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Review Of Karst Research In Western Taurus (Turkey)

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Abstract: Turkey is widely comprised by carbonate rocks, their ages spanning from Paleozoic to Cenosoic. The karstification may cover one third of the country ranging from Aegean Coast to the inadequately studied South East Anatolia. Although there exists a number of studies dealing with karst geology, hydrogeology and geomorphology of the region, we still lack a complete inventory of the subject. A brief sketch about karstic features of Western Taurus based on recent speleological and hydrogeological surveys are presented.

INTRODUCTION

The earliest studies on geology of Turkey were conducted in 1838 (ILHAN, 1971). During 1869- 1879 period, the first article on the speleology of Yarımburgaz Cave (Istanbul) was written by ABDULLAH BEY (1869),(ILHAN 1976, ALAGÖZ 1944). In an article between the years 1900 and 1901, we know that BOSQUET (1901) wrote about the environs of the town Küçükçekmeçe and the stream Sazlidere with its chapel ruins inside the Yarımburgaz Cave. The Italian archaeologist MORETTI (1926 a, b) gave a cursory description of Kocain and Karain Caves in Antalya in 1919. After this date, dealing with Yarımburgaz Cave again, KOCACAN (1921) prepared a report a named "How to survey a cave". Later, ALAGÖZ (1944) compiled his studies. Likewise, geologist AYGEN (1956, 1959, 1965, 1966, 1984) made several significant contributions to karst of Turkey and later studies were concentrated mainly on geomorphology and geographical features.

The first compilation on speleology was produced by CHOPPY (1978) a French speleologist who had explored many caves in Turkey. This was the beginning of an inventory of the Turkish caves. A preliminary study of 600 caves was finished by ÖZBEK(1992). A complete list of Turkish caves in a computerized inventory work including 850 entries were compiled from the literature (ÖZBEK, 1993). As to this information now we can deduce some important facts about karstic formations in Turkey.

Some researchers in Turkes belive that one fifth of the country is covered by carbonate rocks (AYGEN, 1984). Some imply that this ratio must be one third (EROSKAY and GÜNAY, 1979). We will accept the later view in this article as the recent researchers show it is obvious that all over the country, an intensive karstification can be observed.

WEST TAURUS KARST

Taurus Mountains are usually divided into 3 sectors: Western, Middle and Eastern Taurus Mountains (Fig. 1.). Of all these regions, Western Taurus had been studied most. The first reason for this might have been the proximity of the region to the research centers and big cities and the ease in reaching here by the scientists. The second reason could possibly be due to easily recognized features of the karstic formations and the related water resources potential in this region which may have attracted the attention of many scientists.

The Mediterranean region is the most important karst region of the country where karst features are well developed and widely distributed (ŞENGÖR, 1986). Taurus Belt begins at the Aegean Coast as an eastward continuation of the Dinaro-Hellenic arc in the Alpine System and continues through the Mediterranean Coast forming the Tauric Arc around Isparta region, and later crosses to Iran over Southeast Anatolia. In this belt limestone hills as high as 2 500

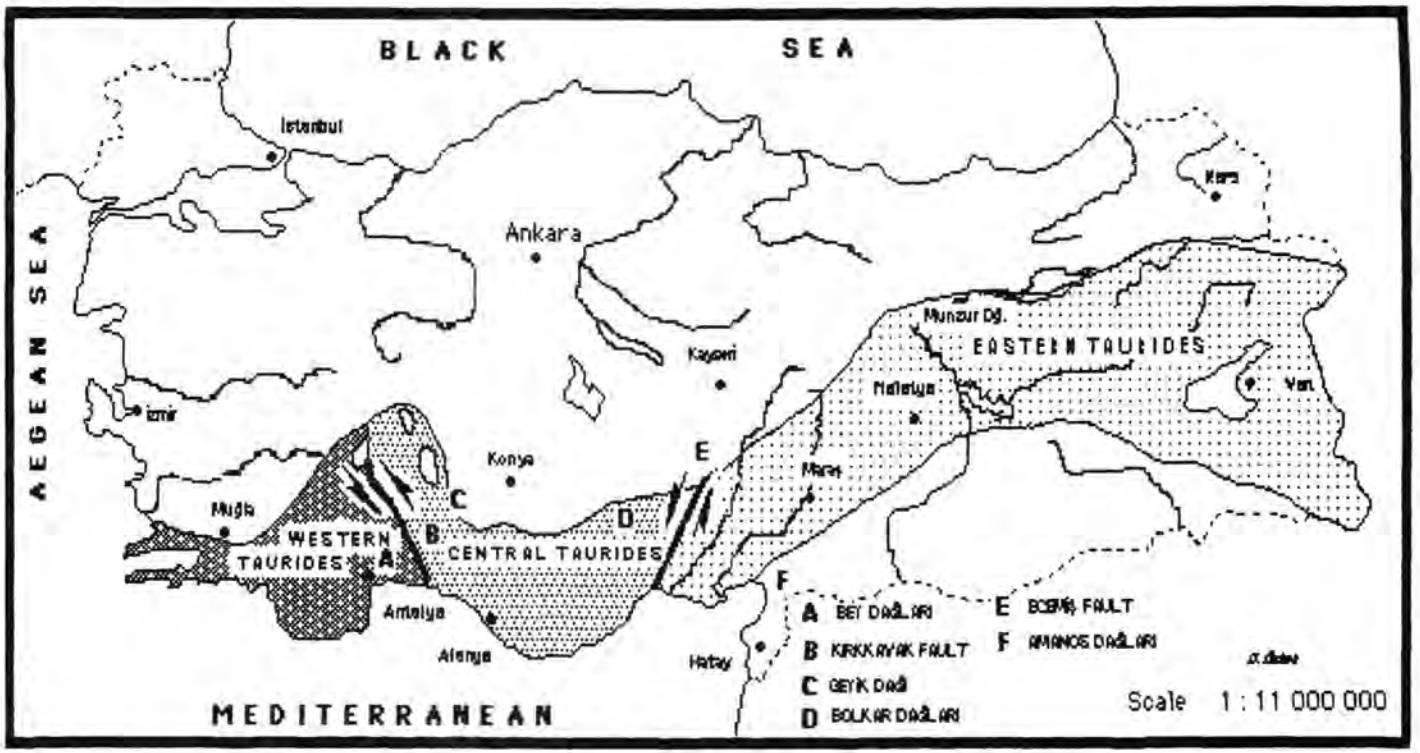

Fig. 1. The broad geographical subdivision of the Taurus Belt according to ÖZGÜL (1984).
A Toros-hegység általános földrajzi tagolása ÖZGÜL (1984) szerint.
A: Bey Mountains B: Kirikkayak Fault C: Geyik Mountains D: Bolkar Mountains
E: Ecemis Fault F: Amanos Mountains

