PRE-MEETING FIELD TRIP (1)

EIGHTH INTERNATIONAL CONGRESS ON RUDISTS
CRETACEOUS RUDISTS AND CARBONATE PLATFORMS
June 23-25, 2008, İzmir-Turkey

IRC 8
EXCURSION GUIDE

Pre-meeting Field Trip (1)
18-22 June, 2008

Campanian-Maastrichtian rudist-bearing mixed silisiclastic-carbonate transgressive-regressive systems tracts of the eastern and southeastern Anatolia: faunal correlation, depositional facies and palaeobigeographic significance

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Front cover photographs:
Rudist level constructed mainly by *Joufia reticulata* Boehm in growth position and dominated by *Colverai variabilis* Klinghardt and *Pseodosabinia sp.,* Yazıhan-Malatya, eastern Anatolia.

Back cover:
Field Trip route map

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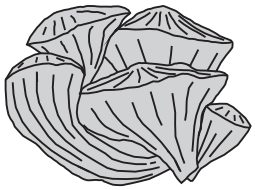
CAMPANIAN-MAASTRICHTIAN RUDIST-BEARING MIXED SILISICLASTIC-CARBONATE TRANSGRESSIVE-REGRESSIVE SYSTEMS TRACTS OF THE EASTERN AND SOUTHEASTERN ANATOLIA: FAUNAL CORRELATION, DEPOSITIONAL FACIES AND PALAEOBIGEOGRAPHIC SIGNIFICANCE



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INTRODUCTION

Five major micro-continental fragments are recognized in Turkey (Şengör and Yılmaz, 1981). These are, from north to south, the Rhodope-Pontide fragment, the Sakarya Continent, the Kırşehir Block, the Anatolide-Tauride Block and the Arabian Plate (Fig. 1a). The Rhodope-Pontide fragment is separeted by the İzmir-Ankara-Erzincan Suture Zone from the Kırşehir Block and Anatolide-Tauride Block. The Arabian platform (plate) is in contact with the Anatolide-Tauride Block along the Bitlis-Zagros Suture Zone. These suture zones were created by the northward subduction and collision processes along the northern and southern branches of the Neotethys Ocean during the Late Cretaceous-Tertiary (Ricou, 1971; Perinçek and Özkaya, 1981; Şengör and Yılmaz, 1981; Görür et al., 1984; Altıner, 1989; Yılmaz, 1993; Yılmaz and Yiğitbaş, 1991; Yılmaz et al., 1993; Yiğitbaş and Yılmaz, 1996; Elmas and Yılmaz, 2003).

In this field trip, the Malatya Basin in the east of the Anatolide-Tauride Block, and Kahta-Adıyaman area in the northernmost part of the Arabian platform will be studied (Fig. 1a). In these areas, a mixed siliciclastic-carbonate transgressive sequence showing similar lithological characters will be examined. The transgressive sequence consists of from bottom to top, reddish clastics, rudist-bearing limestones and pelagic mudstones, all deposited during Campanian-Maastrichtian time. However, the rudist faunas of these two regions consists of the remarkably different genera and species, as discussed below.

FIELD TRIP ITINERARY

The geological setting and the description of the stops of the Malatya and Kahta-Adıyaman areas are as follow:

1. MALATYA BASIN:

The latest Cretaceous-Paleocene Malatya Basin developed over a nappe zone that consists of a lower nappe unit (ophiolitic rocks of the Yüksekova Group) and an upper unit (Malatya Metamorphics) representing a stack of thrust sheets (Yılmaz, 1993; Elmas and Yılmaz, 2003; Yılmaz et al., 1993 a; Yiğitbaş and Yılmaz, 1996). The ophiolitic rocks of the lower nappe unit are outcropping widely in the central and northern parts of the Malatya Basin, around Hekimhan-Yazıhan-Darende-Balaban. The metamorphic rocks of the upper nappe unit are observed only in the southern part of the basin, in the surroundings of Yeşilyurt (Fig. 1b).

According to long-established geological knowledges, the rudists are widespread and very abundant in the Campanian-Maastrictian transgressive-regressive systems tracts of the Malatya Basin. The paleontology of the rudists (Karacabey, 1969, 1970,1972,1974; Karacabey-Öztemür, 1976, 1979,1980, 1981; Özer, 1988 a, b, 1992d, 2002, 2006), the stratigraphy, tectonic and depositional patterns were studied by several authors (Blumenthal, 1938; Stchepinsky, 1944; Ayan and Bulut, 1964; Akkuş, 1971; İzdar and Ünlü, 1985; Gözübol and Önal, 1986; Yazgan and Chessex, 1991; Görmüş, 1990, 1994; Görmüş et al., 2001; Önal and Gözübol, 1992; Yılmaz, 1993; Yılmaz et al., 1993; Gürer, 1966; Bozkaya, 1991; Bozkaya and Yalçın, 1992; Yiğitbaş and Yılmaz, 1996; Demir, 1997; Elmas and Yılmaz, 2003). This area was also proposed as a center of endemic rudist associations in the eastern part of the Mediterranean province (Kauffmann, 1973; Özer, 1992a,b,c, 2006).

We will visit four stops in the middle and northern part of the Malatya Basin around Yazıhan and Hekimhan; the first three stops are in the transgressive sequence and stop-4 is concerned with the regressive sequence (Fig. 1b). We will also study an excellent outcrop of the transgressive sequence in the southern part of the Malatya Basin, close to Yeşilyurt (stop-5).

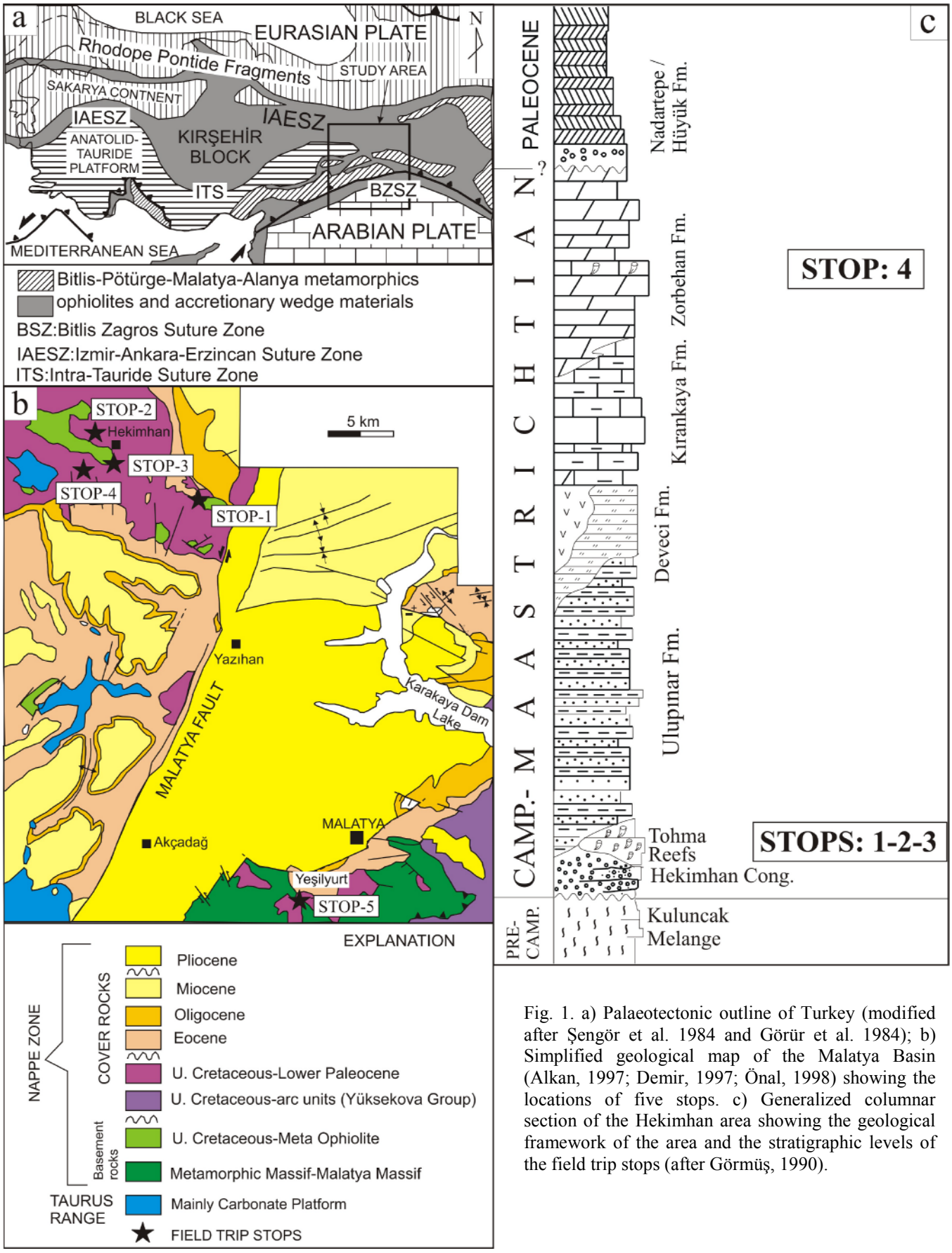

Fig. 1. a) Palaeotectonic outline of Turkey (modified after Şengör et al. 1984 and Görür et al. 1984); b) Simplified geological map of the Malatya Basin (Alkan, 1997; Demir, 1997; Önal, 1998) showing the locations of five stops. c) Generalized columnar section of the Hekimhan area showing the geological framework of the area and the stratigraphic levels of the field trip stops (after Görmüş, 1990).

