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COMPARISON OF TWO PALEOZOIC DOMAINS IN TURKEY: SAIMBEYLI (ADANA) IN TAURIDES AND ARAC (KASTAMONU) IN PONTIDES

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ABSTRACT

The well preserved Paleozoic outcrops, in Turkey, are rarely seen in some localities mainly in Taurides and only in one location in the western Pontides. One of them, in Taurides, is exposed around the Saimbeyli- Adana area, while that of the western Pontides is seen in the Arac-Kastamonu area.

The Saimbeyli paleozoic domain consists, from bottom to top, of the Emirgazi, Degirmentas, Kerkeztepe and Babadere (Cambrian), Armutludere (Ordovician), Halityaylasi and Puscutepe (Silurian),Ayitepesi (Lower Devonian), Safaktepe (M.Devonian), Gumusali (U.Devonian), Ziyarettepesi (L.Carboniferous) Yigilitepe and Mentes (Permian) formations. All these formations show a thickness of approximately 4000 m. As for the lithology, the lowermost part of the Cambrian sequence, namely Emirgazi formation, consists of purple metasandstone and quartzite. The Degirmentas and Kerkeztepe formations,constituting the middle part of this sequence, are made up of white and black recrystallized dolomitic limestone and red-green crystallized nodular limestone, respectively. The Babadere formation, uppermost part of the sequence, comprises green metasiltstone. The Armutludere formation is composed solely of slates representing well developed foliation. The Halityaylasi and Puscutepe formations are made up of metaconglomerate-quartzite alternation and slates, respectively. Among the Devonian units, both of The Ayitepesi and Gumusali formations consist of the alternation of metasandstone, slate and crystallized limestone, whereas the Safaktepe formation is composed purely of crystallized limestone, red colored conglomerate, sandstone, siltstone and claystone alternation.

The Paleozoic units ranging from Cambrian to Devonian in these two domains are seen to have been effected by a very low-grade metamorphism, whereas the Carboniferous and Permian units of these two regions represent only diagenetic conditions. As for the main structural elements, such as folds and faults developed sometimes around lower Cretaceous in these two domains. The Saimbeyli Paleozoic domain has also been affected by some later movements

INTRODUCTION

The aim of this paper is to compare the two well preserved Paleozoic sequences in Turkey. One of these two outcrops is seen in Taurus autochtonous in Saimbeyli (Adana) and the other one in the Arac (Kastamonu) area which is only one example in Western Pontides (Fig.1).

The previous studies in the Eastern Taurus Belt were undertaken by Blumenthal (1941,1944,1947), Abdusselamoglu (1959), Demirtasli (1967), Metin et al., (1982), Ozgul et al., (1973), Ozgul (1976), Tekeli (1980), Tutkun (1983,1984)

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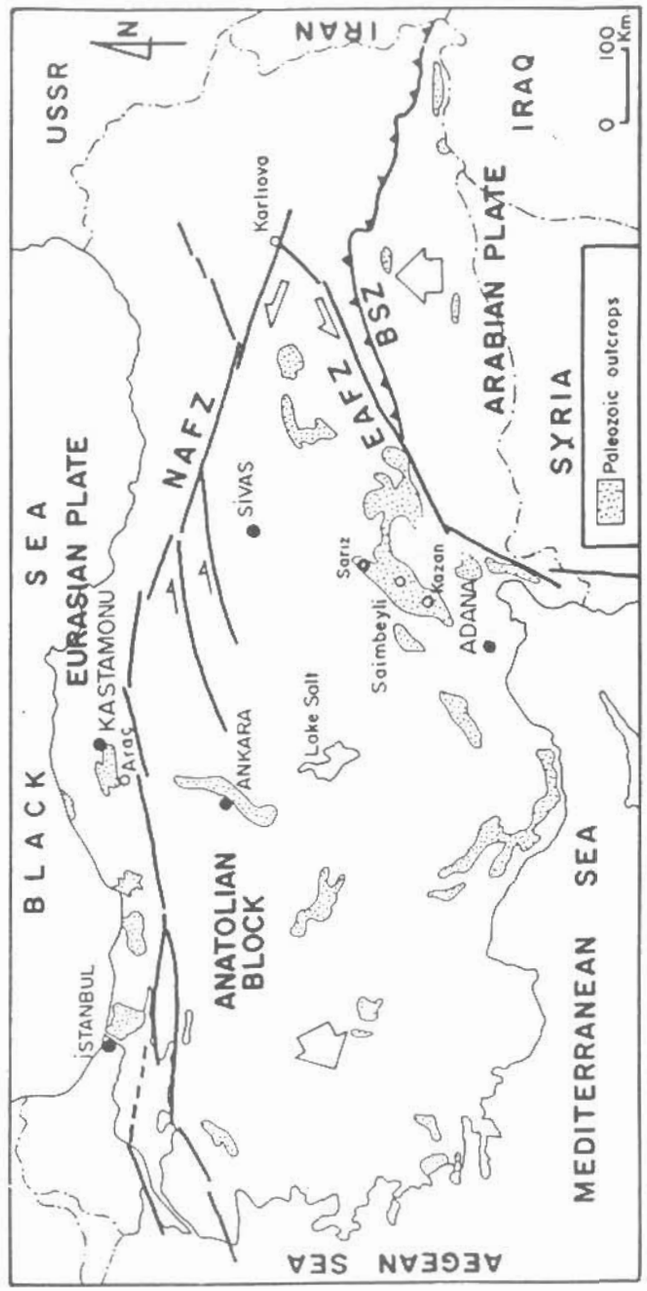

Figure 1. Sketch map showing the locations of the comparative study areaas (Arac and Saimbeyli), the Paleozoic outcrops and the main geotectonical units of Turkey. NAFZ:North Anatolian Fault Zone, EAFZ:East Anatolian Fault Zone, BSZ:Bitlis Suture Zone. The large arrows show the relative motion senses of the plates.

and Metin et al.,(1987).

As for the Western Pontides, the previous general geological studies consist of Blumenthal (1948), Tokay (1952), Gormus (1982) and Aydin et al.,(1986) but some of the recent studies (i.e. Yilmaz,1979,1980; Tuysuz,1986; Boztug,1988,1989) have mostly concerned with the analytical studies of the units in addition to the general geological investigations.

As it is commonly known, the Eastern Mediterranean Region and especially its Anatolian part play an important role for the better understanding of the geological evolution of the Alpine-Himalayan mountain chains (e.g. Dixon & Robertson,1984; Tekeli & Goncuoglu,1983; Le Fort et al., 1986; Poisson,1986).

In this geological context, the pre-lower Mesozoic events in the Anatolian peninsula, have differently been interpreted by various researchers. These different interpretations, of course, have proposed different geological evolution models. For instance, in the available geological-tectonical evolution of the western Pontides related to pre-lower Mesozoic rock units and the paleogeographic position and the subduction polarity of the paleotethyan oceanic domain.