– 3 000 meters and deep valleys and narrow gorges are found. Central Taurus Mountains comprise Ala Mountain (Aladağ), Bolkar Mountains (Bolkardağ) and Geyik Mountains (Geyikdağ) units with the Hadim-Taşkent Triassic formations (ÖNDER, 1984). In the South, this area begins from Alanya to Silifke region (Demirtaşli, 1984) which embodies the deepest karst formation of Turkey with its more than 1000 m depth (MILNER, 1992). The area between Silifke and Southeast Anatolia forms the Eastern Taurus Belt.

ATALAY (1988) indicates the flora and the karst relationship of the Taurus with its sink holes and karstic depressions which has thic and moist soil covers and that hydrophytic plants of the Euro-Siberian species once covered the Dedegöl and Davraz Mountains in the Quaternary period. The stratigraphy of the region contains different carbonate units ranging from Devonian to Quaternary. Quaternary climatic fluctuations and sea level changes have formed most of the coastal and fluvial terraces in Anatolia which reflect the neotectonic movements (EROL, 1984).

1. The connection of the large lakes in the North and the large springs in the South

In the Northern border of the Western Taurus there are three large lakes: Burdur, Eğirdir, and Beyşehir. These are important water reservoirs of the karst system which among these lakes, the Beyşehir Lake has been studied most for the subterranean flow relations between the karstic outflows located in the South and in the lake itself, using fluorescent dye water tracing.

Despite the fact during the Mio-Pliocene, Burdur Lake shaped up as an intramountain basin, it resembles the Tuzgölü (Salt Lake) basin because of its Quaternary history. This region took shape from the Middle Jurassic – Eocene carbonates in a shallow-marine environment. In addition to the carbonates, flysch has a continuation to the late Oligocene. The lake became closed during the Upper Pleistocene easing a brackish water to be filled in the basin (EROL, 1984). The other lakes have salty water because of the lack of subterranaean and surface flow (ILHAN, 1976).

Surface area of Beyşehir Lake (1116 meters in altitude) is 680 km2 and according to the local authorities, the water level has dropped during the recent years diminishing this surface area. Its maximum depth is reported as 1125 meters The Lake is fed by rain and snow melt. Its input is 621 600 000 m3 and its output is 343 000 000 m3 a year (BILGIN, 1991). It looses an important amount of water through numerous sinkholes located along the Western coast of the lake. These sinkholes are katavotras (estavel) working as springs after the rainy seasons.

Beyşehir Lake is belived as the main supplier of water to Manavgat and Köprücay basins through karstic channels. The lake has a surface flow through the Beyşehir Lake to Suğla Lake which is now a dry region. The present situation of the lake has not been adequately studied. Due to the previous irrigation utilizations of the State Hydraulic Works (DSI) and some other factors, Suğla is now not a lake but a large agricultural land.

EROL (1984) explains the lack of information about the Quaternary climatic fluctuations in Eğridir and Beyşehir-Suğla basins by that karstic discharges controlled the lake levels in the past. NAZIK (1986) specifies the faulting and fluvial dissection of the area as an "orogenetic dissected karst". West of Suğla basin is very important for observing the inflow-outflow relations between the Tinaztepe sinkhole and Susuz and Fasıh karst water springs which provide a crucial amount of water to this region. These waters join in a number of siphons or "düdens" on the East side, sucking all the waters thus accumulated. Although there has been many speleological expeditions here in the past (GÜLDALI and NAZIK 1980, GÜLDALI and NAZIK 1992, JAGER and others 1989, CHOPPY 1978, CHABERT 1975, BAKALOWICZ 1970), the area still remains promissing for the future surveys on dry caving and sump diving.

The Eğirdir Lake (924 meters in altitude) is situated in a N-S trending closed basin which is surrounded by ophiolitic and carbonate rocks. The lake has approximately 3916 km^2 drai-

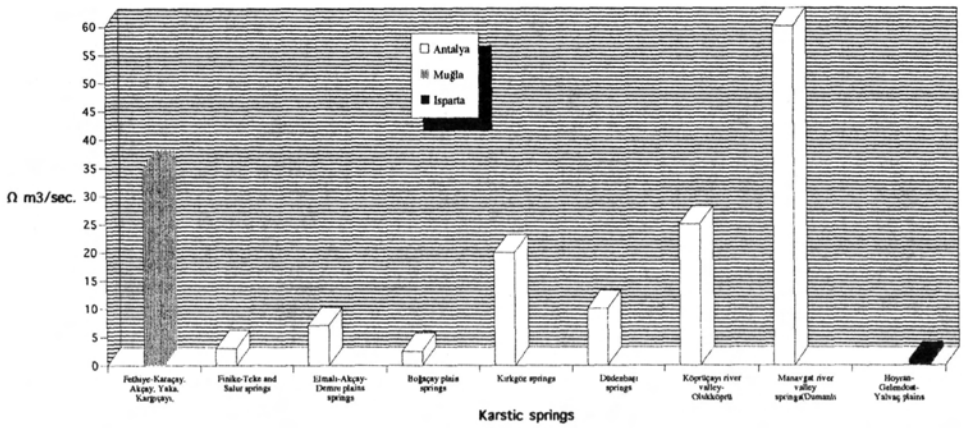

Fig. 2. Water outputs of the important karst springs in the Taurus Mountains.
A Toros-hegység legfontosabb karsztforrásai és vízhozamuk.

nage area. The karstification around the Eğirdir Lake is relatively less developed when compared to other parts of the Taurus Range. The maximum depth of the lake is 16.5 meters where in the Middle Miocene two conjugate faults: Kırkavak and Southwest Anatolian Faults, have formed this depression basin (KARAMAN, 1989). The level of the lake is regulated by an artificial outlet structure which is the starting point of a channel flowing to the Kovada Lake.