DAY-1: June 19th, 2008

a) Yazıhan-Malatya area:

Stop-1: North of Yazıhan-Malatya

This stop is in the north of Yazıhan town (Fig. 1b). We will examine the classical the three characteristic formations of the Campanian-Maastrichtian transgressive sequence, unconformably overlying the metaophiolitic rocks (Fig. 2): reddish conglomerates and -sandstones (Hekimhan Conglomerates), -rudist-bearing sandy limestones (Tohma Reefs), and pelagic mudstones (Ulupınar Formation).

The reddish conglomerates and sandstones of the Hekimhan Conglomerates gradually pass upward into the rudist-bearing Tohma Reefs with a remarkable development of rudists. *Joufia* and *Balabania* are particularly abundant, but, *Colveraia, Pseudosabinia, Pironaea* and small hippuritids are also observed. From bottom to top, the following rudist levels can be distinguished (Fig. 3):

- *Balabania* level: The 10 m- thick, cream-coloured mudstones, sandstones, and muddy limestones are characterized by the abundance of *Balabania* (Fig. 4), but small hippuritids are also present. *Balabania* is frequently preserved in growth position and specimens have been assigned to *Balabania densicostata* Karacabey-Öztemür and *Balabania acuticostata* Karacabey-Öztemür. The small hippuritids are represented by the *Hippurites variabilis* (Munier-Chalmas).

- *Joufia* level: The 1-1.25 m- thick, cream-coloured bioclastic limestone is constructed mainly by *Joufia reticulata* Boehm in growth position (Fig. 5), associated with *Colverai variabilis* Klinghardt and *Pseodosabinia sp.* The specimens belonging to a new genus characterized by the presence of radial and polygonal canals in the left valve can be found in this zone. The new genus will be presented by S.Özer during the rudist meeting,

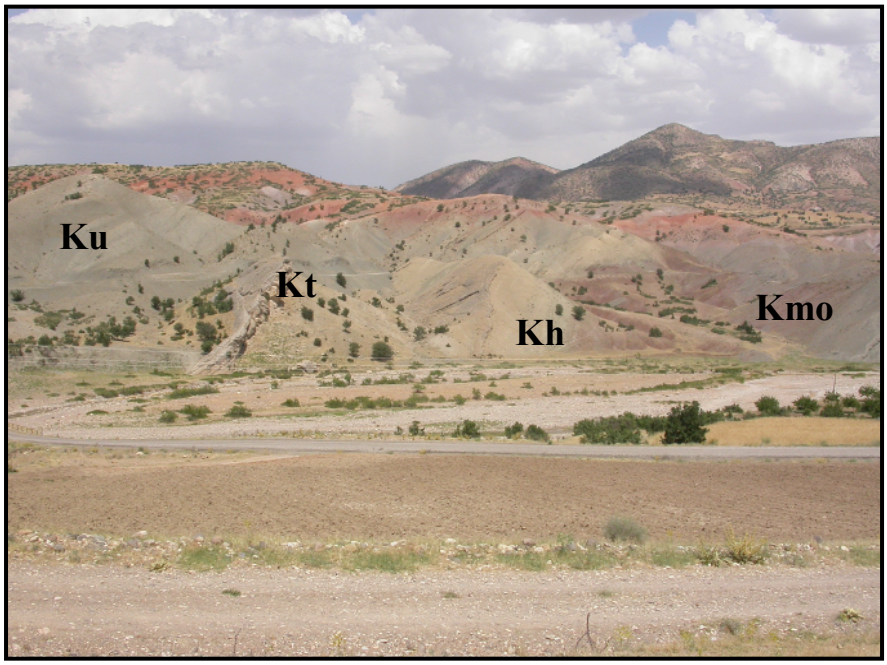

Fig. 2. The transgressive sequence of the Yazıhan area consists of, from bottom to top, the Hekimhan Conglomerates (Kh), Tohma Reefs (Kt) and Ulupınar Formation (Ku) overlying unconformably the metaophiolitic rocks (Kmo) at Stop-1.

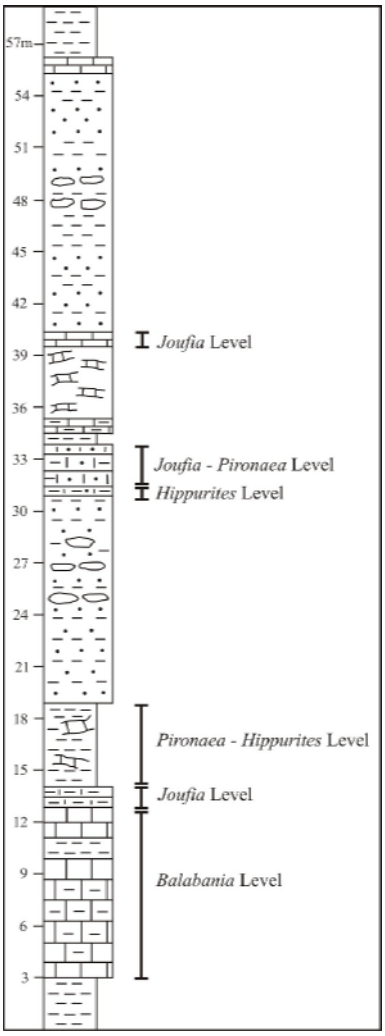

Fig. 3. The measured stratigraphic section showing the separated rudist zones and levels at Stop-1.

Fig. 4. The mudstones, sandstones and muddy limestones rich-in *Balabania* (*Balabania* level) at Stop 1.

Fig. 5. *Joufia* level at Stop-1. Note the beds constructed by abundant *Joufia* specimens in growth position.

Fig. 6. *Pironaea-Hippurites level* at Stop-1. Note the hippuritid specimens in growth position.

- *Pironaea-Hippurites* level: From the 5-m- thick, beige-coloured calcareous mudstones with scattered rudists, *Pironaea polystyla* (Pirona) and *Pironaea anatolica* Karacabey-Öztemür have been determined. Small hippuritids such as *Hippuritella variabilis* (Munier-Chalmas) are also observed (Fig. 6),

- Green-colored sandstones with rare rudists: the 12-15 m- thick sandstones contain very rare rudists such as small hippuritids and in the middle and upper parts of the zone reworked rudist fragments and sand concretations are observed,

- *Hippurites* level: The 0.25-0.30-m- thick, beige-coloured calcareous mudstone and sandstone with small hippuritids (*Hippuritella variabilis* (Munier-Chalmas), *Hippurites lapeirousei* Goldfus),

- *Joufia* and *Pironaea* level*:* The 3-m-thick, beige-colored sandy limestones, calcareous mudstones and sandstones contain *Joufia reticulata* Boehm and *Pironaea* sp. (probably *polystyla)*,

- 1-m-thick, beige coloured calcareous mudstones and sandstones,

- 4-m-thick, beige coloured, massive bioclastic limestones with rudist fragments,

- *Joufia* level: 1-m-thick, beige-coloured limestone with *Joufia reticulata* Boehm,

- More than 45-m-thick, grayish-beige coloured sandstones, and mudstones with probable planktonic foraminifers. In this level, 1-m-thick lenses of sandy limestone with reworked rudist fragments are observed.

Karacabey (1970) determined some hipuritids from the Yazıhan area and suggested a Maastrichtian age. The Sr-istope values of the rudist shells reveal a late Campanian age for the rudist-bearing Tohma Reefs (personal communication with Malte Schlüter, 2008; Schlüter et al., 2008).

b) Hekimhan area-Malatya:

The stratigraphy, biostratigraphy and tectonics of the Hekimhan area have been subject of numerous studies (Blumenthal, 1938; Stchepinsky, 1944; Ayan and Bulut, 1964; Karacabey, 1970; Akkuş, 1971; Karacabey-Öztemür, 1976, 1979, 1980; İzdar and Ünlü, 1985; Gözübol and Önal, 1986; Özer, 1988 a, b, 1992, 2002; Görmüş, 1990, 1994, 1999; Bozkaya, 1991; Bozkaya and Yalçın, 1992; Gürer, 1966; Meriç and İnan, 1997; Meriç and Görmüş, 1997, 1999, 2001; Görmüş et al., 2001). The region is characterized by the unique presence of both, the transgressive and the following regressive sequence of the Malatya Basin. Rudists are very abundants in the Tohma Reefs of the transgressive sequence, while they are rare in the Zorbehan Formation of the regressive sequence (Fig. 1c).

We will investigate three stops in the Hekimhan area, the first two stops at outcrops of the transgressive sequence, and the third stop in the regressive sequence (Fig. 1b).

Stop-2: near Hekimhan-Malatya

This stop is very close to Hekimhan town, in the south of Gazlı Hill and we will be able to examine a diverse association of hippuritids and radiolitid rudists in ac 20-m- thick section (Figs. 7,8).

At the bottom of the section, dark-grey sandstones with lenses of limestone and mudstone in the upper part of the unit are exposed (Fig. 7). Some limestone pebbles, sand concretations and mudstones towards the upper part are present.

