG-381, El Cazón Formation, -8:RV, external view.

Figure 9-9.- ***Globocardium gillieroni*** (Pictet & Campiche). X 2. Locality VG-382, El Cazón Foirmation, -9:LV, external view.

Figure 9-10.- ***Vepricardium (Perucardia) cazonensis n. sp.,*** Macsotay, X 2. Locality VG-381, El Cazón Formation, -10:RV, external view.

Figure 9-11.- ***Cyclocardia circularis*** (Gabb). X 2,5. Locality VG-384, El Cazón Formation, -11:LV, external view.

Figure 9-12.- ***Xenocardita*** sp. 2, Macsotay. X 2,5. Locality MC-441-A, El Cazón Formation. -12:RV, external view.

Figures 9-13, 14.- ***Mytiloides patyagonicus*** (Philippi). X 1. Locality MC-342, Lower Margarita Formtion, -13:LV, external specimen, -14: dorsal view of an articulated specimen: reproduction of PHILIPPI (1899, pl. 23, fig. 2).

Figure 9-15.- ***Ludbrookia neocomiensis*** (d'Orbigny). X 2. Locality VG-382-B, El Dantó dolostones. -15:LV, external view.

Figures 9-16, 17.- ***Dimyodom strambergensis*** (Boehm). X 2. Locality MC-329-D, El Cazón Formation, -16:LV, internal view; -17:RV, external view of a juvenile.

Figure 9-18.- ***Cretiscalpellum hausmanni*** (Koch & Dunker). X 4. Locality PM-08-B, La Margarita mudstones, -18:scutum, external view. This fossil balanid is not studied here.

Plate 9

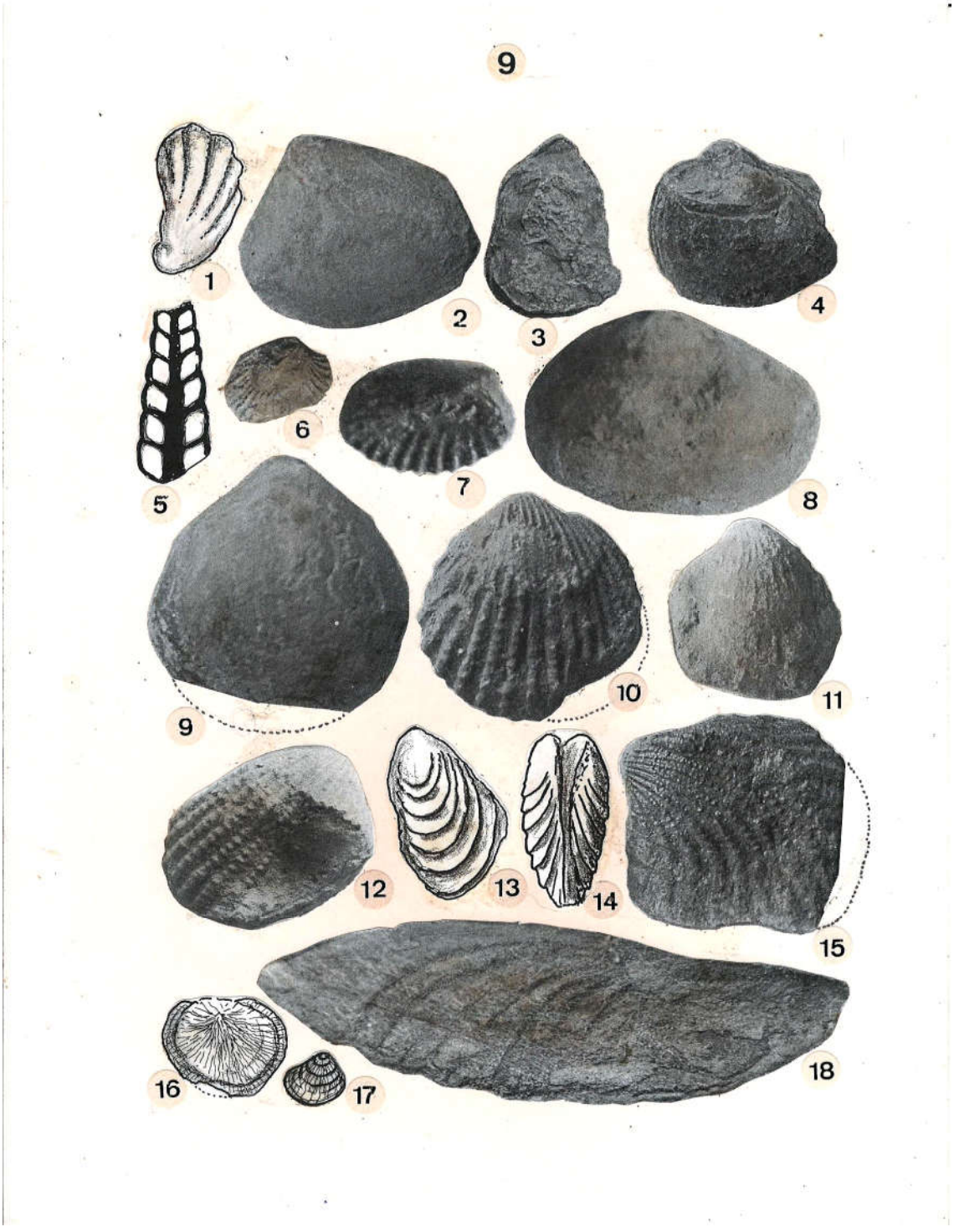

PLATE 10

Morro Blanco Formation, of Berriasian-Valanginian age; El Dantó dolostones, La Margarita mudstones, of Hauterivian age; Chuparipal and Taguarumo Formations, of Barremian age. Carorita Formation, Valanginian age (See plate 1).

Figure 10-1.- ***McLearnia occitanica*** (Pictet). X 1. Locality MO-1297, Carorita Formation, Lara Nappe, of Valanginian age. -1:LV, external view.

Figures 10-2, 3, 4.- ***Acutostrea syriaca*** (Conrad). X 1. Locality VG-565-A, El Dantó dolostones, -2, 4:RV, external view; -3:LV, external view.

Figure 10-5.- ***Anulostrea cf. urgonensis*** (d'Orbigny). X 1. Locality VG-556-A, El Dantó Formation. See pl. 9, fig. 3;

Figure 10-7.- ***Eopecten studeri*** (Pictet & Roux). X 2. Locality M0-1870. Chuperipal Formation. -7:RV, external view.

Figure 10-8.- ***Limatula tombecki*** (d'Orbigny). X 1. Locality PM-8A, La Margarita mudstones, -8:LV, external view.

Figures 10-9, 10'.- ***Curvostrea lotenoensis*** (Weaver). X 1. Locality MO-1233, Morro Blanco Formtion, -9:LV, external view; -10:RV, external view with xenomorphic sculpture.

Figure 10-11.- ***Purpuroidea aff. striata*** Zittel. X 1. Locality BL-88. Morro Blanco Formation, -11:Abapertural view.

Figure 10-12.- ***Euthymipecten astierianus*** (d'Orbigny). X 2. Locality MO-1297, Carorita Formation, -12:RV, external view.

Figure 10-13.- ***Trigonia (Trigonia) cocuyensis, nom. nov.*** Macsotay, X 2,5. Locality 185295 (ETAYO SERNA, 1985-C, [24] :18-19), Macanal shale Formation of Colombia, of Valanginian age. -13:LV, reproduction of ETAYO SERNA, op. cit., pl. 1, fig. 7.

Figure 10-14.- ***Sphaera corrugta*** (Sowerby). X 1. Locality MMH, Su-109 (VON DER OSTEN, 1957: 579) , Taguarumo Formation, -14:LV, external view.

Figure 10-15.- ***Planospirites etalloni*** (Pictet & Campiche). X 1. Locality MC-329, El Dantó dolostones, on the top of a clayey dolomite bed. -15: disarticulated RV and LV.

Figure 10-16.- ***Pachymya (Arcomya) icaunensis*** (Cotteau). X 2. Locality MO-3213, lower Taguarumo Formation, -16:LV, external view.

Plate 10

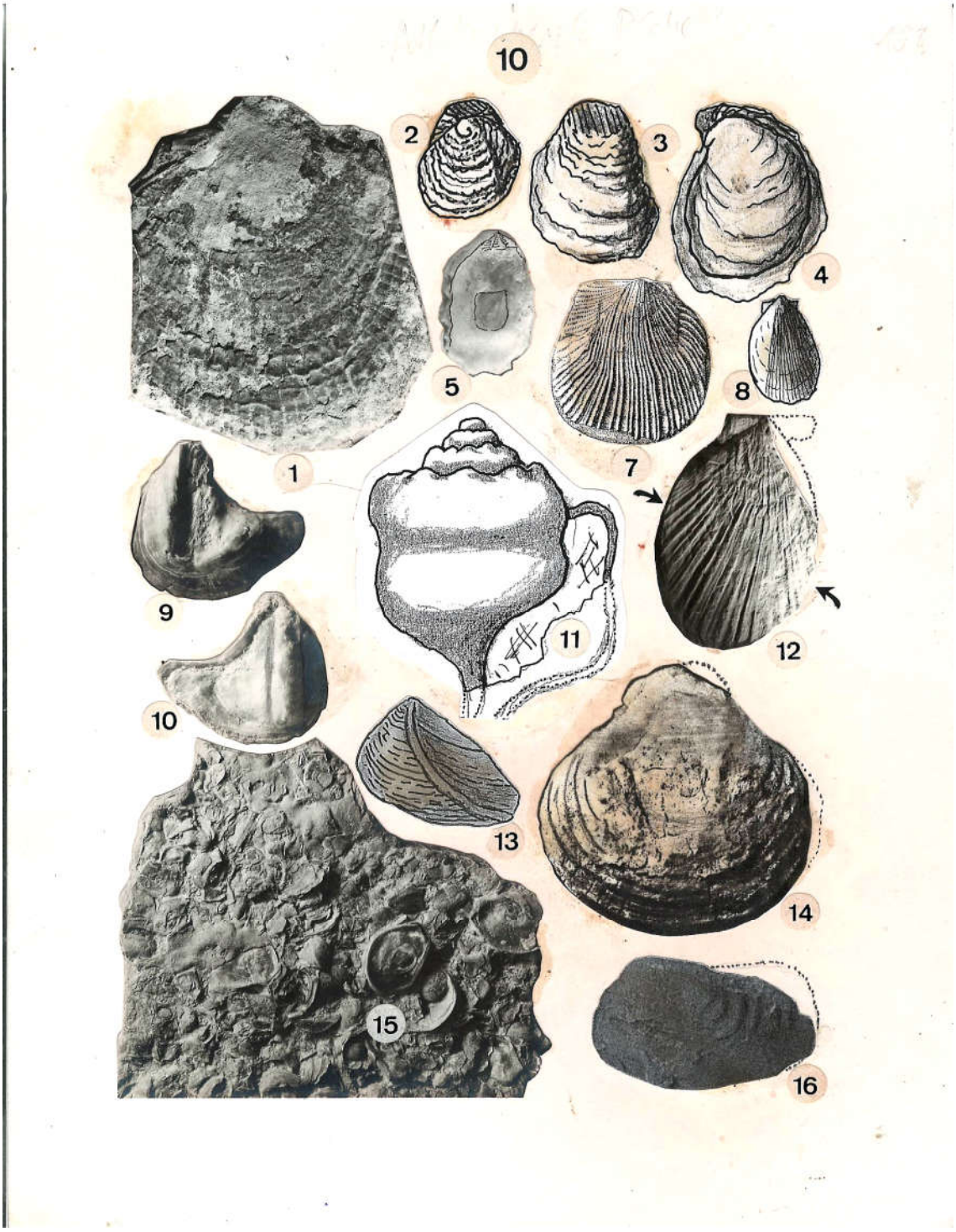

PLATE 11

El Cazón Formation, Berriasian-Valanginian; El Dantó dolostones, La Margarita mudstones and Chururú member of Rio Negro Formation: Hauterivian age; lower carbonatic member of Peñas Altas Formation, late Barremian (See plate 1).

Figure 11-1.- ***Cuneigervilleia neocomiensis*** (Cotteau). X 3. Locality VG-555-A, El Dantó dolostones, -1:LV, external view.

Figure 11-2.- ***Nuculoma naraensis*** (Mongin). X 1,3. Locality VG-556-A, El Dantó dolostones, -2:LV, external view.

Figure 11-3.- ***Corbulamella cf. striatula*** (J. de C. Sowerby). X 4. Locality MO-1305, Chururú member of Rio Negro Formation. -3:RV, external view.

Figure 11-4, 4A.- ***Legumen? cf. chapmani*** (Imlay). X 2. Locality MO-1305, Chururú Member of Rio Negro Formation. -4:LV, external view.

Figure 11-5.- ***Cyprimeria neocomiensis*** (Weerth). X 1. Locality MC-448-A, La Margarita mudstones, -5:LV, external view.

Figures 11-6, 6ª.- ***Cerithiella phillipsi*** (Leymerie). X 2. Locality HA-4451, lower carbonatic member of Peñas Altas Formation. (Reproduced from REHBINDER, 1902, pl. 4, figs. 1, 2).

Figure 11-7.- ***Pholadomya cf. agrioensis*** Weaver. X 1. Locality MO-1305, Chururu member of Rio Negro Formation, -7:LV, external view.

Figure 11-8, 10.- ***Homomya scaphoides*** (Agassiz). X 1. Locality MO-1305, Chururu member of Rio Negro Formation. -8: anterior view, -10:LV, external view.

Figure 11-9.- ***Pseudodidymotis cf. buchii*** (Roemer). X 3,5. Locality VG-382-B, El Dantó dolostones, -9:LV, external viw.

Figure 11-11, 12.- ***Septifer cuvieri*** (Matheron). X 2. Locality PM-19-C, La Margarita mudstones, -11: dorsal view of a limonite pseudomorph. -12:RV, external view.

Figure 11-13, 14.- ***Corbulamella cf. forbesi*** (de Loriol). X 3. MO-1305, Chururu member of Rio Negro Formation. –13 :anterior view of an articulated specimen. -14:RV, external view.

Figure 11-15.- ***Mytilodes cf. ewaldi*** (Schlüter). X 2. Locality VG-555-A, El Dantó dolostones, -15:LV, external view.

Figure 11-16.- ***Nicaisolopha neocomiensis*** (d'Orbigny). X 0,5. Locality HA-4264, lower carbonate member of Peñas Altas Formation (H. ARNAUD et alii., 1999, fig. 23), -16:reproduction of the type specimen (COTTREAU, 1934, pl. 73, fig. 4).

Figure 11 – 17, 21.- ***Eriphyla (Eriphyla) laevis*** (Phillips). X 1. Locality VG-382 B, El Dantó dolostones, -17, 21: reproduction of WOODS (1906, pl. 16, figs. 4, 5).

Figure 11 – 18.- ***Camptonectes (Camptonectes) striatopunctatus*** (Römer). X 1. Locality MC-349-B, El Cazón Formation, -8: reproduction of d'ORBIGNY (1845, pl. 432, fig. 4a).

Figure 11-19.- ***Camptonectes (Camptonectes) cf. insutus*** (Cragin). X 2. Locality VG-555, El Cazón Formation, -19:RV, external view.

Figure 11- 20.- ***Nucula (Nucula) pusilla*** (Philippi). X 3. Locality MO-1305, Chururú member of Rio Negro Formation, -20: RV, external view.

Plate 11

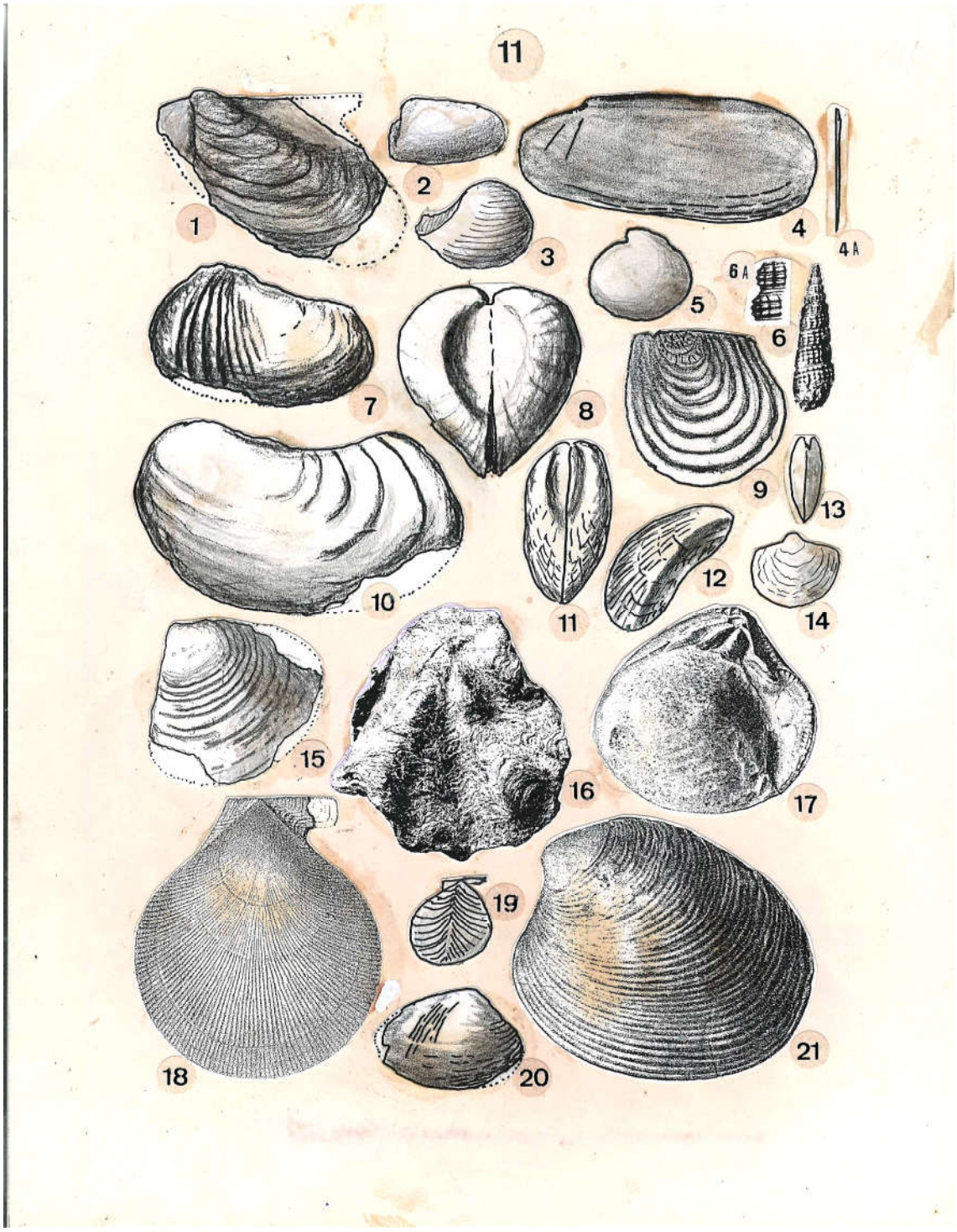

PLATE 12

El Dantó dolostones, La Margarita mudstones, Bergantín Formation, of Hauterivian age; Guayamure Formation, Middle Albian (See plate 1).

Figures 12- 1, 5.- ***Nuculana (Praesaccella) seilacheri new species,*** Macsotay. X 4. Locality VG-555, río Morocoto-Caituco-Ojo de Agua road, (DGC) El Dantó dolostones, -1:LV, external view. -5:RV, external view. HOLOTYPE.

Figure 12 -2.- ***Paleoneilo? etayosernai new species.,*** Macsotay, X 4. Locality 329, Río Pajaral, El Dantó dolostones, -2:RV, external view. HOLOTYPE.

Figure 12- 3.- ***Nuculoma cf. carthusiae*** (Pictet & Roux). X 2. Locality MC-329, El Dantó dolostones, -3:RV, external view.

Figure 12- 4, 7.- ***Anopaea rugosa*** (Philippi). X 1. Locality MC-448-A, La Margarita mudstones. -4, -7: reproduction of PHILIPPI (1899, pl. 38, figs. 13, 13).

Figure 12 - 6, 11.- ***Agnomyax aubouini new species,*** Macsotay. X 2. Locality MC-241-C, La Hacinda, Río Carinicuao (sDLP, DGC) El Dantó dolostones. -6:RV, external view; -11:RV, HOLOTYPE.

Figure 12- 12, 12ª.- ***Oxytoma (Hypoxitoma) arnaudi new species.,*** Macsotay, X 3. Locality MO-1652, Quebrada Guayamure, Lara State, Guayamure Formation (Atarigua para-autochthonous). -12:LV, external view, -12ª:frontal view. HOLOTYPE.

Figure 12 – 8.- ***Ospriasolen erlichi n. sp.,*** Macsotay, X 3. Locality VG-382-B, Quebrada El Imposible, near Ojo de Agua village, (DGC), El Dantó dolostones, -8:LV, external view, HOLOTYPE.

Figure 12 – 9.- ***Agnomyax australis*** (Gabb), X 3. Locality VG-555-A, El Dantó dolostones, -9:LV, external view.

Figure 12 – 10.- ***Thracia cf. phillipsi*** (Roemer). X 2. Locality VG-555, El Dantó dolostones, -10:RV, external view.

Figure 12 – 13.- ***Anomia suboblicua*** (Conrad). X 2. Locality MC-329, El Dantó dolostones, -13:LV, external view.

Figures 12 -14, 14ª.- ***Anthonya aff. cantiana*** (d'Orbigny). X 3. Locality VG-382, El Dantó dolostones, -14:RV, external view, -14a: anterior view of articulated specimen.

Figure 12 -15.- ***Stearnsia subacuta*** (d'Orbigny). X 3. Locality An-85-A (see VIVAS, 1987: 20). Bergantin Formation,

Plate 12

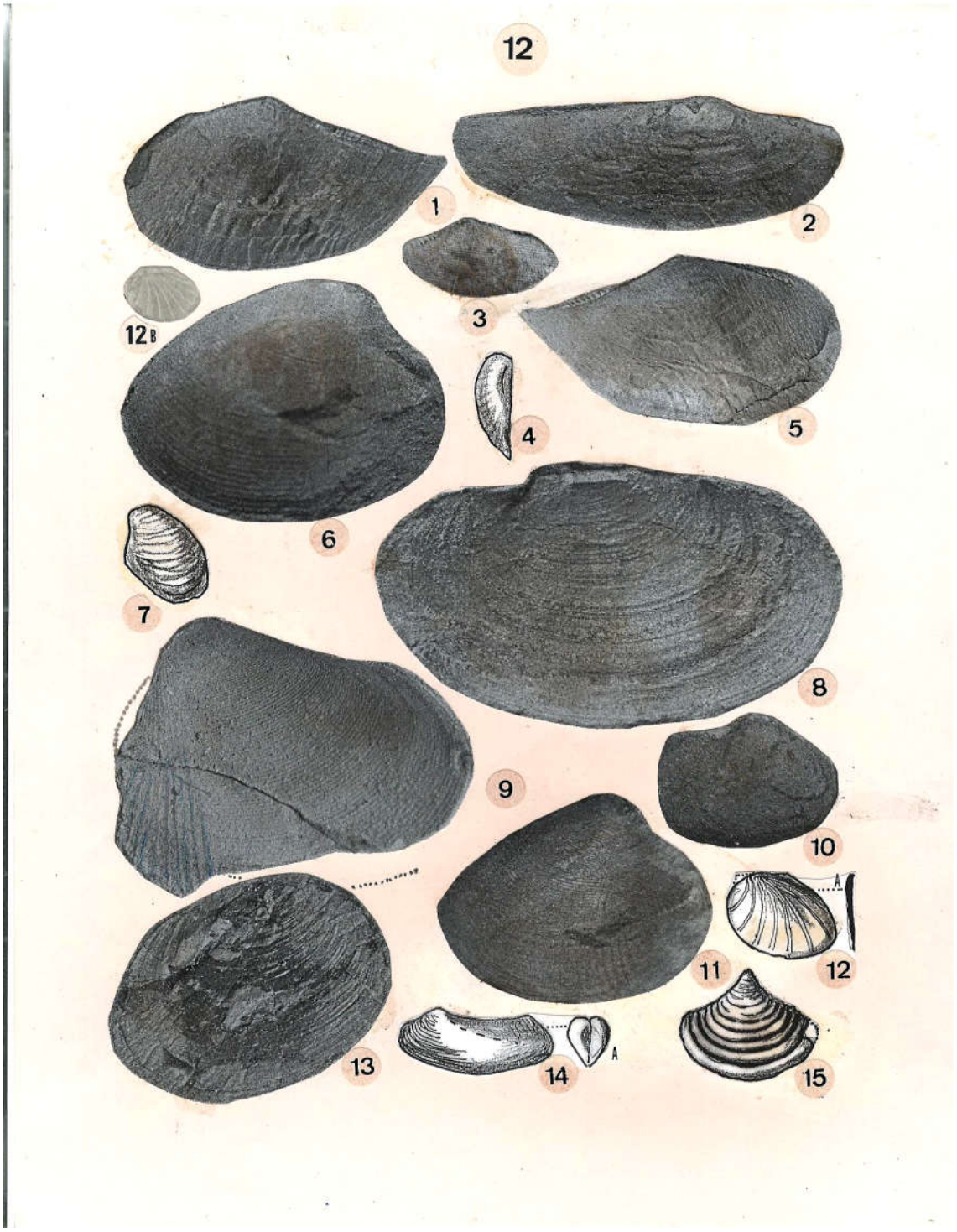

PLATE 13

El Cazón Formation, Berriasian-Valanginian age; El Dantó dolostones, lower Taguarumo Formation, of Hauterivian age; Guácharo member of El Cantil Formation, of Early Albian age (See plate 1).

Figure 13 – 1.- ***Lamellaptychus*** Macsotay, X 1. Locality MC-341-C, El Dantó dolostones,

Figure 13 – 2.- ***Syncyclonema polylasmites*** (Gemmellaro & di Blasi), X 4. Locality VG-353, El Cazón Formation, -2:LV, external view: contours of auricules, are tentative.

Figure 13 - 3.- ***Gresslya (?) laventillensis*** (Waring). X 6. Locality VG-381, El Cazón Formation, -3:LV, external view.

Figure 13 – 4.- ***Idonearca cor*** (Matheron). X 2. Locality MO-2313, lower limestones of Taguarumo Formation, -4:RV, external view.

Figure 13 – 5.- ***Seendia isodontoides*** (Cragin). X 2. Locality MO-3213, lower limestones of Taguarumo Formation, -5:LV, external view.

Figure 13-6, 8.- ***Fenestricardita cf. boyacaensis*** Etayo Serna. X 2. Locality MC-341-C, El Dantó dolostones, -6,-8:LV, external view of adult specimens.

Figure 13-7.- ***Xenocardita pinguis*** (Coquand). X 2. Locality MC-341-C, El Dantó dolostones, -7:RV, external view.

Figure 13 -9.- ***Xenocardita*** sp. indet. 1, Macsotay. X 3. Locality VG-556-A, El Dantó dolostones, -9:RV, external view.

Figure 13 -10.- ***Astieridiscus*** sp. Indet., X 2. Locality Mo-3213, Taguarumo Formation, lower limestones. -10: lateral view.

Figure 13 – 11.- ***Dicranodonta valdensis*** (Pictet & Campiche). X 2. Locality JFS-018, Guacharo member of El Cantil Formation, -11:RV, external view.

Figure 13 – 12.- ***Priscomactra syriaca*** (Conrad). X 3. Locality VG-139, El Cazón Formation, -12:RV, external view.

Plate 13

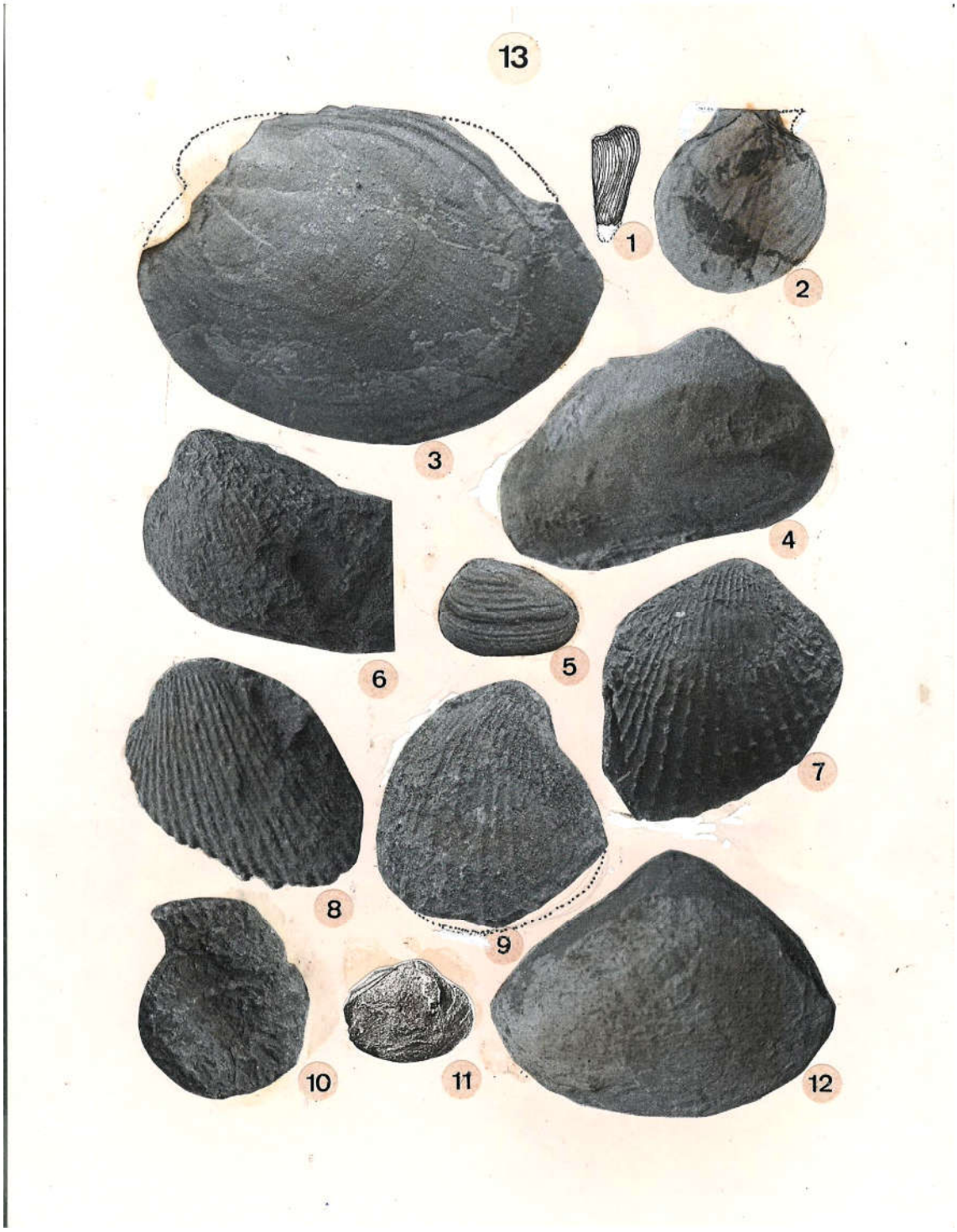

PLATE 14

El Cazón Formation, Berriasian-Valanginian age; El Dantó dolostones, La Margarita mudstones, and Chururú member of Rio Negro Formation, of Hauterivian age; lower carbonatic member of Peñas Altas Formation, and upper Taguarumo and Rio Negro Formations, of Late Barremian age (See plate 1).

Figure 14 – 1, 1a, 1b.- ***Liostrea cunabula*** (Selley). X 1. Locality MO-2521, upper Rio Negro Formation, Perijá region, -1, 1a, 1b::reproduced from CONRAD (1852, pl. 1, fig. 6).

Figure 14 – 2, 2a;- ***Acutostrea directa*** (Blankenhorn), X 1. Locality HA-4367, lowest dolomitic limestone of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 14).

Figure 14 – 3.- ***Aenona ? carteroni*** (d'Orbigny). X 2. Locality MO-905, Lope member of Taguarumo Formation, -3:LV, external view.

Figure 14 – 4.- ***Costigervillia alatior*** (Imlay). X 1. Locality VG-382-B, El Dantó Formation, -4:LV, external view.

Figure 14 – 5, 6.- ***Protocardia colombiana*** Dietrich. X 1,3. Locality MO-2850, Morro Blanco Formation, -5:LV, external view, -6: posterior view of articulated cast.

Figure 14 – 7.- ***Modiolus fittoni*** (d'Orbigny), X 1. Locality MO-1305, Chururú member of Rio Negro Formation. -7: reproduction of MALLADA (1887, pl. 38, fig. 4).

Figure 14 – 8.- ***Laevicardium? cf. ishidoense*** (Yabe & Nagao), X 1. Locality PM-04-C, La Margarita mudstones, -8:RV, external view.

Figure 14 – 9.- ***Cymbophora charltonae new species.*** Macsotay, X 4. Locality VG-382-B, Quebrada El Imposible, near Ojo de Agua, (DGC) El Dantó dolostones, -9:LV, external view. HOLOTYPE.

Figure 14 – 10, 10A.- ***Noetia (Incanopsis) convergidens*** Gerhardt. Locality MC-341-C, El Dantó Formation, -10:RV, external view, X 0,8 -10A:LV, internal view.

Figure 14 – 11.- ***Anisocardia (Collignonicardia) bussoni*** (Busson & Albanesi), Locality MO-3213, lower Taguarumo Formation, -11:LV, external view.

Figure 14 – 12.- ***Corbicellopsis görögae new species.,*** Macsotay, X 1. Locality MO-3213, Chimana Grande Island, Lope inlet, (DAGM), lower Taguarumo Formation, (MACSOTAY et al., 1985, fig. 6A), HOLOTYPE

Figure 14 – 13.- ***Clisocolus inornatus*** (d'Orbigny). X 1. Locality MC-346-C, Taguarumo Formation, -13:VD, external view.

Figurtes 14-14, 14A.- ***Callucina plicatocostata*** (d'Orbigny) X 1,5. Locality PM-04-C, La Margarita mudstones -14:RV, lateral view; -14ª: articulated specimen dorsal view. Reproduced from d'Orbigny (1842, pl. 3, figs. 13, 14).

Figure 14 -15.- ***Pricomactra hessi new species.,*** Macsotay, X 2. Locality VG-382-B, road from Ojo de Agua-Santa Rosa, (DBG) El Cazón Formation, -15:LV, external view, HOLOTYPE.

Figure 14-16.- ***Ceratostreon boussingaulti minos*** (Coquand). X 1. Locality VG-565, Taguarumo Formation, -16 :LV, internal view, reproduction of MALLADA (1887, pl. 48, fig. 1).

Plate 14

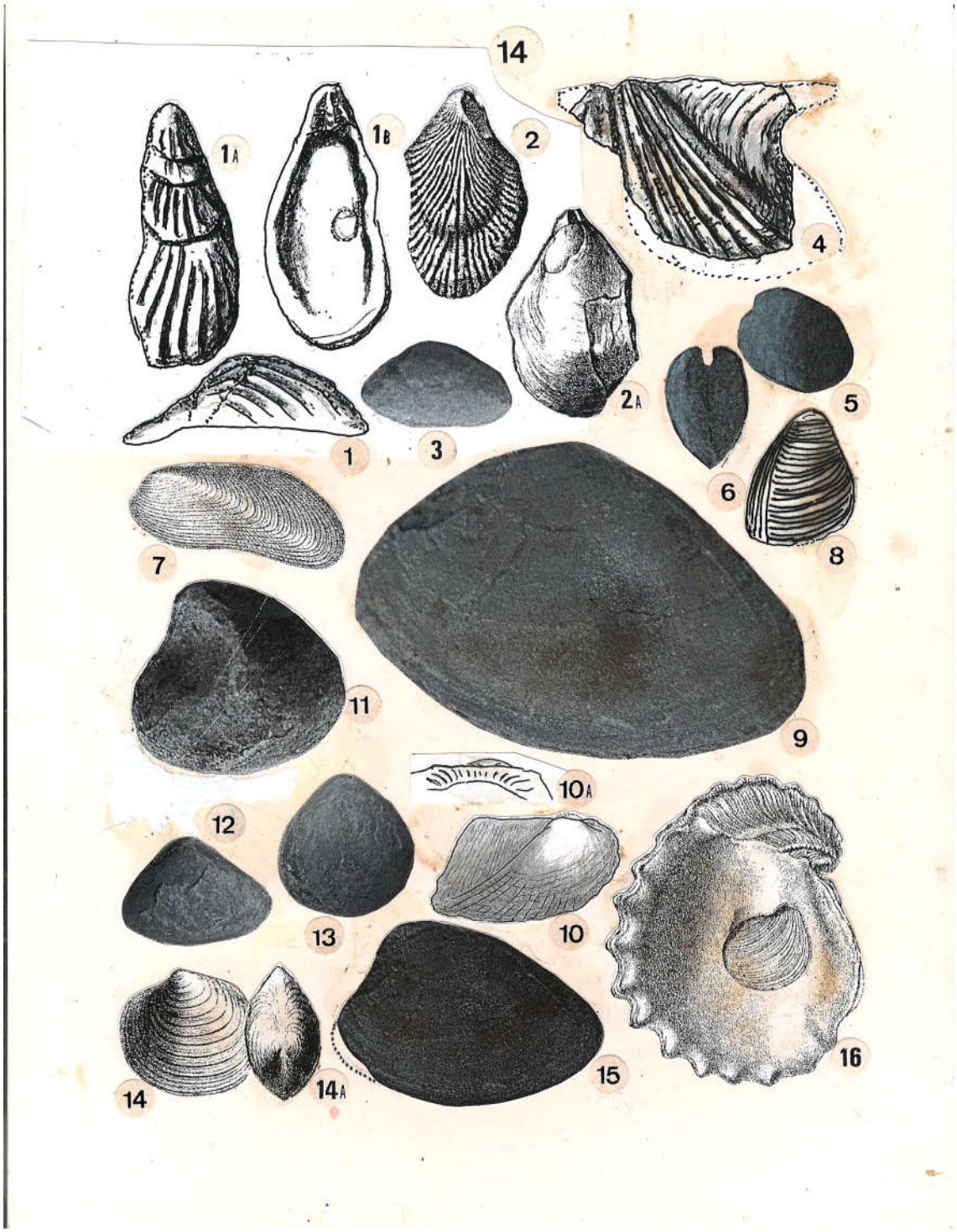

PLATE 15

Morro Blanco Formation, of Berriasian/Valanginian age; El Dantó dolostones, La Margarita mudstones, Chururú member of Rio Negro Formation of Hauterivian age; upper Rio Negro and Tibú Formations, of Barremian –Early Aptian age (See plate 1).

Figure 15 – 1.- ***Buchotrigonia (Syriotrigonia) lorenti*** (Dana). X 1. Locality MC-338-H, El Dantó dolostones, -1:LV, external view.

Figure 15 – 2.- ***Buchotrigonia (Syriotrigonia) cf. deshayesi*** (Vilanova). X 1. Locality BL-9385, El Dantó dolostones, -2:LV, external view.

Figure 15 – 3.- ***Buchotrigonia (Syriotrigonia) libanotica*** (Vokes). X 0,7. Locality MO-1697, Tibú Formation, Perijá, -3:RV, external view.

Figure 15 – 4.- ***Neomiodon sublaevis*** (Roemer). X 1. Locality PM-10-F, La Margarita mudstones, -4:RV, external view.

Figures 15 - 5, 22.- ***Neomiodon cf. brongniarti*** (Koch & Dunker). Locality PM-09-D, La Margarita mudstones, -5:RV, externalview, X 1; -22:LV, juvenile, external view, X 1,5.

Figures 15 – 6, 14.- ***Neomiodon acuta*** (Lisson). X 1. Locality MC-448-A, La Margarita mudstones, -6:RV, -14:LV, both external views.

Figure 15 – 7.- ***Megatrigonia rogersi*** (Kitchin). X 1. Locality MO-1305, Chururú member of Rio Negro Formation, -7:RV, external view.

Figures 15 – 8, 12.- ***Eomiodon cf. verrucana*** (Fucini). X 0,5. Locality PM-10-F, La Margarita Formation, -12:LV, external view.

Figures 15 – 10.- ***Buchotrigonia (Syriotrigonia) gerthi*** (Lisson). Locality VG-556-A, El Dantó dolostones, -10:RV, reproduced from LISSON (1930, pl. 3, fig. 2).

Figure 15 – 11.- ***Rhabdocolpus hausmanni*** (Dunker). X 2. Locality PM-09-D, La Margarita mudstones, -11: reproduced from HUCKRIEDE (1967, pl. 25, fig. 32).

