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BIOSTRATIGRAPHY OF THANETIAN-ILERDIAN BENTHIC FORAMINIFERA IN THE AKÇATAŞ - CEBECİ (NW TOSYA - SE KASTAMONU) REGION

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ABSTRACT.- In this study, the benthic foraminiferal biostratigraphy and paleoecological features of Thanetian-Ilerdian unit were investigated in the northwest of Tosya (SE Kastamonu). The range of the unit, which had been determined as Paleocene-Eocene by former studies, was established as Thanetian-Ilerdian after conducting detailed paleontological research works on this unit. The unit begins with conglomerates from the base and continues with sandstones, sandy limestones and limestones upwards. *Haymanella paleocenica* Sirel, *Idalina sinjarica* Grimsdale, *Mississippina binkhorsti* (Reuss) and *Pseudocuvillierina*? sp. were described in the Thanetian levels of the unit. The Ilerdian levels are characterized by the following benthic foraminifera assemblages: *Glomalveolina lepidula* Schwager, *G. subtilis* Hottinger, *G. pilula* Hottinger, *G. karsica* Sirel, *Alveolina ellipsoidalis* Schwager, *A. moussoulensis* Hottinger, *A. corbarica* Hottinger, *A. laxa* Hottinger, *A. ilerdensis* Hottinger, *A. minervensis* Hottinger, *A. subpyrenaica* Leymerie, *A. decipiensis* Schwager, *A.* aff. *pisella* Drobne, *A. erki* Acar, *A. trempina* Hottinger, *A. aragonensis* Hottinger, *Orbitolites complanatus* Lamarck, *O. megaspericus* Zhang, *Opertorbitolites lehmanni* Montanari. The fossil content and sedimentological features indicate deposition in a shallow restricted platform (10-30 m depth) with low energy at the beginning and subsequently in a deeper carbonate shelf environment (40-80 m) conditions.

Key words: Benthic Foraminifera, Ilerdian, Thanetian, Tosya

INTRODUCTION

This study was carried out in the vicinity of Akçataş and Cebeci villages, which are located to the northwest of Tosya town (SE Kastamonu). The study area is located in the western part of Kastamonu F32-d1 quadrangle of 1:25000 scale (Figure 1).

Geological studies carried out in the Tosya region have mainly focused on economical geology and tectonics. There are also a number of geological studies and geological research reports of the General Directorate of the Mineral Research and Exploration (MTA) carried out in the region. Early studies in the region belong to Coulant (1894) and Pilz (1937), which were concentrated on nickel deposits. Blumenthal (1939, 1948 and 1950) carried out geological research in the area and prepared a 1/100 000 scale geological map. Ayaroğlu (1980), concentrated on the economical possibilities of the region in his

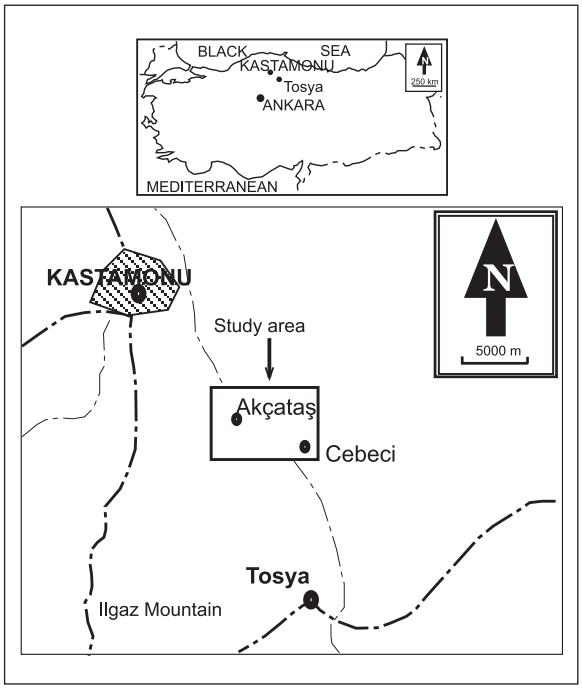

Figure 1- Location map of the investigated area.

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study. Later, Yılmaz and Tüysüz (1984) investigated the regional geology of the area. While some detailed paleontological researches have been carried out in the north and northeast parts of Kastamonu (Tunoğlu, 1992*a*, 1992*b*, 1993 and 1994), no detailed paleontological studies were done on the Tertiary units with fossils in the southeast of Kastamonu, yet. These units were aged as Paleocene-Eocene based on a number of genus determined in the previous studies (Ayaroğlu, 1980; Yılmaz and Tüysüz, 1984). First comprehensive paleontological research in the Akçataş-Cebeci region is reported by Özgen (1998) and Özgen-Erdem et al., (2005), which focused on merely Lower-Middle Ilerdian levels of the unit.

