STRATIGRAPHIC AND MICROPALEONTOLOGIC INVESTIGATION OF THE ALAKIR-1 WELL (FİNİKE), WESTERN TAURIDS, TURKEY

A MASTER'S THESIS

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Geological Engineering

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by

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Approval of the Graduate School of Natural and Applied Sciences

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ABSTRACT

STRATIGRAPHIC AND MICROPALEONTOLOGIC INVESTIGATION OF THE ALAKIR-I WELL (FİNİKE), WESTERN TAURIDS , TURKEY

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In this thesis, a study concerning the micropaleontology and stratigraphy of a thick carbonate sequence of Triassic - Lower Aptian age has been carried out from the Alakır-1 well data. This unit is composed of limestone, dolomitic limestone and dolomite lithologies of the Bey Dağları autochthon in the Western Taurids and located at 17 km north of Finike.

Two lithostratigraphic units, the Alihüseyinler formation represented by dolomites and dolomitic limestone of Triassic - Upper Liassic age and the Burhandere formation mainly composed of limestone of Upper Liassic-Lower Aptian were identified. The microfacies analysis show that the environment of deposition of these lithostratigraphic units indicates a shallow water marine depositional setting in the platform.

Thirtyone species belonging to the benthonic foraminifera and algae were recognized and by the help of this micropaleontologic data, a biostratigraphic zonation model containing 7 zones and 4 subzones was proposed. In this biostratigraphic framework The *Mesoendothyra croatica* zone (Upper Liassic - Bajocian), *Selliporella donzellii* zone (Upper Bajocian), *Pfenderina* gr. *trochoidea-salernitana* zone (Bathonian - Callovian), *Kurnubia* ex.gr.*palastiniensis* zone (Callovian - Oxfordian) and *Clypeina jurassica* zone and its subzones (Kimmeridgian - Tithonian) represent the Jurassic system. For the characterization of the Lower Createaceous series the *Salpingoporella annulata* zone (Neocomian) and *Vercorsella scarsellai* zone and its subzones (Barremian - Lower Aptian) were recognized. The proposed biostratigraphic model proves that the sequence is continuous at least from the Jurassic to Lower Cretaceous in this region of Taurids.

Key words : Bey Dağları, autochthon, Alakır-1 well, lithostratigraphy, biostratigraphy, microfacies, foraminifera, algae.

ÖZET

ALAKİR-1 KUYUSUNUN STRATİGRAFİ VE
MICROPALEONTOLOJİK ÇALIŞMASI (FİNİKE),
BATI TOROSLAR , TÜRKİYE

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Bu çalışmada, Alakır-1 kuyusunun Triyas - Alt Apsiyen yaşlı kalın karbonat istifi, mikropaleontolojisi ve stratigrafisi ile ortaya konulmuştur. Bu birim Batı Toroslardaki Bey Dağları otoktunun kireçtaşı, dolomitik kireçtaşı ve dolomit seviyelerini içermekte olup Finike'nin 17 km kuzeyinde yer almaktadır.

Bu istifde, Triyas - Üst Liyas yaşlı dolomit ve dolomitik kireçtaşları ile temsil edilen Alihüseyinler formasyonu ve ana litolojisini Üst Liyas - Alt Apsiyen kireçtaşlarının oluşturduğu Burhandere formasyonu tanınmıştır. Mikrofasiyes analizleri bu iki litostratigrafik birimin platform içi, sığ deniz ortamında çökeldiğini göstermektedir.

Bentonik foraminifer ve alglere ait otuzbir tür tanınmış ve mikropaleontolojik verilerle 7 zon ve 4 aszon ihtiva eden bir biyostratigrafik zonlama modeli ortaya

konmuştur. Bu modelde *Mesoendothyra croatica* zonu (Üst Liyas-Bajosiyen), *Selliporella donzellii* zonu (Üst Bajosiyen), *Pfenderina* gr. *trochoidea-salernitana* zonu (Batoniyen-Kalloviyen), *Kurnubia* ex.gr.*palastiniensis* zonu (Kalloviyen - Oxfordiyen) ve *Clypeina jurassica* zonu ve aszonları (Kimmeridyen - Titoniyen) Jurasik sistemini temsil eder. Alt Kretase serisi ise *Salpingoporella annulata* zonu (Neokomiyen) ve *Vercorsella scarsellai* zonu ve aszonları (Baremiyen - Alt Apsiyen) ile tanımlanmıştır. Önerilen biyostratigrafik model Batı Torosların bu bölgesinde istifin en azından Juradan Alt Kretase'ye kadar sürekli olduğunu ortaya koymaktadır.

Anahtar kelimeler: Bey Dağları, otokton, Alakır-1 kuyusu, litostratigrafi, biyostratigrafi, mikrofasiyes, foraminifera, alg.

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CHAPTER I

INTRODUCTION

1.1. PURPOSE AND SCOPE

Taurids lying along the southern edge of the Anatolian Plateau comprises the autochthonous rock units of Paleozoic - Mesozoic age and the allochthonous rock units which are thrusted to their present position during Late Mesozoic and Tertiary. The rock sequence of Alakır-1 well which is studied in this thesis, is located at the western sector of the Taurids, in the autochthonous Geyik Dağı unit. This unit is differentiated from others by its stratigraphic properties and represented by shallow water carbonates of Mesozoic age. The Purpose of the study may be outlined as follows :

- to study the lithostratigraphy of the sequence and to correlate the recognized rock stratigraphic units with those of the previous studies.
- to investigate the micropaleontological aspect of the Mesozoic carbonate rock sequences of the Bey Dağları unit from the Alakır-1 well data.
- On the basis of this micropaleontological data, to establish the biostratigraphy and correlate these units with those of the previous studies in the Tethyan

realm.

- to define the depositional environments of the rock units by the help of micropaleontological data as well as other criteria used in the microfacies analysis.

The following limitations should be mentioned in the scope of this study :

- Since the identified Triassic forms were not representative and well preserved, descriptive paleontology of the Triassic forms and algae recognized in the sequence have not been included in the systematic paleontology chapter.
- Diagenetic features of the carbonate rocks were not studied and hence not included in the Microfacies Analysis chapter.

1.2. GEOGRAPHIC SETTING

The Alakır-1 petroleum prospection well is located in southwest Turkey, 17 km north of Finike, between Finike and Kumluca towns near the Alakırçay river (fig.1). On a 1/25.000 scale map, it falls within the boundaries of Antalya $P_{24}a_2$ sheet and lies at the junction of coordinates 36^{o} 23'52'' latitude and 30^{o} 12' 48'' longitude.

1.3. PREVIOUS STUDIES

Altınlı (1944-1945) was the first geologist who defined the main structural elements and mapped a

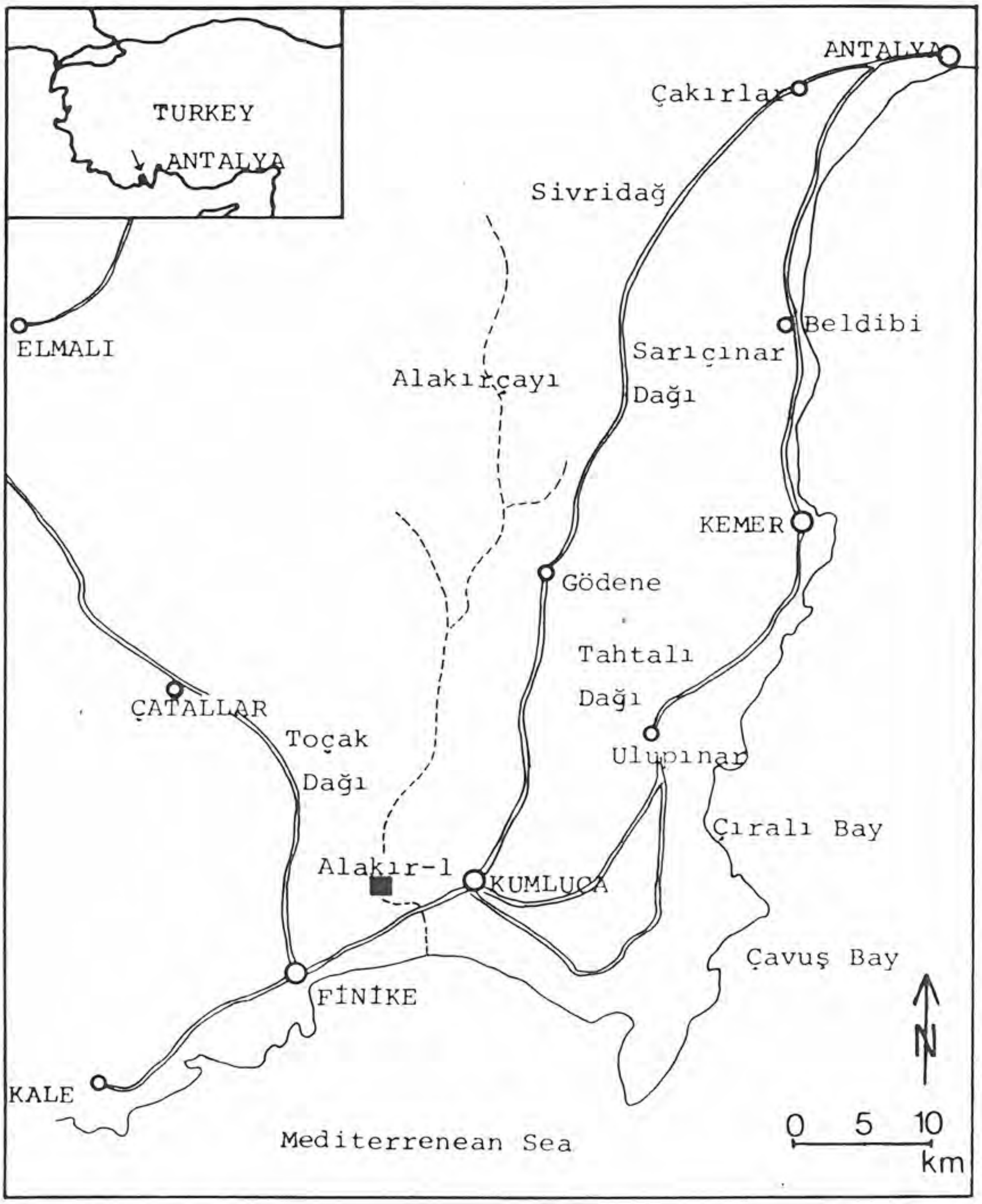


Figure 1 - Location map of the Alakır-1 well.

large sector of the Western Taurids. Although he did not report any fossils, he recognized the Jurassic system underlying the Cretaceous units of the Bey Dağları sequence.

Colin (1955) studied the Paleozoic and Mesozoic carbonate outcrops around Fethiye, Kaş, Finike and Antalya region and indicated the presence of megalodontid limestones and dolomites of probable Triassic, *Clypeina* bearing limestones of Late Jurassic and faunally poor carbonates of Early Cretaceous ages. He also mentioned about a sudden facies change in the Lower Cretaceous sequences.

Pisoni (1967) studied the Kaş region and recognized a carbonate sequence of Maastrichtian age as the oldest unit exposing in this region. He illustrated the benthonic and planktonic fossils identified in this sequence and named the unit as the Kaş limestone. He also defined the overlying units which contain marly, calcarenitic limestones and conglomerates of Lower Miocene age.

Gutnic and Moullade (1967), for the first time in this region of Taurids, described a carbonate sequence of Late Triassic - Late Cretaceous age with their fossil content. This sequence is composed of shallow water carbonates of Upper Triassic to Maastrichtian and pelagic limestones of Maastrichtian ages. These authors also described the genus *Meyendorffina* and *Pseudocyclammina* for the first time in Turkey and carried out a detailed micropaleontological study on the genus *Meyendorffina*.

Kalafatçıoğlu (1973) studied near the Antalya region and described both the lithologies of the Antalya nappes and the comprehensive series. The fossil associations given from the carbonates of comprehensive series are also diagnostic assemblages for the other shallow-water carbonate sequences in the other parts of the Western Taurids.

Bassoullet and Poisson (1975) carried out a detailed study concerning the stratigraphy and micropaleontology of Western and Northwestern part of Bey Dağları unit and recognized the Lias, Dogger and Malm carbonates by their fossil associations. Their study proved that this carbonate sequence is continuous in some sections whereas a time gap corresponding to the Dogger is also a characteristic feature in the stratigraphy of the Mesozoic carbonates.

Poisson (1977) studied a large number of stratigraphic sections in the Western Taurids and proved a continuous sequence form the Lias up to the Late Cretaceous. He described 3 formations (Alihüseyinler, Burhandere and Yağcaköy) in the shallow water carbonate sequence of Mesozoic age and discussed the superposition of these units by the help of lithologic and paleontologic data.

Jaffrezo et al (1978) studied near the İmeciksusus region and presented an inventory of the rich algal associations of Early Cretaceous age. They also indicated that the Lower Cretaceous is a marker chronostratigraphic unit of the Bey Dağları characterized by its rich algal flora.

Şenel (1983) who mainly studied the Antalya nappes discussed their origin and relation with the Bey Dağları and Geyikdağı autochthons. He concluded that the relation between Bey Dağları and Geyikdağı autochthons is tectonic and the southern branch of Neo-Tethys should not have laid to the south of the Bey dağları autochthon and instead, it should have been situated between these two autochthons.

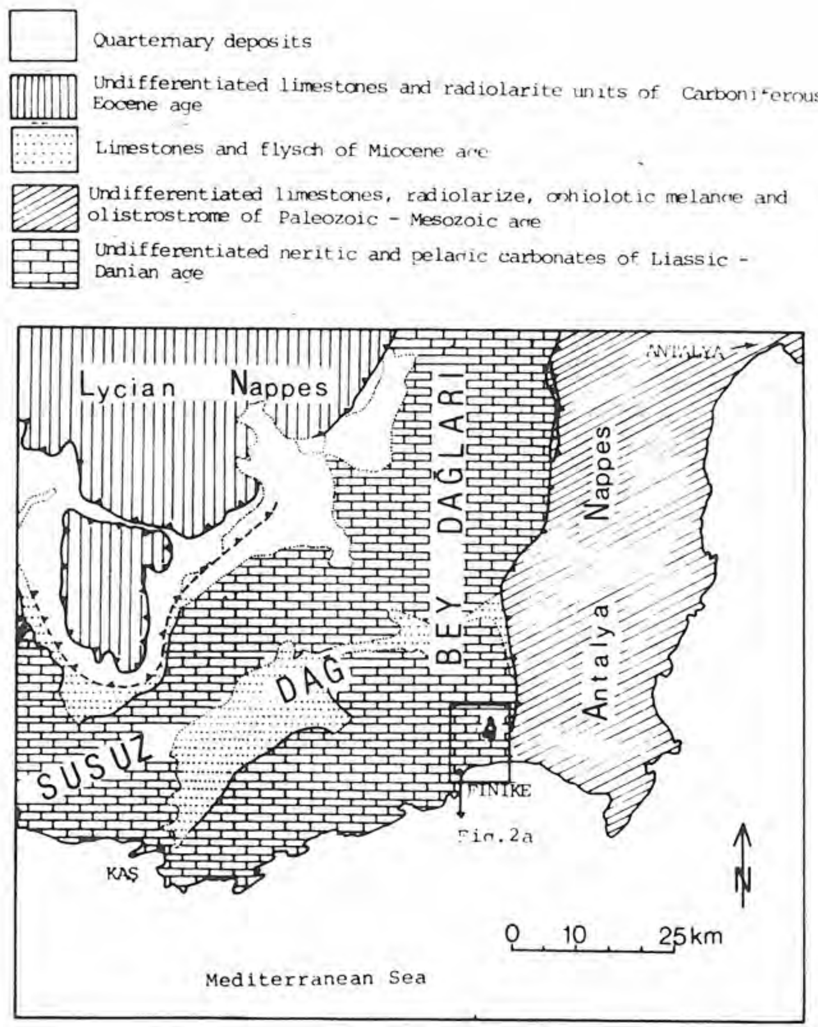
Özbudak et al (1983) studied the Alakır-1 well data and showed the presence of a thick carbonate sequence of Middle Triassic to Early Cretaceous age. The fossil associations given in their study mainly indicate a shallow water marine environment.

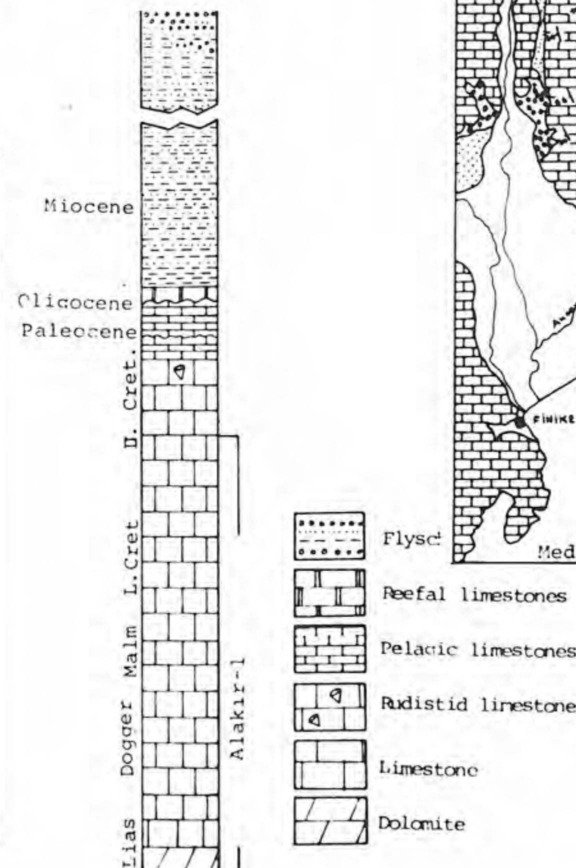
CHAPTER 2

REGIONAL GEOLOGICAL SETTING

The Alakır-1 well is located in the autochthonous Bey Dağları unit which corresponds to the Geyik Dağı unit of Özgül (1976) in the Western Taurids. This unit is mainly composed of carbonate lithologies of Liassic - Late Cretaceous age (fig.2) but in the outcrops it is usually represented by the carbonate and clastic sequences of Cenomanian and younger age. The micritic carbonate sequence of Liassic to Cretaceous age in the autochthonous areas is succeeded by the Upper Cretaceous - Oligocene pelagic carbonates and finally reefal limestones and terrigeneous flysch of Miocene age (fig.2).

The exposures of the Bey Dağları unit is limited by the Antalya nappes from the east. These nappes which are accepted as an indication of southernly located oceanic crust in the Mediterranean basin (Dumont et.al., 1972; Poisson et.al., 1983) are thrusted upon the Bey Dağları platform mainly during the Late Cretaceous and Early Paleocene times (Poisson et.al., 1983). This tectonism was recorded by the olistrostrome deposits including ophiolitic fragments, pillow lavas, radiolarites and Halobia bearing limestones.





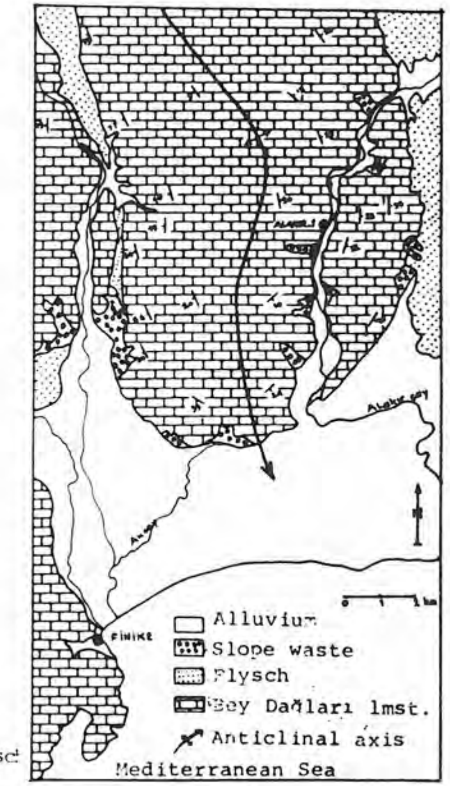


Fig.2a

Figure 2. Location of the Alakır-1 well in the simplified regional geologic maps of the Western Taurids and its stratigraphic position in the generalized columnar section of the Bey Dağları autochthonous unit (Poisson, 1977).

The Lycian nappes, which are located between the Menderes massif and the Bey Dağları autochthon, are thrusted upon the Lower Miocene sediments of the Bey Dağları unit. These nappes contain a variety of lithologies from carbonates of Middle carboniferous - Permian, arkosic sandstones and carbonates of Mesozoic, flysch and wildflysch of Maastrichtian to Eocene age and a peridodite nappe which is the most widespread unit in the western part of the Lycian nappes.

In this structural context, the Bey Dağları autochthon is mainly characterized by the shallow water carbonates of Mesozoic age. The Alakır-1 well penetrating this sequence represents all the characteristic features of this Mesozoic carbonate platform (fig.2) in the Western Taurids as well as the other sequences in the Taurids which are similar to Bey Dağları unit.

CHAPTER 3

STRATIGRAPHY

3.1. LITHOSTRATIGRAPHY

3.1.1. Introduction

This chapter covers the explanation of the rock stratigraphic units recognized in the well. Lithologic explanations of these units reflect the physical features of the rocks in hand specimens and cuttings recovered during the drilling of the well. Features observed under the microscope are described in the Microfacies Analysis chapter.

In the studied samples, a thick carbonate sequence of Lower Aptian-Triassic age has been encountered. Main lithology in the first 2000 m. of this sequence is composed of limestone with some dolomitic limestone and dolomite levels. From these meters to the total depth of the well, dolomite is the main lithology with local dolomitic limestone and limestone intercalations.On the basis of these lithologic properties, two lithostratigraphic units in the formation rank, the Burhandere formation and the Alihüseyinler formation, have been recognized.

Poisson who made an extensive field study in the autochthonous Bey Dağları unit in 1970's, recognized several rock stratigraphic units (formation) in similar sequences. He used macrofossil content of these rock units as physical criteria and he described three formations The Yağcaköy, Burhandere and Alihüseyinler formations in the Jurassic and Cretaceous sequences by the help of both lithologic aspect and macrofossil content of these units. In addition to their lithologic differences, Poisson (1977) defined the Yağcaköy formation by the accumulation of rudistid pelecypods and the Alihüseyinler formation by the presence of megalodonts (big , hearth-shaped pelecypods). Both of these fossil groups can be easily detected on the surface of the rock by their considerably big sizes. He attributed the carbonate sequence between the Yağcaköy and Alihüseyinler formations to another formation and named this unit as the Burhandere formation. This formation does not exhibit any macrofossil accumulation which could be diagnostic for the recognition of the unit.

3.1.2. Burhandere formation :

Lithology :

The Burhandere formation is composed of a thick carbonate sequence generally devoid of terrigeneous clastics. Below, the main intervals in the lithologic sequence of the Burhandere formation are given. These lithologic decriptions were prepared considering the data supplied by the M.T.A. well-site geologist. Generalized columnar section of these lithologics with their fossil content is illustrated in fig.3.

Figure 3. Generalized columnar section illustrating the chronostratigraphy, Lithostratigraphy and fossils of the Alakır well.

26-32 m Limestone : Beige-cream coloured, cryptocrystalline and highly jointed limestone.

44.9-66.5 m Limestone : Beige-cream coloured, generally cryptocrystalline. Some levels are dolomitic.

69-88 m Dolomitic limestone : Yellowish-beige coloured, cryptocrystalline. Some levels are jointed and these joints are filled by calcite.

88-105 m Limestone : Yellowish, beige-cream coloured, microcrystalline to cryptocrystalline. Joints are filled by calcite.

105-144 m Limestone : White, cream coloured, crypto-microcrystalline. Some levels are dolomitic. Joints are filled by calcite and bitumen.

144-160 m Limestone : White, gray and cream coloured, microcrystalline. This interval is highly jointed and joints are filled by calcite and bitumen.

160-162 m Oolitic limestone.

162-198 m Limestone : White, beige and cream coloured, cryptocrystalline to locally microcrystalline. Dolomite is scarsely encountered. This interval is also jointed and joints are filled by calcite or bitumen.

198-239 m Limestone : White, gray and beige coloured, cryptocrystalline to locally microcrystalline. Bitumenous layers are observed. Joints are filled by calcite and bitumen.

239-253 m Limestone : White, beige and cream coloured, cryptocrystalline. Joints are filled by calcite.

253-326 m Dolomitic limestone : Cream coloured, microcrystalline. Joints are filled by calcite.

326-344 m Limestone : White, cream and beige coloured, microcrystalline. Some levels are jointed and these joints are filled by calcite and %2-15 bitumen.

344-370 m Limestone : White, cream and gray coloured, microcrystalline to cryptocrystalline. Limestones of this interval are usually chalky. Joints show calcite infilling.

370-392 m Limestone : White, cream coloured, cryptocrystalline. Limestones are locally chalky. Joints are filled by calcite or bitumen.

392-501 m Limestone and dolomitic limestone with bitumenous levels : Limestones are white, beige and cream coloured, cryptocrystalline or microcrystalline. Some levels are chalky and highly jointed. Joints are filled by calcite and bitumen. Dolomitic limestones are beige, cream coloured, microcrystalline.

501-521 m Limestone : Beige, cream coloured, crypto-microcrystalline. Joints are filled by calcite and bitumen.

521-558 m Limestone and dolomitic limestone : Limestones are white and gray coloured, cryptocrystalline and jointed. Some levels with dead oil and bitumen.

Dolomitic limestones are beige, cream, gray coloured and microcrystalline.