Figure 15 – 13.- ***Flaventia? trita*** (Philippi). X 2,5. Locality PM-09-D, La Margarita mudstones, -13:LV, external view.

Figure 15 – 15.- ***Iotrigonia stowi aisenensis*** Reyes. X 1. Locality ASU-238, El Dantó dolostones, -15:LV, external view (MACSOTAY et al., 1885: 836).

Figure 15 – 16.- ***Cymella altumbonata*** (Anderson). X 4. Locality MC-338-H, El Dantó dolostones, -16:RV, external view.

Figure 15 – 17.- ***Steinmannella (Steinmannella) raimondii*** (Lisson). X 1. Locality MO-1305, Chururú member of Rio Negro Formation, -17:LV, external view.

Figure 15 – 18.- ***Cyclorisma chia*** (d'Orbigny). X 1. Locality MO-1322, limestone 50 meters below the top of Rio Negro Formation, in the type section, Perijá mts., -18:RV, external view.

Figure 15 - 19.- ***Costocyrena oreas*** (Philippi). X 1. Locality JFS-103, La Margarita mudstones, in rhytmites with taphoflora, -19:LV, reproduction of PHILIPPI (1899, pl. 38, fig. 4).

Figure 15- 20.- ***Myrene angulatiformis*** (Arthaber). X 1. Locality VG-569, La Margarita mudstones, -20:LV, external view.

Figure 15-21.- ***Anditrigonia eximia*** (Philppi). X 1. Locality MO-1598, Morro Blanco Formation, -21:RV, external view.

Figure 15 – 23.- ***Neomiodon lateovatus caudatus*** (F. A. Römer). X 1. Locality MC-448-A, La Margarita mudstones, -23:LV, external view.

Figure 15 – 24, 25.- ***Pterocardia isarae*** (Gras). X 1. Locality MO-1322, Río Negro Formation, limestone 50 meters below the top, type section; -24:RV, -25:LV, external views.

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PLATE 16

El Dantó dolostones, La Margarita mudstones, Lower Taguarumo Formation, of Hauterivian age; El Cantil Formation, Early Albian age (See plate 1).

Figure 16 – 1, 2, 5, 6, 9.- ***Hayamia dantoensis new genus, new species*** Macsotay. Locality MC-338-H, El Dantó dolostones, -1:LV, articulated specimen X 1, HOLOTYPE. -5: detail of dorsal area of fig. 16-1; -2: posterior view, -6:anterior view, -9:ventral view.

Figure 16-3.- ***Dicroloma aff. longiscata*** (Buvignier). X 1,5. Locality MO-3213, Taguarumo Formation, lower limestones, -3:external view.

Figure 16-4.- ***Proscala dubisiensis*** (Pictet & Campiche). X 1. Locality MC-388-H, El Dantó dolostones, -4 :lateral view of deformed specimen.

Figure 16-7, 8.- ***Lycettia lanceolata*** (Sowerby). X1. Locality PM-19-C, La Margarita mudstones, -7, -8: reproduction of Sowerby (1836, pl. 17, fig. 15).

Figure 16-10.- ***Ursirivus sp. indet.*** Macsotay, X 4. Locality MC-264-B, El Cantil Formation, topmost limestone, -10:LV, external view of a cast.

Figure 16 – 11.- ***Inoceramus ex gr. neocomiensis*** d'Orbigny. X 1. Locality MC-338, El Dantó dolostones, -11:LV, fragmentary.

Figure 16 – 12.- ***Pseudomiltha germani*** (Pictet & Cmpiche). X 1. Locality MC-388-H, El Dantó dolostones, -12:RV, external view.

Plate 16

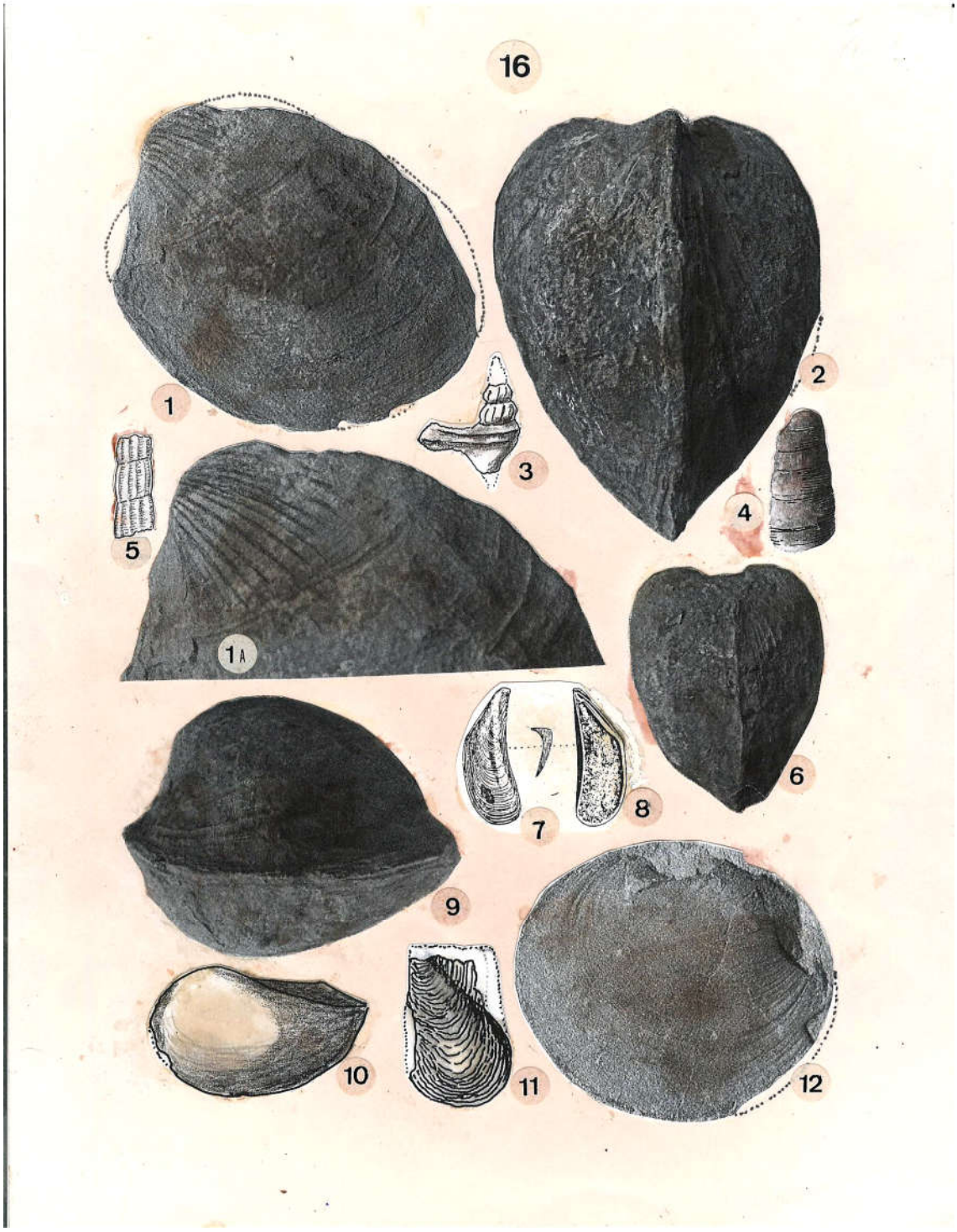

PLATE 17

La Margarita mudstones, Chururú member of Rio Negro Formation, of Hauterivian age; Tibú and Taguarumo Formations, of Barremian age; Upper El Cantil Formation, of Early Albian age (See plate 1).

Figures 17 – 1, 2, 3, 5.- ***Ptrotrigonia (Notoscabrotrigonia) plicatocostata*** (Nyst & Galeotti). X 1. Locality MC-375-B, Taguarumo Formation, -1:LV, -5:RV, external views. -2: frontal view, -3: dorsal view of articulated specimen.

Figure 17 – 4.- ***Buchia aff. blandfordi*** (Stoliczka). X 3. Locality MO-1305, Chururú member of Rio Negro Formation. -4:RV? External view.

Figure 17 – 5.- ***Rutitrigonia cf. fortinensis*** Lambert. X 3. Locality MC-346, Taguarumo Formation, -5:RV, external view.

Figures 17 – 7, 8, 9, 10.- ***Pterotrigonia (Pterotrigonia) caudata*** (Agassiz). X 1. Locality MO-2801, Tibú Formation, Perijá, -7 to -10: reproduced from LYCETT, (1875, pl. 26, figs. 6, 6a, 6b, 7).

Figure 17 – 11.- ***Pholadomya ex gr. texana*** (Conrad). X 0,4. Locality MO-1334, Tibú Formation, Perijá, lowest limestone. -11:LV, external view.

Figures 17 – 12, 14, 15.- ***Pterotrigonia (Notoscabrotrigonia) tocaimaana*** (Lea). X 1. Locality An-77 (VIVAS, 1987), El Cantil Formation, from *Mesorbitolina ovalis* horizon. Reproduction of DIETRICH, (1938, pl. 19, figs. 1, 2a, 2b).

Figure 17 – 13.- ***Mutela? sp. indet.,*** Macsotay. X 1. Locality PM-08-B, La Margarita mudstones, in taphoflora-rich siltstones. -13:RV, lateral view.

Plate 17

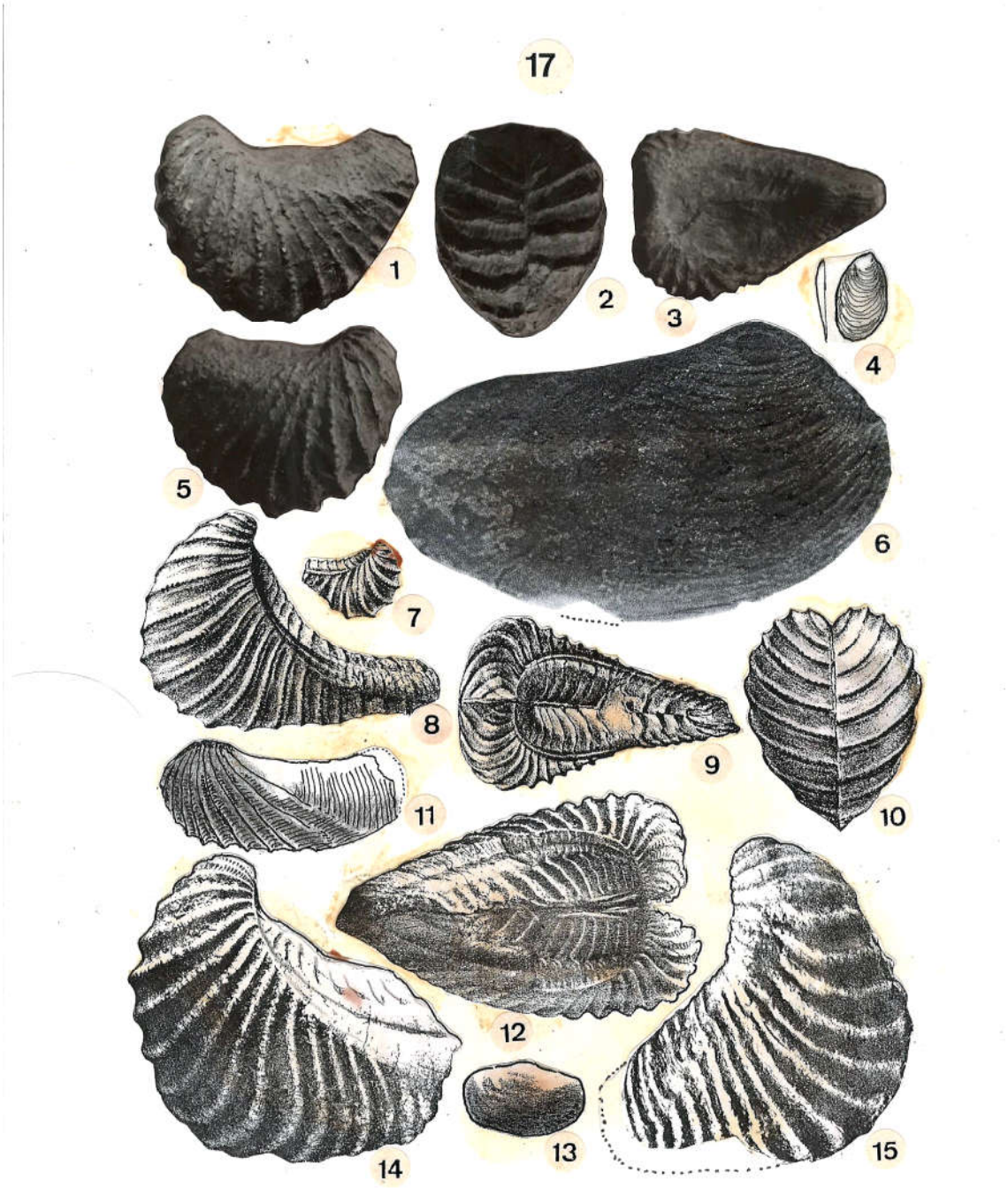

PLATE 18

El Cazón Formation, Berriasian-Valanginian, El Dantó dolostones and lower Taguarumo Formations, of Hauterivian age; upper Taguarumo Formation, Barremian age; Peñas Altas Formation´s lower carbonates, and Guaimaros shale member, and Garcia Formation of Aptian age (See plate 1).

Figures 18 – 1, 5, 6.- ***Panis maroma*** (Von der Osten). X 1. Locality MO-3213, lower limestones of Taguarumo Formation, reproduced from VON DER OSTEN, (1954, pls. 5, 6).

Figures 18 – 2, 7, 8.- ***Excorbula? convergens*** (Gerhardt). X 3. Localñity MO-892, Taguarumo Formation, reproduced from GERHARDT (1898, pl. 5, figs. 10a, b, c).

Figure 18 – 3.- ***Eriphyla (Eriphyla) miyakoensis*** (Nagao). X 1. Locality MC-271, Garcia Formation, -3:RV, external view.

Figure 18 – 4.- ***Aenona andium*** (Gerhardt). X 2. Locality MO-892, lower Taguarumo Formation, green limestones. -4:RV, external view.

Figure 18 – 9.- ***Goniomya mailleana*** (d'Orbigny). X 1. Locality MO-888, Lope Member of the Taguarumo Formation, -9:RV, lateral view.

Figure 18 – 10.- ***Eriphyla (Eriphyla) pikensis*** (Hill). X 1. Locality HA-4387, lower carbonatic member of the Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 17).

Figure 18 – 11.- ***Myopholas cf. peruviana*** Olsson. X 1. Locality MO-1782, Guáimaros shale member of Peñas Altas Formation, (GARCIA JARPA et alii., 1980). -11:RV, external view.

Figures 18 – 12a, b, c.- ***Ambocardia neocomiensis*** (Agassiz). X 1. Locality MC-349-B,, El Cazón Formation, - 12ª: anterior view; -12b:RV, -12c:LV, external view.

Figure 18 – 13.- ***Disparilia amygdala triangularis*** (Coquand), X 1. Locality MO-3213, Lower Taguarumo Formation, green limestones. -13:LV, external view.

Figures 18 – 14, 15.- ***Thetis minor*** Sowerby. X 2. Locality VG-384-A, upper El Cazón Formation, reproduction of d'Orbigny (1846, pl. 387, figs. 1, 2)..

Figures 18 – 16a, 16b, 16c.- ***Anulostrea perazai new species,*** Macsotay. X 1. Locality MC-403, Río Carinicuao, north flank of El Cordón anticline, (DGC) El Dantó dolostones, -16a:VI, external view; -16b:VI, external view; -16c:RV, external view. HOLOTYPE.

Figure 18 – 17.- ***Anopea dispar*** (Philippi). X 0,5. Locality PM-11-A, La Margarita mudstones, -17:RV, reproduction of PHILIPPI (1899, pl. 42, fig. 1a).

Plate 18

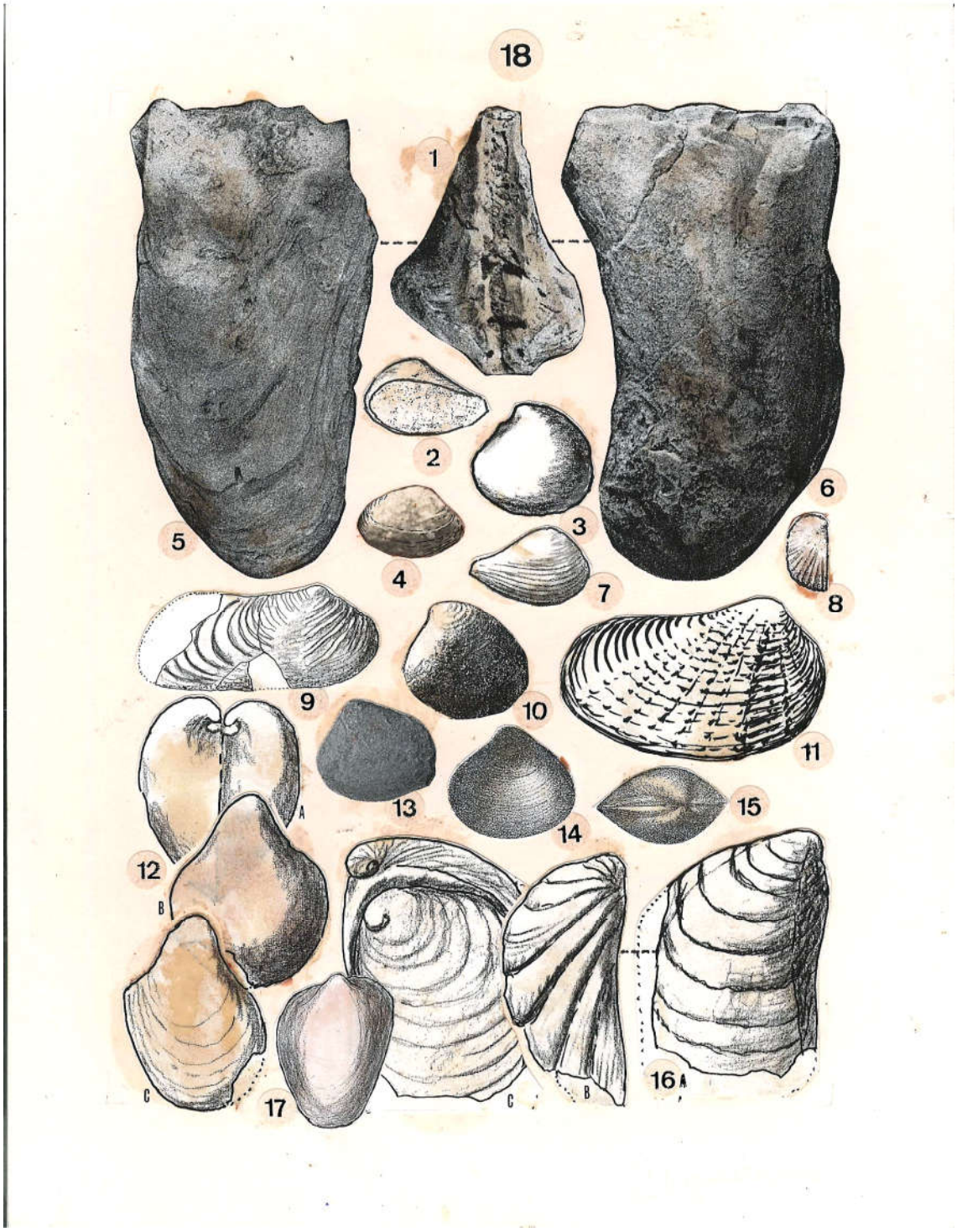

PLATE 19

El Cazón Formation, of Berriasian-Valanginian age; Bergantín sandstones, La Margarita mudstones, El Dantó dolostones, Chururú member of Rio Negro Formation, of Hauterivian age; Tibú and Taguarumo Formations, of Barremian age; Guácharo member of El Cantil Formation (See plate 1).

Figure 19-1.- ***Rostrocardia? boiti*** (Lisson). X 1. Locality VG-555-A, Taguarumo Formation, -1 :RV, external view.

Figure 19 – 2.- ***Inoceramus sebianus*** Buchauer. X 1. Locality PM-10-B, L Margarita mudstones, -2:LV, external view.

Figure 19 – 3.- ***Platymyoidea cf. marullensis*** (d'Orbigny). X 1. Locality VG-384-A, El Cazón Formation, -3:LV, external view.

Figures 19 – 4, 5.- ***Isoarca crassicornis*** (Philippi). X 1. Locality VG-280-A, El Dantó dolostones, -4:LV, externl view, -5: lateral view of articulated specimen.

Figure 19 – 6.- ***Platymyoidea aff. rostrata*** (Agassiz). X 1. Locality MC-448-A, La Margarita mudstones, -6:LV, external view.

Figure 19 – 7.- ***Eocallista huarazensis*** (Fritzsche). X 1. Locality PM-08-C, La Margarita mudstones, -7:LV, reproduction of STEINMANN (1930, fig. 126).

Figures 19 – 8, 9.- ***Ostrea (Ostrea) cotteaui*** Coquand. X 1. Locality VG-382-B, El Dantó dolostones, -8, -9:LV and RV of an articulated specimen.

Figures 19 – 10, 11.- ***Caryocorbula neocomiensis*** (d'Orbigny). X 3. Locality MO-1305, Chururú member of Rio Negro Formation, Uribante trough (FIERRO & USECHE, 1985: 674-675). -10:LV, external view; -11: dorsal view of articulated specimen.

Figure 19 – 12.- ***Virgotrigonia cf. paradisensis*** (Lisson). X 2. Locality VG-736-B, El Cazón Formation, -12:RV, fragmentary.

Figure 19 – 13.- ***Aetostreon aquilinum aquilinum*** (Leymeie). X 1. Locality Vg-381, El Cazón Formation, -13: articulated specimen.

Figure 19 – 14.- ***Linearia cf. subhercynica*** (Maas). X 2. Locality PM-06-C, La Margarita mudstones, -14:RV, external view.

Figure 19 – 15.- ***Myrene dürfieldi*** (Steinmann). X 1. Locality JFS-148, Bergantin Formation, -15:LV, external view.

Figure 19 – 16.- ***Eopecten covuncoensis*** (Weaver). X 0,5. Locality MO-1324, lowest limestone in Tibú Formation, Perijá mts. -16:LV, reproduction of WEAVER (1931, pl. 28, fig. 171).

Figure 19 – 17.- ***Platycardia matris*** (Böhm). X 2. Locality MC-15-F, El Cazón Formation, -17:RV, external view of fragmentary sample.

Figure 19 – 18, 19.- ***Malayomaorica*** sp. indet., Macsotay, X 1. Locality MO-1305, Chururú member of Rio Negro Formation, Uribante hemigraben. -18:RV, -19:LV, external views.

Figure 19 – 20.- ***Acutostrea cf. leymeriei*** (Deshayes). X 1. Locality MC-445-C, Guácharo member of El Cantil Formation. -20:LV, internal view.

Figures 19 – 21, 22.- ***Paralellodon tocaymensis*** (d'Orbigny). X 1. Locality VG-280-A, El Dantó dolsotones, -21:LV, external view; -22: dorsal view. Reproduced from d'ORBIGNY (1842, pl. 6, figs. 1, 2).

Plate 19

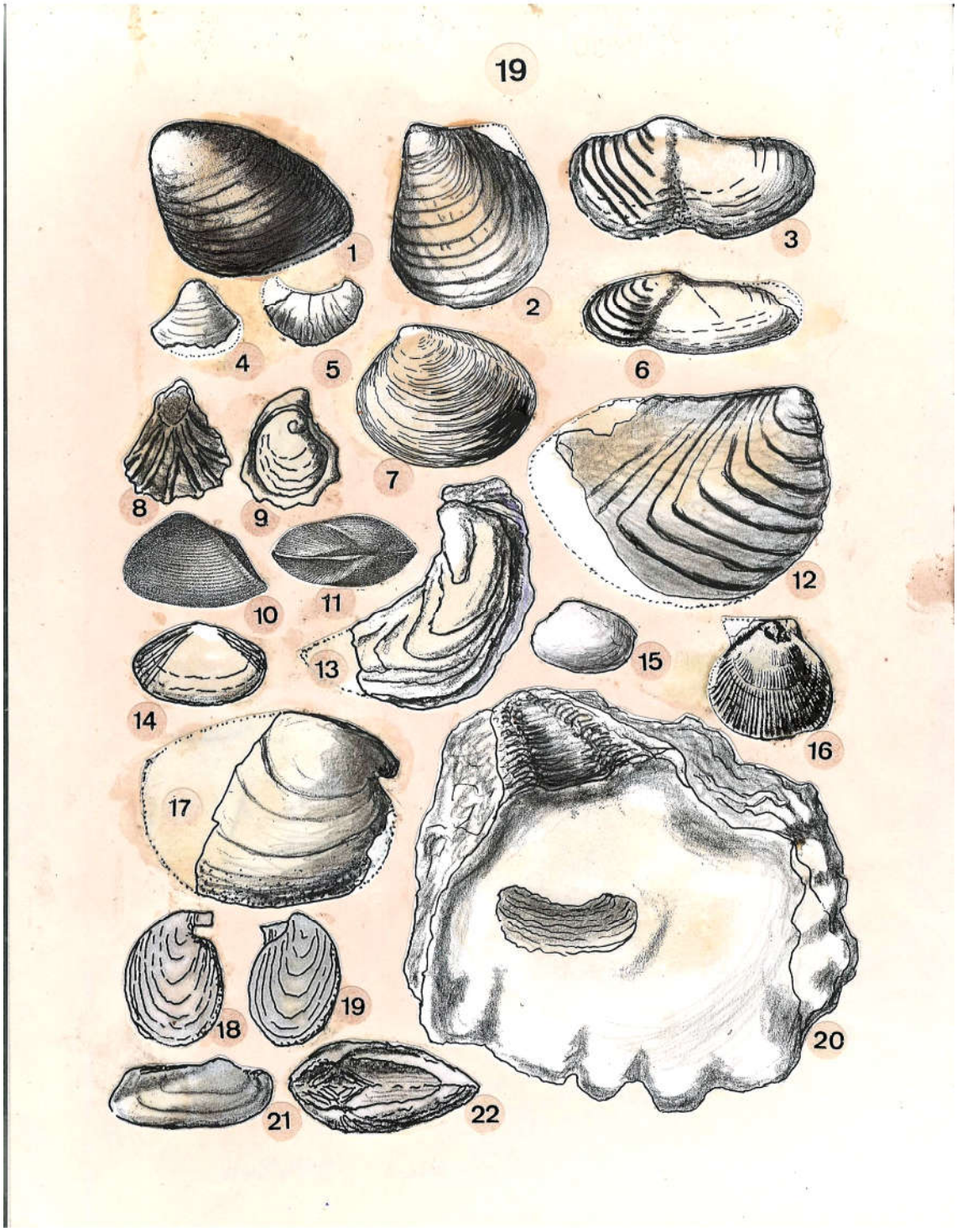

PLATE 20

El Cazón Formation, of Berriasian-Valanginian age; El Dantó dolostones, La Margarita mudstones and Bergantín sandstones, of Hauterivian age; Taguarumo Formation, of Barremian age; Caripito member of Chimana Formation, of Middle Albian age (See plate 1).

Figures 20 – 1, 2, 7, 8, 9.- ***Neithea (Neithella) valangiensis*** (Pictet & Campiche). X 2. Locality VG-382-B, El Cazón Formation, figures reproduced from PICTET & CAMPICHE (1870, pl. 181).

Figures 20 – 3, 4, 10.- ***Buchotrigonia (Buchotrigonia) abrupta*** (Von Buch). X 1. Locality An-317-A, (VIVAS, 1987, FIG. 20) Caripito member of Chimana Formation, Reproduction from VON BUCH (1838, pl. 31, figs. 28, 29, 30).

Figure 20- 12.- ***Proveniella bernensis*** (Leymerie). X 0.7. Locality VG-565, Upper Taguarumo Formation, -12:RV, external view.

Figures 20 – 13, 14.- ***Pterinella petersi*** (Toula). X 0,5. Locality MO-3213, Upper El Dantó Formation, -13, -14:RV, internal and external view.

Figure 20 – 15.- A***nisocardia (Anisocardia) macanalensis*** Etayo-Serna. X 1. Locality PM-09-A, La Margarita mudstones, -15: reproduction from ETAYO SERNA (1985-c, pl. 7, fig. 1)

Figure 20-16.- ***Cuspidaria neocomica*** Somogyi. X 3. Locality PM-08-E, La Margarita mudstones, -16:LV, external view.

Figure 20 – 17.- ***Nucula (Nucula) lingulata*** (d'Orbigny). X 2. Locality MC-342-B, La Margarita mudstones, -17:RV, external view.

Figure 20 – 18.- ***Nuculana (Rollieria) valangiensis*** (Pictet & Campiche). X 2. Locality PM-08-E, La Margarita mudstones, -18:RV, external view.

Figure 20 – 19.- ***Gervillella anceps*** (Deshayes in Letmerie). X 0,5, Locality PM-08-C, La Margarita mudstones, -19:RV, external view.

Figure 20 – 20.- ***Nuculoma planata*** (Deshayes). X 1,5. Locality PM-09-D, La Margarita mudstones, -20:LV, external view.

Figure 20 – 21.- ***Nucula (Rollieria) vibrayi*** (d'Orbigny). X 1. Locality MC-341-C, El Dantó dolostones, -21:RV, external view.

Figure 20 – 22.- ***Desertella cf. foureaui*** Munier-Chalmas. X 1,5. Locality MC-119-A, Bergantin Formation (ex.-Barranquin Formation). -22: LV, external view.

Figure 20 – 23.- ***Geltena cf. mactriforme*** Vokes. X 3. Locality MC-349-B, El Cazón Formation. -23 :LV, external view.

Plate 20

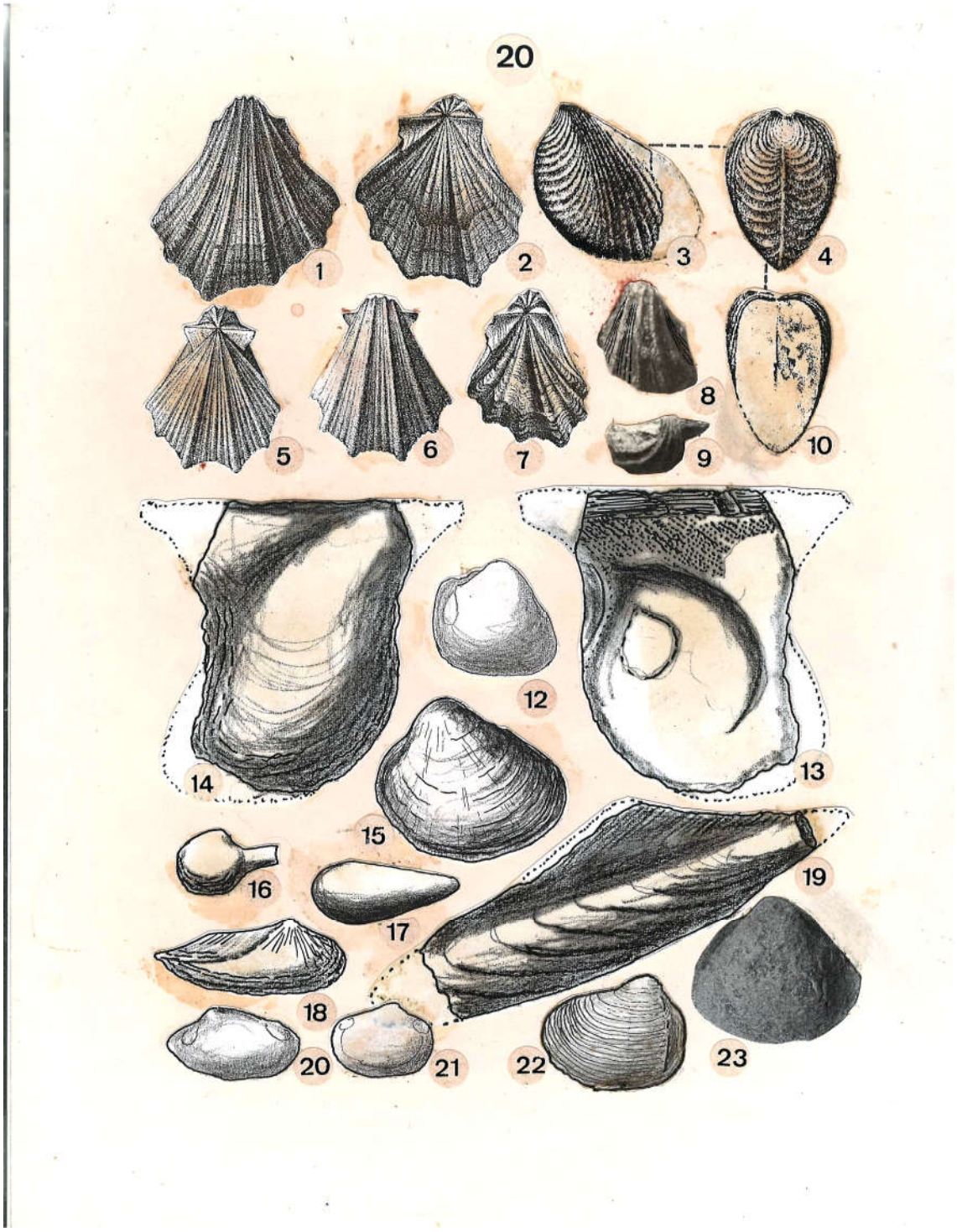

PLATE 21

El Dantó dolostones of Hauterivian age; Taguarumo, and its Lope member, and Tibú Formation of Barremian-Early Aptian age; lower carbonatic member of Peñas Altas Formation, of Late Barremian-Early Aptian age (See plate 1).

Figures 21 – 1, 2.- ***Isognomon militaris*** (Burckhardt). X 0,5. Locality MO-905, Lope member of Taguarumo Formation, -1, -2: reproduced from BURCKHARDT (1903, pl. 15, figs. 3, 4).

Figures 21 - 3, 5.- ***Nemocardium subhillanum*** (Withfield). X 1. Locality MO-3213, lower Taguaruno Formtion, -3, -5:LV, external and internal views.

Figure 21 – 4.- ***Nemocardium birdanum*** (Whitfield). X 1. Locality MO-888, upper Lope member of Taguarumo Formation. -4:LV, external view.

Figures 21 – 6, 16.- ***Neithea (Neithea) atava*** (F. A. Römer). X 1. Locality M0-892, Taguarumo Formation, -16:RV, adult shell; -6: juvenile RV, reproduced from COX (1954, pl. 4, figs. 1, 4).

Figures 21 – 7, 8, 9, 11.- ***Megacucullaea ollonensis nomen novum,*** Macsotay. X 1. Locality MO-1324, curve of Río Negro, lower Tibú Formation, Perijá range. Reproduced from original of GABB (1877, pl. 41, figs. 7, 7a, 8, 8a) from Perú.

Figures 21 – 10.- ***Pteria berriasensis*** Gillet, X 2. Locality MC-338, El Dantó dolostones, -10:LV, external view.

Figures 21 – 12, 13.- ***Acesta cf. longa*** (Roemer). X 1. Locality MC-338-H, El Dantó dolostones, -12, -13, reproduced from MALLADA (1887, pl. 38B, figs. 8, 10).

Figures 21- 14, 20.- ***Callucina neuquensis*** (Haupt). X 1. Locality VG-382-B, El Dantó dolostones, -14, -20: reproduced from Weaver (1931, figs. 238, 240).

Figures 21 – 15, 17, 18.- ***Seendia elongata*** (d'Orbigny). X 2. (-15, 17) X 4(-18). Locality MC-349-B, Taguarumo Formation,

Figure 21 – 19.- ***Disparilia bogotina*** (dÓrbigny). X 1. Locality HA-4371, lower carbonate member of Peñas Altas Formation, Trujillo area, (H. ARNAUD et alii., 1999, Fig. 14). Figures reproduced from d'ORBIGNY (1942, pl. 3, fig. 15).

Plate 21

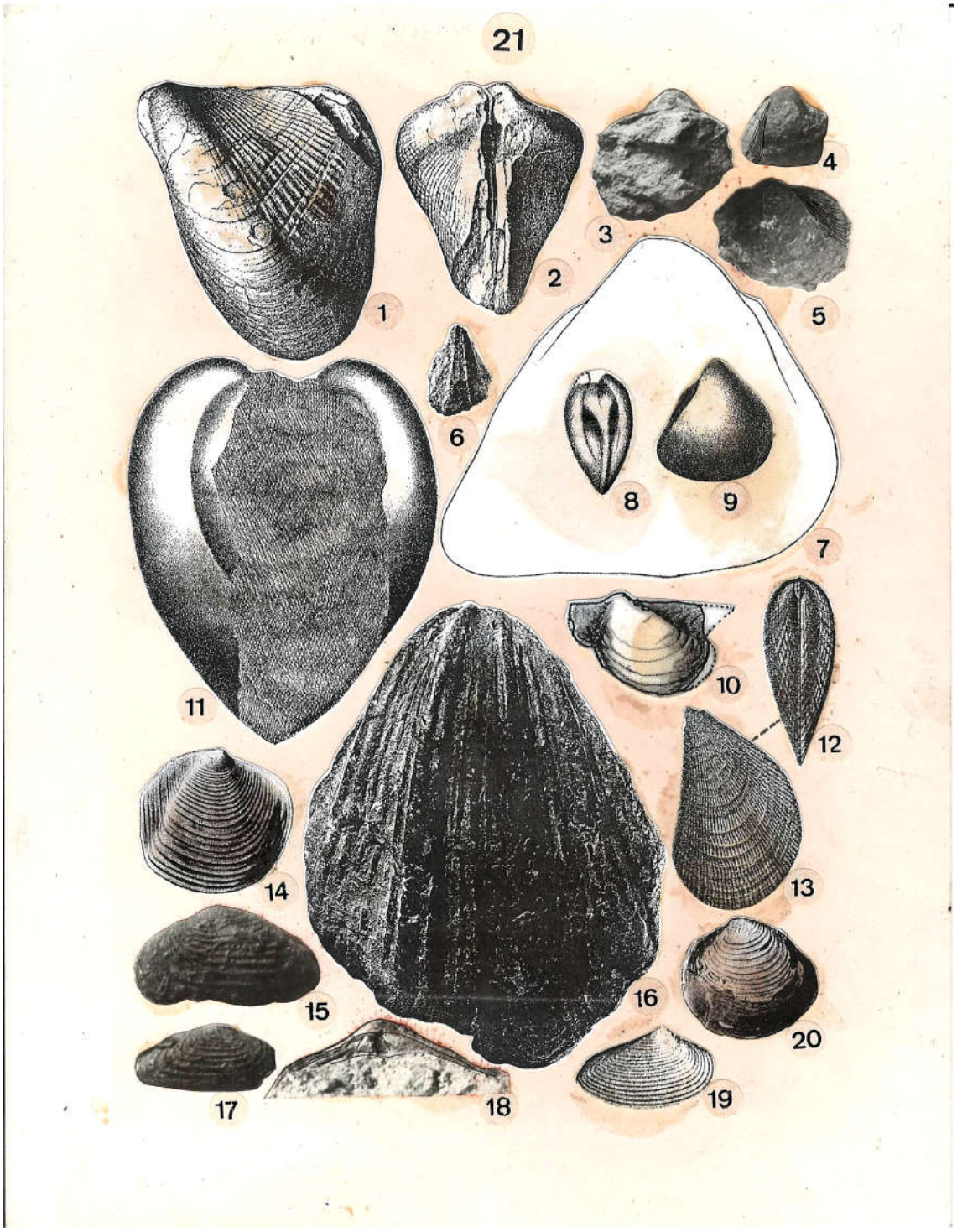

PLATE 22

El Dantó dolostones, La Margarita mudstones, of Hauterivian age; Taguarumo Formation, of Barremian age, and its Lope member, of Early Aptian age.

Figures 22 – 1, 2.- ***Rutitrigonia longa*** (Agassiz). X 1. Locality MO-882, Lope member of Taguarumo Formation, -2, -2: lateral and anterior views of the Holotype of *Trigonia lajoyei* , collected in Macanal shales and Apón Formation of Colombia by d'ORBIGNY (1842, pl. 4, figs. 10, 11), synonymous of *R. longa* (Agassiz).

Figures 22 – 3, 5, 6.- ***Rutitrigonia agrioensis*** (Weaver). X 1. Locality VG-556-A, El Dantó dolostones, Figures reproduced from WEAVER (1931, pl. 27, figs. 142(-3), 143(-6), 144(-5).