This study aimed at putting forward the benthic foraminiferal biostratigraphy, determining the stratigraphic range and interpreting paleoecological features of this unit. The stratigraphic distributions of the benthic foraminifera, which are described in this study, have also been correlated with Tethyan Belt shallow benthic Foraminifera biozones (Serra-Kiel et al., 1998). Towards realizing these objectives, three stratigraphic sections, which are named as Akçataş, Karapınar and Kirenler, have been measured and some 86 systematic samples were collected from the unit (Figure 2,4 -6). Systematic descriptions are based on oriented and random thin sections. All thin sections containing the benthic foraminifera described and shown in this paper are stored in

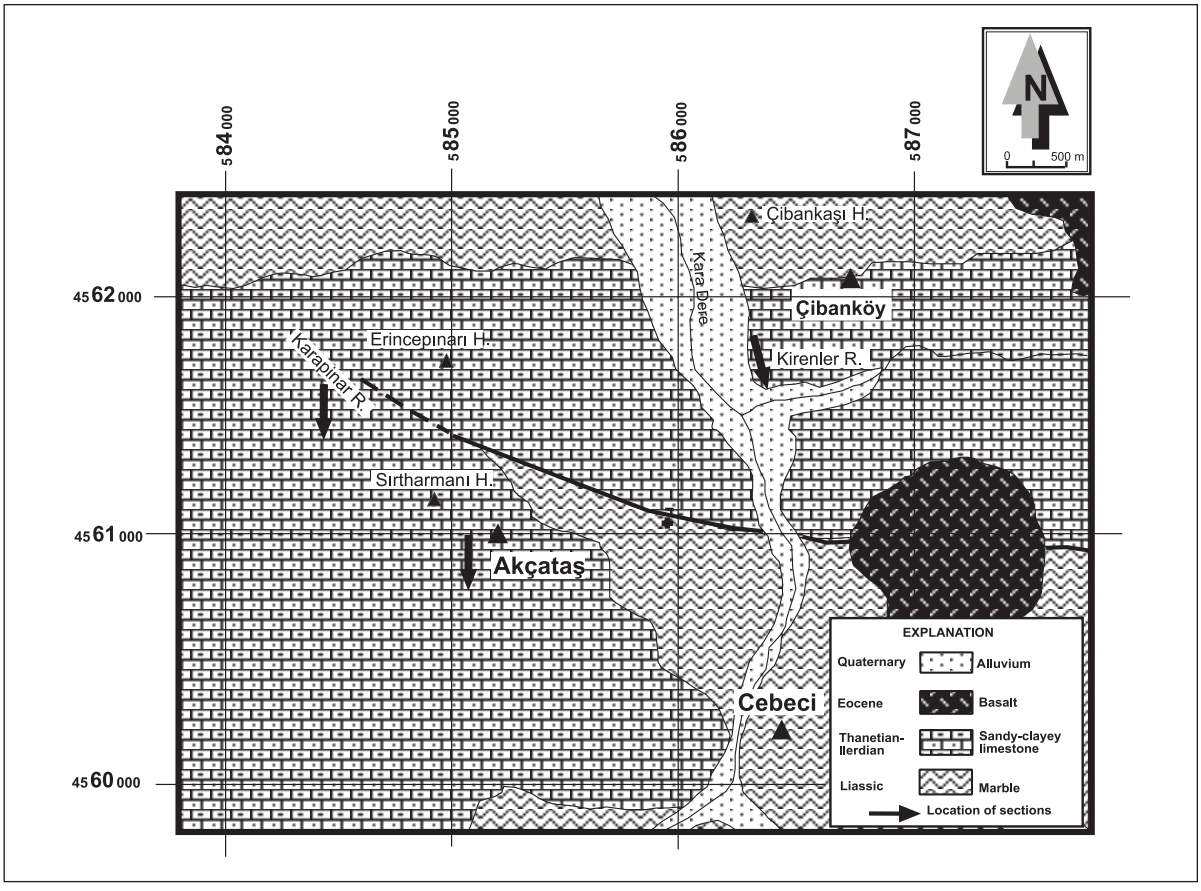

Figure 2- Geological map of Akçataş-Cebeci region (Yılmaz and Tüysüz, 1984).

the palepntological collection of Cumhuriyet University, Department of Geological Engineering, Sivas (Turkey).

STRATIGRAPHY

The Liassic aged Bekirli Metamorphics constitute the basement of the study area (Tüysüz, 1986) and consist of schist, marble, diabase and metadiabase. The limestones, which are dated as Upper Cretaceous in previous studies, were observed as a small outcrop in the vicinity of Cebeci village. *Hellenocyclina beotica* Reichel, *Siderolites* sp. and *Orbitoides* sp. are described in the samples obtained from the unit, which was then assigned to the Late Maastrichtian age (Figure 3). The unit, whose age is determined as Thanetian-Ilerdian in this study, starts with a thin conglomerate level in the base, which overlies Bekirli Metamorphics unconformably. The conglomerates are followed by sandstones, sandy limestones and limestones toward the upper levels. The sandstones are yellowish-brown coloured, well-compacted and carbonated. The sandy limestones are yellowish sometimes gray