The 12-m-thick neritic limestones, subdivided into two units follow over the sandstones (Fig. 8):

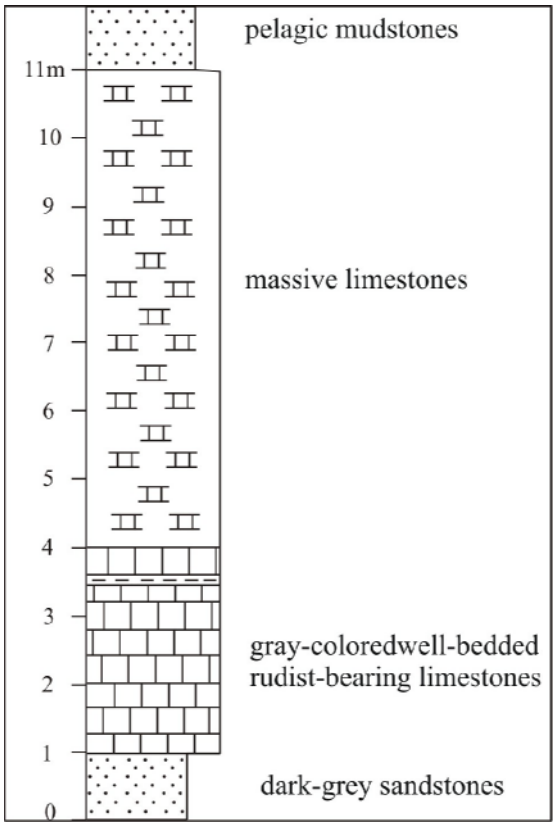

Fig. 7. The measured stratigraphic section of Stop-2, near Hekimhan town.

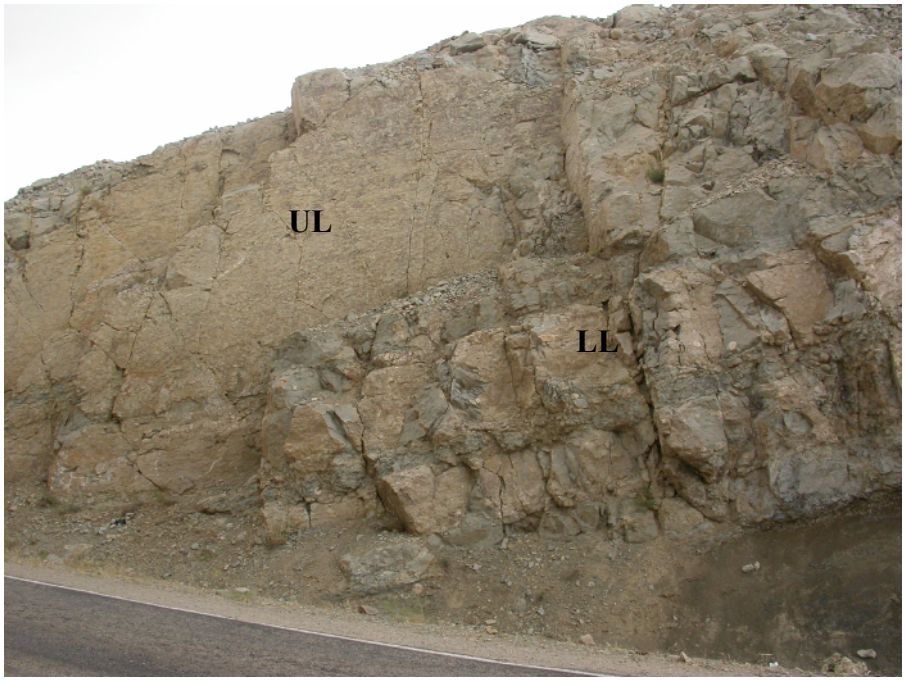

Fig. 8. The neritic limestones of the Tohma Reefs very near Hekimhan which can be distinguished in two parts such as well-bedded rudist-bearing lower level (LL) and massive upper level (UL) but without rudists.

- *the lower level* consists of 5-m-thick, gray-coloured rudist-bearing limestones. Hippuritids dominate and *Hippurites colliciatus* Woodward, *Hippurites lapeirousei* Goldfuss, *Vaccinites loftusi* Woodward and *Pironaea corrugata* Woodward have been determined. Accumulations of *H. colliciatus* (probably bouquets) are frequent (Fig. 9), and sections of *Joufia cappadociensis* (Cox) with one row of canals in the left valve can be observed (Fig. 10). *Joufia reticulata* Boehm and some undetermined radiolitids (probably *Praeradiolites, Radiolites, Miseia* and *Balabania*) are also abundant,

Fig. 9. *Hippurites colliciatus* Woodward. Note the very well developed radial ribs.

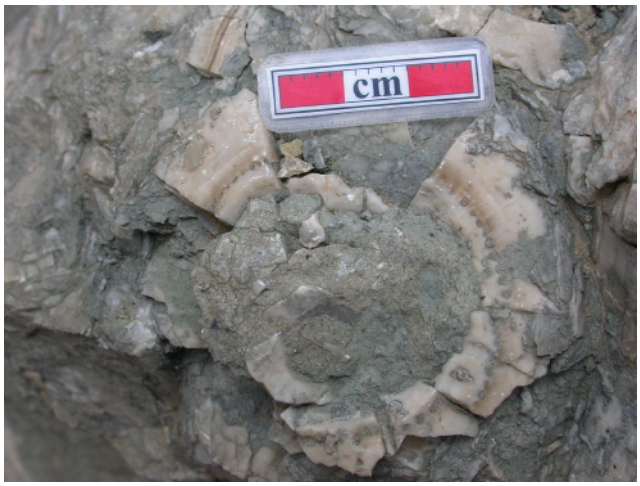

Fig. 10. *Joufia cappadociensis* Cox. Note the one row of canals of the left valve.

- ***the upper level*** is a 7 m- thick, massive-limestone (Figs. 7,8) without any larger rudist shells. It is a grainstone-packstone with rudist fragments. Similar deposits extend over several km in the surroundings of Hekimhan and grade laterally into nodular carbonate mounds that can be observed in the center of Hekimhan town (Fig. 11). Pelagic mudstones overlie the massive limestones of the upper level.

The Sr-istope values of the rudist shells suggest a late Campanian age for the rudist-bearing- lower level in this locality (personal communication with Malte Schlüter, 2008; Schlüter et al., 2008).

Fig. 11. The nodular carbonate mound belonging to the Tohma Reefs (Kt) developed over the ophiolitic Kuluncak Melange (Kmo) in the center of the Hekimhan town.

Stop-3: Hasar hill, center of the Hekimhan-Malatya

At this stop (Fig. 1b), the neritic limestones similar to those at the previous stop-2 are exposed. Hippuritids are very abundant here, and biostromes formed by *Pironaea, Vaccinites* and *Hippurites* can be examined.

Well-preserved specimens of *Pironaea corrugata* Woodward, *Pironaea polystyla* (Pirona), *Vaccinites loftusi* Woodward, *Vaccinites ultimus* Milovanovic, *Vaccinites vesiculosus* Woodward, *Hippurites colliciatus* Woodward, *Hippuritella variabilis* Munier-Chalmas, and *Hippurites lapeirousei* Goldfuss are found. *Balabania* and *Joufia* are rare (Figs. 12,13).

Massive limestones follow over the rudist biostromes.

A late Campanian age for this locality was derived from Sr-isotope values of rudists (personal communication with Malte Schlüter, 2008; Schlüter et al., 2008).

Fig. 12. Hippuritid levels rich-in *Pironaea, Vaccinites* and *Hippurites* in growth position at the Hasar Hill, Hekimhan (Stop 3).

Fig. 13. The well developed and preserved in growth position *Vaccinites* and *Pironaea*-bearing beds, Hasar Hill, Hekimhan (Stop 3). Some *Joufia* specimens (arrow) are also observed.

Stop-4: Sarıkız-Malatya

The regressive sequence will studied at this locality (Fig. 1b). Here, the Zorbehan Formation can be examined, following over a cream-coloured sandstone-mudstone alternation without any fossils (Fig. 14):

- 3-4-m-thick, dark-gray *Loftusia*- bearing limestones (Fig. 15) with some sections of *Miseia* (*Miseia hekimhanensis* Karacabey-Öztemür, *Miseia bilacunosa* Özer),
- 1-2-m-thick, gray-coloured calcareous mudstones.
- 1-m-thick, gray-black, bituminous muddy limestones with *Loftusia* and rudists. However, the rudist fauna consists only of a single species of *Miseia bilacunosa* Özer (Fig. 16). Corals are also found in this level.
- 1.5-2-m-thick, dark gray calcareous mudstones.
- 1.5-m-thick, dark gray muddy limestone lense with *Loftusia* and *Miseia bilacunosa* Özer.

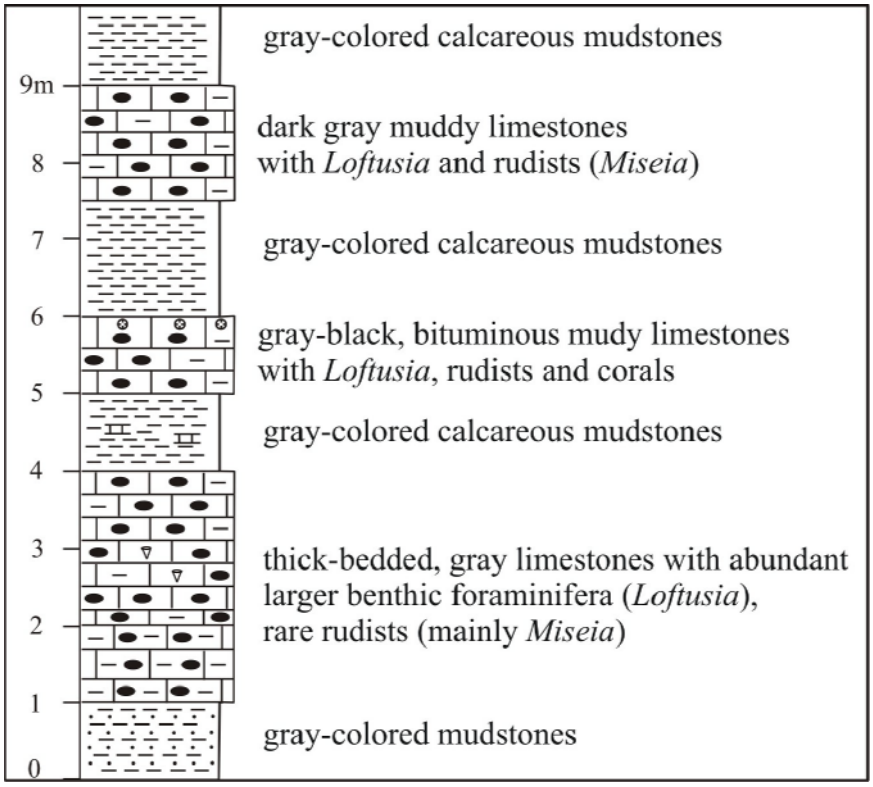

Fig. 14. Sarıkız measured stratigraphic section.

