

HYDROCARBON POTENTIAL OF THE KAHRAMANMARAŞ AND ELBİSTAN AREAS

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ABSTRACT. - The Taurus mountains, which developed in the conjoining zone of the Anatolian and Arabian Plates, underwent a disruption between Bolkar mountain and Engizek mountain. This can be explained by the fact that the area was traversed and transformed by two major strike-slip faults situated at Mersin-east Bolkar mountain-Kayseri in the west and Antakya (Hatay)-Elazığ-Bingöl in the east. In fact, the east-west oriented 200 km. wide area, covering the gulf of İskenderun and the northern part of Adana, was compressed and deflected as far as the north of Sarız and the Arabian Plate was dislocated prior to the faulting, and moved circa 120 km. inside Anatolia. Linked to this movement, the Miocene Nappe cover was dragged too far in the exactly opposite direction, i.e., to the south, and changed the original form of the mountain sequence. This relocation resulting from tectonic activities has emphasized, from the viewpoint of the settling of the formations belonging to the Arabian Plate, the importance of the area north of Bolkar mountain-Engizek mountain line or the Taurus sequence and defined the hydrocarbon potential of Elbistan region. As to the Kahramanmaraş area, the fact that the oil-producing formations of the Southeast Anatolia are found in this also, it continues to be an important objective.

INTRODUCTION

My first investigations relating to the Kahramanmaraş area took place in 1980 on behalf of a private oil company. At the beginning I made the 1:25,000 scale geological map of the area extending from Kahramanmaraş to the foot of Engizek mountain. Apart from having steeper flanks, these anticlines, covered with Eocene-age limestones, exhibited no difference from the known structures of southeast Anatolia. The limestone cover is directly underlain by the Karadut formation. This configuration can be seen clearly in the faulted zones south of Ahırdağı anticline.

During the said investigation and the field trip I made later to the northwest of Kahramanmaraş, I noticed that the autochthon formations were, as many geologists have observed and are aware of, formations belonging to the Arabian Plate and this led to my hypothesis regarding the hydrocarbon potential of the region. The Elbistan plain which is covered by the Miocene Nappe, has, along with the Kahramanmaraş area, become an important objective.

The most important question regarding the Kahramanmaraş area was whether or not the target levels of southeast Anatolia exist here also. The data on which Figure 1e was based, shows clearly that the formations existing extensively in the northwest and in the south of Kahramanmaraş definitely support the positive view regarding the Kahramanmaraş area. As to the extension of the structures observed on the surface and below the surface this was proven by the seismic profile MS-101 taken by Placid Oil Company in 1986.

The important questions concerning Feke, Saimbeyli, Sarız, Afşin and the Elbistan areas, located north by northwest of the Kahramanmaraş area, was how far and in what manner had the Arabian Plate advanced. Kahramanmaraş and its vicinity has been the subject of study since 1975 from the viewpoint of continental movements related to the Anatolian and Arabian Plates. However, none of those investigations (Perinçek, 1979; Yiğitbaş, 1980; Perinçek and Özkaya, 1981; Yılmaz, 1981; Tekeli and Erendil, 1986; Tarhan, 1986; Yoldemir, 1990; Yılmaz, 1990; Çemen et al., 1990; Kozlu and Fourcade, 1990; Günay et al., 1990) has brought forth a clear view or picture regarding the thrust zone, although they have furnished data and advanced opinions in connection with the various tectonic phases and depositional environments between the two plates. Consequently, our views regarding the thrust line between the plates and the situation of the present Arabian Plate are based, jointly, on our field observations, MTA data (MTA, 1961, 1962) and further studies we have conducted.

GENERAL GEOLOGY

The thick sedimentary cover which extends over the surface of Southeast Anatolia is the northwestern part of the large sedimentary cover of the Arabian trough. It is bounded by the Taurus mountains in the north.

Kahramanmaraş, Feke, Saimbeyli, Sarız and the Elbistan region is the northernmost part of the Arabian basin, and its autochthon formations belong to the same plate.

At the north of the Taurus mountain, there is the Anatolian Plate of which Pre-Cambrian and Paleozoic aged formations are metamorphosed and probably originate from different sources.

Except the Thrace basin, oil has not been discovered within the sediments deposited on the Anatolian Plate and such a possibility is remote. The Taurus mountains which are a part of the Alpin Orogenic Belt between the Alps and the Himalayas, is a mountain chain formed as a result of the squeezing of the sediments/magmatic materials of the Tethyan Sea between the Arabian or African Plate and the Anatolian Plate beginning in the Cretaceous time. Two important tectonic movements both going forward to the south opened and ended during this Taurus Orogeny, the first one is the Upper Cretaceous gravity slide and the second is the Miocene Nappe.

The anticlines of the Kahramanmaraş area are formed by the Eocene age limestones, and they form high mountain chains in the east-west direction. The synclines between these mountains/anticlines have been filled by the coarse elastics of Miocene age.

Those materials which form mixed and rough topography at the north of the Kahramanmaraş area, beginning from the Engizek mountain, belong to the Miocene Nappe formations, and they are mostly ophiolites and also metamorphic blocks (Yılmaz and Yiğitbaş, 1990) carried from the Anatolian Plate. It is accepted that the Tertiary and older formations under this nappe cover belong to the Arabian Plate outside of the thrust zone.

Allochthon rock bodies belonging to the Upper Cretaceous gravity slide and/or Miocene Nappe, and also autochthon formations of the Arabian Plate exist as a blend in the south of the Kahramanmaraş area (Fig. 2).

STRATIGRAPHY

It is different to define stratigraphy of the Kahramanmaraş area before the Midyat formation. At two small overlapping zones in the south of the Ahırdağı anticline the Karadut formation is exposed in small dimensional (Fig. 2). On the basis of this, we can with certain say that the Karadut formation started directly after the Midyat limestone section. The thickness of the Karadut formation can not be estimated by field observation. But two sources can be helpful for the thickness and also the lithology of the complex. One of the sources is seismic line MS-101 which only shows the thickness (Fig. 3). The other source is the Haydarh-2 well which was drilled by Türkiye Petrolled Anonim Ortaklığı (TPAO) in 1983, 33 km. east of this seismic line, showing both thickness and lithology.

The base of the Karadut formation is not known exactly. But from the sources that have contributed to the preparation of Figure 1 it can be seen that, from the Feke-Saimbeyli-Sarız area to the north and northwest of the Kahramanmaraş area, from the Gaziantep area (including wells) in the south, from the Amanos mountains in the south and southwest, and finally from the Adıyaman area in the east and southeast of them and also from some surface and subsurface data obtained from the wells and geological maps/measured sections give, in our view, reliable stratigraphic information about the Kahramanmaraş area. Thus, the fence diagram that forms Figure 1 represents the lithologic units of this environment, and the stratigraphic section in Figure 4 shows a synthesis depending on that data.

PALEOZOIC

Cambrian

The Cambrian series that seems to be a typical section in Derik, west of Mardin has a striking resemblance to the Değirmentaş, formation in the Sarız area which was measured by various companies, (also the ones exposed at the Amanos mountains, and the section that outcrops it to a small extent at the Penbeğli-Tutköy area in the west of Adıyaman). Since the Kahramanmaraş area is in the middle of these exposed sections it is highly probable that the same section exists there also.

It is hard to estimate the total thickness of this series which is composed of the elastics at the base, carbonates in the middle, and again the elastics at the top. It is possible that the thickness of this section may be about 2000 m. (Fig. 1,4).

Ordovician-Silurian

The Ordovician-Silurian sections in the Gaziantep area are almost the same in lithology as the Bedinan formation; mostly composed of black shales at Derik.