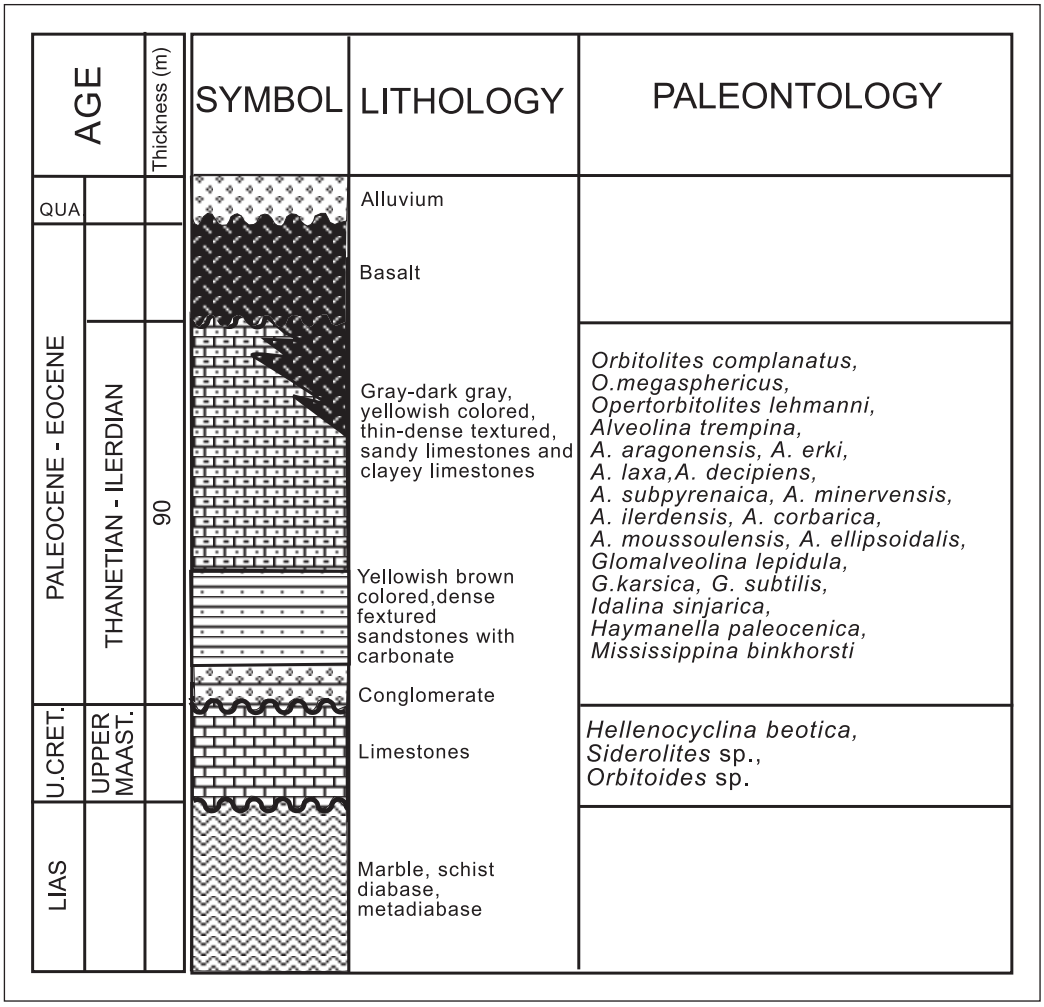

Figure 3- Generalized columnar section of the investigated area (nonscale).

coloured, well-compacted and fossiliferous. The limestones, which outcropped most, are gray-white sometimes yellowish coloured, thin-dense textured, fossilliferous and contain small amount of clays. Sedimentary petrography analyses show that the unit is presented with boundstones and wakestones, which contain benthic foraminiferal fragments within a micritic cement.

Haymanella paleocenica Sirel, *Idalina sinjarica* Grimsdale, *Mississippina binkhorsti* (Reuss), *Pseudocuvillierina*? sp., *Rotalia* sp., *Miscellanea* sp. and *Discocyclina* sp. are found in the lower levels of the unit. These levels are aged Thanetian. *Idalina sinjarica* Grimsdale, *G. lepidula* Schwager, *G. subtilis* Hottinger, *G. karsica* Sirel, *A. ellipsoidalis* Schwager, *Orbitolites complanatus* Lamarck, *O. megasphericus* Zhang, *Opertorbitolites lehmanni* Montanari, *Glomalveolina* sp., *Triloculina* sp., *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Lockhartia* sp., *Asterigerina* sp., *Miscellanea* sp., *Nummulites* sp., *Operculina* sp., *Discocyclina* sp. and *Haddonia* sp. have been determined in the Lower Ilerdian levels. *G. lepidula* Schwager, *G. pilula* Hottinger, *A. ellipsoidalis* Schwager, *A. moussoulensis* Hottinger, *A. corbarica* Hottinger, *A. laxa* Hottinger, *A. ilerdensis* Hottinger, *A. minerrvensis* Hottinger, *A. subpyrenaica* Leymerie, *A. decipiens* Schwager, *A.* aff. *pisella* Drobne, *A. erki* Acar, *O. complanatus* Lamarck, *O. megasphericus* Zhang, *Opertorbitolites lehmanni* Montanari, *Glomalveolina* sp., *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Lockhartia* sp., *Asterigerina* sp., *Miscellanea* sp., *Rotalia* sp., *Gypsina* sp., *Nummulites* sp., *Assilina* sp., *Operculina* sp. and *Discocyclina* sp. have been defined in the Middle Ilerdian levels. *G. lepidula* Schwager, *A. trempina* Hottinger, *A. aragonensis* Hottinger, *O. complanatus* Lamarck, *Op. lehmanni* Montanari, *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Lockhartia* sp., *Miscellanea* sp., *Asterigerina* sp., *Rotalia* sp., *Gypsina* sp., *Nummulites* sp., *Assilina* sp., *Operculina* sp. and *Discocyclina* sp., have been described in the Upper Ilerdian levels (Plate I, II). However this formation has not been named in the previous studies, to avoid a confusion, the formation has not been named in this study either. But instead, the unit is stated as Thanetian-Ilerdian aged. Eocene basalts are observed in places in the investigated area (Yılmaz and Tüysüz, 1984). The youngest deposits are Quaternary alluviums.