The Sarıkız locality is characterized by the abundance of *Loftusi*a such as *Loftusia anatolica* Meriç, *L. morgani* Douvillé, associated with other benthic foraminifers like *Omphalocyclus macroporus* (Lamarck), *Orbitoides apiculatus* Schlumberger, *O. medius* (d'Archiac) indicating a Maastrichtian age (Görmüş, 1990, 1999; Meriç and Görmüş, 1997, 1999, 2001; Görmüş et al., 2001). The Sr-isotope values of the rudists also support this age (personal communication, Malte Schlüter, 2008; Schlüter et al., 2008).

The rudist fauna of the regressive sequence is very poor compared with those of the Yazıhan-Hekimhan area and consists exclusively of *Miseia*. This contrasts the rich rudist fauna of the transgressive sequence of the Malatya Basin.

Fig. 15. The limestones rich in *Loftusia* of the regressive sequence in the Sarıkız locality (Stop-4).

Fig. 16. The sections of the *Miseia bilacunosa* Özer, Sarıkız locality (Stop-4).

DAY-2: June 20th, 2008

c) Yeşilyurt area-Malatya

The Yeşilyurt area is located in the southern part of the Malatya Basin (Fig. 1b). A transgressive sequence is exposed, consisting of, from bottom to top, the Kırmızıgüney, İnekpınarı and Kapullu Formations (Fig. 17). The transgressive sequence rests unconformably on the Malatya Metamorphics (Permo-Carboniferous marble, recrystallized dolomitic limestone and schist; Gözübol and Önal,

1986; Önal and Gözübol, 1992; Önal and Kaya, 2007; Özer and Sarı, 2007; Özer et al., 2007).

The transgressive sequence of the Yeşilyurt area clearly shows a similar lithological evolution when compared to the Yazıhan and Hekimhan regions.

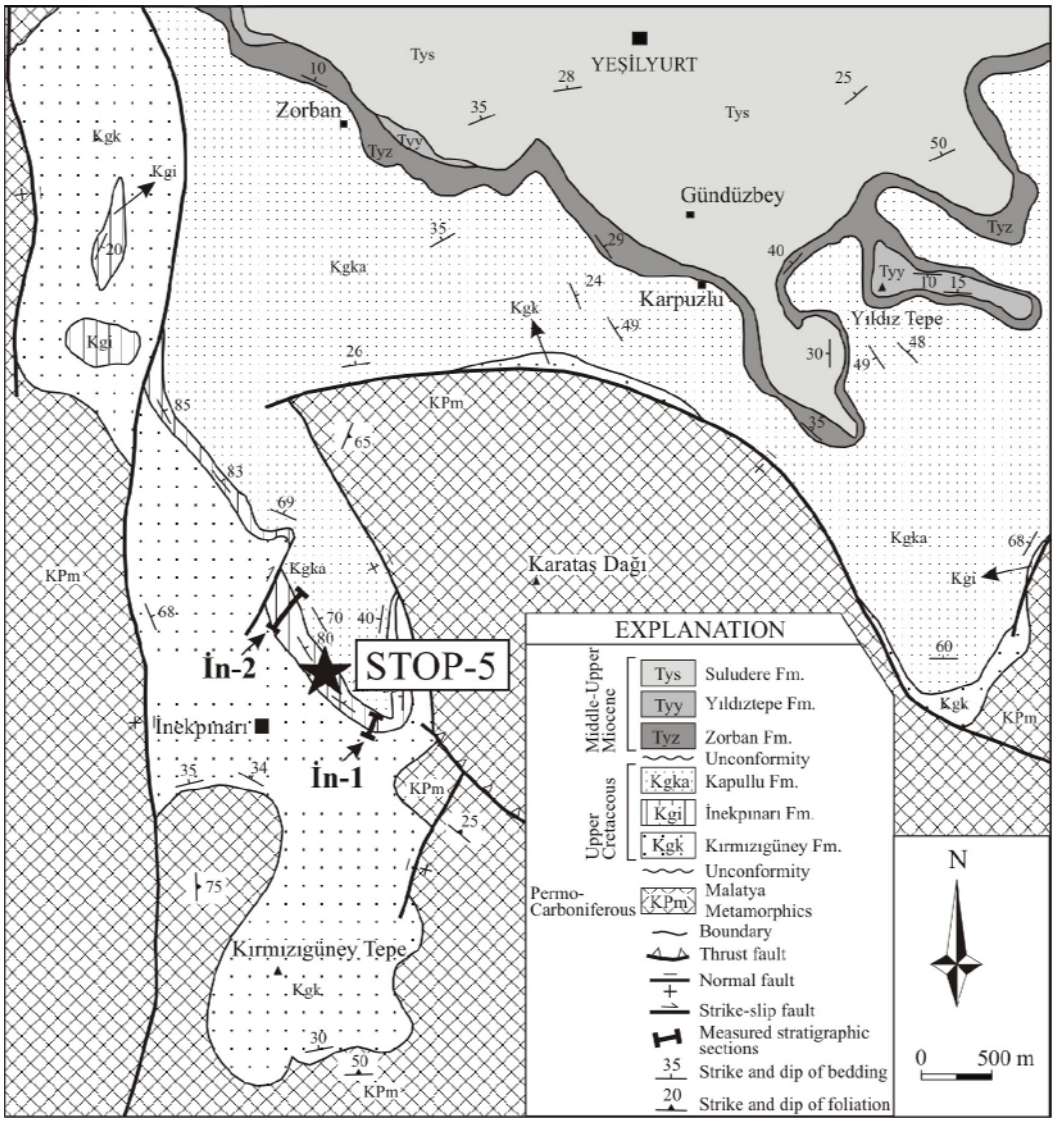

Fig. 17. Geological map of the Yeşilyurt area (simplified from Önal and Kaya, 2007) showing the location of Stop-5, where two stratigraphic section are measured (İn-1 and İn-2).

Stop-5: İnekpınarı locality, Yeşilyurt-Malatya

Two stratigraphic sections were measured from the İnekpınarı locality- (Stop-5, south of Yeşilyurt town) which are summarized in figure 18 (Özer et al., 2008).

The transgressive sequence starts with well-consolidated, poorly to moderately sorted reddish-brown conglomerates of the Kırmızıgüney Formation, which shows an overall fining upward trend and interfingers with sandstones and mudstones. The conglomerates show trough cross-stratification while the sandstones are occasionally cross-stratified. The mudstones are generally well-consolidated and laminated. The formation contains no macrofossils. The sedimentary facies suggest deposition in alluvial and fluvial environments at the beginning of the transgression (Önal and Kaya, 2007). The palaeo-current data of the conglomerates indicate that the direction of transportation was from south to north in the southern part of the Malatya Basin (Önal and Kaya, 2007).