One of those hypotheses great discussions for the pre-Mesozoic evolution of the Anatolian part of the Alpine-Himalayan chain is thought to have been sourced by the lack of the analytical detailed geological data in the global worldwide scaled studies and the well known complexity of this part of the world. In other words, some of these types of large scale studies have not been based on the comparative field data obtained from the type localities representing well preserved outcrops.

In this paper, therefore, the similarities and differences between the two well preserved Paleozoic sequences in Turkey (Saimbeyli-Adana in Taurides and Arac-Kastamonu in Pontides) will be comparatively presented in order to enlighten the pre-Mesozoic development of the Anatolian Peninsula in Paleozoic.

It is believed that such a paper may help to produce new opinions on this subject.

COMPARATIVE CHARACTERISTICS OF THE PALEOZOIC UNITS

All the Paleozoic and older rocks in the two studied areas to be compared in a chronostratigraphic order by means of their lithostratigraphy, partly mineralogical-petrographical features and fossil contents.

PRECAMBRIAN

In the Saimbeyli (Adana) part of the Eastern Taurides, Precambrian basement can not be observed. As for the Arac (Kastamonu) region in the western Pontides, the Precambrian basement is seen under the Cambrian rocks as a well exposed outcrop (Fig.2). These basement rocks, have been recently determined as the Dorukyayla gneiss which consists, from bottom to top, of amphibole-pyroxene gneiss, amphibole-mica gneiss, mica gneiss and quartzo-feldspathic gneiss with some aplite-pegmatite and microdioritic vein rocks. In the northeastern part of the Daday-Devrekani massif (approximatelly 150 km far away from the Arac region), sillimanite-K.feldspar gneiss, amphibole gneiss, amphibole-mica gneiss, mica gneiss, calc-silicate gneiss, calc-silicate marble and diopsite marble have been determined as the Precambrian rocks, namely Daday-Devrekani metasedimentary group by Yilmaz (1981), Boztug et al.,(1984) and Yilmaz & Boztug (1986). All these determinations easily show that the Precambrian rocks of the Arac region have been

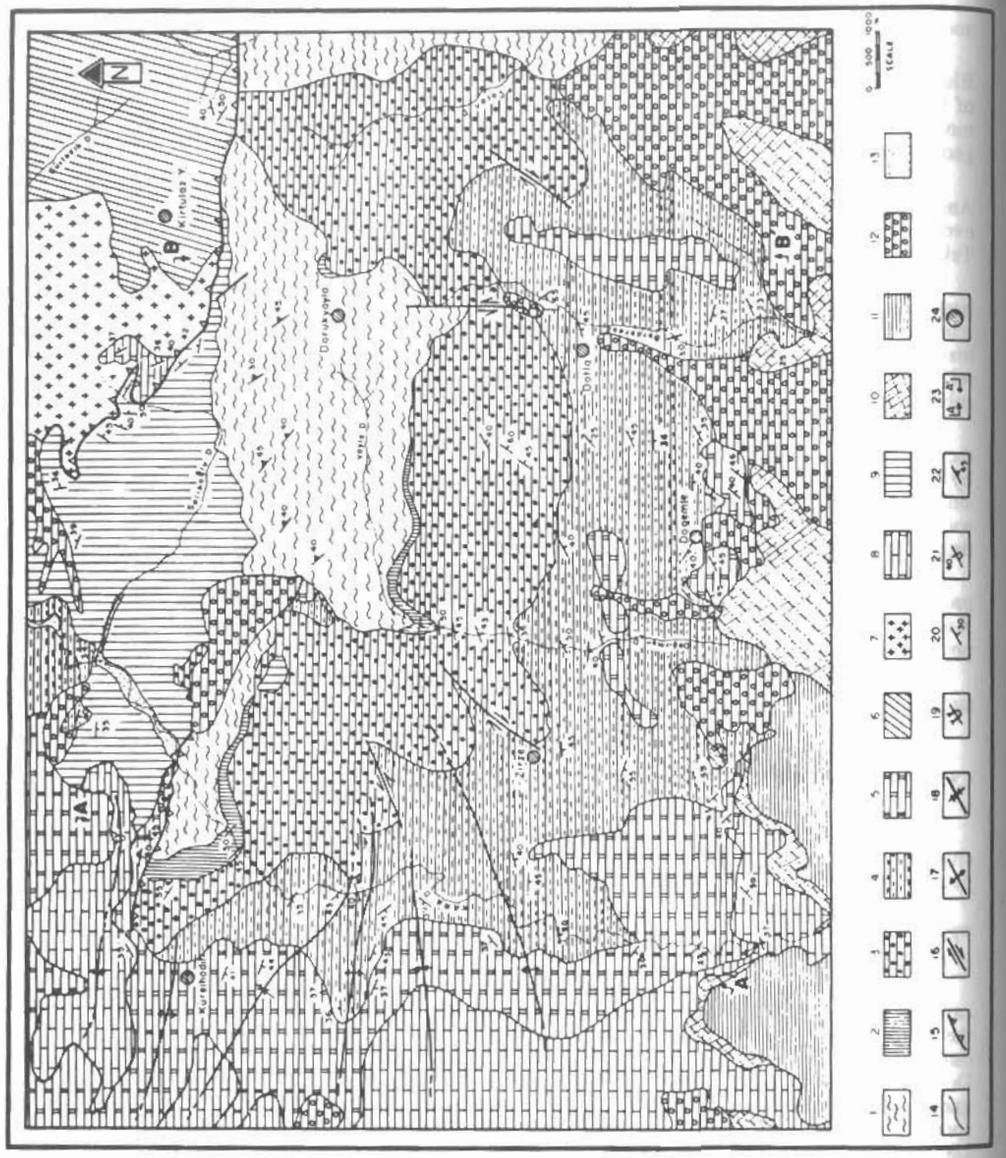

Figure 2. For key see next page

Figure 2. Geological map of the Arac-Kastamonu region (western Pontides). 1: Dorukyayla gneiss (Precambrian), 2: Yayladere formation (Cambrian), 3: Dotla formation (Ordovician), 4: Zirze formation (Silurian),5: Kureihadit formation (Devonian), 6: Kirtulaz formation (? Permian-Triassic),7: Kurek granitoid (Middle Jurassic), 8: Yukarikoy formation (U.Jurassic-L.Cretaceous), 9: Catak formation (L.Cretaceous), 10: Soganli formation (M.Eocene), 11: Cemalettin formation (U.Eocene), 12: Karabuzey formation (Neogene), 13: Quaternary alluvium, 14: Formation boundary, 15: Thrust fault, 16: Strike-slip fault, 17: Anticline axis, 18: Syncline axis, 19: Overturned syncline axis, 20: Strike and dip, 21: Overturned bedding, 22: Foliation, 23: Cross section line, 24: Villages.