According to WALDRON (1984), the base of Kovada dolomite is generally tectonic in origin. Where approximate thickness of the Kovada dolomite reaches up to 200 meters, some researchers have pointed out different limestone layers like Permian aged ones in this region. As Upper Jurassic fossiles are found at the base of this dolomitic structure, the researcher implied its age as Jura or pre Jura. KARAMAN (1989) implies that the morphogenesis of this basin is related with the Miocene aged Kovada and Kaşıkara faults.

Kovada Lake (880 meters in altitude) is situated on massive limestones loosing some of its waters through sinkholes. It is belived that Olukköprü springs are fed by Kovada Lake. The environment of the lake is a national park defending the original Mediterranean vegetation.

In the Southern part of the region there are three famous spring-groups:the Pınarbası-Kırkgözler springs, the Olukköprü Spring and the Dumanli spring (fig. 2.).

The Pınarbası-Kırkgöz group is is along an approximately Eas-West oriented fault zone by the old Antalya-Burdur road. These are the primary springs of the Antalya travertine area (AYGEN, 1966, 1969) and it would seem reasonable to presume these springs to have created the travertine plateau (YEVJEVICH, 1979). All other springs of the travertine are secondary springs and although it is not proven, there are some views that these fed by Kırkgöz group. From the high productive spring (15 m^3/ sec), the water flows in to two different paths:

1. Kırkgöz springs – Biyikli Sinkhole – Varsak doline -Düdenbaşı underground river – – Düdenbasi Spring.
2. Kırkgöz springs – Yağca Sinkhole – coastal springs.

New diving attempts have been made by some Yugoslavian and Turkish divers to Kırkgözler springs in the previous years intending to find out the size and flow characteristics of this huge system. These divers revealed the long suspected size of the system and the divers had to abandon their exploration due to lack of the necessary equipment and unexpected depth.

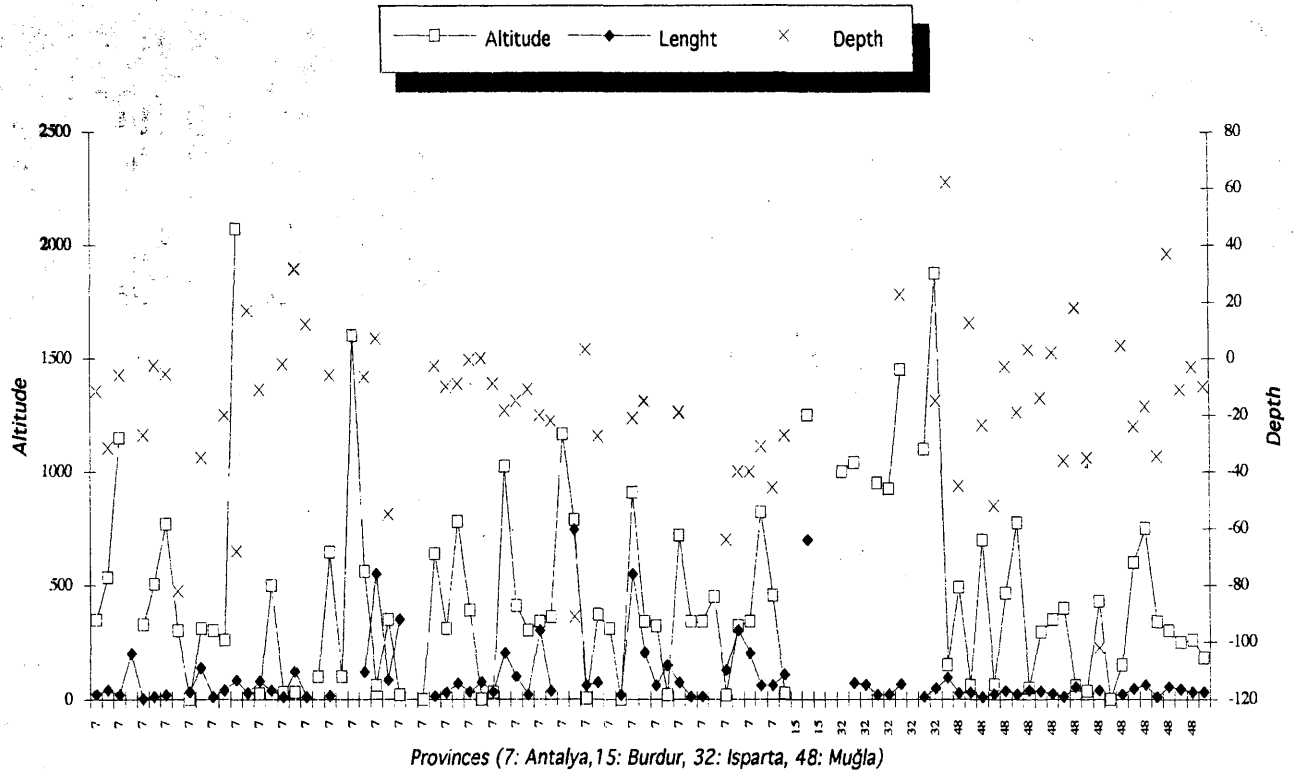

Fig. 3. Synogram of the altitude, length, and depth of 96 caves in the Western Taurus Mountains. (Data are given in table 1.)

A tengerszínt-feletti magasság, a hossz és a mélység szinogramja 96 nyugat torosi barlang esetében. (Részletes adatok az 1. táblázatban).