Figures 22 – 4, 7.- ***Rutitrigonia longa ornatissima*** (Petter-Receveur). X 0,8. Locality MO-905, Lope member of Taguarumo Formation, -4 :LV, lateral view, -7 :RV, external view.

Figure 22 – 8.- ***Myophorella (Myophorella) blancheti new species,*** Macsotay. X 0,6. Locality MO-892, northwest of Puerto Escondido Sucre state (DAGM) Taguarumo Formation, -8:LV, external view. HOLOTYPE Ucvmg/IO-2133.

Figures 22 – 9, 10, 13.- ***Mediterraneotrigonia hondaana*** (Lea). X 0,6. Locality MO-905, Lope member of Taguarumo Formation, -9, -13:LV, external views. -10:LV, internal view.

Figures 22 – 11, 12, 14.- ***Mediterraneotrigonia valentina*** (Vilanova). X 0,6. Locality MO-3213, green limestone in Lower Taguarumo Formation. -12, -14:LV, external view. -11:RV, internal view. -14: reproduction, VON DER OSTEN (1854, pl. 7, fig. 4).

Figures 22 – 16, 17.- ***Barbatia (Barbatia) raulini*** (Leymerie). X 1. Locality PM-08-B, La Margarita mudstones, articulated specimen ; -16 :RV, exteral view, -17 : upper view.

Figure 22 – 15.- ***Trigonarca cf. peruana*** (Gabb).. X 1. Locality VG-382, El Dantó dolostones, -15:RV, external view.

Plate 22

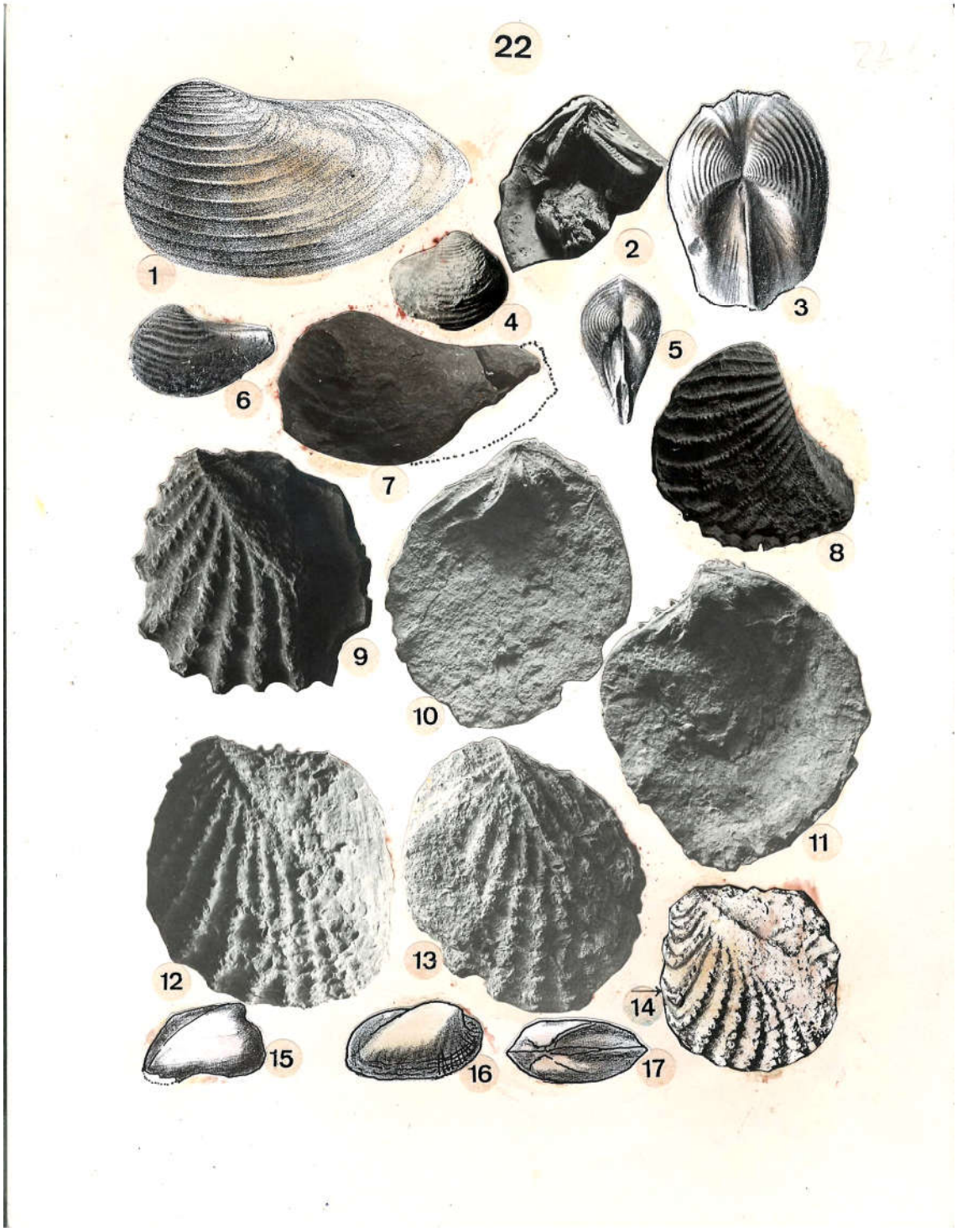

PLATE 23

Bergantin sandstones, El Dantó dolostones of Hauterivian age; Taguarumo Formation, of Barremian age; Lope member of Early Aptian age; lower Borracha and El Cantil Formations, Late Aptian and upper Borracha Formation, of Early Albian age (See plate 1).

Figures 23 – 1, 13.- ***Musculiopsis coycuarensis new name,*** Macsotay, X 1, Locality MC-228-B, upper Bergantin sandstones, Monagas state, of Hauterivian to Early Barremian age. -1:LV, -13:RV.

Figures 23 – 2, 3, 8.- ***Tylostoma czabalayae new species,*** Macsotay, X 1. Locality MO-5623, south of Nueva Colombia, Taguarumo Formation, Sucre state, -2: apertural view, -3,-8: adapertural view, all adult shells. HOLOTYPE, Ucvmg/IO- 2140.

Figure 23 – 4.- ***Coninoda arigoi*** (Vilanova). X 1. The illustration is a copy of *C. tourneforti* (Verneuil & Lorière, 1868, pl. 2, fig. 3) for comparison with *Coninoda sp. aff. arigoi* (Vilanova) of the Maestrazgo Basin, Spain, dated as Aptian.

Figure 23 – 5.- ***Parsimonia antiquata*** (Sowerby). X 2. Locality MO-892, Taguarumo Formation, -5:lateral view.

Figure 23 – 6.- ***Heteroptygmatis cf. pseudoconvexa*** (Stanton). X 1. Locality MO-888, Lope member of Taguarumo Formation, -6 : axial section.

Figure 23 – 7.- ***Pterodonta aubouini, new species,*** Macsotay, X 1. Locality MO-890, Punta La Cruz, Manare peninsula, Lower Borracha Formation, (DAGM). -7:ventral viuew, HOLOTYPE. Ucvmg/IO-2141.

Figure 23 – 9, 10.- ***Acteonella (Pchelintsevella) baconica*** (Benkö-Czabalay). X 2. Locality MO-881, Taguarumo Formation, -9: apertural view of a juvenile shell; -10: idem., an adult shell.

Figure 23 - 11.- ***Aporrhais nodifera*** (Koch & Dunker). X 2. Locality VG-382-B, El Dantó dolostones, - 11:adapertural view.

Figure 23 – 12.- ***Perissoptera ex gr. parkinsoni*** (Mantell). X 1. Locality MO-890, Upper Borracha Formation, -12 : adapertural view of an adult specimen.

Figure 23 – 14.- ***Chilodonta elegans*** (Deshayes). X 1. Locality MO-881, Taguarumo Formation, -14: lateral view.

Figure 23 – 15.- ***Ampullinopsis cf. gardonensis*** (Cossmann). X 1. Locality MC-324, Lower El Cantil Formation, -15: abapertural view of adult. Shell.

Plate 23

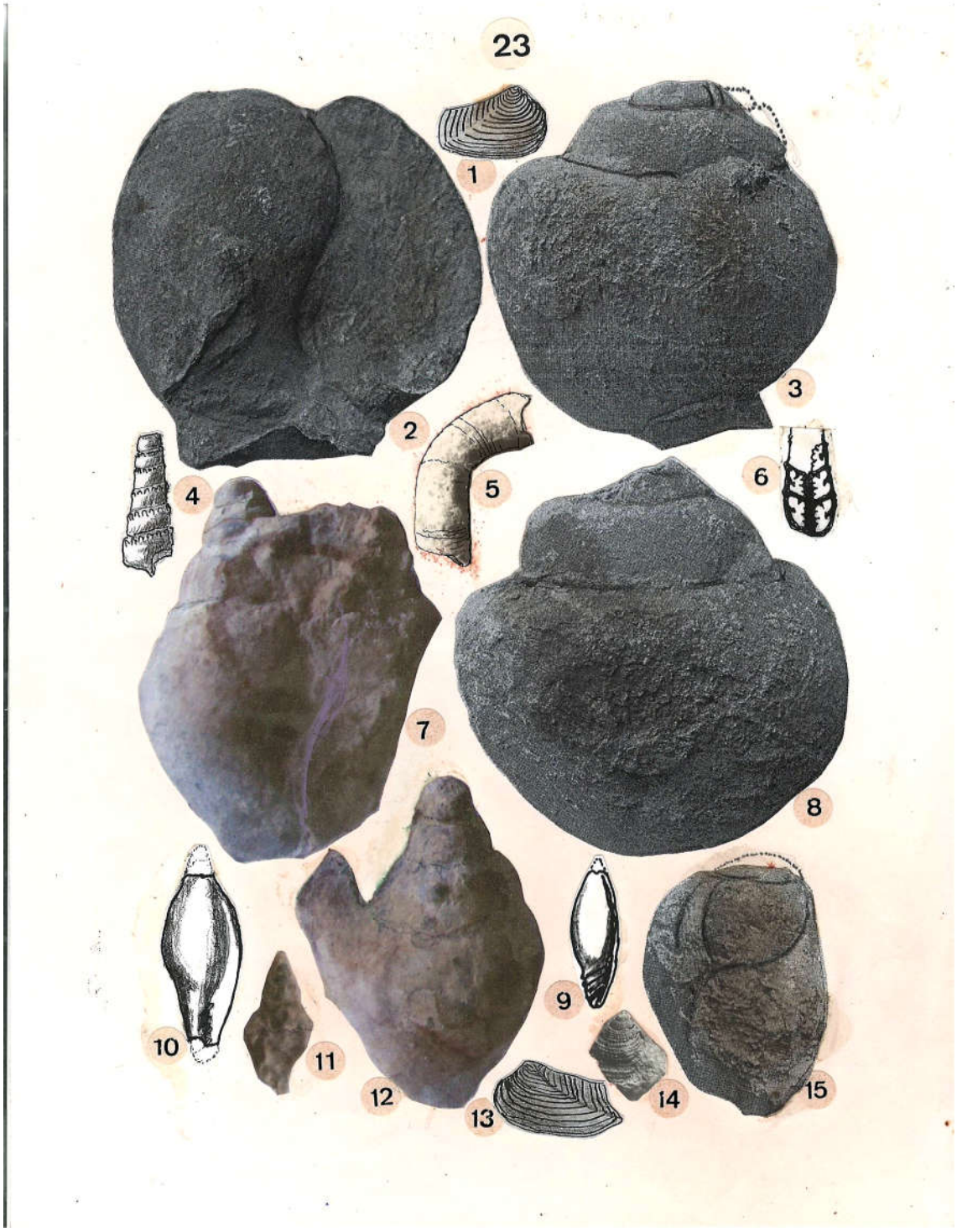

PLATE 24

Taguarumo and Chupariral Formations, of Barremian – Early Aptian age.

Figures 24 – 1, 5.- ***Tylostoma (Odostomopsis) enayi new species,*** Macsotay. X 2. Locality VG-382-B, Quebrada El Imposible, Serrania de La Paloma (DGC),Taguarumo Formation of Barremian age. -1;adapical view, -5: abapical view. HOLOTYPE Ucvmg/IO-2142,

Figures 24 – 2, 3, 7.- ***Leviathania vonderosteni new species,*** Macsotay, (X 1). Locality VG-459-B, Pica El Algarrobito – cerro El Caserio Santa Ana, Sucre state, Taguarumo Formation, of Early Barremian age. -2,-7: abapertural view of adult Shell, -3: adapaertural view. HOLOTYPE, Ucvmg/IO-2143.

Figure 24-4.- ***Tylostoma magharensis*** Abbass. X 1. Locality VG-276, Chuparipal Formation, -4: abapertural view.

Figure 24-6.- ***Eriptycha busnardoi new species,*** Macsotay. X 4. Locality MO-896, west of Patiño inlet, Sucre state, (DAGM) Taguarumo Formation, of Late Barremian age. -6: apertural view.

Figure 24 – 7.- ***Tylostoma depressum*** Pictet & Campiche. X 1. Locality MC-346-A, Taguarumo Formation, -7: abapertural view.

Figures 24 – 8, 9, 10.- ***Gyrodes manueli*** (Choffat). X 1. Locality MO-5613: Taguarumo Formation, -9: adapertural view, -10: abapertural view.

Figure 24 – 11.- ***Acutostrea cf. leymeriei*** (Deshayes). X 1. Locality MO-5613: Taguarumo Formation, -11: juvenile LV-s attached to the umbilical area of ***Gyrodes manueli*** (Choffat).

Figure 24 - 12.- ***Haustator lopense new species,*** Macsotay, X 1,6. Locality MO-905, east side of Cachimena inlet, Sucre state, (DAGM) lower Lope Member of Taguarumo Formation, of Late Barremian age. -12: dorsal view of adult shell. HOLOTYPE: Ucvmp/IO-2015.

Plate 24

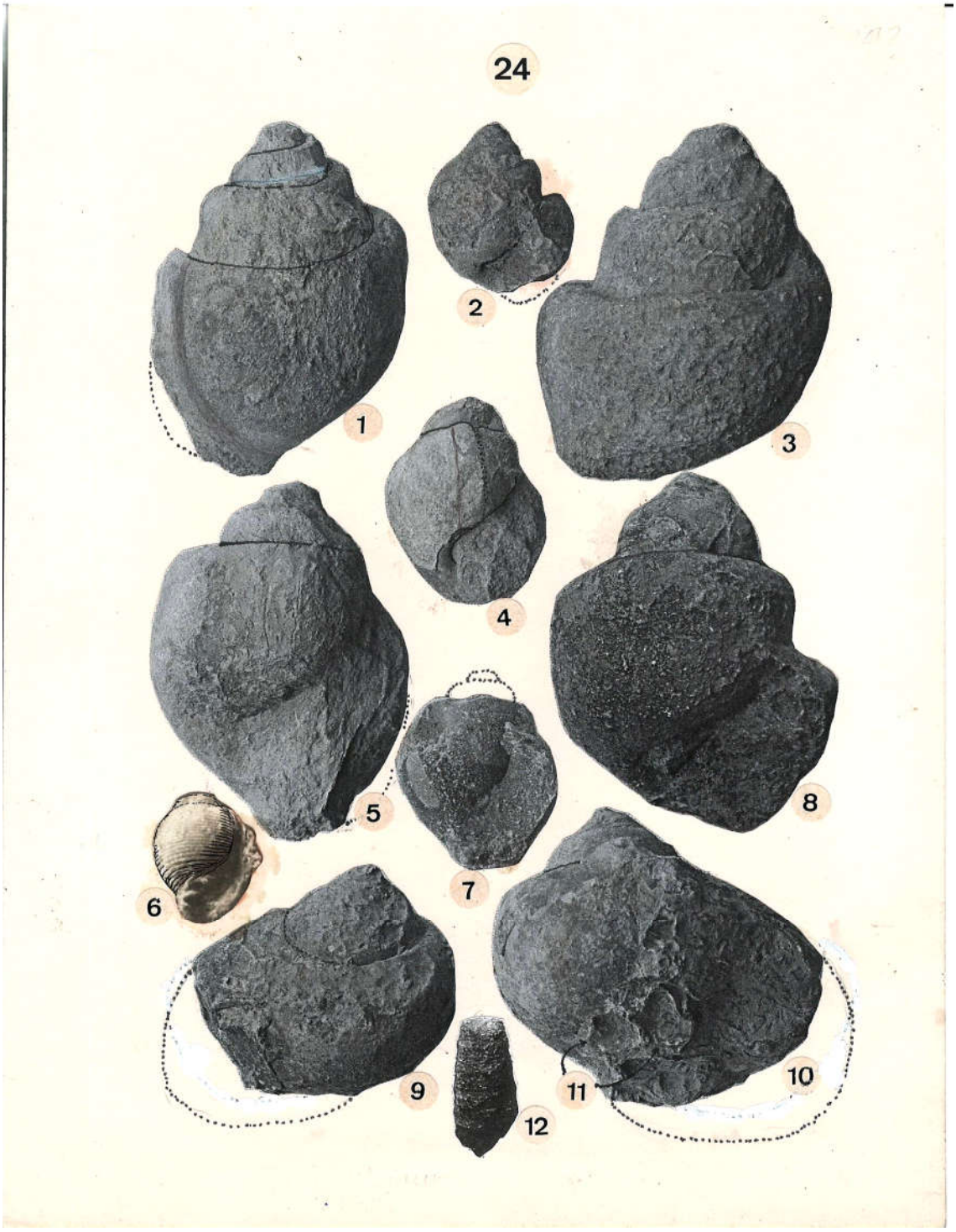

PLATE 25

Lower Taguarumo Formation, of Hauterivian age; Taguarumo Formation and its Lope member, Chuparipal Formation, of Barremian age. Lower carbonatic member of Peñas Altas Formation, early Aptian age; Lower Borracha and Guacharo member of El Cantil Formation, of Late Aptian age (See plate 1).

Figure 25 – 1.- ***Astralium cf. bellavistenis*** Delpey, X 1,5. Locality MO-905, Lope member of Taguarumo Formation, -1: adapertural view.

Figures 25 – 2, 3.- ***Akera cf. neocomiensis*** Cossmann, X 2. Locality MO-892, Taguarumo Formation, -2: abapertural view; -3: adapertural view.

Figures 25 – 4, 5.- ***Arcotia studeri peruana*** (Fritzsche). X 1. Locality PM-87-B, Lope member of Taguarumo Formation, -4, -5: ab- and ad-apertural views.

Figures 25 - 6, 7, 8, 9.- ***Discohelix (Discohelix) brouzetensis*** (Cossmann). Locality MO-888, Lope member of Taguarumo Formation, -6, -7: X 3, lateral view; -8, -9: X 2, lateral view.

Figures 25 – 10.- ***Laevinerinea bauga trinidadensis*** (Dietrich). X 1. Locality MC-375, Upper Taguarumo Formation. -10: axial section, drawing of the author.

Figure 25 – 11.- ***Haustator colombiana*** (Jaworsky emend. Royo & Gomez). X 0,75, Locality VG-381, Taguarumo Formation, -11: abapertural view.

Figures 25 – 12, 18.- ***Itieria (Campichia) truncata*** (Pictet & Campiche). Locality PM-87-B, Chuparipal Formation, -12: X 4, 18: natural section, X 2.

Figures 25 - 13, 14.- ***Aphanoptyxis böhmi*** (Blanckenhorn). X 1. Locality MO-905, Lope member of Taguarumo Formation, -13, -14: abapertural view.

Figure 25 – 15.- ***Mayeria valdenis*** (Pictet & Renevier). X 2. Locality MO-888, Lope mem,ber of Taguarumo Formation. -15: adapertural view.

Figure 25 – 16.- ***Lissochilus squamosus*** (White). X 4. Locality MO-892, Taguarumo Formation, -16: adapertural view of a fragmentary shell.

Figure 25 – 17.- ***Aptyxiella (Acroptyxis) rigida*** (Nagao). X 1,5. Locality HA-4469, lower carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 18).

Figure 25 – 19.- ***Diozoptyxis cf. lamanonis*** (Coquand). X 2. Locality MC-119-A, lower García Formation, of Early Aptian age; -19: adapertural view, worn specimen.

Figure 25 – 20.- ***Eustoma pellati*** (Cossmann). X 1. Locality MO-890, lower Borracha Formation, -20: abapertural view of a well preserved cast.

Figure 25 – 21.- ***Contortella cf. ornata*** Pchelintsev, X 1. Locality MO-890, lower Borracha Formation, -21: natural cross section, drawn from outcrop.

Figure 25 – 22.- ***Calliostoma gaudini*** (Pictet & Campiche). X 1,5. Locality MO-1718, lower carbonatic member of Peñas Altas Formation. -22: abapertural view of an adult shell.

Figure 25 – 23.- ***Cassiope lujani*** (Verneuil). X 1. Locality MO-1502, lower carbonatic member of Peñas Altas Formation, -23 :abapertural view.

Figure 25 -24.- ***Aptyxiella (Acroptyxis) vogdti vogdti*** (de Mortillet). X 3. Locality MO-4269, lower carbonatic member of Peñas Altas Formation. -24: axial section of shell, drawn from outcrop.

Figures 25 - 25, 26.- ***Helicocryptus cf. mexicanus*** (Böse). X 4,6. Locality MO-3213, lower Taguarumo Formation, in green limestones; -25: abapertural view, -26: lateral view.

Figures 25 – 27.- ***Trajanella cf. japonica*** Nagao, X 2. Locality MC-370-D, Taguarumo Formation, -27: adapertural view.

Figures 25 – 28, 28A.- ***Mesalia cf. planicostata*** (Peron). X 1,5. Locality MO-905, Lope member of Taguarumo Formation, -28: adapertural view; -28ª: last whorl preserved, X 4.

Figure 25 – 29. ***Leviathania cf. gasullae*** (Coquand). X 1. Locality FA-58-A, Guácharo member of El Cantil Formation, -29: abapertural view.

Figure 25 – 30.- ***Pseudomesalia manzourensis*** (Abbass). X 2. Locality MO-905, Lope member of Taguarumo Formation. -30: lateral view of fragmentary shell,

Plate 25

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PLATE 26

El Dantó dolostones, of Hauterivian age; Taguarumo, Yúruma and Chuparipal Formations, of Barremian age; Lope member of Taguarumo and Lower Borracha Formations, of Early Aptian age (See plate 1).

Figure 26 – 1.- ***Angaria keenae*** Von der Osten. X 2,6. Locality MO-896, Taguarumo Formation, -1: adapertural view.

Figure 26 - 2.- ***Metriomphalus schwarki*** Von der Osten. X 2,6. Locality MO-907, El Dantó dolostones, -2: adapertural view.

Figure 26 – 3.- ***Microschiza (Cloughtonia) aptiensis*** (Landerer). X 0,66 Locality MMH Su-190, Lope member of Taguarumo Formation, -3: adapertural view.

Figure 26 – 4.- ***Metriomphalus taguarumensis*** Von der Osten. X 4,3. Locality MMH, Su-130, Taguarumo Formation, -4 : abapertural view.

Figure 26 – 5.- ***Boltenella sp .indet.*** Macsotay, X 1. Locality MO-905, Lope member of Taguarumo Formation, -5: abapertural view. Ucvmg/IO-2143.

Figure 26 – 6.- ***Tylostoma allaudiensis*** (Coquand). X 1,6. Locality MO-896, Taguarumo Formation, -6: abapertural view.

Figure 26 – 7, 8.- ***Ampullospira praelonga*** (Deshayes). X 1. Locality MC-324-B, Lower Borracha Formation, -7: abapertural view, -8: lteral view.

Figure 26 – 9, 24.- ***Trobus damesis*** (Blanckenhorn). X 1,6. Locality MO-896, Taguarumo Formation, -9: abapertural view; -24: juvenile shell (reproduced from WHITFIELD, (1891, pl.9, fig. 11).

Figure 26 – 10, 13.- ***Columbellina catedralis*** (Von der Osten). X 1. Locality: MMH Su-90; west coast of Picuda Grande Island, lower Taguarumo Formation, of late Hauterivian age. -10, -13: abapertural and adapertural views reproduced from VON DER OSTEN (1954, pl. 14, fig. 4 and pl. 15, fig. 3).

Figure 26 – 11.- ***Rhabdocolpus krauskopfi*** (Von der Osten). X 4. Locality MMH Su-90 ; lower Taguarumo Formation, -11 : abapertural ? view.

Figure 26 – 12.- ***Turritella pelusae*** Von der Osten. X 1,6. Locality MO-3213, east of Patiño inlet, lower Taguarumo Formation, -12: adapertural view.

Figures 26 – 14, 15, 21.- ***Cassiope strombiformis*** (Schlotheim). X 1. Locality Las 5 Ceibas, south of Cumana (WELLS, 1944) El Dantó dolostones, of late Hauterivian age: all figures in abapertural view.

Figures 26 – 16.- ***Aporrhais cf. picteti*** (de Loriol). X 2,6. Locality VG-556-A, El Dantó dolostones, -16 : dorsal view.

Figures 26 – 17, 18.- ***Tessarolax boussingaulti*** (dÓrbigny). X 1 ?. Locality MO-1728, Hacienda Escorzonera, Yúruma Formation of Early Barremian age (MACSOTAY 1980-b, fig. 12) -17, 18: reproduction of d'ORBIGNY (1842, pl. 3, figs. 2, 3).

Figures 26 – 19.- ***Ringinella inflata*** (Fitton). X 2. Locality MO-892, Taguarumo Formation, -19:abapertural view.

Figures 26 – 20.- ***Parsimonia antiquata*** (Sowerby). X 2. Locality MO-892, northwest of Puerto Escondido, Taguarumo Formation, of Early Barremian age. Polychaeta..

Figures 26 – 22.- ***Confusiscana infulata*** (Wolleman). X 2. Locality MO-3213, El Dantó dolostones, -22: abapertural view.

Figure 26 – 23.- ***Itieria rugifera*** (Zittel). X 1. Locality PM-87-B, Chuparipal Formation, of Barremian age. Drawn by the author, from the picture of an outcrop.

Figure 26 – 25.- ***Columbellina fulviae new species,*** Macsotay. X 1. Locality MO-896, west of Patiño inlet, upper Taguarumo Formation, of Late Barremian age. -25:abapertural view, attached to a colony of ***Filograna socialis*** (Goldfuss).

Figure 26 – 26.- ***Filograna socialis*** (Goldfuss). X 1. A large Polychaeta colony, grown upon a shell of ***Columbellina fulviae.***

Figure 26 – 27.- ***Rhabdocolpus forbesi*** (d'Orbigny). X 2. Locality MO-5622, El Yaque quarry, Upper Taguarumo Formation, of Late Barremian age. -27: abapertural view of an adult specimen.

Plate 26

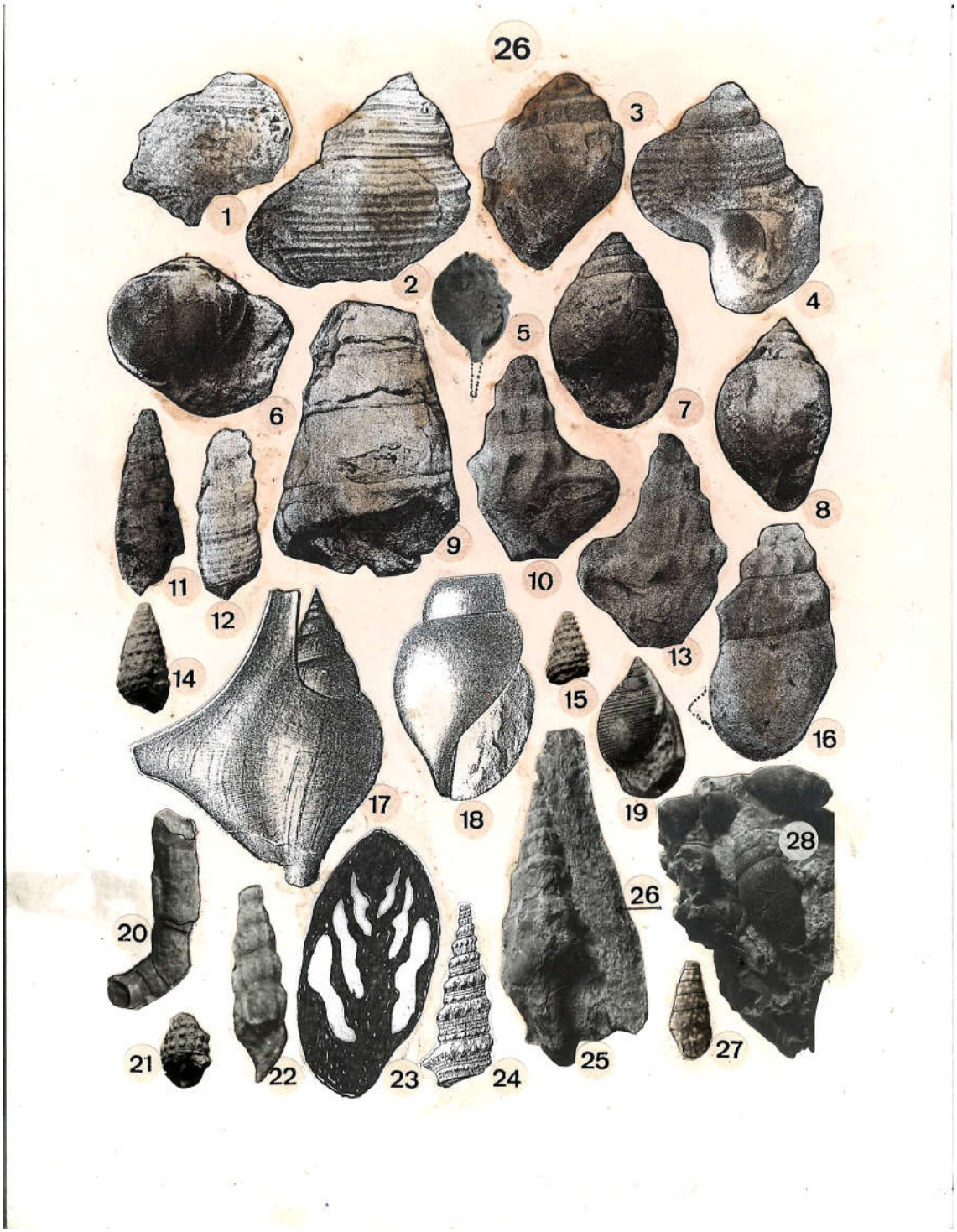

PLATE 27

Taguarumo Formation, of Barremian age; Tibú Formation, and Lope member of Taguarumo Fomation, of Late Barremian-Early Aptian age; Lower Borracha Formation, of Late Aptian age; Upper Borrach Formation, of Early Albian age (See plate 1).

Figure 27 – 1.- ***Trochacteon (Sevanella) zumoffenni*** Delpey. X 1. Locality MO-1721, Tibú Formation, (Atarigua para-autochthon), Lara state, - 1 : drwan by the author from outcrop of massive limestone.

Figures 27 - 2, 9- ***Pictavia pungens*** (Sowerby). X 1,5. Locality MO-881, Taguarumo Formation, -2: abapertural view, -9: adapertural view.

Figures 27 -3, 4.- ***Ampullinopsis indurata*** (Conrad). X 1. Locality MO-1375, upper Borracha Formation, -3, 4: adapertural view of adult specimens.

Figures 27 – 5, 12.- ***Pileolus urgonensis*** (Pictet & Campiche). X 3. Locality MO-888, Lope member of Taguarumo Formation. -5: abapertural view, -12: adapertural view.

Figure 27 – 6.- ***Microschiza (Coronatica) pellati*** (Cossmann). X 1. Locality MO-1722, Tibú Formation, Atarigua para-autochthon, Lara state. -6: adapertural view.

Figures 27 – 7, 8.- ***Microschiza (Coronatica) ornata*** (Fraas). X 1. Locality MO-890, Lower Borracha Formation, -7: abapertural view, -8: adapertural view.

Figure 27 - 10.- ***Lissochilus squamosa*** (White). X 2,3. Locality MO-877, Taguarumo Formation, -10: abapertural view.

Figure 27 – 11.- ***Pterodonta cf. marticensis*** Matheron, X 1,5. Locality MO-905, Lope member of Taguarumo Formation, of early Aptian age. – 11: adapertural view.

Fihures 27 – 13, 14.- ***Pterodonta aubouini new species,*** Macsotay. X 1,5. Locality MO-890, Punta La Cruz, peninsula de Manare, Sucre state, Lower Borracha Formation, (DAGM) of Late Aptian age. -13: apertural view, -14: dorsal view. HOLOTYPE, Ucvmg/IO-2141.

Figure 27 -15.- ***Planospirites manarensis nom. nov.*** Macsotay, X 1,5. Locality MO-890, Punta La Cruz, peninsula de Manare, Sucre state, lower Borracha Formation, (DAGM), of Late Aptian age. -15:LV, internal view.

Figure 27 – 16.- ***Columbellina fulviae new species,*** Macsotay, X l. Locality MO-892, Cachimena inlet, Sucre state, Taguarumo Formation, (DAGM) of Barremian age. -16: dorsal view of adult shell. HOLOTYPE, Ucvmg/IO-2112.

Figure 27 – 17.- ***Ampullina syriaca*** (Conrad), X 2. Locality MO-870, lower Borracha Formation, -17: dorsal view of an adult shell.

Figure 27 – 18.- ***Acteon marullensis*** (d'Orbigny). X 2. Locality MO-892, Taguarumo Formation, -18: apertural view of adult shell.

Plate 27

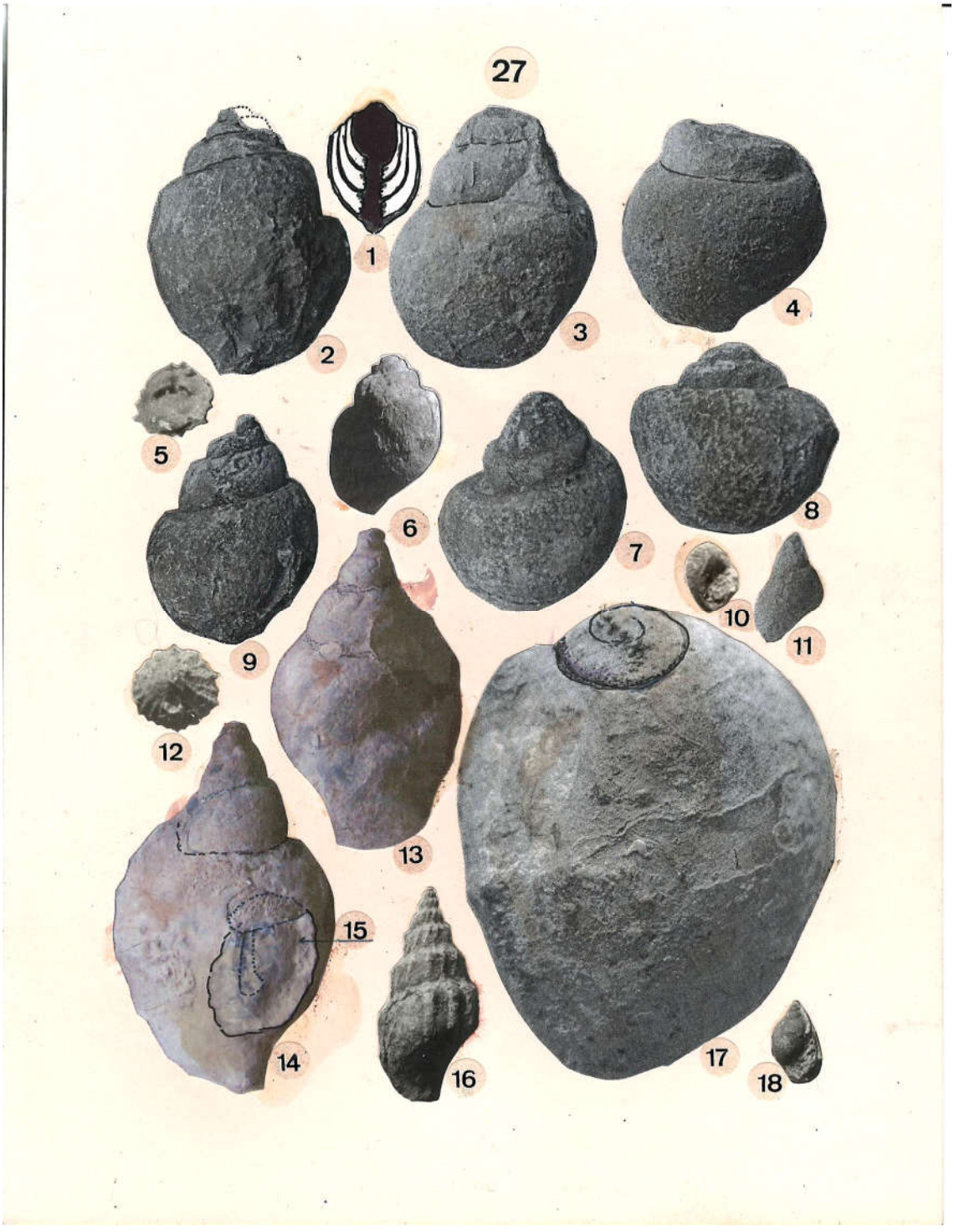

PLATE 28

El Cazón Formation, of Berriasian-Valanginian age; El Dantó dolostones, and Lower Taguarumo Formation, of Hauterivian age; upper Taguarumo Formation, and its Lope member, lower carbonatic member of Peñas Altas Formation, of Late Barremian-Early Aptian age (See plate 1)

.

Figure 28 – 1.- ***Pseudomelania germane*** Pictet & Campiche. X 2. Locality MO-3213, lower Taguarumo Formation, -1: apertural view of an adult shell.

Figures 28 – 2, 8.- ***Fibulella jaccardi*** (Pictet & Campiche). X 2. Locality MO-3213, lower Taguarumo Formation, -2: apertural view of adult specimen. –8: dorsal view, showing axial sculpture in detail.

Figures 28 – 3, 7.- ***Praestomatia chimanaensis new species,*** Macsotay, X 3. Locality MO-3213, lower Taguarumo Formation, Lope inlet of Chimana Grande Island, of Late Hauterivian age. -3: dorsal view of cast; -7: apetural view of cast, HOLOTYPE, Ucvmg/IO-2142.

Figure 28 – 4.- ***Nododelphinula munita*** (Forbes). X 3. Locality MO-892, Taguarumo Formation, - 4: dorsal view.

Figure 28 – 5, 17.- ***Chartronella cf. pauper*** (Pictet & Campiche). Locality MO-5623, Upper Taguarumo Formation, -5: dorsal-diagonal view; -17: apertural-oblique view.

Figure 28 – 6.- ***Gyrodes cf. contracta*** (Gabb). X 2. Locality MO-3213, lower Taguarumo Formation, -6: apertural view.

Figure 28 – 9.- ***Pseudomelania gresslyi*** Pictet & Campiche. X 2. Locality MC-329, El Cazón Formation, -9: dorsal view.

Figure 28 – 10.- ***Boltenella? steffenkieli new species,*** Macsotay. X 2. Locality MO-892, Taguarumo Formation, Puerto Escondido, Sucre state, Taguarumo Formation, (DAGM), of Early Barremian age. – 10:apertural view, HOLOTYPE, Ucvmp/IO-2143,

Figure 28 -11.- ***Eymarella truncata*** (Pictet & Campiche). X 2- Locality MO-888, Lope member of Taguarumo Formation, -11 : dorsal view.

Figure 28 – 12.- ***Pterodonta aff. homariensis*** Blanckenhorn, X 1. Locality MO-3190, uppermost limestone bed of Borracha Formation, -12: axial cross-section.

Figure 28 - 13.- ***Alamirifica magnicostata*** (Conrad). X 1,5. Locality MO-892, Taguarumo Formation, -13: apertural view.

Figure 28 – 14.- ***Perissoptera vilanovae*** (Coquand). X 1,3. Locality MO-892, Taguarumo Formation, -14 : apertural view.

Figure 28 – 15.- ***Cultrigera moreausi*** (d'Orbigny). X 2. Locality MO-1278, La Peña huts, along Barbacoas-Montevideo road, lowest exposed beds in Peñas Altas Formation, Trujillo state. -15: dorsal view.

Figure 28 – 16.- ***Ampullospira drumensis*** (Sayn). X 1,3. Locality MO-892, Lope member of Taguarumo Formation, -16: dorsal view of damaged specimen.

Figure 28 – 18.- ***Serrifusus stinnesbecki new species,*** Macsotay, X 1. Locality MO-892, eastern extreme of Puerto Escondido inlet, Sucre state, Lope member of Taguarumo Formation, of Lower Aptian (Bedoulian) age. – 18. Apertural view. Ucvmp/IO- 2131, HOLOTYPE.