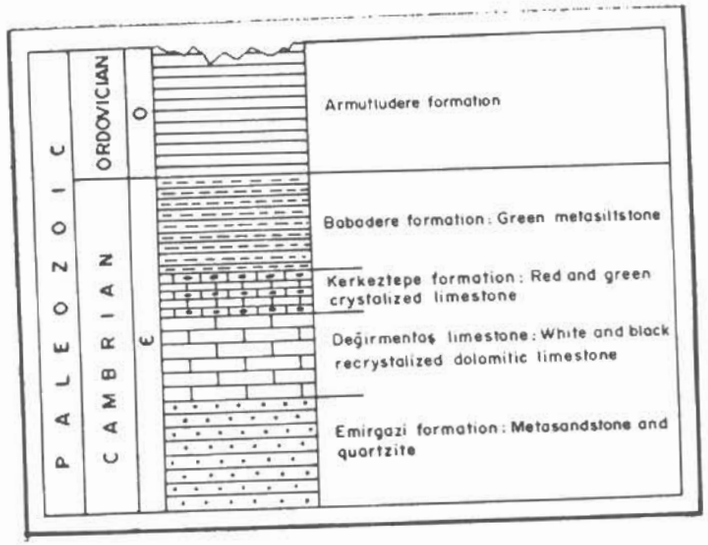

Figure 3. Generalized columnar section of the Cambrian sequence in the Eastern Taurides (After Metin et al.,1987).

formed by high-grade metamorphism before Cambrian.

CAMBRIAN

In the studied part of the Saimbeyli area, Cambrian rocks are not exposed. But in the southern and northern parts of this area around the Sariz and Kozan districts (Fig.1), the Cambrian rocks outcrop in the wide-spread areas (Ozgul et al.,1973; Demirtasli,1967; Ozgul et al., 1972; Metin et al.,1982; Metin,1983; Metin et al.,1987). Lowermost part of the exposed Cambrian in Eastern Taurides is called Emirgazi formation consisting of purple metasandstone and quartzite (Fig.3). In this Cambrian sequence, the Degirmentas white and black recrystallized dolomitic limestone and Kerkeztepe formation comprising red-green crystallized nodular limestone from the middle part. The uppermost part of this sequence is made up of green metasiltstone of the Babadere formation (Metin et al.,1987). In this sequence, Trilobites and primitive Brachiopods (Ozgul et al.,1972) and Lower Cambrian conodonts have been found by Metin (1983).

In the Arac region of Pontides, The Cambrian rocks, called the Yayladere formation, are clearly seen on top of the Precambrian Dorukyayla gneiss with a depositional contact (Figs.2 and 4). The Yayladere formation is made up, from bottom to top, of metaconglomerate, metasandstone, green quartz-slate and red quartz-slate. The mineralogical-petrographical studies based on the clay mineralogy and vitrinite reflectance show that the Yayladere formation has been effected by a very low-grade regional metamorphism (Boztug,1989). Arpat et al., (1979) found some brachiopods representing the Lower Cambrian age in this formation.

From these data, it may be clearly concluded that the Emirgazi and Babadere formations, forming the lowermost and uppermost parts of the Cambrian sequence of the Eastern Taurides, can be correlated with the Yayladere formation by means of lithological similarities. On the other hand, the carbonate deposition of the Cambrian sequence (i.e. Degirmentas limestone and Kerkeztepe formation) in the Eastern Taurides can not be observed in the Cambrian Yayladere formation of the western Pontides which is detrital in character in whole sequence (Figs.3 & 4).

ORDOVICIAN

In the Saimbeyli area, the Ordovician rocks called Armutludere formation (Fig.5), are characterized by the alternation of the blue and gray colored slates and metasiltstones possessing a total thickness up to 800-1500 m (Fig.6). The Armutludere formation includes Trilobites and the species of the primitive Brachiopods and Graptolites (Metin et al.,1982; Metin et al.,1987) yielding Ordovician age. The formation characteristically includes "cone in cone" sedimentary structures.

The Ordovician rocks of the Arac region in the western Pontides, recently called Dotla formation consists mainly of white and gray colored quartzite and rarely of yellowish to brownish slates. The Dotla formation, with a total thickness ranging from 800 to 1000 m., possesses a clay mineral assemblage and vitrinite reflectance data representing typical very low-grade metamorphism conditions (Boztug, 1989) some fossils have been found in the uppermost levels of the Dotla formation representing the Upper Ordovician age. These fossils, resembling with those of the Saimbeyli region, are of trinucleid Trilobite and Brachiopods from the primitive Orthis group.

One can easily conclude that the Ordovician rocks of the Saimbeyli and Arac regions can be correlated with each other especially on the basis of fossil content

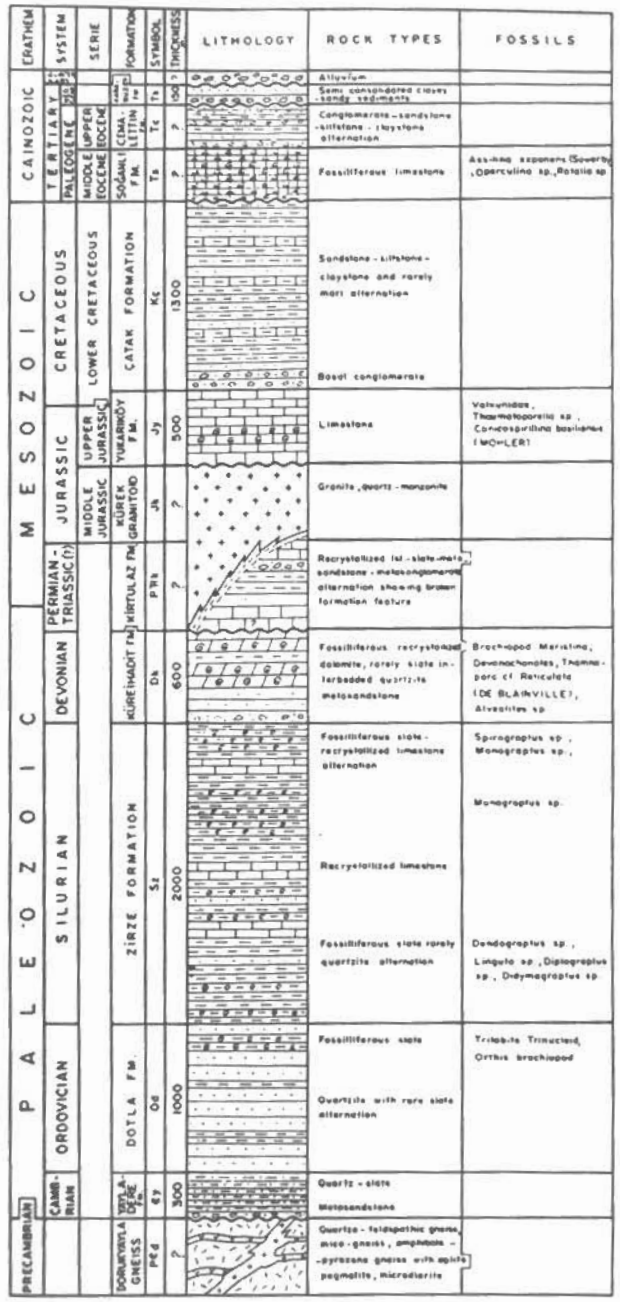

Figure 4. Generalized columnar section of the Arac-Kastamonu region (Western Pontides).

and metamorphism, however, there is a difference in the lithology of the Dotla formation with a prevailing quartzite component.