558-598 m Limestone : White, cream and gray coloured, crypto-microcrystalline. Some levels are locally dolomitic and chalky. Joints are filled by calcite and bitumen. Levels with dead oil in these joints are also observed.

598-619 m Dolomite : Gray and beige coloured. Dolomite crystals are fine to medium grained. Dolomites are interclated with dolomitic limestones and clayey bands. Joints are filled by dead oil.

619-649 m Limestone and dolomitic limestone : Limestones are white, gray coloured and cryptocrystalline. This interval is locally chalky and jointed. Joints show clay and calcite infilling. Dolomitic limestone levels are beige and pale gray coloured with dead oil.

649-692 m Limestone : Cream, beige and sometimes brownish coloured, cryptocrystalline. Greenish clayey and locally chalky levels are observed.

692-729 m Limestone : Beige and cream coloured, crypto-crystalline. This interval has also some chalky and dolomitic levels with bitumenous and clayey matter.

729-755 m Alternation of dolomitic limestone and limestone.

755-802 m Dolomitic limestone : White, beige, cream and light brown coloured dolomitic limestones are interclated with bitumenous and clayey levels. Joints are filled by calcite or dead oil.

802-838 m Limestone and dolomitic limestone : Clayey limestones are interclated with dolomitic limestones.

838-869 m Limestone : Beige, dark gray coloured and cryptocrystalline. Limestones are interclated with clays and gray coloured sandstones. Argillaceous levels contain pyrite.

869-948 m Limestone : White, cream, beige coloured and cryptocrystalline and highly compact. Chalky and clayey levels are observed in some horizons.

948-1034 m Limestone : White, cream, beige coloured and cryptocrystalline. Some levels are dolomitic and chalky. Joints are filled by calcite and silt locally, clay and sandstone level are interclated with limestones.

1034-1045 m Limestone : Beige, cream coloured and densely jointed.

1045-1057 m Dolomite : Beige and cream coloured. Dolomite grains are fine grained.

1057-1091 m Alternation of dolomitic limestone and dolomite.

1091-1131 m Limestone : Beige, cream, light gray coloured and crypto-microcrystalline. Some levels are dolomitic and chalky. Joints are filled by calcite and argillaceous matter.

1131-1139 m Limestone : Beige, cream and dark gray coloured, cryptocrystalline.

1139-1188 m Limestone : Beige, cream and light gray coloured, cryptocrystalline. In this interval some levels are chalky and clayey. Joints are filled by calcite, silt and clay.

1188-1355 m Limestone : Beige, cream coloured and cryptocrystalline. Some levels are chalky. Joints are filled by calcite, silt and clay.

1355-1500 m Limestone : Beige, cream coloured and cryptocrystalline. This interval is highly chalkified and very loose. Joints are irregular and filled by calcite and clay.

1500-1503 m Bitumenous limestone.

1503-1541 m Limestone : Beige, light gray coloured and cryptocrystalline. Some levels are chalky and dolomitic.

1541-1566 m Alternation of dolomitic limestone and dolomite.

1566-1595 m Dolomitic limestone : Beige, gray, light brown coloured and microcrystalline. Bitumenous levels are observed.

1595-1610 m Limestone : Beige, cream coloured and cryptocrystalline.

1610-1692 m Limestone : Beige, cream, light brown coloured. Locally dolomitic and interclated with bitumenous levels. Ooids are observed. Joints are filled by silt.

1692-1976 m Limestone : Beige, cream, light gray coloured and cryptocrystalline. Some levels are dolomitic and chalky. Dead oil is observed between dolomite crystals.

1976-1997 m Limestone : Beige or cream coloured, cryptocrystalline. Some levels are dolomitic and chalky. Towards the lower levels, silty dolomites and pyrite infillings are observed.

Thickness:

The apparent thickness of the Burhandere formation is given as the depth penetrated in the formation. For the calculation of the true thickness of the sequence, the average dip angles have been taken. The average dip angle between 26 and 1900 m is 20^{o} and between 1900 and 3740 m is 40^{o}. The calculated true thickness of Burhandere formation is 1836 m.

Boundaries :

The upper levels of the Burhandere formation are erosional and its upper boundary with the overlying Yağcaköy formation is not observed. The boundary between the Burhandere and Alihüseyinler formations has been drawn, considering the lithology change limestone to dolomitic limestone, in the absence of the megalodont bearing lumachells.

Fossil assemblage :

The fossil assemblage of the Burhandere formation is represented by the benthonic foraminifera, dasycladacean algae and other invertebrate fossil fragments. The stratigraphic distributions of these fossils is illustrated in fig.4.

The following fossils have been identified :

"Pseudotextulariella septfontainei" Altıner, Decrouez Zaninetti

Bolivinopsis sp.

Nezzazata sp.

Vercorsella scarsellai (De Castro)

Debarina cf. *hahounerensis* Fourcade, Raoult and Vila

Haplophragmoides sp.

Orbitolinopsis capuensis (De Castro)

Cuneolina camposaurii Sartoni and Crescenti

Cuneolina sp.

Pfenderina gr. *trochoidea-salernitana*

Rectocyclammina sp.

Parurgonina caelinensis Cuvillier, Foury and Pignatti-Morano

Praekurnubia sp.

Protopeneroplis striata Weynschenk

Kurnubia ex.gr. *palastiniensis* Henson

Satorina apuliensis Fourcade and Chorowicz

Nautiloculina sp.

Mesoendothyra croatica Gusic

Valvulina sp.

"*Siphovalvulina*" sp.

Salpingoporella dinarica Radoicic

Salpingoporella annulata Carozzi

Campbeliella striata Carozzi

Clypeina jurassica Favre

Selliporella donzellii Sartoni and Crescenti

Cayeuxia sp.

Thaumatoporella parvovesiculifera Raineri

Favreina sp.

Textularidae

Miliolidae

Ostracod shell fragments

Age :

The above fossil assemblage suggests an age from the Upper Liassic to the Lower Aptian for this formation. The biostratigraphic framework established by the use of these fossils led to recognize several chronostratigraphic intervals in the formation. The Upper Liassic to Bajocian,

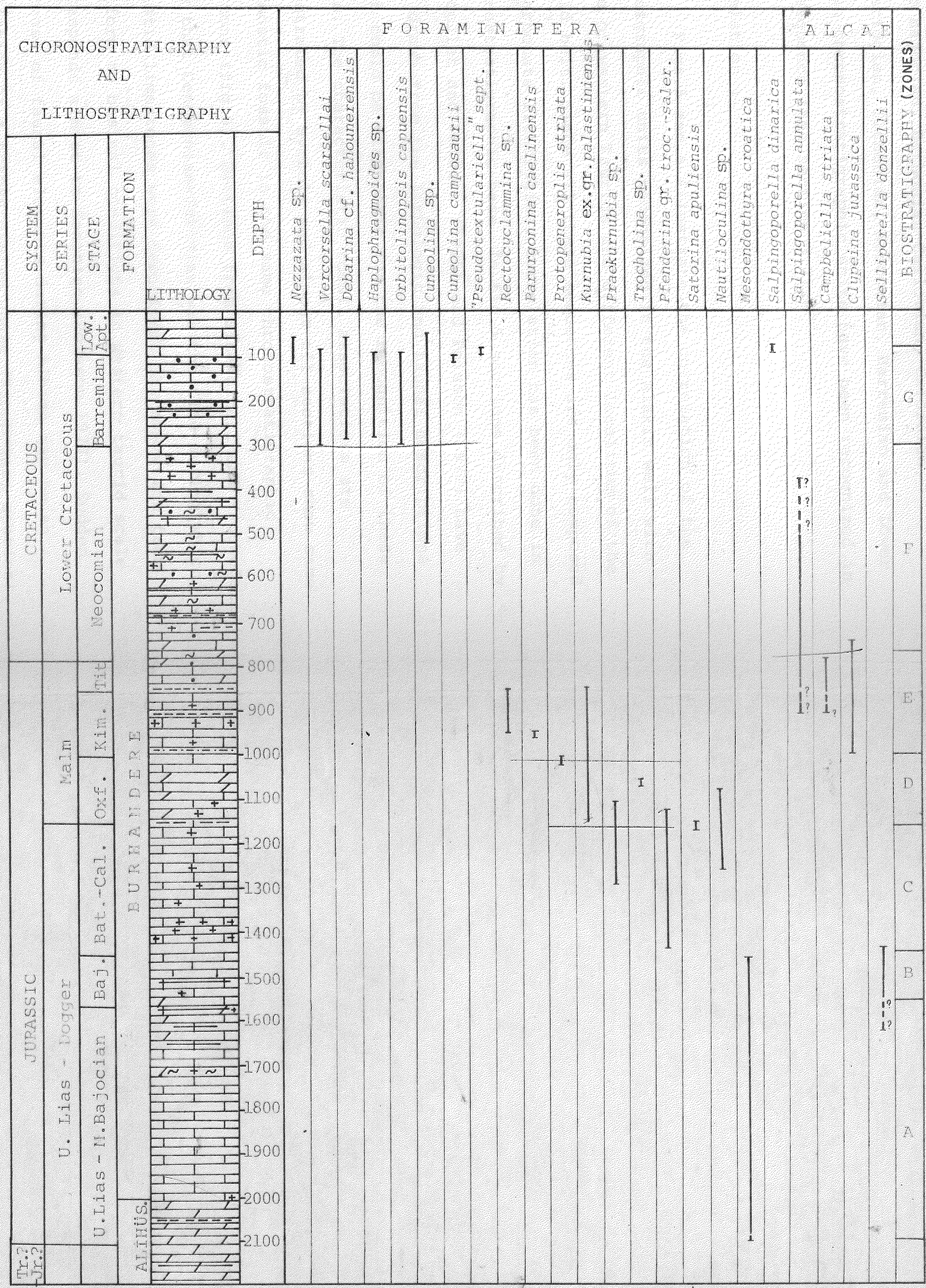


Figure 4. Stratigraphic distribution of the foraminifera and algae in the Jurassic and Cretaceous sequence of the Alakır well.

Upper Bajocian, Bathonian-Callovian, Oxfordian, Kimmeridgian, Tithonian, Neocomian, Barremian and Lower Aptian chronostratigraphic units have been recognized in the sequence (see section 3.2).

Correlation :

Figs.5 and 6 illustrate the correlation of the stratigraphic units recognized in the Alakır well with those of western Taurids and different localities of the Taurid belt. Since all these sequences are only composed of carbonate lithologies, correlation has been done in chronostratigraphic base. In fig.5 sections described by Bassoullet and Poisson (1975) and Poisson (1977) have been drawn from the lithologic and faunal descriptions which could be diagnostic for the recognition of these units. The characteristic fossil associations are illustrated by symbols and almost all sections show same diagnostic fossils in the same chronostratigraphic horizons (fig.5). Sections from Sinekçibeli and Kapuboğazı show that Cenomanian-Turonian was the time during which rudistid limestones were deposited. The evolution from platform to basinal conditions in western taurid scale corresponds almost to Senonian (Poisson 1977). Sudden increase of faunal elements during Albian may be an indication of a transgressive phase (Kapuboğazı section). Neocomian is known by its poor faunal content in all sections illustrated in fig.5.

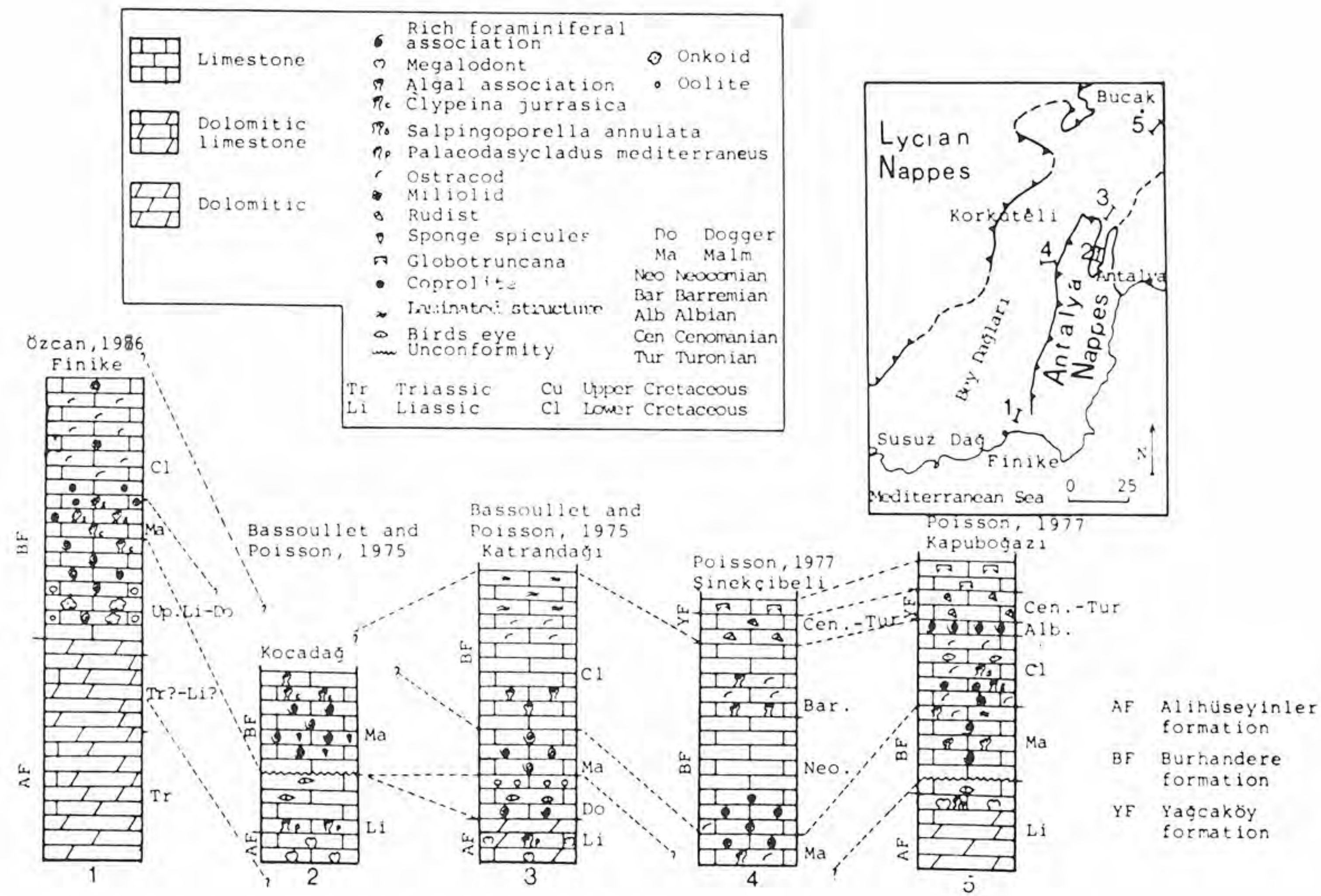


Figure 5. Correlation of rock units in Bey Dağları autochton.

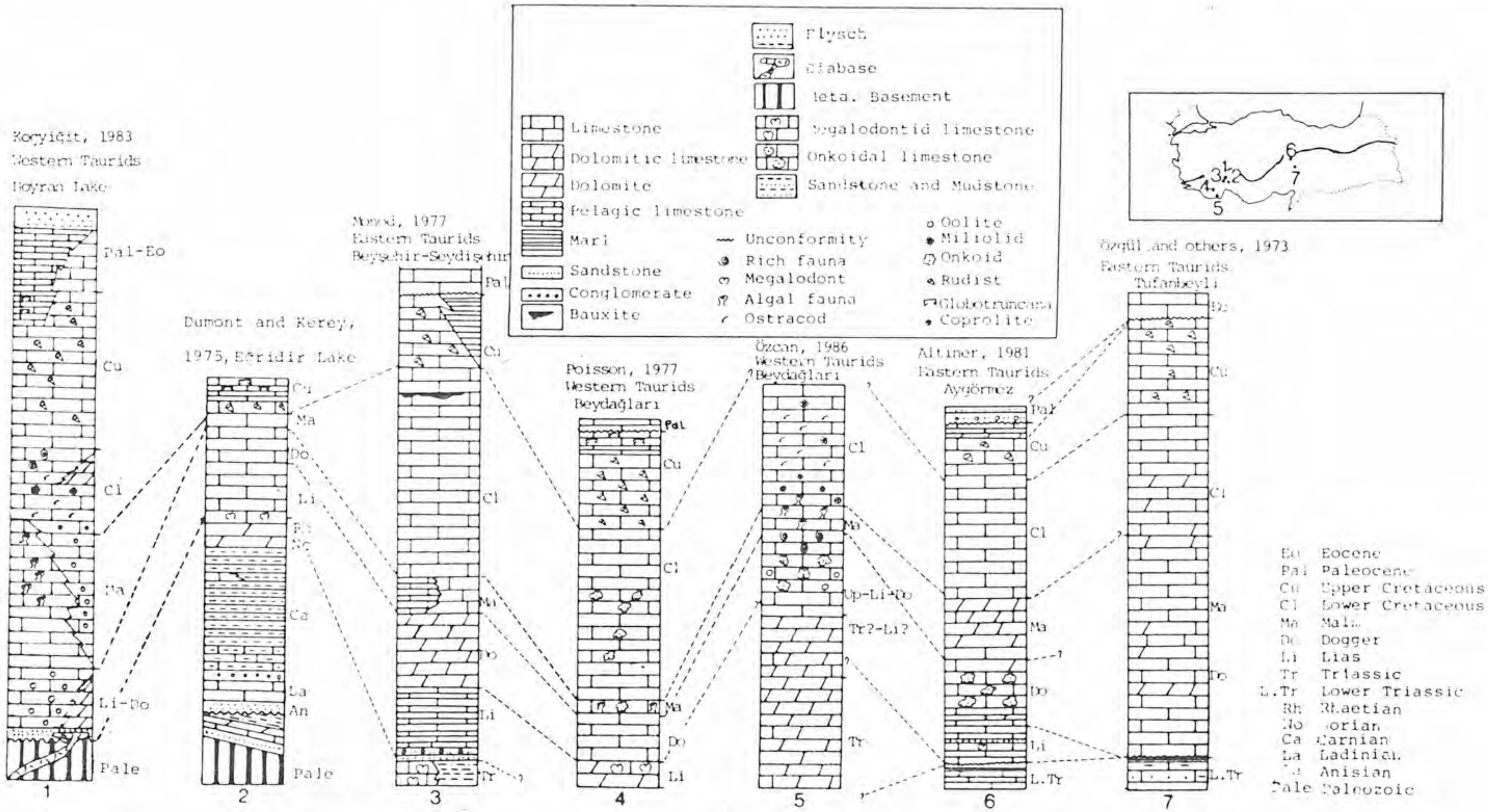


Figure 6. Correlation of the rock units in Taurids.

Upper Malm is important for the important development of dasycladacean algae. In such thick, monothonous carbonate sequences, these algae are helpful for the subdivision of the rock units. Although the whole Dogger is represented in the Burhandere formation in the studied well, it is missing in the Kocadağ and Kapuboğazı sections. There exists a para or disconformity in Dogger in these sequences. Since no any difference in litho and biofacies can be observed in the sequence below and above of this unconformity, lithostratigraphic boundary has been placed below this unconformity where the definite lithologic change is observed. In this case, the Burhandere formation includes an obscure unconformity characterized by a hiatus in Dogger.

3.1.3. Alihüseyinler formation

Lithology :

This formation is mainly composed of dolomites with dolomitic limestone and few limestone intercalations. The lithologic sequence of the formation is explained below depending on the data supplied by the M.T.A. well-site geologist. Generalized columnar section of these lithologies and their fossil content are illustrated in fig.3.

1997-2110m Dolomite : Beige, cream, light greenish coloured and microcrystalline. These dolomitic sequences are interclated with gray, greenish clayey levels.

Stylolites are observed. Joints are scarce and filled by calcite, silt and pyrite.

2110-2283 m Dolomite: Beige, cream, light gray and light greenish. In some levels, dolomitic limestones interclations are seen. Joints are filled by calcite, silt and pyrite. Some levels contain %2 bitumen.

2283-2388 m Dolomite and dolomitic limestone : White, light cream coloured and microcrystalline dolomitic limestones are interclated with dolomites. Levels with bitumen and dead oil are observed. This interval is also jointed and joints are filled by dolomite crystalls and silt.

2388-2406 m Dolomite : Beige and cream coloured, microcrystalline dolomites show solution cavities.

2406-2419 m Dolomitic limestone : This interval is represented by chalkified and dolomitic limestone.

2419-2524 m Dolomite and %25-30 dolomitic limestone : Dolomites are beige, cream, light brown coloured and less densely jointed. These joints are filled by dolomite and silt size terrigenous material. Dolomitic limestones are beige-cream, light gray coloured and microcrystalline.

2524-2546 m Alternation of dolomite and dolomitic limestone.

2546-2667 m Dolomitic limestone : Beige-cream, light gray coloured and microcrystalline. In additon to the dolomitic limestones this interval is composed of %20-30 dolomite and %5 limestone. Joints are filled by dolomite and pyrite. Some levels are rich in iron oxide.

2667-2702m Alternation of dolomitic limestone and dolomite.

2702-2808m Dolomitic limestone, dolomite and limestone : This interval is composed of dolomitic limestone, %10-20 dolomite and %5 limestone.

2808-2929m Dolomitic limestone : Local dolomite interclations are observed.

2929-2959m Dolomitic limestone : Beige, cream, light gray coloured. Spaces between dolomite grains are filled by carbonaceous material. Bitumenous levels are observed.

2959-2968m Limestone : Beige, cream and light gray coloured, cryptocrystalline.

2968-2993m Dolomitic limestone.

2993-3000 m Limestone : Beige-cream and light gray coloured limestone.

3000-1005 m Dolomitic limestone : Beige-cream coloured. Dolomite crystals are microcrystalline. Local dolomite levels are interclated with dolomitic limestones. Sections with bitumen and dead oil are encountered.

3105-3191mDolomitic limestone : Dolomitic limestones are interclated with dolomites.

3191-3263m Alternation of limestone, dolomite and dolomitic limestone : Limestones are beige and dirty white-coloured. Some levels are chalky.

3263-3272m Limestone : White, dirty white, cryptocrystalline and sometimes brecciated.

3272-3342m Dolomitic limestone : Beige-cream, dirty white and light brown coloured. Dolomite crystals are generally microcrystalline.

3342-3389m Dolomitic limestone : White, beige-cream and light brown coloured locally jointed. Bitumenous levels are observed.

3389-3443m Dolomitic limestone with interclation of dolomite levels.

3443-3530m Dolomitic limestone : White, light brown, beige-cream coloured and crypto-microcrystalline. Upper levels are argillaceous and lower levels are rich in bitumen. Locally dolomite layers are observed.

3530-3603m Limestone : Beige-cream and gray coloured. Locally argillaceous, jointed and brecciated. Joints are filled by dolomite. Some levels are dolomitic.

3603-3652m Limestone : Light gray coloured and cryptocrystalline. Some levels are argillaceous and interclated with dolomitic limestone.

3652-3724m Dolomitic limestone : Dirty white, beige-cream coloured. Lower levels are brecciated and contain limestone interclation.

Thickness: The apparent thickness of the Alihüseyinler formation in the well is 1740 m. However, the beds are steeply dipping in this interval with an average of 40^{o}. The calculated true thickness of this formation is 1332 m.

Boundaries :

In the type section of the Alihüseyinler formation, the unit is represented by limestones or dolomitic limestones which contain lumachelles of megalodonts in the upper levels and by dolomites in the lower levels. In this study, in the absence of megalodonts, formation boundary between the Alihüseyinler and Burhandere formations has been drawn where the lithologic change from dolomitic limestone or limestone to dolomite was observed. According to Poisson (1977) the lowest stratigraphic level in the Alihüseyinler formation corresponds to Liassic-Triassic? age. This author could not observe the rock units under Liassic in surface outcrops and could not define the lower boundary of the Alihüseyinler formation. Uniform persistance of dolomitic lithologies continue to the total depth of the well. Therefore the lower boundary of this formation can be extended to the end of sequence which is of Triassic age.

Fossil assemblage :

Although strong dolomitization destroyed the original features and fossils, some of the fossils could hardly be recognized in less dolomitized levels (fig.3). However they are not representative and well preserved to illustrate in this study. Fossils with a question mark indicate the uncertain determination.

The stratigraphic distributions of the fossils recognized in the Alihüseyinler formation have not been illustrated. However their stratigraphic positions are shown in fig.3. Following fossils have been identified.

Mesoendothyra croatica Gusic

Valvulina sp.

"Siphovalvulina" sp.

Involutina ? sp.

Agathammina ? sp.

Earlandia sp.

Trochammina ? sp.

Age :

This fossil assemblage suggests an age from Triassic to lower-upper Liassic.

Correlation :

Correlation of the Alihüseyinler formation recognized the Alakır well with previous studies is illustrated in fig.5.

In the sections, Lias is represented by the megalodontid limestones or dolomitic limestones in the upper levels and by dolomites in the lower horizons. Megalodonts are very diagnostic in these sections and are taken as lithologic criteria for defining the upper boundary of the Alihüseyinler formation. However the sequence recognized in the Alakır well does not contain any megalodont and the boundary between the Alihüseyinler and Burhandere formations has been drawn where the major lithologic change was observed.

Chronostratigraphically, these large pelecypods probably correspond to the upper levels of dolomites in which original features are completely destroyed. The lower parts of this formation correspond to Triassic system and the main lithology is dolomite or dolomitic limestone without any fossil. In the Alihüseyinler formation of the Alakır well, the presence of Triassic system was recognized for the first unit in the Beydağları autochton.