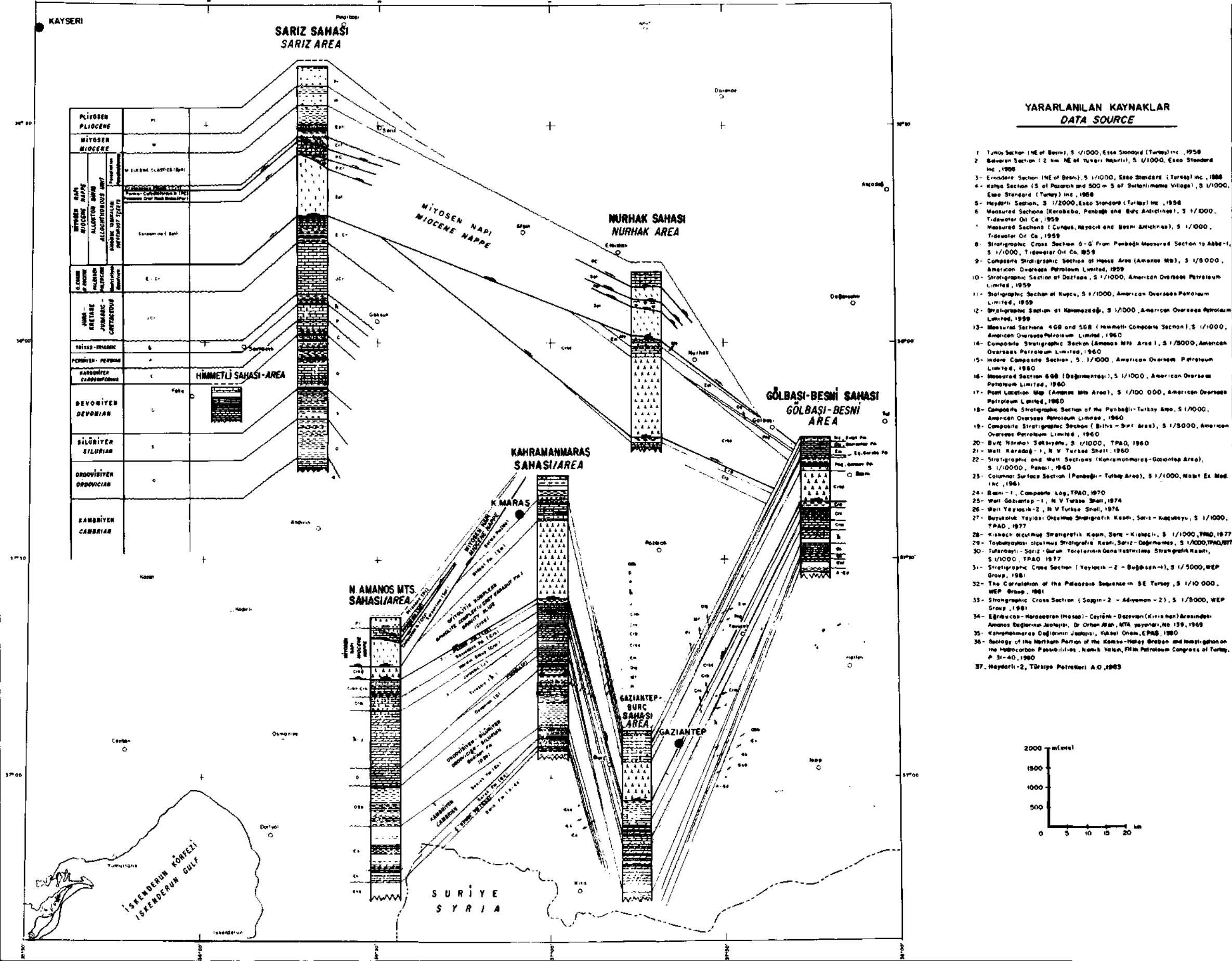


Fig. 1 - The fence diagram of the vicinity of the Kahramanmaraş Area. Scale Hor.: 1:500,000, Ver.: 1:50,000.

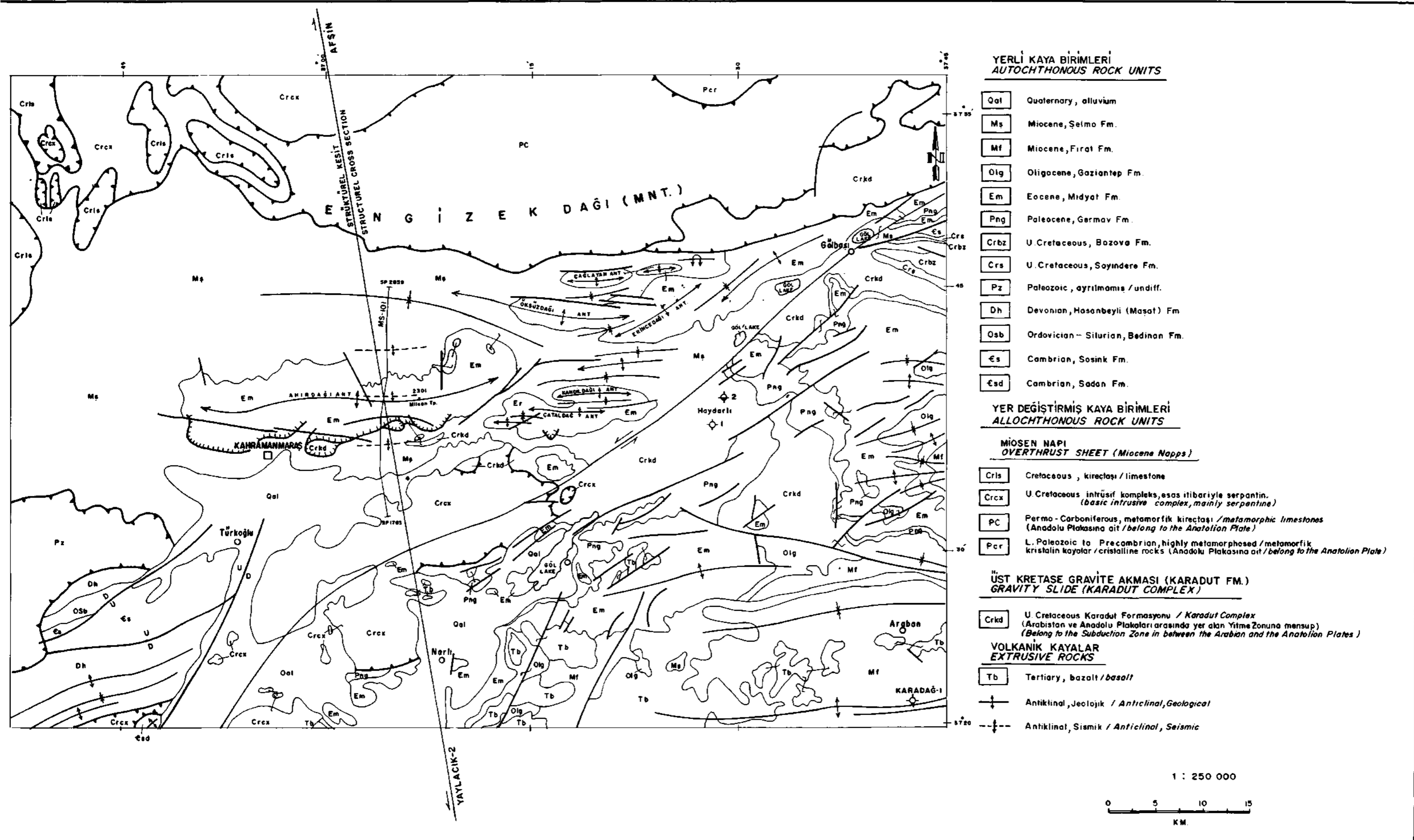


Fig. 2 - Geologic map of the Kahramanmaraş area. Scale: 1:250.000.