SILURIAN

In the Saimbeyli area, The Silurian rocks, called Halityaylasi formation, consist of metaconglomerate-quartzite alternation. Apart from this formation, the Puscutepe slate with Monograptus sp., Yukariyayla formation consisting of recrystallized limestone with Orthoceras sp. and Sirdamlar formation comprising slate with metasandstone alternation (Metin et al.,1987) have been determined. In the Eastren Taurides, the Silurian rocks have approximately of 200 m thickness.

As for the Silurian rocks of the Arac region in the western Pontides, they have recently been called Zirze formation with a thickness up to 2000 m. The main lithology of this formation is characterized mostly by black and yellow slates with some fossils such as Dendograptus sp., Lingula sp.,Diplograptus sp.,Didymograptus sp.,Monograptus sp. and Spyrograptus sp. typically yielding Lower, Middle and Upper Silurian. The clay minerals and vitrinite reflectance data from the slates of the Zirze formation show that these rocks have also been affected by the very low-grade regional metamorphism similar to those of the Yayladere (Cambrian) and Dotla (Ordovician) formations. In addition to these slates, some blue and gray limestone and white-grayish black quartzite can be observed as intercalations in the Zirze formation.

As obviously seen from these data, the lithological characteristics and fossil assemblages of the Silurian rocks in the Saimbeyli and Arac regions may be correlated with each other, even though the Silurian rocks in the western Pontides are much thicker than those of the Eastern Taurides.

DEVONIAN

The Devonian rocks have been subdivided into three formations called, from bottom to top, the Ayitepesi, Safaktepe and the Gumusali formations in the Saimbeyli area and even whole Eastern Taurides. The Ayitepesi formation, 400 m in thickness, consists of the alternation of the metasandstone, slate and crystallized limestone with Spirifer cf.undiferus (Roemer), Acrospirifer sp. and Orthoceras sp. yielding Lower Devonian. The Safaktepe formation, 1500 m in thickness, is made up of dolomitic crystallized limestone with Amphypora ramoza (Philips) and Thamnophyllum sp. representing Middle Devonian. The Upper Devonian Gumusali formation, possessing 500 m thickness, comprises metasandstone- slate and crystallized limestone alternation with a fossil association of Spinatripa sp., Cyrtospirifer sp., Cyphoterorhynchus sp. Sartenaer 1964, Hexagonaria sp., Alveolites sp., Disphyllum sp., Zaphrentis sp., Thamnopora sp. and Spirifer sp.

The Devonian rocks in the Arac region of the western Pontides called Kureihadit formation comprising, from bottom to top, metaconglomerate, metasandstone, quartzite, dolomitic recrystallized limestone and slates. The Kureihadit formation, with a totel thickness up to 600 m., can be subdivided into two units e.g., Lower Devonian consisting of metaconglomerate, metasandstone and quartzite; and Upper Devonian made up of dolomitic recrystallized limestone with rarely slate alternation (Aydin et al.,1986). But all these rocks have been mapped as the Kureihadit formation of Devonian age in the Arac region. The clay mineralogy and vitrinite reflectance data from the rarely observed slates of this formation also represent a very low-grade regional metamorphism conditions. The characteristic fossils of the Kureihadit formation are Brachiopod meristina, Devonochonotes, Thamnopora sp., Alveolites sp. and Thamnopora cf. reticulata (De Blainville).

As clearly seen. the Devonian rocks of the Saimbeyli and Arac regions of the Taurides and Pontides, respectively, are similar to each other in lithology, fossil contents and a very low-grade matemorphic nature.

CARBONIFEROUS

In the Saimbeyli area, only the Upper Carboniferous rocks, called the Ziyarettepesi formation have been determined. This formation consists solely of biomicritic limestones including some fossils such as Syringopora sp., Lithostrotion sp., and Chonetes sp. On the other hand, some authors pointed out that the existence of the Lower and Middle Carboniferous rocks, namely the Tuzludere formation and the Kuskayasi sandstone, respectively just around the Saimbeyli region (Metin et al.,1987). While the Tuzludere formation consists from bottom to top of grey-yellow marl and bituminous shale, the Kuskayasi sandstone comprises purely grey colored sandstones.

As for the Carboniferous rocks in the western Pontides, they do not outcrop in and around the Arac region. But they typically outcrop in and around the Zonguldak basin, approximately 100 km far from the north of the Arac region (Fig.1), bearing the well known Carboniferous hard coal measures in Turkey and even in the world. Aydin et al., (1986) describes the Alacaagzi and Zonguldak formation of Lower and Middle-Upper Carboniferous, respectively. Both of these formations consist of gray-yellow conglomerate-sandstone-siltstone with hard coal measures. These alternating rocks include some fossils such as Archaediscus sp., Tetrataxis sp., Goniatites sp., Girvanella sp., Neuropteris schleani, Neuropteris gugentea and syrtosporites sp. (Aydin et al.,1986).

The main similarity between the Carboniferous rocks of the Eastern Taurides and Western Pontides is their diagenetic nature. As for the difference between them, while the Zonguldak region of the Western Pontides includes famously known hard coal measures, the Saimbeyli region of the Eastern Taurides bears only the bituminous shales (Table 1).

PERMIAN

In the Saimbeyli area, the Permian rocks, called the Yigilitepe formation, consist purely of limestones with Mizzia sp., Geinitzina sp., Nankinella sp., Calvezina sp., Waagenophyllum sp., and Frondina sp.

On the other hand, Metin et al.,(1987) have determined the Mentes formation consisting of quartzitic sandstone around the Saimbeyli area.

As for the Arac region of the Western Pontides, The Permian rocks do not expose anywhere. They only outcrop around the Zonguldak basin. Akyol et al.,(1974) determined these rocks as the Cakraz formation consisting of red colored conglomerate-sandstone-siltstone and claystone alternation.