Name of Cave	Traffic Code	Town	Z	L	D	Geology
AKBEL	7	KALKAN	350	24	-11.5	MZZK ki
ALABELEN	7	KAŞ	535	41	-31.5	EO ki
ALIÇLIAĞIL	7	FİNİKE	1150	21	-6	Üst Kre ki
ANTALYA	7			200		
ARKAKAPICIK	7	MERKEZ Döşemealtı	327	4	-27	ki
ARPALIK	7	KALE (DEMRE)	505	13	-2.5	EO ki
ASARÖNÜ	7	FİNİKE	770	19	-5.5	Üst Kre ki
ASARÖNÜ ÖREN KUYUSU	7	FİNİKE	300		-82	Kre ki
AŞIRLIADA	7	KALE (DEMRE)	0	33		EO ki
AYİİNİ	7	KUMLUCA	310	137	-35	Kre ki
BALICAK	7	MERKEZ Döşemealtı	300	10		KRE ki
BÜYÜKDİPSİZ	7	MERKEZ	260	40	-20	KRE ki
CIVGUŞ DÜDENİ	7	ELMALI	2070	85	-68	KRE ki
CULA DELİĞİ	7	ELMALI		29	17	
ÇAMLICA	7	KALE (DEMRE)	25	80	-11	EO ki
ÇARKİNİ	7	MERKEZ Döşemealtı	500	40		KRE ki
DEĞİRMENLİK- DERE	7	KAŞ	30	10	-2	KRE ki
DERYA	7	MERKEZ	32	124	31.5	PLE ki
DEVRETBAŞI	7	ELMALI		11	12	
DİPSİZİN	7	MERKEZ	100			MZZK ki
DİVLE BOĞAZI	7	KALE (DEMRE)	645	16	-6	EO ki
DOMUZBURNU	7	MERKEZ	100			MZZK ki
ERİKİNİ	7	ELMALI	1600			
GEYİKBAYIRI	7	MERKEZ	560	120	-6.5	PERMki
GÖYNÜK	7	KEMER	60	549	7	JURA ALT KRE
GÜVERCİNLİK	7	MERKEZ Döşemealtı	350	85	-55	ki
HIDIRELEZ	7	KAŞ	20	350		KRE JURA ki
İNBURNU	7	MERKEZ				
İNCİRLİ	7	DEMRE	0			NEO ki
İNCİRLİİN	7	KALE	640	15	-2.5	EO ki
İNCİRLİK KUYU	7	MERKEZ Döşemealtı	310	30	-10	ki
İNDAĞ	7	MERKEZ Döşemealtı	780	70	-9	ki
KAKLIK	7	KAŞ	390	33	-0.5	EO ki
KAPUTAŞ DENİZ (MAVİ)	7	KAŞ	0	75	0	KRE ki
KARADELİK	7	KALE (DEMRE)	30	31.5	-9	MZZK ki
KARAGÖL DÜDENİ	7	ELMALI	1025	202.5	-18.5	ÜST KRE PAL
KARAİN	7	MERKEZ Döşemealtı	410	100	-15	KRE ki
KARANLIKGÖZ	7	MERKEZ Döşemealtı	300	20	-11	ki
KIRKGÖZLER (MEVLANA)(HARUI	7	MERKEZ Döşemealtı	340	300	-20	KRE ki
KIZILİN	7	MERKEZ Döşemealtı	360	35	-22	KRE ki
KOCAİN	7	ELMALI	1165			
KOCAİN	7	MERKEZ	788	744	-91	KRE ki
KONAKALTI	7	MERKEZ	3	60	3	PLE ki
KÜÇÜKDİPSİZ	7	MERKEZ	370	74	-27.5	KRE ki
MACARİNİ	7	MERKEZ Döşemealtı	310			KRE ki
MARA (1)	7	FİNİKE	0	20		ÜST KRE ki
MOLLADELİĞİ	7	KEMER	910	549	-21	Ju, Alt Kre, ki
MUSTANİNİ	7	MERKEZ Döşemealtı	340	205	-15	KRE ki
ÖKÜZİNİ	7	MERKEZ Döşemealtı	320	60		KRE ki

Tab. 1. Altitude, length, and depth data of 96 caves in the Western Toros.
96 nyugat-torosi barlang tengerszint-feletti magasság, hossz és mélység adatai. (I)

PAPAZKAYASI	7	MERKEZ	20	149		PLE ki
PEYNİRDELİĞİ	7	KEMER	720	74	-19	KRE Ki
PINARBAŞI KAYAODAŞLAR (1)	7	MERKEZ Döşemealtı	340	10		ki
PINARBAŞI KAYAODAŞLAR (2)	7	MERKEZ Döşemealtı	340	13		ki
SIRTLANİNİ	7	MERKEZ Döşemealtı	450			KRE ki
SULUİN	7	FİNİKE	18	128	-64	Üst Kre, ki
SULUİN	7	MERKEZ Döşemealtı	320	300	-40	ki
TABAK	7	MERKEZ Döşemealtı	340	200	-40	ki
TEPEARASI	7	FİNİKE	821	60	-31	Üst Kre ki
YAVU (YAVRU) DÜDENİ	7	KAŞ	455	60	-45.5	EO ki
YERKÖPRÜ	7	MERKEZ	27	110	-27	PLE ki
İNCİRÖNÜİNİ	15	BUCAK				
İNSUYU	15	MERKEZ	1250	700		MZZK ki
İNSUYU (2)	15	MERKEZ				TER ki
KIZILİN	15	MERKEZ				ki
BOZANÖNÜ	32	MERKEZ	1000			
DELİKÖNÜ	32	MERKEZ	1040	71		MİO
GÜVERCİNLİK	32	KEÇİBORLU		65		TRİ
İNTEPE	32	GÖNEN	950	20		KRE
KAPALIİN	32	MERKEZ	925	21		
KAPIKAYA	32	MERKEZ	1450	67	22.5	KRE ki
KOCAİN	32	MERKEZ				ki
ÖKÜZBATTI	32	MERKEZ	1100	10		şi
YAYLA OBRUĞU	32	GÖNEN Merkez	1875	47.5	-15	JURA KRE ki
ARMELLİ	48	MARMARİS	150	95	62	KRE ki
ASARİNİ	48	MARMARİS	490	26	-45	ki
ÇENE	48	DALAMAN	60	30	12.5	KRE ki
DELİKBELEN DÜDENİ	48	FETHİYE	700	11	-23.5	KRE
GELME ÇİNGİREK	48	MARMARİS	65	24	-52	KRE ki
GÜROLUK	48	FETHİYE	465	38	-3	KRE ki
GÜVERCİNLİK	48	MUĞLA Merkez	775	24	-19	KRE ki
İNÖNÜ	48	ORTACA	50	40	3	KRE ki
KARABELEN	48	DALAMAN	295	35	-14	KRE ki
KARACAİN	48	FETHİYE	350	25	2	KRE Kg
KARADİKEN DÜDENİ	48	MARMARİS	400	13	-36	KRE ki
KARAKOVUK	48	MARMARİS	60	53	18	KRE ki Kg
KEÇİBÜKÜ ÇENGİREK	48	MARMARİS	35		-35	TRİ KRE ki
MAHALBAŞI ÇİNGİREK	48	MARMARİS	430	38.5	-102	KRE ki
MARMARİS DENİZ	48	MARMARİS	0			
MEMELİ İN	48	FETHİYE	150	22	4.5	MZZK ki
PEYNİRİNİ	48	MERKEZ Yeşilyurt	600	46	-24	MZZK ki
PEYNİRLİK DÜDEN	48	MERKEZ	750	62.5	-17	MZZK ki
TAŞBAŞI ÇİNGİREK	48	FETHİYE	340	12	-34.5	KRE EO
TURUNÇ	48	MARMARİS	300	56	37	KRE ki
TURUNÇPINAR (İSLİİN)	48	FETHİYE	250	44	-11	KRE
YAĞDELİĞİ	48	DALAMAN	260	33	-3	KRE ki
ZEYNEPİNİ	48	DALAMAN	180	32	-10	KRE ki