MEASURED STRATIGRAPHIC SECTIONS

Akçataş measured stratigraphic section

The section was measured within Akçataş village, which is located 10 km northwest to the Tosya town (Figure 2). The section is situated in the Kastamonu F32d1 quadrangle (start point: 4 561 000 - 585 100; end point: 4 560 900 - 585 100). Some 27 samples were collected along the section, which advanced from north to south for a total of 90 m in thickness (28 m Lower Ilerdian and 62 m Middle Ilerdian) (Figure 4). The unit is represented by gray, varigated coloured, thin-dense textured limestones in this section. *Idalina sinjarica* Grimsdale, *Glomalveolina subtilis* Hottinger, *G. lepidula* Schwager, *G. karsica* Sirel, *Alveolina ellipsoidalis* Schwager, *Orbitolites complanatus* Lamarck, *Opertorbitolites lehmanni* Montanari, *Glomalveolina* sp., *Alveolina* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Lockhartia* sp., *Asterigerina* sp., *Miscellanea* sp., *Nummulites* sp., *Operculina* sp., *Discocyclina* sp. and *Haddonia* sp. were described in the Early Ilerdian levels. The benthic foraminifera such as *G. lepidula* Schwager, *G. pilula* Hottinger, *Alveolina ellipsoidalis* Schwager, *A. moussoulensis* Hottinger, *A. laxa* Hottinger, *A. minervensis* Hottinger, *A. subpyrenaica* Leymerie, *A. decipiensis* Schwager, *A.* aff. *pisella* Drobne, *Orbitolites complanatus* Lamarck, *O. megasphericus* Zhang, *Opertorbitolites lehmanni* Montanari, *Glomalveolina* sp., *Alveolina* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Lockhartia* sp., *Asterigerina* sp., *Miscellanea* sp., *Nummulites* sp. and *Discocyclina* sp. were determined in the Middle Ilerdian levels (Figure 4).