Figure 28 – 19.- ***Columbellina priamus*** (Coquand). X 2 Locality VG-384-A, Taguarumo Formation, of Barremian age; -19: dorsal view.

Figure 28 - 20.- ***Eunerinea (Eunerinea) hicoriensis*** (Cragin). X 1. Locality MO-905, Lope member of Taguarumo Formation, -20 : apertural view, -20A :internal view.

Plate 28

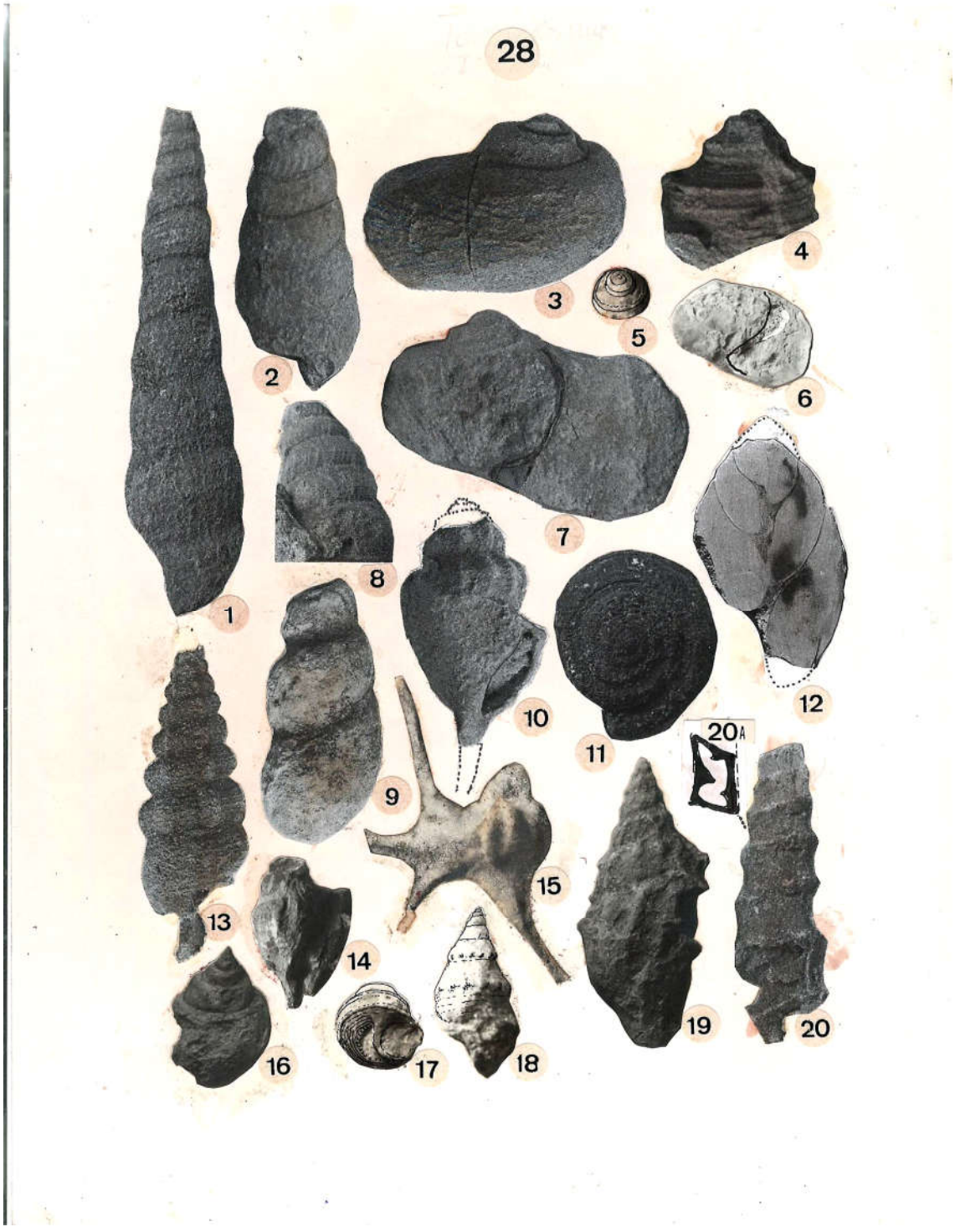

PLATE 29

Tguarumo and Chuparipal Formations, of Barremian age; Lower carbonatic member of Peñas Altas lower Garcia Formation, and Lope member of Taguarumo Formation, of Early Aptian age; Lower Borracha Formation, of Late Aptian age (See plate 1).

Figure 29 – 1, 7.- ***Cossmannea royogomezi new species,*** Macsotay, X 2. Locality MO-905, La Cueva inlet, of Borracha island, Lope member of Taguarumo Formation, DAGM, of Early Aptian age. -1:axial section of a fragment, -7: apertural view of an adult shell. HOLOTYPE: Ucvmp/IO-2141.

Figure 29 – 2.- ***Nerinella utrillasensis*** (Verneuil & Lorière). Axial cut, reproduced from DELPEY, (1942, fig. 114), from the Aptian of Spain. Illustrated fror comparison with *C. royogomezi* n. sp.

Figure 29 – 3, 4.- ***Aptyxiella vogti archimedi*** (d'Orbigny). X 1. Localkity MMH Su-110, Picuda Grande island, west coast, Taguarumo Formation, -3: dorsal view, -4: axial cross-cut, slightly enlarged.

Figures 29 – 5, 6.- ***Neoptyxis galatea*** (Coquand). X 2. Locality MO-888, Lope member of Taguarumo Formation, -6: apertural view, -5: axial section,

Figures 29 – 8, 9.- ***Nerinella dupini*** (d'Orbigny). X 2. Locality MO-888, Lope member of Taguarumo Formation, -9 : apertural view, -8 : axial section, X 2.

Figures 29 – 10, 11.- ***Eunerinea aptiensis*** (Pictet & Campiche). Locality HA-4452, lower carbonatic member of Peñas Altas Formation, -11 : dorsal view, X 1 ; -10 : X 2.

Figure 29 – 12.- ***Neoptyxis essertensis*** (Pictet & Campiche). Locality MO-3162, Chuparipal Formation, (Text-fig. V – 04). -12: axial cut, X 2,5.

Figure 29 – 13.- ***Cossmannea opposita*** (Costa). X 1. Locality MO-905, lower Borracha Formation, -13: axial section.

Figure 29 – 14.- ***Diptyxis lüttickei*** (Delpey). Locality MO-886, Lope member of Taguarumo Formation, -14: axial cross-section, X 2.

Figure 29 – 15.- ***Strombus (Dilatilabrum) sp. indet.,*** Macsotay, X 1. Locality MC-90-A, quebrada El Pulvio, basal García Formation, -15: dorsal view, reproduced from ETAYO SERNA, (1985-c, pl. 1, fig. 11).

Figure 29 – 16, 22.- ***Fibulella bekfayensis*** (Delpey). Locality MO-881, Taguarumo Formation, -16: apertural view, X 3,5. -22: Axial cut, X 2.

Figure 29 – 17.- ***Phaneroptyxis anguillina*** (Castillo & Barcena). X 1. Locality MO-3162, Chuparipal Formation, -17: axial cut of an adult specimen.

Figure 29 – 18.- ***Teleoptyxis micromorpha*** (Cossmann). X 2. Locality PM-87-B, Taguarumo Formation, -18: axial cut.

Figure 29 – 19.- ***Aptyxiella (Acroptyxis) vogti vogti*** (Pictet & Campiche). X 1. Locality HA-4269, lower carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 23).

Figures 29 – 20, 21.- ***Diptyxis euphyes*** (Felix). Locality PM-58-D, Taguarumo Formation, of Late Barremian age; -21: dorsal view of adult shell; -20: axial cut, X 1,5.

Figure 29 – 23.- ***Ceritella cf. chateleti*** (Cossmann). X 2. Locality MO-905, Lope member of Taguarumo Formation.

Figures 29 – 24, 29.- ***Neoptyxis astrachanica*** (Rehbinder). Locality MO-888, Lope member of Taguarumo Formation, -29: X 4,3; -24: axial cut, X 5.

Figure 29 – 25.- ***Adiozoptyxis coquandi*** (d'Orbigny). Locality MO-890, lower Borracha Formation, -25: axial section, X 1.

Figure 29 – 26.- ***Eunerinea chamousseti*** (Pictet & Campiche). Locality HA-4369, lower carbonatic member of Peñas Altas Formation (ARNAUD et alii., 1999, fig. 14). -26: X 1,5.

Figures 29 – 27, 28. ***Nerinella bruni*** (Cossmann). X 2. Locality MO-888, Lope member of Taguarumo Formation, -28: dorsal view of an adult shell ; -27 :axial cut, X l.

Plate 29

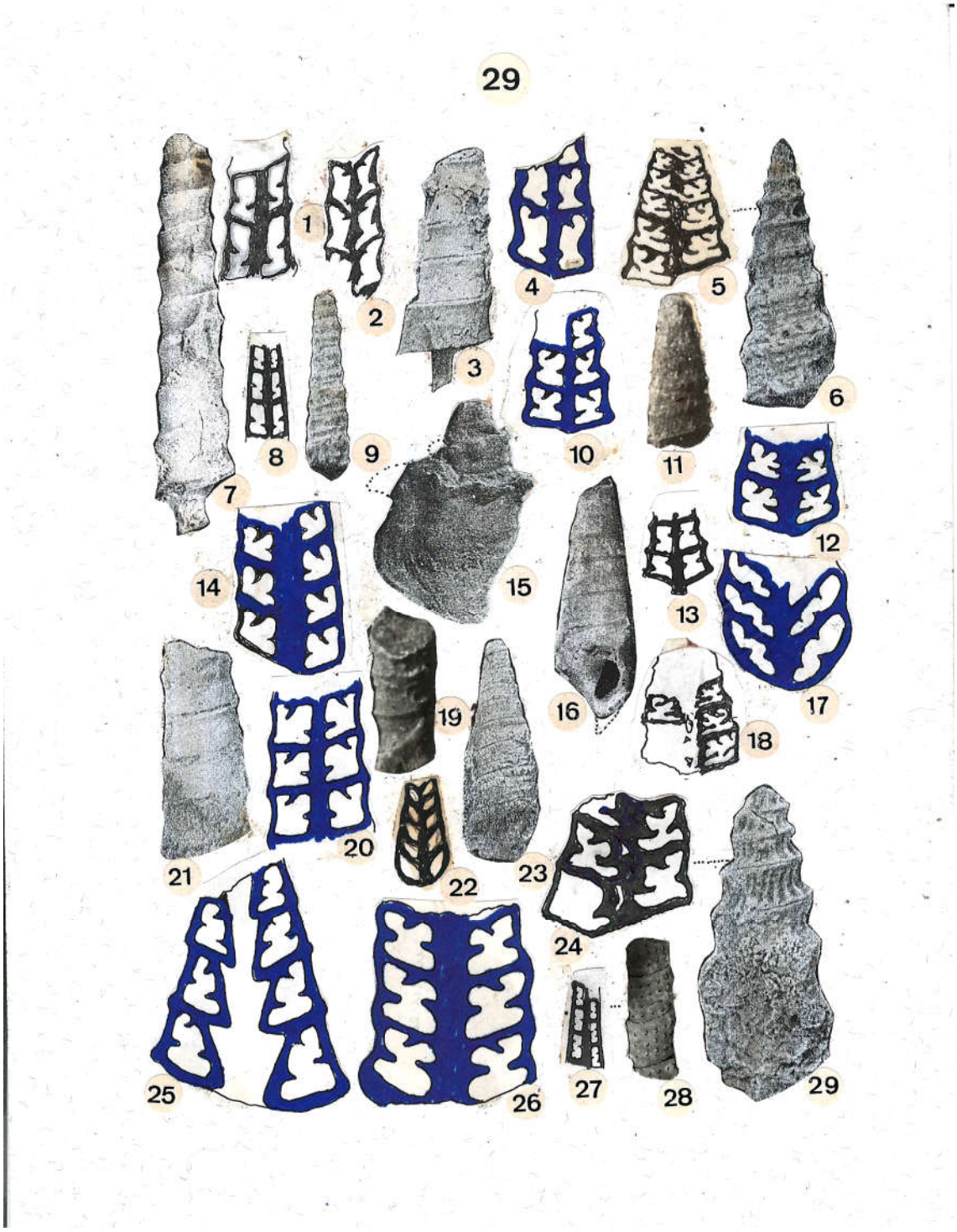
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PLATE 30

Bathyal molluska. El Cazón Formation of Berriasian-Valanginian age; Carorita Formation, and Rottier shale Formation (France) of Hauterivian age; Guácharo member of El Cantil Formation of Early Albian age; Valle Grande, Lisure and Guayamure Formations, of Middle Albian age (See plate 1).

Figures 30 – 1, 4, 5.- ***Pseudomiltha? rottierensis new species,*** Macsotay. Locality: Rottier, Drome, France, - a carbonatic lens in calcareous shales of Hauterivian age. -1:LV, X 0,5, -4: long, narrow anterior scar on RV; -5:RV, postero-dorsal area of a cast, showing an additional small muscle scar, X 2.

Figures 30 – 2, 3.- ***Cirsocerithium tirolense*** Rahman. X 2. Locality MO-1659. Guayamure Formation, Atarigua para-autochthonous unit, (MACSOTAY & VIVAS, 2011). -2,-3: apertural view.

Figures 30 – 4, 8.11.- ***Humptulipsia macsotayi*** Kiel, Campbell & Gaillard. X 1. Locality: Rottier, Drome, France, in shales of Hauterivian age; -4: apertural view, Holotype; -8: axial cut of the paratype. -11: apertural view of paratype.

Figure 30 – 6.- ***Thyasira sculpta*** forma ***barremiensis*** Mongin. X 3. Locality: Carorita hill, Carorita Formation, Lara nappe, of Hauterivian age. -6:RV, external view.

Figure 30 – 7.- ***Poromya (Poromya) sp. indet.*** X 1. Locality: Carorita hill, Carorita Formation, of Hauterivian age. -7: RV, reproduction of WOODS (1899, pl. 5, fig. 5b).

Figure 30 – 9, 14.- ***Propeamussium (Propeamussium) agassizi*** (Pictet & de Loriol). X 2. Locality: Carorita hill, Carorita Formation, of Hauterivian age. -9, 14: RV, external view.

Figure 30 – 10.- ***Anomia peruana*** Gabb. X 3. Locality: MO-2313, caño Cusare, Lisure Formation, Perijá, -10:LV, external view.

Figure 30 – 12.- ***Camptonectes (Hunanonectes) peruanus*** (Rivera). X 1. Locality MC-329-D, El Cazón Formation, -12:LV, external view.

Figure 30 – 13.- ***Entolium signollesae new species,*** Macsotay, X 1. Locality: Le Dat, Vaud Canton, Switzerland, of Berrasian age. -13: LV, external view. Sample nº 38351, of the Musée Geologique de Lausanne, loaned by Dr. L. Charollais.

Figure 30 – 15.- ***Brunonia pervinquieri*** Dimitrova. X 1. Locality MC-445-C, Upper Guácharo member of El Cantil Formation, of Early Albian age. -15: external view of cast.

Figure 30 – 16.- ***Neritopsis cf. gaultina*** (Pictet & Campiche). X 0,8. Locality VG-411-C, Valle Grande Formation, of Middle Albian age. -16: dorsal view.

Figure 30 – 17.- ***Thyasira cf. simplex*** (G. Mahmoud). X 3. Locality MC-431-A, Valle Grande Formation, -17: RV, external view.

Plate 30

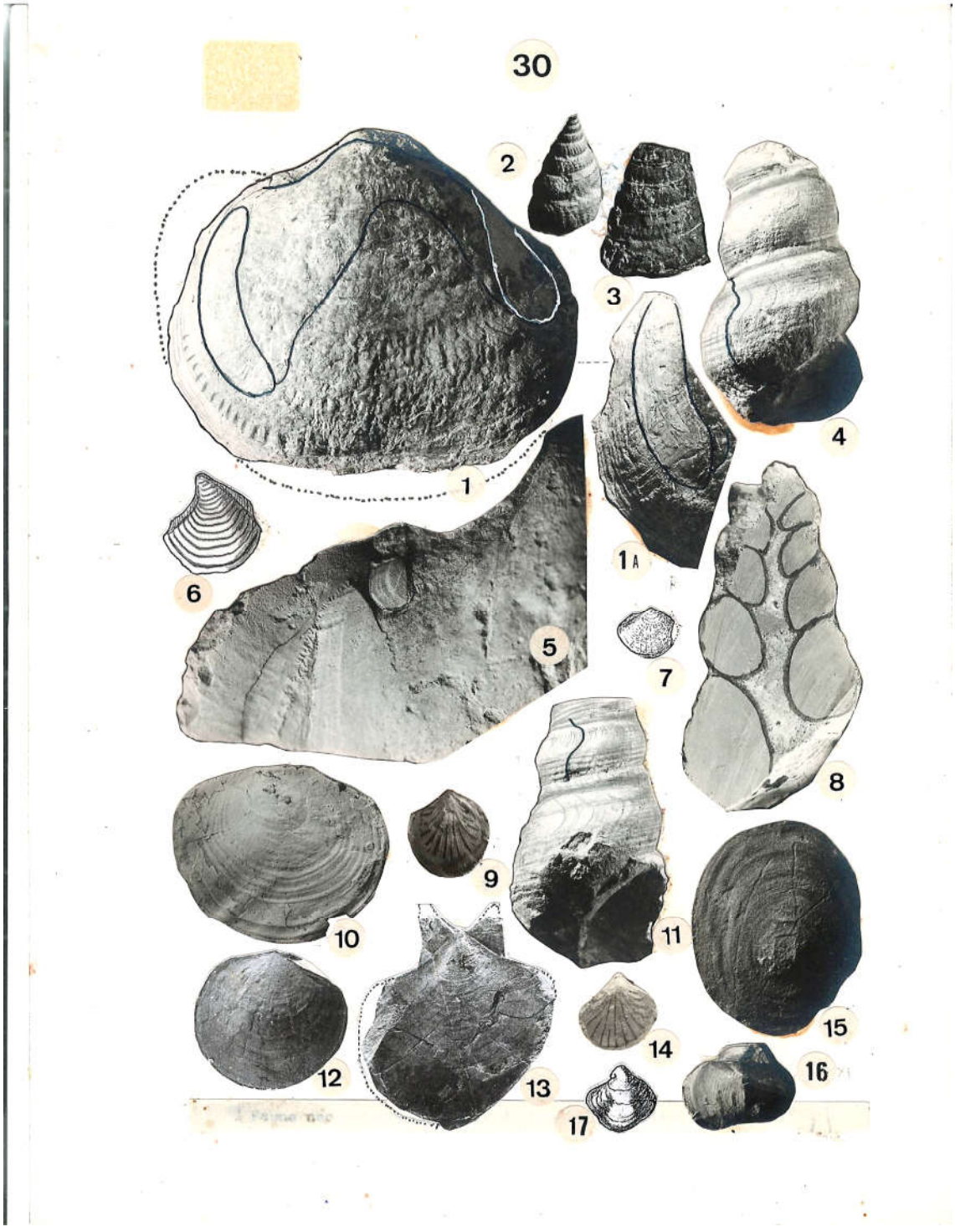

PLATE 31

El Dantó dolostones, of Hauterivian age; Taguarumo Formation, of Barremian age; Lower El Cantil Formation, of Late Aptian age (See plate 1).

Figure 31-1.- ***Amphidonte subhaliotoidea*** (Nagao). X 1. Locality MC-271-D, lower El Cantil Formation, -1 : RV, interior view.

Figures 31 – 2, 6.- ***Aetostreon latissimum*** (Lamarck). X 1. Locality JFS-48-A, Cantarrana, southwest of Cumaná, Sucre state, Taguarumo Formation, -2: articulated specimen, external view from the RV side; -6: internal view.

Figures 31-3, 4, 5.- ***Rastellum (Arctostrea) macroptera*** (Sowerby). X 1. Locality MC-341-C, El Dantó Formation, -3: RV, external view, -4:LV, external view; -5: lateral view of articulated specimen.

Figure 31 – 7.- ***Gyreostrea (Pseudogyra) acuticosta*** (Nyst & Galeotti) X 1. Locality MO-1502, lower carbonatic member of Peñas Altas Formation, of Early Aptian age. -7:LV, internal view.

Plate 31

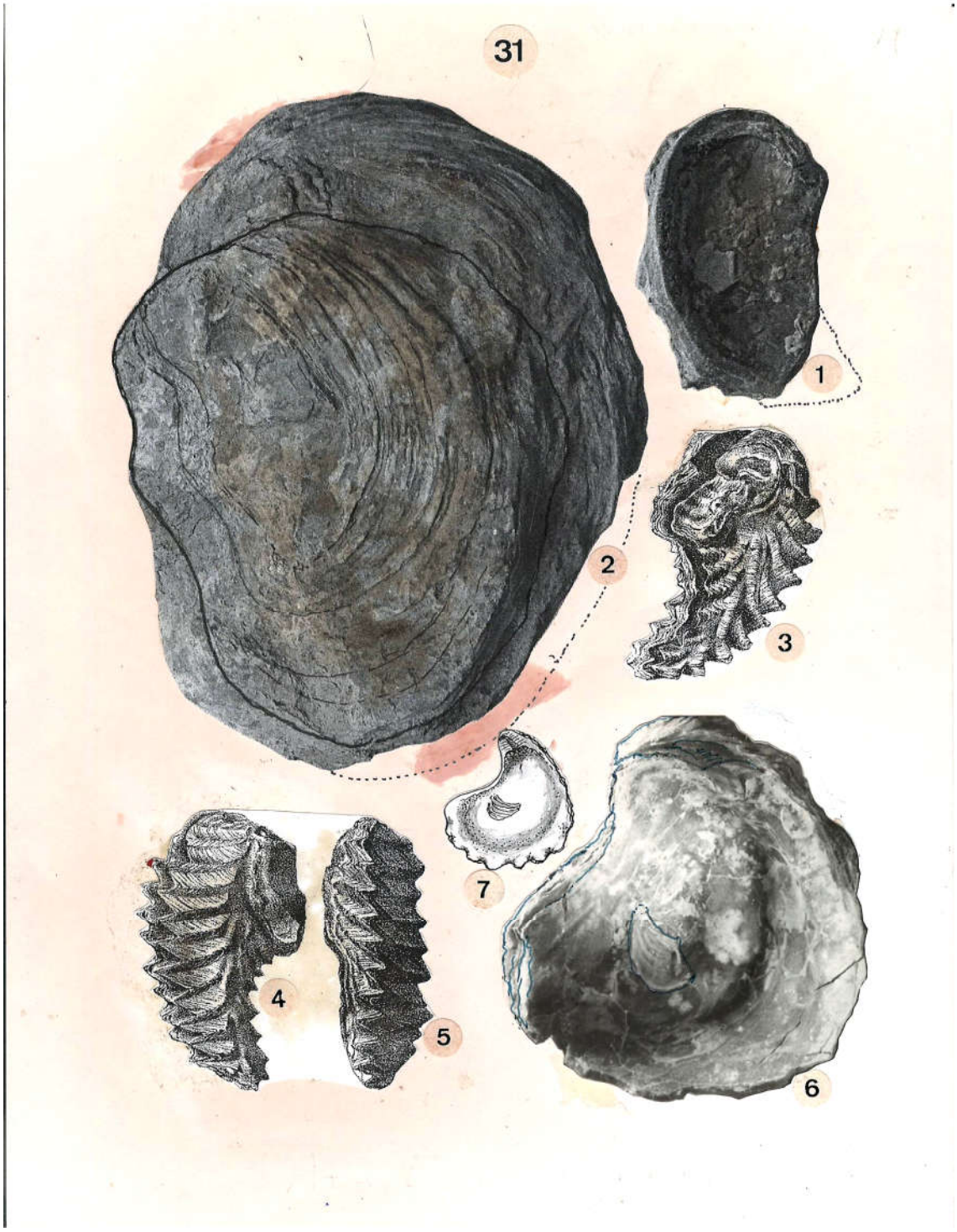

PLATE 32

El Dantó dolostones and Taguarumo Formation, of Hauterivian-Barremian age; lower Borracha and El Cantil Formations, of Late Aptian age (Plate 1).

Figures 32 – 1, 2.- ***Parmicorbicula neaeroides*** (Blanckenhorn). X 2. Locality MO-887, lower Taguarumo Formation, -1:RV, external view, -2:LV, external view.

Figures 32 – 3, 12.- ***Ludbrookia dietrichi*** (Royo y Gomez). X 1,3. Locality VG-376-D, Lope member of Taguarumo Formation, Late Barremian-Early Aptian age. -3:RV, external view, -12:RV, internal view.

Figures 32 – 4, 5, 7.- ***Gervillaria alaeformis*** (Sowerby). Locality MO-2796, Lower El Cantil Formation, -4:RV, external view X 0.75; -5: LV, external view, X 0,75; -7:LV, interior view, with details of hinge-line, X 2.

Figure 32 - 6, 10, 14.- ***Ptychomya solita*** (d'Orbigny). X 1. Locality MC-372-B, Taguarumo Formation, -6: fragment showing typical ornamentation of posterior area, -10:LV, external view; -14:RV, external view.

Figure 32 –8, 9.- ***Ludbrookia stabileana*** (de Loriol). X 2. Locality VG-672, Taguarumo Formation, -9:LV, external view; -8:LV, juvenile shell, attached to ***Gervillaria alaeformis*** (Sowerby).

Figure 32 – 11.- ***Ryderia cf. spathulata*** (Forbes). X 3. Locality MO-3213, lower Taguarumo Formation, in between green limestones -11:LV, external view.

Figure 32 – 13.- ***Prohinnites leymerii*** (Deshayes). X 1. Locality MO-892, El Dantó dolostones, -13:RV, external view.

Figure 32 – 15.- ***Anomia cf. convexa*** (Jean de Carlo Sowerby). X 2. Locality MO-888, Lower Borracha Formation, -15:RV, external view.

Figure 32 – 16.- ***Idonearca glabrata*** (Philippi). X 2. Locality PM-29-A, Taguarumo Formation, -16:RV, external view.

Plate 32

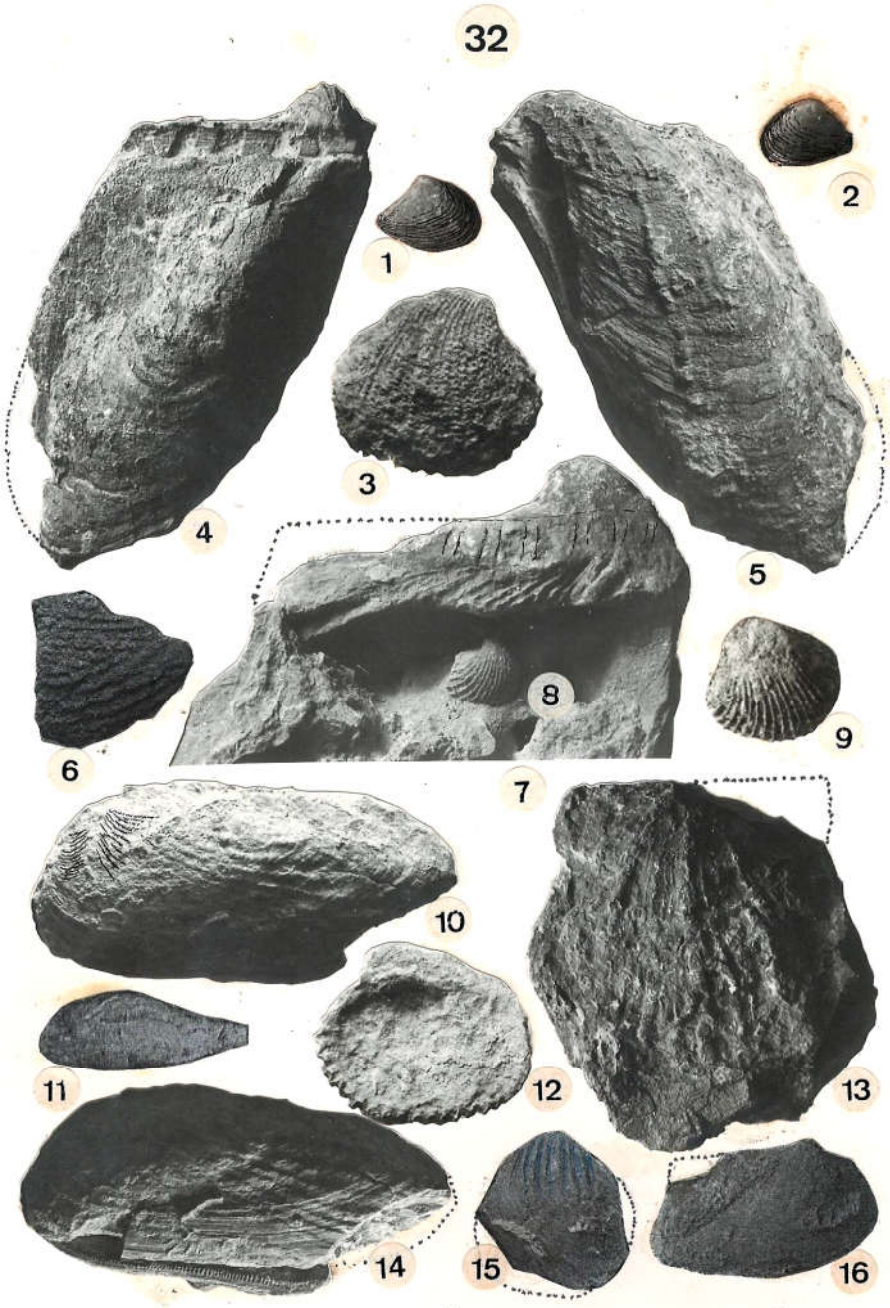

PLATE 33

El Dantó dolostones, of Hauterivian age; Chuparipal, Tibú, Rio Negro Formations, and lower carbonatic member of Peñas Altas Formation, of Barremian age. Lower Borracha Formation, of Early Aptian age; upper carbonatic member of Peñas Altas Formation, of Early Albian age (Plate 1).

Figures 33 – 1, 11.- ***Scittila putucualensis new species,*** Macsotay, X 1. Locality VG-285-A, road from Santa Rosa-Río Putucual, Sucre State, Lower Borracha Formation, -1:LV, external view; HOLOTYPE, Ucvmp/IO-2131; -11:RV, external view.

Figure 33 – 2.- ***Trochonerita mammaeformis*** (Renoux). X 0,5. Locality VG-276, Chuparipal Formation, -2 : apertural view, drawn from DIMITROVA (1994, pl. 1, fig. 7).

Figure 33 – 3, 3a.- ***Caryocorbula cf. elegantula*** (d'Orbigny). X 4. Locality MC-421-A, upper Taguarumo Formation,

Figure 33 - 4.- ***Corbicellopsis silinensis*** (Richards). X 1. Locality MC-346, Taguarumo Formation, -4:LV, copied from RICHARDS (1947, pl. 8, fig. 11).

Figure 33 – 5.- ***Globocardium ascanioi new species,*** Macsotay. X 1. Locality MO-2489, Macoita river, Perijá mountains, Tibú Formation, on the top of the limestone of metric thickness, with *Aetostreon latissimus,* of Late Barremisn-Early Aptian age. -5:RV, external view. HOLOTYPE Ucvmp/IO-2132.

Figure 33 – 6.- ***Pholadomya (Pholadomya) silinensis*** Richards. X 1; Locality HA-4367, Lower carbonatic member of Peñas Altas Formation, (ARNAUD, 1999, fig. 14) in dolomitic limestone. -6:LV, external view.

Figure 33 – 7.- ***Buchotrigonia (Buchotrigonia) cf. scheibei*** (Dietrich).X 0,7. Locality CH-207, El Dantó dolostones, -7:LV, external view.

Figures 33 – 8, 9.- ***Homomya cf. scaphoides*** (Agassiz). X 2. Locality MO-1037, Tibú Formation, Tachira state, -8: anterior view, -9:RV, lateral view.

Figures 33 – 10, 12.- ***Pholadomya (Pholadomya) cf. gigantea*** (Sowerby). X 1. Locality HA-4447, lower carbonatic member of Peñas Altas Formation, Trujillo state, -10.:LV, external view. -12: anterior view, following BURCKHARDT (1903, pl. 15, fig. 1).

Figures 33 – 13, 13a, 13b.- ***Gyrostrea (Gyrostrea) speetonensis nomen novum*** Macsotay, X 1. Locality HA-4424, La Pastora-Jabon road, above *Mesorbitolina* marls, Trujillo state, uppewr carbonatic member of Peñas Altas Formation, of Early Albian age.

Figures 33 – 14, 20, 20a.- ***Psilomya cornueli*** (d'Orbigny). X 1. Locality HA-4414, upper carbonatic member of Peñas Altas Formation, -14: dorsal view; -20:RV, external view; -20a: detail of ornamentation.

Figures 33 – 15, 15a.- ***Nagaoella ? euterpe*** (Coquand) X 1,5. Locality MO-1375, Lower Borracha Formation, -15:LV, external view, -15a:ventral view; showing pelomorphic deformation.

Figures 33 – 16, 17, 18.- ***Eriphyla cf. striata*** (Sowerby). X 1. Locality MC-431-A, Valle Grande Formation, -16:RV, external view; -18:LV, internal view; following WOODS (1906, pl. 17, figs. 3, 4)., -17: cast of an articulated specimen.

Figures 33 – 19.- ***Oonia cf. capduri*** Cossmann. X 1. Localityu MO-1322, upper Rio Negro Formation, Perijá mountains, -19:apertural view.

Figures 33 – 21, 22.- ***Mesomiltha? syriaca*** (Conrad). X 1,5. Locality VG-432, Valle Grande Formation, reproduction of CONRAD (1852, pl. 10, fig. 57).

Plate 33

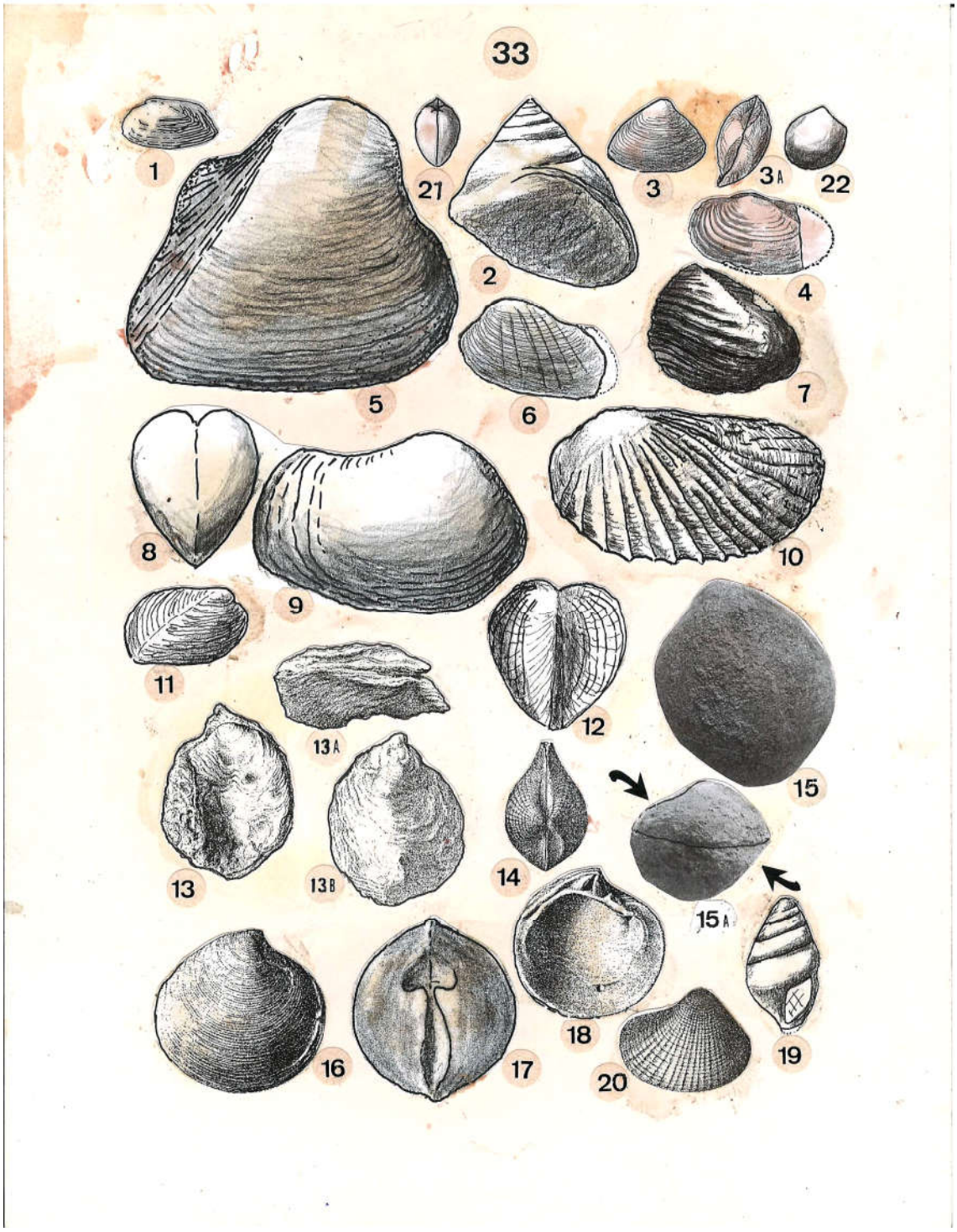

PLATE 34

Chuparipal, Taguarumo and Tibú Formations, of Barremian age; Garcia Formation, of Aptian age; Borracha and El Cantil Formations, of Late Aptian to Early Albian age; Valle Grande and Chimana Formations, of Middle Albian age (See plate 1).

Figures 34 – 1, 4, 12.- ***Eucycloscala cf. pyrene*** (White). X 4. Locality MC-346-A, García Formation, -1: apertural view. -4: lateral view, and -12: dorsal view.

Figure 34 – 2.- ***Strombus (Dilatilabrum) sp. indet.*** X 2. Locality MC-90-A, Garcia Formation, -2: dorsal view of a juvenile specimen.

Figure 34 – 3.- ***Gyrodes excavata*** (Michelin). X 2. Locality MC.84-C, upper El Cantil Formation, -3: apertural view.

Figure 34 – 5.- ***Blackdownia ex gr. quadrata*** (Sowerby). X 2. Locality MO-3160, lower Borracha Formation, -5: aperturalñ view of the unique cast of an adult specimen.

Figure 34 – 6.- ***Sequania? sp. indet.*** X 2. Locality MC-119, lower Garcia Formation, of Early Aptian age. -6: dorsal mview of a cast.

Figure 34 -7.- ***Terebralia (Pyrazisinus) orientalis*** (Conrad). X 1,6. Locality MC-125-A, basal bed of El Cantil Formation, of Late Aptian age. -7:dorsal view.

Figures 34 – 8, 9.- ***Valvatidae gen. nov.*** Macsotay. Locality MC-324-B, lower El Cantil Formation, of Late Aptian age; -8: apertural view of an adult shell, X 4; -9: juvenile shell´s cast, X 1.

Figures 34 – 10, 13.- ***Ampullinopsis cureti*** (Cossmann). X 1,6. Locality MO-2127, Tibú Formation, of Atarigua para-autochthone (STEPHAN, 1985).

Figure 34 – 11.- ***Neritoma (Neridomus) fluctuoides*** (Whitfield). X 3. Locality JFS-174, Chimana Formation, -11: apertural view of an adult specimen.

Figure 34 – 14.- ***Turritella orbignyana*** Cotteau. X 2. Locality MO-890. Lower Borracha Formation, -14: apertural view, the specimen has been pelomorphically deformed.

Figures 34 – 15, 23.- ***Semisolarium moniliferum*** (Mongin). X 2. Locality VG-424.A, Valle Grande Formation, -15: dorsal view and, -23: apertural view of an adult shell.

Figure 34 – 16.- ***Dicroloma carinata*** (Michelin). X 1,6. Locality PM-29-A, Valle Grande Formation, -16 : drawing based on seven fragments.

Figure 34 – 17.- ***Pterodonta cf. globulus*** (Coquand). X 1. Locality MC-66-A, El Cantil Formation, upper limestones. -17 : apertural view.

Figure 34 – 18.- ***Harpagodes beaumonti*** (d'Orbigny). X 0,5. Locality MO-2818, Chuparipal Formation, -18: adult shell, drawn from 3 samples collected in the same bed.

Figure 34 – 19.- ***Discotectus cf. crispus*** (Blanckenhorn), X 2. Locality PM-29-A, upper Taguarumo Formation, -19: apertural view.