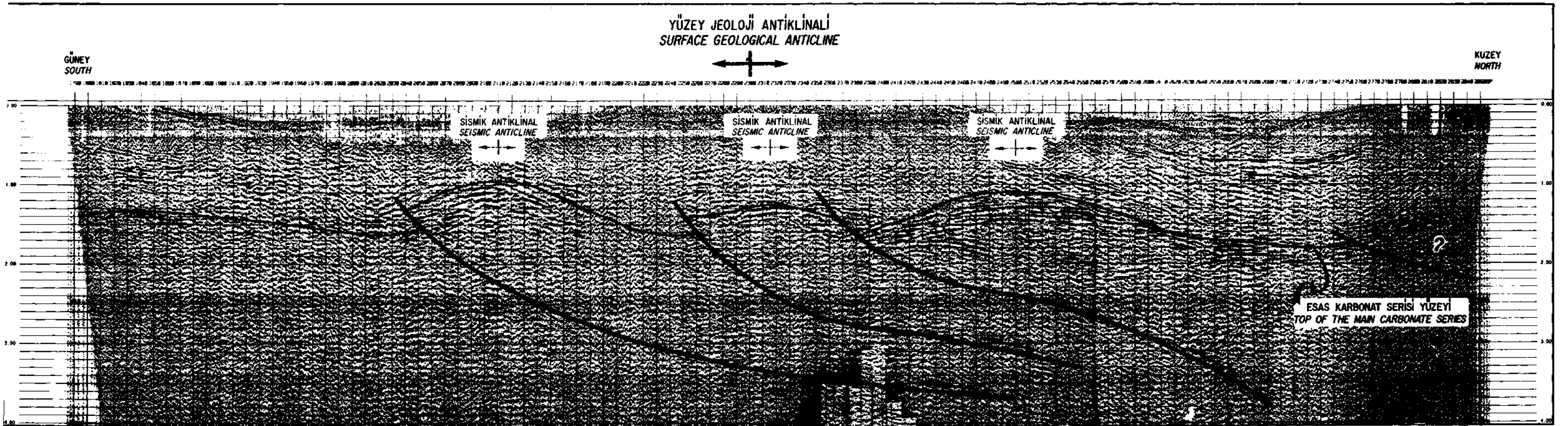


Fig. 3 - Seismic line MS-101.

The same-age section in the Amanos mountains contains the following units (Atan, 1969) at the base of the Kardere formation; mainly quartz sandstone of a coastal facies, the Kızılaç formation; fine-grained sandstone, mudstone and shale deposited in a slowly deepening sea, the Akçadağ formation; coarse elastics believed to be deposited under shallow marine conditions, and at the top, the Bahçe formation; thin-bedded black shales and mudstones believed to have been deposited in a deep sea environment (Fig. 4).

The Ordovician-Silurian section exposed at the Toybuk Yaylası (location in the Sarız area) is formed of shales; 1050 m.; calcareous shales; 310 m. a coarse clastic member; 95 m. sandy shales; 80 m. altogether 1535 m. in thickness according to the measurement taken by TPAO.

The Upper Cretaceous carbonate series overlies the Cambrian section with a large unconformity in the Penbeğli-Tutkoy area. Thus, the younger part of the Paleozoic series is not exposed there, and it is very difficult to form a clear idea of the thicknesses and the lithologies of the Ordovician-Silurian formations expected in the eastern pan of the Kahramanmaraş area.

Some Ordovician-Silurian formations, however, would be expected in the Kahramanmaraş area because of the thick sections exposed in the Amanos mountains, and in the Sarız area, and observed in the well around the city of Gaziantep (Fig.1,4).

Devonian

There are no Devonian formations in the Gaziantep, Urfa and Adıyaman areas. This indicates the Devonian formations were eroded at the top and also around the axial zone of the Mardin-Adıyaman uplift.

However, Devonian formations are present in the Amanos mountains. There, it is observed (Alan, 1969), that conglomerates and sandstones (Kırtaş formation) overlie the eroded surface of the Silurian formations and that shale interbedded in a limestone section (Hasanbeyli formation) was deposited in the more stable parts of this area (Yoldemir and Perinçek, 1990). These very fossiliferous limestones belong to the Devonian period according to paleontological data.

Devonian formations are also present in the Feke, Saimbeyli, Sarız areas. At the Toybuk Yaylası location (in the Sarız area) a Devonian section 540 m. thick has been noted by TPAO. The main parts of this section (410 m.) are formed of limestone and 50 m. of sandstone, 50 m. of calcareous shale and 30 m. of shale.

A good sandstone section, although not very thick, between the Silurian shales and the Permian limestones in the Hazro uplift belongs to the Devonian period in age.

If we consider that the Devonian formations exist in the Amanos mountains (Sarız and Hazro areas), then it is highly probable that a Devonian with a similar facies measuring approximately 225 m. of thickness can be found in the Kahramanmaraş area also (Fig. 4).

Permian

There are no Carboniferous layers found in the South and Southeast Anatolia. Also, there are no Permian formations in the Gaziantep and Amanos mountain areas. The Silurian/Bedinan formation underlies the Triassic sequence in the An1-1 well located 20 km. east of the city of Gaziantep.

Gaziantep-1 and Yaylacık-2 wells were abandoned in the Triassic formations, but the Permian aged formations are not believed to exist in these locations.

On the other hand, the conditions are different in the eastern pan of the Mardin-Adıyaman uplift, in the Hakkari area, and the northeastern part of the same uplift and in the Hazro area. In the Hakkari area the Permian section at the Belek location has a total thickness of 1080 m.; a shale-sandstone unit at the base of 40 m.; a limestone unit at the top of 1040 m. Also in the Hazro area, a limestone unit at the base, a sandstone unit in the middle, and again a limestone unit at the top together form the Permian section of which is mostly composed of limestone, with a total thickness of about 350 m.

In the Sarız area, (Kıskaçlı location) the Permian section measured by TPAO is formed of shale (150 m. thick) with some interbeds of sandstone at the base which is overlain by limestone above the shale (235 m. thick).

At the Kahramanmaraş area a Permian section with a maximum thickness of 150-200 m. can be expected (Fig. 4).

MESOZOIC

The Mesozoic-age formations that are observed all over Southeast Anatolia as a thick series; will, in all probability, be present in the Kahramanmaraş area also.

Triassic-Upper Cretaceous

Main carbonate series (Triassic-Mardin group). - The carbonate section cut in the Ar1-1 well in the Gaziantep area consists of: basal clastic horizon (Uludere formation of Triassic age); 239 m. in thickness; 696 m. Triassic carbonates; 75 m. Jurassic limestones; and 661 m. Mardin group carbonates. Thus, the total thickness of the Mesozoic series which attain a total thickness of 1671 m., the major part, 1432 m., consists of limestone and dolomite. "Gaziantep-1" well was abandoned after having penetrated 85 m. of Triassic elastics. Above this clastic horizon, 1402 m. Triassic; 496 m. Jurassic; and 467 m. Mardin group was cut and all of them were composed of carbonates. The Jurassic, as compared to "Ar1-1", was found to be thicker and the reason for this is explained as the repetition of the same formation due to a fault. The total thickness of this section is 1700 m. in this area.

"Karadağ-1" well which is 74 km. southeast of the city of Kahramanmaraş was abandoned in the Triassic elastics level after penetration at 76 m. Above this level, it was composed of all carbonates and with in a total thickness of 1239 m. is found a section containing Triassic that is 569 m., Jurassic 145 m., and Mardin group 525 m.