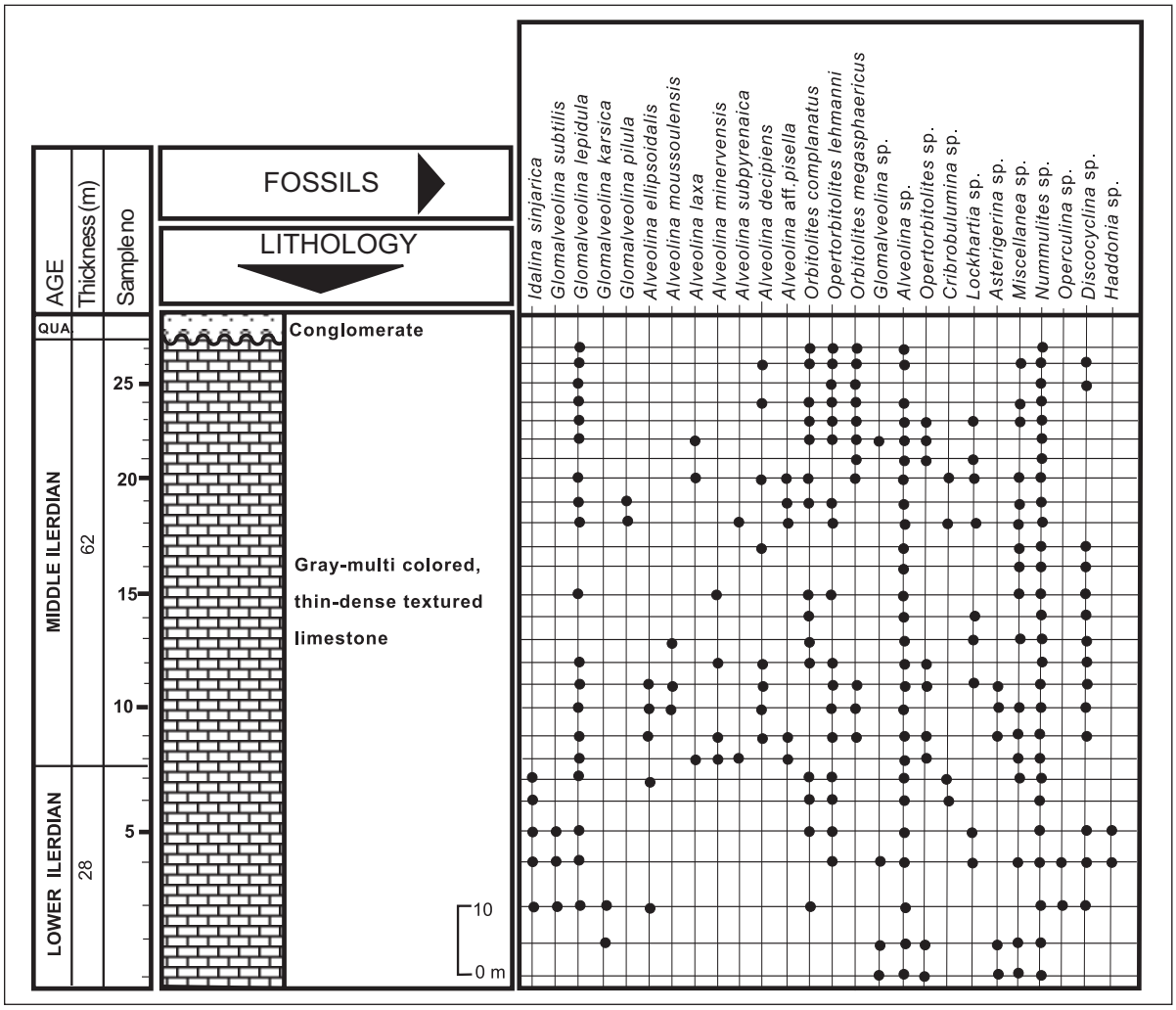

Figure 4- Akçataş section, Akçataş, NW Tosya, SE Kastamonu.

Karapınar measured stratigraphic section

This section was measured from the Karapınar ridge, which is 1 km northwest of the Akçataş village (Figure 2). The section is located in the Kastamonu F32d1 quadrangle (start point: 4 561 600 - 584 500; end point: 4 561 500 - 584 500) and has been measured from north to south. Middle-Upper Ilerdian levels of unit are ob-served in this section. A total of 65 m thickness (27 m Middle Ilerdian and 38 m Upper Ilerdian) was measured and some 24 samples collected (Figure 5). Middle Ilerdian levels are formed from sandy limestones in the base; gray, white coloured, dense textured limestones in the top and are characterized by *Glomalveolina lepidula* Schwager, *Alveolina moussoulensis* Hottinger, *A. ilerdensis* Hottinger, *A. minervensis* Hottinger, *A. subpyrenaica* Leymerie, *A. decipiensis* Schwager, *Orbitolites complanatus* Lamarck, *O. megasphericus* Zhang, *Opertorbitolites lehmanni* Montanari, *Glomalveolina* sp., *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Lockhartia* sp., *Miscellanea*