Tab. 1. Altitude, length, and depth data of 96 caves in the Western Toros.
96 nyugat-torosi barlang tengerszínt-feletti magasság, hossz és mélység adatai. (II)

JENNINGS (1971) explains Kırkgözler as an upwelling through gravels and in swamps. The water rise on the edge of an erosion surface against the Cretaceous limestone (AYGEN,* 1984). According to Yevjevich (1979), Kırkgözler springs have a total flow rate of about 1—15 m3/sec. and the springs have a highly regulated flow. As the same researcher indicates that "the residence time of infiltrated water (rain, snowmelt), measured by changes in natural isotopes, coming out to be very long (40–100 years or even more)". It is obvious that like the other subterranean water systems in the regione, these systems may have capacious reservoirs.

The water of the Pınarbaşı springs accumulated in Bıyıklı sinkhole before. But now, a notable amount of water os only found during the periods of owerflowing. About a kilometer to the East of Kırkgöz springs the Bıyıklı's falled water rises again in the Varsak doline after flowing 14 kilometers underground in the Upper Triassic -Upper Cretaceous Ispartaçay Formation (YEVJEVICH, 1979). This collapsed doline has a length of 180 meters and a width of 44 meters while its depth reaches to 20 meters. Water coming out of from a wide orifice at the Northern part, travels a distance of about 180 meters at the surface and falls down in a cascading slope of the sinkhole at the Southern end.

After flowing 3 kilometers underground, it comes to surface again in the Düdenbaşı (or Düdençay) which is a vauclusean type syphoned fountain. The water coming from the power station flows again to Düdenbasi through a canal and forms a waterfall.

The falling distance of Düdenbasi is 50 meters. Other springs discharge at the lower level of the waterfall with the discharge rate of about 13 m^3/sec. The water flowing out from the fall forms a second cascade on the travertines as it reaches the sea. The karst system of the Antalya travertine region was first investigated by AYGEN (1969) in the early 1960' ies and then by French and English speleologists.

The Köprüçay -Olukköprü springs are located 7 kilometers North of Beşkonak village. The rate of discharge of the springs is over 30 m^3/ sec. even in the most arid periods. Many of the springs are situated in 1 km long part of a narrow canyon and discharge from the intensively karstified Köprüçay conglomerates of limestone components, cemented with a carbonate material. Like the other springs in the vicinity, this spring has a residence time about 10–50 years according to the natural isotope composition and content researchers (YEVJEVICH, 1979).

According to DEĞIRMENCI and GÜNAY (1989), in Köprüçay basin groundwater circulation has formed three basic types of caves: spring, sinkhole and passage types. Among these springs, in other saying resurgence type of caves are usually at the groundwater discharge points. Sometimes sinkhole and resurgence type caves are usually at the groundwater discharge points. Sometimes sinkhole and resurgence type caves are connected by means of passage type caves and there are sumps at the end and at the beginning of these passage type caves.

The outlets of the springs within the Köprüçay Canyon are generally karstic cavities, developed along nearly horizontal strata. It is possible to observe also previous outlets on the walls of the canyon. The outlets of the right side are observed to be larger than those on the opposite side. The caverns facing each other on both sides give the impression of a siphoning action.

The reasons forcing the springs to discharge at this zone are the contact between the conglomerates and impervious Köprüçay Formation, and the presence of a fault, trending SE – NW at 2 kilometers South of Olukköprü Springs acting as impermeable barrier for the ground water. No springs can be seen at the South of the Canyon, While towards North a series of springs occur as large discharges until the Kırkgeçit Creek.

AYGEN (1968) declared the Dumanlı springs as the largest karst spring all over the world due to its average discharge of 50 m^3/ sec. with its annual outflow of about 1 600 000 000.0 cubic meters (KARANJAC and GÜNAY, 1979). Recently the orifice of it is below the maximal lake level of the Oymapınar Dam. Before the dam construction, it was evident that Manavgat River supplied more than one third of its water from the Dumanlı, in dry periods.