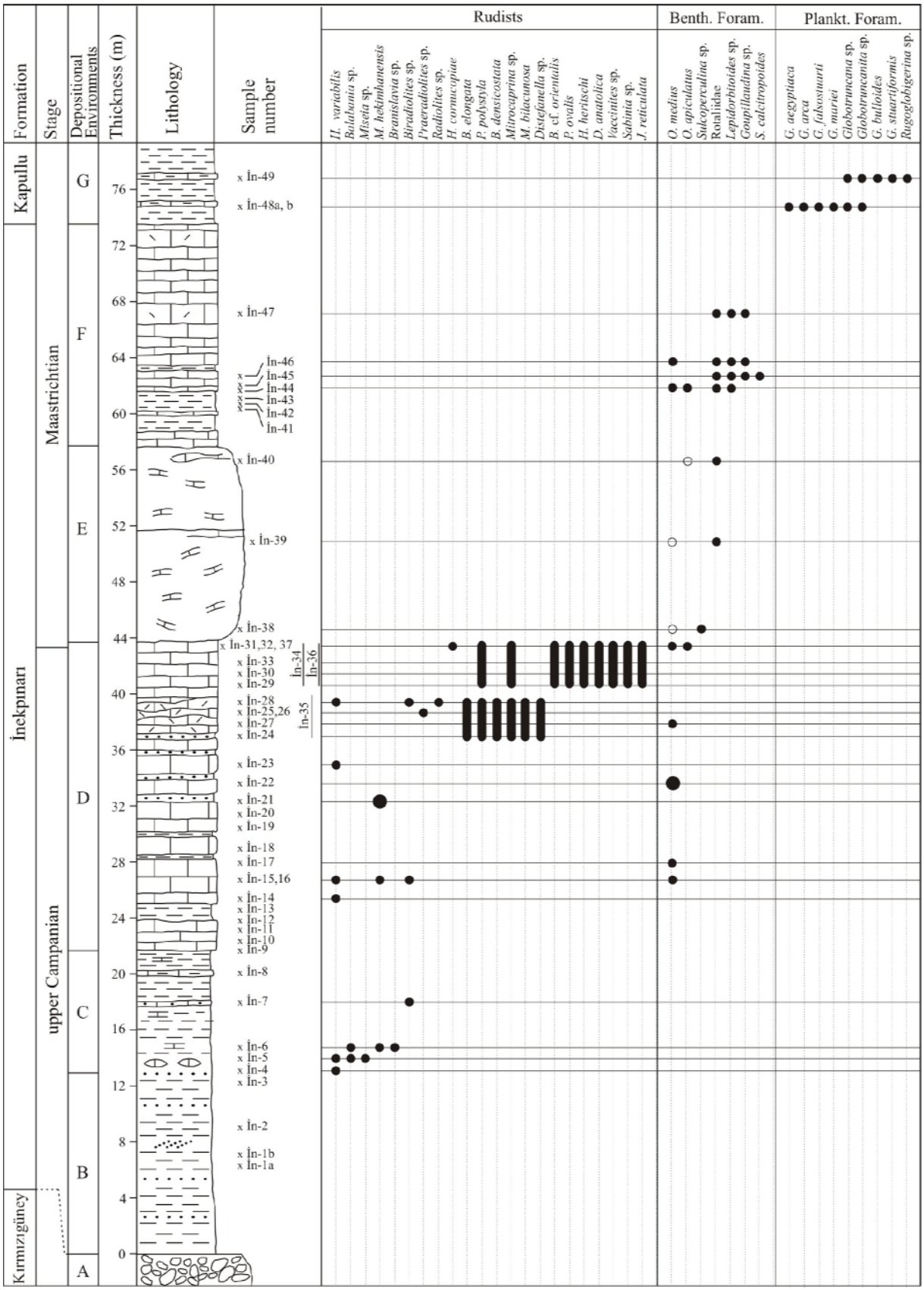

Fig. 18. İnekpınarı-Yeşilyurt (Stop-5) genaralized columnar stratigraphic section showing the distribution of the rudists, benthonic and planktonic foraminifers and also depositional environments of the formations (A to F) (See Fig. 22 for depositional environments) (after Özer et al., 2008).

The reddish continental clastics pass upward into, and are interbedded with, mudstones and -siltstones of the İnekpınarı Formation. The presence of cross-bedded (or occasionally rippled) mudstones-siltstones, and the occurrence of miliolids within mudstones and bituminous limestones indicates the development of a tidal-flat / beach to lagoonal environments in the platform. The middle and upper parts of the miliolid-bearing mudstones contain, 15 to 20-cm-thick lenticular rudist lithosomes consisting of small representatives such as *Miseia*. Bioclastic limestone nodules are also observed within the mudstones. These data indicate the development of shallow marine conditions. The presence of rich benthonic assemblages towards the top within the alternation of mudstones, bioclastic limestones and limestones suggests the presence of a shallow sea environment. The limestone beds of mudstone-limestone alternations contain tabular biostromes of radiolitids such as *Miseia, Balabania* and small hippuritids. In these levels some beds with gastropods and corals are also present. The alternating beds are overlain by a level with remarkable rudist biostromes containing *Balabania*, small hippuritids (especially *Hippuritella variabilis* (Munier-Chalmas), *Mitrocaprina, Pseudopolyconites* and *Miseia* which suggest a successive colonization of the inner platform by rudists. These tabular biostromes with *in situ* rudist accumulations are 2 to 8-m-thick with 150 to 200-m-of lateral extend. Between the rudist biostromes some limestones rich in gastropods (actaeonellids) and hermatypic corals are observed. The uppermost part of the formation consists of massive, 60 to 70-m-thick bioclastic limestones presenting a high relief in the outcrop profile (Fig. 19). This level consists mainly of rudist fragments and associated corals, algae and probably gastropod fragments in carbonate mud matrix and does not contain reef constructing organisms. These biotic and sedimentary characteristics suggest the development of carbonate mounds at the edge of the shallow platform. This carbonate mound is capped by 4 to 6-m-thick beds of bioclastic limestones with large benthonic foraminifers, and calcareous mudstones. The absence of rudists in the carbonate mound and overlying bioclastic limestones suggests unfavorable conditions for the rudist associations.

Fig. 19. Panoramic view of the transgressive sequence in the İnekpınarı locality (Stop-5). A) reddish clastics of the Kırmızıgüney Formation, B-F) İnekpınarı Formation: B) tidal flat / beach facies, C) lagoonal facies, D) rudist biostromes, E) carbonate mound, F) cover beds, G) pelagic mudstones of the Kapullu Formation. Correlate the levels A to G with Fig. 18.

The uppermost part of the transgressive sequence comprises mudstones of the Kapullu Formation, which are rich in planktonic foraminifers and interbedded with turbiditic sandstones and cherty limestones. These deposits indicate that the drowning of the platform caused the demise of the shallow platform and consequently the rudist associations and other benthonic organisms.
The rudist fauna suggests a Campanian-Maastrichtian age for the İnekpınarı Formation (Önal and Kaya, 2007; Özer et al., 2007). The benthonic foraminifers also indicate a Campanian-Maastrichtian age; however *O. apiculatus* Schlumberger is considered to be characteristic for the Maastrichtian in Turkey (Meriç, 1987, 1988 a,b; Meriç et al., 1997; Meriç and Tansel, 1987; Meriç and İnan, 1997, 1988; Meriç and Görmüş, 2001). The species appears in the middle of the measured section (Fig. 21). The Sr-isotope data obtained from rudists just below the *O. apiculatus* level reveal a late Campanian age (personal communication with Malte Schlüter, 2008; Schlüter et al., 2008).

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2. KAHTA-ADIYAMAN AREA

Large parts of southeastern Turkey belong to the northernmost margin of the Arabian Platform that was part of the African Plate during the Cretaceous (Fig. 20). The Kastel intracratonic basin formed over the lower autochthonous units of the Arabian platform (Precambrian to Upper Cretaceous platform-type carbonates) during the Campanian. During the deposition of the Kastel Formation that consists of alternating mudstones and sandstones with planktonic foraminifers, the allochthonous units were transported into the basin by gravity slides (Fig. 21). The allochthonous units are giant nappe stacks of ophiolitic associations (Kızıldağ ophiolites in the Hatay area, Keban-Cilo ophiolites in the northern Adıyaman area) at the top and sub-ophiolitic thrust sheets (Koçali and Karadut complexes) at the bottom (Yılmaz, 1993). The upper autochthonous units were deposited on top the ophiolitic nappes and consist of , from bottom to top, reddish clastics (Terbüzek Formation), shallow-water carbonates (Besni Formation), and pelagic mudstones (Germav Formation). These units show pronounced lateral facies changes indicating diachronous transgressive sedimentation and are overlain by clastics of the Gercüş Formation and the carbonates of the Midyat Formation of Eocene age (Righo de Righi and Cortesini, 1964; Ricou, 1971; Sungurlu, 1974; Yalçın, 1976; Perinçek, 1979; Perinçek and Özkaya, 1981; Şengör and Yılmaz, 1981; Altıner, 1989; Yılmaz and Yiğitbaş, 1991; Yılmaz, 1993; Yılmaz et al.,1993; Elmas and Yılmaz, 2003).

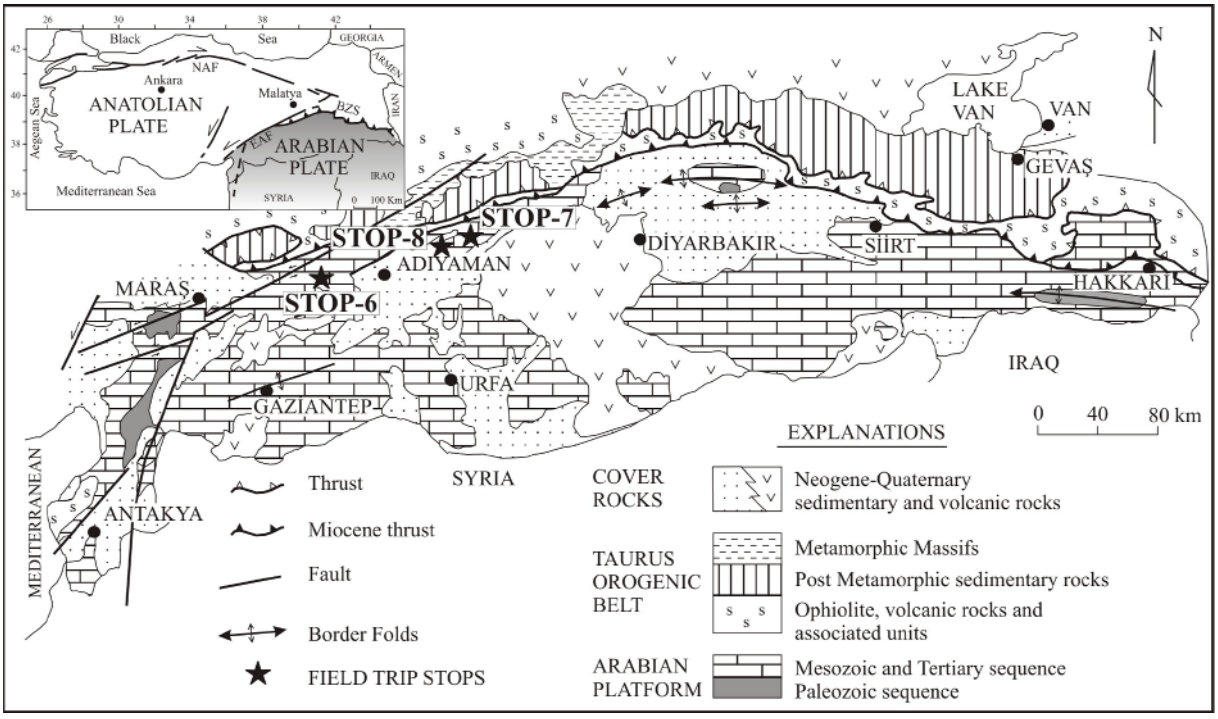

Fig. 20. Genaralized geological map of southeastern Anatolia showing location of the field trip stops (simplified from Perinçek, 1979 and Yılmaz, 1993).