POST-PALEOZOIC UNITS IN THE TWO AREAS

In the Saimbeyli region, post-Paleozoic units can be summarized as below;

The Katarasi formation of Triassic comprises alternating of sandstone- marl and clayey limestone. The Koroglutepesi formation of Upper Jurassic-Lower

TABLE 1

	FORMATION E TAURIDE	FORMATION W PONTIDE	ROCK TYPE E TAURIDE	ROCK TYPE W PONTIDE	FOSSIL CONTENT E TAURIDE	FOSSIL CONTENT W PONTIDE	THICKNESS m E TAURIDE	THICKNESS m W PONTIDE	METAMORPHISM E TAURIDE	METAMORPHISM W PONTIDE
PERMIAN	Yiğilitepe Menteş (1)	Çakraz (2)	Limestone Quartztic sandstone	Claystone Siltstone Sandstone Conglomerate	Mizzia sp. Geinitzina sp. Nankinella sp. Palvezina sp. Waagenophyllum sp.		300	2000	Diagenetic	Diagenetic
CARBONIFEROUS	Zivarettepesi Kuşkayası (1) Tuzludere (1)	Zonguldak (3) Alacaağzı (3)	Biomicritic lst. Sandstone Marl Bituminous sh	Conglomerate Sandstone Siltstone Shale Hard coal	Syringopora sp. Lithostrotion sp. Chonetes sp.	Archaediscus sp. Tetrataxis sp. Goniatites sp. Girvanella sp. Neuropteris schleani Neuropteris gugenrae Cystoporites sp.	500	1500	Diagenetic	Diagenetic
UPPER DEVONIAN	Gümüşali	Mürelhadit	Metasandstone Slate Crystalized limestone	Slate Dolomitic Recrystalized Limestone	Spinatripa sp. Cyrtospirifer sp. Hexagonaria sp. Alveolites sp. Disphyllum sp. Zaphrentis sp. Thamnopora sp. Spirifer sp. Cyrtopterorhyncus sp.	Brachiopod meristina Devonochonetes Thamnopora sp. Alveolites sp. Thamnopora cf. reticulata (De Blainville)	500	600	Very low-grade	Very low-grade
MIDDLE DEVONIAN	Şafaktepe		Dolomitic crystalized Limestone	Quartzite Metasandstone Metaconglomerate	Amphipora ramosa (Phillips) Thamnophyllum sp.		1500		Very low-grade	
LOWER DEVONIAN	Ayitepesi		Metasandstone Slate Crystalized limestone		Spirifer cf. undiferous (Roemer) Orthoceras sp. Acrospirifer sp.		400		Very low-grade	
SILURIAN	Sıradamlar (1) Yukarıyayla (1) Pusçutepe (1) Halityaylası	Zirze	Metasandstone Slate Crystalized limestone Quartzite Metaconglomer.	Quartzite Crystalized limestone Slate	Orthoceras sp. Monograptus sp.	Cyrtograptus sp. Monograptus sp. Didymograptus sp. Diplograptus sp. Dendrograptus sp. Lingula sp.	200	2000	Very low-grade	Very low-grade
ORDOVICIAN	Armutludere	Dotla	Slate Metasiltstone	Quartzite Slate	Graptolites sp. Prim.Brachiopod Trilobites sp.	Primitive Brachiopods(Orthis group) Trinucleid trilobite.	800-1500	800-1000	Very low-grade	Very low-grade
CAMBRIAN	Babadere (1) Kerkeztepe (1) Değirmentaş (1) Emirgazi (1)	Vayladere	Metasiltstone Cristalized nodular lmst. Metasandstone Quartzite	Quartz-Slate Metasandstone Metaconglomerate.	Conodonts Brachiopods Trilobites sp.	Brachiopods	?	300-400	Very low-grade	Very low-grade
PRECAMBRIAN	—	Dorukyayla gneiss Daday-Devrekani metased. group	—	Sillimanite-mica gneiss. Amphibol-Pyroxene gneiss.	—	—	—	?	—	High-grade

Table 1. Comparison of the Paleozoic units in the Saimbeyli-Adana (Eastern Taurides) and Arac-Kastamonu (Western Pontides)regions.
1:From Metin et al., (1987) 2:From Akyol et al., (1974) 3:From Aydin et al., (1986)

Cretaceous and the Yaniktepe formation of Upper Cretaceous are characterized by the fossiliferous limestones. The Cenozoic units in this area, consist, from bottom to top, of the alternating of clayey limestone, sandstone and marl of the Hocabet formation, Paleocene-Eocene in age and the conglomerates of the Sumbuldag formation, Miocene in age (Figs.5,6).

As for the Arac region, in the Western Pontides, the oldest units of the post-Paleozoic cover is the Kirtulaz formation of (?) Permo-Triassic consisting of the recrystallized limestone, slate, metasandstone and metaconglomerate showing also broken formation structure. The Middle Jurassic Kurek granitoid is one of the members of the arc-related Kastamonu granitoid belt (Yilmaz & Boztug,1986). The Upper Jurassic- Lower Cretaceous fossiliferous limestones of the Yukarikoy formation and the Lower Cretaceous flyschoidal rocks of the Catak formation constitute the sedimentary units of the within arc basins developed sometimes between Upper Jurassic and Lower Cretaceous periods. The Tertiary units, from bottom to top, are the fossiliferous limestone of the Soganli formation of Middle Eocene, the alternation of the conglomerate, sandstone, siltstone and claystone of the Cemalettin formation of Upper Eocene and semi-consolidated clayey-sandy sediments of the Karabuzey formation of Neogene (Figs.2,4).

COMPARATIVE STRUCTURAL FEATURES OF THE TWO AREAS

In the Saimbeyli area of the Eastern Taurides, all the rock units ranging from Ordovician to Lower Cretaceous in age have been folded and faulted in the NE-SW direction. These structural elements (folds, overturned folds, oblique faults, thrust faults and overthrusts) therefore, are thought to have been synchronously developed sometimes around Lower Cretaceous (Fig.5).

As for the Arac region, the structural elements are assumed to have been created in the pre-Alpine and Alpine periods. The foliation planes in the pre-Cambrian aged Dorukyayla gneiss are the products of the pre-Alpine deformation. The structural elements of the Alpine period, are the fold axis, thrust faults and strike-slip faults affecting all the rock units from Ordovician to Lower Cretaceous. While the trend of the fold axis and thrust faults is E-W, the strike-slip faults trend at NE-SW (Fig.2). These Alpine structural elements in the Arac region, are considered to develope synchronously due presumably to N-S compressional regime created both by the main subduction zone in the south of the Arac region (Boztug,1988) and the back-arc opening of the Black Sea Basin (Le Touzey et al.,1977) in the north of the Arac region sometimes around Lower Cretaceous.