For the correlation of the rock units recognized in this study in a wider scale, 6 sections from the different localities of the taurids have been selected (fig.6). These sections represent the Hoyran Lake region (Koçyiğit 1983), Eğridir Lake region (Dumont and Kerey, 1975), Bey-şehir-Seydişehir region (Monod, 1977), Bey Dağları (Poisson, 1977), Pınarbaşı, Kayseri region (Altıner, 1981) and Tufan-beyli region (Özgül and others, 1973). The first four and the Tufanbeyli section are from the Geyikdağı unit and the Pınar - başı section is from the Aladağ unit (Özgül, 1976). All the sections are characterized by the shallow water car-bonate sedimentation at least from the Liassic to Seno-nian. Although the stratigraphy of the Alakır-1 well is continuous from the Triassic to the Lower Aptian, a hiatus in the deposition corresponding to Middle-Late Triassic time in the Tufanbeyli and Pınarbaşı sections is observed. The Lower Triassic is generally represented by sandy, clayey limestones, marls or mudstones in the sections of Altıner (1981) and Özgül & others (1973). Since the levels representing the Lower Triassic was not penetrated in the Alakır-1 well, these sections could not be correlated with our sequence. The Lias is generally represented by the megalodont-bearing dolomitic limestones in the Bey Dağları section, the megalodontid limestones in the Aygörmez and Eğridir Lake sections and by the oolitic limestones and limestone in the others. The Dogger sequence described by Altıner (1981) can be correlated with the Alakır-1 well by the presence of the onkoidal facies. In both sections, the onkoidal limestones are restricted only to Dogger. This series is represented by the oolitic limestones and dolomites (Kocyiğit, 1983), the dolomites (Monod, 1977) and by the limestones (Dumont & Kerey, 1975) in the other section. The Malm is also represented by the shallow water carbonates in all section except the Beyşehir-Seydişehir section of Monod (1977) in which a local deepening during the Malm has been recognized. The Malm in the Alakır-1 well is recognized by the abundance of dasycladacean algae (*Clypeina, Salpingoporella, Campbeliella*) and can be easily correlated with the Bey Dağları section of Poisson (1977) and Hoyran lake section of Kocyiğit (1983). The Lower Cretaceous is also represented by shallow water carbonates in all sequences generally devoid of rich and diagnostic fossil assemblage. In these sequences, ostracods and miliolids are very abundant (Kocyiğit, 1983). The rudistid Limestones of Late Cretaceous age is present in all sections except in the sequence recognized in the Alakır-1 well. The upper parts of these sequences sometimes evolve into a palegic type sedimentation which forms the latest Mesozoic sequence in some of these sections (Poisson 1977, Altıner 1981, Kocyiğit 1983, Dumont and Kerey 1975).

3.2. BIOSTRATIGRAPHY

In recent years, thick Mesozoic carbonate sequences in Apennines, Dinarids and Carpathians have been studied by the zonation of biostratigraphically related species or organisms. In this study, we also introduce a similar zonation. This zonation depends on empirically overlapping ranges or empirical ranges of organisms (fig.7). The following biostratigraphic zones or subzones have been established in the sequence of Alakır-1 well;

Zone A, *Mesoendothyra croatica* (fig.7) :

The lower and upper boundaries of this zone are recognized by the first appearance of *Mesoendothyra croatica* and *Selliporella donzellii* respectively. The type of this zone is a concurrent-range zone and represents the interval between 2100 and 1550 m of the sequence. Fossil assemblage identified in this zone are *Mesoendothyra croatica, Valvulina* sp., " *Siphovalvulina* " sp. and *Thaumatoporella parvovesiculifera*. This zone, chronostratigraphically corresponds to Upper Lias-Middle Bajocian.

ZONE B, *Selliporella donzellii* (fig.7) :

The lower boundary of this zone is recognized by the first appearance of *Selliporella donzellii* and the upper boundary by *Pfenderina* gr. *trochoidea - salernitana*. The type of this zone is also a concurrent-range zone and represents the interval between 1550 and 1440 m of the sequence.

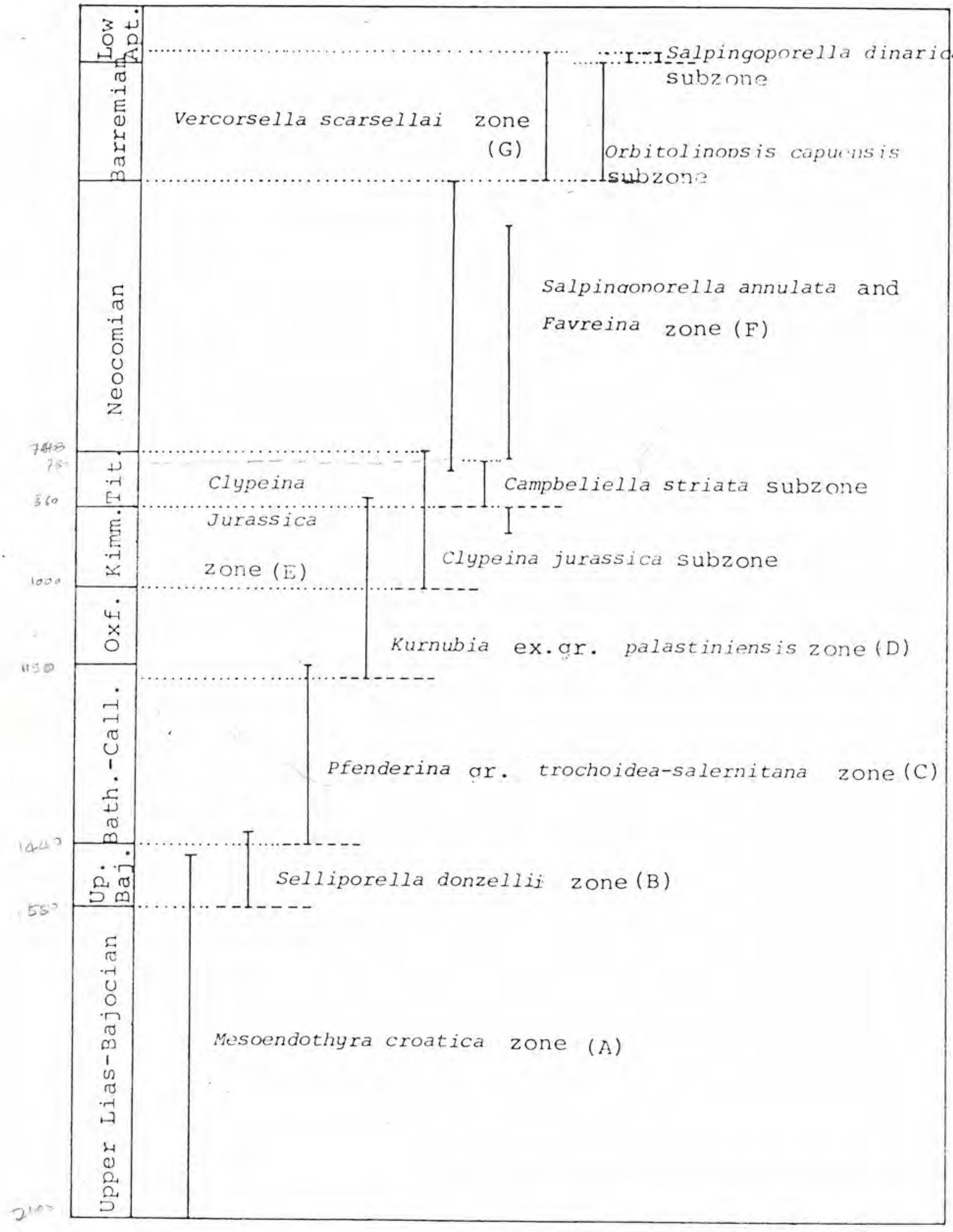


Figure 7. Biostratigraphic zonation of Alakır-1 well sequence in Western Taurids autochthonous Bey Dağları unit.

Diagnostic faunal and floral elements of this zone are *Selliporella donzellii, Mesoendothyra croatica, valvulina* sp. and *"Siphovalvulina"* sp.. This zone corresponds to Upper Bajocian.

ZONE C, *Pfenderina* gr. *trochoidea - salernitana* (fig.7):

The first appearances of *Pfenderina* gr. *trochoidea - Salernitana* and *Kurnubia* ex.gr. *palastiniensis*, respectively, define the lower and upper boundaries of this concurrent-range zone. It represents the sequence between 1440 and 1150 m depth of the well and is composed of the following faunal and floral elements; *Pfenderina* gr. *trochoidea-salernitana, Praekurnubia* sp., *Nautiloculina* sp., *Satorina apuliensis, Selliporella donzellii* and *Valvulina* sp.. This zone corresponds to Bathonian and partly to Callovian.

ZONE D, *Kurnubia* ex. gr. *palastiniensis* (fig.7):

This zone which is characterized by the first appearance of *Kurnubia* ex. gr. *palastiniensis* in its lower level and by *Clypeina jurassica* in its upper level is also a concurrent-range zone. It is represented by a sequence of rock between 1150 and 1000 m interval of the well. Main fossil groups of this zone are *Kurnubia* ex. gr. *palastiniensis, Praekurnubia* sp., *Pfenderina* gr. *trochoidea-salernitana, Nautiloculina* sp. and *Protopeneroplis striata.* This zone chronostratigraphically corresponds to Oxfordian and partly to Callovian.

ZONE E, *Clypeina jurassica* (fig.7) :

Clypeina jurassica zone is characterized by the total empirical range of *Clypeina jurassica* (first and last appearance of this algae) and represents the interval between 1000 and 748 m of the sequence. It is composed of two subzones which are explained respectively below. Main fossil groups of this zone are ; *Clypeine jurassica, Campbeliella striata, Salpingoporella annulata, Rectocyclammina* sp., *Kurnubia* ex. gr. *palastiniensis* and *Parurgonina caelinensis.* This zone corresponds to Kimmeridgian - Tithonian

SUBZONE E_1, *Clypeina jurassica* (fig.7) :

This subzone is represented by the first appearance of *Clypeina jurassica* in its lower level and by *Campbeliella striata* in its upper level. It is a typical concurrent range zone represented by a sequence of rock between 1000 and 860 m interval of the well. *Clypeina jurassica, Salpingoporella annulata, Kurnubia* ex. gr. *palastiniensis, Parurgonina caelinensis* and *Rectocyclammina* sp. are the main faunal and floral elements. This subzone corresponds to Kimmeridgian.

SUBZONE E_2, *Campbeliella striata* (fig.7) :

This subzone is a typical range zone and characterized by the first and last appearance of *Campbeliella striata.* It represents the interval between 780 and 860 m of the sequence. *Campbeliella Striata, Clypeina jurassica, Kurnubia* ex. gr. *palastiniensis,* are the major faunal and floral elements. This subzone corresponds to Tithonian. However the upper most limit of this stage is drawn by the last appearance of *Clypeina Jurassica*

ZONE F, *Salpingoporella annulata* (fig.7) :

The limits of this zone are defined by the disappe-arance of the marker of the underlying zone, *Clypeina jurassica* and the first appearance of the marker of the overlying zone, *Vercorsella scarsellai* . This is a typical assemblage zone and the most representative fossil is *Salpingoporella annulata*. It represents the interval between 780 and 300 m of the sequence. Main fossil groups are *Salpingoporella annulata*, *Cuneolina* sp.,Coprolites (*Favreina*), miliolids and ostracod shell fragments. Chronostratigraphically, this assemblage zone represents Neocomian.

ZONE G, *Vercorsella scarsellai* (fig.7) :

This zone is characterized by the total empirical range of the species *Vercorsella scarsellai* and represents the interval between 300 and 90 m of the sequence. It is composed of two subzones explained below. Main faunal and floral associations of this zone are *Vercorsella scarsellai*, *Orbitolinopsis capuensis*, *Cuneolina* sp., *Debarina* cf. *hahounerensis*, *Nezzazata* sp., *Bolivinopsis* sp., *Salpingoporella dinarica* and miliolids. This zone corresponds to Barremian and partly to Lower Aptian.

SUBZONE G_1, *Orbitolinopsis Capuensis* (fig.7):

The boundaries of this subzone are defined by the first and last appearance of *Orbitolinopsis capuensis*. This subzone is a typical range zone and sequence between 300 and 96 m interval is represented by this range zone. Diagnostic fossil assemblages are *Vercorsella scarsellai, Orbitolinopsis capuensis, Cuneolina* sp., *Haplophragmoides* sp., *Debarina* of *hahounerensis, Nezzazata* sp. ostracod shell fragments and miliolids. This subzone corresponds to the Barremian stage.

SUBZONE G_2, *Salpingoporella dinarica* (fig.7) :

This subzone is a range zone represented by the total empirical range of *Salpingoporella dinarica* and characterize the interval between 96 and 90 m of the sequence. *Cuneolina* sp., *"Pseudotextulariella septfontainei", Nezzazata* sp., *Salpingoporella annulata, Debarina* cf. *hahounerensis* are the main fossil groups. This subzone corresponds to the lower part of the Lower Aptian.

3.2.1. Correlation of the biostratigraphic zones.

For the correlation of the biostratigraphic zones recognized in this study, five biostratigraphic models have been selected. Three of models are from the Apennines and others are from the Taurids (fig.8). Below, the correlation of these zones and subzones recognized in the Alakır-1 well is presented.

	ÖZCAN, 1986 FINIKE	ALTINER, 1981 Aygörmez, KAYSERI	M.CHIOCCHINI et.al.,1979 Apennines, ITALY	Sartoni and Crescenti, 1962 Apennines, ITALY	FARINACCI and RADOICIC, 1964 Apennines, ITALY	TOSUN, 1986 Karaburun, IZMIR
Albian		Cuneolina gr. pavonia		Cuneolina pavonia parva	Cuneolina pavonia parva and Nummoloculina heimi	
Aptian	V. Scarsellai	Pseudotex.? scarsellai S.dinarica / Praeorbitolina lotzei Palorbitolina lenticularis	Salpingoporella dinarica		Salpingoporella dinarica	Palorbitalina lenticularis salpingoporella dinarica
Barremian	Orbitolinopsis capuensis	Orbitolinopsis capuensis	Pseudotextulariella scarsellai and Cuneolina camposaurii	Cuneolina camposaurii		Everticyclammina hedbergi / O.cf. capuensis
Hauterivian	Salpingoporella annulata				Salpingoporella annulata	
Valanginian			Favreina salavensis and Salpingoporella annulata			
Berriasian	Favreina	Salpingoporella annulata clypeina? solkani				Pseudocyclammina lituus
Tithonian	Clypeina jurassica / Campbeliella striata		Clypeina jurassica	Salpingoporella apenninica / Clypeina jurassica and Vaginella striata	Clypeina jurassica and "Bankia" striata	
Kimmeridgian	Clypeina jurassica	Clypeina				
Oxfordian	Kurnubia ex.gr. palastiniensis	Preakurnubia Kurnubia	Kurnubia palastiniensis	Kurnubia palastiniensis / Macroporella sellii	Cladocoropsis mirabilis	
Callovian	Pfenderina gr.	Pfenderina gr. trochoidea		Pfenderina salanitana	Trochaminids Verneulinids Textularians / Pfenderinids	
Bathonian	trochoidea-salernitana	A. cuvillieri / L. mesojurassica (= Satorina apuliensis)	Pfenderina salernitana / Valvulinidae			
Bajocian	Selliporella donzellii / Mesoendothyra croatica	Selliporella donzellii	Selliporella donzellii / Trochamminidae / Mesoendothyra croatica	Thaumatuporella parvovesiculifera	S.donzellii / Atypical zone	
Aalenian			Echinodermata, Mollusks, Favreina	Palaeodasycladus mediterraneus	Palaeodasycladus mediterraneus	
Toarcian						Palaeodasycladus mediterraneous
Pliensbachian		Orbitopsella primaeva	Orbitopsella	Orbitopsolla praecursor		
Sinemurian			Thaumatoporella parvovesiculifera			
Hettangian				Atypical zone	Atypical zone	

Figure 8. Correlation of the biostratigraphic zones.

In the scarceness of other faunal and floral elements, the *Palaeodasycladus mediterraneus* and *Orbitopsella* zones are the only biostratigraphic zones representing the Lias in the carbonate platform sequences of the Tethyan realm. Although the lower boundary of *Palaeodasycladus mediterraneus* zone extends to the base of Lias in some sections presented from Yugoslavia (Velic, 1977), it is generally restricted to the Sinemurian - Aalenian interval (Sartoni Crescenti, 1962 and Farinnacci & Radoicic, 1964). The *Orbitopsella* zone is usually considered as a subzone and represents Pliensbachian stage (Altıner, 1981) or upper part of this stage (Chiocchini et al, 1979).

The *Mesoendothyra croatica* zone which covers a part of the Upper Liassic and Bajocian in our model, is not used in other models. However, Velic (1977) established the same zone in the Lower Dogger sequences in Dinarids.

The *Selliporella donzellii* zone which corresponds to the Bajocian in Apennines (Sartoni & Crescenti, 1962; Farinnacci & Radoicic, 1964) represents the Upper Bajocian in the studied well. The same zone also characterizes a part of the Bajocian stage in the biostratigraphic model of Altıner (1981).

The *Pfenderina* gr. *trochoidea - salernitana* zone which corresponds to the Bathonian - Callovian interval in the models of Sartoni & Crescenti (1962) and Farinnacci & Radoicic (1964), represents Bathonian and a part of Callovian in our sequence. The same biostratigraphic zone is used for the characterization of the Bathonian and a part of Oxfordian stages in the eastern Taurids (Altıner, 1981). This zone is used to represent the Upper Bathonian sequences in Italy (Chiocchini et al, 1979).

The *Kurnubia* ex. gr. *palastiniensis* zone represents the Upper Callovian and Oxfordian in this study. The Kurnubia palastiniensis zone of Sartoni and Crescenti corresponds to Oxfordian. Where as, the same biostratigraphic zone covers a much larger Chronostratigraphic interval, from Callovian to a part of the Kimmeridgian stage in the biostratigraphic models of Chiocchini et al (1979).

Clypeina jurassica and *Campbeliella striata* are the very important markers of the Kimmeridgian-Tithonian and Tithonian stages respectively. The *Clypeina jurassica* zone which represents the Kimmeridgian and Tithonian stages in our model, corresponds to the Kimmeridgian and a part of the Tithonian in the biostratigraphic models of Sartoni & Crescenti (1962) and Farinnacci & Radoicic (1964). In the studied sequence, two subzones, the *Campbeliella striata* corresponding to the Tithonian and the Clypeina jurassica representing the Kimmeridgian have been established in the *Clypeina jurassica* zone.

Biostratigraphically, it is not easy to characterize the Neocomian in the platform sequences of the Tethyan realm. However *Salpingoporella annulata* and coprolites *(Favreina)* characterize the Neocomian in almost every model. *Salpingoporella annulata* zone defined in this study presents a direct correlation with that of Chiocchini et all (1979). However, in the model proposed by Tosun (1986), part of this interval is represented by *Pseudocyclammina lituus* and *Everticyclammina hedbergi* zones.

In the studied sequence, the *Vercorsella scarsellai* zone corresponds to the Barremian and a part of Aptian. This zone is composed of two subzones, *Orbitolinopsis capuensis* subzone representing the Barremian and *Salpingoporella dinarica* subzone corresponding to the Lower Aptian. The *Orbitolinopsis capuensis* subzone proposed in this study can be correlated with that of Altıner (1981) and Tosun (1986). The *Salpingoporella dinarica* subzone characterize the Lower Aptian in the proposed model in this study and easily correlated with the same zone defined by Farinnacci & Radoicic (1964). However, this biostratigraphic subzone is defined in a larger time interval, corresponding to Barremian and Lower Aptian in the models of Altıner (1981) and Tosun (1986).

CHAPTER 4

MICROFACIES ANALYSIS

4.1. INTRODUCTION

The most essential part of the facies analysis in this chapter covers the differentiation of microfacies types that can be interpreted genetically. Main criteria for defining these microfacies types are those features whose existence are linked with certain sedimentary environments. The characteristic features used for this purpose are;

- Matrix
- Cement
- Particle: Skeletal or non-skeletal, size, shape, percentage and texture which is formed by their mutual relationships.
- Association of organisms

Using presence or absence, or relative frequency of above selected features Wilson's (1975) standart microfacies (SMF) and facies zones (FZ) are adapted. The diagenetic features of the carbonates are not studied and thus excluded in the definition of the microfacies types.

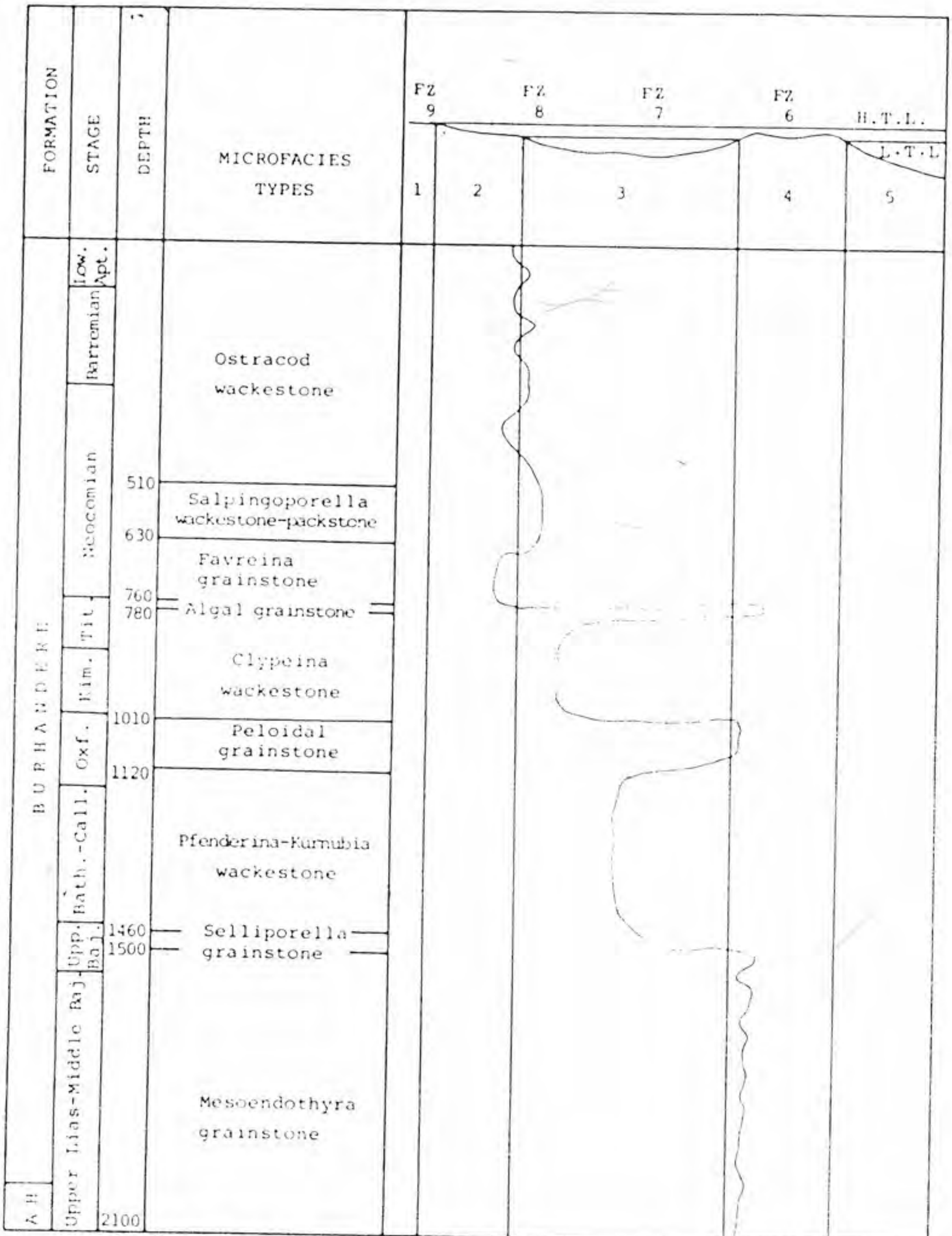
9 microfacies and 4 subfacies have been recognized in the study and succession of these facies

together with their environmental interpretations are illustrated in fig.9. Lower levels of *Mesoendothyra* grainstone gradeto underlying dolomite or dolomitic limestones in which original features are destroyed. These lithologies continue upto the end of sequence and hence excluded from this study. Below, the description of these facies is given in descending order.

4.2. DESCRIPTION OF THE MICROFACIES

4.2.1. Ostracod wackestone (fig.10):

This microfacies is represented by a sequence of rocks from the first meters to about 510 m. depth of the well. Although it consists of a variety of types, ostracod wackestones are regularly and frequently observed at different levels of this sequence. Ostracods, being the main constituent, show either a preferred orientation or random distribution in a micritic groundmass. This matrix is usually devoid of cement (fig.10). Fecal pellets or peloids and miliolids are the main contributors. Biologically, this microfacies is rather poor when compared to its submicrofacies which are defined by abundance of the cuneolinid, miliolid foraminifera and the peloids.



FZ Facies zones of Wilson (1975)

1. Supratidal environment
2. Intertidal environment
3. Subtidal, lagoonal environment
4. Reef and back reef shoal environment
5. Reef front

H.T.L. High tide level
L.T.L. Low tide level
AH Alihüseyinler formation

Figure 9. Microfacies types with their proposed depositional setting.