In the Amanos mountain there is a Triassic transgression that is seen after a Permo-Carboniferous discontinuity and this Triassic transgression starts with the Ar1ık formation that forms the clastic unit at the bottom and has a thickness of 130 m. (Atan, 1969). The Küreci limestone which was deposited under stable conditions, and the upper part belonging to Jurassic (Atan, 1969), lies above it; 235 m. in thickness. The Karadağ limestone, 300 m. in thickness and of Albian-Cenomanian age, overlies the Küreci formation with a basal conglomerate level and an angular unconformity. In summary, the Triassic to Cenomanian section totals 665 m. in thickness in the Amanos mountains area.

Eighty-seven km. east/northeast of the city of Kahramanmaraş in the "Besni-1" well, elastics were encountered below the main carbonate series and were considered as Cambrian in age until the 1980 s. But, during these years, paleontological determinations made by TPAO showed that this clastic level belonged to the Triassic Uludere formation. The section at Besni-1, 455 m. in thickness, is composed of 130 m. of Triassic elastics at the base, 84 m. of Triassic limestone in the middle, and 241 m. of the Mardin group's carbonates at the top.

At the Haydarlı-2 well, which is located 48 km. east of the city of Kahramanmaraş, the main carbonate series was 496 m. thick of this 154 m. was Mardin group (limestone, a thin marl level at the base), 80 m; Areban formation (sandstone, shale) and 262 m.; Triassic-Jurassic limestones.

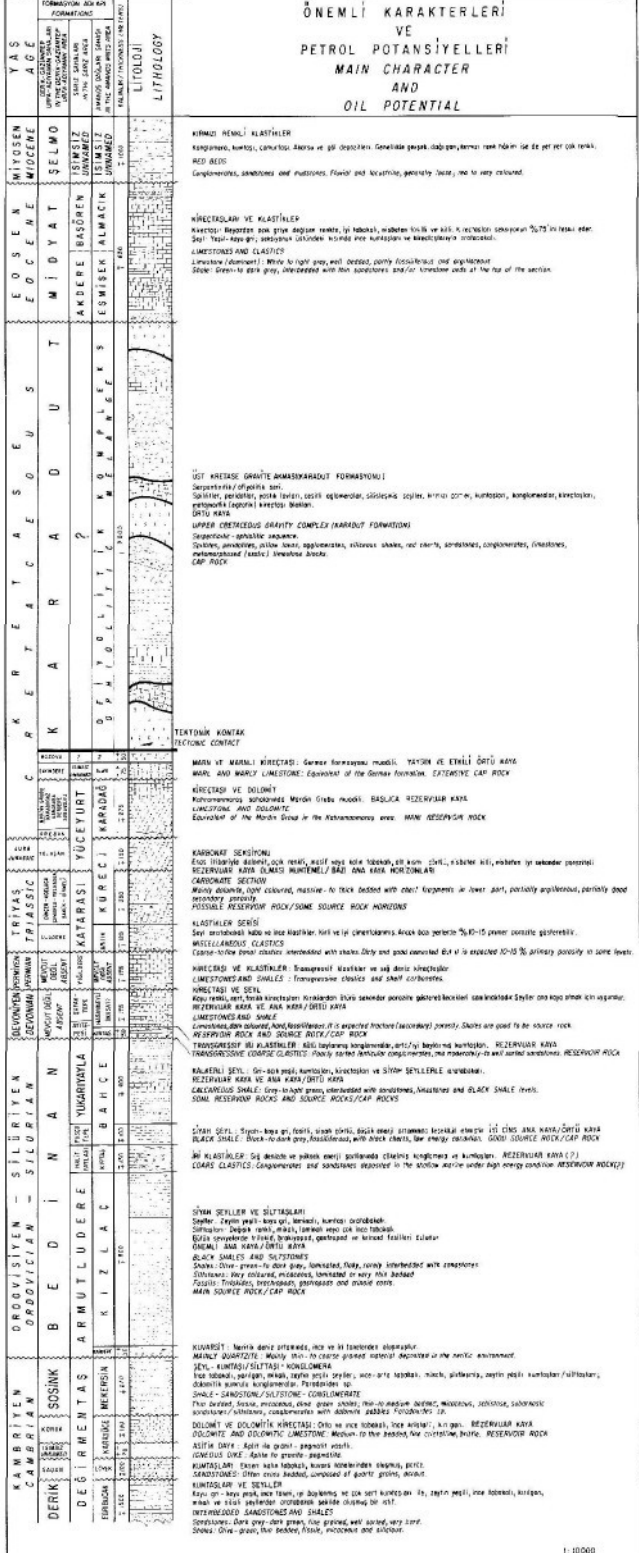
In the Sarız area there is a very thick carbonate section deposited during the periods Triassic to Cretaceous. The total thickness of the measured section of Triassic (Katarası formation) and Jurassic/Upper Cretaceous (Yüceyurt formation) is more than 1500 m.

After determination of these series-aged Triassic-Upper Cretaceous layers around the Kahramanmaraş area, it is expected that a limestone/dolomite section with a basal clastic unit of approximately 750-850 m. in thickness exists there (Fig. 1,4).

Upper Cretaceous

Argillaceous limestone-marl sequence (Sayındere and Bozova formations). - The section, in the east of Diyarbakır and covering the Mardin group as a thick and monotonous shale series, is called Germav formation. Many authorities believe that this series is the main source rock in this area.

Fig. 4 - Composite stratigraphic section of the Kahramanmaraş area. Scale: 1:10,000.



ÖNEMLİ KARAKTERLERİ
VE
PETROL POTANSİYELLERİ
MAIN CHARACTER
AND
OIL POTENTIAL

LİTOLOJİ
LITHOLOGY

KIRMIZI RENKLİ KLASTİKLER
Konglomera, kumtaşı, çamurtaşı. Akarsu ve göl depozitleri. Genellikle yeşil, koyu kırmızı, siyah ve siyah gri renkte.
RED BEDS
Conglomerates, sandstones and mudstones. Fluvial and lacustrine, generally base, red to very coloured.

MİREKTAJLAR VE KLASTİKLER
Kireçtaşı, berrak ve koyu yeşil renkte, iyi tabakalı, mabeyin kırılgan ve alt kısımlarında sementasyon %75'ten fazla eder.
Seyil, yeşil-koyu gri, sementasyon oranında ince kumtaşı ve kireçtaşağıya geçmiştir.
LIMESTONES AND CLASTICS
Limestone (lumest) : White to light grey, well bedded, partly fossiliferous and argillaceous.
Seyil : Green-to grey grey, interbedded with thin sandstones and/or limestone beds at the top of the section.

ÜST KRETASE GRAVİTE AKMASIYARADUT FORMASYONU
Serpentinli/afonik ser.
Sapfirler, peridotler, porsit taşları, çeşitli oğulmermer, silisli ve silisli taşlar, kırılgan çamur, kumtaşı, konglomera, kireçtaşı, piritli kumtaşı (sarı) kireçtaşı taşları.
ÜST KAYA
UPPER CRETACEOUS GRAVITY COMPLEX (BARADUT FORMATION)
Serpentine - aphanitic sequence.
Sapfirs, peridotites, pillow basalts, ophiolitic shales, red cherts, sandstones, conglomerates, limestones, pyritized sandstone (sarı) limestone blocks.
CAP ROCK

TEKTONİK KONTAK
TECTONIC CONTACT

MARİ VE MARİLİ KİREÇTAŞI : Geçmiş formasyonu mudur. YATIR VE ETKİLİ ÖRTÜ KAYA
MARL AND MARLY LIMESTONE : Equivalent of the German formation. EXTENSIVE CAP ROCK

KİREÇTAŞI VE DOLOMIT
Kahramanmaraş bölgesinde Marlı Grubu mudur. BAŞLIKA REZERVUAR KAYA
LIMESTONE AND DOLOMITE
Equivalent of the Marlı Group in the Kahramanmaraş area. MAIN RESERVOIR ROCK

KARBONAT SEKSİYONU
Erosiyonla dolmuş, çok renkli, üstü koyu kumtaşı, alt kısmı çirli, üstte kırılgan, mabeyin iyi sementasyonlu.
REZERVUAR KAYA (MARI MUKTEMEL) BAZI ANA KAYA HORIZONLARI
CARBONATE SECTION
Mainly dolomite, high coloured, massive-to thick bedded with chert fragments in lower part, partially argillaceous, partially good sementation, porous.
Possible reservoir rock/some source rock horizons

KLASTİKLER SERİSİ
Seyil aralıklı ve ince kumtaşı, kırılgan ve iyi sementasyonlu. Ancak bazı yerlerde %10-15 primer porozite gösterebilir.
MİCELLENARUS KLASTİKLER
Coarse-to-fine sandstones interbedded with shales. Dirty and good cemented but it is expected 10-15 % primary porosity in some levels.