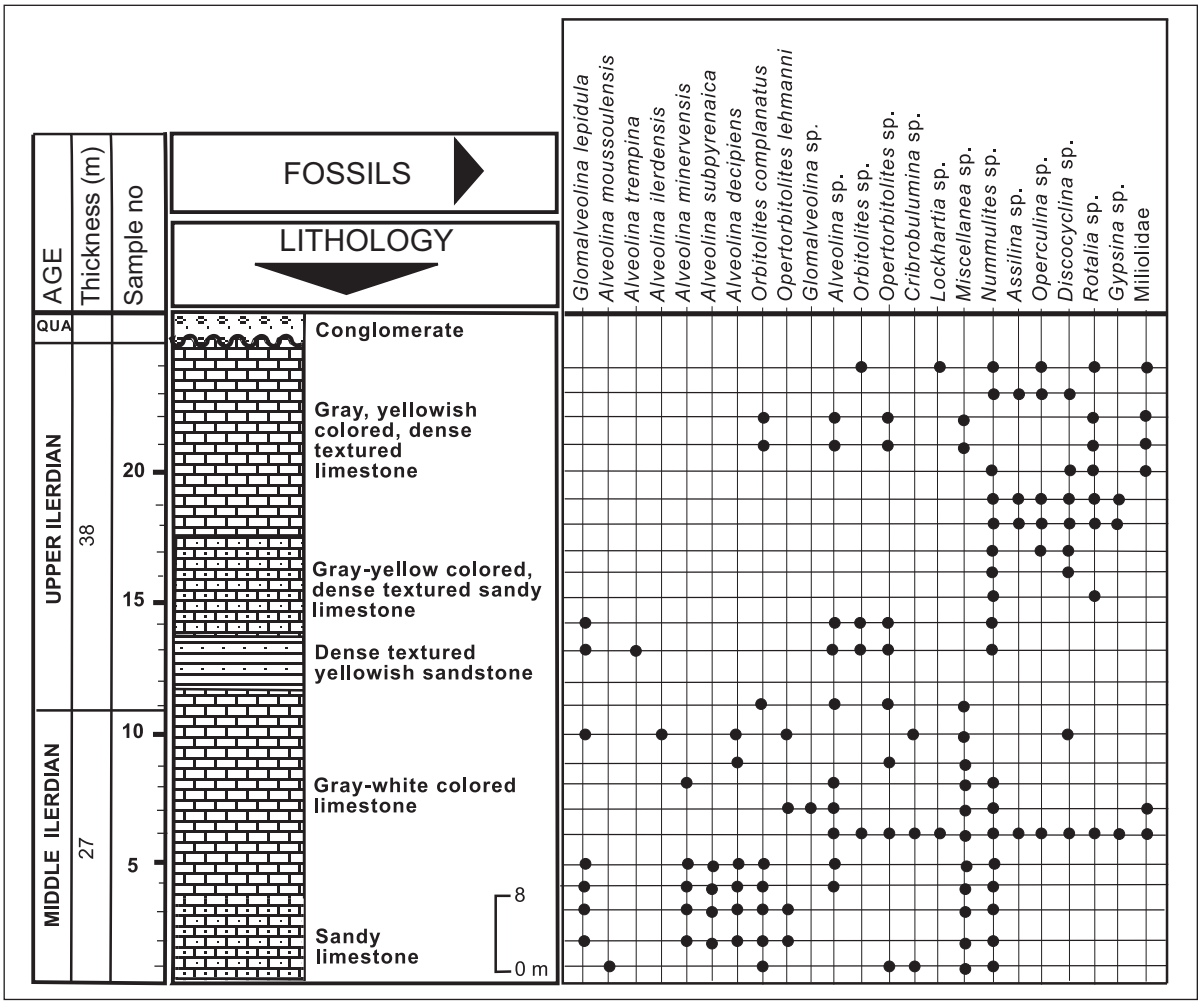

Figure 5- Karapınar section, NW Akçataş, NW Tosya, SE Kastamonu.

sp., *Nummulites* sp., *Assilina* sp., *Operculina* sp., *Discocyclina* sp., *Rotalia* sp. and *Gypsina* sp. Upper Ilerdian levels are represented by yellowish coloured, well-compacted sandstones, gray-yellowish coloured, dense textured sandy limestones and gray sometimes yellowish coloured, dense textured limestones from base to top. *G. lepidula* Schwager, *A. trempina* Hottinger, *Orbitolites complanatus* Lamarck, *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Lockhartia* sp., *Miscellanea* sp., *Nummulites* sp., *Assilina* sp., *Operculina* sp., *Discocyclina* sp., *Rotalia* sp. and *Gypsina* sp. were observed in these levels (Figure 5).

Kirenler measured stratigraphic section

This section was measured from Kirenler ridge, which is 500 m southwest of Çibanköy (Figure 2). It is situated in the Kastamonu F32 d1 quadrangle (start point: 4 561 750 - 586 200; end point: 4 561 650 - 586 250). Previously Lower-Middle Ilerdian levels were studied by Özgen (1998). In this subsequent study, basal and top levels of this section are worked. A total thickness of 59 m (7 m Thanetian, 18 m Lower Ilerdian, 26 m Middle Ilerdian and 8 m Upper Ilerdian) was measured and 35 samples collected (Figure 6). The section starts with conglomerates

in the base and continues with sandstones with carbonate, gray sometimes yellowish colored, thin-dense textured clayey limestones toward top levels. *Haymanella paleocenica* Sirel, *Idalina sinjarica* Grimsdale, *Mississippina binkhorsti* Reuss, *Pseudocuvillierina*? sp., *Rotalia* sp., *Miscellanea* sp. and *Discocyclina* sp. were described in the levels containing sandstones with carbonate. These levels are given Thanetian age. The Lower Ilerdian levels are characterized by *Idalina sinjarica* Grimsdale, *G. lepidula* Schwager, *G. karsica* Sirel, *A. ellipsoidalis* Schwager, *Orbitolites complanatus* Lamarck, *O. megasphericus* Zhang, *Opertorbitolites lehmanni* Montanari,