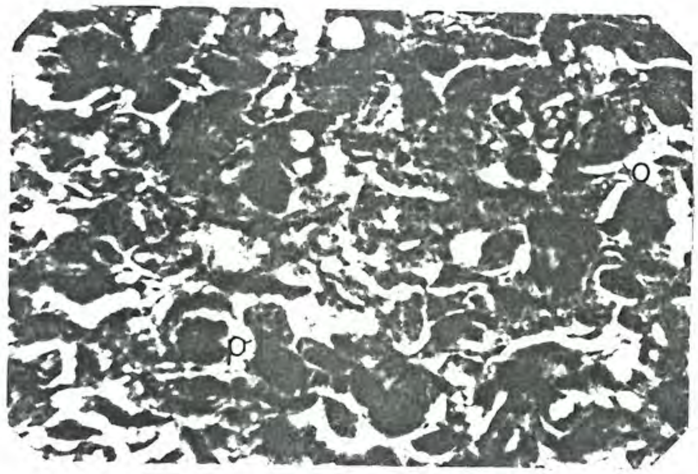


Figure 10. Ostracod wackestone. Note the preferred orientation of ostracods (o) and peloids (p). A.500-502 m , x 40. Burhandere formation.

4.2.1.1. *Cuneolina* wackestone subfacies (fig.11) :

This type is recognized by the abundance of *Cuneolina* sp. and miliolids embedded in a micritic matrix (fig.11). The other faunal associations are absent in this sub-microfacies.

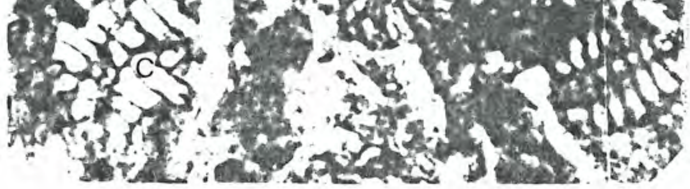


Figure 11. *Cuneolina* wackestone. *Cuneolina* sp.(c) in micritic matrix. A.45 - 46 m , x 40. Burhandere formation.

4.2.1.2. Miliolid grainstone subfacies (figs.12, 13) :

The faunal content of this submicrofacies is the richest among those of other subfacies. The groundmass is usually composed of sparry calcite but in some levels lime mud is observed in the matrix. Miliolids which are rarely observed in other microfacies become very abundant in this type. Peloids and clasts form about 30% of all the skeletal and nonskeletal fragments in volume (figs.12 and 13). Other faunal elements are represented by foraminifera *Debarina, Orbitolinopsis, Haplophragmoides, Nezzazata,* textularids and ostracod shell fragments.

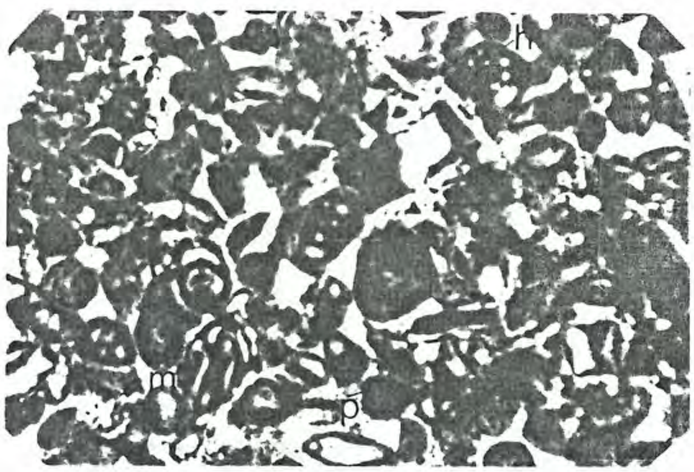


Figure 12. Miliolid grainstone. Miliolids (m) *Haplophragmoides* sp. (h) and peloids (p) in sparitic groundmass. A.290-292 m , x 40. Burhandere formation.

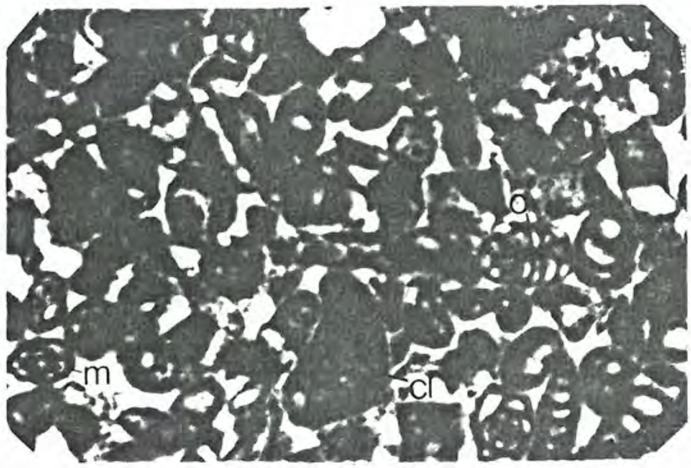


Figure 13. Miliolid grainstone. Miliolids (m), clasts (cl), *Orbitolinopsis* (o) in sparitic groundmass. A.260-262 m , x 40. Burhandere formation.

4.2.1.3. Peloidal grainstone subfacies (fig.14) :

Groundmass is composed of sparry calcite. Peloids are well-sorted and subrounded (fig.14). Some algal-coated particles are observed in several horizons. Locally, pelmicritic laminae intercalations are observed between pelsparitic grainstone levels. Biologically *Haplophragmoides*, some miliolids and rare textularids are determined.

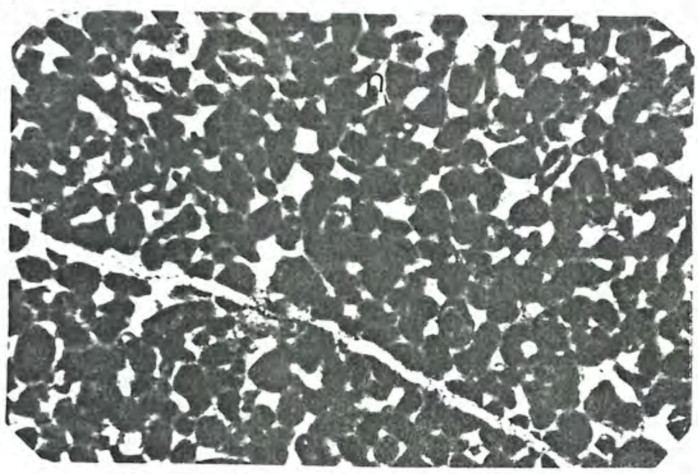


Figure 14. Peloidal grainstone. Sections of *Haplophragmoides* sp. (h) and well-sorted peloid grains. A.120-122 m , x 40. Burhandere formation.

4.2.1.4. Mudstone subfacies (fig.15) :

This type is characterized by a micritic groundmass, devoid of fossils. All the above mentioned facies types and mudstone subfacies are oftenly disrupted by dolomitization. These dolomite rhombs are randomly scattered in the groundmass (fig.15). Towards the lower levels of the sequence dolomitization masks the original texture.

Figure 15. Dolomitized mudstone. Well crystallized dolomite rhombs in pure lime mud. A.390-392 m., x 40. Burhandere formation.

Depositional environment :

Faunal associations recognized in the Ostracod wackestone facies indicate a shallow water marine environment far away from organic build-ups. The presence of restricted type of fauna in ostracod-peloid assemblage is an indication of deposition in restricted bays and ponds. Peloids are possibly derived from organic pelleting of mud deposited on tidal flats and may represent only very slight water movement. These microfacies are interpreted as SMF19-FZ8 of Wilson (1975). Miliolid grainstone subfacies with its rather rich faunal elements may indicate the deposition in shallow water lagoonal environment in which water is slightly agitated so that lime mud is winnowed out. *Cuneolina* wackestone with its miliolid association may represent a depositional environment deeper than above mentioned ones and below wave base in lagoonal environment. The last two subfacies types can be considered as SMF9-FZ7 of Wilson (1975). So it can be deduced that Ostracod wackestone and its subfacies show an environment of deposition varying from very shallow lagoonal to tidal flat environments or vice versa.

4.2.2. *Salpingoporella* wackestone-packestone (figs.16, 17):

This microfacies type is observed from about 510 m. depth of the well. In these meters it is composed of a pure micritic matrix with a little amount of scattered *Salpingoporella* or pure mudstone which is strongly affected by dolomitization. Absence of other biological or non-biological elements is diagnostic. Towards the lower levels, increase in the percentage of the biological constituents, especially *Salpingoporella,* is observed and packstones become prodominant (fig.16). In these lower levels, from the beginning of 630 m., mainly coprolites *(Favreina)* become the prodominant element to contribute this microfacies type (fig.17). This microfacies gradually grades into *Favreina* grainstone with the increase of coprolites and decrease in the percentage of *Salpingoporella*.

Figure 16. *Salpingoporella* packstone. *Salpingoporella annulata* (s) and *Clypeina solkani* (Cs). A.630-632 m ,x 40 Burhandere formation.

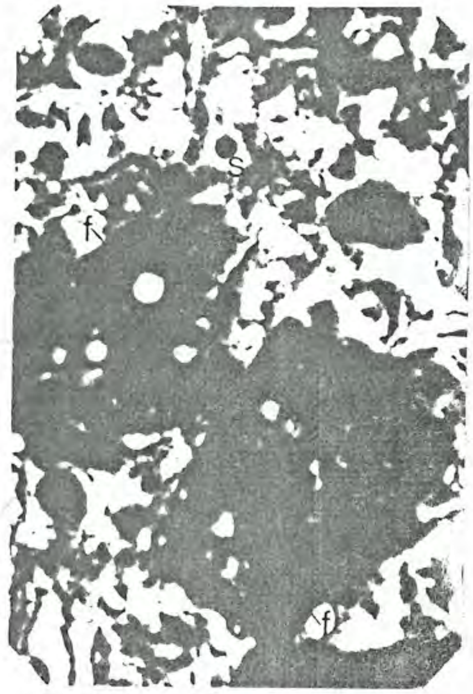


Figure 17. *Salpingoporella* packstone. *Salpingoporella annulata* (s) and *Favreina* (f). A.630-632 m , x 40 Burhandere formation.

Depositional environment :

Presence of the micritic matrix indicates a depositional environment in quite water environments. It is unnecessary to correlate this microfacies with shelf facies with open circulation because of the fact that the diversity of fauna in open marine shelf facies is high. Absence of peloids, laminations and fenestral fabrics is an indication of depositional environment away from tidal conditions. Although groundmass does not contain any sparite, we can assign this microfacies to SMF18, FZ-7 of Wilson (1975), indicating a depositional environment in deeper parts of tidal bars and channels of lagoons so that lime mud is winnowed out.

4.2.3. *Favreina* grainstone (Figs.18, 19):

This microfacies is observed between 630-760 m. interval and characterized by densely packed coprolites in sparry calcite cement (fig.18, 19). Lime mud (micrite) is usually absent. In the upper parts of the sequence it grades into *Salpingoporella* wackestone with *Favreina* and in the lower parts it passes rapidly into algal grainstone microfacies.

This microfacies is not uniform in itself and may also show a variation from pure lime mud to lime mudstone with peloids. Pelsparites with abundant *Favreina* is more common than others. Biologically, this microfacies is devoid of other constituents except few *Salpingoporella* which is found in several horizons. Strong dolomitization also affects the original features of this microfacies.

Depositional environment :

This microfacies type with its very poor biological content and sparitic groundmass may represent a wave and current-controlled depositional environment. In the absence of ostracod-peloid assemblage we can assign this microfacies to rather shallow part of lagoon, near to the intertidal zone. This microfacies can be considered as SMF16-FZ7 and 8 of Wilson (1975).

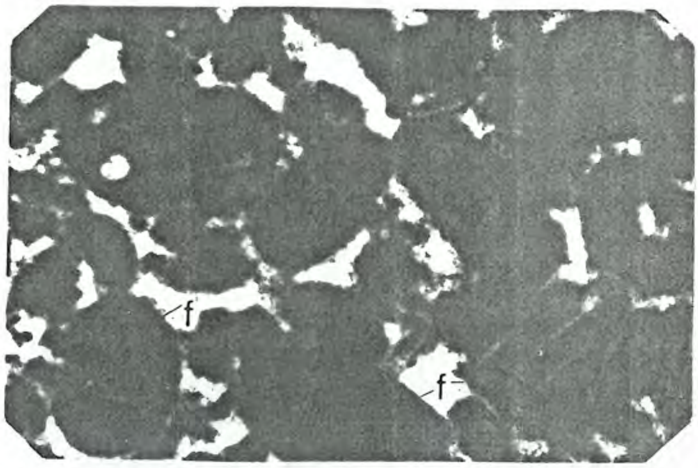


Figure 18. *Favreina* grainstone. Densely packed *Favreina* (f) in sparitic groundmass. A.679-680 m , x 40. Burhandere formation.

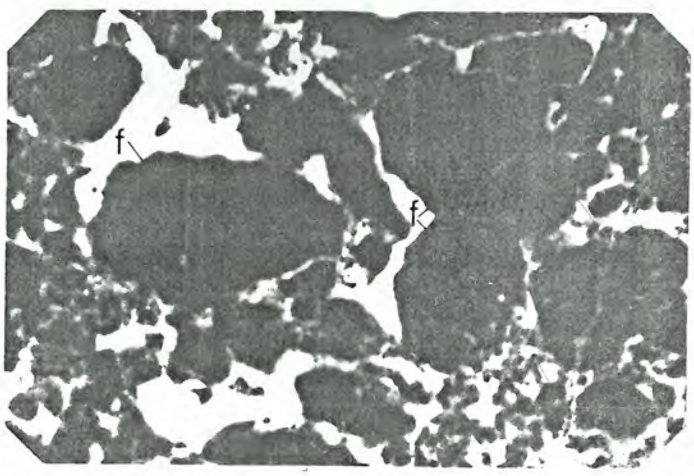


Figure 19. *Favreina* grainstone. *Favreina* in sparitic groundmass. A.770-780 m x 40. Burhandere formation.

4.2.4. Algal grainstone (fig.20) :

Groundmass is sparite and completely devoid of micrite. This microfacies is quite different from the other microfacies types by its coarse grained (>750μ), condense, very rich algal flora in a sparitic groundmass (fig.20). Algal fragments are well rounded and usually covered by algal films. Biologically, other organisms are very scarce except some *"Siphovalvulina"*. This microfacies is observed between 760 m. and 780 m. depths and underlain by the sequence which represents *Clypeina* microfacies.

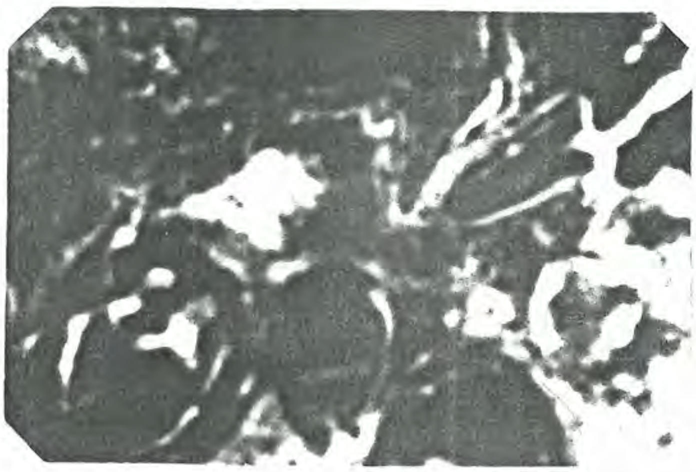


Figure 20. Algal grainstone. Well rounded algal fragments in sparitic groundmass. A.770-772 m , x 40. Burhandere formation.

Depositional environment :

Absence of micrite in the groundmass and presence of well rounded algal particles requires a depositional environment with constant wave or current action and mud removed by winnowing. These grainstones are deposited in back-reef shoal environments in agitated water. Dasycladacean grainstones are also deposited in tidal bars and channels of lagoons in restricted marine shoals. However, association of peloids with dasycladacean algae is very diagnostic for this environment. For this reason, a back-reef shoal environment setting is appropriate for the environment of deposition of this microfacies. This microfacies type can be assigned to SMF12-FZ6 of Wilson (1975).

4.2.5. *Clypeina* wackestone (figs.21, 22, 23, 24, 25) :

This microfacies is represented between 780 m. and 1010 m. depths of the well and starts with pure lime mudstones in which densely spaced secondary dolomite rhombs are scattered. Matrix is dark-brown coloured micrite. Biologically, *Clypeina jurassica* is associated with *Campbeliella striata* in the upper levels (figs.21, 22) and grades into peloid-rich mudstones. Impoverishment of biota in these levels is distinct. Towards 820 - 830 m., the microfacies suddenly changes its character with a marked increase in the percentage of biota, peloids and clasts (fig.23). *C. jurassica* is absent in these levels. Starting from 860 m., two above mentioned lithologic types show an alternation between *C. jurassica* bearing lime wackestones and quite densely packed, peloid rich pelsparites (fig.24). This microfacies contains rare *Kurnubia* (fig.25) lower levels of Clypeina wackestone grades into pelsparites.

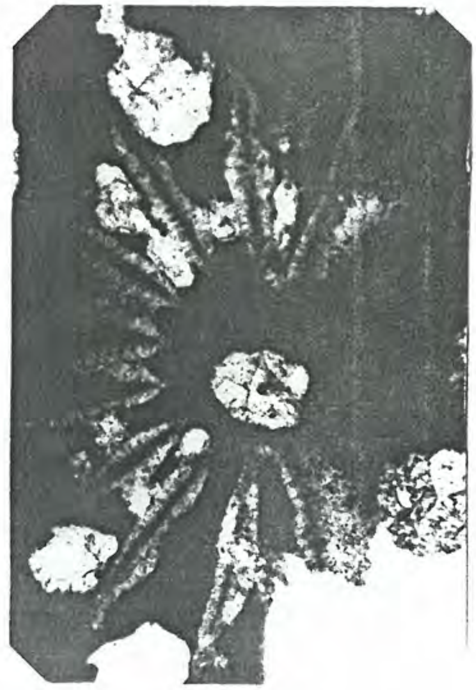


Figure 21. *Clypeina* wackestone
Upper levels with *Clypeina jurassica* (c) and *Campbeliella striata* (Cs) A. 790-792 m , x 40. Burhandere formation.

Figure 22. *Clypeina* wackestone
Upper levels in which *Clypeina jurassica* is embedded in a dark-brown limemud. A. 800 m , x 40. Burhandere formation.

Depositional environment :

Pure lime mud which is devoid of cement is an indication of deposition in quite calm water. In the absence of fenestral fabric and ostracod-peloid assemblage, micritic matrix with algae and scattered foraminifera may represent deposition in very restricted bays and ponds or more deeper parts of lagoon. This microfacies is attributed to SMF 19 - FZ7 and 8 of Wilson (1975).

Figure 23. *Clypeina* wackestone. Levels with peloids and clasts. A.848-850 m , x 40. Burhandere formation.

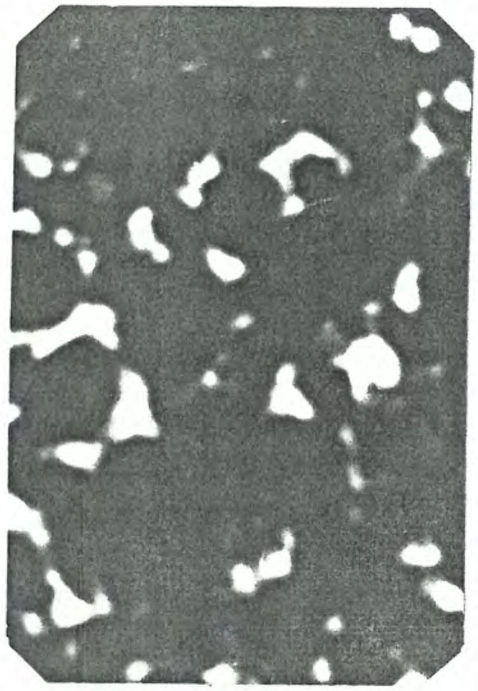


Figure 24. *Clypeina* wackestone. Levels with peloids. A.932-934 m , x 40. Burhandere formation.

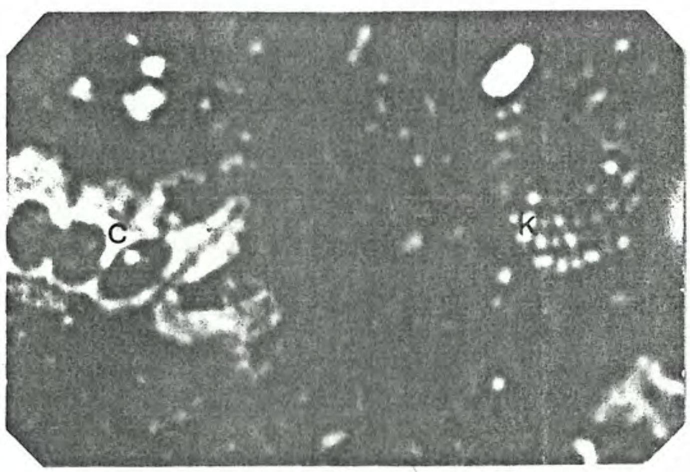


Figure 25. *Clypeina* wackestone. *Clypeina jurassica* and *Kurnubia* association. A.908-910 m , x 40. Burhandere formation.

4.2.6. Peloidal grainstone (fig.26) :

This microfacies is represented from 1010 m. to 1120 m. depths of the well. Groundmass is completely composed of sparite in some levels, sparite and micrite in others. Presence of large peloids and clasts is very diagnostic. Usually, these large peloids or clasts are found together within smaller and equal-sized peloids (fig.26).

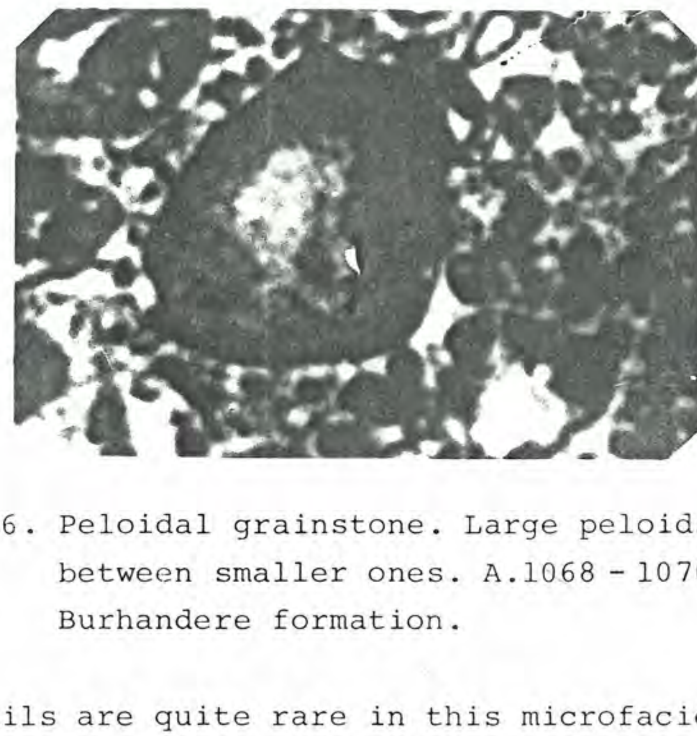


Figure 26. Peloidal grainstone. Large peloids and clasts between smaller ones. A.1068 - 1070 m , x 40. Burhandere formation.

The fossils are quite rare in this microfacies. *Protopeneroplis*, *Nautiloculina*, some echinoid and algal fragments have been identified. In some levels of this sequence, this microfacies passes into lime mudstones which lack peloids and clasts. In these levels, presence of *Kurnubia* is highly characteristic. This microfacies with its poor biota passes , in its lower levels, to *Pfenderina-Kurnubia* wackestone microfacies rich in *Kurnubia*, *Praekurnubia* and

Pfenderina. This abrupt change in the faunal elements as well as in the original fabric of the rock suggest that vertical distribution of some fossil groups may be controlled by the vertical facies change.

Depositional environment :

Although peloidal grainstones are usually restricted to tidal flat environments, faunal elements are almost absent in this depositional environment. However, even if fossils are rare our microfacies contain some foraminifera which are ecologically restricted to more high energy parts of the platform *(Protopeneroplis)*. So author thinks that this microfacies represents deposition in shoal environments in agitated water, near to lagoon. It is attributed to SMF14-FZ6 of Wilson (1975).

4.2.7. *Pfenderina-Kurnubia* wackestone (figs.27, 28, 29):

This microfacies type starts from about 1120 m. and is traced down to 1460 m. depth of the well. Groundmass is composed of pure micrite without any sparite and it is consistent all throughout this interval (figs.27, 28). Peloids are very rare but observed in several horizons. Dolomite rhombs are randomly and scarcely spaced in micritic mass. Structural features, such as lamination, birds-eye are not observed.

Starting from 1248 m., algal balls are observed down to the lower limit of the sequence representing this microfacies. These algal balls are very frequent between 1248 and 1300 m. (fig.29). Biologically, *Pfenderina* is the main element and accompanied by *Kurnubia, Praekurnubia, Valvulina, "Siphovalvulina"* and some other agglutinated foraminifera.

Figure 27. *Pfenderina* wackestone. *Pfenderina* sp.(p) in micritic mass. A.1156 m , x 40. Burhandere formation.

Figure 28. *Pfenderina* wackestone. A.1156 m , x 40. Burhandere formation.