Figure 34 – 20.- ***Euspira jaworskii*** (Weaver). X 1. Locality MO-3213, lower Taguarumo Formation, (MACSOTAY et al., 1986: 7177, fig. 6A) of Late Hauterivian age.-2O: dorsal view of adult specimen.

Figure 34 – 21.- ***Globiconcha cf. ponderosa*** (Coquand). X 0,7. Locality MO-1000, Upper Borracha Formation, -21: apertural view of a cast.

Figure 34 – 22.- ***Tubulostium cf. hourcqui*** Collignon. X 2. Locality JFS-174, Chimana Formation, -22: lateral view of an adfult shell (A), dorsal view (C), and a cross-section (B). Polychaeta.

Figure 34 – 24, 25.- ***Globiconcha maxima*** (Vilanova). X 1. Locality MO-3200, Upper Borracha Formation, Reproduced from VILANOVA (1863, pl. 4, fig. 7).

Figure 34 – 26.- ***Helicacanthus maestrei*** (Verneuil & Lorière). X 1,5. Locality MO-3213, lower Taguarumo Formation, -26: dorsal view of an adult shell.

Figure 34 – 27.- ***Delpeya cottreaui*** Collignon. X 2. Locality MC-372-B, Garcia Formation, of Late Aptian age. -27: dorsal view.

Plate 34

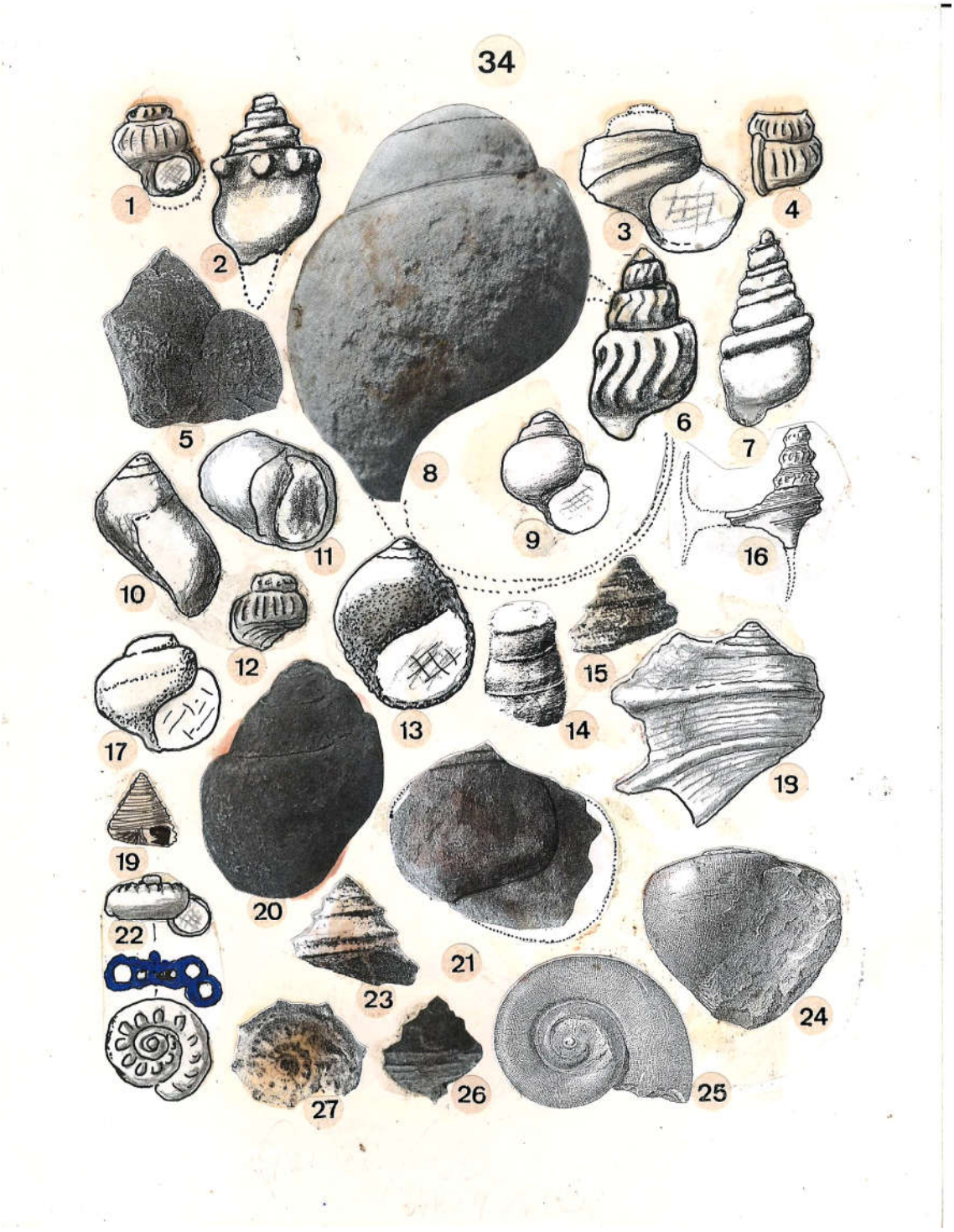

PLATE 35

Lower carbonatic member of Peñas Altas Formation, García and lower El Cantil Formations, of Aptian age. Guácharo member of El Cantil, and upper Borracha Formations of Early Albian age; Caripito member of Chimana Formation of Middle Albian age (See plate 1).

Figure 35 – 1.- ***Alamirifica magnicostata*** (Conrad). X 1, reproduction of CONRAD (1852, pl. 10, fig. 64). Locality MC-382-C, Lower Garcia Formation,

Figures 35 – 2, 14.- ***Amberleya (Eucyclus) saxoneti*** (Pictet & Roux). X 3. Locality MC-260-D, Garcia Formation, -2, -14 : dorsal view of two casts, one of them encrusted by goethite.

Figures 35 – 3, 7.- ***Harpagodes desori*** (Pictet & Campiche). X 3. Locality MC-260-D, García Formation, -3 : dorsal view and -7 :apertural view of an inmature shell. Both are decorticated casts, with desication cracks filled with goethite.

Figure 35 – 4.- ***Microschiza sautieri*** (Coquand). X 3. Locality MC-260-D, García Formation, -4 : apertural view of a decorticated specimen.

Figures 35 – 5, 8.- ***Hemicerithium? coxi*** (Collignon). X 3. Locality MC-260-D, García Formation. Dorsal views of two casts, one encrusted with goethite (5) and the other, preserving partially the ornamentation (8).

Figures 35 – 6, 12.- ***Cirsocerithium harborti*** (Wollemann). X 3. Locality MC-105-B, Garcia Formation, -6: apertural view of an adult specimen, -12: dorsal view, with the ornamentationpreserved in siderite.

Figures 35 – 9, 10.- ***Aphanoptyxis buloti new species,*** Macsotay, Locality MO-3188, La Cueva inlet, Borracha island, Upper Borracha Formation, of Early Albian age. -9: axial section, showing internal structures; -10: dorsal view.

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Figure 35 – 11.- ***Haustator cf. scheibei*** Jaworski. X 3. Locality MC-260-C, Garcia Formation, -11: apertural view of a cast.

Figure 35 – 13.- ***Keilostoma pupoides*** (Cragin). X 3. Locality MC-445-C, Upper Guácharo Member of El Cantil Formation, -13: apertural view.

Figures 35- 15, 16.- ***Purpuroidea borrachensis nom. nov.*** Macsotay, X 1. Locality MO-888, La Cueva inlet, Borracha Island, Lower Borracha Formation, of Late Aptian age. -15: dorsal view,-16: apertural view of a well preserved cast.

Figure 35 – 17.- ***Laevinerinea mutabilis*** (Delpey). Drawn in natural size. Locality HA-4371, lower carbonatic member of Peñas Altas Formation, -17: axial cross-section.

Figures 35 – 18, 22.- ***Lissochilus asper*** (Blanckenhorn). X 2. Locality MC-235-E, Lower El Cantil Formation, -18 and 22: dorsal and apertural view of a gerontic shell.

Figures 35 – 19.- ***Dentalium cf. cylindricum*** (Sowerby). X 1. Locality VG-280-A, Garcia Formation, of late Aptian age. Associated to belemnites; -19A: section of aperture, -19B:section at apex, slightly enlarged.

Figure 35 – 20.- ***Microschiza (Coronatica) ornata*** (Fraas) X 2. Locality MO-890, Lower Borracha Formation, -20:juvenile specimen, showing the nodular shoulder.

Figure 35 – 21.- ***Leviathania vilanovae*** (Landerer). X 2. Locality MC-275-D, Caripito member of Chimana Formation, -21: apertural view of an adult specimen

Plate 35

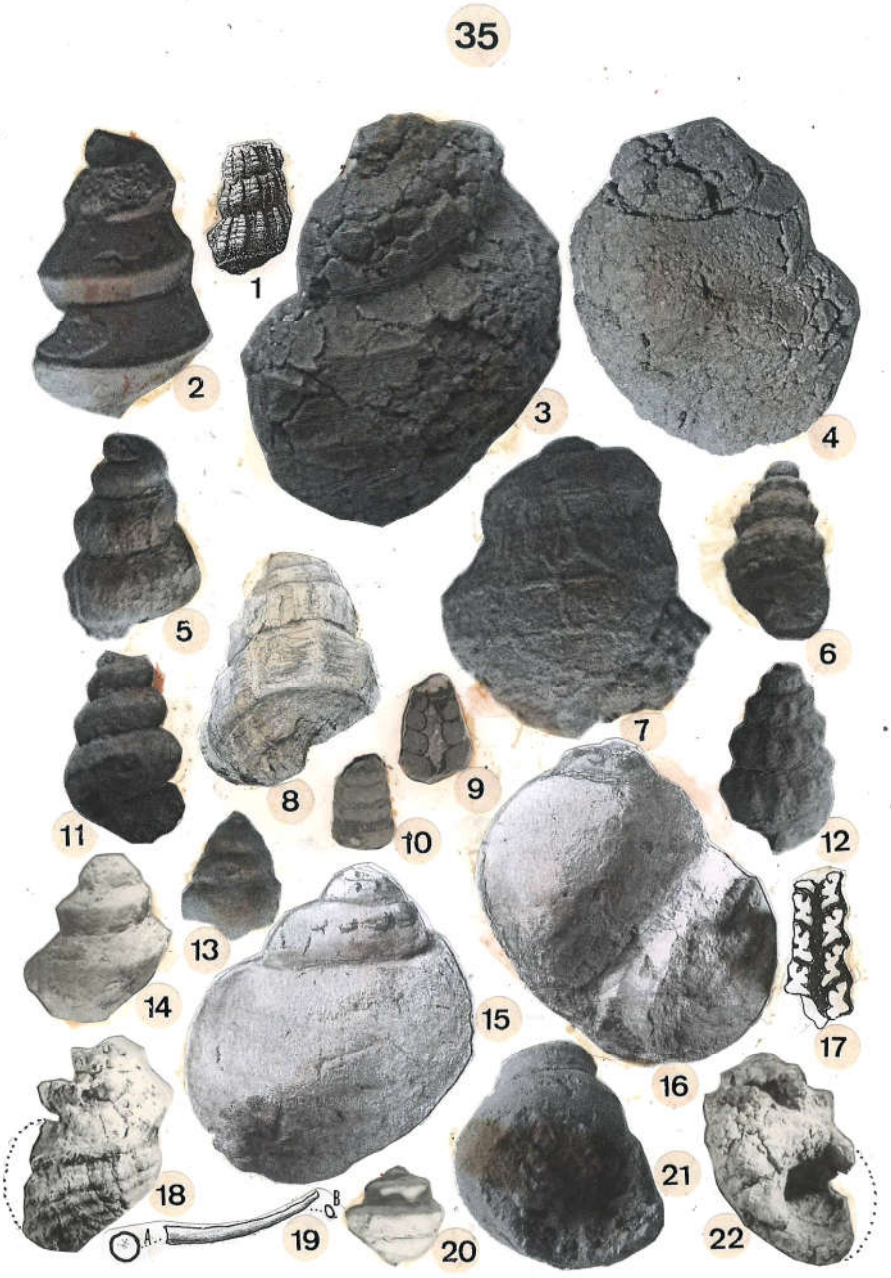

PLATE 36

La Margarita mudstones, of Hauterivian age; García Formation, of Aptian age; Machiques member of Apón Formation, of Early Albian age (See plate 1).

Figures 36 – 1 to 3, 7 to 15,.- ***Acila (Truncacila) bivirgata*** (Sowerby), X 4. Locality MC-426-B, Garcia Formation, - 1, 2, 3, 7, 15:RV, external views all articulated specimens; -8, 10, 11, 14:LV, external views, showing great individual variability in sculpture, while the convexity is rather standard; -4, 13: X 1.

Figures 36 – 18, 19, 20, 21.- ***Acila (Truncacila) cf. schencki*** Stoyanow. X 1 (-18), X 4 (19 to 21). Locality PM-04-C, La Margarita mudstones, -18: dorsal view of articulated valves; -19 to -21:RV and LV of articulated shells.

Figure 36 – 5.- ***Nuculana (Rollieria) scapha*** (d'Orbigny). X 4. Locality MC-446-E, Garcia Formation, -5:LV, external view.

Figure 36 – 6.- ***Yoldia (Yoldia) cf. kissoumi*** McLearn. X 4. Locality MC-240-F, Garcia Formation, -6:LV, internal view.

Figure 36 – 8.- ***Tessarolax rouxii*** (Pictet & Renevier). X 2. Locality MC-446-E, Garcia Formation, -8: dorsal view, restitution of two fragments.

Figure 36 – 16.- ***Anomia laevis*** Sowerby. X 2. Locality MO-2036, Barrême, France, the stratotype of Barremian stage (BUSNARDO, 1963). -16:LV. In Venezuela, the maximum abundance of this taxon is in Machiques member of Apón Formation, in the Perijá mountain front outcrops.

Figure 36 – 17.- ***Aporrhais cf. affinis*** (Coquand). X 2. Locality MC-426-B, Garcia Formation, -17 :dorsal view, restitution of two fragments.

Plate 36

PLATE 37

Taguarumo Formation, of Barremian age, Garcia and Lower Borracha Formations, of Aptian age; Bobare Formation, of Early Albian age; Chimana and Valle Grande Formations, of Middle Albian age (See plate 1).

Figure 37 – 1.- ***Plicatula inflata*** Sowerby. X 3. Locality JFS-03, Chimana Formation, -1:LV, external view.

Figure 37 – 2.- ***Plicatula placunea*** d'Orbigny, X 3. Locality MC-126-A, Garcia Formation, -2 :LV, external view.

Figure 37 – 3.- ***Lucina ? teutoburgensis*** Weerth. X 1. Locality VG-139, Garciia Formation, -3 :RV, external view.

Figure 37 – 4.- ***Venilicardia pseudoglobosa*** (de Loriol). X 2; Locality VG-139, Garcia Formation, -4:LV, external view, biodegraded and disarticulted.

Figure 37 – 5.- ***Priscomactra callosa*** (Roemer). X 1. Locality VG-139, Garcia Formation, -5:RV, external view, partially decorticated.

Figure 37 – 6.- ***Flaventia ovalis*** (Sowerby). X 2. Locality VG-139, Garcia Formation, -6:LV, external view.

Figure 37 – 7.- ***Aphrodina cf. cretacica*** (d'Orbigny). X 2. Locality VG-139, Garcia Formation, -7:LV, external view.

Figures 37 – 8, 12.- ***Tancredia (Isotancredia) cf. gibba*** (Coquand). X 1,5. Locality VG-398, Valle Grande Formation, -8:LV, and -12:RV, external views. Associated to belemnites and bryozoa.

Figure 37 – 9.- ***Cymbophora verneuili*** (Landerer). X 2. Locality MC-126-A, García Formation, -9 :LV, external view.

Figure 37 – 10.- ***Polyptyxis dayi*** (Blanckenhorn). X 1, drawn from a limestone sample-Locality MO-1324, olistolith with Early Albian fossils in Bobare Formatiuon, allochthonous in the Lara Nappe.

Figure 37 – 11.- ***Truncatella shurae*** (Shalem). X 1. Locality MO-888, Lower Borrach Formation, -11: Silica pseudomorph of an adult shell, external view.

Figure 37 – 13.- ***Proveniella argentina*** (Behrendsen) X 2. Locality VG-139, Garcia Formation, -13: Articulated adult specimen, where the LV is diagenetically crushed.

Figure 37 – 14.- ***Mesolinga? argine*** (Coquand) X 1. Locality VG-139, Garcia Formation,. -14:LV, external view.

Figure 37 – 15.- ***Brachymeris cf. circulus*** (Wollemann). X 3. Locality VG-139, Garcia Formation, -15:RV, external view.

Figure 37 – 16.- ***Panzacorbula colombiana*** (d'Orbigny). X 3. Locality VG-139, Garcia Formation, -16:LV, external view.

Figure 37 – 17.- ***Pterodonta gaultina*** (Pictet & Renevier). X 2. Locality VG-139, García Formation. -17 : dorsalñ view of an adult specimen.

Figure 37 – 18.- ***Cryptoplocus libanensis*** (Hamlin). X 1,7. Locality MMH, Su-180 , Taguarumo Formation, type locality, of Barremian age. (reproduced from VON DER OSTEN, 1957, pl. 65, fig. 18).

Plate 37

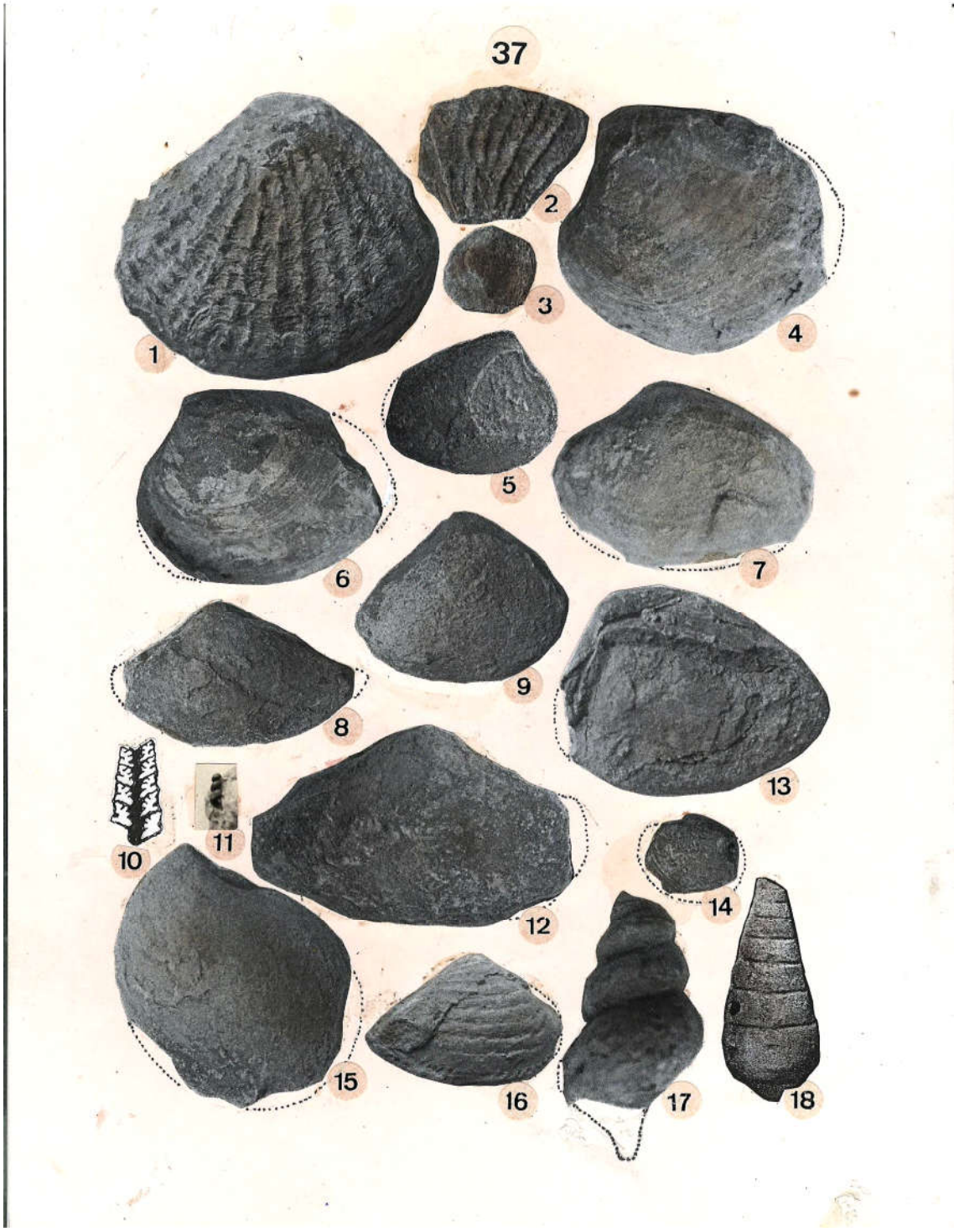

PLATE 38

El Cazón Formation, of Berriasian-Valnginian age, García Formation, of Aptian age; Lower El Cantil Formation, of Late Aptian age, Upper El Cantil, of Early Albian age; Chimana Formation, of Middle Albian age (See plate 1).

Figure 38 – 1.- ***Drepanocheilus coquandi*** (Cossmann). X 2. Locality MO-1143, in an olistolith with Late Aptian mollusks. -1: dorsal view, drawn from sample.

Figure 38 – 2.- ***Ampullospira whitei*** Cossmann. X 2. Locality VG-465, Lower El Cantil Formation, -2: apertural view.

Figure 38 – 3.- ***Pseuomelania gresslyi*** (Pictet & Campiche). X 2. Locality MC-329, El Cazón Formartion, -3: apertural view of an adult specimen.

Figure 38 – 4.- ***Tylostoma materinum*** White. X 2. Locality FA-58-A, Lower El Cantil Formation, -4: dorsal view of an adult shell, carrying attached a RV of ***Anomia peruana*** Gabb, (Figure 38 -5).

Figures 38 – 6, 13.- ***Pseudomelania albensis*** (d'Orbigny). X 1,5. Locality MC-444, upper El Cantil Formation. -6, -13: apertural view of two adult shells.

Figure 38 – 7.- ***Goniocheila tarrantensis*** (Stanton). X 2. Locality FA-58-A, Lower El Cantil Formation, -7 : dorsal view of a cast.

Figures 38 – 8, 12.- ***Aporrhais? subfusiformis*** (Shumard). X 2. Locality FA-58-A, Lower El Cantil Formation, -8: juvenile shell, -12: adult shell, both in apertural view.

Figure 38- 9.- ***Oonia trinidadensis*** Cox, X 2. Locality MC-70-A, El Cantil Formation, lower horizons,with ***Mesorbitolina texana/M. ovalis*** of Late Aptian age. -9:apertural view of a not completely adult specimen.

Figure 38 – 10.- ***Globiconcha utriculus*** (Coquand). X 2. Locality MC-2644-A, lower El Cantil Formation, -10 :apertural view.

Figure 38 – 11.- ***Tessarolax americana*** (d'Orbigny). X 4. Locality MC-426, basal beds of Chimana Formation, -11: dorsal view of juvenile specimen.

Figure 38 – 14, 15.- ***Pseudomlania elegantula*** Nagao. X 2. Locality MC-86, García Formation, -14 and -15: apertural view of two adult specimens.

Plate 38

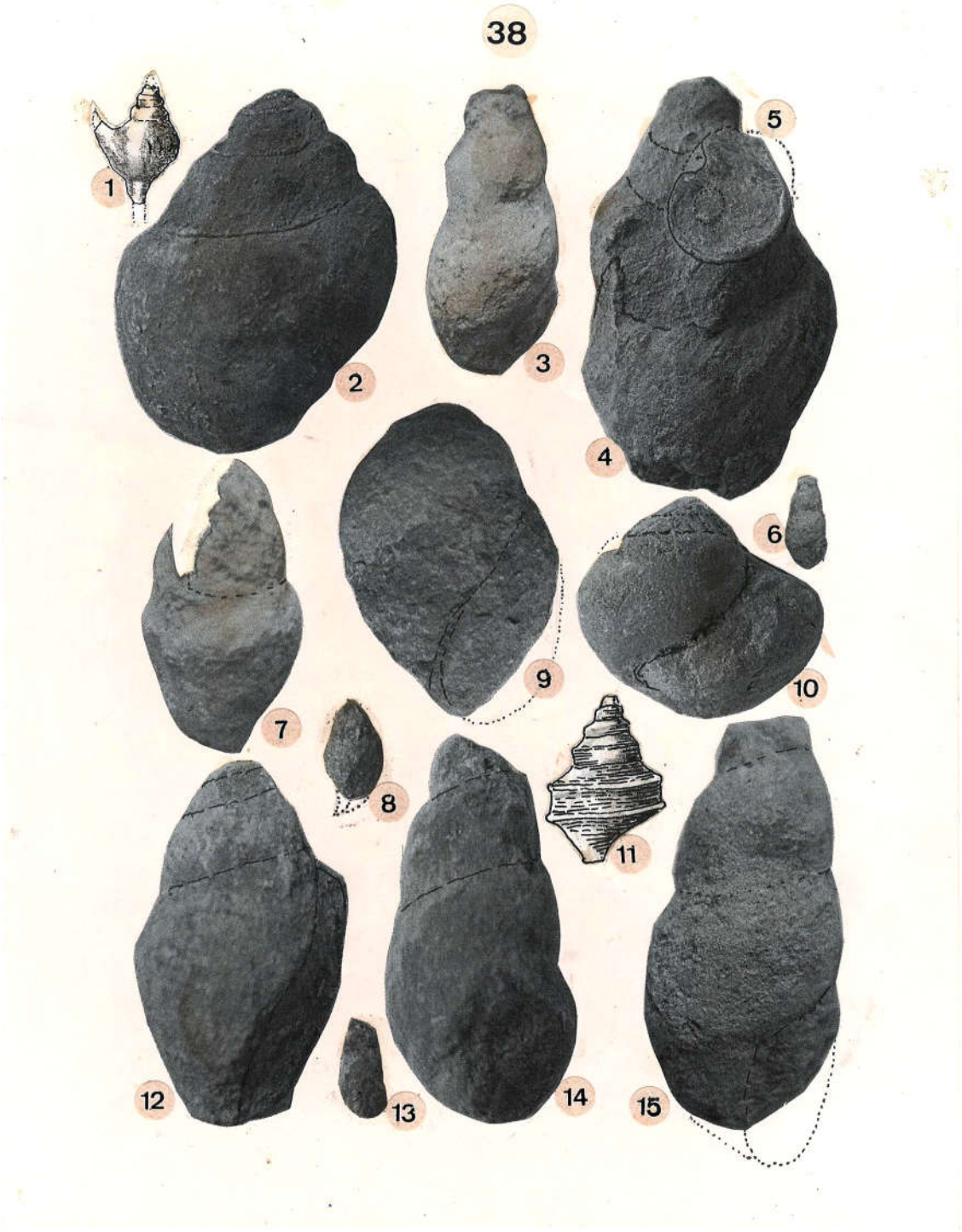

PLATE 39

Taguarumo and Lower carbonatic member of Peñas Altas Formations, of Barremian-Early Aptian age; Garcia Formation, of Aptian age; Valle Grande and Chimana Formation, of Middle Albian age (See plate 1).

Figures 39 – 1, 17.- ***Freiastarte numismalis*** (d'Orbigny). X 4. Locality PM-12-A, Garcia Formation, -1, -17: RV, external view, articulated specimens.

Figure 39 – 2, 8.- ***Eomiodon libanoticus*** (Fraas). X 4. Locality PM-12-A, Garcia Formation, -2, -8:RV, external views, adult and juvenile articulated valves.

Figure 39 - 3, 10.- ***Freiastarte subcostata*** (d'Orbigny). X 4. Locality VG-376, Taguarumo Formation, -3, -10:RV, external views.

Figure 39 – 4.- ***Barbatia marullensis*** (d'Orbigny). X 4. Locality MC-426-C, Garcia Formation, -4: articulated valves.

Figures 39 – 5, 9.- ***Disparilia truncata*** (Von Buch). X 4. Locality JFS-171, Chimana Formation, -5:LV, external view; -9: articulated shell seen from the left side.

Figures 39 – 6, 7.- ***Freiastartye debilidens*** (Gerhardt). X 4. Locality MC-372-B, Valle Grande Formation, -6:LV, and -7:RV, external views.

Figure 39 – 11.- ***Scittila carteroni*** (d'Orbugny). X 1. Locality MC-341-C, Garcia Formation, -11 :LV, external view.

Figure 39 – 12, 13.- ***Nuculana (Rollieria) nuculoides*** (Gbb). X 2. Locality MC-86-I, García Formation, -12, -13:RV, external and internal view. Reproduced from GERHARDT (1897, pl. 2, fig. 6).

Figure 39 – 14.- ***Anisocardia (Collignonicardia) montserrati*** (Vilanova). X 0,7. Locality MC-361, Garcia Formation, -14:RV, external view.

Figures 39 – 15, 16.- ***Nicaniella (Trautscholdia) claxbyensis*** (Woods), X 4. Locality VG-280-A, -16: anterior view, showing comisural plications.

Figures 39- 18.- ***Maccoyella bogotina*** (d'Orbigny). X 0,7. . Locality : Tuluá Colombia, from the Tahami-Calima allochthonous Nappe, with age not older than Aptian (TOUSSAINT & RESTREPO 1983).

Figures 39 – 19, 19A.- ***Pholadomya (Procardia) robberae*** Wollemann. X 0,7. Locality: El Zanjon del muerto, vía Ira, lower Peñas Altas Formation, -19:RV, external view. -19ª: anterior view.

Figure 39 – 20.- ***Eriphyla pseudostriata*** (d'Orbigny). X 1. Locality MC-426-C, Garcia Formtion. -20:RV, external view.

Figure 39 – 21.- ***Trigonocallista cf. compacta*** (de Loriol). X 1. Locality VG-139, Garcia Formation, -21:LV, external view.

Figure 39 – 22.- ***Cercomya cf. gurgitis*** (Pictet & Campiche). X 2. Locality MC-260-B, Garcia Formation, - 22 :RV, external view

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Plate 39

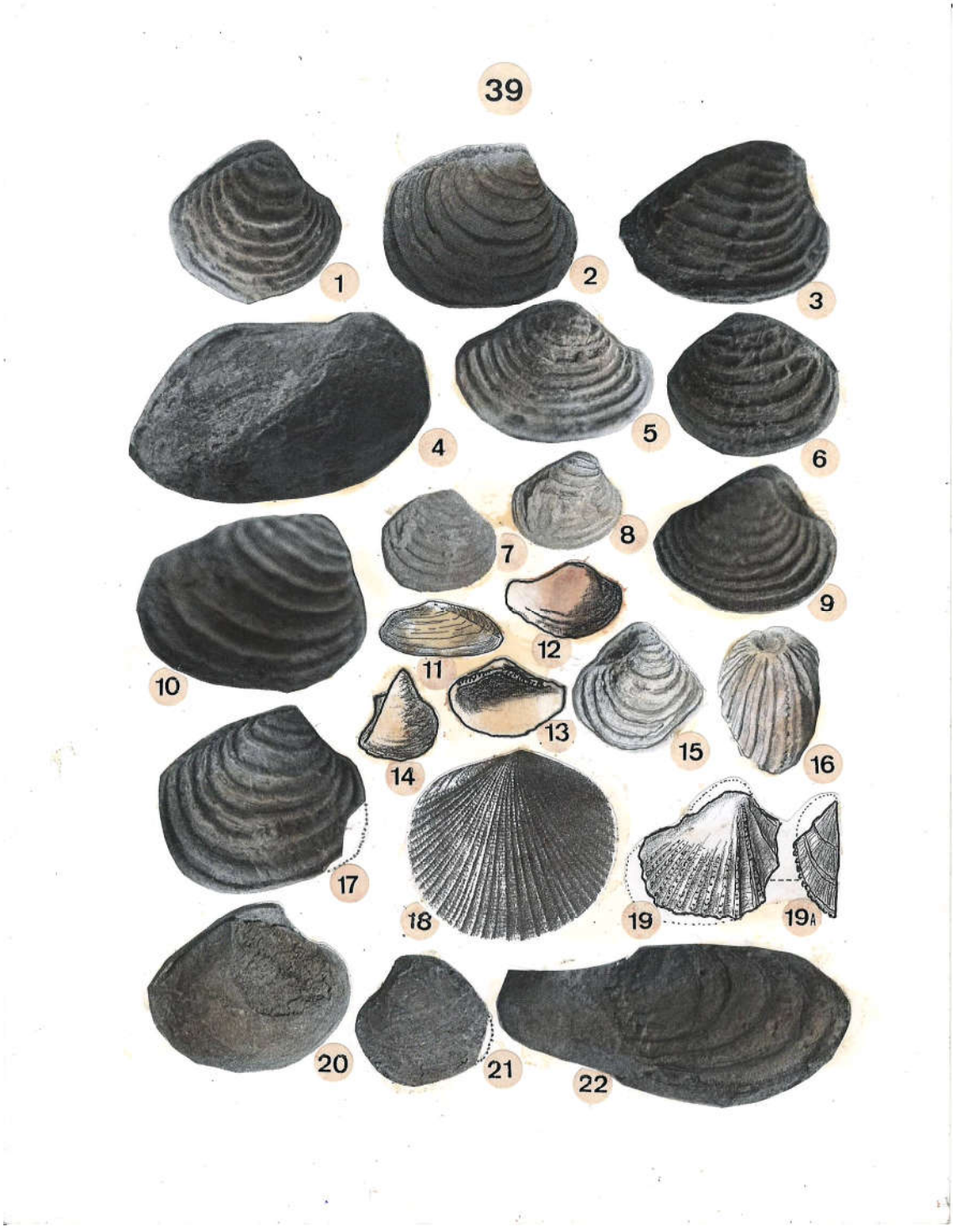


PLATE 40

El Dantó dolostones and La Margarita mudstones, of Hauterivian age ; Chuparipal Formation, of Barremian age ; Garcia Formation, of Aptian age; Guacharo Member of El Cantil Formation, and lower carbonatic member of Peñas Altas Formation, of Early Albian age. Valle Grande Formation, of Middle Albian age (See plate 1).

Fiigures 40 – 1, 2.- ***Pleuriocardia severiense*** (Hill). X 1,5. Locality VG-110, Valle Grande Formation, -1:LV, -2:RV, external views.

Figure 40 – 3.- ***Callucina (Callucina) cf. olea*** Vokes. X 1,5. Locality VG-110, Valle Grande Formation. -3:RV, external view, biodegraded shell.

Figure 40 – 4.- ***Protocardia (Protocardia) cf. janus*** (Coquand). X 2. Locality PM-06-C, La Margarita mudstones, -4:LV, external view.

Figures 40 – 5, 7.- ***Costocyrena crenulicosta*** (Whitfield). X 3. Locality VG-110, Valle Grande Formation, -5 :LV, and -7 :RV, external views.

Figure 40 – 6.- ***Costocyrena sp. indet.,*** Macsotay, X 3. Locality VG-110, Valle grande Formation, -6:LV, external view.

Figure 40 – 8.- ***Pycnodonte (Phygraea) invalida*** (White). X 1. Locality HA-4409, Arbol Redondo section, upper Carbonatic member of Peñas Altas Formation, -8: LV, external view.

Figure 40 – 9.- ***Eodonax hartenbergeri new species,*** Macsotay. X 3. Locality VG-110, DGC, Valle Grande Formation. -9 :RV, external view, shell evidencing biodepredation. HOLOTYPE, Ucvmp/IO-1944;

Figure 40 – 10.- ***Paleomoera cf. moreana*** (d'Orbigny). X 3. Locality VG-110. Valle Grande Formation, -10 :LV, external view.

Figure 40 – 11, 12.- ***Rostrocardia branneri*** (White). X 1,3. Locality HA-4428, upper carbonatic member of Peñas Altas Formation, -11:RV, -12:LV, both external views.

Figure 40 – 13, 14.- ***Ceratostreon weatherfordensis*** (Cragin). X 1. Locality VG-465, Guácharo member of El Cantil Formation, -13, -14:LV, external and internal view, a senile shell.

Figure 40 – 15.- ***Aetostreon couloni*** (d'Orbigny). X 0,5. Locality MO-3161, Chuparipal Formation, upper marls (MACSOTAY & ALVAREZ, 1987). -15:LV, internal view.

Figure 40 – 16.- ***Neohibolites minor*** Stolley. X 1. Locality MC-372-B, Valle Grande Formation.

Figures 40 – 17, 18.- ***Neohibolites wollemanni*** Stolley. X 1. Locality VG-432, Valle Grande Formation.

Figures 40 – 19, 20.- ***Aetostreon subsinuatus*** (Leymerie). X 1. Locality MO-3159, El Dantó dolostones, -19:LV, internal view, -20: articulated shell, lower Taguarumo Formation,

Figure 40 – 21.- ***Plicatula carteroni*** d'Orbigny. X 4. Locality MC-426-C, García Formation, -21 :RV, external view.

Plate 40

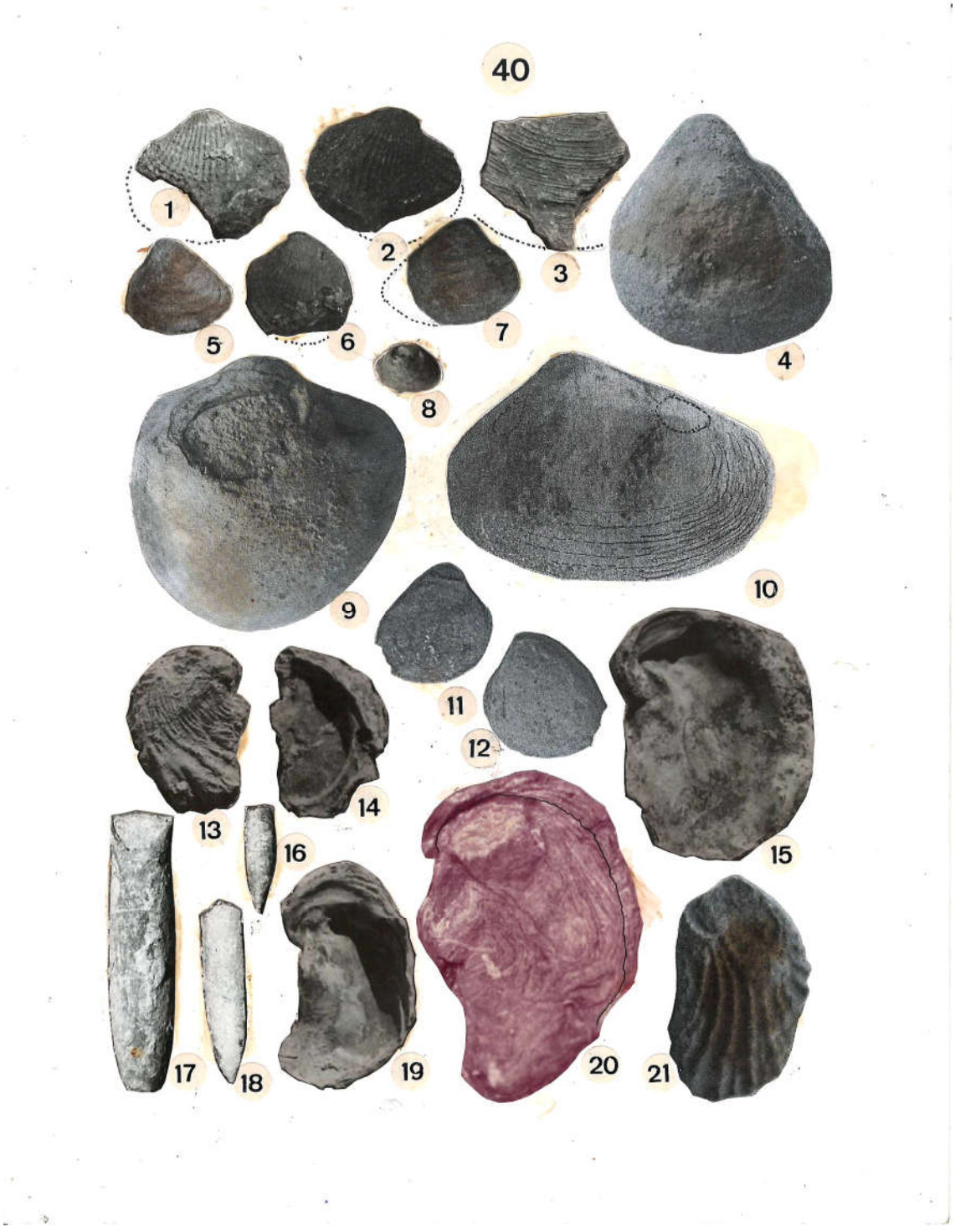


PLATE 41

Garcia Formation, Early to Late Aptian; Borracha Formtion, Late Aptian to Early Albian (See plate 1).