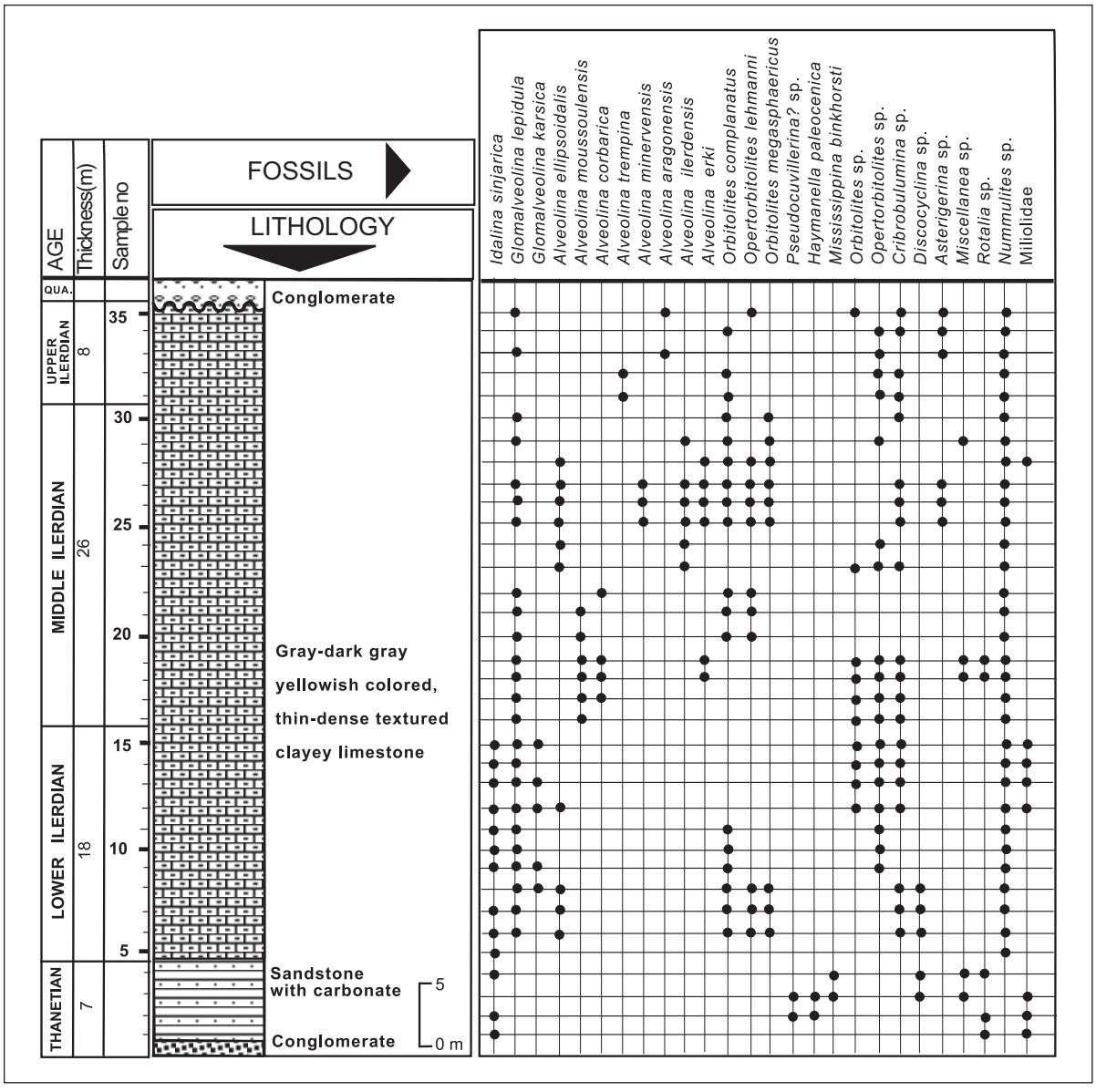

Figure 6- Kirenler section, SW Çibanköy, NW Tosya, SE Kastamonu.

Triloculina sp., *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Cribrobulumina* sp. and *Nummulites* sp.

In the Middle Ilerdian aged levels, *G. lepidula* Schwager, *A. ellipsoidalis* Schwager, *A. moussoulensis* Hottinger, *A. corbarica* Hottinger, *A. ilerdensis* Hottinger, *A. minervensis* Hottinger, *A. erki* Acar, *Orbitolites complanatus* Lamarck, *O. megasphericus* Zhang, *Opertorbitolites lehmanni* Montanari, *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Asterigerina* sp., *Miscellanea* sp., *Rotalia* sp. and *Nummulites* sp. were found. Late Ilerdian aged levels are represented by *G. lepidula* Schwager, *A. trempina* Hottinger, *A. aragonensis* Hottinger, *Orbitolites complanatus* Lamarck, *Opertorbitolites lehmanni* Montanari, *Alveolina* sp., *Orbitolites* sp., *Opertorbitolites* sp., *Cribrobulumina* sp., *Nummulites* sp. and *Asterigerina* sp. (Figure 6).

BIOSTRATIGRAPHY AND DISCUSSION

In this section stratigraphic ranges of benthic foraminifera defined in the studied area are correlated with Shallow Benthic Foraminifera Biozones (SBZ) of the Tethyan Belt (Serra-Kiel et al., 1998).

Similar to Serra-Kiel et al., (1998), *Idalina sinjarica* Grimsdale is observed in the Thanetian-Lower Ilerdian levels of the unit (SBZ 3-6).

As in the Tethyan Belt Shallow Benthic Foraminifera Biozones (Serra-Kiel et al., 1998), *Glomalveolina lepidula* Schwager is found in the Ilerdian (SBZ 5-9) levels of the study area. In the Tethyan Belt Biozones, while *Alveolina moussoulensis* Hottinger, *A. subpyrenaica* Leymerie and *A. laxa* Hottinger are shown in the lower levels of Middle Ilerdian (SBZ 7), *A. corbarica* Hottinger is shown in the upper levels of Middle Ilerdian (SBZ 8) and *A. decipiens* Schwager is shown in Middle Ilerdian (SBZ 7-8) by Serra-Kiel et al., (1998). However, these species are observed in the Middle Ilerdian levels of the northwestern Tosya region. According to Serra-Kiel et al. (1998) *A. trempina* Hottinger characterizes Upper Ilerdian levels (SBZ 9) in the Tethyan biozones. The same stratigraphic range has been determined for *A. trempina* Hottinger in the studied area. *A. ellipsoidalis* Schwager indicate Early Ilerdian (SBZ 6) in the Tethyan biozones (Serra-Kiel et al., 1998) and Early-Middle Ilerdian in this study. *A. aragonensis* Hottinger and *A. ilerdensis* Hottinger are shown in the Middle-Late Ilerdian (SBZ 7-9) of the Tethyan biozones (Serra-Kiel et al., 1998). The former species is found in the Upper Ilerdian levels while the latter is observed in the Middle Ilerdian levels of the studied area.