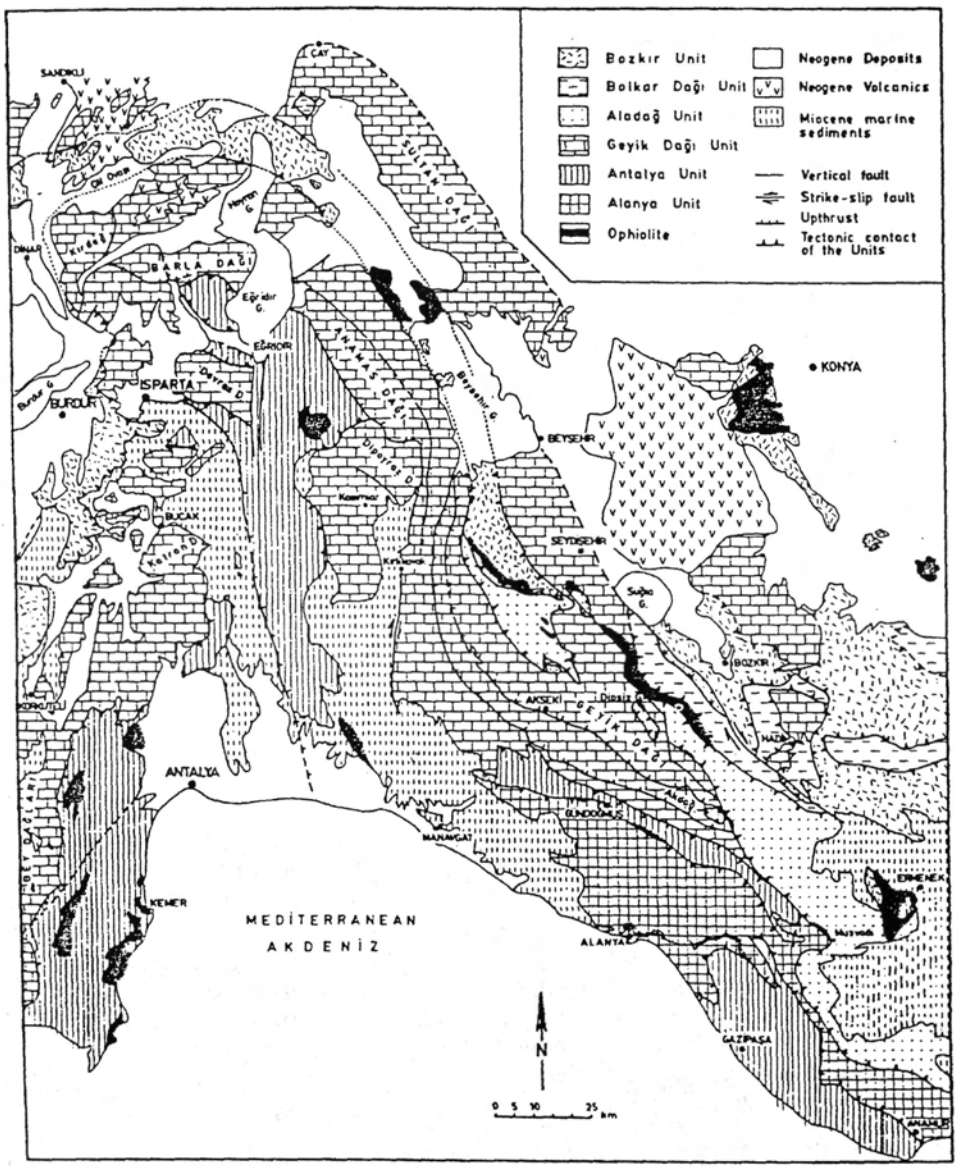

Fig. 4. Schematic map of the tecto-stratigraphic units in the area between Western and Central Taurides (ÖZGÜL, 1984).
A Nyugati- és a Középső -Toros -hegység egyszerűsített tektonikai térképe ÖZGÜL (1984)-szerint.

Elmalı-Karagöl and Avlan Lake karst system

The big basin in front of Elmalı town, where the lakes of Avlan and Karagöl are, is one of the largest poljes of Turkey. The streams flowing into Karagöl Cave and the sinkholes of Yaka formed on the bank of Avlan Lake. In 1958 Aygen cut the water going into the Karagöl Cave by a temporary baricade which was built at the canal. In 1987, the cave was searched again to find a way through the narrow fissures. But the team could find no way through these numerous cracks (ÖZBEK, 1988). In recent years when the water of the lakes rises to a risky level, D.S.I. (State Water Works) let the water run through the conduit leading to Karagöl sinkhole (düdeni). Nowadays, the water run into Karagöl and Avlan Lake poljes through the conduit pouring out to Finike valley, Başgöz, Aykirca and Gökpınar springs and the other karstic springs on the sea level near Finike.

The dry caves of Katrandağ

Karain cave and the nearby cavities alongside the surmounting hills on the Cretaceous aged limestones of Katrandağ belong to an old karstic system which were once active. Although their present speleomorphologies show vadoz type facade, their water marks and formation levels with the other caves present the fact that they are a part of the Kırkgözler karstic system. Now most of their entrances filled up with the Quaternary deposits, these caves are the most important sedimentation traps enclosing the shelters and tool marking sites of the *Homo sapiens neanderthalensis*. Karain cave also enclose the fossils of an abundant fauna indicating that during the last Ice Age. The Antalya Plateau was a suitable habitat for these animals (Fig. 5.).

Kırkgözler Cave

This cave is situated 50 meters to Kırkgözler springs and it hase rich formations with interesting archaeological finds consisting ceramic and human skeletons. After 300 meters the cave situated in the Cretaceous limestones descends to a sump which is throught to be related with the spring.

Insuyu Cave

It is the second cave after Damlataş which has been opened to tourism. It is situated 13 kilometers to the South of Burdur, formed in Mesozoic limestones. The carbonated mineral water coming from a fault just in front of the entrance of the cave makes a mixture with the underground streams (AYGEN, 1984). The environs of the cave consists of different rocks ,like Eocene flisch and limestones, ophiolits belonging to Pliocene lake units Plio-Pleistocene travertines. From the limestone- ophiolit, and limestone -flisch contact there are various spring discharges having approximately an output of 5–30 l/sec. There are more than six deep water wells near Insuyu Cave for the drinking water demands of Burdur. The three wells near Insuyu have about 180 l/sec discharge rate. The water level of Insuyu Cave dropped drastically in the last five years due to official and other borings to get water for drinking and irrigation. Recently most of the lakes in the cave are dry and there very little hope to constitute the past situation.

