

Preliminary Report on a vertebrate fossil assemblage from the Late Cretaceous of Chihuahua, Mexico

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Geologic and Stratigraphic Setting

The two study areas are located in the northeast part of the Chihuahua state, Mexico; the first one is called “Región Altares” and the second one is known as “Región San Miguel”. The deposits present in the Región Altares are exclusively from the continental and marine members of the Late Cretaceous Aguja Formation; the Región San Miguel has some small windows that show badly weathered portions of the Javelina Formation, and also displays outcrops of the continental and marine sections of the Aguja Formation. The age range extends from Late Campanian to Late Maastrichtian (83.5–65.5 Ma).

The continental member of the Aguja Formation consists of greenish-gray mudstones and yellowish-gray sandstones that present ripple marks in the lower part of the section along with cross stratification, as well as limonite lenses in smaller proportion. The marine member is conformed by a sequence of dark gray mudstones, and yellowish-gray limolites.

Palaeontology

The strata sequence of the continental Aguja Formation displays a great variety of large tree trunks and stumps, mainly from tall dicotyledonous trees that conformed a tropical evergreen community during the Upper Cretaceous (Lehman and Wheeler, 2001), and among the vertebrates, fossils of turtles, dinosaurs and crocodilians have been collected.

In the marine member of the Aguja Formation were discovered a great quantity of invertebrates as gastropods, e.g. the bivalves *Exogyra* sp., and inoceramids, as well as ostreine oysters. Also ammonites of the genus *Platoniceras* sp. are common. The vertebrate remains located so far include shark teeth and some fragments of dinosaur bones.

Among the fossil material referred to dinosaurs its apt to mention nine sauropod dinosaur bone fragments, portions of a right tibia, from which eight

parts can be put together to complete a single element about 1.35 meter long (Fig. 1); the remaining fragment can probably be the proximal end of the left tibia, the identification was based on the synapomorphic character proposed by Salgado *et al.* (1997) for the Titanosauria, who mentions that the distal end of the tibia is broader transversely than antero-posteriorly.



Fig. 1 — Right tibia of the Titanosaurid sauropod from Chihuahua in internal view. Scale bar = 10 cm.

No elements are duplicated and the identified bones all fall within a narrow size range, suggesting that they represent a single individual. Little or none preparation was required due to the well preservation of the remains. Preliminary comparisons with other specimens and the reconstruction made by Lehman and Coulson (2002) indicate that these

materials belonged to an adult titanosaurid sauropod approximately 25 meters long.

In the same locality has been found additional dinosaur material tentatively assigned to the family Hadrosauridae, identification made based upon the maxillary fragments collected.

Discussion

According to Sankey (2001), in the Aguja Formation of the Big Bend area in southern Texas have been discovered elements from saurischian dinosaurs: *Saurornitolestes* cf. *langstoni*, *Richardoestesia* cf. *gilmorei*, *R. isocles*, as well as indeterminate remains assigned to the family Tyrannosauridae, among others. Also recorded are materials assigned to the ornithischian families Ankylosauridae, Hadrosauridae, Ceratopsidae, and Pachycephalosauridae. Montellano-Ballesteros et al. (2000) and Westgate et al. (2001) pointed out that the dinosaur material found so far in the northern part of Chihuahua belong to the families Ceratopsidae, Tyrannosauridae, Dromaeosauridae and Titanosauridae. Some of these had not been recorded before in Chihuahua, and some not even in Mexico, therefore we consider very important to continue the research on this area.

The Titanosauria (as defined by Bonaparte and Coria, 1993) has a wide geographic range, it has been found in North America, South America, Europe, Asia, Africa, and Australia (Weishampel et al., 2004; Upchurch et al., 2004). It also constitutes the most diverse sauropod clade with more than 30 genera recorded from all continental landmasses (Hunt et al., 2004). Their stratigraphic range spans from the Late Jurassic to the Late Cretaceous, being the only sauropod family that survived to the end of the Mesozoic Era. Although in Mexico there have been collected scattered fossil remains assigned to this family from the Late Cretaceous of Puebla (Ferrusquía-Villafranca et al., 1993), and Chihuahua (Montellano-Ballesteros, 2003), they are based on fossil ichnites and vertebral centra, making the material studied here the first record of limb elements assigned to a titanosaurian sauropod (cf. *Alamosaurus sanjuanensis*) from Mexico.

Conclusions

We consider the importance of the sauropod titanosaur species *Alamosaurus sanjuanensis* to be two fold: first, because it needs to be better documented to be able to compare it with other species of North American titanosaurs recently described and second,

because has been implicated in the Late Cretaceous faunal interchange between North and South America (Lucas and Hunt, 1989; Sullivan and Lucas, 2000).

This region of Chihuahua comprised in the study area is considered to be within the range of the *Alamosaurus-Quetzalcoatlus* association (Lehman, 2001), where the genus *Alamosaurus* is unquestionably the dominant land vertebrate in the environment; although ceratopsians and hadrosaurs are present, they are known from only a few specimens.

The sauropod *Alamosaurus sanjuanensis* (Gilmore, 1922) is the most common fossil found in Late Cretaceous (Maastrichtian) continental strata from the Southeast United States, and one of the last sauropods, which had become extinct in North America after the Early Cretaceous and reintroduced during the Late Cretaceous probably migrating from South America (Lehman, 1987). Therefore, it is common practice to assign the sauropod dinosaur fossils recovered from the Aguja Formation on the Mexican side of the Big Bend to this dinosaur species, and we follow this here. Additional fieldwork and comparative morphometric analysis will shed more light on the specific assignation of these remains as well as the existing relationships among the additional poorly known genera of North American titanosaurs.

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