In the Saimbeyli area, although recent trends of the structural elements such as folds and faults are in NE-SW direction, just before Lower Cretaceous, the trends of the main mountain chain axe and the structural elements should have been approximately in the E-W direction. That N-S oriented compressional regime and its products at that time have changed into NE-SW direction by the later northward movement of the Arabian plate subducting beneath the southeastren part of the Anatolian plate along the Bitlis Suture Zone. Besides, the yearly northward movement velocity of the Arabian plate is bigger than that of the African plate as it is clearly seen from the NE twisting of the eastern part of the Taurides and the left lateral offset in the Dead Sea Transform.

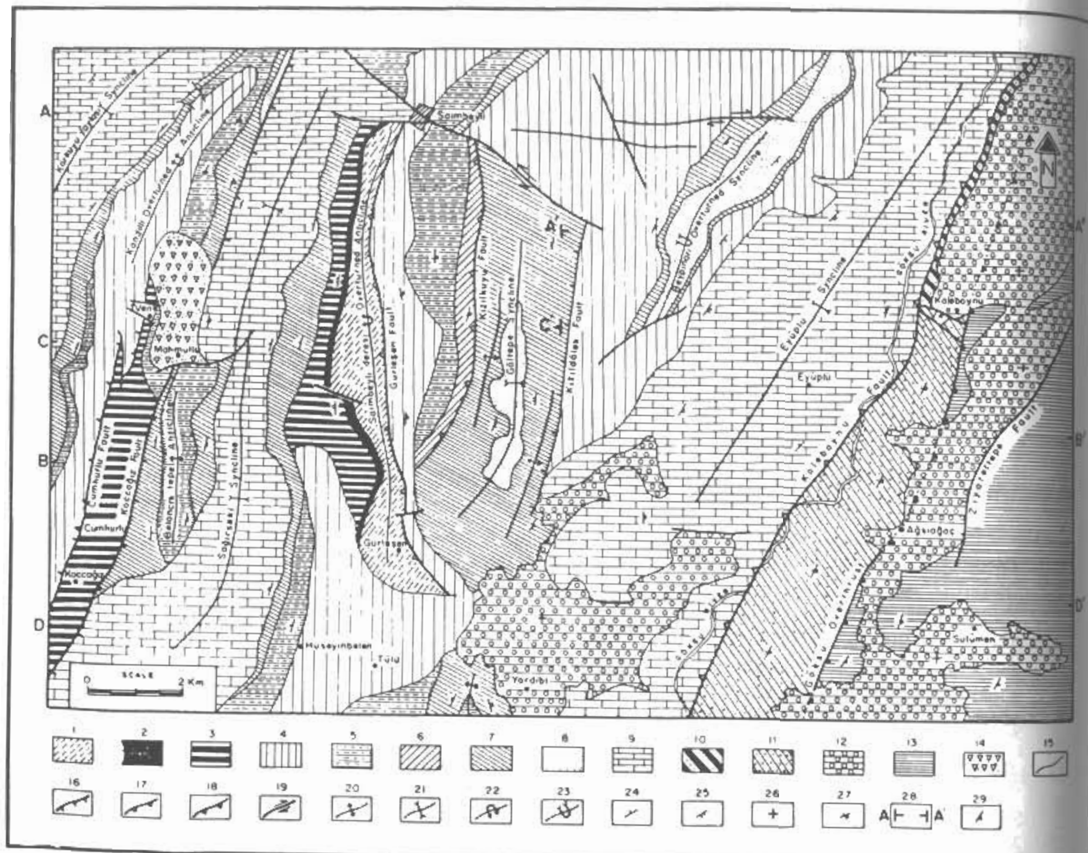

Figure 5. Geological map of the Saimbeyli-Adana region (Eastern Taurides) 1: Armutludere formation (Ordovician), 2: Halityaylasi formation (Silurian), 3: Ayitepesi formation (L.Devonian), 4: Safaktepe formation (M.Devonian), 5: Gumusali formation (U.Devonian), 6: Ziyarettepesi formation (Carboniferous), 7: Yigilitepe formation (Permian), 8: Katarasi formation (Triassic), 9: Koroglutepesi formation (U.Jurassic-L.Cretaceous), 10: Yaniktepe limestone (U.Cretaceous), 11: Hocabet formation (Paleocene-Eocene), 12: Sumbuldagi formation (Miocene), 13: Allochtonous Binboga massif (Devonian-Cretaceous), 14: Talus-Alluvium (Quaternary), 15: Formation boundary, 16: Oblique fault, 17: Thrust fault, 18: Overthrust, 19: Strike- slip fault, 20: Anticline axis, 21: Syncline axis, 22: Overturned anticline axis, 23: Overturned syncline axis, 24: Strike and dip (0-30), 25: strike and dip (30-60), 26: Horizontal bedding, 27: Overturned bedding, 28: Cross sect.Line, 29: Foliation.