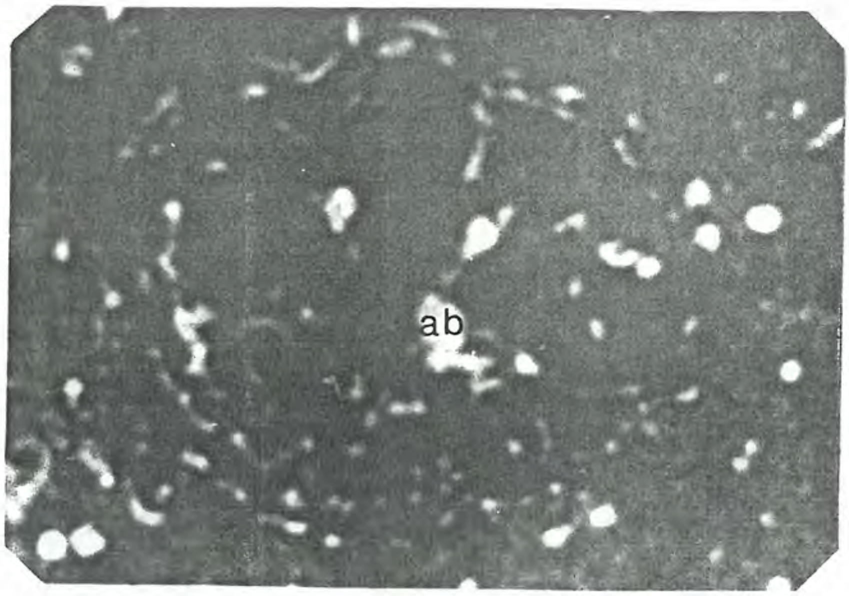


Figure 29. *Pfenderina* wackestone. Algal balls (ab) in micritic matrix. A.1370-1380 m , x 40. Burhandere formation.

Depositional environment :

Presence of pure micritic matrix devoid of cement is an indication of deposition in calm water. The low diversity of faunal elements with many individuals is one of the diagnostic criteria to differentiate this depositional environment from shelf environment with open circulation. Absence of coated grains and sparitic cement also distinguishes this microfacies type from other low energy depositional environments. This microfacies type can be considered SMF22-FZ7 and 8 of Wilson (1975), representing a subtidal lagoonal part of the platform.

4.2.8. *Selliporella* grainstone (fig.30) :

In this microfacies type large *Selliporella* fragments of about 1,5-2 mm in size are densely cemented in sparitic groundmass. Clasts are the main non-skeletal fragments (fig.30). Biologically, *Mesoendothyra* and some agglutinated foraminifera are the main contributors.

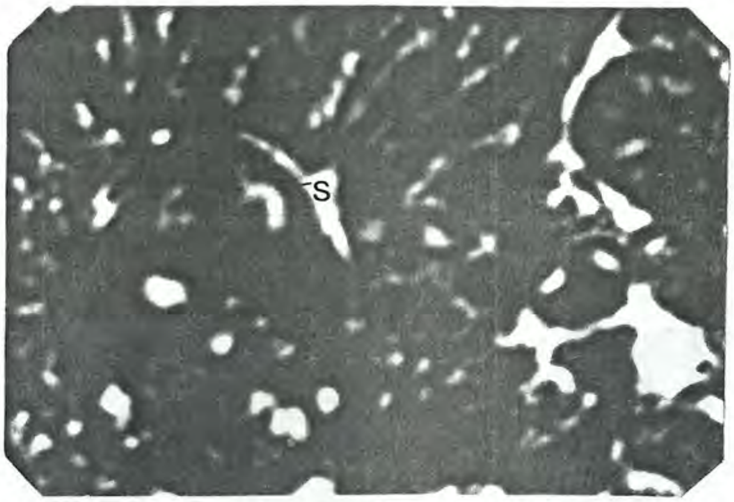


Figure 30. *Selliporella* grainstone. *Selliporella donzellii* (s) in sparitic groundmass. A.1518-1520 m , x 40 Burhandere formation.

Depositional environment :

This microfacies also represents, as other algal grainstone microfacies types, a depositional setting in slightly agitated water, in back-reef shoal environments. Absence of micrite is an indication of constant current or wave action. It is assigned to SMF12-FZ6 of Wilson (1975).

4.2.9. *Mesoendothyra* grainstone (figs.31, 32, 33, 34) :

This microfacies is represented by a sequence of rocks between 1500-2100 m depths of the well. The groundmass is composed of sparry calcite and devoid of lime mud. The most diagnostic feature of this facies is the presence of ooids and onkoids (fig.31) which are not observed in other facies types. *Mesoendothyra* fragments are common in these levels. This oolitic or onkoidal facies with peloids is frequently observed except some levels which are composed of lime mud containing *Mesoendothyra* in the matrix (fig.32).

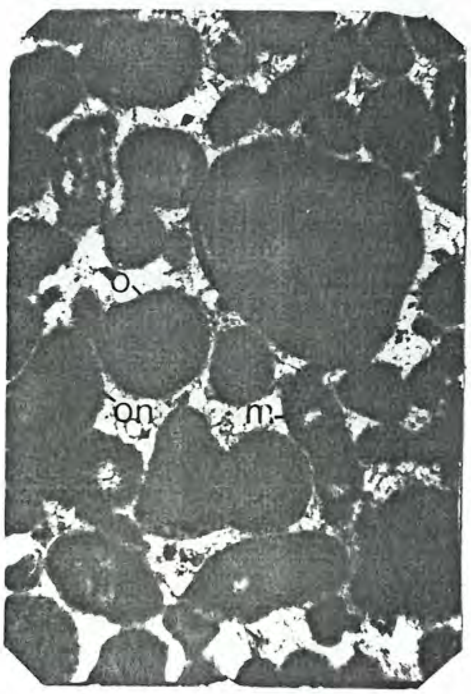


Figure 31. *Mesoendothyra* grainstone. Ooids(o), onkoids(on), peloids (p) and *Mesoendothyra* (m) in sparitic groundmass.A.1732 m , x 40 Burhandere formation.

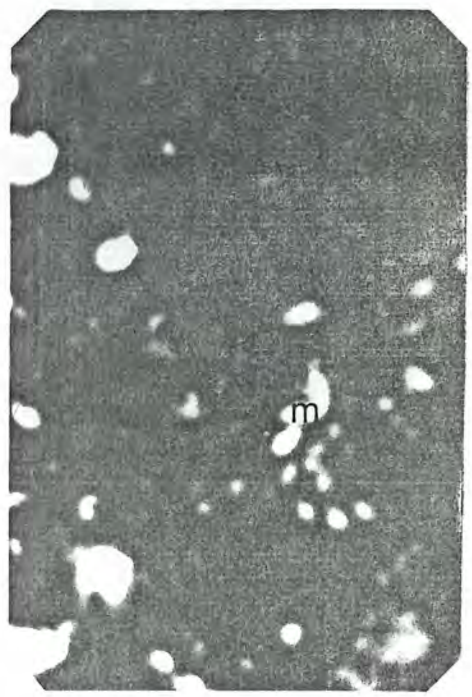


Figure 32. *Mesoendothyra* grainstone. *Mesoendothyra* (m) in lime mud. A.1602 m , x 40. Burhandere formation.

In the lower levels of the sequence, *Thaumatoporella* becomes dominant biological element. Other faunal and floral elements of the *Mesoendothyra* grainstone microfacies are *Selliporella* (in upper levels), *Valvulina, "Siphovalvulina"* and other Ataxophragmiid foraminifera. This microfacies passes to dolomites or dolomitic limestones in which dolomitization masks the original texture.

Figure 33. *Mesoendothyra* grainstone Peloids (p) and *Mesoendothyra* (m) in sparitic groundmass A.1800 m, x 40. Burhandere formation.

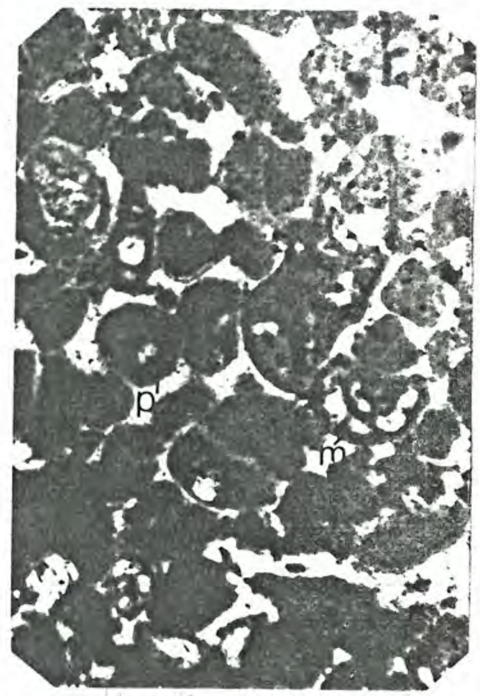


Figure 34. *Mesoendothyra* grainstone *Mesoendothyra* (m) and peloid (p) grains in sparry calcite A.1522 m, x 40. Burhandere formation.

Depositional environment :

Ecological distribution of *Mesoendothyra* in the high energy zones the of back-reef areas has been mentioned before by Pelissié and Peybernés (1982). Presence of sparry calcite in the groundmass and ooids together with onkoids strongly suggest a depositional environment in high energy zones of the shelf. This environmental setting corresponds to the back-reef shoal environments of agitated water. Levels with lime mud can be attributed to the lower energy zones of the platform representing a transition from quiet water depositional setting to shoal environments. This microfacies type represents SMF13 and 15 - FZ6 of Wilson (1975) (fig.9).

CHAPTER 5

MICROPALEONTOLOGY

5.1. SYSTEMATIC PALEONTOLOGY

In the studied sequence of Alakır-1 well, different families, genera and species of the foraminifera were identified. In the classification of these microfossil groups, the classifications of Loeblich and Tappan (1964, 1984) were taken as a base. However, new changes in different ranks of these fossil groups, have been considered in proper places.

5.1.1. Foraminifers

Order Foraminiferida Eichwald, 1830

Suborder Fusulinina Wedekind, 1937

Family?

Genus *Protopeneroplis* Weynschenk, 1950

Protopeneroplis striata Weynschenk, 1950

(pl.3, fig.8)

1950 *Protopeneroplis striata* - Weynschenk, p.13, pl.2, figs.12-14.

1976 *Protopeneroplis striata* - Farrinacci, p.153-154, pl.1, figs.1-6.

1977 *Protopeneroplis striata* - Azema, Chabrier and Jaffrezo, pl.3, figs.1-3.

1985 *Protopeneroplis striata* - Tosun, p.65-66, pl.7, fig.8.

1985 *Protopeneroplis striata* - Çetintaş, p.39-41, pl.1, fig.1.

Description :

Test is planispirally coiled, bilaterally symmetrical andinvolute. Septa are thick and chambers are almost rectangular. Wall is composed of two layers, inner of microgranular, outer hyaline and fibreous. In the hyaline wall regularly arranged calcareous striations are present.

Dimensions (in mm) :

Equatorial diameter : 0.26

Wall thickness : 0.015

Remarks :

Although its aperture and involute coiling are not observed, this species can be easily differentiated from other planispirally coiled foraminifera by having two layered wall structure and striations in the hyaline wall. *Protopeneroplis striata* differs from *P. trochangulata* in having smaller dimensions, striations on the wall and planispiral coiling.

Stratigraphic distribution in the sequence : Oxfordian

Suborder Textulariina Delaga and Herouard, 1896

Superfamily Lituolacea de Blainville, 1827

Family Lituolidae de Blainville, 1825

Genus *Debarina* Fourcade, Raoult, Vila, 1972

Debarina cf. *hahounerensis* Fourcade, Raoult, Vila, 1972

(pl.1, figs.1-4)

1972 *Debarina hahounerensis* n. gen. n. sp. - Fourcade, Raoult, Vila, p.1-3, pl.1, figs.3-4.

1972 *Debarina hahounerensis* - Fourcade and Raoult, pl.3, figs.1-3.

1978 *Debarina hahounerensis* - Velic and Sokac, pl.3, figs. 4-5.

1978 *Debarina* sp. (*? Debarina hahounerensis*) - Sokac and Velic, pl.8, figs.1-2.

1980 *Debarina* cf. *hahounerensis* - Arnaud-Vanneau, pp.359-361, pl.78, figs.5-6.

1982 *Debarina hahounerensis* - Altıner and Decrouez, pl.4, figs. 1-5.

1985 *Debarina* cf. *hahounerensis* - Tosun, p.43-44, figs.8-9.

Description :

Test is enrolled, planispirally coiled. Wall is finely agglutinated, calcareous and rather thick. Chambers are nearly subrectangular, regularly increasing in volume in subsequent whorls. Septa are slightly inclined forward and have same thickness as the wall. Proloculus is observed and quite large. Aperture system is not observed in the absence of axial sections, although indicated as multiple, interiomarginal in the original description. Number of chambers in the last whorl varies between 10 and 12.

Dimensions (in mm) :

	Fig.1	Fig.2	Fig.3	Fig.4
Equatorial diameter	0.30	0.350	0.220	0.280

Thickness of the wall	0.020	0.020	0.015	0.015
Diameter of proloculus	0.055	0.070	0.040	0.050

Remarks :

One of the most diagnostic feature of this species is its apertural system. In the absence of axial sections, apertural system could not be defined in this study. However, chamber form and dimensions suggest that these specimens should be identified as *Debarina hahounerensis* with a certain reservation. This species differs from the species of the genus *Haplophragmodies* in having multiple, interimarginal aperture. In equatorial sections, it differs from the species of genus *Nautiloculina* in the absence of bilamellar septa.

Stratigraphic distribution in the sequence: Barremian to Lower Aptian

Genus *Nautiloculina* Mohler, 1938

Nautiloculina sp.1

(pl.3, figs.3-5)

Description :

Test is planispirally enrolled, involute and bilaterally symmetrical. Umbilical region is biconvex by the thickening of the successive lames. Wall is finely agglutinated and calcareous. In the absence of the equatorial sections, apertural system of this species is not observed, although it is given as simple, basal in the original definition of the genus *Nautiloculina*.

Dimensions (in mm) :

	Fig.3	Fig.4	Fig.5
Diameter of the test:	0.48	0.3	0.61
Axial thickness :	0.26	0.18	0.35

Remarks :

Nautiloculina sp.1 is differentiated from the species *Debarina hahounerensis* by having a bilamellar septa and a single aperture.

Stratigraphic distribution in the sequence : Callovian-Oxfordian

Nautiloculina sp.2

(pl.3, fig.1)

Description :

Test is planispirally enrolled, involute and bilaterally symmetrical. Wall is finely agglutinated, calcareous and thick.

Dimensions :

	Fig.1
Diameter of the test :	0.48
Axial thickness :	0.33

Remarks :

This species is differentiated from *Nautiloculina* sp.1 by having a thicker wall structure.

Stratigraphic distribution in the sequence :Callovian-Oxfordian

Subfamily Haplophragmoidinae Maync, 1952

Genus *Haplophragmoides* Cusman, 1910

Haplophragmoides sp.

(pl.1, figs.5-6, 9)

Description :

Test is planispirally coiled. Wall is calcareous and finely agglutinated. Chambers are almost subrectangular with a considerable volume increase in the successive whorls. Septa are slightly inclined forward. Aperture is not observed, although stated as interiomarginal, simple. Number of chambers in the last whorl varies between 8 and 10.

Dimensions (in mm):

	Fig.5	Fig.6	Fig.9
Equatorial diameter	0.22	0.21	0.18
Thickness of the wall	0.015	0.02	0.015
Diameter of the proloculus	-	-	-

Remarks:

This species is differentiated from *Debarina hahounerensis* in having smaller size and interiomarginal, simple aperture.

Stratigraphic distribution in the sequence : Barremian

Subfamily Cyclammininae Marie, 1941

Genus *Mesoendothyra* Dain, 1958

Mesoendothyra croatica Gusic, 1969

(pl.8,figs.1-8, pl.9, figs.1-8)

1969 *Mesoendothyra croatica* n.sp-Gusic, p.65-67, pl.Xl, figs. 1-8.

1978 *Mesoendothyra croatica* - Velic and Sokac, pl.3, figs. 1-3.

1980 *Mesoendothyra croatica* - Septfontaine, pl.1, fig.16.

1982 *Mesoendothyra croatica* - Pelissie and Peybernes, p.122-128, pl.3, figs.5-6.

Description:

Test is enrolled in the first 2-3 whorls, semi - involute, planispirally coiled and followed afterwards by an uncoiled rectilinear stage (pl.8,fig.5;pl.9,figs.2,5-6). Uncoiled stage is not observed in every specimen. Plane of coiling varies very slightly in some specimens(pl.8, fig.4) whereas completely planispiral in others. In axial sections, slightly concave umbilical region is well defined. Number of chambers in the whorls varies between 9 and 11. Uncoiled rectilinear part of the test consists of 3 chambers (pl.8,fig.5; pl.9, fig.2,5-6). Chambers regularly increased in height and diameter reaching a maximum volume in the last whorl. The wall is calcareous and finely agglutinated.

Septa are short (pl.8,fig.1-2,7-8; pl.9, fig.3) and convex towards the aperture. Aperture is simple, basal in coiled part, shifting to the center of the septal plate in uncoiled stage. Specimen figured in pl.9, fig.5, shows that aperture becomes cribrate in the uncoiled stage.

Plate 8.

Dimensions (in mm) :	Fig.1	Fig.2	Fig.3	Fig.4	Fig.5	Fig.6	Fig.7	Fig.8
Maximum length (=height) of the test	0.35	0.52	0.61	0.69	0.98	0.3	0.58	0.62
Diameter of the coiled part	0.35	0.52	0.61	0.69	0.56	0.3	0.58	0.62
Diameter of the uncoiled part	--	--	--	--	0.28	--	--	--
Thickness of the test in umbilical region	--	--	--	0.2	--	0.11	--	--
Thickness of the wall	0.025	0.02	0.025	0.03	0.035	0.03	0.03	0.03
Maximum height of the chambers	0.07	0.1	0.12	0.11	0.11	0.045	0.15	0.1
Diameter of the aperture	--	--	--	--	0.04	--	--	--

	Plate 9					
	Fig.1	Fig.2	Fig.3	Fig.4	Fig.5	Fig.6
Maximum length of the test	0.7	0.73	0.31	0.34	1.125	0.84
Diameter of the coiled part	--	0.35	0.31	0.34	0.5	0.48
Thickness of the test in umlical region	--	0.2	--	--	0.3	0.3
Thickness of the wall	0.04	0.02	0.015	0.02	0.03	0.05
Maximum height of the chambers	0.1	0.1	0.08	0.08	0.11	0.13
Diameter of the aperture	--	0.03	--	--	0.02	--

Remarks:

This study proves that this species is an important index fossil for the Dogger sediments of autochthonous Bey Dağları unit and it is not only restricted to the Lower Dogger but also covers a part of Upper Liassic. This species is usually found in limestone levels which were deposited in high energy environments. Studies in Europe also supports this observation (Pelissié and Peybernes, 1982).

M. croatica is distinguished from *Mesoendothyra izjumiana* Dain, by having a well developed uncoiled uniserial stage and lacking a plectogyroidal initial stage, resulting in an entirely planispiral mode of coiling.

Stratigraphic distribution in the sequence: Upper Liassic to Bajocian.

Genus *Rectocyclammina* Hottinger, 1967

Rectocyclammina sp.

(pl.7 fig.6-8)

Description :

Test is planispirally coiled in early stage and later uncoiled with an uniserial chamber arrangement. Wall is composed of sub-epidermal reticulate layer. Aperture is single and terminal.

Dimensions (in mm) :

	Fig.6	Fig.7	Fig.8
Lenghth of the test	0.620	0.680	0.800
Thickness of the wall	0.090	0.100	0.120

Remarks :

The genus *Everticyclammina* differs from *Rectocyclammina* in having an elongated aperture system, an alveolar wall, instead of having a subepidermal reticulate wall structure and a well developed planispiral part. On the other hand, the genus *Pseudocyclammina* differs from the genus *Rectocyclammina* by having multiple aperture system and alveolar wall structure.

Stratigraphic distribution in the sequence : Kimmeridgian.

Family Ataxophragmiidae Schwager, 1877

Subfamily Valvulininae Berthelin, 1980

Genus *Valvulina* D'Orbigny, 1826

Valvulina sp.1

(pl.10,fig.6)

Description :

Test is triserial and compressed. Wall is simple, microgranular. Chambers are rapidly increasing in size. Aperture is at the base of chamber with a large valvular tooth.

Dimensions (in mm):

Height of the test : 1.40

Valvulina sp.2

(pl.10, figs.8,10)

Description :

Test is triserial and highly compressed. Wall is simple, microgranular. Chambers are rapidly increasing in volume. Aperture is at the base of chamber with a valvular tooth.

Dimensions (in mm) :

	Fig.8	Fig.10
Height of the test :	1.10	0.93

Remarks :

This species differs from other species of genus *Valvulina* by having a more compressed test form.

Valvulina sp.3
(pl.10 fig.9)

Description :

Test is triserial. Wall is simple, microgranular. Chambers are rapidly increasing in volume. Internal part of the chamber tends to be divided by supplementary pillars as in the genus "*Paravalvulina* ".

Dimensions (in mm):

Height of the test : 0.80

Valvulina sp.4
(pl.10,fig.11)

Description :

Test is triserial and compressed. Wall is simple, microgranular and thicker than the other species of genus *Valvulina* .

Dimensions (in mm):

Height of the test : 1.10

Valvulina sp.5

(pl.10,fig.12)

Description :

Test is triserial and highly compressed. Chamber slowly increase in volume. Aperture is at the base of the chamber with a large valvular tooth.

Dimensions (in mm) :

Height of the test : 1.03

Remarks :

This species differs from other species of genus *Valvulina* by having a more compressed test form.

Stratigraphic distribution in the sequence : Jurassic - Lower Cretaceous

Genus *"Siphovalvulina"* Septfontaine,1980

"Siphovalvulina" sp.

(pl.10, figs.1-5,7)

Description:

Test is biserial or triserial in successive whorls. Chambers are almost subrectangular or rounded and connected with a siphon-like canal in the central part. Wall is simple and microgranular.

Dimension (in mm) :

		Fig.1	Fig.2	Fig.5
Height of the test	:	0.56	0.48	0.21

Remarks :

This species is very common in the Upper Liassic and Bajocian of the Alakır-1 well sequence together with *Mesoendothyra croatica*.

Family Nezzazatidae Hamoui and Saint Marc, 1970

Subfamily Nezzazatinane Hamoui and Saint Marc, 1970

Genus *Nezzazata* Omara, 1956

Nezzazata sp.

(pl.2, fig12)

Description :

Test is trochospirally coiled and biconvex in axial sections. Wall is finely agglutinated, calcareous and imperforate. Chambers are subrectangular. Aperture is not observed.

Dimensions (in mm)

Diameter of the test : 1.08

Height of the test : 0.93

Stratigraphic distribution in the sequence : Lower-Aptian

Superfamily Textulariacea Ehrenberg, 1839

Family Textulariidae Ehrenberg, 1839

Genus *Bolivinopsis* Yakovlev, 1891

Bolivinopsis sp.

(pl.2 fig.11)

Description :

Test is planispirally coiled in the early part and followed by an uncoiled biserial part towards the last stage of ontogeny. Wall is calcareous and agglutinated.

Remarks :

This form is sporadically observed in the Lower Cretaceous sequence of the Alakır-1 well. If highly reduced planispirally coiled part is not observed in unoriented sections this genus might be confused with the genus *Textularia*.

Stratigraphic distribution in the sequence: Barremian - Lower Aptian

Family Pfenderinidae Smout and Sugden, 1962

Subfamily Pfenderininae Smout and Sugden, 1962

Genus *Pfenderina* Henson, 1948

Pfenderina gr. *trochoidea-salernitana*

(pl.4,figs.1-10; pl.5,figs.3-8,pl.6,fig.2 ; pl.7, figs.8-10)

1962 *Pfenderina salernitana* n.sp.-Sartoni and Crescenti, p.280-282, pl.XVI; pl.XVII,figs.1-2.

1962 *Pfenderina trochoidea* - Sartoni and Crescenti, p.282, pl.17, fig.2; pl.49, fig.2,8.

1969 *Pfenderina salernitana* - Gusic, pp.76,pl.VI, fig.2; pl.VIII, fig.1.

1969 *Pfenderina trochoidea* - Gusic, pp.76-77, pl.VI,figs. 3-4.

1969 *Pfenderina neocomiensis* - Gusic, pp.77,pl.VI, fig.1.

1975 *Pfenderina salernitana* - Bassoullet and Poisson, pl.2, fig.9.

1979 *Pfenderina* gr. *trochoidea* - Altıner and Septfontaine, pp.8-9, pl.1, figs.18-19.

1980 *Pfenderina salernitana* - Septfontaine, pl.2, fig.7.

1982 *Pfenderina salernitana* - Pelissie and Peybernes, pl.3, fig.2.

Description :

Test is trochospirally enrolled, elongated or subglobular. Centre of the test is occupied by a microgranular-labyrinthic pillar system which is better observed towards the later stage of the ontogeny (pl.4, figs.1,3,5). Wall is microgranular. Chambers are numerious and extend to touch the central pillar system. Aperture is in the form of a tunnel traversing the central pillar system.