MİREKTAJ VE KLASTİKLER : Transgresif kumtaşı ve seyil deniz kireçtaşı.
LIMESTONES AND SHALES : Transgressive clastics and shelf carbonates.

KİREÇTAŞI VE SEYİL
Koyu renkli, sert, kırılmaya dayanıklı kumtaşı. Üstte sementasyonlu gösteren kumtaşı ve altta sementasyonlu kumtaşı.
REZERVUAR KAYA VE ANA KAYA/ÖRTÜ KAYA
LIMESTONES AND SHALE
Carbonaceous dolomite, hard, fossiliferous. It is expected fracture (secondary) porous. Shales are good to be source rock.
RESERVOIR ROCK AND SOURCE ROCK/CAP ROCK

TRANSGRESİF İNİ KLASTİKLER : Ağır tabakalı kumtaşı ve seyil, üstte sementasyonlu, altta sementasyonlu. REZERVUAR KAYA
TRANSGRESSIVE COARSE CLASTICS : Mainly sorted lamellar conglomerates, low porosity-to well sorted sandstones. RESERVOIR ROCK

KALIN SEYİL : Gri-koyu yeşil, kumtaşı, kireçtaşı ve SEYİL SEYİLLERLE karışım.
REZERVUAR KAYA VE ANA KAYA/ÖRTÜ KAYA
CALAREGUS SHALE : Grey-to light green, interbedded with sandstones, limestones and black shale (yeşil).
SOME RESERVOIR ROCKS AND SOURCE ROCKS/CAP ROCKS

İYİ SEYİL : Yeşil-koyu gri, kırılgan, üstte sementasyonlu, altta sementasyonlu. ÜST ANA KAYA/ÖRTÜ KAYA
BLACK SHALE : Black-to-dark grey, fossiliferous, with thick cherts, low energy conditions. GOOD SOURCE ROCK/CAP ROCK

İYİ KLASTİKLER : İyi sementasyonlu ve yüksek enerji şartlarında çözümlenmiş kumtaşı ve kumtaşı. REZERVUAR KAYA (?)
COARSE CLASTICS : Conglomerates and sandstones deposited in the shallow marine under high energy condition. RESERVOIR ROCK(?)

İYİ SEYİL VE SİLİTASLARI
Seyil. Seyil yeşil-koyu gri, kırılgan, kumtaşı aralıklı.
SİLİTAS : Düşük enerji, mabeyin, üstte sementasyonlu, altta sementasyonlu. ÜST ANA KAYA/ÖRTÜ KAYA
BLACK SHALES AND SILTSTONES
Shales : Olive-green-to dark grey, laminated, dirty, rarely interbedded with carbonates.
Siltstones : Very coloured, micaceous, laminated or very thin bedded.
Fossils : Trilobites, brachiopods, graptolites and small corals.
MAIN SOURCE ROCK/CAP ROCK

KUVAZİT : İnce ve koyu yeşil, üstte sementasyonlu, altta sementasyonlu.
MAINLY QUARTZITE : Mainly thin-to coarse grained material deposited in the marine environment.

SEYİL - KUMTAŞI/SİLİTASİ - KONJOMERAT
İnce sementasyonlu, kırılgan, mabeyin, üstte sementasyonlu, altta sementasyonlu. ÜST ANA KAYA/ÖRTÜ KAYA
SHALE - SANDSTONE/SILTSTONE - CONJOMERATE
Thin bedded, fossil, micaceous, clay grain shales, fine-to-medium bedded, micaceous, siltstone, sandstone, siltstone, conglomerates with dolomite pebbles. Fossiliferous (s).

DOLOMIT VE DOLOMITİK KİREÇTAŞI : Ortalama sementasyonlu, üstte sementasyonlu, altta sementasyonlu. REZERVUAR KAYA
DOLOMITE AND DOLOMITIC LIMESTONE : Medium-to the bedded, fine crystalline, brittle. RESERVOIR ROCK

ASİTİK KAYA : Açık yeşil, üstte sementasyonlu, altta sementasyonlu.
ARGILLUS DİKE : Açık yeşil, üstte sementasyonlu, altta sementasyonlu.

KUMTAŞI : İnce ve koyu yeşil, üstte sementasyonlu, altta sementasyonlu. ÜST ANA KAYA/ÖRTÜ KAYA
SANDSTONES : Often cross bedded, composed of quartz grains, dark.

KUMTAŞI VE SEYİLLER
Koyu yeşil-koyu gri, kırılgan, üstte sementasyonlu, altta sementasyonlu. ÜST ANA KAYA/ÖRTÜ KAYA
SANDSTONES AND SHALES : Dark grey-dark green, fine grained, well sorted, very hard.

SEYİL : Yeşil-koyu gri, kırılgan, üstte sementasyonlu, altta sementasyonlu. ÜST ANA KAYA/ÖRTÜ KAYA
SHALES : Olive-green, fine bedded, fossil, micaceous and silty.

The monotonous character of this formation in the west of Diyarbakır has been changing and turning into calcareous shale, argillaceous limestone and marl. The Sayındere formation (argillaceous limestone) and Bozova formation (marl) are two sediment units which are different equivalents of the Germav formation in the Urfa, Adiyaman and Gaziantep areas.

The total thickness of the argillaceous limestone-marl sequence is 1290 m. in the "Suvarlı-2" well; 1208 m., in "Karadağ-1" well; 680 m., in "Arıl-1" well; 544 m., in "Gaziantep-1" well; 509 m., in "Besni-1" well and 283 m. in "Yaylacık-2" well.

Argillaceous limestone-marl sequence is the only unit between the main carbonate series and Upper Cretaceous gravity slide (ophiolitic complex), and it can be surmised that its thickness at the Kahramanmaraş area will be between 100-150 m. and that it will make a good cap rock (Fig. 1, 4).

Gravity slide (ophiolitic complex or Karadut formation). - Karadut formation is a congregation of rocks that were deposited in the Tethys Sea which was sometime inactive but from time to time so active as to become narrower under the actions of both the confronting Arabian and Anatolian Plates. These consist, basically, of these groups; sediments such as shales, limestones, conglomerates and sandstones; basic magmatics that are related to the faults of the bottom of the sea; the large, old (metamorphic), exotic rock blocks that were broken off the Anatolian Plate and had fallen over the other rocks in the sea. This formation that has a mixed lithology moved south during the Upper Cretaceous period when the Tethys Sea was squeezed with time. This active body gained speed due to the slippery character of the serpentinitic blocks and, due to a gravity slide formed a tectonic contact with the Mardin group rocks, reaching areas far to the south (Fig. 5, 6).