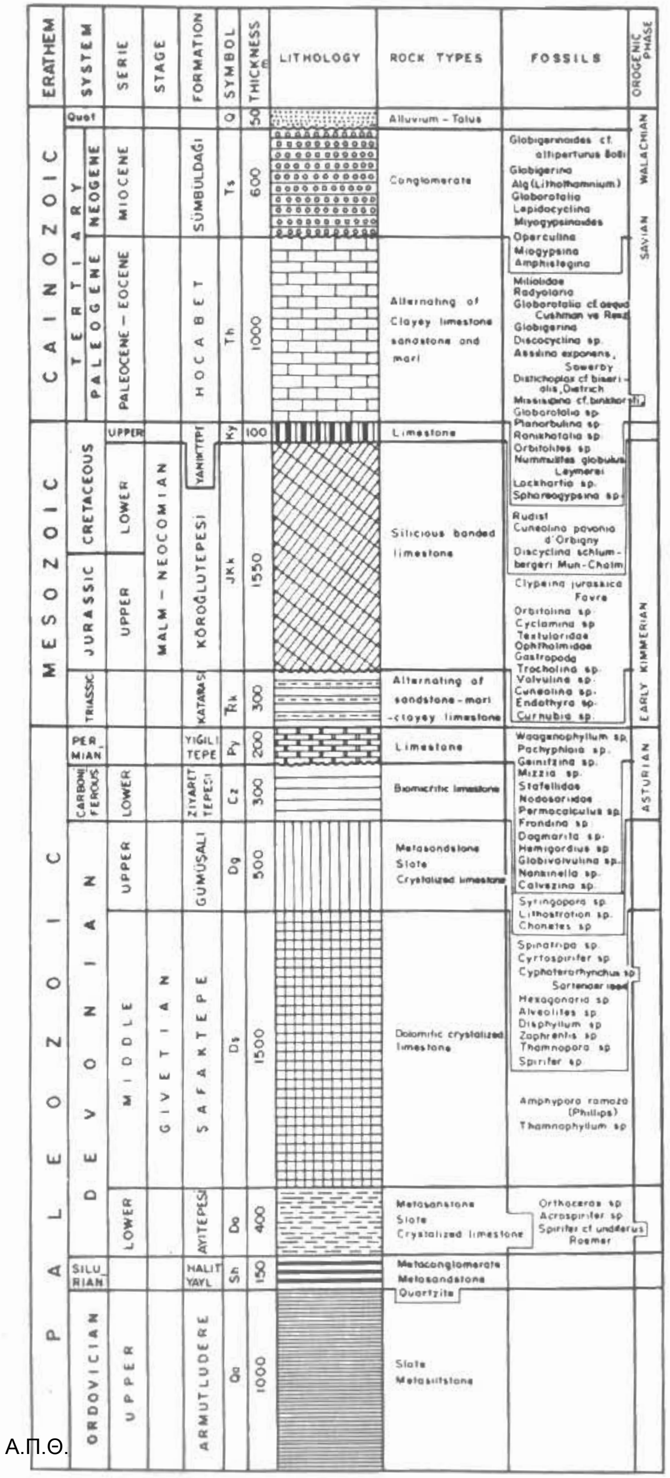

Figure 6. Generalized columnar section of the Saimbeyli-Adana region (Eastern Taurides).

CONCLUSION AND DISCUSSION

Before looking at the similarities and differences between the Paleozoic rocks of the Saimbeyli and Arac regions of the Eastern Taurides and Western Pontides, respectively, it is necessary to remind that all those rocks are deposited somewhere before the breaking up of the Pangea (Dietz and Holden,1970). However, Boztug et al.(1984) and Yilmaz and Boztug (1986) suggested that the Precambrian and older rocks units in the Kastamonu region of the Western Pontides should belong to the southernmost dip of the Eurasian plate before the beginning of Middle Jurassic (see Fig.4 , Yilmaz and Boztug,1986). As for the eastern part, including the Saimbeyli area, of the Taurus belt, it is commonly known that this part of the Anatolian Peninsula has been deposited in an environment belonging to the Gondwanaland platform in the pre-Mesozoic time (Sengor,1984).

The comparative study of the Paleozoic rocks of the Saimbeyli and Arac regions of the Easternn Taurides and Western Pontides, respectively, show that the Cambrian rocks are similar to each other except the carbonate deposition in the Saimbeyli area (Table 1). The Ordovician rocks in these two domains include almost the same lithology and fossil contents. There are some differences between the rock types and thicknesses of the Silurian rocks in these two area, but having the similar fossil contents (Table 1). The Devonian rocks of these two regions possess similar rock types, but they differ from each other by their thicknesses and partly their fossil contents (Table 1). There is a slightly difference between the rock types and thicknesses of the Carboniferous rocks of the Eastern Taurides and Western Pontides. In addition to this difference, the Carboniferous rocks of the Western Pontides bear the famously known hard coal measures instead of the bituminous shales of the Eastren Taurides (Table 1). The Permian rocks of these two regions also show some differences in their lithology and thicknesses. As clearly seen from data in Table 1, the main similarity of the Paleozoic rocks from Cambrian to Devonian, in these two domains, is their very low-grade metamorphic nature. Besides this big similarity, the lithologic characteristics and fossil contents of the Paleozoic rocks, ranging from Cambrian to Devonian in age, are also similar (Table 1). After Devonian, The Carboniferous and Permian rocks have the same diagenetic depositional character.

All these data may show that the Paleozoic rocks of the Saimbeyli and Arac regions, might have been deposited in the similar environments or similar facieses close to each other before the breaking up of the Pangea i.e. before the forming of the Eurasian plate and Gondwanaland platform. They also have not been strongly affected by the metamorphic events in the Alpine phase.

Neither Saimbeyli nor Arac Paleozoic sequence has structural elements older than Alpine period. Both of those two Paleozoic domains have been folded and faulted sometimes around Lower Cretaceous tectonics, has been affected by some later events which caused the changement of the primary structural elements into a trend of NE-SW direction.

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REFERENCES

Abdusselamoglu,S.,1959, Yukari Seyhan Bolgesinde Dogu Toroslarin jeolojik etudu. *MTA Derleme Rap.No.2668*, Ankara.

Adamia,S.A.,Bergougnan.H.,Fourquin,C.,Haghipour,A., Lordkipanitze,M.D.,Ozgul,N.,Ricou,L.E. and Zakariadze,G.S., 1980, The Alpine Middle east between the Aegean and the Oman traverses:*International Geological Congress, 26th, colloque C5, Geology of the Alpine chains born of Tethys: Memorie du Bureau de recherce Geologiques et Minieres*, no.115,p.122-136.

Akyol,Z.,Arpat,E.,Erdogan,B.,Goger,E.,Guner,Y.,Saroglu,F., Senturk,I.,Tutuncu,K., and Uysal,S.,1974, Cide Kuruca Sile dolaylarinin jeoloji haritasi.*MTA Turkiye Buyuk Olcekli Jeoloji Haritalari Servisi*,Ankara.

Arpat,E.,Tutuncu,K.,and Uysal,S.,1978, Safranbolu yoresinde Kambriyen-Devoniyen istifi: *Turkiye Jeol.Kur.32. Bilimsel Teknik Kurultayi, Bildiri Ozetleri*,s.67,Ankara.

Aydin,M.,Sahinturk,O.,Serdar,H.S.,Ozcelik,Y.,Akarsu,I. Ungor,A.,Cokugras,R. and Kasar,S.,1986, Ballidag-Cangaldagi (Kastamonu) arasindaki bolgenin jeolojisi.*Turkiye Jeoloji Kur. Bult.*.,29,1-16, Ankara.

Bergougnan,H. & Fourquin,C.,1982, Discussion of "Remnants of a pre-Late Jurassic Ocean in northern Turkey: Fragments of Permian- Triassic paleo-Tethys?".*Geol.Soc.Am.Bull.*, 93,929-932.

Blumenthal,M.M.,1941, Nigde-Adana vilayetleri dahilinde Toroslarin jeolojisine umumi bakis.*MTA Derleme Rap.No.6*, s.49, Ankara

Blumenthal,M.M.,1944, Kayseri ile Malatya Arasinda Toros Bolumunun Permo-Karbonifer Arazisi.*MTA Derleme Rap.No.1/31*, s.105-118, Ankara.

Blumenthal,M.M.,1947, Seydisehir-Beysehir Hinterlandindaki Toros Daglarinin Jeolojisi.*MTA Derleme Rap.No.2*,242 s. Ankara.

Blumenthal,M.M.,1948, Bolu civari ile Asagi Kizilirmak Mecrasi arasindaki Kuzey Anadolu silsilelerinin jeolojisi.*MTA yayini*. B-13, Ankara.