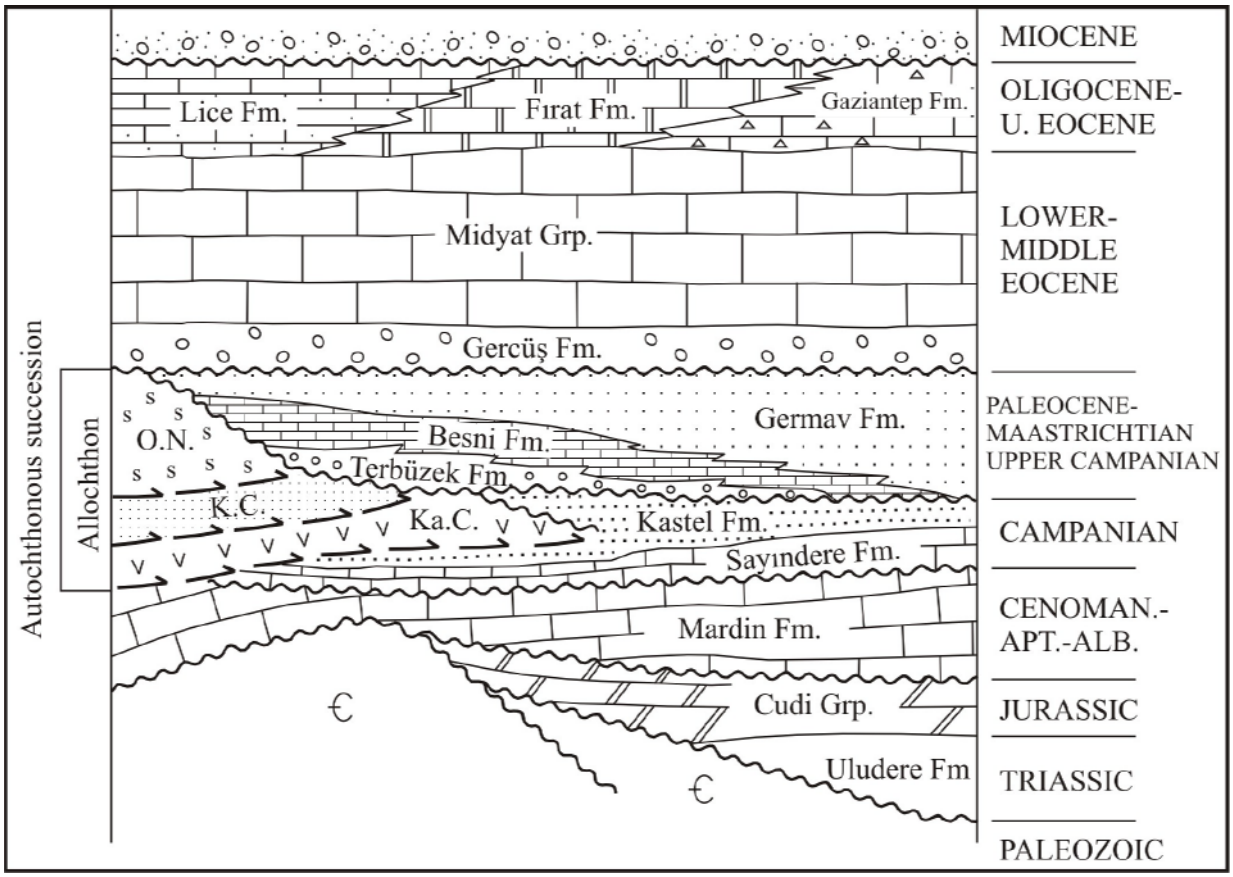

Fig. 21. Generalized geographic cross section of southeastern Anatolia showing the lower and upper autochthonous units and the allochthonous units (modified from Sungurlu, 1974 and Perinçek, 1979). Ka.C.: Karadut Complex, K.C.: Koçali Complex, O.N.: Ophiolitic nappes

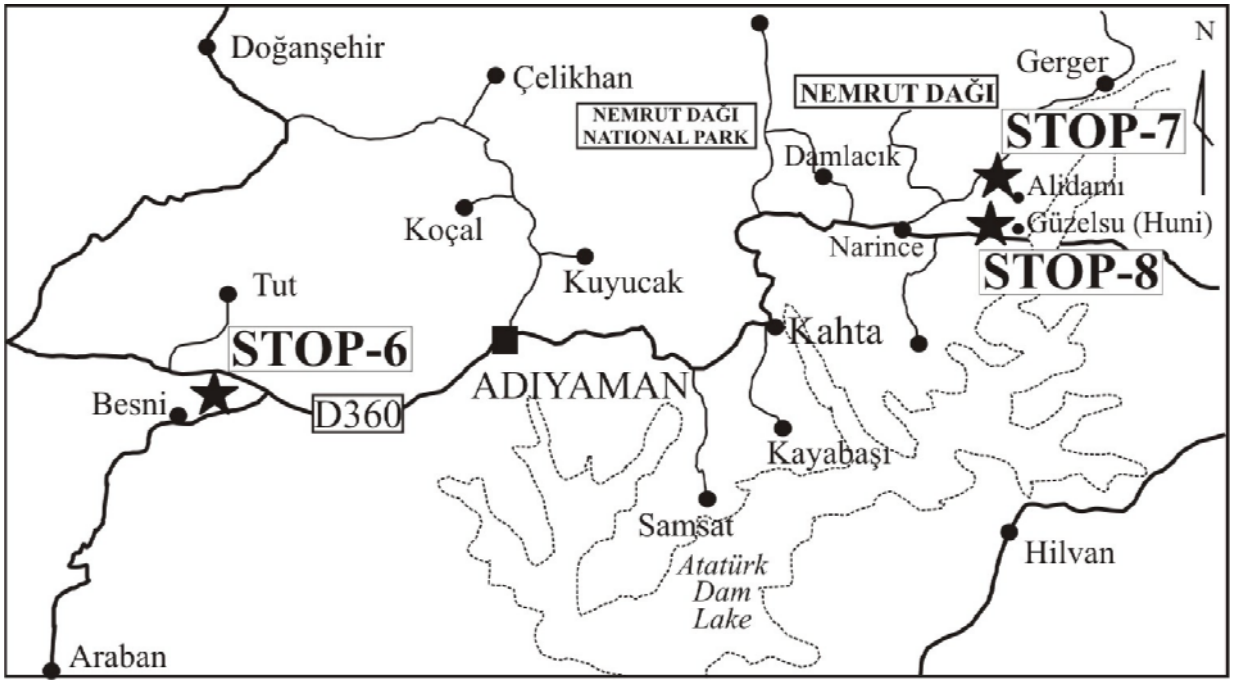

Fig. 22. Location map of the Adıyaman area showing the field trip stops.

In the Kahta-Adıyaman area, the rudist-bearing transgressive sequence follows over the Koçali Complex and the Kastel Formation. In this area, rudists are found in the three formations of the transgressive sequence. The clastics of the Terbüzek Formation contain rudist limestone lenses, the shallow-water carbonates of the Besni Formation yield abundant and diverse rudist associations, and the mudstones of the Germav Formation have floatstone beds with fragmented rudists that were derived from the Terbüzek and Besni Formations.

For the rudists of the Kahta-Adıyaman area, a Maastrichtian age was proposed by Karacabey-Öztemür (1979) and Özer (1986, 1992 a,b,c, 2006) according to the presence of typical benthic foraminifers in the rudist limestones (Meriç et al, 1985, 1987, 2001; Meriç and Görmüş, 2001). However, Özcan (1993, 2007) identified some benthic foraminifera in the lowest limestone lense with rudists and concluded on a Late Campanian age. Recently, Steuber et al. (2008) and Schlüter et al. (2008) concluded on a Late Campanian age, based on Sr-isotope values from the rudist shells.

Özer (1992 c) suggested that the transgressive sequence of the southeastern Anatolia was deposited on a gently sloping, distally steepened carbonate ramp on the northern shelf of the Arabian platform. The ramp includes beach and shallow shelf deposits with clastics and carbonates that grade seaward into basinal mudstones. The persistence of the pelagic mudstones in the upper part of the sequence indicates the continuation of the transgression and the final drowning of the shallow ramp.

We will study the transgressive sequence at three stops (Fig. 22):

Stop-6: near Besni town-Kahta

At this stop we will have a panoramic view of the transgressive sequence that was deposited unconformably over the yellowish-gray pelagic mudstones of the Kastel Formation (Özer, 1992 c). The different facies of the Terbüzek, Besni and Germav formations are obvious at this locality (Fig. 23). The Terbüzek Formation consists of 40-45 m- thick, reddish conglomerates and sandstones. It is followed by 25-30 m- thick gray shallow limestones with rare rudists, gastropods and large benthic foraminifers of the Besni Formation, and grayish-gray pelagic mudstones with thin sandy limestones lenses of the Germav Formation. The formations show lateral and vertical changes indicating diachronous deposition.