At the "Haydarlı-2" well of TPAO, which is 48 km. to the east of the city of Kahramanmaraş, drilling was started in this formation and the thickness was determined to be 1696 m. If we take the erosion of the upper part into consideration, it can be said that the thickness around Haydarlı-1,2 wells should be about 1800 m. The same formation has about 1800-2200 m. thickness in Oluklu, Palanlı, Bölükyayla and Kayatepe wells, all of which are to the north of the Adiyaman oil field.

If we take into consideration that the Kahramanmaraş area was in the north/northwest of Adiyaman before the occurrence of the Antakya-Elazığ-Bingöl strike-slip fault, the thickness of the Karadut formation should be more than that of the Adiyaman area e.g., and be 2000-2200 m. (Fig. 1, 4, 6).

TERTIARY

Except for some limited Karadut outcrops that emerged because of the small overlaps at the south of the Ahırdağı anticline, the Kahramanmaraş area is completely covered up by the formations of the Tertiary age. The anticlines that form high mountains are all covered by thick Eocene limestones. The synclines between them are filled by the elastics of Miocene age (Fig. 2, 7).

Eocene

Midyat formation. - The thick limestone mantle that forms the Midyat formation along the dry stream beds that cut the Ahırdağı and Öksüzdağı anticlines seems to be suitable for investigation of lithology and measurement of the sections. Panoil Oil Company measured these limestone series from the Ahırdağı anticline axis to the Kozludere village. According to the measurements, the total thickness of the emerged part of the formation is 525 m. and it consists of 50 m. clastic level at the base, 365 m. of monotonous limestones in the middle, and 110m. of cherty calcareous shales at the top. Including the unexposed part of the formation the total thickness would be about 600 m.

In another cross-section line at the Çataldağ anticline the Panoil Oil Company measured 500 m. of thickness. The calcareous shales turn into marls in this area.

A measurement made at the Öksüzdağı anticline up to the Oruçınarı village showed that almost all of the section is composed of limestone and only a black shale level that includes thin sandstone and limestone bands. The section can be about 600-650 m. in thickness in this anticlinal area.

The thickness of the Midyat formation becomes larger around Erinceadağı anticline and may have reached 650-700 m. (Fig. 2, 4).

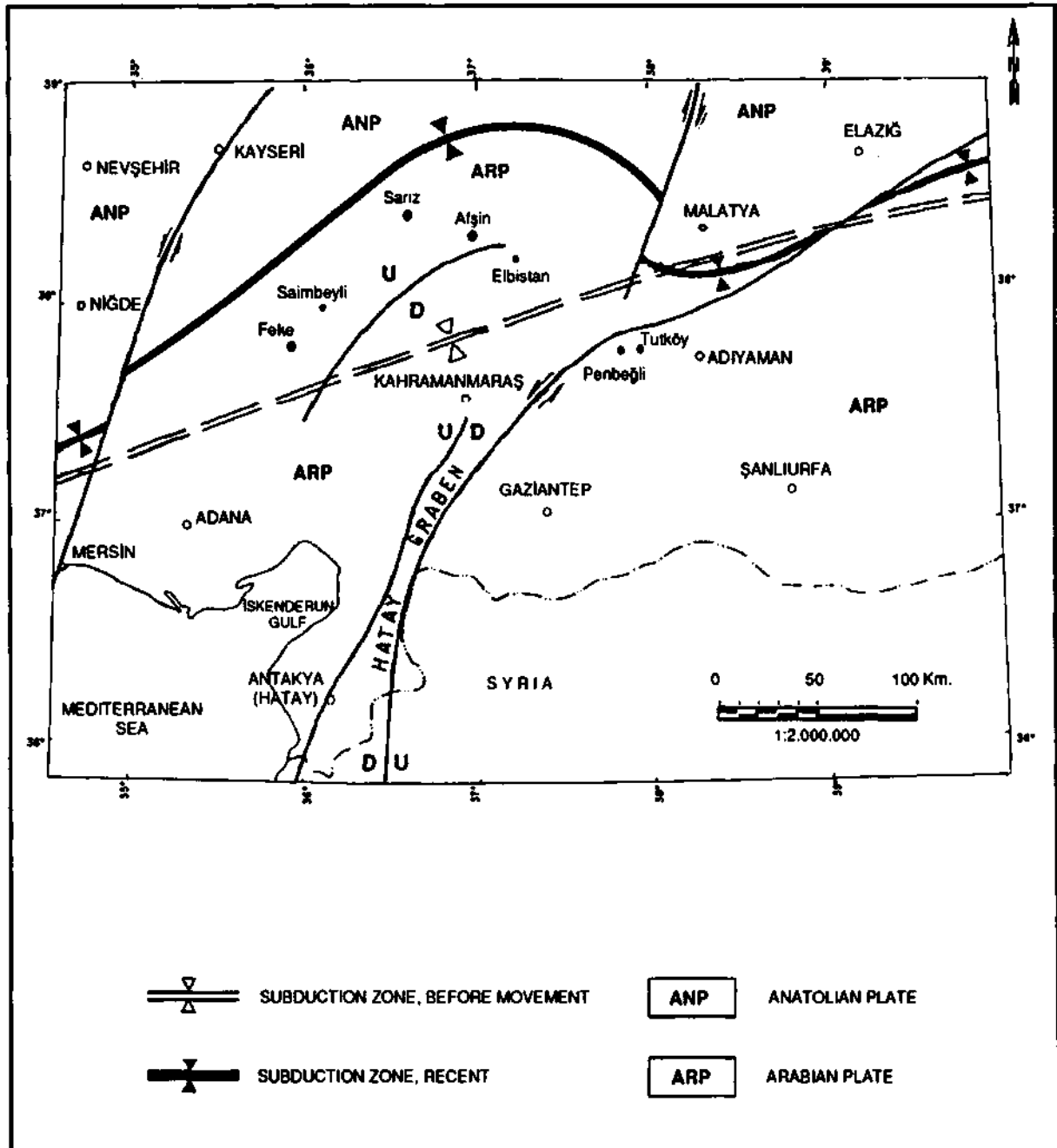


Fig. 5 - Plate movements and displacement of the subduction zone around Kahramanmaraş. Scale 1:2.000.000.

Miocene

Şelmo formation. - Vary coloured elastics as the interbedded shale and sandstone within the synclines and the other deep zones of the Kahramanmaraş area have the same character as the Şelmo formation that is an extensive cover at Diyarbakır-Siirt areas, and that's why it is given the same name. The upper pan of the series is gravelled, and was transformed into uncemented fluvial deposits; this part belongs to the Pliocene in age (Fig. 2, 4).