The marine caves

The sea caves in this region were first examined by Aygen in 1960'ies. After 1980, the Mediterranean Coast was searched for the caves suitable for touristical utilizations by a group in MTA (State's Mineral Research and Exploration Office). However, these studies were only for touristical purposes and scientific studies were insufficient. Nowadays the hydrogeology departments of the universities and geologists from different institutions study the coastal karst of the region. According to AYGEN *(1984) the names of the important sea caves are Incilrli cave near Finike, Kekova Island sea caves, Kapıtaş (Mavi) Cave, Güvercinlik and Güvercinini

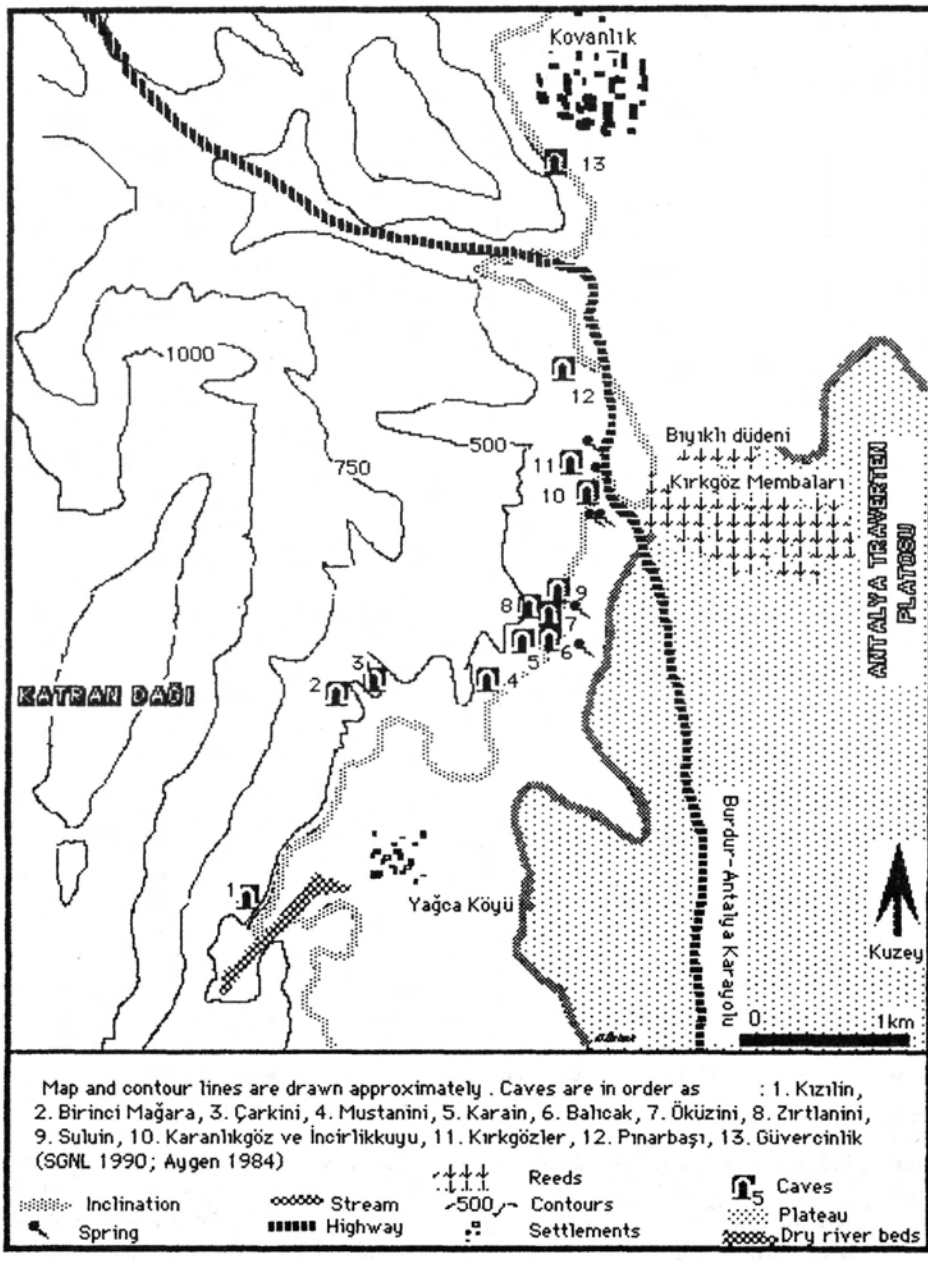

Fig. 5. Karain Cave and its surrounding.
A Karain-barlang környéke (Antalya-tól ÉNY-ra) Inclination – lejtő Spring – forrás Stream – vízfolyás Highway – Antalya -Burdur autóút Reeds – nádas Contours – színtvonalak Settlements – települések (Yağca Köyü, Kovanlık) No. 1-13. – barlangok Plateau – az antalyai édesvízi mészkőfennsík

sea caves Marmaris sea cave, Karaada sea cave. In 1990 some Chechoslovakian cpeleologists explored some caves near Finike where they found sumps at the ends (SCHMIDT,* 1991). Most of these caves are near or exactly at the subterranean outlets which mix the sea water and their outlets are belived to be the final parts of the long subterranean karst water nets.

CONCLUSIONS

Turkey is comprised by carbonate rocks from Paleozoic to Cenosic and the karst covers nearly one third of the country. In result of the compilation of the speleological studies in the past, an inventory was adapted to make correlations with the tectonic movements and the karstic formations. As it is obvious from the maps presented in the article, the karstic formations are condensed near the faults (Fig. 1., 4., 6.).

On the Mediterranean Coast there lies an important number of karstic fissures where spring waters mix the sea. According to hydrogeologists these springs are parts of huge karst water systems.

From this inventory we can deduce the fact that nearly 80% of the caves on Western Taurus Mountains lie in Mesozoic limestones. Cave formations can be found on the belts as high as 2000 meters above sea level. The length of these karstic cavities may be about 800 meters (fig. 3.) In contrast to the Central Taurus karst where karstic cavities can be found as deep as 1000 meters on the West Taurus the deepest cave is 102 meters.

To obtain certain information about tectonic-karst formation correlation, the ages of the rocks, the depth of the karst and subterranean karst water net etc., further studies must be made.