Dimensions (in mm):

Pl.4	Fig.1	Fig.3	Fig.4
Height of the test(H)	1.4	1.75	2.5
Diameter of the test(D)	0.675	0.825	0.850

	Fig.1	Fig.3	Fig.4
H/D	2.07	2.1	2.9

	Fig.5	Pl.5	Fig.3
Height of the test(H)	1.6		1.5
Diameter of the test(D)	0.750		0.9
H/D	2.1		1.66

Remarks :

The recognation of the species of the genus *Pfenderina* offers some difficulties as in the case of the genus *Kurnubia*. Sartoni and Crescenti (1962) placed Smout and Sugden's (1962) *P.neocomiensis* in synonym with *P.salernitana* and distinguished three species in the genus *Pfenderina, P.trochoidea, P.neocomiensis* and *P.salernitana*, on the basis of size variations(height/diameter). Gusic (1969) also followed the classification system of Sartoni and Crescenti (1962) considering size as a criteria. *Pfenderina salernitana* is distinguished from the other species, particularly from *P.trochoidea* by the elongate and highly conical shape of the test (high H/D ratio). On the contrary, a great similarity with the species *P.neocomiensis* can be noted. However, the central pillar system in *P.salernitana* lacks spongy labyrinthic structure of *P.neocomiensis* and *P.trochoidea* and is characterized by a homogenous and dark mass in thin sections. In addition, the infilling of labyrinthic passages in *P.salernitana* has taken place in all whorls being quite distinct from those of other species.

This classification scheme is applied in this study also. However it appears that unless the different forms with specific size limits are not restricted to different stratigraphic horizons, it is unnecessary to distinguish these different species. This is the idea that Maync (1966) also insisted on. He indicated that there is no reason to differentiate *P.trochoidea* from *P.neocomiensis (=P.salernitana)* which are distinguished from each other by the differences in size or slightly varying external shape. He also stated that both species are found in the same stratigraphic horizon without any intermediate form.

In the absence of adequate material, it seems impossible to reach a well defined taxonomical differentiation in the species of the genus *Pfenderina*. In our specimens, size range (H/D) varies between 1.66 and 2.9. This size range corresponds to that of *P.neocomiensis*. However, since it is known that stratigraphic position of this species in Europe is limited to Valanginian, the forms of Alakır well are assigned to *P.salernitana* and then this species is included in *Pfenderina* gr. *trochoidea - salernitana* .

Stratigraphic distribution in the sequence: Bathonian to Callovian

Genus *Satorina* Fourcade and Chorowicz, 1980

Satorina apuliensis Fourcade and Chorowicz, 1980

(pl.5, figs.1-2)

1969 *"Meyendorffina bathonica"* - Gusic, pl.4, fig.4.

1969 *Orbitammina elliptica* - Gusic, pl.4, fig.3.

1979 *"Lituonella" mesojurassica* - Altıner and Septfontaine, p.8, pl.1, figs.13-15.

1979 *Meyendorffina bathonica* - Altıner and Septfontaine, p.8,pl.1, figs.16-17.

1980 *Satorina apuliensis* n.gen. n.sp.-Fourcade and Chorowicz, p.267-280, pl.1, figs.1-12; pl.2, figs.1-11.

Description :

Test is cylindrical or conico-cylindrical and trochospirally coiled in the early stage and followed by an uniserial uncoiled stage. Only uniserial, rectilinear part is observed in our samples. The wall consists of a central column which has a labyrinthic structure. Radial pillars tend to extend towards the inner peripheral part of the chamber forming small chamberlets. Although the aperture is not observed it is indicated as multiple on the surface of septal plate.

Dimensions (in mm):

Height of the test	: 1.250
Diameter of the uncoiled part	: 0.850

Remarks :

In the absence of complete sections of this foraminifera in our material, the peripheral part of the chamber and the apertural system are not clearly observed. However, these radial pillars are partly visible in fig.1. This genus is differentiated from other genera of the family Pfenderinidae by possessing uniserial, rectilinear stage and having a radial septa extending from the labyrinthic central column towards the inner peripheral part of the chamber. The main difference between *Meyendorffina bathonica* Aurouze and Bizon and this species is the absence of the sub-epidermal layer in the latter species. In *Satorina apuliensis* the radial pillar system is an internal structure of the chamber. In some sections, the pillars tend to touch to the wall so that both species may show similar figures in longitudinal tangential sections. However, in transversal sections, these two genera are easily differentiated by the presence or absence of the subepidermal layer.

Stratigraphic distribution in the sequence: Bathonian to Callovian

Subfamily Kurnubiinae Redmond, 1964

Genus *Kurnubia* Henson, 1948

Kurnubia ex. gr. *palastiniensis* Henson, 1948

(pl.6, fig.3-5,7,8,12; pl.7, figs.1-5)

1948 *Kurnubia palastiniensis* - Henson, pl.16, fig.8,11; pl.18, fig.10,11.

1948 *Valvulinella jurassica* - Henson, pl.16,fig.1-4,10; pl. 18, fig.8-9.

1969 *Kurnubia wellingsi* - Gusic, p.77-79,pl.8,figs.1,2,4.

1969 *Kurnubia palastiniensis-wellingsi* - Gusic, p.77-79, pl.8, fig.3; pl.9, fig.6.

1969 *Kurnubia palastiniensis* - Gusic, p.77-79, pl.9, figs.1-5

1969 *Kurnubia jurassica - palastiniensis* - Gusic, p.77-79, pl. 10, figs.1-2.

1969 *Kurnubia jurassica* - Gusic, p.77-79, pl.10,figs.3-6.

1969 *Kurnubia palastiniensis* - Bassoullet and Guernet, pl.2, figs.4-6.

1969 *Kurnubia* cf. *wellingsi* - Bassoullet and Guernet, pl.3, fig.7.

1975 "*Kurnubia* sp" - Leikine and Vila, pl.2, figs.1-4,6.

1975 *Kurnubia palastiniensis* - Leikine and Vila, pl.2,figs.5-7.

1975 *Kurnubia palastiniensis* - Bassoullet and Poisson, pl.3, figs.1-3,6.

1977 *Kurnubia palastiniensis* - Azema, Chabrier, Fourcade and Jaffrezo, pl.3, fig.12.

1982 *Kurnubia palastiniensis* - Pelissie and Peybernes, pl.3, fig.8.

Description:

Test is highly elongated trochospirally coiled in early stage and with or without uniserial final stage. Centre of the test is occupied by a pillar system. Wall is finely agglutinated. Subepidermal layer is composed of both horizontal and vertical lames.

Dimensions (in mm):

PL.6	Fig.4	Fig.7	Fig.8	Fig.12	
Length	0.65	--	--	--	
Diameter	0.27	0.40	0.5	0.52	
PL.7	Fig.1	Fig.2	Fig.3	Fig.4	Fig.5
Length	0.9	--	0.580	0.65	0.9
Diameter	0.5	0.45	0.30	0.22	0.63

Remarks :

The subdivision of the genus *Kurnubia* into species rank is really problematic. After Smout and Sudgen (1962) who used the development of an uniserial final stage as a criteria to distinguish *K.jurassica* from *K.palastiniensis,* Sartoni and Crescenti (1962) considered both species as synonymous because of the existence of intermediate forms. They recognized two species, *K.palastiniensis* and *K.wellingsi,* on the basis of spirally and size differences. Former one is smaller in size and low-spirally coiled. However, Maync (1965-1966) stated that he has observed all transitions between *K.palastiniensis, K.wellingsi* and *K.jurassica* and proposed that all these varying but intergrading morphotypes occur jointly at the type locality. This is highly suggestive of their biological unity. He defined his specimens as *Kurnubia* gr. *palastiniensis* distinguishing three forma on the basis of length - diameter relationship. Gusic (1969) also adapted Maync's idea and distinguished three species on the basis of size variations without considering spirality and development of an uniserial final stage. Applying the same classification, the present author also shares Gusic's idea, which indicates that, a general impression of the uniformity of the various species of the genus *Kurnubia* can be obtained by studying a large number of variously oriented sections and also believes that extreme pulverization of the morphologically greatly varying but intergrading forms into different species, if found jointly, is unuseful.

Stratigraphic distribution in the sequence : Uppermost Callovian to Kimmeridgian

Genus *Praekurnubia* Redmond, 1964

Praekurnubia sp.

(pl.6,figs.1-2,6,9-11,13)

Description :

Test is very high trochospiral and generally uniserial at the final stage. Chambers are subdivided into chamberlets by vertical partitions. Centre of the test is occupied by a primitive columella. Wall is calcareous and finely agglutinated.

Dimensions (in mm) :

	Fig.1	Fig.6	Fig.9	Fig.11
Length (height) of the test :	1.23	1.03	0.75	0.9
Diameter of the test:	0.3	0.3	0.29	0.33

Remarks :

This genus is differentiated from the genus *Kurnubia* by having only vertical partitions and more primitive internal structure (columella). The initial trochospiral coiling is not observed in our specimens. In its evolutionary trend, the genus *Praekurnubia* may be accepted as a primitive *Kurnubia* .

Stratigraphic distribution in the sequence :Callovian-Oxfordian

Genus *Pseudotextulariella* Barnard and Banner, 1953

"Pseudotextulariella septfontainei" Altıner, Decrouez and Zaninetti, 1982

(pl.2 , figs.4)

1982 *"Pseudotextulariella septfontainei"* - Altıner, Decrouez and Zaninetti,*in* Altıner and Decrouez, pl.6,figs.12-13.

1986 *"Pseudotextulariella septfontainei"* - Tosun, p.65,pl.6, figs.12-13.

Remarks:

This species was recognized but not described by Altıner and Decrouez (1982). The description of this species will not be given in this study because of the inadequate sections. Altıner (1981) recorded this form with typical orbitolinid assemblage of the Aptian age and considers it as a very good, Lower Aptian marker in the Taurids.

Stratigraphic distribution in the sequence : Lower Aptian

Family Cuneolinidae Saidova, 1981

Subfamily Cuneolininae Saidova, 1981

Genus *Cuneolina* D'Orbigny *in* dela Sagra, 1839

Cuneolina camposaurii Sartoni and Crescenti, 1982

(pl.1, fig.8)

1962 *Cuneolina camposaurii* - Sartoni and Crescenti, p.275-276, pl.XLVII, figs.1-3.

1985 *Cuneolina laurentii* - Tosun, p.55-56, pl.5, figs.7-8,10.

Description :

Test is biserial and slightly flabelliform. Wall is calcareous, imperforate and agglutinated. Chambers are divided into chamberlets by radial partitions (= Radial septa). Height of the chamber is larger than thickness of interchamber layering. Secondary horizontal partitions and aperture are not observed.

Dimensions (in mm):

	Fig.8
Radial distance from apex to base	0.3
Width of the last chamber	0.26
Height of the chamber	0.040
Distance between radial partitions	0.030
Thickness of the wall	0.010
Thickness of the septa	0.010
Number of primary chambers per mm	27

Remarks:

Although the aperture has not been observed (which is generally considered to represent the diagnostic characteristic of the genus in respect to the genus *Pseudotextulariella*) its flabelliform shape of the test may be one of the criteria to differentiate this species from the species of the genus *Pseudotextulariella*. This species differs from *Cuneolina laurentii* Sartoni and Crescenti and *Cuneolina hensoni* Dalbiez in possessing a large number of primary chambers (20-25) per mm and a thinner interchamber layering. The number of primary chambers per mm is 7 and 10 in *C.hensoni* and *C.laurentii* and the thickness of interchamber layering exceeds the height of the chamber. This species also differs from *Cuneolina tenuis* Velic and Gusic in having a 10 times thicker wall. The comparison with *Vercorsella scarsellai* (De Castro) are listed in the description of this species.

Stratigraphic distribution in the sequence : Lower-Aptian

Cuneolina sp.

(pl.1, figs.11-13)

Description :

Wall is calcareous, agglutinated. Chambers are subdivided into chamberlets by radial partitions. Aperture is not observed.

Dimensions (in mm):

	Fig.11	Fig.13
Number of the chamberlets per mm	23	30
Average width of the radial septa	0.04	0.03

Remarks :

In the absence of the longitudinal sections and apertural system, these specimens could not be assigned to any described species of the genus *Cuneolina.*

Stratigraphic distribution in the sequence : Neocomian to Lower Aptian.

Genus *Vercorsella* Arnaud-Vanneau, 1980

Vercorsella scarsellai (De Castro), 1963

(pl.1, figs.7,10)

1963 *Cuneolina scarsellai* - De Castro, p.71-76, pl.1-2

1972 *"Cuneolina" scarsellai* - Fourcade and Raoult, pl.2, figs. 4,10,12.

1973 *Pseudotextulariella ? scarsellai* - Velic, pl.2, fig.2; pl. 4, figs.1,3; pl.9, figs.1-3.

1979 *Pseudotextulariella ? scarsella* - Velic and Sokac, pl.3, fig.1.

1980 *Vercorsella* aff. *scarsellai* - Arnaud-Vanneau, p.523-524, pl.71, fig.8.

1982 *Pseudotextulariella? scarsellai* - Altıner and Decrouez, pl.3, fig.10-11,15-17.

1985 *Vercorsella scarsellai* - Tosun, p.57-58, pl.6, figs.3-7.

Description :

Test is biserial, conical and longitudinally compressed and almost circular in transversal sections. Secondary partitions which are not observed in the first stage of ontogeny are seen towards the last stages. At this stage, number of vertical partitions is less than five for each chamber. Chambers regularly increase in volume from apex to base. Interchamber layering is as thick as the chamber height as it is case in some of the species of the genus *Cuneolina*. Wall is imperforate, calcareous and finely agglutinated. Aperture is not observed.

Dimensions (in mm):

	Fig.7	Fig.10
Height of the test	0.540	--
Thickness of the wall	0.030	0.030
Number of the vertical partitions	2 (in the last chamber)	4
Height of the chamber	0.035	--
Width of the last chamber	0.180	--

Remarks :

V. scarsellai is more conic and compressed than *Vercorsella arenata* Arnaud-Vanneau which has an apicle angle 32-35^{o}. This species differs from the species of the genus *Cuneolina* in having more compressed test from, less number of vertical partitions, undivided initial chambers and unique and basal aperture system.

Stratigraphic distribution in the sequence : Barremian to Lower Aptian.

Family Orbitolinidae Martin, 1890

Genus *Orbitolinopsis* Macoin, Schroader, Vila, 1970

Orbitolinopsis capuensis (De Castro, 1964)

(pl.2, figs.1-3,5-10)

1964 *Campanellula capuensis* n.sp.-De Castro, p.55-59, pl.1, figs.1-20.

1972 *Orbitolinopsis capuensis*- Fourcade and Raoult, pl.1, figs.1-3.

1973 *Campanellula capuensis* - Velic, pl.III, figs.1-2.

1978 *Orbitolinopsis capuensis*- Velic and Sokac, pl.V, figs. 6-7.

1982 *Orbitolinopsis capuensis* - Altıner and Decrouez, pl.V, fig.7.

1985 *Orbitolinopsis capuensis* - Tosun, p.61-62, pl.7, fig.1.

Description :

Test is conicocylindrical or bell-shaped with rounded apex and plane base. It is trochospiral in the early stage with sphaerical proloculus (fig.9) and 4 to 5 chambers in a whorl. Wall is finely agglutinated, calcareous and imperforate. Chambers are simple, subrectangular in axial sections, regularly increasing in number and volume. In transversal sections the chambers are nearly triangular (fig.7-8) in shape, with the unequal shorter side at the outer margin of the section.

Dimensions (in mm):

	Fig.1	Fig.5	Fig.6	Fig.9	Fig.10
Height of the test	0.27	0.30	0.24	0.46	0.25
Diameter of the proloculus	--	--	--	0.03	--
Height of the chamber	0.035	0.035	--	0.03	--
Widthness of chamber	--	0.07	--	0.07	--
Diameter of last formed whorl	0.140	0.18	--	0.23	--
Thickness of the wall	0.01	0.01	0.01	0.01	0.09

Remarks :

This species is an index foraminifera of the Barremian stage and described for the first time in Italy. Its aperture system could not be clearly observed in our samples, although it is indicated as interiomarginal in the original description.

Stratigraphic distribution in the sequence : Barremian.

Family Orbitolinidae Martin, 1980

Genus *Parurgonina* Covillier, Foury and Pignati-Morano,1968

Parurgonina caelinensis Covillier, Foury and Pignati-Morano, 1968

(pl.3, figs.2,6)

1969 *Lituonella dinarica* - Gusic, p.67-70, pl.XIII, figs. 1-2; pl.XIV, figs.1-4.

1969 *Urgonina (Parurgonina)* cf. *caelinensis* - Bassoullet and Guernet, pl.2, fig.10.

1977 *Parurgonina caelinensis* - Azema, Chabrier, Fourcade, Jaffrezo, pl.2, figs.1,4,7,9.

1978 *Parargonina caelinensis* - Velic and Sokac, pl.V,figs.4-5

1982 *Parurgonina caelinensis* - Pelissie and Peybernes, pl.3, fig.16.

Description:

Test is conical and subdivided by helicoidal numerous chambers. Wall is finely agglutinated and calcereous. Aperture system is not well observed in the absence of adequate sections.

Stratigraphic distribution in the sequence : Kimmeridgian

Suborder Rotaliina Delage and Herouard 1896

Involutinacea Bütschli, 1880

Involutinidae Bütschli, 1880

Trocholina Paalzow, 1927

Trocholina sp.

(pl. 3, fig. 9)

Description :

Test is trochospirally coiled, conical and compressed with a slightly convex base. Internal pillar system is not observed due to diagenetic features which led to the calcite crystal growth umbilical part wall is calcareous and hyaline.

Dimensions (in mm):

Length : 1.00

Basal diameter : 0.95

Remarks :

The species of the genus *Trocholina* are differentiated from each other by L/D ratio, apicle angle and arrangement of pillars in the umbilical portion. Since this form is very sporadic in our material, these features are not well defined in this study.

Stratigraphic distribution in the sequence : Oxfordian

Suborder Miliolina Delage and Herouard 1896

Superfamily Miliolacea Ehremberg, 1839

Family Miliolidae Ehrenberg, 1839

Remarks :

In this study miliolids are not included in descriptive paleontology section of this chapter. Since classification of these foraminiferas depends mainly on aperture system, it is quite hard to carry out an descriptive paleontology. However, these foraminiferas are very abundant in Lower Cretaceous sequence of Alakır-1 well together with ostracod shell fragments. Disappearence of these foraminifers in Malm, Dogger and Lias sequences is diagnostic.

5.2. DASYCLADACEAN ALGAE AND OTHER ORGANISMS

In this study, a rich dasycladacean algae association has been studied in the Lower Cretaceous and Malm series. In addition to the zones established by the foraminifera, their abundance in the rock units led to recognize some biostratigraphic zones. The species of the dasycladacean algae recognized in the Alakır-1 sequence are *Salpingoporella dinarica*, *Salpingoporella annulata*, *Campbeliella striata*, *Clypeina jurassica* and *Selliporella donzellii* (plate 11 and 12). These species were used for the characterization of the biostratigraphic zonation of the sequence (Fig.7).

Although it is very sporadic, *Salpingoporella dinarica* is an index fossil of the Aptian stage. This form resembles to *Salpingoporella annulata* superfically. However, it is easily differentiated from *S.annulata* by a dark lining in the inner side of the tube.

S.annulata is a very common Lower Cretaceous dasyclad and usually accompanied by *Favreina* (Anamurian coprolites). It can be easily recognized by its elongated, conical tube which contains regularly arranged pores in the wall.

Campbeliella striata is also a very good index fossil and used for the recognition of Tithonian stage. It is used as a marker for the definition of *Campbeliella striata* zone. It is recognized by a tube which enlarges in size towards the ends.

Clypeina jurassica is a very common Kimmeridgian - Tithonian dasyclad recognized in the Jurassic sequences of the Apennines, Dinarids, Taurids and the Middle East. It is also commonly used in the biostratigraphic zonation models of the Jurassic sequences in the Tethyan realm. In addition to its diagnostic form, it is easily differentiated from other algae by having a yellowish dark brown colour.

Selliporella donzellii is also a very widespread dasyclad and used in the biostratigraphic zonations to characterize the Bajocian or Upper Bajocian sequences. Nevertheless, it seems that the stratigraphic position of this form is not as certain as the above mentioned algal groups.

In addition to these dasycladacean algae, *Thaumatoporella parvovesiculifera* which is considered as an algae by some authors is possibly an organism with an animal affinity (Flügel, 1982). This form consists of tubes which follow the relief of the sediment. *Thaumatoporella parvovesiculifera* is very common in the *Mesoendothyra croatica* zone of the Alakır-1 well sequence and sometimes used as a marker of the zone in the Lower Jurassic sequences.

Anamurian coprolites (*Favreina*) which are possibly pelecypod or gastropod excrements are very abundant in the Lower Cretaceous series of the Alakır-1 well sequence. These coprolites are also widely used in the biostratigraphic models.

CHAPTER 6

CONCLUSION

Micropaleontological and stratigraphical analyses of the Alakır-1 well led to the following conclusions.

1. Two rock stratigraphic units, the Alihüseyinler formation characterized by dolomite and dolomitic limestone lithologies of Triassic-Upper Liassic age and the Burhandere formation composed mainly of limestone lithologies of Upper Liassic-Lower Aptian age were recognized in the studied well.

2. The microfacies analysis indicates that this carbonate sequence was deposited in a shallow marine water environment including the tidal flats, lagoon and back reef shoal depositional setting of the platform. 9 microfacies and 4 submicrofacies representing the depositional setting of this carbonate sequence from Upper Liassic to Lower Aptian were established. These microfacies analyses show that the depositional setting of these carbonates oscillates between reef and back reef shoal environments and subtidal lagoonal environment in Jurassic time. However the environment of deposition of this sequence becomes more restricted and mainly reflects tidal flat and shallow water lagoonal setting.

3. Thirty-one species belonging to the benthonic foraminifera and algae were identified. In this faunal and floral inventory, the foraminifers are oftenly found in the Bajocian, Bathonian, Callovian, Barremian and Aptian stages, whereas the algae are very common in the Neocomian, Kimmeridgian and Tithonian chronostratigraphic units. The foraminifers recognized in the Alakır-1 well mainly belong to the lituolacean superfamily and the algae are represented by the dasyclads. Coprolites *(Favreina)* are very commonly encountered in the Neocomian.

4. A biostratigraphic zonation model which contains 7 zones and 4 subzones was proposed. In this model, The *Mesoendothyra croatica* zone (Upper Liassic-Bajocian), *Selliporella donzellii* zone (Upper Bajocian), *Pfenderina* gr. *trochoidea-salernitana* zone (Bathonian-Callovian), *Kúrnubia* ex.gr. *palastiniensis* zone (Callovian-Oxfordian) and *Clypeina jurassica* zone and its subzones (Kimmeridgian-Tithonian) represent the Jurassic system. For the characterization of the Lower Cretaceous, the *Salpingoporella annulata* zone (Neocomian) and *Vercorsella Scarsellai* zone and its subzones were established. This biostratigraphic zonation model shows that this sequence is continuous at least from Lower Jurassic to the Lower Aptian.

5. Although the micropaleontolagical data is fragmentary the presence of the Triassic system in this sequence was proved for the first time in the Beydağları unit.

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APPENDIX

EXPLANATION OF THE PLATES (1-12)

PLATE 1

Fig.1. *Debarina* cf. *hahounerensis* Fourcade, Raoult, Vila; equatorial section, A.94-96 m, x160.

Fig.2. *Debarina* cf. *hahounerensis* Fourcade, Raoult, Vila; equatorial section, A.110-112 m, x160.

Fig.3. *Debarina* cf. *hahounerensis* Fourcade, Raoult, Vila; equatorial section, A.94-96 m, x160.

Fig.4. *Debarina* cf. *hahounerensis* Fourcade, Raoult, Vila; equatorial section, A.94-96 m, x160.

Fig.5. *Haplophragmoides* sp.; nearly equatorial section, A.260-262 m, x160.

Fig.6. *Haplophragmoides* sp.; nearly equatorial section, A.260-262 m, x160.

Fig.7. *Vercorsella scarsellai* De Castro; longitudinal section, A.94-96 m, x160.

Fig.8. *Cuneolina camposaurii* Sartoni and Crescenti; nearly longitudinal section, A.110-112 m, x160.

Fig.9. *Haplophragmoides* sp.; nearly equatorial, ablique section, A.280-282 m, x160.

Fig.10. *Verocorsella scarsellai* De Castro; transversal section, A.94-96 m, x160.

Fig.11. *Cuneolina* sp.; transversal-oblique section, A.94-96 m, x160.

Fig.12. *Cuneolina* sp.; transversal-oblique section, A.280-282 m, x160.

Fig.13. *Cuneolina* sp.; nearly transversal section, A.94-96 m, x.160.