Boztug,D.,Debon,F.,Le Fort,P. and Yilmaz,O.,1984, Geochemical characteristics of some plutons from the Kastamonu Granitoid Belt (northern Anatolia,Turkey).*Schweiz.mineral.petrogr.Mitt.*, 64,389-403.

Boztug,D.,1988, Daday-Devrekani Masifi guneybati kesiminin mineralojik-petrografik ve jeokimyasal incelenmesi. (PhD thesis).*Hacettepe University,Dept.of Geology*,Ankara. (unpublished)

Boztug,D.,1989, Clay mineralogy and vitrinite reflectance of the Paleozoic and Mesozoic shales forming the epicontinental cover of Eurasian plate in Kastamonu region,western Pontides,Turkey.*Terra Abstracts, V.1,No.1,EUG V Strasbourg,20-23 March,1989*, OS 03-52, p.311.

Demirtasli,E.,1967, Pinarbasi-Sariz-Magara ilceleri arasindaki sahanin litostratigrafi birimleri ve petrol imkanlari.*MTA Derleme Rap.No. 4389*, Ankara.

Dietz,R.S. & Holden,J.C.,1970, The Break up of Pangea. Continents Adrift and Continents Aground, with introductions by J.Tuzo Wilson, *Scientific American*,p.126-137.

Dixon,J.E. & Robertson,A.H.F.(eds),1984, The Geological evolution of the eastern Mediterranean.*Geol.Soc.London.spec.publ.*17,848p.

Gormus,S.,1982, Yigilca (Bolu KB) yoresinin stratigrafisi*Yerbilimleri*,9,91-110,Ankara.

Le Fort,P.,Colchen,M. and Montenat,C. (eds),1986, Orogenic evolution of southern Asia (from Turkey to Indonesia).*Memories Sciences de la Terre*,No.47,429p.

Letouzey,J.,Biju-Duval,B.,Dorkel,A.,Gonnard,R.,Kristchev,K., Motadert,L. and Sungurlu,O.,1977, The Black Sea: A marginal basin-Geophysical and geological data, in Biju-Duval,B. and Montadert,L. (eds),*Structural history of the Mediterranean basins*. Editions Technip, Paris,p.363-376.

Metin,S.,Papak,I.,Keskin,H.,Ozsoy,I.,Polat,N.,Altun,I., Inanc,A.,Haznedar,H.,Konuk,O., and Karabalik,N.N.,1982, Tufanbeyli-Sariz-Goksun- Saimbeyli arasinin jeolojisi.*MTA Derleme Rap.No.7129*,Ankara.

Metin,S.,1983, Dogu Toroslarda Derebasi (Develi), Armutalan ve Gedikli (Saimbeyli) Koyleri arasinin jeolojisi.(PhD thesis), *University of Istanbul, Dept.of Geology*,Istanbul.

Metin,S.,Ayhan,A. and Papak,I.,1987, Dogu Toroslarin bati kesiminin jeolojisi (GGD Turkiye).*MTA Derg*. 107, 1-12, Ankara.

Ozgul,N.,Metin,S. and Dean,W.T.,1972, Dogu Toroslarda Tufanbeyli ilcesi (Adana) dolayinin Alt Paleozoyik stratigrafisi ve faunasi.*MTA Derg*. 79, Ankara.

Ozgul,N.,Metin,S.,Goger,I.,Bingol,I. and Baydar,O.,1973, Tufanbeyli dolayinin Kambriyen-Tersiyer kayalari.*Turkiye Jeol.Kur.Bult*. 16/1,82-101,Ankara.

Ozgul.N.,1976, Toroslarin Bazi Temel Jeoloji Ozellikleri.*Turkiye Jeol.Kur.Bult*.,19/1, Ankara

Poisson,A.,1986, The Anatolian Micro-continent in the Eastren Mediterranean Context. The Neotethysian Oceanic Throughs.*Sciences de la Terre, Memorie* 47, pp.311-328.

Sengor,A.M.C.,Yilmaz,Y. and Ketin,I.,1980, Remnants of a pre-Late jurassic ocean in northern Turkey: Fragments of Permian-Triassic paleo-Tethys?.*Geol.Soc.Am.Bull*. 91,599-609.

Sengor,A.M.C.,1984, The Cimmeride Orogenic System and the Tectonics of Eurasia.*Geol.Soc.Am.Special Paper*, 195, 82 p.

Sengun,M.,Acar,S.,Akat,U.,Akcoren,F.,Altun,I.,Armagan,F., Deveciler,E.,Erdogan,K.,Keskin,H. and Sevin,M.,1987, Paleotetis'in konumu ve tukenisi.*Turkiye Jeol.Kurultayi-1987, Bildiri Ozetleri* , s.2.

Tekeli,O.,1980, Toroslarda Aladaglarin Yapisal Evrimi.*Turkiye Jeol. Kur.Bult*.,23/1, Ankara.

Tekeli,O. & Goncuoglu,M.C. (eds),1983, Geology of the Taurus Belt, *Proceedings. International Symposium on the Geology of the Taurus Belt,1983*, Ankara, 342p.

Tokay,M.,1952, Karadeniz Ereglisi-Alapli-Kiziltepe-Alacaagzi Bolgesi Jeolojisi.*MTA Mecmuasi*, 42/43, 35-78,Ankara.

Tutkun,S.Z.,1983, Saimbeyli (Adana) Yoresinin Jeolojisi ve Tektonik Ozellikleri. (PhD thesis),*Univ.of Ankara,Dept.of Geology*,Ankara, (unpublished).

Tutkun,S.Z.,1984, Saimbeyli (Adana) Yoresinin Stratigrafisi.*C.U. Muh.Fak.Derg.Seri A, Yerbilimleri*, 1/1,31-41, Sivas.

Tuysuz,O.,1986, Kuzey Anadolu'da iki farkli ofiyolit toplulugu: Eski ve yeni Tetis'in artiklari.*Doga TU. Muh.ve Cev*., 10/2, 172-179, Ankara.

Yilmaz,O.,1979, Daday-Devrekani Masifi Kuzeydogu kesimi metamorfitleri. Docentlik tezi,*Hacettepe Univ*., Ankara. (unpublished).

Yilmaz,O.,1980, Daday-Devrekani Masifi kuzeydogu kesimi litostratigrafi birimleri ve tektonigi.*Yerbilimleri*,5/6,101-135,Ankara.

Yilmaz,O.,1981, Daday-Devrekani Masif Ebrek metamorfitinin petrografisi ve tum kayac kimyasi.*Yerbilimleri*, 8,71-82, Ankara.

Yilmaz,O. & Boztug,D.,1986, Kastamonu Granitoid Belt of Northern Turkey: First arc plutonism product related to the subduction of the paleo-Tethys.*Geology*, 14,179-183.