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Áttekintés a Nyugati -Toros -hegység (Törökország) karsztjának kutatásáról

Törökországban a karsztvidékek és a barlangok vizsgálatának előzményei az 1800-as évekre nyúlnak vissza. A tudományos igényű kutatásokat Temuçin Aygen (Temudzsin Ajgen) geológus kezdte el századunk ötvenes éveiben. Rajta kívül számos külföldi expedíció is értékes feltárómunkát végzett.

Számítások szerint az ország területének egyötöde karsztvidék. Ennek jelentős része a Toros-hegység vonulatában található. A hegység kőzettani felépítésében meghatározóak a karbonátos kőzetek, melyeknek képződése a devontól az eocénig tartott. A Nyugati- Torosban találjuk a legszebb, legjellegzetesebb karsztjelenségeket is. Az eddigi kutatások is jórészt ide koncentrálódtak.

A terület hidrológiai szerkezetében alapvető fontosságúak azok a nagykiterjedésű tavak (Beysehir, Egirdir, Burdur), melyek a hegység fővonulatától É-ra esnek. A tavak vize víznyelőkön keresztül jut a karsztba és egy számos részletében még ismeretlen rendszeren átjutva a hegység déli oldalán bővízű karsztforrásokban lát újra napvilágot. A források három csoportba tömörülnek:

1. Pinarbasi -Kirkgözler csoport
2. Olukköprü csoport
3. Dumanli csoport

A török kutatók szerint a Dumanli-források a világ legbővizűbb karsztforrásai. átlagos hozamuk 50 m3/ sec., és ez a hozam nem mutat ingadozást az év csapadékos és száraz periódusaitól függően. Több közülük ma már erőművet működtet.

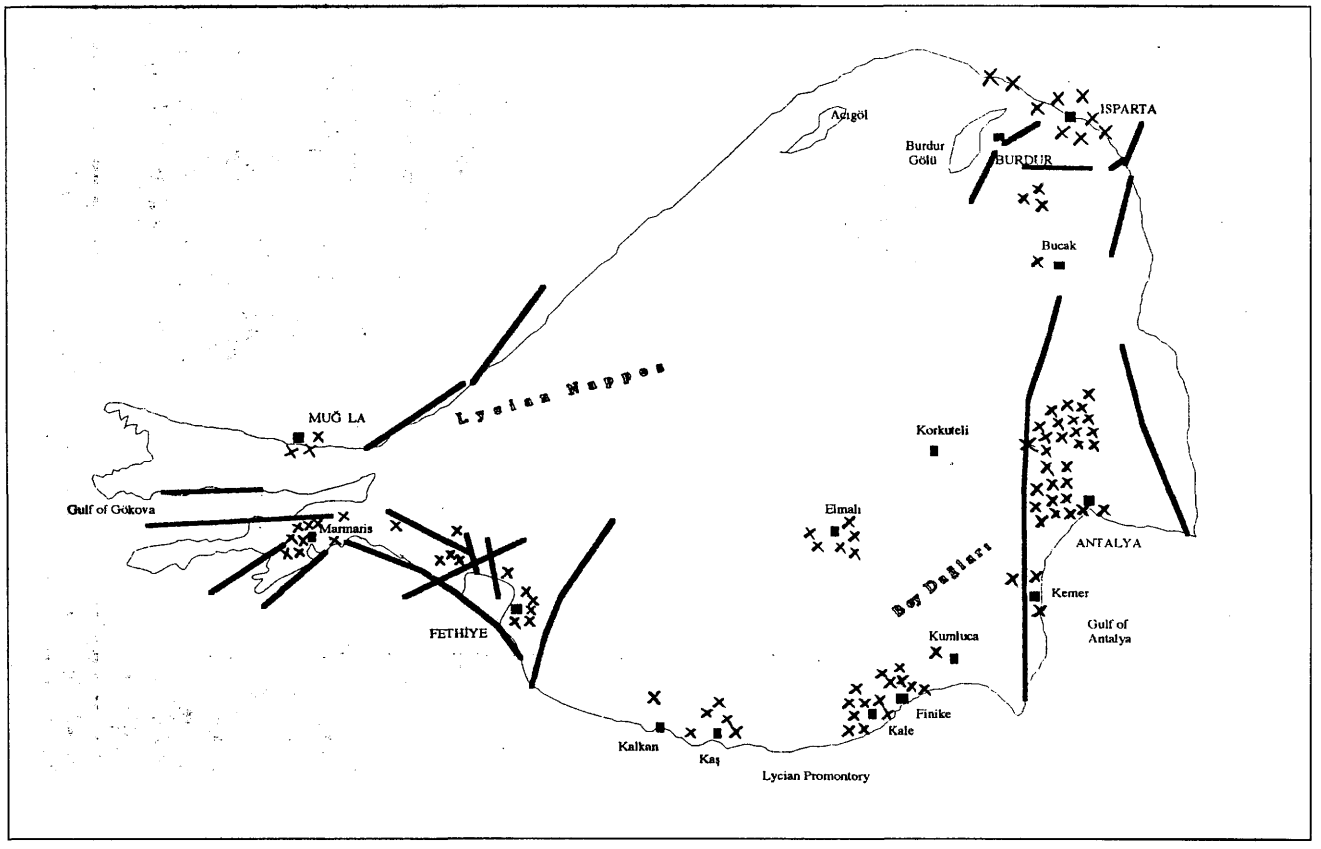

Fig. 6. Distribution of the West Taurus caves in relation to faults (caves shown in their approximate position).
A barlangok eloszlása a Nyugati -Torosban a törésvonalakhoz viszonyítva.
(A barlangok jelölt helyzete hozzávetőleges).

Az aktív patakos barlangokon kívül a száraz , üledékkel feltöltött barlangok vizsgálata még a kezdeteknél tart. Közülük a Karain a legjobban kutatott, ahonnan *Homo sapiens neanderthalensis* csontmaradványai, valamint gazdag fosszilis fauna és paleolit-anyag ismert.

Turisztikai szempontból különösen érdekesek Finike környékének tengerparti barlangjai.

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