PLATE 1

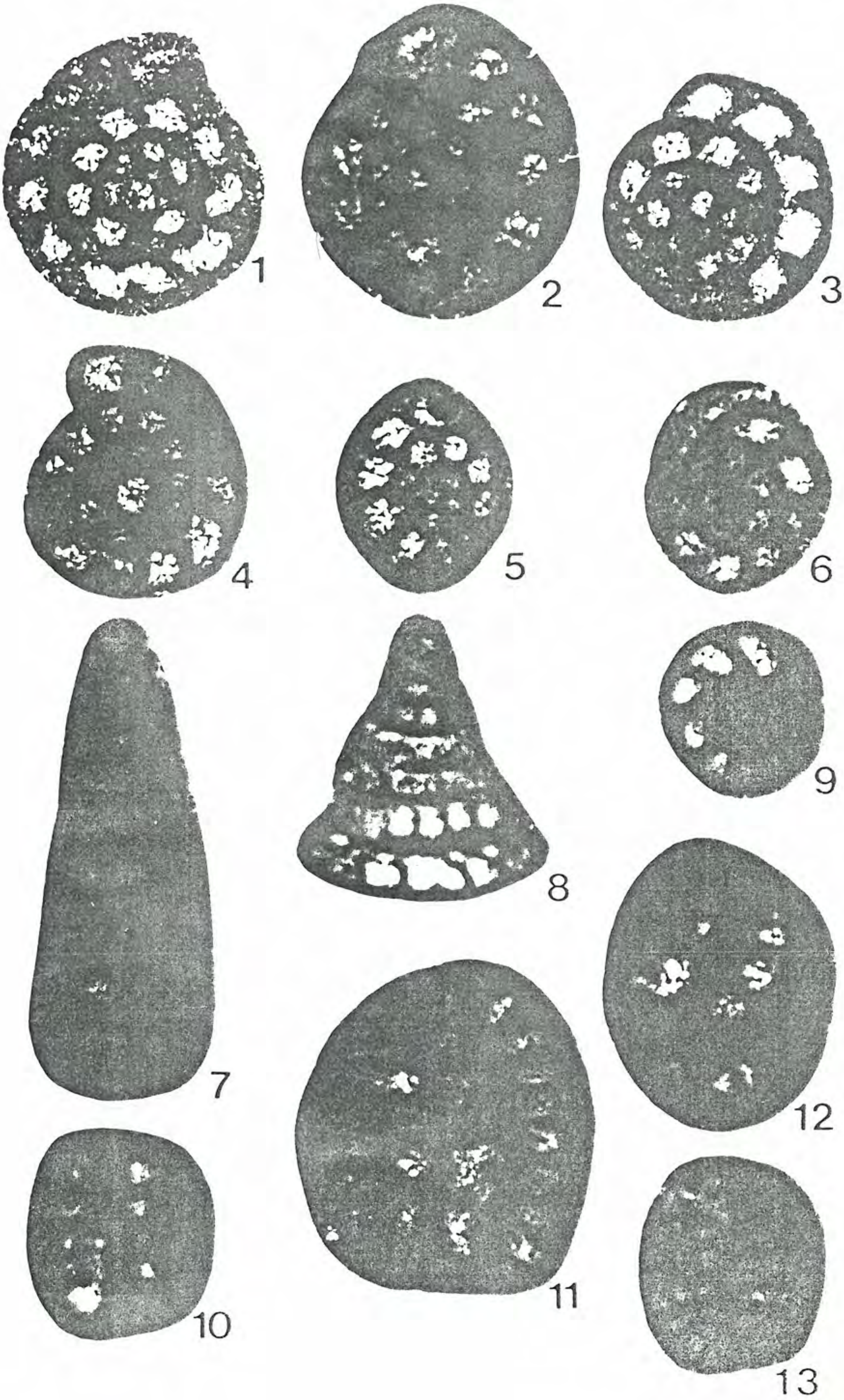

PLATE 2

Fig.1. *Orbitolinopsis capuensis* (De Castro); longitudinal-oblique section, A.260-262 m, x160.

Fig.2. *Orbitolinopsis capuensis* (De Castro); longitudinal section, A.260-262 m, x160.

Fig.3. *Orbitolinopsis capuensis* (De Castro); longitudinal-tangential section, A.290-292 m, x160.

Fig.4. "*Pseudotextulariella septfontainei*" Altıner, Decrouz and Zaninetti,transversal section, A.94-96 m,x160.

Fig.5. *Orbitolinopsis capuensis* (De Castro); longitudinal section, A.260-262 m, x160.

Fig.6. *Orbitolinopsis capuensis* (De Castro); longitudinal-tangential section, A.260-262 m, x160.

Fig.7. *Orbitolinopsis capuensis* (De Castro); transversal, slightly oblique section, A.260-262 m, x160.

Fig.8. *Orbitolinopsis capuensis* (De Castro); transversal section, A.94-96 m, x160.

Fig.9. *Orbitolinopsis capuensis* (De Castro); longitudinal section, A.300-302 m, x160.

Fig.10. *Orbitolinopsis capuensis* (De Castro); longitudinal-tangential section, A.300-302 m, x160.

Fig.11. *Bolivinopsis* sp.; longitudinal section, A.45-46 m, x40.

Fig.12. *Nezzazata* sp.; longitudinal section, A.94-96 m, x40.

PLATE 2

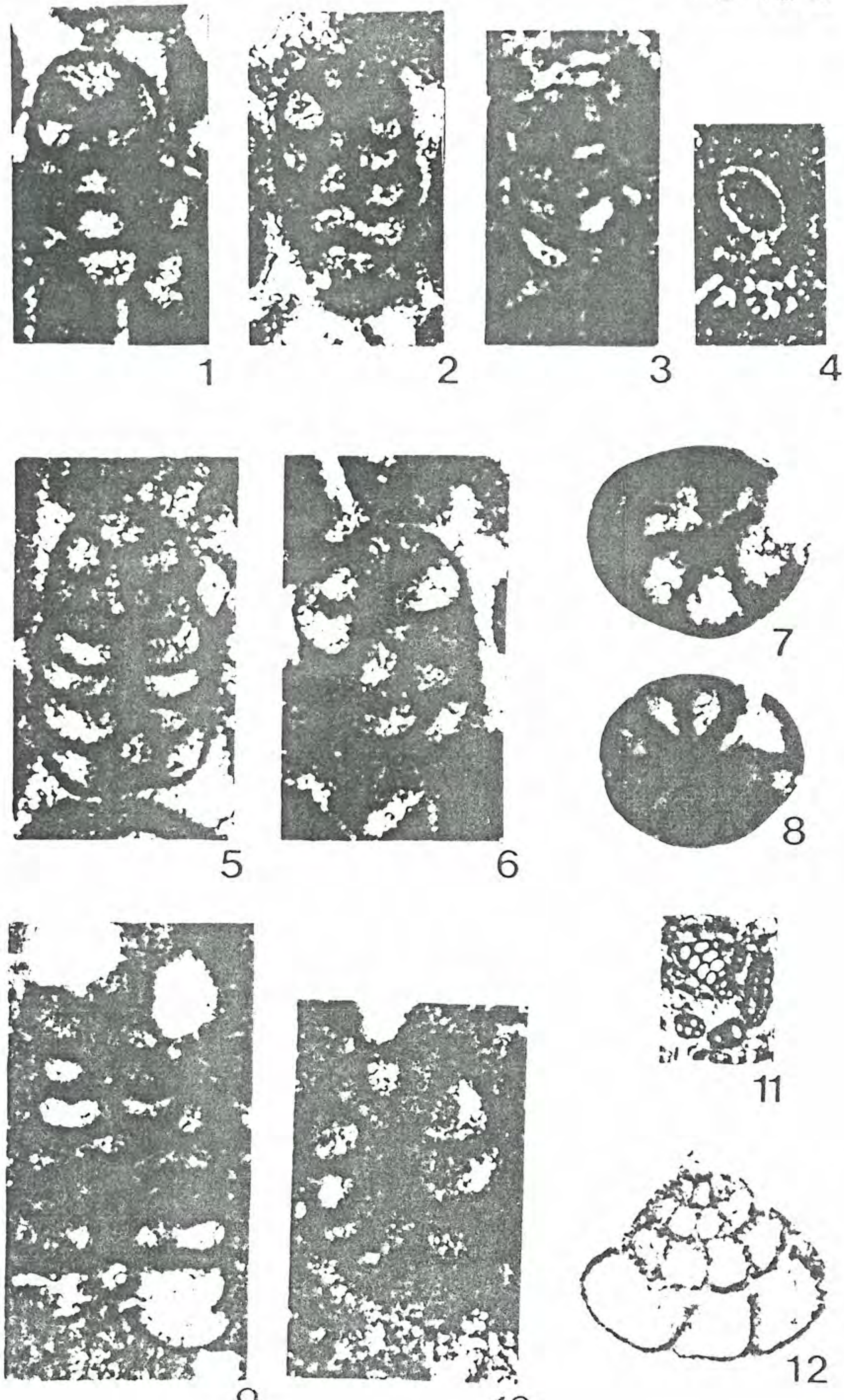

PLATE 3

Fig.1. *Nautiloculina* sp.2; axial section, A.1078-1080m,x160.

Fig.2. *Parurgonina caelinensis* Cuvillier,Foury and Pignotti-Morano; transversal seciton, A.960 m, x40.

Fig.3. *Nautiloculina* sp.1; axial section, A.1118-1120 m, x160.

Fig.4. *Nautiloculina* sp.1; axial section, A.1078-1080 m, x160.

Fig.5. *Nautiloculina* sp.1; axial section, A.1156-1158 m, x160.

Fig.6. *Parurgonina caelinensis* Cuvillier, Foury and Pignotti-Morano; longitudinal section, A.960 m,x40.

Fig.7. Undifferentiated form, A.1442 m, x40.

Fig.8. *Protopeneroplis striata* Weynschenk, equatorial section, A.1016 m, x160.

Fig.9. *Trocholina* sp. oblique section, A.1078-1080 m, x40.

PLATE 3

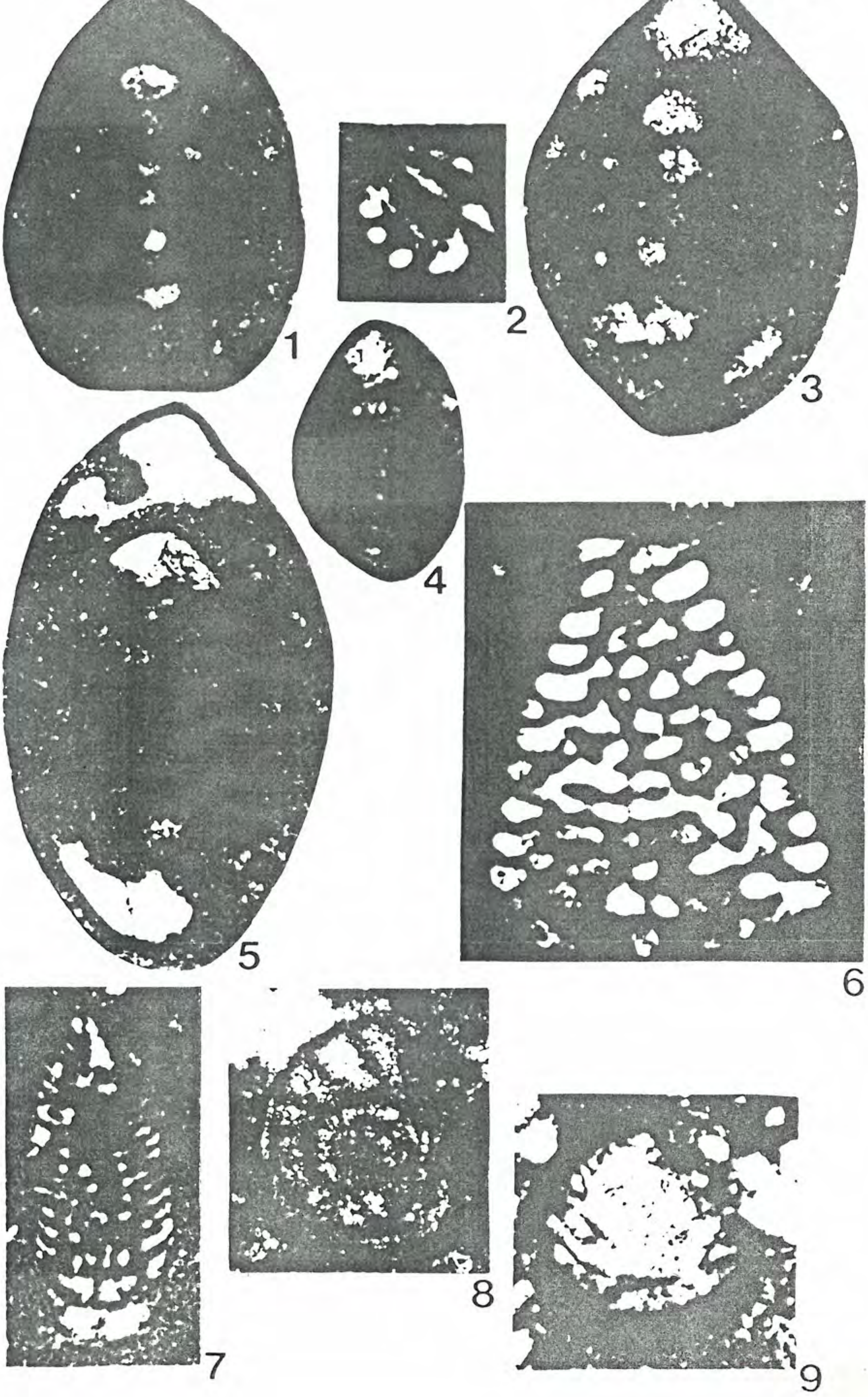

PLATE 4

Fig.1. *Pfenderina* gr. *trochoidea* Smout and Sugden; Longitudinal section, A.1156 m, x 40.

Fig.2. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal section, A.1156 m, x 40.

Fig.3. *Pfenderina* gr. *trochoidea* Smout and Sugden; longitudinal section, A.1156 m, x 40.

Fig.4. *Pfenderina* gr. *trochoidea* Smout and Sugden; longitudinal section, A.1442 m, x 40.

Fig.5. *Pfenderina* gr. *trochoidea* Smout and Sugden; longitudinal section, A.1156 m, x 40.

Fig.6. *Pfenderina* gr. *trochoidea* Smout and Sugden; longitudinal section, A.1400 m, x40.

Fig.7. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal-ablique section, A.1156 m, x 40.

Fig.8. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal section, A.1156 m, x 40.

Fig.9. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal section, A.1156 m, x40.

Fig.10. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal, slightly longitudinal section, A.1156 m,x40

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PLATE 4

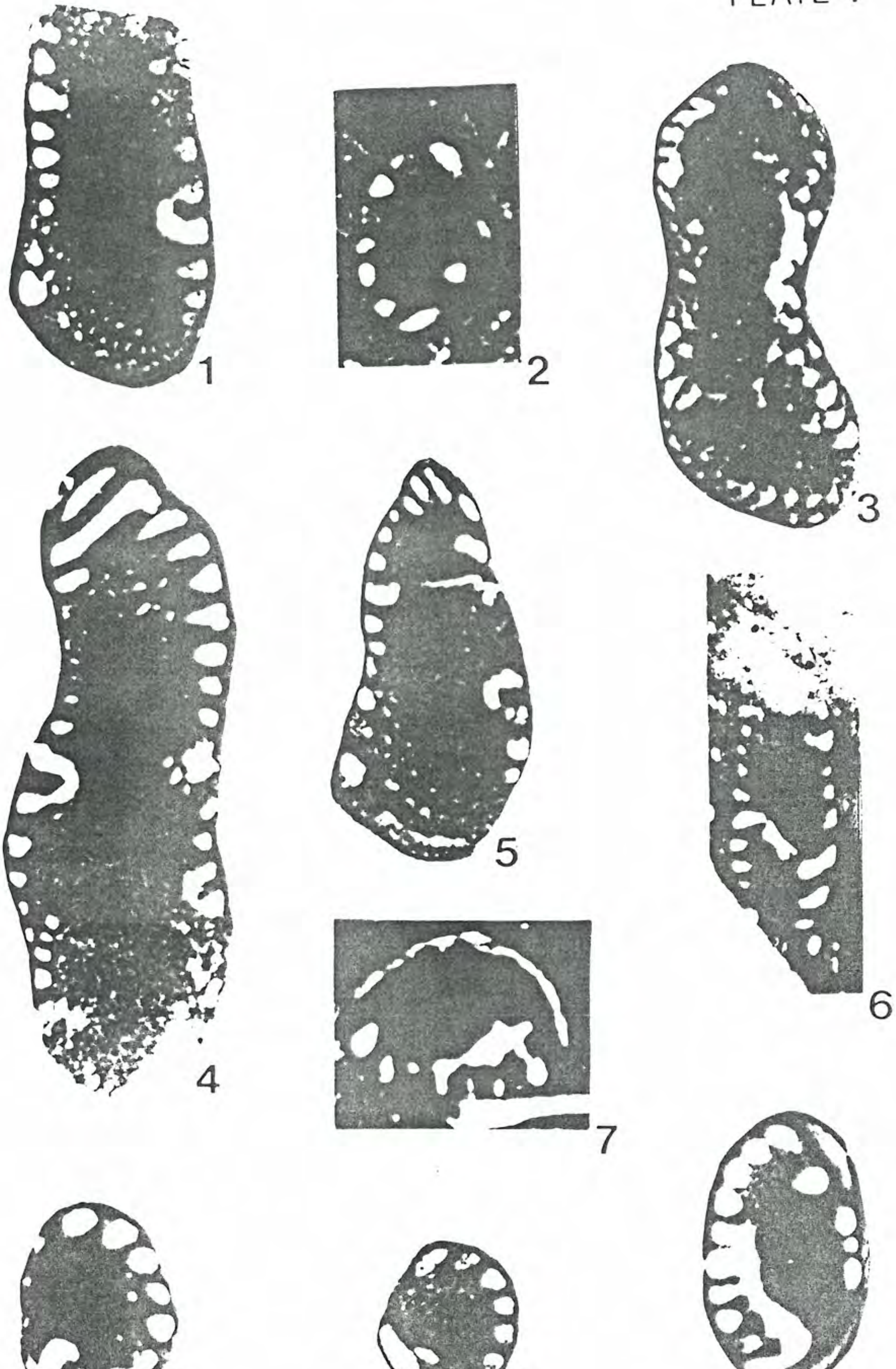

PLATE 5

Fig.1. *Satorina apuliensis* Fourcade and Chorowicz; longitudinal section, A.1156 m, x40.

Fig.2. *Satorina apuliensis* Fourcade and Chorowicz; transversal-longitudinal section, A.1156 m, x40.

Fig.3. *Pfenderina* gr. *trochoidea* Smout and Sugden; longitudinal section, A.1228-1230 m, x40.

Fig.4. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal section, A.1156 m, x160.

Fig.5. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal-oblique section, A.1156 m, x40.

Fig.6. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal section, A.1150 m, x40.

Fig.7. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal-oblique section, A.1442 m, x40.

Fig.8. *Pfenderina* gr. *trochoidea* Smout and Sugden; transversal-oblique section, A.1128-1130 m, x160.

PLATE 5

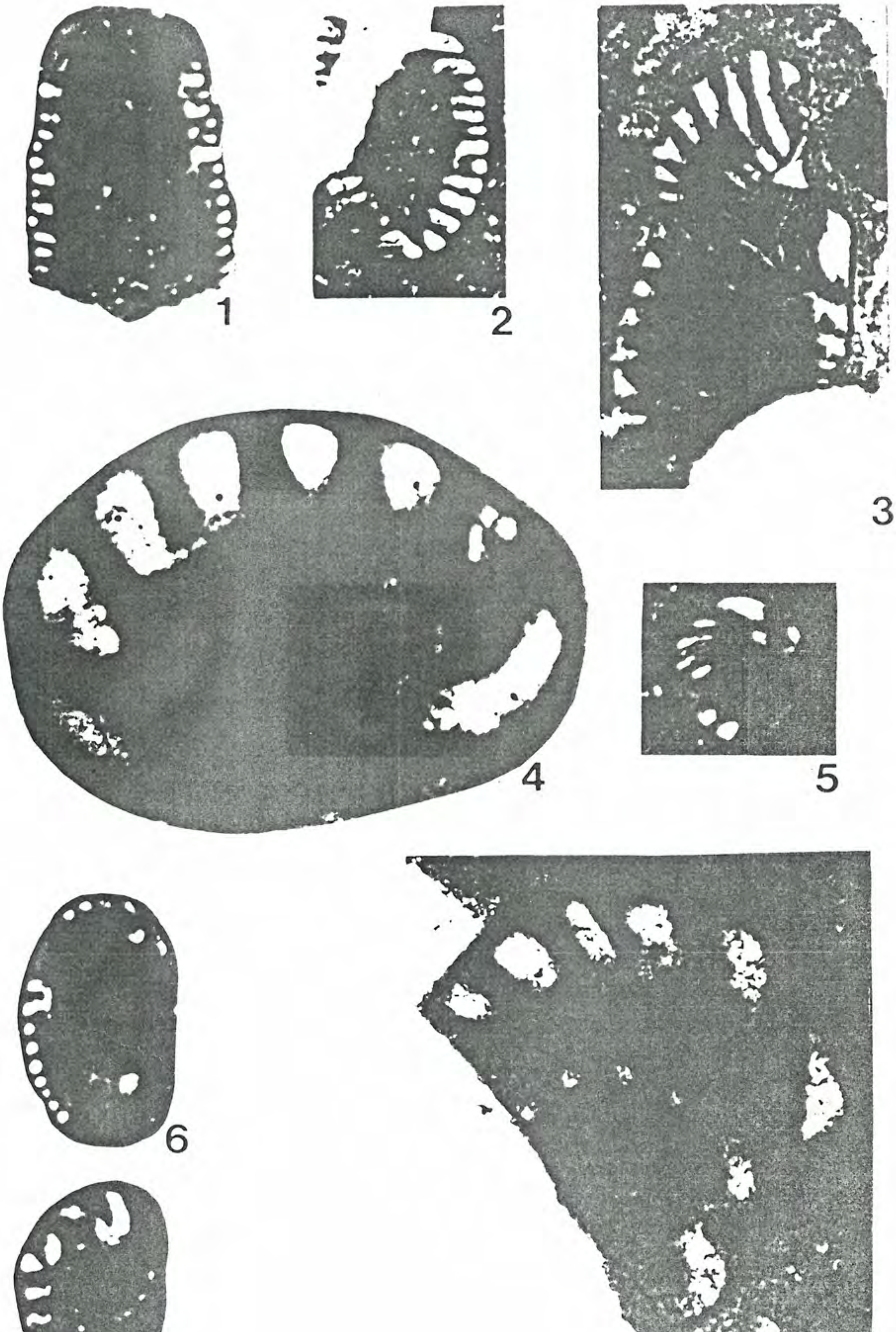

PLATE 6

Fig.1. *Praekurnubia* sp.; longitudinal section, A.1148-1150 m, x40.

Fig.2. *Pfenderina* and *Praekurnubia* sp.; longitudinal and transversal sections, A.1128-1130 m, x40.

Fig.3. *Kurnubia* ex.gr.*palastiniensis* ; transversal section, A.1148-1150 m, x160.

Fig.4. *Kurnubia* ex.gr. *palastiniensis* (forma *jurassica*); longitudinal-tangential section, A.952-954 m,x40.

Fig.5. *Kurnubia* ex.gr. *palastiniensis* , transversal, oblique section, A.1156 m, x40.

Fig.6. *Praekurnubia* sp; longitudinal section, A.1156 m,x40.

Fig.7. *Kurnubia* ex.gr. *palastiniensis* (forma *jurassica*); transversal section, A.898-900 m, x40.

Fig.8. *Kurnubia* ex.gr. *palastiniensis* (forma *palastiniensis*); transversal section, A.940-942 m, x40.

Fig.9. *Praekurnubia* sp; longitudinal section, A.1156 m,x40.

Fig.10. *Praekurnubia* sp; transversal section, A.1138 m, x40.

Fig.11. *Praekurnubia* sp; longitudinal section, A.1156 m, x40.

Fig.12. *Kurnubia* ex.gr. *palastiniensis* (forma *palastiniensis*); transversal-oblique section, A.1088-1090 m,x40.

Fig.13. *Praekurnubia* sp; transversal section, A.1156 m,x40.

PLATE 6

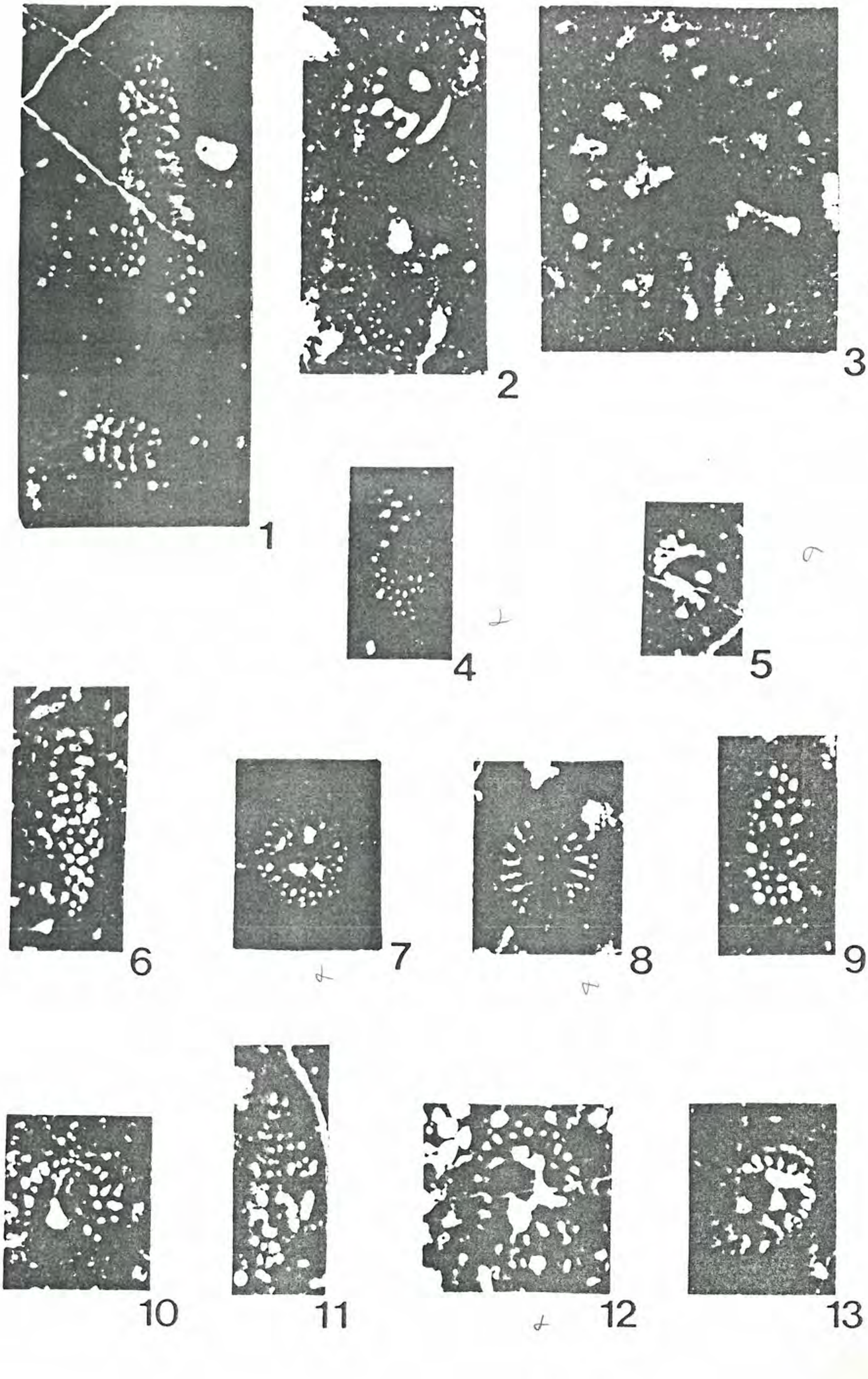

PLATE 7

Fig.1. *Kurnubia* ex. gr. *palastiniensis* ; longitudinal section, A.878-880 m, x40.