Figure 41 – 1.- ***Proveniella argentina*** (Behrendsen). X 1,5. Locality VG-570, Garcia Formation, -1:LV, external view.

Figures 41 – 2, 4.- ***Protocardia janus*** Coquand. X 1. Locality MO-890. Lower Borracha Formation, Reproduction of MALLADA (1887, pl. 36, figs. 1, 2).

Figures 41 – 3, 5.- ***Eriphyla trapezoidea*** (Anthula). X 1. Locality MC-271-F, Lower Borracha Formation, Reproduction of ANTHULA (1899, pl. 4, figs. 1a, 1b).

Figures 41 – 6, 7, 7a.- ***Gryphaeostrea canaliculata*** (Sowerby). X 1. Locality MO-892, upper Borracha Formation, Reproduction of PICTET & CAMPICHE, (1871, pl. 193, figs. 4, 7).

Figure 41 – 8.- ***Chondrodonta urgonensis*** (Pictet & Campiche). X 1. Locality MO-890, lower Borracha Formation, -8 :LV, external view.

Figure 41 -9.- ***Mimachlamys cf- daubrei*** (Coquand). X 1. Locality MC-426-B, lower Borracha Formation, Reproduction of MALLADA (1887, pl.39, fig. 1).

Figure 41 – 10.- ***Disparilia charollaisi new species,*** Macsotay, X 1. Locality MO-890, Punta La Cuz, peninsula de Manare, Sucre state, lower Borracha Formation, DAGM, of Late Aptian age. -10:RV, external view. HOLOTYPE, Ucvmp/IO-1945.

Figure 41 – 11.- ***Neocrassina (Neocrassina) cf. obovata*** (Sowerby). X 1. Locality MO-890, lower Borracha Formation, -11:LV, external view.

Plate 41

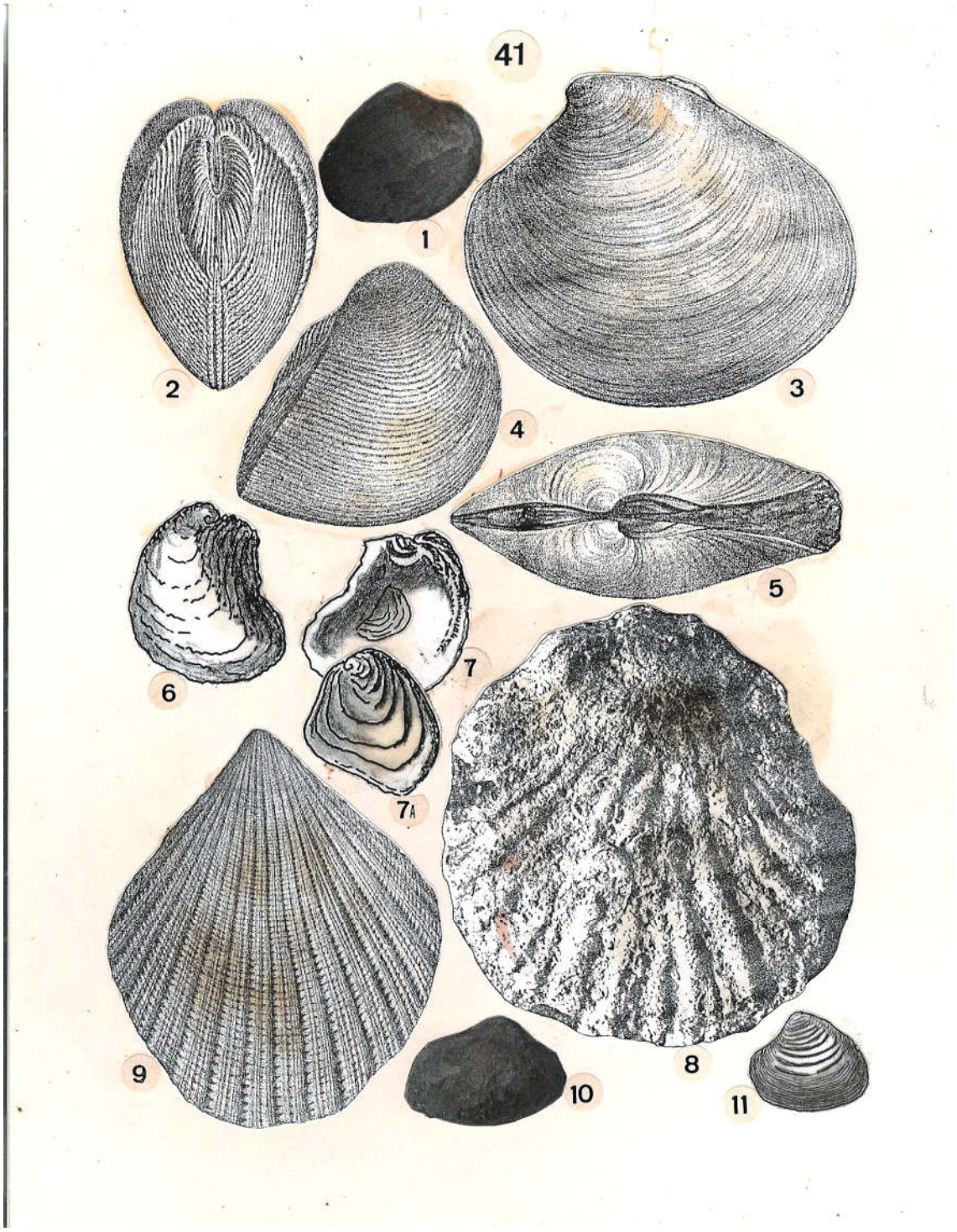


PLATE 42

Garcia Formation, Early to Late Aptian age; Borracha Formation, Late Aptian to Early Albian age (See plate 1).

Figure 42 – 1.- ***Pinna (Pinna) robinaldi*** (d'Orbigny). X 1,5. Locality HA-4436, lower carbonatic member of Peñas Altas Formation, -1:RV, external view.

Figure 42 - 2.- ***Amphiaraus soleniscus*** (Vokes). X 1,5. Locality HA-4467, lower carbonatic member of Peñas AltasFormation. -2:RV, external view.

Figure 43 - 3.- ***Perissoptera orbignyana*** (Pictet & Roux). X 1,5. Locality HA-4467, lower carbonatic member of Peñas Altas Formation, -3: dorsal view.

Figures 42 – 4, 6.- ***Trajanella komarensis*** Pchelintsev. X 1,5. Locality HA-4436, lower carbonatic member of Peñas Altas Formation, -4,-6: dorsal view of two adult specimens.

Figures 42 – 5, 20.- ***Epicyprina angulata*** (Sowerby). X 1,5. Locality HA-4467, lower carbonatic member of Peñas Altas Formation, -5:LV, external view, -20:RV, external view.

Figures 42 – 7.- ***Dicranodonta nana*** (Leymerie). X 2. Locality MC-86-I, Valle Grande Formation, -7:RV, exterrnal view, and anterior view.

Figures 42 – 8.- ***Cylichna tombecki*** (Pictet & Renevier). X 2. Locality HA-4437, lower carbonatic member of Peñas Altas Formation, -8: apertural view of adult shell.

Figure 42 – 9.- ***Contortella sp. indet.*** X 1. Locality HA-4436, lower carbonatic member of Peñas Altas Formation, -9 : axial section, drawn from limestone outcrop.

Figure 42 – 10, 13.- ***Grammatodon (Nanonavis) securis*** (Leymerie) X 1,5. Locality MC-119-A, lower Garcia Formation, -1º0, -13:RV, LV, external view. Reproduced from WOODS, (1899, pl. 7, figs. 14a, 14b).

Figure 42 – 11.- ***Ampullinopsis claveli new species,*** Macsotay, X 1. Locality HA-4440, lower carbonatic member of Peñas Altas Formation, of Late Barremian-Early Aptian age (H. ARNAUD et alii., 1999, Fig. 17). -11: apertural view of an adult shell. HOLOTYPE, Ucvmp/IO-2143.

Figure 42 – 12.- ***Megalocardia medialis*** (Conrad). X 0,5. Locality HA-4486, lower carbonatic member of Peñas Altas Formation, -12: RV, external view.

Figure 42 – 14.- ***Loxo brongniarti*** (Leymerie). X 1,5. Locality HA-4436, lower carbonatic member of Peñas Altas Formation, -14:LV, external view.

Figures 42 – 15, 16.- ***Tylostoma tumidum*** Shumard, X 1,5. Locality HA-4419, lower carbonatic member of Peñas Altas Formation, collected in *Mesorbitolina texana-M. ovalis* marls.

Figure 42 – 17.- ***Turritella (Torquesia) raimondi*** Gabb. X 3, Locality HA-4336, La Puya member of Peñas Altas Formation. Reproduced of GABB (1877, pl.40, fig. 2).

Figure 42 – 18.- ***Proveniella rosacea*** Casey. X 1,5. Locality HA-4440, lower carbonatic member of Peñas Altas Formation, -18:RV, external view.

Figure 42 – 19.- ***Eoursivivas aligera*** (Hamlin). X 3. Locality HA-6440, lower carbonatic member of Peñas Altas Formation, -19:RV, external view.

Figure 42 -21.- ***Pleuromya borealis*** Warren). X 1,5. Locality HA-4436, lower carbonatic member of Peñas Altas Formation, -21: external view.

Plate 42

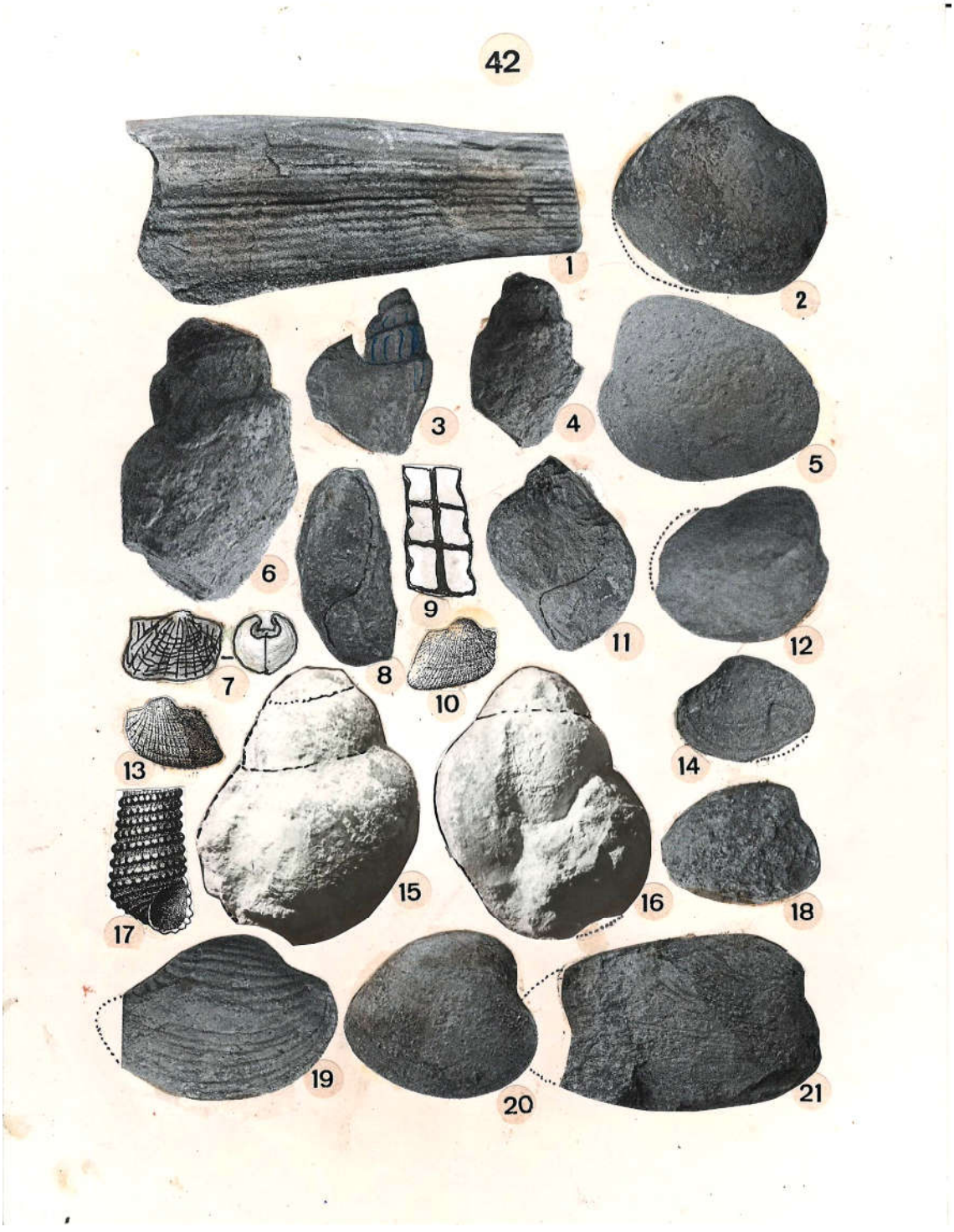


PLATE 43

El Cantil Formation, of Late Aptian to Early Albian age; Guácharo member of El Cantil Formation of Early Albian age; Chimana Formation, of Middle Albian age (See plate 1).

Figures 43 – 1, 5.- ***Cyprimeria conspicua*** (Coquand). (=*C. texana* [Roemer]), X 1,5. Locality An-77, El Cantil Formation, -1:LV external view; -5: articulated specimen, posterior view.

Figures 43 -2, 4.- ***Loxo subbrongniarti*** (d'Orbigny). X 1,5. Loclity An-77, El Cantil Formation, -2:LV, external view; -4: dorsal view of articulated specimen.

Figure 43 - 3.- ***Harpagodes espinosi*** (Landerer). X 1,5. Locality An-77, Cerro Las Callecitas, El Cantil Formation, (VIVAS, 1987, DBG) of Late Aptian age.

Figure 43 – 6.- ***Leviathania vilanovae*** (Landerer).X 1,5. Locality An-77, El Cantil Formation, -6: dorsal view of an adult specimen.

Figures 43 – 7, 10.- ***Ilymatogyra polygona*** (Von Buch). X 1. Locality MC-126, Upper El Cantil Formation, -7: articulated specimen, showing RV in place. -10: LV, externa view.

Figure 43 – 9.- ***Planocaprina trapezoides*** (Palmer). X 1. Locality: VG-614, Guácharo member of El Cantil Formation, -9:drown from outcrop, AV, transverse section.

Figure 43 – 11.- ***Coalcomana ramosa*** (Boehm). X 1. Locality VG-621, Guácharo member of El Cantil Formation, -11:AV transverse section.

Figure 43 – 12.- ***Pinna (Plesiopinna) atriniformis*** Amano, X 1. Locality MO-1563, El Chorreron road to Pertigalete, Anzoategui state, Chimana Formation, (DAGM). -12:LV, external view of a cast.

Figure 43 – 13.- ***Pinna (Pinna) comancheana*** Cragin. X 1,5. Locality An-77, El Cantil Formation, (DBG, VIVAS, 1987) -13:RV, external view.

Figure 43 – 14.- ***Megacucullaea gabrielis*** (Leymerie). X 1,5. Locality An-77, El Cantil Formation (DBG) -14:LV, external view.

Figure 43 – 15.- ***Ptychomya (Pleuroconcha) daedalea*** (Coquand). X 1,5. Locality An-77, El Cantil Formation -15:RV, external view.

Figure 43 – 16.- ***Isocyprina (Venericyptina) carinata*** (de Loriol). X 1,5 Locality An-77, El Cantil Formation, -16: dorsal view, articulated specimen. See plate 46, fig. 6.

Plate 43

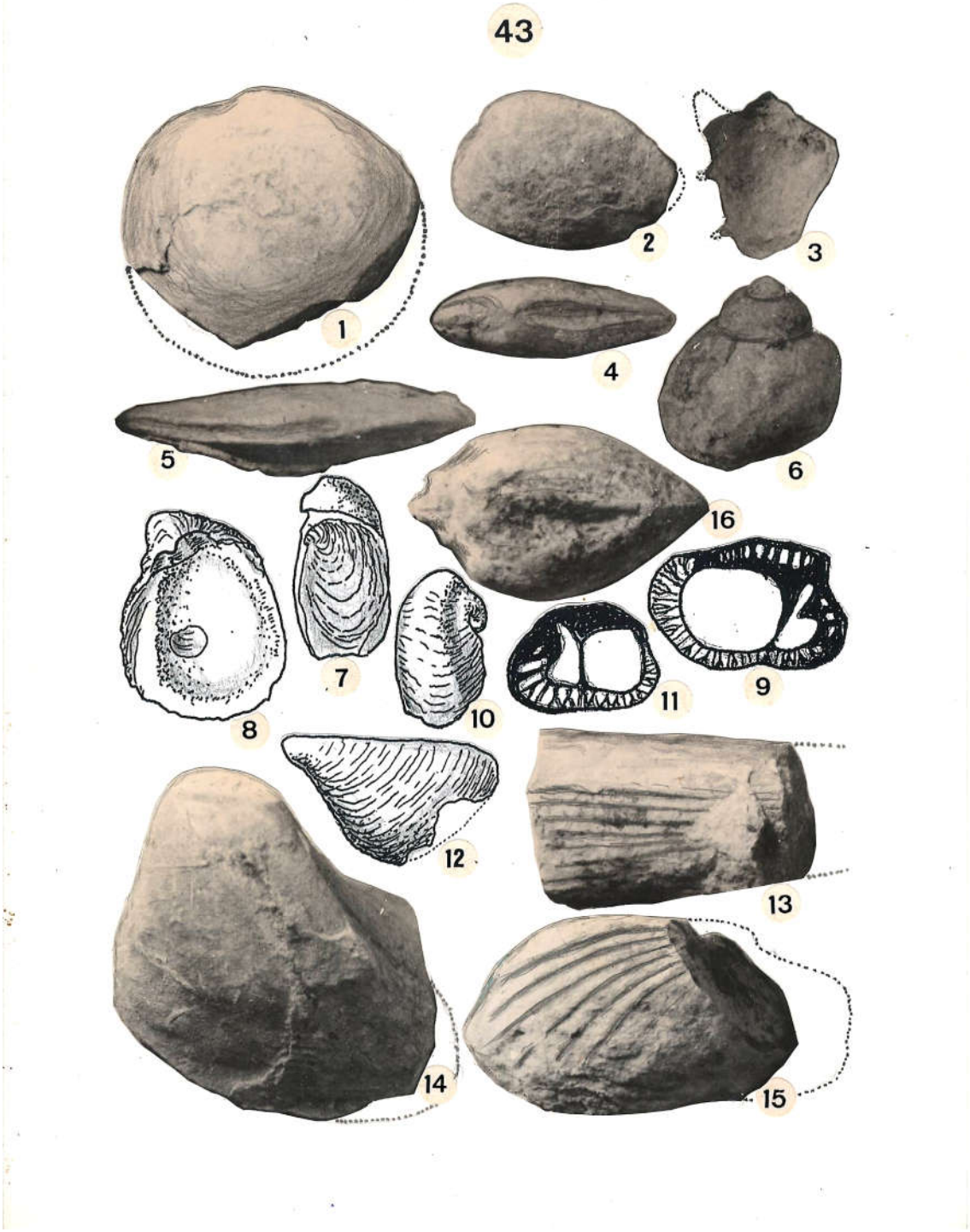


PLATE 44

García Formation, Early-Late Aptian; El Cantil Formation (DBG) of Late Aptian age; Escandalosa Formation of Early Cenomanian age (See plate 1).

Figures 44 – 1, 3.- ***Pachythaeruys cf. collignoni*** (Freneix), X 1,5, Locality An-77, El Cantil Formation -1: and -3:LV, external views;

Figure 44 – 2.- ***Crassatella cf. sabaudi*** Pictet & Roux. X 1,5, Locality An-77, El Cantil Formation, -2 :LV, external view.

Figure 44 – 4.- ***?Nemodon simillima*** (Whiteaves). X 2. Locality HA-4581, Río Santo Domingo section, Escandalosa Formation, (H. ARNAUD et alii., 1999, fig. 37), -4:RV, internal view.

Figure 44 – 5.- ***Flaventia cf. sylvatica*** (Coquand). X 1,5. Locality An-77, El Cantil Formation, -5:LV, external view.

Figure 44 - 6.- ***Crassatella (Sublandinia) caudata*** Gabb. X 1,5. Locality An-77, El Cantil Formation, -6 :RV, external view.

Figure 44 – 7.- ***Venilicardia protensa*** (Woods). X 1,5. Locality An-77, El Cantil Formation, -7:LV, external view.

Figures 44 – 8, 8a.- ***Proveniella roissyi*** (d'Orbigny). X 1,5. Locality MC-446, Garcia Formation. Reproduced from GERHARDT (1896, pl. 5, figs. 11, 11a, as *Crassatella [Plionema] aequalis* non HOLZAPFEL, 1889).

Figure 44 – 9.- ***Trigonarca gerhardti*** Olsson. X 1,5. Locality An-77, El Cantil Formation, -9: RV, external view.

Figures 44 – 10, 11.- ***Homomya solida*** (Cragin). X 1,5. Locality An-77, El Cantil Formation, -10:LV. posterior area, broken off, -11:RV of another cast.

Plate 44

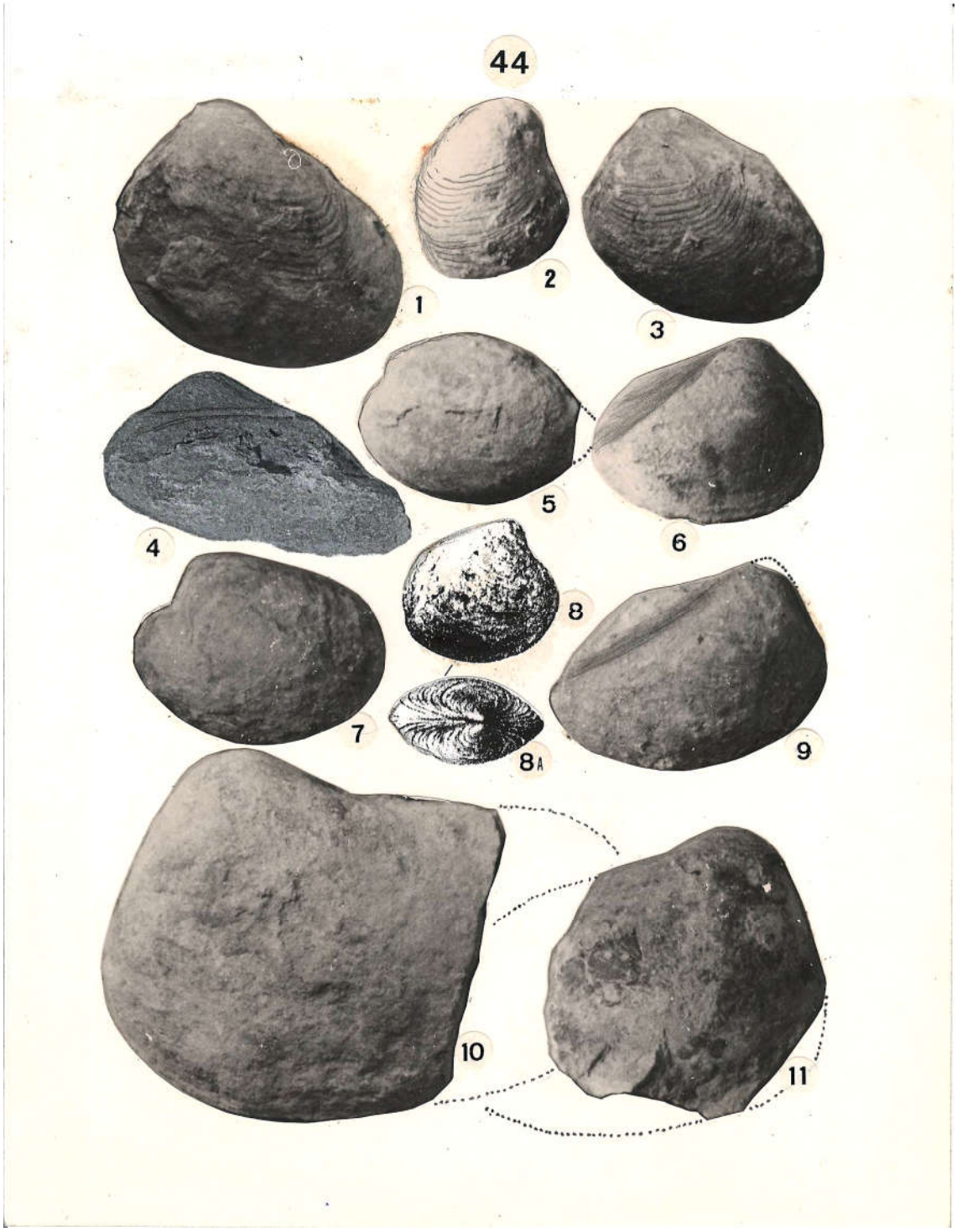


PLATE 45

El Catil Formtion (DBG) of Late Aptian-Early Albian age; Caripito member of Chimana Formation, of Middle Albian age (See plate 1).

Figure 45 – 1.- ***Venilicardia protensa*** (Woods). X 1,5. Locality An.77, El Cantil Formation (DGC, VIVAS, 1987) -1: dorsal view of articulated specimen. See pl. 44, fig. 7)

Figure 45 -2.- ***Epicyprina angulata*** (Sowerby). X 1,5. Locality An-77, El Cantil Formation, -2:RV, external view; muscle scars on cast were remarked.

Figure 45 – 3.- ***Psilomya gigantea*** (Sowerby). X 1,5. Locality An-77, El Cantil Formation, -3:LV, external view.

Fiigure 45 – 4.- ***Aphrodina whitei*** (Böse), X 1,5, Locality An-317-A, Caripito member of Chimana Formation, (DBG) , -4:LV, external view.

Figure 45 – 5.- ***Cymbophora petrosa*** (Conrad). X 1,5. Locality An-77, El Cantil Formation, -5:RV, external view.

Figure 45 – 6.- ***Cymbophora pervetus*** (Conrad). X 1,5. Locality An-77, El Cantil Formation, -6 :RV, external view.

Figure 45 – 7.- ***Clisocolus gaultinus*** (Pictet & Roux). X 1,5. Locality An-77, El Cantil Formation, -7 :LV, external view.

Figures 45 - 8, 9.- ***Psilomya ligeriensis*** (d'Orbigny). X 1,5. Locality MC-271-F, El Cantil Formation, -8:RV, -9:LV, both external views.

Figure 45 – 10.- ***Platycardia supermensa*** (White). X 1. Locality An-77, El Cantil Formation, -10:RV, external view.

Plate 45

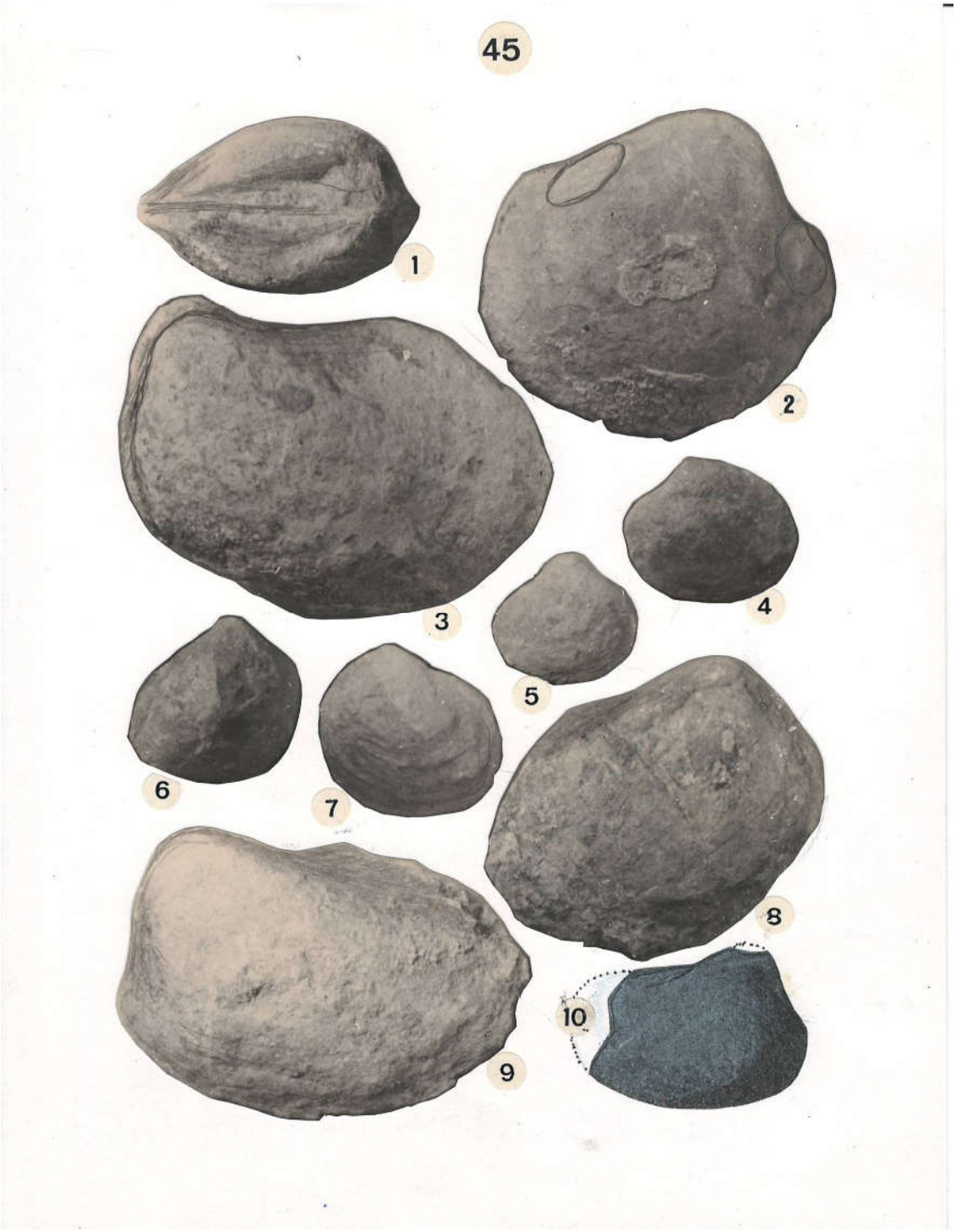


PLATE 46

El Cantil Formation, (DBG) of Late Aptian age (See plate 1).

Figure 46 – 1.- ***Pseudomiltha cf. cycloides*** (Philippi). X 1,5. Locality An-77, El Cantil Formation, -1:RV, external view.

Figure 46 – 2.- ***Parsimonia paluxiensis*** (Hill). Polychaeta attached to the RV of *Pseudomiltha cf. cycloides* (Philippi). (Fig. 46 – 1).

Figure 46 – 3.- ***Pachythaerus subregularis*** (Douville). X 1,5. Locality An-77, El Cantil Formation, -3: dorsal view, of an articulated specimen.

Figure 46 – ***Sinonia? hayamii new species,*** Macsotay, X 3. Locality An-77, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG, VIVAS & MACSOTAY, 1986) in the *Mesorbitolina ovalis* Zone (GÖRÖG & ARNAUD-VANNEAU, 1996). See figure 48-8.

Figure 46 -5.- ***Linotrigonia (Oistotrigonia) archiaci*** (d'Orbigny). X 2. Locality An-77, El Cantil Formation, reproduction of d'ORBIGNY (1844, pl. 290, fig. 3a).

Figure 46 -6.- ***Isocyprina (Venericyprina) carinata*** (de Loriol). X 2,0. Locality An-77, El Cantil Formation, -6:LV, lateral view.

Figure 46 – 7.- ***Psilomya gigantea*** (Sowerby). X 1,5. Locality An-77, El Cantil Formation, -7:RV, external view.

Figure 46 – 8.- ***Noetia (Incanopsis) palestina*** (Whitfield), X 1,5. Locality An-77, El Cantil Formation, -8:RV, external view.

Figure 46 – 9. ***Homomya cf. bravoensis*** (Whitney). X 1,5. Locality An-77, El Cantil Formation, -9:LV, external view.

Plate 46

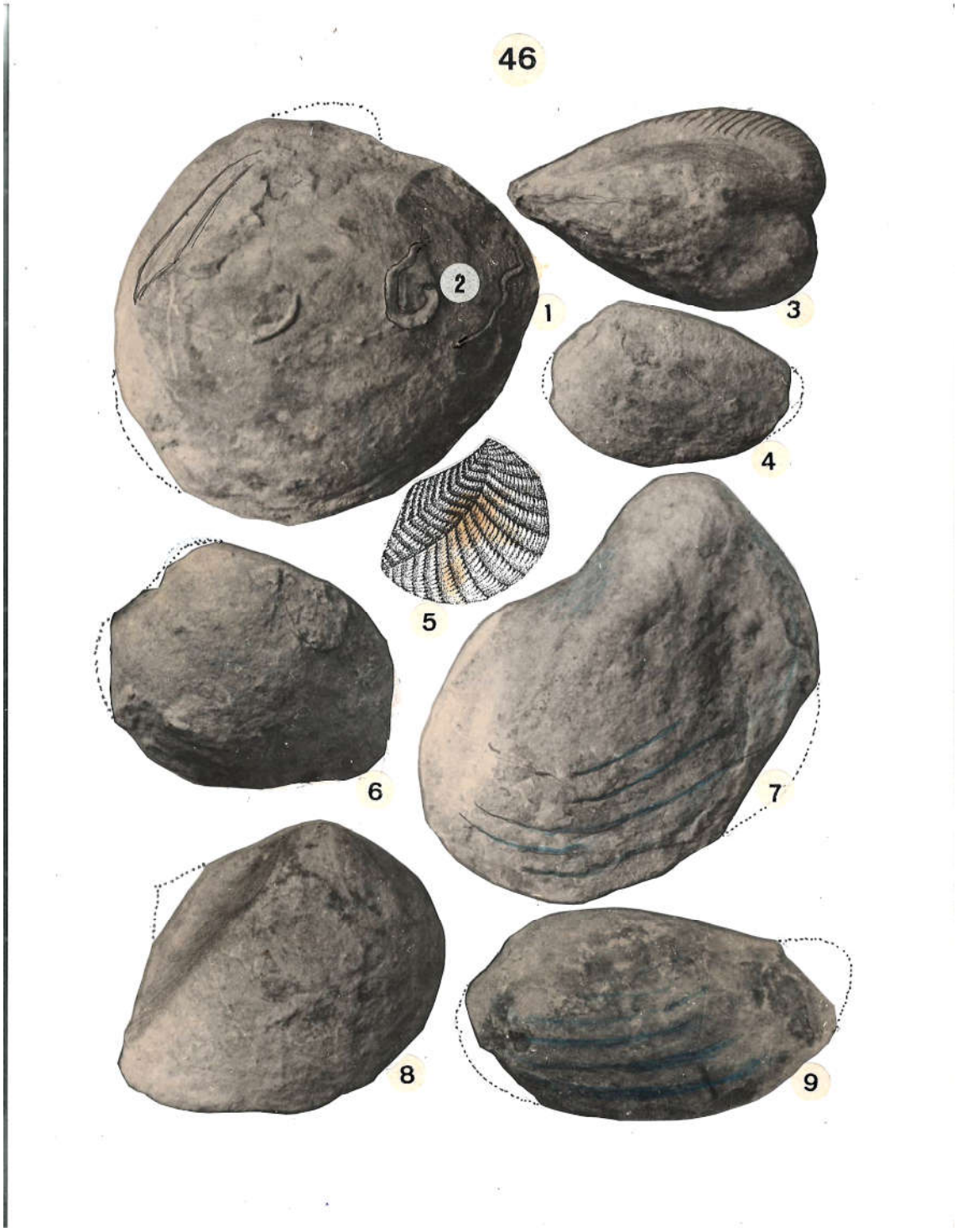


PLATE 47

Taguarumo Formation, of Barremian age, Garcia Formation, of Early-Late Aptian age; El Cantil of Late Aptian age; Guácharo Member of El Cantil Formation, and upper carbonatic member of Peñas Altas Formation, of Early Albian age; Valle Grande Formation, of Middle Albian age; and La Puya member of Peñas Altas Formation, of Middle-Late Albian age (See plate 1).

Figure 47 – 1.- ***Clisocolus ebrayi*** (de Loriol). X 2. Locality An-77, El Cantil Formation, -1 :LV, external view.

Figure 47 – 2, 3, 4.- ***Isoarca cantilensis new species,*** Macsotay. X 0,6. Locality MC-86-C, Pico Garcia, Monagas state, (DBG) El Cantil Formtion, -2:RV, external view; -3:LV, external view; -4: frontal view of the articulated valves, HOLOTYPE. Ucvmp/IO-2325.

Figure 47 – 5.- ***Proveniella cf. meyeri*** (Woods). X 2. Locality MC-372, Garcia Formation, -5:RV, external view.

Figure 47 -6.- ***Tylostoma ricardi*** (Morris & de La Torre, emend. Macsotay). X 2. Locality HA-4502, upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 29). -6: dorsal view.

Figure 47 – 7.- ***Rastellum (Arctostrea) colubrina*** (Lamarck). X 0.5. Locality MO-905, Tguarumo Formation, -7:RV, external view.

Figure 47 – 8.- ***Sinonia? hayamii new species,*** Macsotay, X 3.Locality An-77, El Cantil Formation, (VIVAS, 1987) -8:RV, external view. See plate 42, fig. 1.

Figure 47 – 9.- ***Psilomya fletcheri*** (Whitney). X 1. Locality An-77, El Cantil Formation, -9:RV, external view.

Figure 47 – 10.- ***Aguilerella cf. dissita*** (White). X 1. Locality HA-4343, La Puya member oif Peñas Altas Formation, (ARNAUD, 1999, fig. 33). -10:LV internal view.

Figure 47 – 11.- ***Psilomya banderaensis*** (Whitney). X 1,5. Locality MC-243-E, upper El Cantil Formation, (DBG) -11:RV, external view.

Figure 47 -12.- ***Paraesa ceciliana*** (dÓrbigny). X 1. Locality MC-372-B, Valle Grande Formation, -12:LV, external view, preserving part of the shell.

Figure 47 – 13.- ***Icanotia cf. peruviana*** (Olsson). X 1,5. Upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 29). -13:LV, external view.

Figure 47 – 14.- ***Pachymya (Arcomya) pectorosa*** (Conrad). X 1., Locality An-77, El CantilñFormation, -14:LV, external view.

Figure 47 – 15.- ***Venilicardia lineolata*** (J. Sowerby). X 0,5. Locality MC-445-A, Guácharo member of El Cantil Formation, -15:LV, reproduced from DIETRICH (1938, pl. 21, fig. 4).

Figure 47 -16.- ***Panopea (Myopsis)? plicata*** (Sowerby). X 1. Locality An-77, El Cantil Formation, -16:RV, external view.