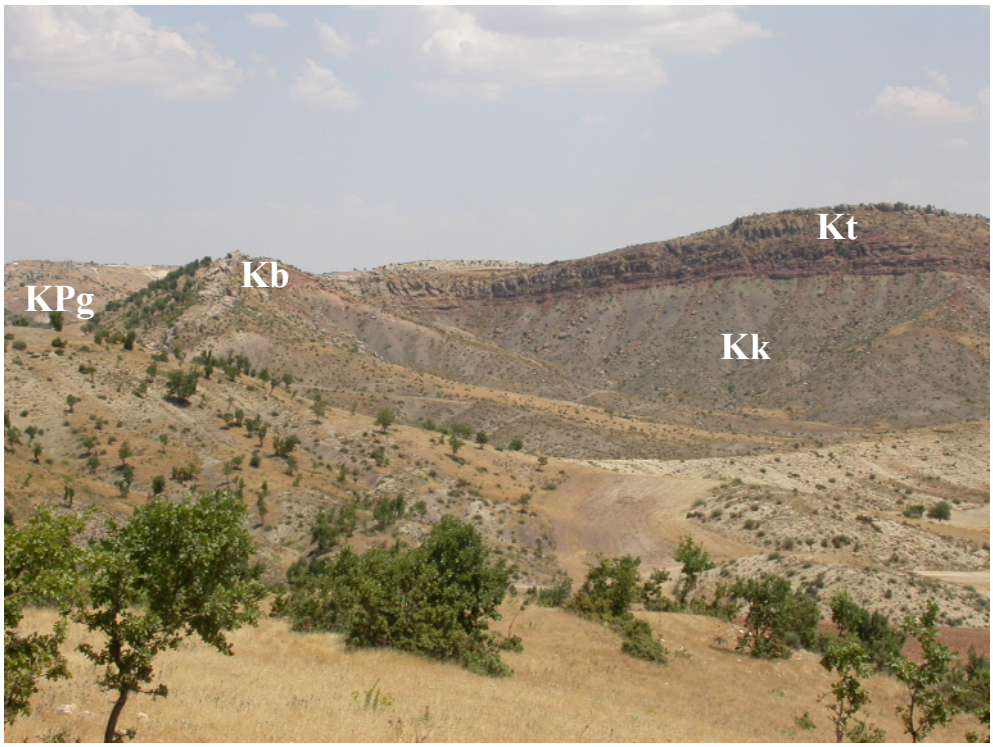

Fig. 23. Panoramic view of the transgressive sequence consisting of the reddish clastics of the Terbüzek (Kt), limestones with rudists of the Besni (Kb) and pelagic mudstones of the Germav (KPg) Formations, rests by an angular unconformity over the pelagic mudstones of the Kastel Formation (Kk) (Stop-6).

The depositional facies indicate the presence of a low relief detrital platform at the beginning of the transgression (Özer, 1992 c). High energy clastics of the Terbüzek Formation were deposited near the shoreline of this platform. The lower part of the Besni Formation consists of transgressive sandstones formed in shallow-water, moderate energy conditions. Some large benthic foraminifers and rare rudists indicate shallow marine conditions. The absence of corals, algae and gastropods may have resulted from the terrigenous clastics that inhibite the development of such communities. The upper part of the Besni Formation consists of shallow-marine limestones. The termination of the terrigenous influx allowed the development of carbonate deposits with benthic macro- and microfossils. No reef structures can be seen. The carbonates of the Besni Formation are transitional with low-energy pelagic mudstones of the Germav Formation. The persistence of the pelagic mudstones in the upper part of the Germav Formation indicates the drowning of the platform.

DAY-3: June 21th, 2008

Stop-7: Alidamı-Kahta

Around Alidamı village, the basement rocks consist of the Kastel Formation and the Koçali Complex (Fig. 24).

At this locality, six sandy limestone lenses with rudists, each 1 to 8-m-thick, are separated by the clastics of the Terbüzek Formation (Figs. 25,26). The distribution of rudists is given in Fig. 25. Specimens of *Vaccinites vesiculosus* Woodward and *Vautrinia syriaca* (Vautrin) in growth position are observed in all of the limestone lenses (Figs. 27,28). The specimens of *V. vesiculosus* are small in size, similar to those of Oman when compared with Anatolian and Mediterranean representatives. The third level contains specimens of *Paracaprinula syriaca* Piveteau (Steuber et al., 2008; Steuber and Özer, 2008). Sr-isotope values of this level indicate a late Campanian age (Steuber et al., 2008; Schlüter et al., 2008). Specimens *Dictyoptychus* are observed in the limestone lenses life in position (Fig. 31). The fifth and sixth lenses are characterized by the abundance of *Dictyoptychus. D. euphratica* Karacabey-Öztemür, *D. leesi* (Kühn) and *D. striatus* (Douvillé) have been determined (Karacabey-Öztemür, 1979; Özer, 1986). The limestone lenses also contain specimens of *Pseudosabinia, Pironaea*, and small hippuritids.

The Terbüzek Formation laterally interfingers with the Besni Formation and passes upward into the pelagic mudstones of the Germav Formation, in which the bioclastic limestone lenses containing reworked rudist fragments belonging especially to *Dictyoptychus*, are observed (Fig. 25).

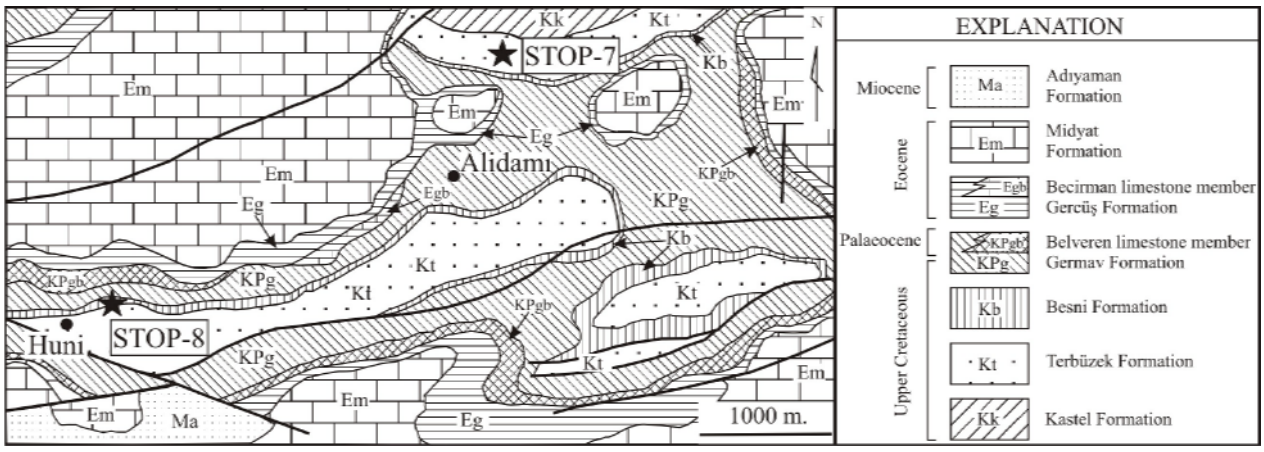

Fig. 24. Geological map of northeast of Kahta, around Alidamı village, showing the location of the field trip stops (simplified from Yalçın, 1976).

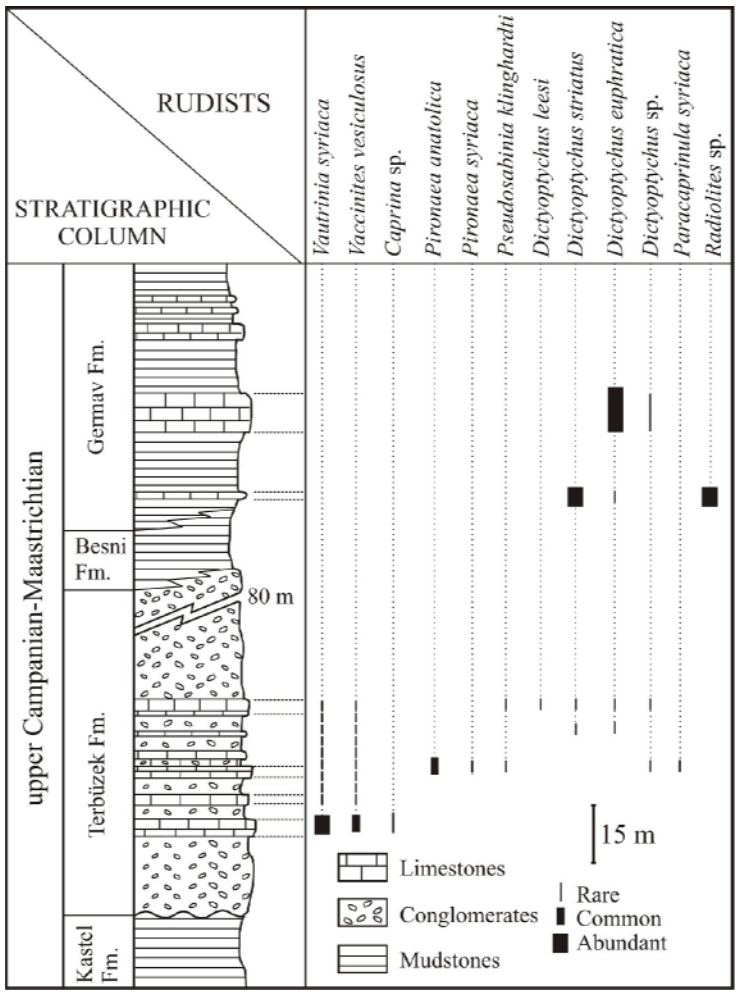

Fig. 25. Measured stratigraphic section of the Alidamı locality (stop-7) (after Meriç et al. 1985 and Özer, 1986).