Fig.2. *Kurnubia* ex. gr. *palastiniensis* ; transversal section, A.848-850 m, x40.

Fig.3. *Kurnubia* ex. gr. *palastiniensis* ; longitudinal section, A.1016 m, x40.

Fig.4. *Kurnubia* ex. gr. *palastiniensis* ; longitudinal section, A.1118-1120 m, x40.

Fig.5. *Kurnubia* ex. gr. *palastiniensis* ; longitudinal-oblique section, A.898-900 m, x40.

Fig.6. *Rectocyclammina* sp.; axial section, A.848-850 m, x40.

Fig.7. *Rectocyclammina* sp.; axial section, A.848-850 m, x40.

Fig.8. *Rectocyclammina* sp.; axial section, A.848-50 m,x40.

Fig.9. *Pfenderina* gr. *trochoidea-salernitana* ; transversal section, A.1156 m, x40.

Fig.10. *Pfenderina* gr. *trochoidea-salernitana* ; transversal section, A.1138 m, x40.

Fig.11. *Pfenderina* gr. *trochoidea-salernitana* ; longitudinal section, A.1171 m, x40.

PLATE 7

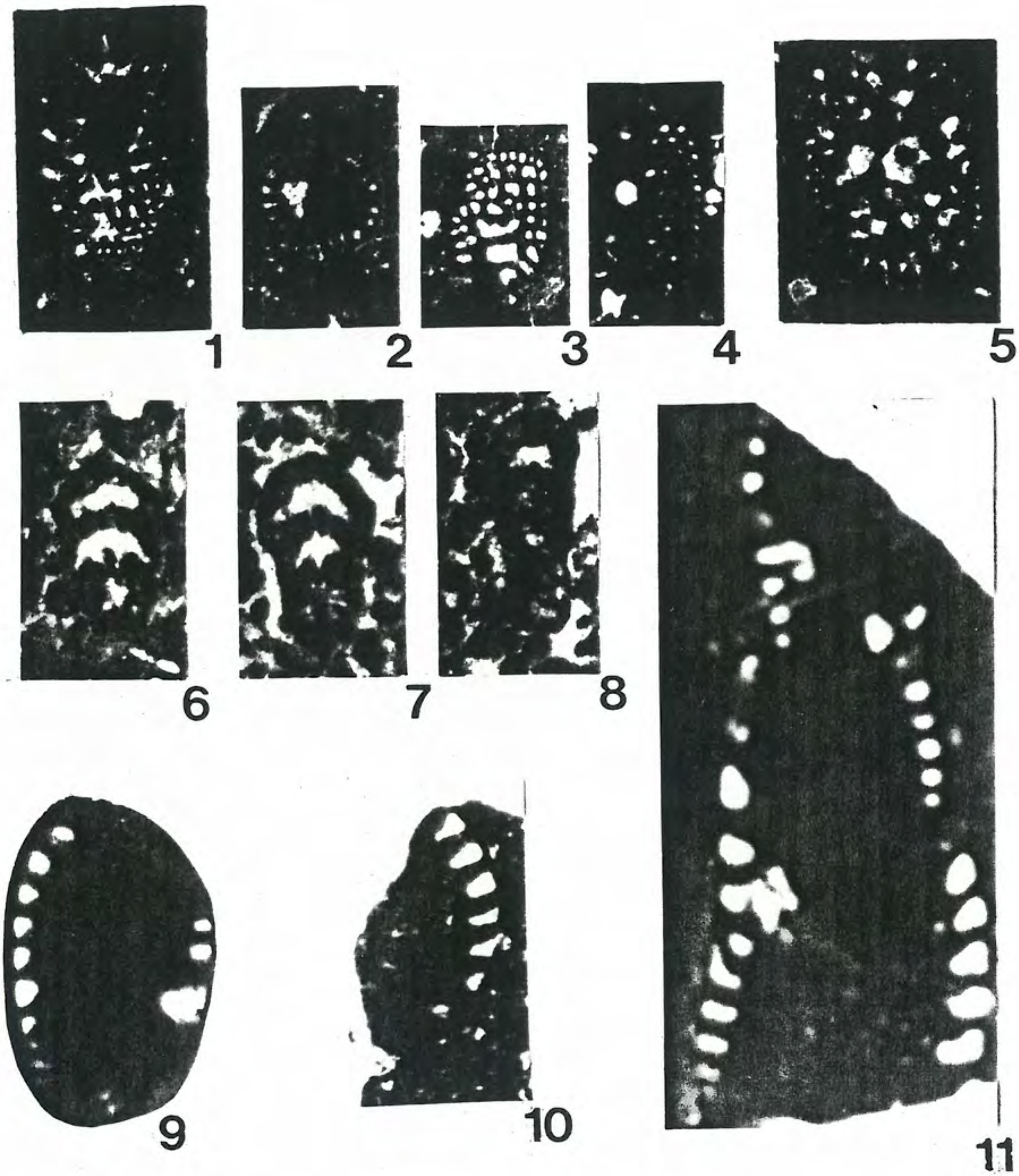

PLATE 8

Fig.1. *Mesoendothyra croatica* Gusic; equatorial section, A.1522 m, x160.

Fig.2. *Mesoendothyra croatica* Gusic; equatorial, slightly oblique section, A.1568-1570 m, x160.

Fig.3. *Mesoendothyra croatica* Gusic; equatorial-oblique section, A.1572 m, x160.

Fig.4. *Mesoendothyra croatica* Gusic; axial section, A.1522 m, x160.

Fig.5. *Mesoendothyra croatica* Gusic; equatorial-oblique section, A.1480-1490 m, x40.

Fig.6. *Mesoendothyra croatica* Gusic; axial section, A.1522 m, x160.

Fig.7. *Mesoendothyra croatica* Gusic; equatorial section, A.1568-1570 m, x40.

Fig.8. *Mesoendothyra croatica* Gusic; equatorial section, A.1460-1462 m, x40.

PLATE 8

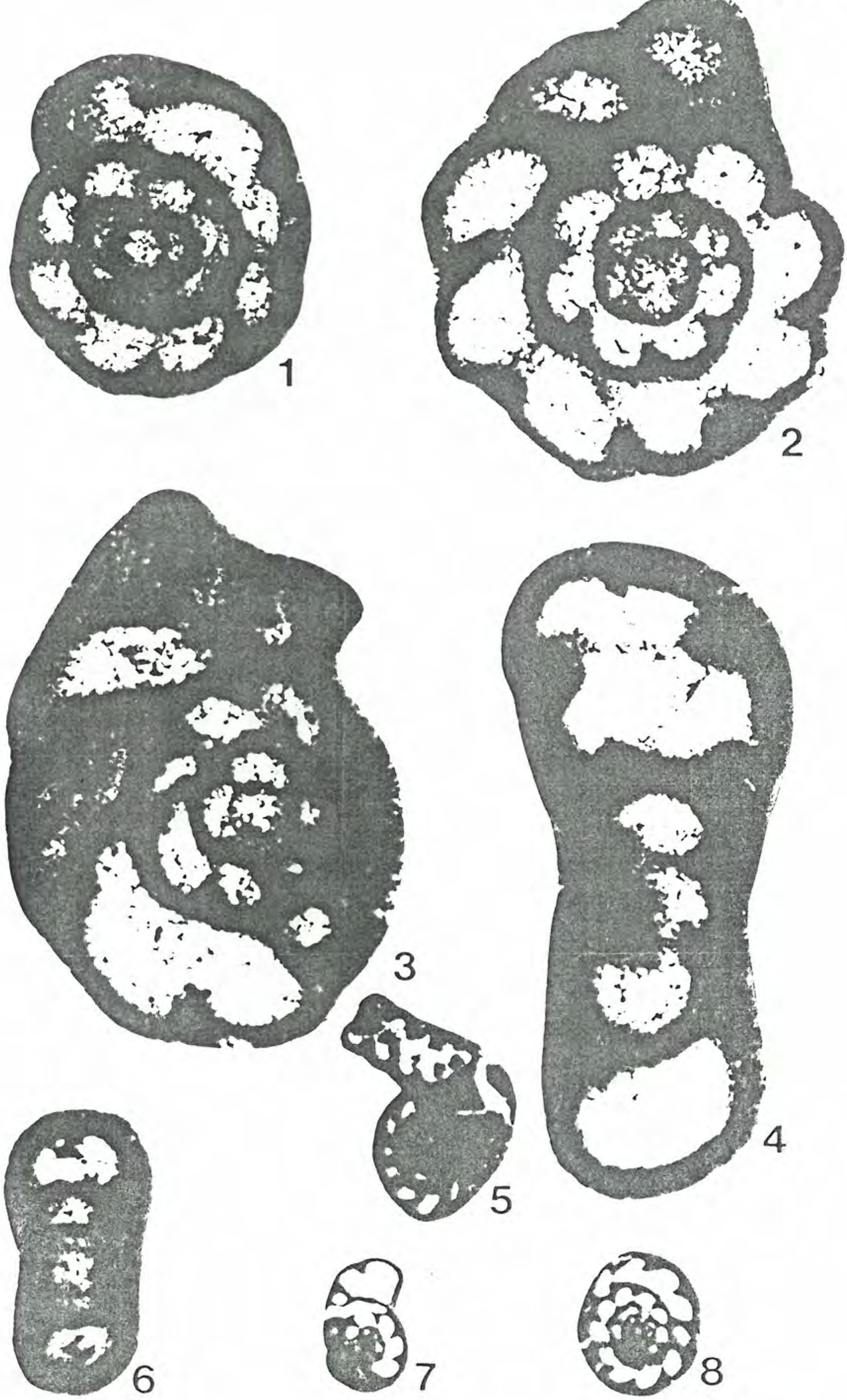

PLATE 9

Fig.1. *Mesoendothyra croatica* Gusic; equatorial-oblique section, A.1538-1540 m, x160.

Fig.2. *Mesoendothyra croatica* Gusic; equatorial section, A.1568-1570 m, x160.

Fig.3. *Mesoendothyra croatica* Gusic; equatorial section, A.1671-1674 m, x160.

Fig.4. *Mesoendothyra croatica* Gusic; equatorial-oblique section, A.1632 m, x160.

Fig.5. *Mesoendothyra croatica* Gusic; axial section, A.1538-1540 m, x40.

Fig.6. *Mesoendothyra croatica* Gusic; equatorial, slightly oblique section, A.1632 m, x40.

Fig.7. *Mesoendothyra croatica* Gusic; axial section, A.1932 m, x160.

Fig.8. *Mesoendothyra croatica* Gusic; axial-oblique section, A.1602 m, x160.

PLATE 9

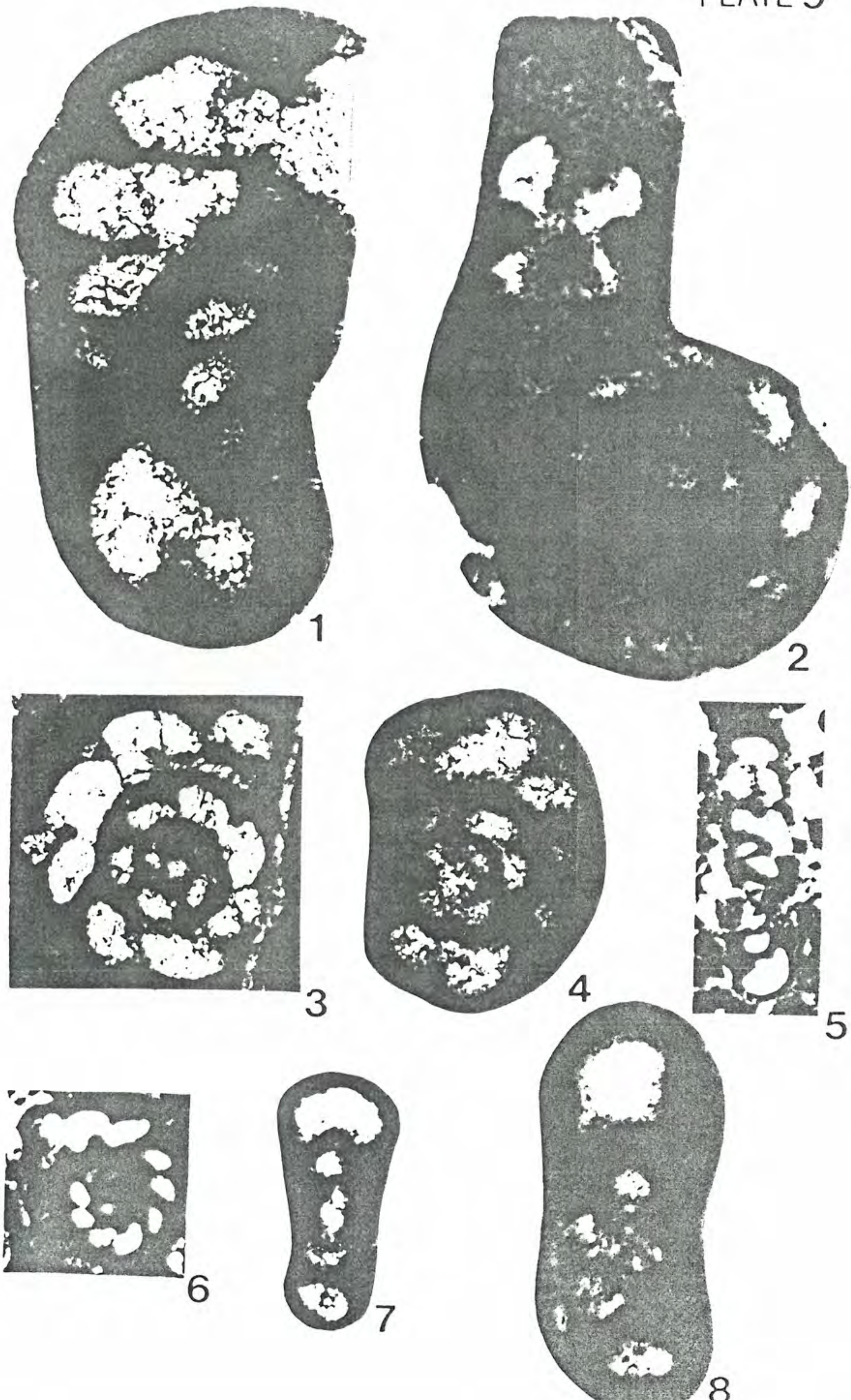

PLATE 10

Fig.1. *"Siphovalvulina"* sp.; longitudinal section, A.1520 m, x160.

Fig.2. *"Siphovalvulina"* sp.; longitudinal section, A.1500-1502 m, x160.

Fig.3. *"Siphovalvulina"* sp.; transversal-oblique section, A.1156 m, x40.

Fig.4. *"Siphovalvulina"* sp.; longitudinal-oblique section, A.1460-1462 m, x160.

Fig.5. *"Siphovalvulina"* sp.; longitudinal section, A.1500-1502 m, x160.

Fig.6. *Valvulina* sp.1; longitudinal section, A.510-512 m, x40.

Fig.7. *"Siphovalvulina"* sp.; transversal-oblique section, A.1480-1490 m, x160.

Fig.8. *Valvulina* sp.2; longitudinal section, A.924-926 m, x40.

Fig.9. *Valvulina* sp.3; longitudinal section, A.1158-1160 m, x40.

Fig.10. *Valvulina* sp.2; longitudinal section, A.460-462 m, x40.

Fig.11. *Valvulina* sp.4; longitudinal section, A.848 m,x40.

Fig.12. *Valvulina* sp.5; longitudinal section, A.90-92 m, x40.

PLATE 10

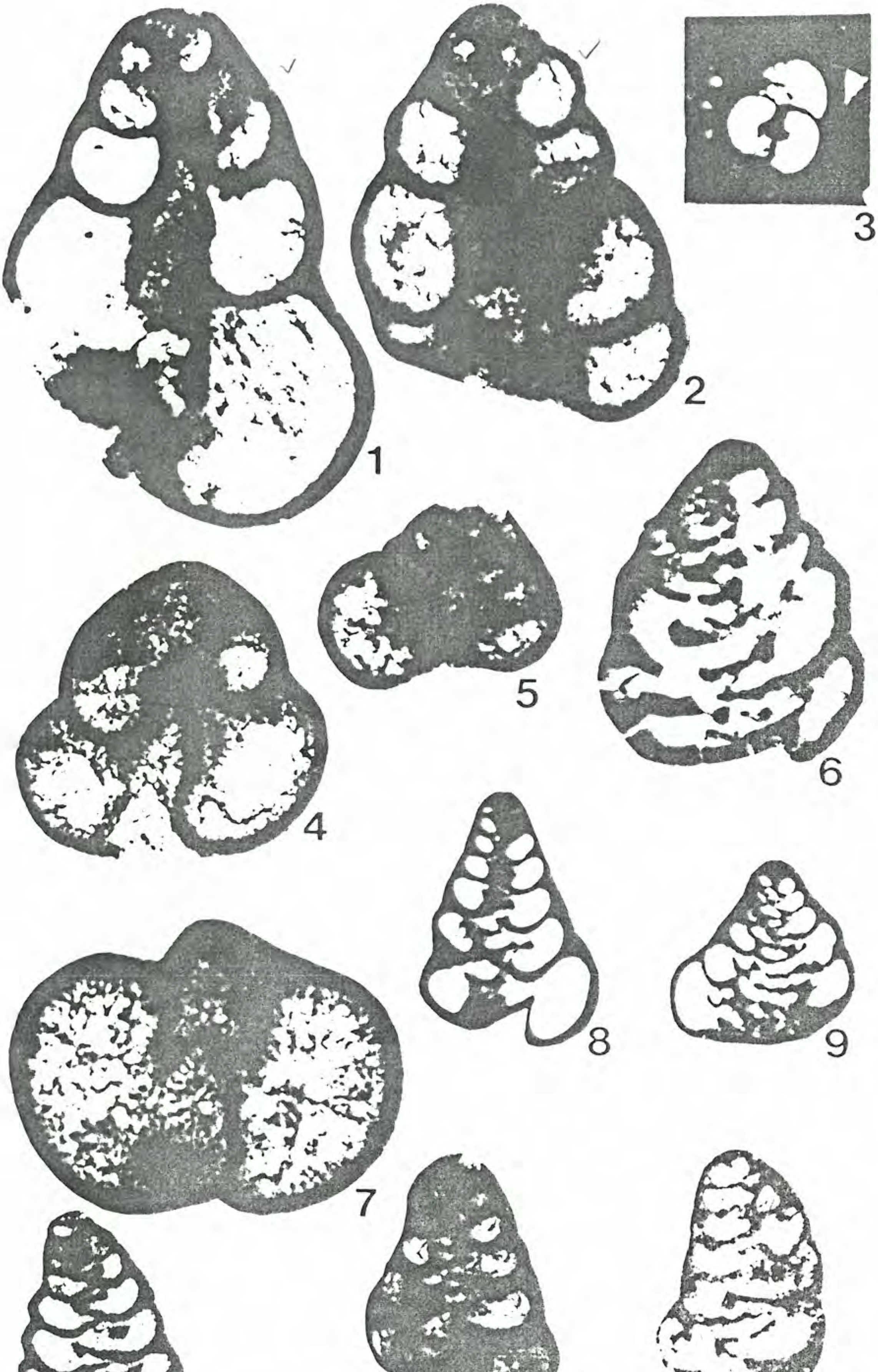

PLATE 11

Fig.1. *Campbeliella striata* Carozzi; transversal section, A.800 m, x40.

Fig.2. *Campbeliella striata* Carozzi; longitudinal section, A.782-784 m, x40.

Fig.3. *Campbeliella striata* Carozzi; transversal section, A.790 m, x40.

Fig.4. *Clypeina jurassica* Favre; transversal section, A. 774 m, x40.

Fig.5. *Clypeina jurassica* Favre; transversal section, A. 818-820 m, x40.

Fig.6. *Clypeina jurassica* Favre; tangential-oblique section, A.800 m, x40.

Fig.7. *Cayeuxia* sp.; longitudinal section, A.952-954 m,x40.

Fig.8. *Salpingoporella dinarica* Radoicic; transversal section, A.90-92 m, x40.

PLATE 11

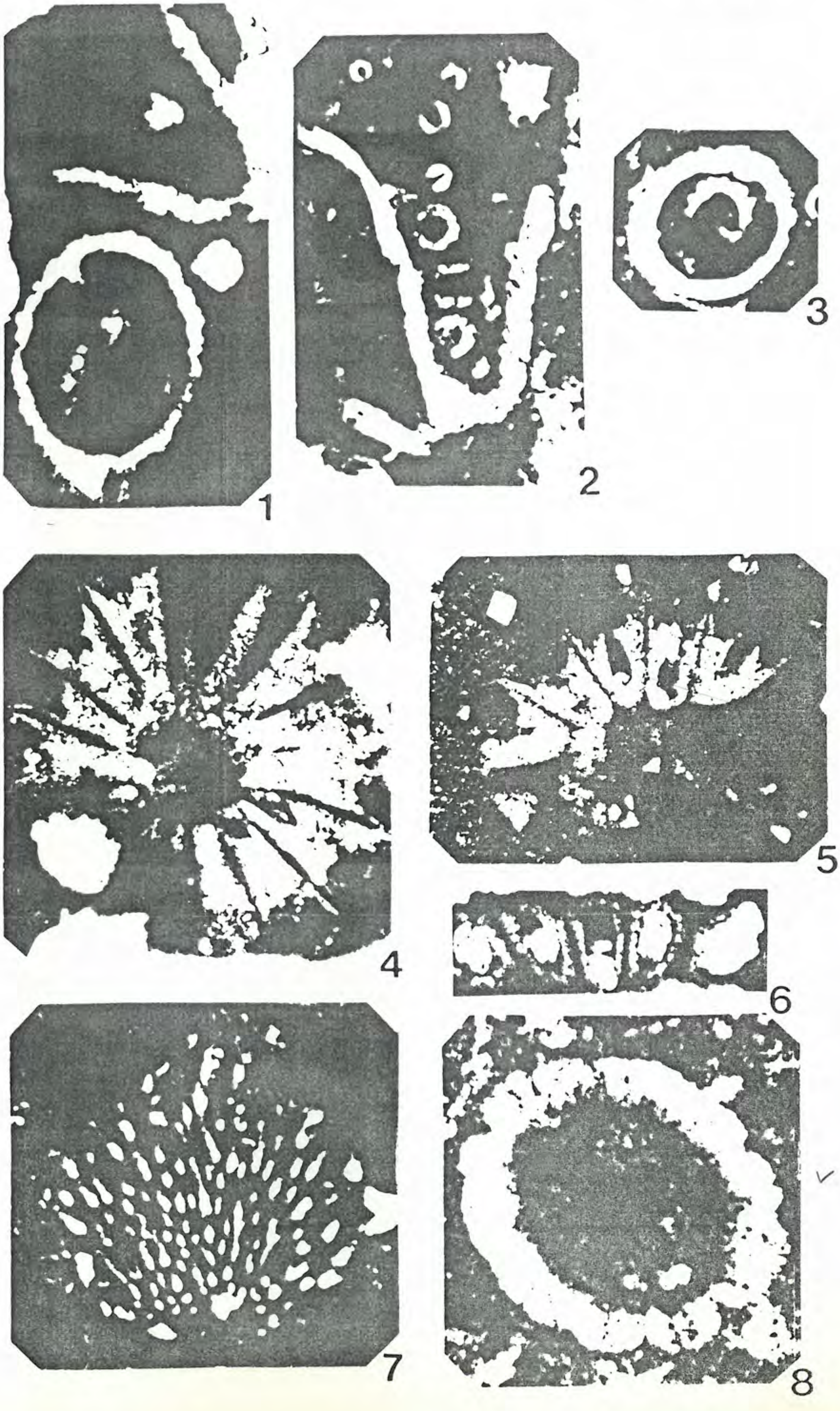

PLATE 12

Fig.1. *Selliporella donzellii* Sartoni and Crescenti; A.1470 m, x40.

Fig.2. *Cayeuxia* sp ; A.888-890 m, x40.

Fig.3. *Thaumatoporella parvovesiculifera* ; A.1500-1502 m, x40.

Fig.4. *Favreina* sp ; A.1838-1840 m, x40.

Fig.5. *Selliporella donzellii* Sartoni and Crescenti; A.1460 m, x40.

Fig.6. *Salpingoporella annulata* Carozzi ; A.610 m, x40.

PLATE 12