Plate 47

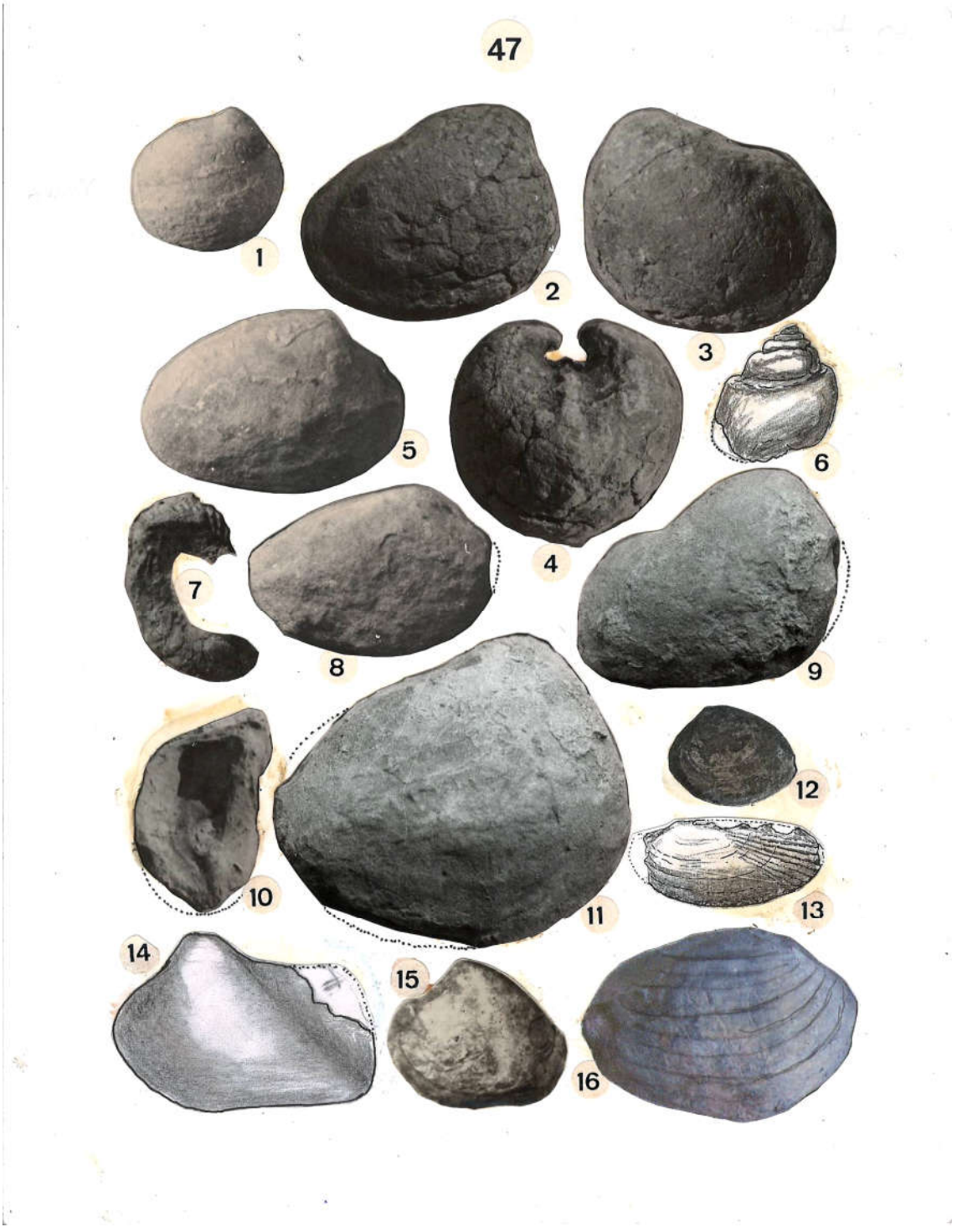


PLATE 48

La Margarita mudstones, of Hauterivian age; Tibú and Taguarumo Formations of Late Barremian-Early Aptian age; Garcia and Lower El Cantil Formations, of Aptian age; Hormiguera member of El Cantil Formation, of Late Aptian age; Lisure and Aguardiente Formations, Caripito member of Chimana Formation, of Middle Albian age (See plate 1).

Figure 48 – 1,- ***Pleuromya colombiana*** (d'Orbigny). X 1. Locality MC-448-A, La Margarita mudstones, -1:RV, external view of cast.

Figures 48 – 2, 3, 8.- ***Pleuromya hedbergi new species,*** Macsotay, Locality MO-6307, Cerro Las Callecitas, Anzoategui state, from the *Mesorbitolina ovalis* zone, (DBG) El Cantil Formation, of Early Aptian age. -2:RV, external view; -8:RV, external view X 3, -3: anterior view. HOLOTYPE, Ucvmp/IO-2144.

Figure 48 – 4.- ***Aphrodina longa*** (Conrad). X 1. Locality MO-2313, Upper Lisure Formation, -4:LV, external view.

Figures 48 -5, 10, 11.- ***Crassatella (Sublandinia) caudata*** Gabb. X 1. Locality MO-3132, Aguardiente Formation. All figures reproduced from STEINMANN (1881, pl. 6) based on samples from Pariatambo Formation, Perú.

Figure 48 – 6.- ***Brachymeris cf. seminalis*** (Stephenson). X 4. Locality MO-6207, lower El Cantil Formation, -6:RV, external view.

Figures 48 – 7, 12.- ***Nemetia cf. triangularis*** (Whitfield). X 2. Locality MC-266-A, in black shales of Hormiguera Member of El Cantil Formation, -7: articulated cast, anterior biew, -12:RV, external view.

Figures 48 – 9.- ***Ampullinopsis desectus*** Kollmann, X 2. Locality MC-273-E, upper El Cantil Formation, -9: apertural view.

Figures 48 – 13.- ***Trigonarca consobrina*** (d'Orbigny). X 1. Locality MO-892, Taguarumo Formation, -13:RV, external view. Reproduced from DIETRICH (1938, pl. 17, fig. 6).

Figure 48 – 14.- ***Brachymeris ex gr. aspera*** (Stephenson). X 2. Locality MC-95-A, Caripito Member of Chimana Formation, -14:RV, external view.

Figure 48 – 15.- ***Oxytoma (Oxytoma) cornueli*** (d'Orbigny). X 1. Locality MC-126-A, lower Garcia Formation, -15:LV, reproduction of WOODS (1905, pl. 8, fig. 1).

Figure 48 – 16.- ***Pachymya (Arcomya) declivis*** (Conrad). X 2. Locality MO-1334, Tibú Formation, Uribante hemigraben, -16:LV, reproduced from DIETRICH (1938, pl. 17, fig. 4).

Plate 48

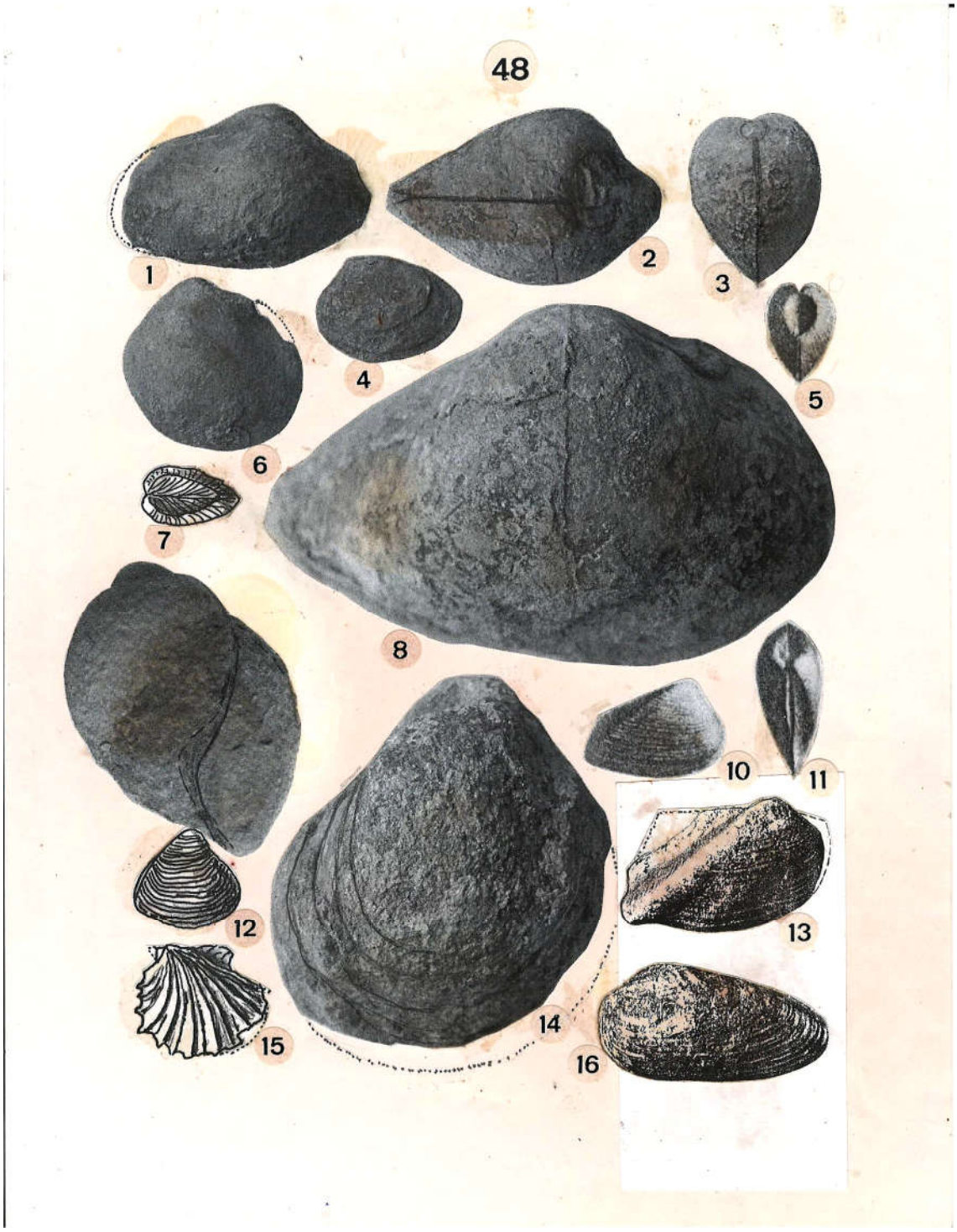


PLATE 49

El Dantó dolostones, of Hauterivian age, El Cantil Formation, of Late Aptian-Early Albian age; Guácharo Member of El Cantil Formation, of Early Albian age; Caripito Member of Chimana Formation, of Middle Albian age (Plate 1).

Figures 49 – 1, 2, 3, 4.- ***Idonearca brevis*** (d'Orbigny). X 2. Locality An-77 lower El Cantil Formation -1, -3:LV, external view. -2, -4:RV, external view.

Figure 49 – 5, 6.- ***Isoarca freneixae new species*** Macsotay, X 1. Locality MC-346-B, dolomitic shales in Cautaro, Sucre state (DGC) El Dantó dolostones, of Hauterivian age. -5:LV, external view. -6:RV, external view, HOLOTYPE, Ucvmp/IO-2146.

Figures 49 – 7, 8.- ***Trigonarca cuneus*** (Conrad). X 0,5. Locality MO-2875, Upper El cantil Formation, -7:LV; -8:RV, both external views.

Figures 49 – 9, 10.- ***Coelastarte leanzai new species,*** Macsotay. X 1. Locality MO-2790, Cerro Las Callecitas, Anzoategui state, El Cantil Formation, (DBG) of Late Aptian age, -9:LV, -10:RV, both external views. HOLOTYPE, Ucvmp/IO-1778.

Figures 49 – 11, 12.- ***Idonearca glabra*** (Parkinson). X 1, Locality MO-2876, Caripito member of Chimana Formation, -11:LV, external view, -12:RV, external view

Figures 49 – 13, 17.- ***Idonearca knechteli*** (Richards). X 1. Locality MO-2877, upper El Cantil Formation, -13:LV, external view, -17: dorsal view of articulated shell.

Figures 49 – 14, 18.- ***Idonearca terminalis*** (Conras). X 1. Locality MO-2877, upper El Cantil Formation, -14:RV, external view, -18: anterior view of articulated specimen.

Figures 49 - 15, 16.- ***Idonearca collignoni new species,*** Macsotay. X 1. Locality MO-2877, El Ojal del Purgatorio, upper El Cantil Formation, -15:LV, external view. -1º6: anterior view of the articulated specimen, showing the alternative furrows. HOLOTYPE, Ucvmp/IO-2150.

Figures 49 – 19, 20, 24.- ***Megacucullea gabrielis*** (Leymerie). X 0,5. Locality An-77, Lower El Cantil Formation, associated to *Mesorbitolina ovalis,* -19: articulated specimen, dorsal view, -20: the same, posterior view, -24:RV, external view.

Figures 49 – 22, 23.- ***Idonearca acuticarinata*** (Nagao). X 1. Locality with no number, near Cueva del Guacharo, Monagas state, donated by Christian Beck, Guacharo Member of El Cantil Formation, (DGC, sDLP) of Early Albian age. -22: reproduction of DIETRICH (1938, pl. 16, fig. 8) LV, external view. -23:LV, drawing based on fragmentary shell.

Figure 49 – 21.- ***Callucina cf. horni*** (Whitney). X 1. Locality MO-2877, lower El Cantil Formation, -21:RV, external view.

Figure 49 – 25.- ***Tylostoma ricardi*** (Morrison & De La Torre). X 1. Allochthonus limestone, reworked in El Cobre Formation, Cuba, of Eocene age. -25 : lateral view, restitution of MORRISON & DE LA TORRE (1983, pl. 9, fig. 4).

Plate 49

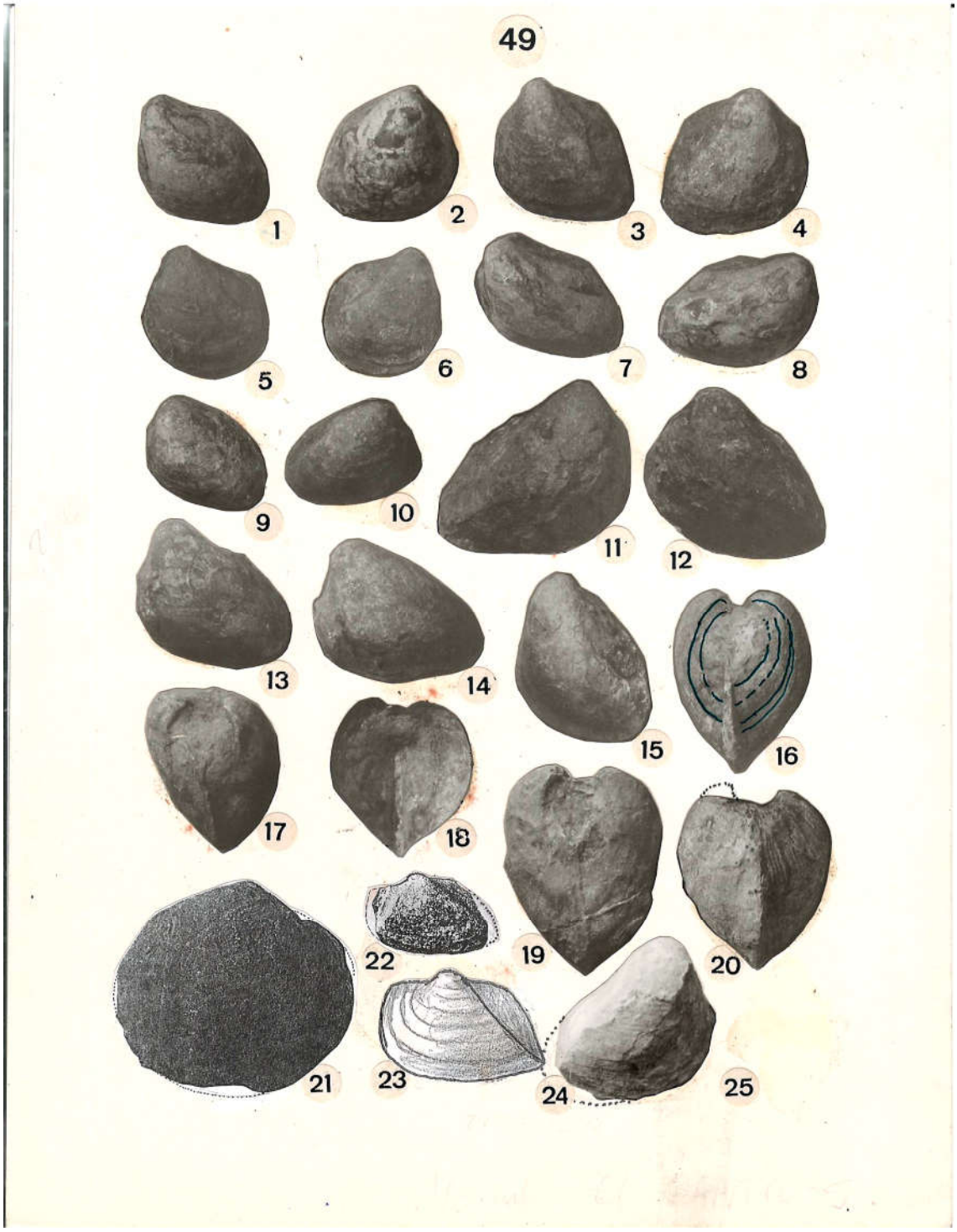


PLATE 50

El Cantil, Upper Borracha, upper carbonatic member of Peñas Altas Formation, of Eartly Albian age; La Puya Member of Peñas Altas Formation, of Middle-Late Albian age; Valle Grande and Caripito Member of Chimana Formation, of Middle Albian age; Majagual Formation, of Late Albian-Early Cenomanian age. Allochthonous in Bobare Formation (See plate 1).

Figure 50 – 1.- ***Amaurellina rhodani*** (Pictet & Roux). X 1. Locality MO-1375, Upper Borracha Formation, -1: dorsal view.

Figure 50 – 2.- ***Euspira sergipensis*** (Maury). X 4. Locality MO-878, Borracha Formation, -2 : apertural view.

Figure 50 – 3.- ***Tylostoma triplica*** (Whitfield). X 1. Locality MO-1375, upper Borracha Formation, -3; dorsal view.

Figures 50 - 4, 6.- ***Tylostoma brasilianum*** Maury. X 0,5. Locality MO-1375,, upper Borracha Formation, -4, -6: dorsal view.

Figure 50 – 5.- ***Tylostoma syriacum*** (Conrad). X 0,5. Locality FA-58-A, upper El Cantil Formation, -5: dorsal view.

Figures 50 – 7, 9.- ***Tylostoma intermedium*** Choffat. X 1. Locality MO-1375, upper Borracha Formation, - 7:apertural view, -9: dorsal view.

Figure 50 – 8.- ***Protohemichenopus angulosus*** (d'Orbigny). X 1. Locality MC-426-C3. Valle Grande Formation, -8: reproduced from d?Orbigny (1842, pl. 3, fig. 4).

Figure 50 – 10.- ***Pseudomesalia deserti*** (Douvillé). X 1. Locality MO-1375, upper Bottacha Formtion, -10 : apertural view.

Figures 50 – 11, 24.- ***Teleoptyxis cf. subnodulosa*** (Futterer) X 1. Locality MO-5620, Majagual Formation, -11: axial surface exposed by weathering; -24: axial section.

Figure 50 – 12.- ***Eunerinea (Eunerinea) syriaca*** (Conrad, emend. Blanckenhorn). X 1. Locality MO-5521, Majagual Formation, -12: axial section.

Figure 50 – 13.- ***Perissolax trochoides*** Gabb. X 1. Locality MO-3121, Píche member of Apón Formation, -13; apertural view, reproduction of GABB (1877, pl. 39, fig. 4).

Figure 50 – 14.- ***Teleoptyxis peruviana*** (Olsson). X 1. Locality VG-02, Caripito member of Chimana Formation, (YORIS, 1985) -14: axial section, reproduced from OLSSON (1934, pl. 10. Fig. 1).

Figure 50 – 15.- ***Serrifusus cf. rusticus*** (Briart & Cornet). X 1. Locality VG-424-A, Chimana Formation, -15: dorsal view.

Figure 50 – 16.- ***Aphanoptyxis excavata*** (Brongniart) X 1. Locality HA-4343, La Puya member of Peñas Altas Formation, -16: axial section.

Figure 50 – 17.- ***Carinia aff. multilamellosa*** (Delpèy). X 0,5. Locality MO-1324, Limestone, olistolith reworked in Bobare Formation, -17: axial cut.

Figure 50 – 18.- ***Teleoptyxis cedrorum*** (Blnckenhorn). X 1, Locality MO-5620, Majagual Formation, -18: axial section.

Figure 50 – 19.- ***Aptyxiella (Acroptyxis) banderaensis nomen novum,*** Macsotay, X 1. Locality MO-892, Punta El Peñon, Los Bordones, Sucre state, Upper Borracha Formation, (DAGM) of Early Albian age. -17: axial cut.

Figures 50 – 20, 21.- ***Acteonella (Pchelintsevella) gracilis*** (Douville). X 1. Locality VG-02, Caripito Member of Chimana Formation, -20, -21 : naturally eroded axial sections.

Figure 50 – 22.- ***Eunerinea schotti*** (Conrad). X 1. Locality HA-4427, upper carbonatic member of Peñas Altas Formation, -22: axial section.

Figure 50 – 23.- ***Coxella new genus, majagualensis new species,*** Macsotay, X 1. Locality MO-5597, Fila Victor Marín, Casanay, Sucre state, Upper Majagual Formation, (DEP), of Early Cenomanian age. -23: axial cut.

Plate 50

PLATE 51

Mapurite member of El Cantil Formation, of Late Aptian age; upper carbonatic member of Peñas Altas Formation, and Píche member of Apón Formation, of Early Albian age; Lisure, Aguardiente and Valle Grande Formations of Middle Albian age; La Puya member of Peñas Altas Formation, of Late Albian age. Olistoliths in Bobare Formation (See plate 1).

Figure 51 – 1.- ***Merklinia? viteli*** (Pictet & Campiche). X 1,5. Valle Grande Formation, -1 :RV, external view.

Figure 51 – 2.- ***Megalocardia medialis*** (Conrad). X 1. Locality MO-3110, Píche member of Apón Formation, -2:LV, external view.

Figure 51 – 3.- ***Neocrassina (Neocrassina) obovta*** (Sowerby). X 2. Locality MO-3110, Píche member of Apón Formation, -3: reproduced from WOODS (1906, pl. 15, fig. 16).

Figures 51 – 4, 5.- ***Caryocorbula cf. peruana*** (Gabb). X 2. Locality MO-1757, Upper Aguardiente Formation, -4:RV, external view; -5: dorsal view of the same.

Figure 51 – 6.- ***Eoursivivas martinae*** (Whitney). X 6. Locality MO-2313, Lisure Formation, -6: LV, external view.

Figure 51 – 7.- ***Epicyprina expansa*** (Coquand). X 1. Locality HA-4424, Upper carbonatic member of Peñas Altas Formtion, -7:LV, external view.

Figures 51 – 8, 12, 13.- ***Parvamussium cf. kimurai*** (Hayami). X 4. Locality MC-332-B, Valle Grande Formation, drawn from samples.

Figure 51 – 9.- ***Idonearca terminalis*** (Conrad). X 1. Locality HA-4409, upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 25). -9:LV, external view.

Figure 51 – 10.- ***Pholadomya (Pholadomya) cf. gigantea*** (Sowerby). X 0,5. Locality ED-13-B, Mapurite Member of El Cantil Formation, -10:LV, external view.

Figure 51 – 11.- ***Gyrodes gaultinus*** (Sowerby). X 1, Locality HA-4336, La Puya member of Peñas Altas Formation, -11 : apertural view.

Figure 51 – 14.- ***Parallelodon tocaymensis*** (d'Orbigny). X 1. Locality MO-1757, Aguardiente Formation, Uribante Hemigraben, Tachira state, -14:RV, reproduction of d'Orbigny (1842, pl. 6, fig. 1).

Figure 51 – 15.- ***Panopea (Panopea) rathbuni*** (White). X 1. Locality MO-.3110, Píche member of Apón Formation, -15:RV, external view.

Fihures 51 – 16, 17.- ***Protocardia (Protocardia) texana*** (Conrad). X 2. Locality MO-3110, Píche Member of Apón Formation, -16:RV, cast, -17: reproducion from CONRAD (1857, pl. 6, fig. 6a).

Figure 51 -18.- ***Goniocheila (Monocuphus) brittsi*** (Stanton). X 2, Locality MC-246-B, Valle Grande Formation, -18 : dorsal view.

Figure 51 -19.- ***Diptyxis hottingeri*** (Collignon). X 2. Locality MO-1324, limestone olistolith in Bobare Formation (Lara Nappe), -19: axial section, naturally exposed.

Figure 51 – 20.- ***Maghrebella deserti*** (Douvillé). X 1. Locality HA-4347, La Puya member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 33).-20 :LV, external view.

Figures 51 – 21, 22, 23, 24.- ***Grammatodon (Nanonavis) carinatus*** (Sowerby). X 1. Locality MC-426, lower Valle Grande Formation, goethite pseudomorphs, Reproduced from WOLLEMAN (1900, pl. 2, figs. 10, 11).

Plate 51

PLATE 52

Upper carbonatic member of Peñas Altas, upper Borracha Formations, of Early Albian age; Valle Grande, Lisure and Chimana Formations, of Middle Albian age; La Puya member of Peña Altas Formation, of Late Albian age; Maraca and La Grita member of Capacho Formation, of Early Cenomanian age (See plate 1).

Figure 52 – 1.- ***Pholadomya (Pholadomya) pedernalis*** Roemer. X 1. Locality JFS-171, Chimana Formation, -1:RV, external view.

Figures 52 – 2, 3.- ***Vanikoro aff. pricei*** Passendorfer, non de Loriol. X 2. Locality HA-4336, La Puya member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 33). -2, -3 :dorsal view of two adult shells.

Figure 52 – 4.- ***Tylostoma cf. chihuahuense*** Böse). X 1. Locality HA-4343, Locality HA-4343, La Puya Membner of Peñas Altas Formation, -4: dorsal view, showing pelomorphic deformation.

Figure 52 – 5.- ***Birostrina subsulcata*** (Whiltshire). X 1. Locality MO-1475, Lisure Formation, topmost bed in type section. -5:LV, external view.

Figures 52 – 6, 7.- ***Cyclocardia dux*** (Gerhardt). X 1. Locality MO-1153, Guayacan Member of Capacho Formation, La Teta de Niquitao, Trujillo state, -6:LV, internal view; -7: the same, external view.

Figure 52 – 8: ***Anisocardia (Collignonicardia) lapuyana new species,*** Macsotay, X 1. Locality HA-4333, La Aguada de los Chivos, Trujillo state, La Puya Member of Peñas Altas Formation, of late Middle Albian age. -8:RV, external view. HOLOTYPE, Ucvmp/IO-2133.

Figure 52 – 9.- ***Protocardia (Protocardia) pauli*** (Coquand). X 1. Locality MO-2324, Upper Maraca Formation, (Perijá) -9:LV, external view.

Figure 52 – 10.- ***Keilostoma cf. sergipensis*** (Maury). X 2. Locality HA-4336, La Puya Member of Peñas Altas Formation, -10: dorsal view.

Figures 52 – 11, 14.- ***Homomya brasiliensis*** (White). X 2. Locality HA-4343, La Puya Member of Peñas Altas Formation, -11:RV, -14:LV, both external views.

Figures 52 - 12, 12a.- ***Cymbophora syriaca*** (Conrad). X 1. Locality HA-4337, La Puya Member of Peña Altas Formation, (ARNAUD et alii., 1999, fig. 32). -12:RV, external view, -12ª:dorsal view.

Figures 52 – 13.- ***Globiconcha*** sp. indet. X 0,5. Locality MC-431, Valle Grande Formation, -13: apertural view.

Plate 52

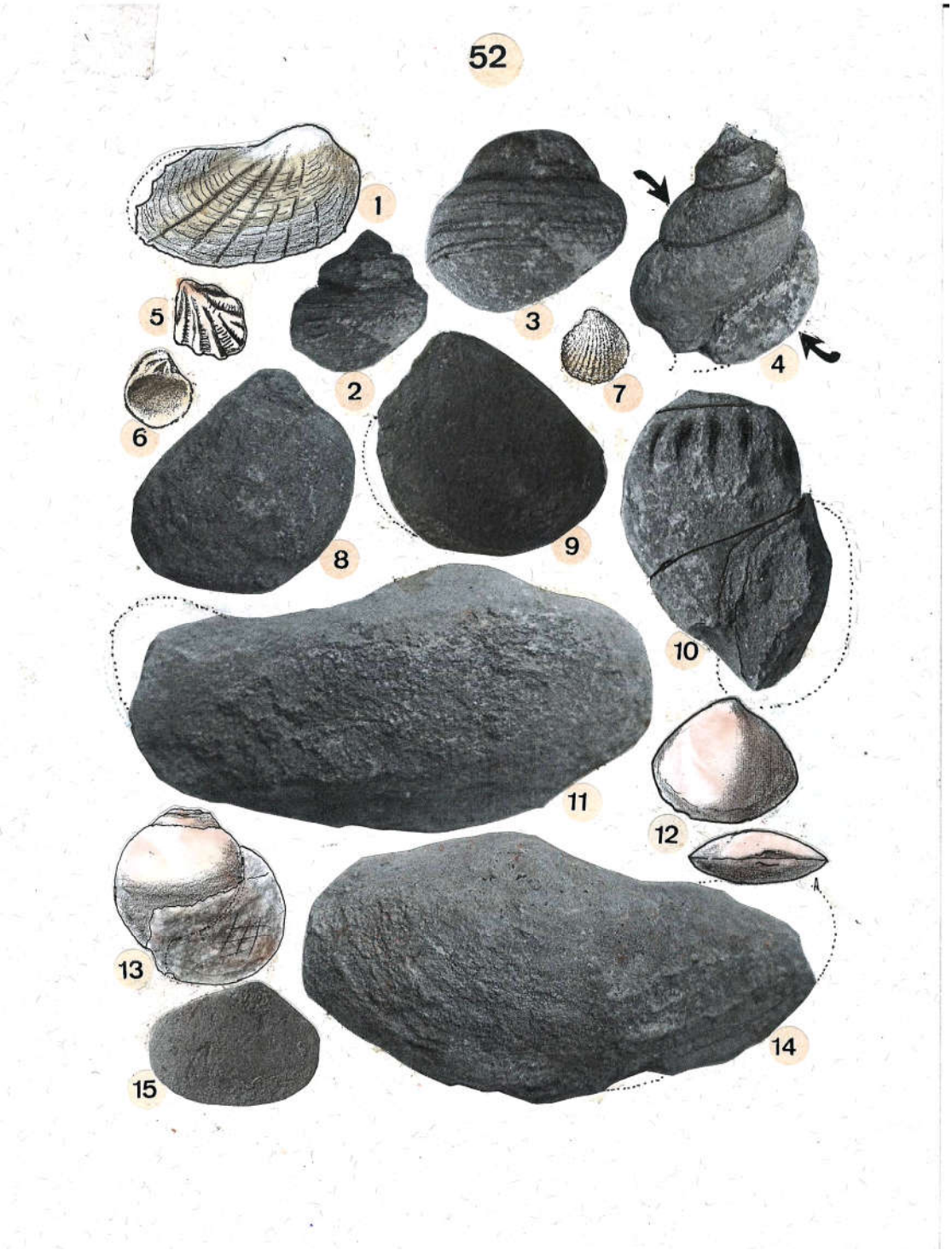


PLATE 53

Píche Member of Apón Formation, of Early Albian age; Valle Grande Formation, of Middle Albian age; La Grita member of Capacho Formation, of Early Cenomanian age (See plate 1).

Figures 53 -1, 2.- ***Panopea (Panopea) gurgitis*** (Brongniart). X 2. Locality MO-3131, Píche Member of Apón Formation.,-1:LV, external view;-2:RV, external view, pelomorphically deformed.

Figures 53 – 3, 4.- ***Laternula shattucki*** (Adkins). X 1. Locality MO-3131, Píche meber of Apón Formation, -3:RV, -4:LV, external views.

Figures 53 – 5, 6.- ***Nayadina larviformis*** (Gabb). X 2. Locality MO-3220, La Grita Member of Capacho Formation, -5:LV,external view, reproduced from GABB (1877, pl. 42, fig. 3), -6:LV, internal view.

Figure 53 – 7.- ***Pseudomelania benahensis*** (Böhm). X 1. Locality MO-3131, Píche Member of Capacho Formation.-7: apertural view, adult specimen.

Figures 53 – 8, 12.- ***Trigonocallista curvirostris*** (Coquand). X 1. Locality MO-3121, Pícho Member of Apón Formation, -8:LV, -12:RV, both external views.

Figure 53 – 9.- ***Panopea (Panopea) brasiliensis*** (White). X 1. Locality 3121, Píche Member of Apón Formation, -9:RV, external view.

Figure 53 – 10.- ***Pseudodidymotis*** sp. 1, X 1. Locality VG-398-B, Valle Grande Foirmation, -10:RV, external view.

Figure 53 – 11.- ***Panopea (Panopea) indifferens*** (Coquand). X 1. Locality MO-2131, Píche Member of Apón Formation, -11: RV, external view.

Plate 53

PLATE 54

Lower carbonatic member of Peñas Altas Formation, Early Aptian age; Píche member of Apón Formation, upper carbonatic member of Peñas Altas Formation, and upper El Cantil Formation, of Early Albian age (Plate 1).

Figure 54 – 1.- ***Panopea (Panopea) newberryi*** Shumerd. X 1. Locality MO-3121, Píche member of Apón Formation, -1:LV, external view.

Figure 54 – 2, 4.- ***Pleuromya pleuromyaeformis*** Choffat. X 2. Locality MO-3121, Píche Member of Apón Formation, -2:LV, -4:RV, both external views.

Fiugure 54 – 3.- ***Ludbrookia cf. constanti*** (d'Orbigny). X 2. Locality HA-4502, upper carbonatic member of Peñas Altas Formation, -3:LV, external viuw, with a profile of the ribs.

Figures 54 – 5, 9.- ***Panopea (Panopea) inaequivalvis*** (dÓrbigny).X 2. Locality MO-3121, Piche member of Apón Formtion, -5:LV, -9:RV, external views.

Figure 54 – 6.- ***Cretocardia*** sp. indet. X 2. Locality 3110, Píche Member of Apón Formation, -6:LV, external view, fragmentary shell.

Figure 54 – 7.- ***Thracia rotundata*** (Sowerby). X 0,5. Loclity MO-2790, upper El Cantil Formation, -7:RV, extyernal view; shell fragment preserved anteriorly.

Figure 54 – 8.- ***Agapella rotunda*** Vokes. X 1. Locality HA-4520, lower carbonatic member of Peñas Altas Formtion, (ARNAUD et alii., 1999, fig. 22). -8:RV, external view.

Plate 54

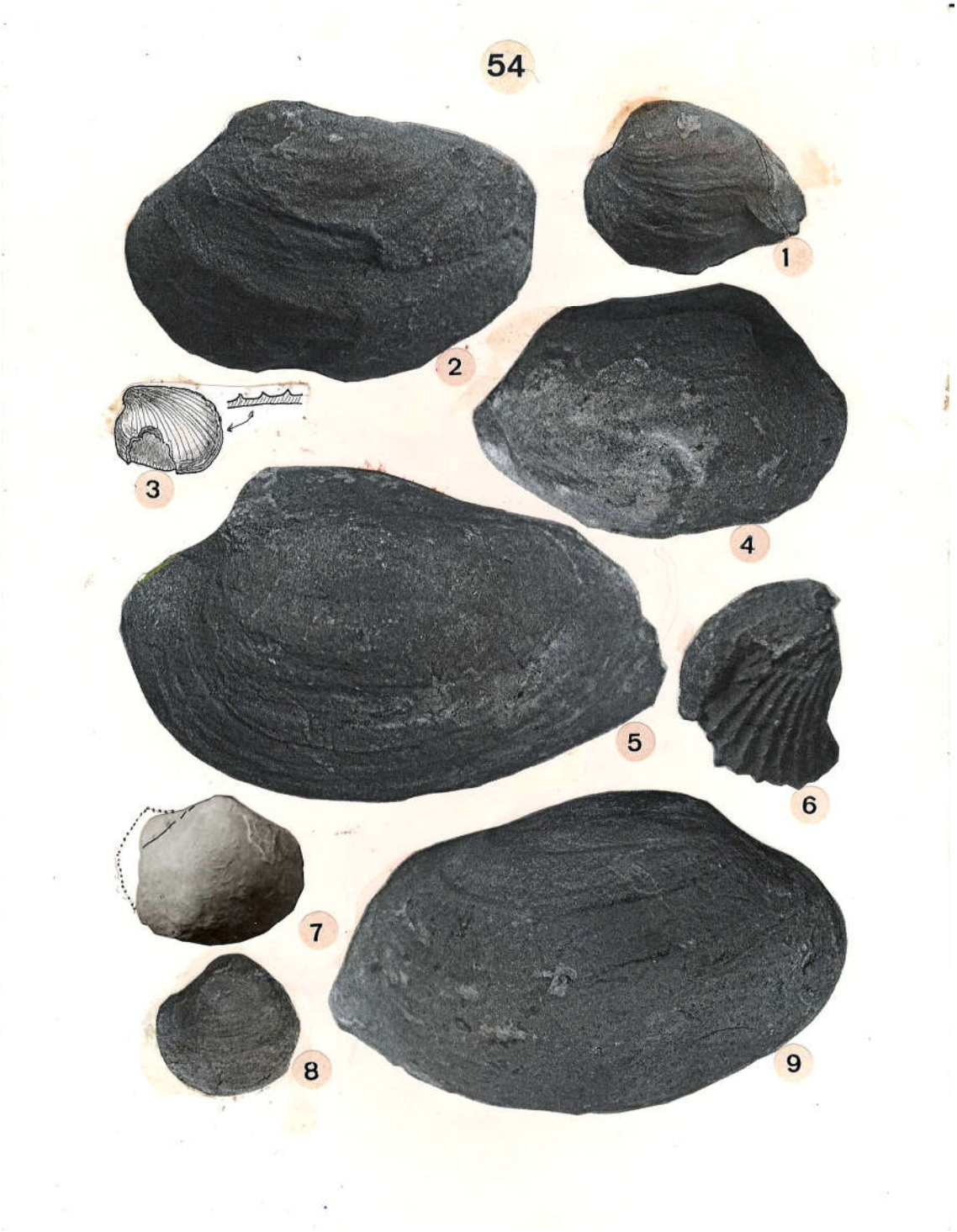


PLATE 55

Píche Member of Apón Formation, upper carbonatic member of Peñas Altas Formation, of Early Albian age. Lisure, Aguardiente Valle Grande Formations, and Caripito Member of Chimana Formation, of Middle Albian age; Bobare Formation, of Albian-Cenomanian age (See plate 1).

Figures 55 – 1, 2, 4.- ***Modiolus socorrinus*** (d'Orbigny). X 1. Locality MO-3131, Píche Member of Apón Formation, -1:LV -4:LV, -2:RV, all external views.

Figures 55 – 3, 11.- ***Eocallista hübneri*** (Steinmann). X 1,5. Locality MO-1315, Aguardiente Formation, --3 :dorsal view of articulated specimen ; -11 : RV, both reproduced from STEINMANN (1881, pl. 7, figs. 3, 4).

Figures 55 – 5, 6.- ***Globocardium sphaeroideum*** (Forbes). X 2. Locality HA-4427, Upper carbonatic Member of Peñas Altas Formation, -5, -6: reproduced from WOODS (1904-1913, pl. 31, figs. 2, 3).

Figure 55 – 7.- ***Nucula (Leionucula) albensis*** (d'Orbigny). X 1. Locality 3131, Lisure Formation, -7:LV, external view.

Figure 55 – 8.- ***Peruviella sergipensis*** (Maury). X 1. Locality MO-1145, limestone olistolith of Bobare Formation, reworked in Moran Formation, of Eocene age. -8: axial section, exposed on erosional surface.

Figures 55 – 9, 10.- ***Trigonarca peroblicua*** (Von Buch). X 1. Locality HA-4428, upper carbonatic member of Peñas Altyas Formation, (ARNAUD et alii., 1999, fig. 26). -9:LV, -10:dorsal view, reproduced from VON BUCH (1839, figs. 13, 14).

Figure 55 – 12.- ***Perissoptera maxima*** (Price). X 3. Locality VG-452, Valle Grande Formation, -12:shell, lacking the body whorl.

Figure 55 - 13.- ***Texigryphaea pitcheri*** (Morton). X 2. Donated by Dr. Virgil WINKLER, collected in Quebrada Santa Rosita, topmost limestone of P'icheMember of Apón Formation. -13:LV, external view.

Figures 55 – 14, 16.- ***Trinacria*** sp. indet. X 2. Locality VG-471, Caripìto Member of Chimana Formation, -14, -16:RV, external and internal view of the only sample.

Figure 55 – 15.- ***Ataphrus cf. yokoyamai*** Nagao. X 1,5. Locality JFS-04, Valle Grande Formation, -16 : apèrtural view.

Figure 55 – 17.- ***Drepanocheilus muleti*** (de Loriol). X 2. Locality VG-432, Valle Grande Formation, -17 : dorsal view.

Plate 55

PLATE 56

Píche member of Apón Formation, Guácharo member of El Cantil Formation, and upper carbonatic member of Peñas Altas Formation, of Early Albian age; Chimana and Valle Grande member of Middle Albian age; La Puya member of Peñas Altas Formation, and Maraca Formation, of Late Albian age; Guayacan Member of Capacho Formation, of Late Turonian age (Plate 1).

Figure 56 – 1, 3.- ***Tortartica roemeri*** (Cragin). X 1,5. Locvality MO-3121, Píche Member of Apón Formation, -1, -3: reproduction from CRAGIN (1893, pl. 37, figs. 1-2).

Figure 56 – 2.- ***Perissolax sowerbyi*** (Seeley). X 2. Locality MO-1156, Guayacan Member of Capacho Formation, Niquitao area, Trujillo state. -2: apertural view.

Figures 56 – 4, 5.- ***Ludbrookia arivechensis*** (Heilprin). X 1. Locality MC-271-C, Chimana Formation, -4:RV, -5:LV, reproduced from SCOTT (1977, pl. 1, figs. 1, 5).