Fig. 26. Rudist-bearing limestone lenses within the reddish clastics of Terbüzek Formation, Alidamı locality (Stop-7).

Fig. 27. *Vaccinites vesiculosus,* in growth position, Alidamı locality (Stop-7).

Fig. 28. *Dictyoptychus, Vautrinia* and *Vaccinites*, in growth position, Alidamı locality (Stop-7).

Stop-8: Huni village-Kahta

Between Alidamı and Huni villages, the calcareous sandstones on top of the Terbüzek Formation contain specimens of *Dictyoptychus euphratica* Karacabey-Öztemür (Fig. 22). Some hippuritids, radiolitids and large benthic foraminifers are also present.

Özer (1986) proposed a Maastrichtian age for the rudists of this locality. This is confirmed by Sr-isotope values that indicate a mid-Maastrichtian age for these levels (Steuber et al., 2008; Schlüter et al., 2008).

PALAEOBIOGEOGRAPHY

The taxonomic diversity, evolution range and geographic distribution of the Upper Cretaceous rudists were accepted important criteria for the determination of the paleobiogeographic units and subunits in Tethyan realm by many authors (Coates, 1973; Kauffmann, 1973; Philip and Allemann, 1982; Philip, 1981, 1982, 1985, 1998; Camoin et al., 1983; Ferrandini et al., 1985; Negra and Philip, 1986; Philip and Platel, 1987; Sladic-Trifunovic, 1987; Gili et al., 1987; Pons and Sirna, 1992). In Turkey, the distribution of the Upper Senonien rudists have been demonstrated by Özer (1983) and also the relationships the Anatolian-Tauride Platform (ATP) and Arabian Platform (AP) have been discussed according to the rudist distribution by Özer (1992 a,b). Recently, the Upper Cretaceous rudist faunal composition and the relations of the platforms of Turkey were presented by Özer (2006).

The geographic distributions and faunal content of the rudists allows us to determine to relationships of the ATP and AP during the Campanian-Maastrihtian time. The rudists of these platforms are listed in the Table-1.

The ATP and AP show inconsistently taxonomic diversity and abundance of rudists as follows:

The ATP is characterized by a rich rudist fauna and a very high taxonomic diversity in contrast the AP. This platform is also characterized by the presence of new genera and species such as *Balabania* Karacabey-Öztemür, *Kurtinia* Karacabey-Öztemür and *Darendealla* Karacabey-Öztemür and *Miseia regularis* Karacabey-Öztemür, *M. hekimhanensis* Karacabey-Öztemür, *M. osculata* Karacabey-Öztemür, *M. bilacunosa* Özer, *M. merici* Özer, *Bournonia anatolica* Özer and *Branislavia occidentalis* Özer (Karacabey, 1970; Karacabey-Öztemür, 1976, 1980; Özer, 1983, 1987, 1988 a,b, 1992 a,b,d, 2006).

The AP is characterized by four endemic genera (*Vautrinia* (Vautrin), *Dictyoptychus* Douvillé, *Hatayia* Karacabey-Öztemür and Selçuk, *Paracaprinula* Pivetau) and two species (*Pironaea syriaca* Vautrin, *Hippurites syriaca* Vautrin) presenting only a geographic distribution in the southeastern Anatolia (Özer, 1992 a-c, 2006; Steuber et al., 2008; Steuber and Özer, 2008). These rudists show also a very restricted geographic distribution in the Tethyan provinces. The genera *Vautrinia* was determined from Syria, and *Dictyoptychus* from Somalia and Oman Peninsula (Kühn, 1929; Vautrin, 1933; Dubertret, 1966; Pons et al., 1992; Morris and Skelton, 1995; Skelton and Smith, 2000). The genera *Hatayia* and *Paracaprinula and* species *Pironaea syriaca* and *Hippurites syriaca* were not found until today in other platforms of Turkey and also in the Mediterranean province.

The characteristic geographic distribution of rudists and the sharp breaks of the diversity gradient of the faunal content indicate the presence of a barrier separated the ATP and AP during the Campanian-Maastrichtian time. This obstacle was correspondent with the southern branch of the Neotethyan Ocean (Fig. 32), which was played an active role for the individualization of the platforms and greatly prevented the faunal changes between the platforms.

Table-1. Rudist distributions in the Anatolide-Tauride Platform and Arabian Platform (after Özer 1992 a, b and c; Özer, 2006). ● only Anatolid-Tauride platform, ■ only Arabian platform, **x** occurrences in both platforms.

RUDISTS	**ANATOLIDE-TAURIDE PLATFORM** Central-Eastern Anatolia	**NORTHERN ARABIAN PLATFORM** Southeastern Anatolia
Balabania acuticostata	●	
Balabania denticostata	●	
Balabania elongata	●	
Balabania meltinensis	●	
Biradiolites bulgaricus	●	
Biradiolites sp.	**x**	**x**
Bournonia anatolica	●	
Bournonia sp.	**x**	**x**
Branislavia baceviensis	●	
Branislavia orientalis	●	
Colveraia darendeenensis	●	
Colveraia variabilis	●	
Colveraia sp.	●	
Darendeella anatolica	●	
Dictyoptychus euphratica		■
Dictyoptychus orantica		■
Dictyoptychus leesi		■
Dictyoptychus striatus		■
Dictyoptychus sp.		■
Durania sp.	●	
Gorjanovicia sp.	●	
Hatayia spinosus		■
Hippurites colliciatus	●	
Hippurites cornucopiae	**x**	**x**
Hippurites heritchi	●	
Hippurites lapeirousei	●	
Hippurites syriaca		■
Hippuritella variabilis	●	
Hippuritella (Tetracoinites) sp		■
Joufia cappadociensis	●	
Joufia reticulata	●	
Kurtinia hemispherica	●	
Lapeirousia jouanneti	●	
Lapeirousia plana	●	
Lapeirousia sp.	**x**	**x**
Lapeirousella anatolica		■
Lapeirousella yalazensis		■
Miseia bilacunosa	●	
Miseia hekimhanensis	●	

Miseia merici	●	
Miseia osculata	●	
Miseia regularis	●	
Mitrocaprina bulgarica	●	
Pironaea anatolica	x	?x
Pironaea timacensis	●	
Pironaea polystyla	x	x
Pironaea syriaca		■
Pironaea sp.	x	x
Praeradiolites sp.	x	x
Pseudopolyconites ovalis	x	x
Pseudosabinia klinghardti	x	x
Pseudosabinia rtanjica	●	
Pseudosabinia triangularis.	●	
Radiolites angeoides	●	
Radiolites squamosus	●	
Radiolites sp.	x	x
Sabinia sp.	●	
Sphaerolites solutus	●	
Vaccinites loftusi	●	
Vaccinites orientalis	●	
Vaccinites ultimus	●	
Vaccinites vesiculosus	x	x
Vaccinites atheniensis	●	
Vautrinia syriaca		■

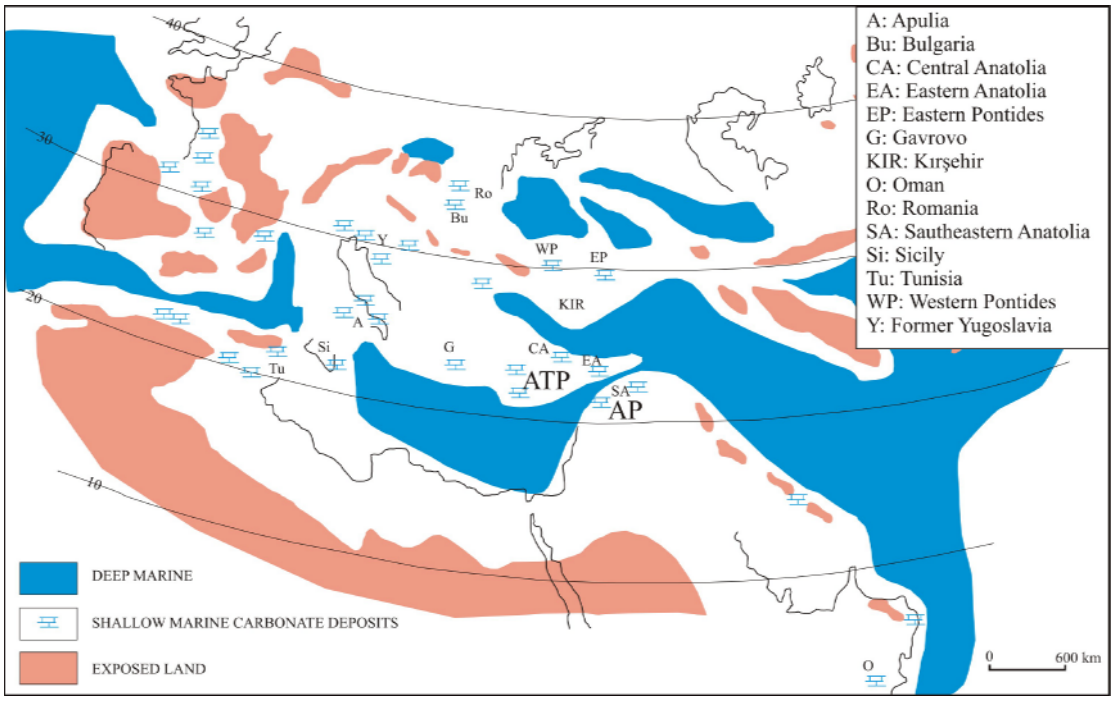

Fig. 30. Campanian-Maastrichtian palaeogeographical reconstruction of the Mediterranean area showing the setting of the Anatolid-Tauride Platform (ATP) and Arabian Plate (AP) (simplifiedd after Dercourt et. al., 1986).

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