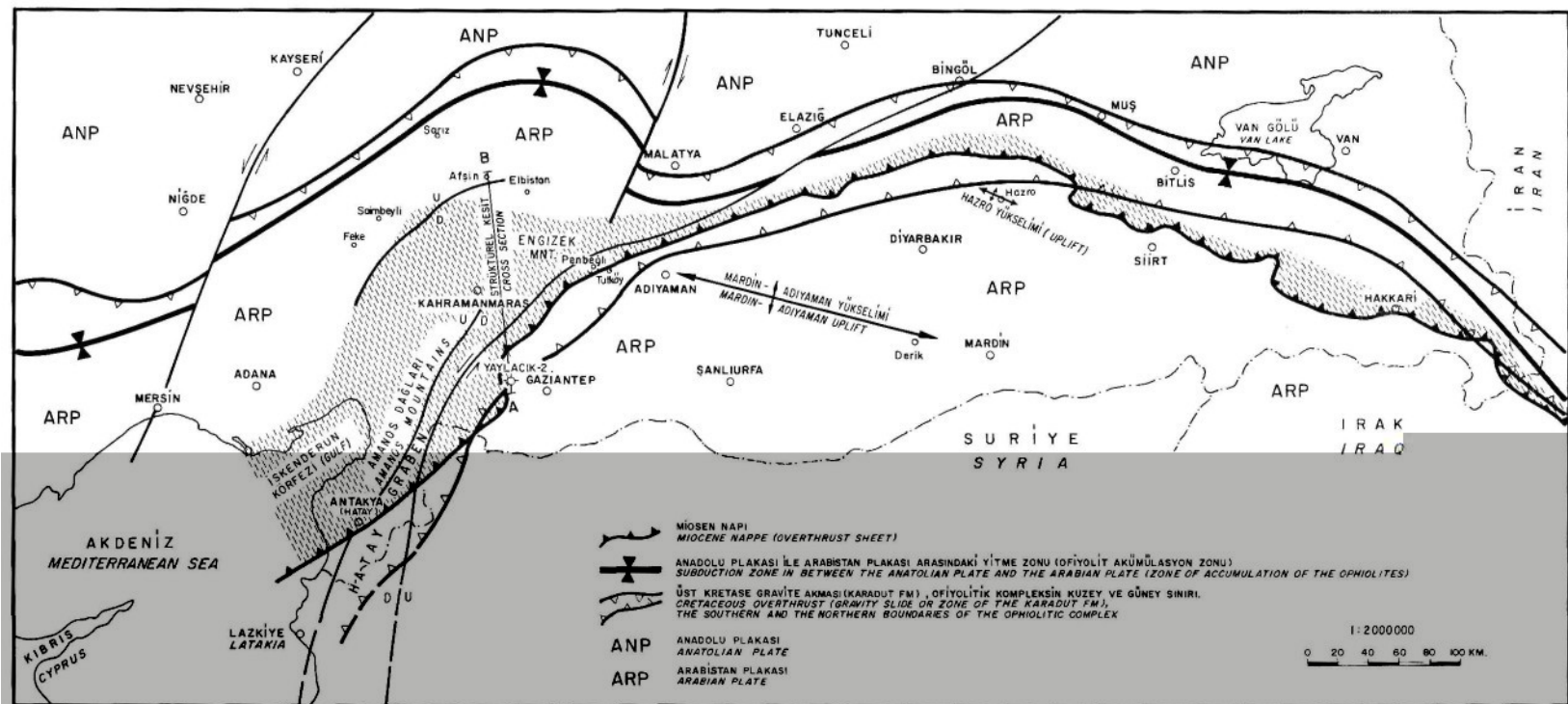


Fig. 6 - Main tectonic features in between the Anatolian Plate and the Arabian Plate in S/SE Turkey. Scale 1:2,000,000.

TECTONIC

The tectonic that is before Alpine Orogeny in Southeast Anatolia has not been investigated carefully because Alpine tectonics dominate the whole region, even the whole of Turkey, in forming the present structure. The developments that started the formation of the tectonic features of the Kahramanmaraş area belong to the final part of the Upper Cretaceous period. The corresponding movements of the Arabian Plate and Anatolian Plate (Kozlu et al., 1991) to the north-south direction forced all the faults and folds to be in the east-west direction. The Taurus mountain and the nappes belonging to them (also the foothills and thrust faults bounding these at their south side) are all in east-west direction. But the secondary block movements formed structures and faults in varying directions (Fig. 2).

The seismic line MB-101 of the Kahramanmaraş area indicates that the first structures occurred in the Upper Cretaceous layer (Fig. 3). The three separate folds of Cretaceous and older age exist under the fold of the Kahramanmaraş (Ahırdağı) anticline which is at the surface and can only be explained by a tectonic age difference (Fig. 3, 7). It is clear that the forces that dragged the Karadut formation as a gravity slide broke off and folded the lower levels. The same formation was subject to erosion during an important part of the Paleocene. Age at the Middle Eocene period the sea moved in again and the Midyat limestones and coarse elastics, which form the Şelmo formation, were deposited at the surface (Fig. 4).

The last phase of Alpine Orogeny was very strong during the Miocene period. While the young formations were folded for the first time, old and young masses between the two plates was dragged far south, forming the Miocene nappe.

The peaks of the holds of the Upper Cretaceous carbonate sections are 1 to 1.3 msn depth (two way time) in seismic records, and the flanks have a high slope (Fig. 3). For the structures to take their final shapes the forces that formed the Miocene nappe should have had an absolute effect.

The biggest structure of the Kahramanmaraş area is the Ahırdağı anticline which has a length of 32 km. and width of 10 km. This anticline which is about the same size of the big structures of the Middle East is situated north of the city of Kahramanmaraş. This forms a large mountain with a height of 2301 m. at the Milcan hill, and has an east-west orientation. Öksüzdağı and Erinceadağı anticlines that exist at the northeast and east are smaller than the Ahırdağı mountain. Çağlayan, Kandıldağı, Çataldağ and the other anticlines follow them (Fig. 2).

There is no doubt that there exists many large anticlines under the Engizek mountain (nappe) cover. But the thickness of the covering mass and hard topography render the area to be beyond economic limitations.

Here we can emphasize a comment that the Elbistan plain that is 60 km. to the south of the subduction zone is a very interesting objective/virgin area. Were a wildcat well to be started on this plain, first the Pliocene series should be cut and next the Miocene nappe should be reached, after that autochthon Tertiary (Şelmo and Midyat formations), and then the Karadut formation should be cut finally, the target zone (main carbonate series) should be reached. The total depth from the surface to the target zone should be about 5000 m.

SOURCE ROCK, RESERVOIR ROCK AND CAP ROCK POTENTIAL

Source rocks

There is an expectation for source rock potential of several formations at Kahramanmaraş area. Starting from the bottom they can be listed as follows:

Amrutludere (Kızlaç) formation having about 800 m. of thickness and Ordovician aged, and Pusçutepe formation, which is thought to belong to Silurian, are both source rocks having good qualifications. Also, the dark colored shale levels of the Bahçe formation of Silurian is a source rock.

Upper-Middle Devonian aged Şafaktepe (Hasanbeyli) formation contains shales with pyrite that shows dark colored anaerobic conditions that are precipitated at the quiet sea medium. Dark-colored, very fossiliferous and shale interbedded limestone levels are also source rocks.

Germav formation which is a very thick shale section at Siirt, Diyarbakır, Urfa and Adıyaman areas, and also some shale/carbonate levels of the Triassic age form source rocks of the main carbonate series.

The formations of Paleozoic age are also source rocks for the same carbonate series in one point of view (Fig. 1, 4).

Reservoir rocks

Koruk dolomites which belong to the Cambrian period are the first reservoir level of the stratigraphic column.

According to the field observations of TPAO, the Halıyaylası formation which is in the Ordovician-Silurian series is a coarse clastic unit and deposited under high energy conditions however, no evaluation has been made regarding its porosity. Akçadağ formation, which is an equivalent of this series at Amanos mountains, has poor porosity (Atan, 1969). But, these elastics that are deposited between Ashgillian and Landoverian are simply equivalents for the porous Handof-A and Handof-B levels which contain gas and oil that are encountered in the Diyarbakır area. This point is of interest. Wherever they are found in the Kahramanmaraş area as "porous" it is most probable that they will contain hydrocarbons.

In the Sarız area, the upper part of the Silurian is composed of the shale-limestone interbedded section (Yukanyayla formation). In the same deposition period, because the Kahramanmaraş area is very close to the Mardin-Adıyaman uplift, it was higher than Sarız. Because of this, the sandstone levels that are potential reservoir rocks might have developed.

Ayıtpeşi formation that belongs to the Lower Devonian is composed of sandstones and limestones which were deposited in the shallow sea during weak-medium energy conditions. When the Devonian sands of the Hazro area are exposed, and contain oil, the Lower Devonian section of the Kahramanmaraş area is most likely be a reservoir rock.