Figure 56 – 6.- ***Didymotis cf. trinidadensis*** Sommermeier. X 1. Locality MO-1154, Guayacan Member of Capacho Formation, -6 :RV, external view.

Figure 56 – 7.- ***Protocardia coquandi*** (Següenza). X 2. Locality MO-1154, Guayacan Member of Capacho Formation, -7:RV, external view.

Figure 56 – 8.- ***Aenona elliptica*** (Whitfield). X 1. Locality MO-1156, Guayacan Member of Capacho Formation, -8:RV, external view.

Figure 56 – 9.- ***Nerinella itaporangica*** Maury, X 2. Locality HA-4502, upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 29). Drawing of a natural section.

Figure 56 – 10.- ***Pharodina cf. cuneata*** (Sowerby). X 1,5. Locality MO-1156, Guayacan Member of Capacho Formation. -10:RV,, external view.

Figure 56 – 11.- ***Brachymeris aff. fallax*** (Forbes). X 1. Locality MO-1154, Guayacan Member of Capacho Formation, -11:RV, external view.

Figure 56 – 12.- ***Trigonocallista cf. puella*** (de Loriol). X 2. Locality MO-4508, upper carbonatic member of Peñas Altas Formation (ARNAUD, et alii., 1999, fig. 29). -12:LV, external view.

Figure 56 – 13.- ***Pholadomya (Buchardiomya) cf. picteti*** Mayer-Eymar. Locality HA-4337, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 32). -13: LV, external view

Figure 56 – 14.- ***Epicyprina syriaca*** (Corad). X 1. Locality MO-1156, Guaycan member of Capacho Formation, -14: RV, external view.

Figure 56 – 15.- ***Vokesula Raimondi*** (Gabb). X 3. Locality JFS-002, Valle Grande Formation, -15: RV, external view.

Figure 56 – 16.- ***Cymbophora cf. peruana*** (Steinmann). X 2. Locality MC-444, Guacharo Member of El Cantl Formation, -16: RV, external view.

Figure 56 – 17.- ***Ludbrookia cf. belviderensis*** (Cragin). X 1. Locality MO-2478, lower Maraca Formation, -17: reproduced fromn SCOTT (1977, pl. 1, fig. 18).

Figure 56 – 18.- ***Cyprimeria meridionalis*** (Seguenza). X 1. Locality MO-1156, Guyacan Member of Capacho Formation, -18:LV, external view.

Figure 56 – 19.- ***Venilicardia inornata*** (d'Orbigny). X 0,5. Locality MC-446-A, GuachjaroMember of El Cantil Fornation. -19:RV, externl view.

Figure 56 – 20.- ***Limaria (Limaria) wacoensis*** (Roemert). X 1. Locality MO-2351, Píche meber of Apón Formation, -20:LV, external view. Reproduction of BÖSE (1910, pl. 14, fig. 8).

Figure 56 – 21.- ***Pachymya (Arcomya) cf. gigas*** (Sowerbt). X 2. Locality MO-3110, Píche Member of Apón Formation, -21:RV, external view.

Figure 56 – 22.- ***Chondrodonta cf. glabra*** Stanton. X 1. Locality MO-2351, Píche mebre of Apón Formation, -22: natural cross-cut in massive limestone.

Plate 56

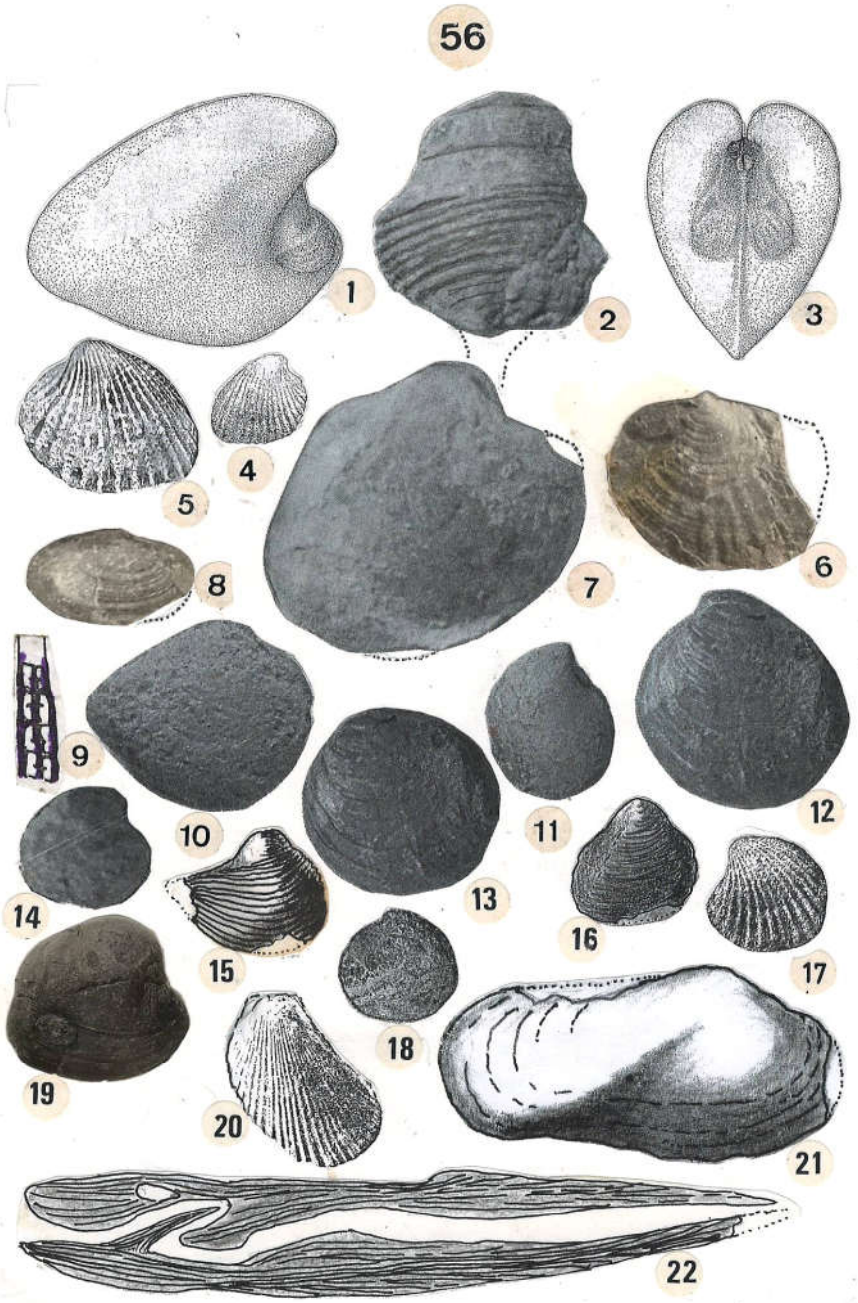


PLATE 57

Lower El Cantil Formation, Late Aptian; Guacharo Member of El Cantil Formation, and upper carbonatic member of Peñas Altas Formation, of Early Albian age; Corral Viejo member of Chimana Formation, La Puya Member and lower Maraca Formation, of Late Albian age. La Grita member of Capacho Formation, upper Maraca and Lower Escandalosa Formations, of Cenomanian age. (See plate 1).

Figure 57 – 1.- ***Oonia sp. indet.*** Macsotay. X 1. Locality MC-2794, lower El Cantil Formation, -1: drawing of a natural section, exposed on outcrop.

Figures 57 – 1, 2.- ***Gyrostrea (Pseudogyra) palaemon*** (Coquand). X 1. Locality MC-446-C, Guácharo Member of El Cantil Formation, reproduction from MALLADA (1887, pl. 43, figs. 1, 3).

Figures 57 – 4, 6, 7.- ***Camaleolopha syphax*** (Coquand). Locality MO-2333, Río Yasa, Perijá, upper Maraca Formation, -4:RV, internal view, X 2; -6, -7:RV and LV, external views.

Figure 57 -5.- ***Ceratostreon hilli*** (Cragin). X 1. Locality HA-4336, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 32).

Figure 57 – 8.- ***Bathrotomaria cf. chouberti*** Collignon. X 1. Donation of Tulio Peraza, Corral Viejo Member of lower Chimana Formation, -8: dorsal view of an adult shell.

Figure 57 – 9.- ***Amphidonte (Amphidonte) subhaliotoidea*** (Nagao). X 1. Locality MC-271-D, Lower El Cantil Formation, in shaly facies. -9:LV, external view.

Figure 57 – 10.- ***Cameleolopha syphax*** (Coquand). Spiny variety. X 1. Locality MO-2314, Lower Maraca Formation, -10: reproduced from SUTTON (1946, pl. 4, fig. 2).

Figure 57 – 11.- ***Cyclorisma parva*** (Sowerby). X 1. Locality HA-4508, upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 29).

Figure 57 – 12.- ***Paraesa faba*** (Sowerby). X 2. Locality MO-1156, La Grita member of Capacho Formation, Niquitao area, Trujillo state. -12:LV, external view.

Figure 57 – 13.- ***Calorebama*** sp. indet., X 2. Locality Bali-4, Lower Escandalosa Formation, Barinas state,-13: apertural view.

Figure 57 – 14.- ***Pleuriocardia syriaca*** (Conrad). X 1. Locality MC-119-A, Caripito Member of Chimana Formation, -14:RV, external view of a cast.

Figures 57 - 15, 16.- ***Flaventia belviderensis*** (Cragin) X 1. Locality HA-4508,upper carbonatic member of Peñas Altas Formation, Trujillo state, -15:RV, and -16:LV, external views of the same casts.

Plate 57

PLATE 58

Upper El Cantil Formation, of Early Albian age; Valle Grande and Aguardiente Formations, of Middle Albian age; Boquerón Formation, of Late Albian-Early Cenomanian age; Escandalosa Formation, of Cenomanian – Late Turonian age; La Panela beds, Cenomanian. (See plate 1).

Figures 58 – 1, 2, 3, 4.- ***Rhynchostreon subsquammatum*** (dÓrbigny). X 1. Locality MO-5885, lower sandstones, of Escandalosa Formation, -1, -4:LV, external view; -2:LV, anterior view, -3: apticulated specimen, posterior view.

Figure 58 – 5.- ***Parvamussium chimanensis new species,*** Macsotay, X 4. Locality MO-3243, Las Playuelas inlet, Chimana Grande island, (DAGM), Boquerón Formation, of Late Albian-Cenomanian age. -5: RV, external view. HOLOTYPE, Ucvmp/IO-2152, associated to *Mariella bergeri* (Brongniart).

Figures 58 – 6, 7, 10.- ***Rhynchostreon suborbiculatum suborbiculatum*** (Lamarck). X 1. Locality MC-426-C, Valle Grande Formation, -6:LV, internal view; -7:LV, adult specimen,-10:LV, juvenile specimen.

Figures 58 – 8, 9.- ***Rhynchostreon suprareticulatum*** (Jourdy), X 2,5. Locality MO-5185, basal Escandalosa Formation, (Uribante hemigraben), -8:LV, partially eroded: -9:LV. external view.

Figures 58 -11, 12, 16.- ***Amphidonte conica*** (Sowerby). X 1. Locality MO-2876, upper El Cantil Formation, -11:RV, external view, -12:LV,frontal view; -16:LV, external view.

Figure 58 – 13.- ***Chondrodonta aff. munsoni*** (Hill). X 1. Locality MO-1261, Uppermost bed of Aguardiente Formation, Merida, of Cenomanian age.-13: mold of external surface.

Figures 58 -14, 15.- ***Pycnodonte (Phygraea) vesicularis vesiculosa*** (Sowerby). X 1. Locality MO-4051, La Panela hill, Chacual Complex, Anzoategui state (VIVAS & MACSOTAY, 1995). -14:LV, external view, -15: anterior view, reproduced from WOODS (1910, pl. 55, figs. 13a, 13b).

Figures 58 – 16, 17.- ***Dentonia peruviana*** (Steinmann). X 1. Collected by Tulio PERAZA, in carbonaceous flaser bedded sand/silt in Lower Aguardiente Formation, reproduction of STEINMANN (1881, pl. 8, fig. 1).

Plate 58

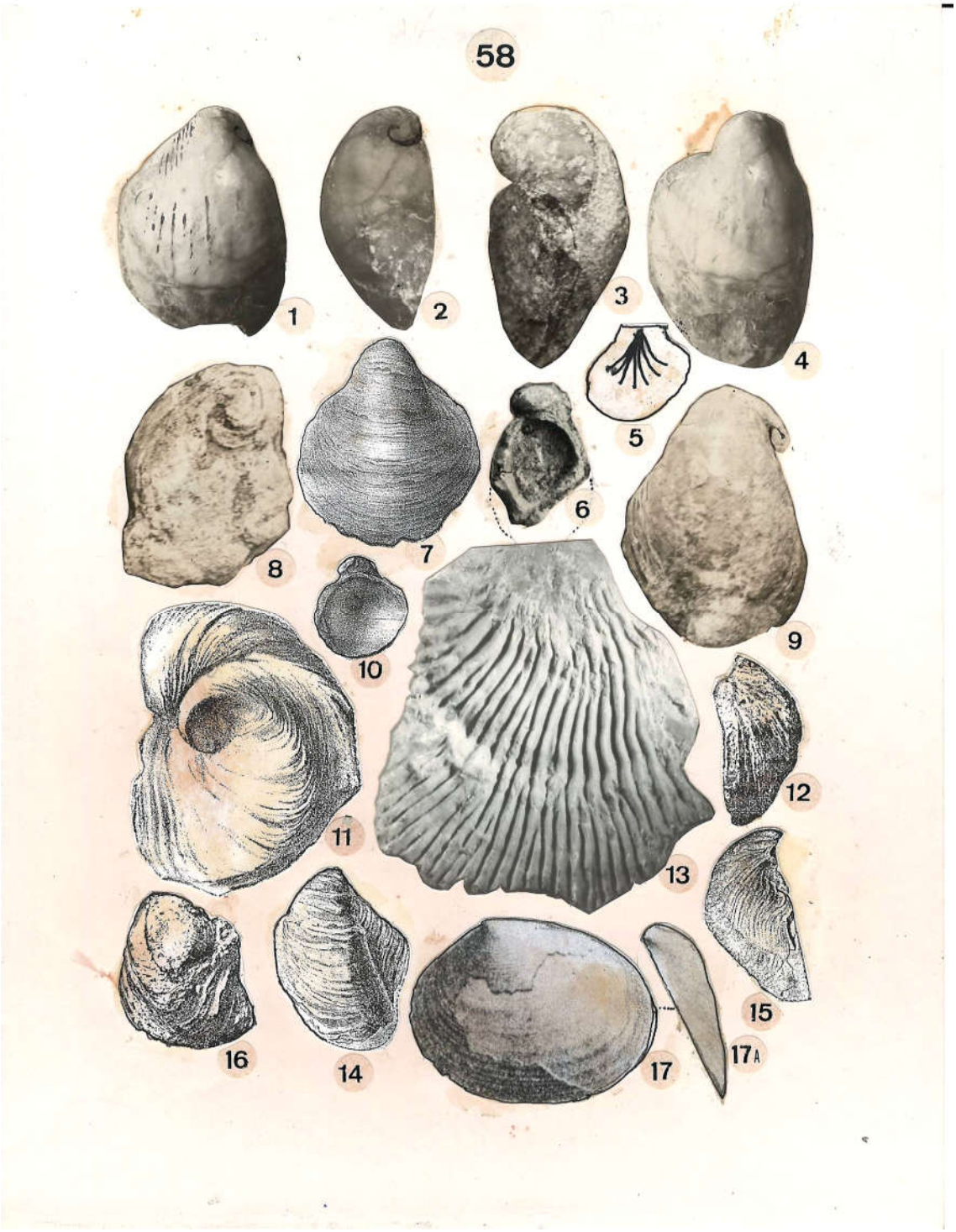


PLATE 59

Píche member of Apón Formation, upper carbonatic member of Peñas Altas Formation, of Early Albian age; Lisure, lower Chimana and Aguardiente Formations, of Middle Albian age; La Puya Member of Peñas Altas Formation, of Late Albian age; upper Maraca Formation of Early Cenomanian age; La Osa Member of Barquisimeto Formation, of Turonian age. (Plate 1).

Figure 59 – 1.- ***Mutiella pulchelliphyla*** (Gerhardt). X 4. Locality MO-2310, Lisure Formation, -1: RV, external view.

Figure 59 – 2.- ***Panopea (Myopsis?) nana*** Coquand. X 2. Locality MO-2310, Lisure Formation, -2:RV, external view.

Figure 59 – 3.- ***Megacucullaea orientalis*** (Douvillé). X 1. Locality MO-1563, Lower Chimana Formation, -3 : reproduction of GERHARDT (1898, pl. 5, fig. 4-b).

Figures 59 – 4, 5.- ***Pholadomya (Bucardiomya) picteti*** Mayer-Eymar. X 2. Locality MO-3121, Píche Member of Apón Formation, -4:;LV, -5:RV, both external views.

Figure 59-6.- ***Arcotia peralveata*** (Conrad). X 1. Locality HA-4343, la Puya Member of Peñas Altas Formation, -6: reproduced from CONRAD (1852, pl. 20, fig. 120).

Figure 59 – 7.- ***Pachythaerus myophoroides*** (Steinmann). X 2,5. Locality MO-1335, Aguardiente Formation, -7 :RV, external view,

Figure 59 – 8.- ***Potamides peregrinorsa*** (d'Orbigny). X 1. Locality MO-1563, lower Chimna Formation, -8 : dorsal view.

Figure 59 – 9.- ***Crassatina (Chattonia) maroimensis*** (White). X 2. Locality HA-4335, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, Fig. 32);

Figure 59 – 10.- ***Nagaoella cf. delettrei*** (Coquand). X 1. Locality MO-1156, Guayacan Member of Capacho Formation, -10:RV, external view.

Figure 59 – 11.- ***Ambocardia praecisa*** (White). X 3. Locality MO-2333, Maraca Formation, Perijá region, -11:RV, external view.

Figure 59 – 12.- ***Actinostreon euzebioi*** (Maury). X 1. Locality HA-4409, Upper carbonatic member of Peñas Altas Formation, -12: reproduction of MAURY (1936, pl. 78, fig. 14).

Figure 59 - 13.- ***Pleuriocardia syriaca*** (Conrad). X 1. Locality HA-4508, La Puya Member of Peñas Altas Formation, -13:RV, external view.

Figure 59 – 14.- ***Pachymya (Pachymya) cf. austinensis*** Shumard. X 0,5. Locality HA-4427, upper carbonatic member of Peñas Altas Formation. (ARNAUD et alii., 1999, fig.26).

Figure 59 – 15.- ***Carinia laraensis*** **new species,** Macsotay, X 0,5. Locality MO-1679, Carorita Arriba, estado Lara, in limestone conglomerates of La Osa Member of Barquisimeto Formation, (MACSOTAY et alii., 1985), of Turonian age. -13: axial section, naturally exposed. HOLOTYPE Ucvmp/IO- _____.

Figure 59 – 16.- ***Didymotis ottorenzi new species,*** Macsotay. X 1. Locality MO-2333, Yasa River, Perijá region, Upper Maraca Formation, of Early Cenomanin age. -12:RV, external view.

Plate 59

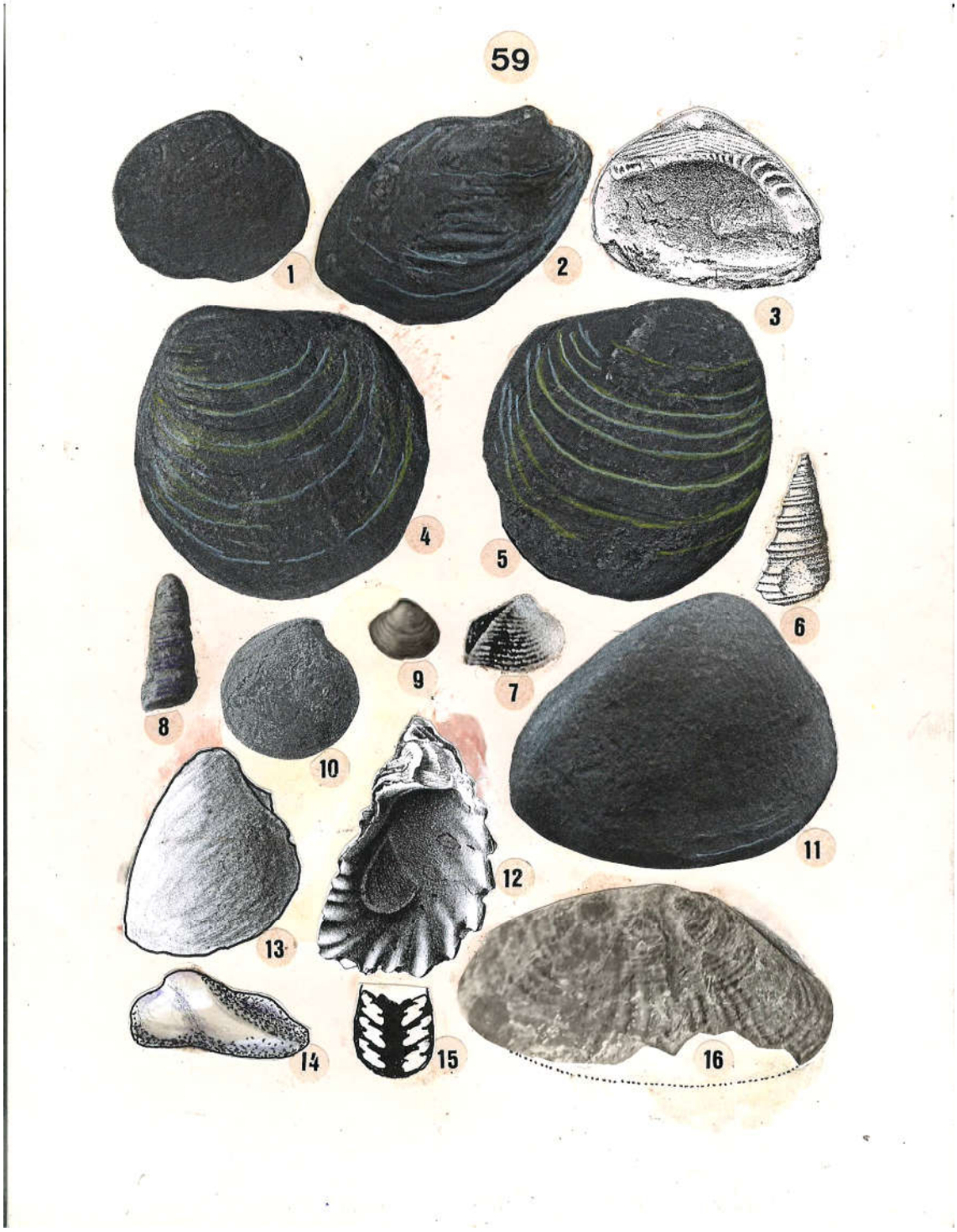


PLATE 60

Píche member of Apón Formation, and lower carbonatic member of Peñas Altas Formation, of Early Albian age. Lisure Formation, of Middle Albian age; lower Maraca and La Puya Member of Peñas Altas Formation, of Late Albian age; Upper Maraca and lower Escandalosa Formations, of Cenomanian age. (See plate 1).

Figure 60 – 1.- ***Pterodonta? bhamdunensis*** (Blanckenhorn). X 1,5. Locality HA-4343, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 33) -1: lateral view of adult shell.

Figure 60 – 2, 13.- ***Ceratostreon flabellatum aethiopica*** (Gortani). X 1. Locality Beli-4, Lower Escandalosa Formation, -2: apertural view; -13:LV, external view.

Figure 60 – 3.- ***Goniocheila travisensis*** (Stanton). Locality HA-4343, La Puya Member of Peñas Altas Formation, Trujillo state, (ARNAUD et alii., 1999, fig. 33). -3: dorsal view.

Figure 60 – 4.- ***Epicyprina graua*** (Gortani). X 1. Locality HA-4511, upper carbonatic member of Peñas Altas Formation (ARNAUD et alii., 1999, fig. 29). -4:LV,external view.

Figure 60 – 5.- ***Rhynchostreon suborbiculatum mermeti*** (Coquand). X 1. Locality MO-2333, upper Maraca Formation, -5:LV, external view.

Figure 60 – 6.- ***Ptychomya cf. salvani*** Palla. X 1. Locality MO-3121, Píche Member of Apòn Formation, -6:LV, external view.

Figures 60 – 7, 16.- ***Ceratostreon hilli*** (Cragin). X 1. Locality HA-4336, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 32). -7, -16;LV, external views both.

Figures 60 – 8.- ***Panopea (Panopea) brasiliensis*** (White). X 1. Locality HA-4431, upper carbonatic member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 26). -8:LV, external view of a juvenile shell.

Figure 60 – 9.- ***Tylostoma kentense*** Stanton. X 2. Locality MO-2478, upper Maraca Formation, -9: apertural view, incomplete shell.

Figure 60 – 10.- ***Maghrebella subparallela*** (Gerhardt). X 1. Locality MO-2478, Maraca Formation, -10:RV, fragmentary specimen.

Figure 60 – 11.- ***Panopea (Myopsis) nagaoi*** Hayami. X 1,6. Locality HA-4337, La Puya Member of Peñas Altas Formation, (ARNAUD, et alii., 1999, fig. 32).

Figure 60 – 12.- ***Pseudomelania magna*** (Karakasch). X 0,5. Locality HA-4347, La Puya member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 33). -12: dorsal view.

Figure 60 – 14.- ***Epictprina indurata*** (Conrad). X 1. Locality HA-4335, La Puya Member of Peñas Altas Formation, (ARNAUD et alii., 1999, fig. 32). -14:LV, external view.

Figure 60 – 15, 17.- ***Pseudaphrodina ricordeana*** (d'Orbigny). X 1. Locality MO-3121, Píche Member of Apón Formation, -15:RV; -17:RV, both external views.

Fgure 60 – 18.- ***Venilicardia olivensis*** Vokes. X 2. Locality MO-2310, Lisure Formation, -18:RV, external view.

Plate 60

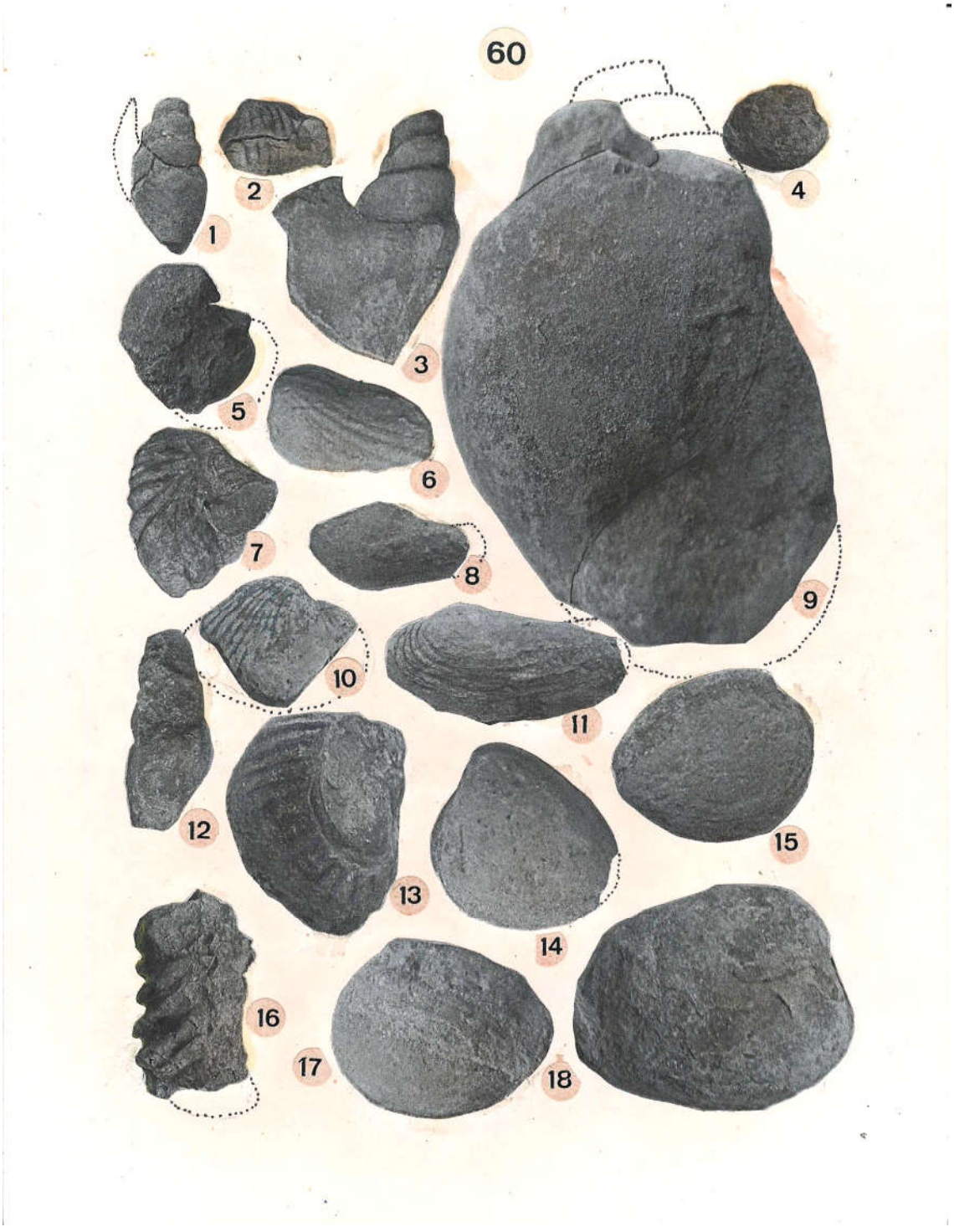


PLATE 61

Caripito Member of Chimana Formation, of Middle Albian age, L Puya Member of Peñas Altas Formation, of Late Albian age; Maraca, Boqueron and Majagual Formations, of Late Albian-Early Cenomanian age; La Grita Member of Capacho Formation, of Earky Cenomanian age (See plate 1)

Figures 61 – 1, 2.- ***Amphidonte walkeri*** (White). X 1,3. Locality MO-2333, Maraca Formation, -2: reproduction from STANTON, (1947, pl. 31, figs. 1, 2).

Figure 61 -3.- ***Neithea (Neitheops) quinquecostata*** (Sowerby). X 1. Locality HA-4335, La Puya Member of Peñas Altas Formation (ARNAUD et alii., 1999, fig. 32). -3: reproduced from COTTREAU (1922 pl. 1, fig. 9a).

Figure 61 – 4.- ***Propeamussium (Propeamussium) parva*** (Gabb). X 4. Locality MO-3243, Boqueron Formation, (DAGM) (ROD & MAYNC, 1954, AAPG Bull., 38 [2]: 251). -4:RV, external view.

Figure 61 – 5.- ***Plicatula modioloides*** White. X 1. Locality MC-95-A, Cripito Member of Chimana Formation, -5:LV, external view, reproduced from MYCZYNSKI & ITURRALDE VINENT, (2005, fig. 4-.11).

Figures 61 – 6, 7.- ***Linotrigonia (Linotrigonia) limbata*** (d'Orbigny) X 1. Locaklity MO-2333, upper Maraca Formation, reproduced from PERVINQUIÈRE (1912, pl. 15, figs. 6a, 5b).

Figures 61 – 8, 8a.- ***Pterotrigoniua (Pterotrigonia) tocaymaana peruana*** (Paulcke). Locality HA-4335, La Puya Member of Peñas Altas Formation, reproduction from PAULCKE (1903, pl. 15, figs. 9, 9a).

Figure 61 – 9.- ***Metacerithium ornatissimum tatricum*** Passendorfer, X 2. Locality MC-95-A, Caripito Member of Chimana Formation, -9: siderite pseudomorph, apertural? view.

Figures 61 – 10, 11.- ***Pterotrigonia (Acanthotrigonia) crenulata*** (Lamarck). X 2. Locality MO-2433, upper Maraca Formation, -10, -1: reproduction of d'ORBIGNY (1844, pl. 295, figs. 4, 6).

Figure 61 – 12.- ***Plicatula fourneli*** (Coquand). X 1. Locality MO-2125, La Grita member of Capacho Formation, -12:RV, external view. Reproduced from BARBER (1958, pl. 7, fig. 3).

Figure 61 – 13.- ***Chlamys raimondi*** (Gabb). X 1. Locality MO-2333, Lower Maraca Formation, -13 : reproduction of GABB (1877, pl. 42, fig. 1).

Figure 61 – 14.- ***Linotrigonia (Linotrigonia) cf. clavigera*** (Cragin). X 2. Locality MO-2333, Upper Maraca Formation, -14 :LV, external view.

Figure 61 – 15.- ***Pholadomya (Pholadomya) syriaca*** (Conrad). X 1. Locality MO-2333, Upper Maraca Formation, -15 : reproduced from CHOFFAT (1886, pl. 1, fig. 18a).

Figure 61 – 16.- ***Carinia valdesiensis*** (Cox). X 1. Locality JFS-516-B, Majagual Formation, -16: reproduction of GEMMELLARO (1865, pl. 4, fig. 2).

Figure 61 – 17.- ***Nuculoma peruana*** (Gabb) X 3. Collected by Tulio Peraza, in Boqueron Formation, on Chimana Grande Island, (DAGM), Anzoategui state, (ROD & MAYNC, 1954, fig. 17) -17: reproduction of GABB (1877, pl. 41, fig. 11).

Plate 61

PLATE 62

Aguardiente Formation, of Middle Albian age. La Grita Member of Capacho Formation, of Late Albian-Early Cenomanian age; Lower Escandalosa Formation, of Cenomanian age.

Figures 62- 1, 9, 10.- ***Gyrostrea (Gyrostrea) africana*** (Lamarck) X 1. Locality HA-4551, Lower Escandalosa Formation, Barinas,-1, -9, -10: reproduction of COQUAND (1869, pl. 30, figs. 5, 6, 8).

Figure 62 – 2.- ***Nagaoella cf. forgemoli*** (Coquand). X 0,6. Locality MO-1153, La Grita Formation of Capacho Formation, -2 :RV, external view.

Figures 62 – 3, 4.- ***Gyrostrea (Gyrostrea) delettrei*** (Coquand). X 1. Locality HA-4551, Lower Escandalosa Formation, Barinas state, -3, -4:reproduction of Coquand (1869, pl. 47, figs. 3, 4).

Figure 62- 5.- ***Trochacteon (Neocylindrites) crisminensis*** (Choffat). X 2. Locality MO-2125, Tachira state, La Grita Member of Capacho Formation, -5 ; axial section, reproduced from LUPU (1966, pl.3, fig. 25-b).

Figures 62 – 6, 7.- ***Coninoda mammata*** Kollmann. X 1. Locality HA-4576, Aguardiente Formation, (ARNAUD et alii., 1999, fig. 37), -6:axial section, drawn from outcrop. -7: dorsal view.

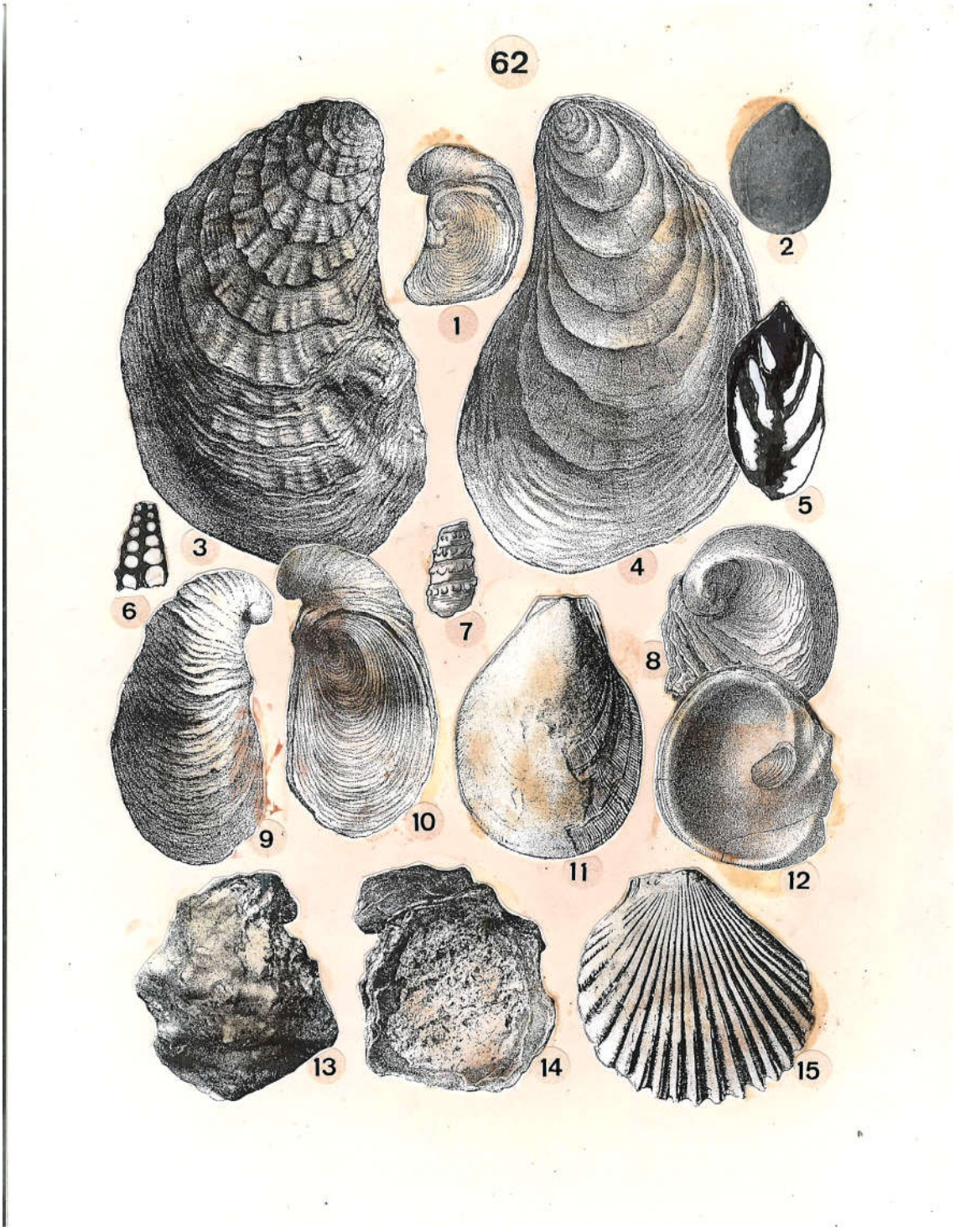
Figures 62 – 8,12.- ***Amphidonte haliotoidea*** (Sowerby). X 1. Locality MO-2333, Upper Maraca Fomation, -8:LV, external view, -12:LV, internal view.

Figure 62 – 11.- ***Ctenoides rapa*** (d'Orbigny). X 1. Locality MO-2333, Upper Maraca Formation, -11 : reproduced from WOODS (1904, pl. 7, fig. 1).

Figures 62 -13, 14.- ***Exogyra (Costagyra) olisiponensis*** (Sharpe). X 1. Locality MO-2324, Upper Maraca Formation, -13, -14: reproduction of COLLIGNON (1971, pl. F, fig. 5).

Figure 62 -15.- ***Ctenoides canalifera*** (Goldfuss). X 1. Locality MO-2333, Upper Maraca Formation, -5: reproduction of WOODS (1904, pl. 1, fig.3).

Plate 62



Hantkeniana 11

Contributions of the Department of Palaeontology
Eötvös University, Budapest, Hungary
2025

Olivér MACSOTAY

(1940-2020)

Born in Budapest, Hungary in 1940, emigrated with his family to Venezuela in 1949. Studied geology at the Universidad Central de Venezuela, his first job was as Marine Geologist in the Instituto Oceanográfico de Venezuela, diving, sampling and studying living marine molluska for five years. Hired as Itinerant Paleontologist in Venezuela´s Ministerio de Minas e Hidocarburos's Geological Exploration Department, as a back-up of Geological Cartography. Awarded with a scholarship during the World Oil Crisis in 1976, realized a PhD Thesis, on Molluskan correlation of Early Cretaceous of Venezuela with the European stratotypes, at the Claude Bernard University (Lyon 1), Earth Sciences Department finishing in October 29, 1980. Back in Venezuela, continued the exploration activites, having published 130 scientific articles in Spanish, English and French languages until 2011. Published the book entitled "Moluscos representativos de la Plataforma de Margarita, Venezuela, with description of 24 new species", citing 420 living species including many observations on marine molluskan ethology.

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