If the Triassic dolomites which form the lower part of the main carbonate series have some evaporitic levels to serve as a rock for every carbonate unit this section may be an important reservoir horizon.

Mardin group carbonates are the most important reservoir objectives of the Kahramanmaraş area. This series which is the reservoir for oil and natural gas of the Southeast Anatolia will be the main target for the exploration wells which are to be planned for the Kahramanmaraş area in the future (Fig. 1, 4).

Cap rocks

For all of the Halıyaylası formation and sandstone levels of the Yukarıyayla formation the Silurian shale are ideal cap rocks.

Devonian section has many shale interbeds to serve as a cap rocks for this section's reservoir levels.

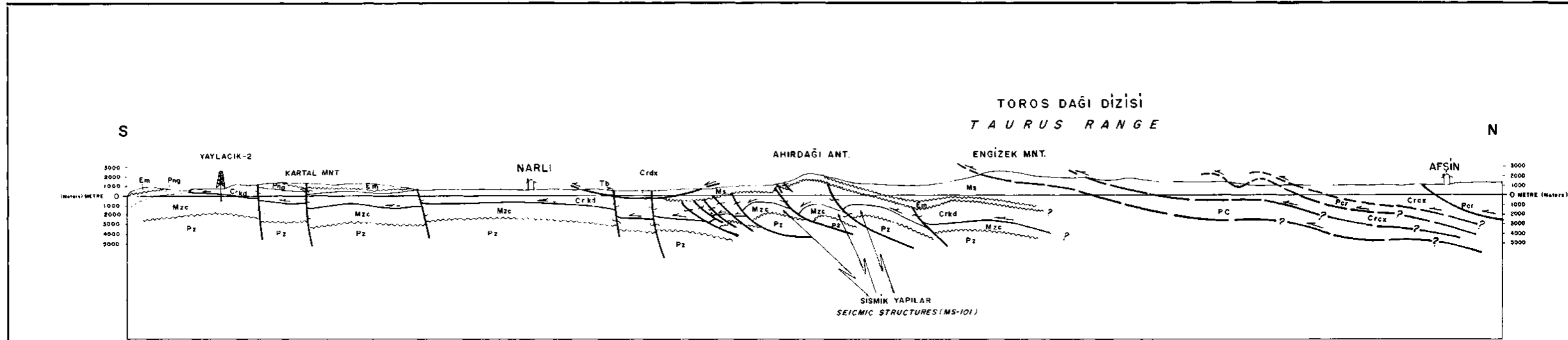
The evaporitic bands which can be seen in the Triassic section will also act as a cap rock levels.

Sayındere and Bozova formations are extremely good cap rocks for the Mardin group. Besides this, it should be mentioned that the Karadut formation, which has a complex mass and that contains serpentine blocks and other impermeable rock levels, is a rock in a broad perspective. As a matter of fact, the formations at the south of the boundary of this gravity slide (zero line) have lost their economic values, but flushing to the north of the zero line is prevented because of this formation (Fig. 1,4).

CONCLUSION

Kahramanmaraş area is in the Arabian Plate from which the oil of Turkey is produced; it contains all of its sediments, and has the same structural properties.

It is rich in the source rock, reservoir rock and cap rock. Eventhough a great portion of south and southeastern Anatolia that is at the south of the 0 (zero) line, where the Upper Cretaceous gravity slide (Karadut formation) ended it, lost its economic value because of its being subject to flushing. The Kahramanmaraş area, in my opinion, has not been subject to flushing and hence has protected its economic potential.



YERLİ KAYA BİRİMLERİ
AUTOCHTHONOUS ROCK UNITS

LEJAND / LEGEND :

Ms	Üst Miosen, Şelmo Fm. <i>U. Miocene, Şelmo Fm.</i>
Em	Orta-Üst Eosen, Midyat Fm. <i>U./M. Eocene, Midyat Fm.</i>
Png	Paleosen, Germav Fm. <i>Paleocene, Germav Fm.</i>
Mzc	Trias-Üst Kretase, Esas Karbonat Serisi <i>Triassic-U. Cretaceous, Main Carbonate Sequence</i>
Pz	Paleozoik, Kambriyen - Permian <i>Paleozoic, Cambrian to Permian</i>

YER DEĞİŞTİRMİŞ KAYA BİRİMLERİ
ALLOCHTHONOUS ROCK UNITS

MIOSEN NAPI
MIOCENE NAPPE (OVERTHRUST SHEET)

Crck	Üst Kretase, Entrüsv Kompleks, Yitme Zorundan Hasıl Olmuş Serpantinler. <i>U. Cretaceous, Intrusive Complex, Mainly Serpentine Derived From The Subduction Zone</i>
PC	Permo-Karbonifer, Anadolu Plakasından Kopmuş Metamorfik Kireçtaşları. <i>Permo-Carboniferous, Metamorphic Limestones Broken Off The Anatolian Plate.</i>
Pcr	Anadolu Plakasından Kopmuş Kristalin Kütleler. <i>Crystalline Rock Slides Broken Off The Anatolian Plate.</i>

ÜST KRETASE GRAVİTE AKMASI
U. CRETACEOUS GRAVITY SLIDE

Crkd	Üst Kretase, Karadut Formasyonu. <i>U. Cretaceous, Karadut Formation.</i>
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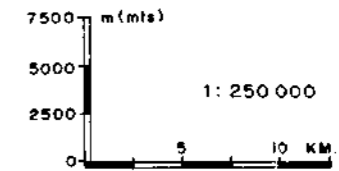


Fig. 7 - Structural cross section through the Yaylacık-2, Ahırdağı anticline (Kahramanmaraş) and Afşin town. Scale 1:250.000.

Previously, it was a serious concern whether or not the anticlines which are seen as mountains at the surface and whose flanks are being represented with limestones, continue at deep/objective levels. In 1986, a seismic line, MS-101, was shot by Placid Oil Company and this proved that the structures do exist under the gravity slide. After more detailed seismic records were taken it is now strongly believed that there might be many more subsurface structures which are ready to be tested within this area.

The wildcat wells would be on the anticlines that are covered by the Midyat limestone, the thicknesses of the sections that are expected to be cut are as follows: Midyat limestone; 150 m., Karadut formation; 2000 m., Sayındere and Bozova formations; 125 m., main carbonate series; 800 m., Permian; 175 m., Devonian; 225 m., Silurian (only Bahçe formation); 525 m.

In view of these thicknesses, in order to reach the Mardin group it will be necessary to drill to 2275 m. If it is necessary to test all of the carbonate series, it would require 3000 m. of drilling program.

In order to test various reservoir levels of Devonian and Silurian/Halityaylası formation it is necessary to drill to 4000m.

At the Haydarlı-2 well with an altitude of 947 m., the Mardin group was reached at minus (-) 738 m. after 1685 m. drilling. At the Ahırdağı anticlinal, a test well would be at approximately plus (+) 2250 m. altitude, and the same group would be reached at minus (-) 25 m. which shows that it is 700 m. higher when compared to the Haydarlı-2 well and this is a very critical advantage for the target level.

It is clearly known that the Elbistan plain, which is located southeast of Sanz, is composed of Miocene nappe materials. Shortly, the autochthon formations of the Kahramanmaraş, Feke, Saimbeyli and Sarız areas which belong to the Arabian Plate, is the same under the nappe cover of the Elbistan plain. This is not an estimation. It may be that it is a late remembrance of this subject matter. Because of this, the emphasis of the geology of these areas is enough for pointing out the geology and hydrocarbon potential of the Elbistan area.

It is the first time that the Elbistan plain seems to be an objective area for hydrocarbon. If positive results are taken from this point then there may emerge new target areas up to the south of Van lake and places that are nearer to the subduction zone.

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