PALEOENVIRONMENTAL INTERPRETATION

Paleoenvironmental interpretations of the Thanetian-Ilerdian unit are mainly based on *Alveolina* species, other described benthic foraminifera and sedimantological data. As in most benthic foraminifera the test shape of Alveolina genus is an important criterion in the paleoecological studies (Hottinger, 1960, 1977, 1997; Lutherbacher, 1970; Hottinger and Dreher, 1974; Larsen, 1976; Hallock and Glenn, 1986). Hottinger (1960) stated that species of *Alveolina ellipsoidalis, Alveolina subpyrenaica* and *Alveolina decipiens* groups live in restricted platform environments with normal salinity. Similarly Luterbacher (1970), in his study on environmental distribution of Tertiary benthic foraminifera of Tremp basin, expressed that spheric alveolinids were found in lagoonal deposits while elongated alveolinids restricted in platform deposits. Both studies revealed that *Orbitolites* and *Opertorbitolites* inhabit together with these *Alveolina* species in identical environmental conditions. These types of environments, where low energy conditions are dominant, are characteristic for *Alveolina, Orbitolites* and *Opertorbitolites* assemblages (Hottinger, 1960).

The presence of Upper Cretaceous limestones with larger benthic foraminifera in the stu-

died area indicates the activity of shallow water conditions during this period. The units in the region were affected from the Laramian phase of Alpin orogenesis in the end of Late Cretaceous (Ayaroğlu, 1980). Following this period sea advanced forward and covered the region in the Thanetian. The beginning of Thanetian-Ilerdian unit with a basal conglomerate, and continuning with sandstones and sandy limestone lithologies are the evidences of this transgression. Poor fossil content of Thanetian levels which is mostly characterized by small rotaliid foraminifera (*Cuvillierina, Mississippina, Miscellanea, Rotalia*) indicate restricted platform environment with abnormal salinity (Hottinger, 1960).

However, Lower-Middle Ilerdian levels of the unit contain abundantly *Alveolina, Opertorbitolites* and *Orbitolites* species. These fossil assemblages with porcellaneous shell walls (Grenier, 1969; Murray, 1973; Reiss and Hottinger, 1984) and boundstones and wakestones with micritic cement indicate low energy conditions. Presence of these fossil assemblages and sedimentological data show that these levels of the unit were deposited in a shallow (about 10-30 m depth) restricted platform environment with normal salinity. Starting from upper levels of Middle Ilerdian and to the Upper Ilerdian, genera *Nummulites* and *Assilina* become more dominant. These fossil assemblages indicate the development of a deep (40-80 m depth) carbonate shelf environment in this period (Henson, 1950; Hottinger, 1960; Örçen et al., 1994).

CONCLUSION

In this study paleontological investigations are carried out on Thanetian-Ilerdian unit, which outcrops in the southeast (NW Tosya) of Kastamonu. In the study area a unit, which was aged Paleocene-Eocene by previous studies conducted in the region, unconformably overlies the Bekirli Metamorphics. However this study determined that the unit is Thanetian-Ilerdian aged.

The unit begins with basal conglomerate and continues upward with sandstones, sandy limestones and limestones. The following benthic foraminifera are described: *Haymanella paleocenica* Sirel, *Idalina sinjarica* Grimsdale, *Mississippina binkhorsti* (Reuss) in the Thanetian levels; *İdalina sinjarica* Grimsdale, *G. lepidula* Schwager, *G. subtilis* Hottinger, *G. karsica* Sirel, *A. ellipsoidalis* Schwager, *Orbitolites complanatus* Lamarck, *O. megasphericus* Zhang, *Opertorbitolites lehmanni* Montanari in the Lower Ilerdian levels; *G. lepidula* Schwager, *G. pilula* Hottinger, *A. ellipsoidalis* Schwager, *A. moussoulensis* Hottinger, *A. corbarica* Hottinger, *A. laxa* Hottinger, *A. ilerdensis* Hottinger, *A. minervensis* Hottinger, *A. subpyrenaica* Leymerie, *A. decipiens* Schwager, *A.* aff. *pisella* Drobne, *A. erki* Acar, *O. complanatus* Lamarck, *O. megasphericus* Zhang, *Op. lehmanni* Montanari in the Middle Ilerdian levels and *G. lepidula* Schwager, *A. trempina* Hottinger, *A. aragonensis* Hottinger, *O. complanatus* Lamarck, *Op. lehmanni* Montanari in the Upper Ilerdian levels. The stratigraphic range of these species presents close similarities with Tethyan Belt Shallow Benthic Foraminifer Biozones (Serra-Kiel et al., 1998) except for a few differences. The fossil assemblage and sedimentological data indicate the deposition of the Thanetian levels in restricted platform environment with abnormal salinity, the deposition of the Lower-Middle Ilerdian levels in a shallow and restricted platform environment with normal salinity, and finally the deposition of the Upper Ilerdian levels in a deep carbonate shelf environments in the region.

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PLATES

PLATE I

Haymanella paleocenica Sirel, Thanetian

Figure 1-2- Vertical sections, megalospheric form (Kirenler section, Nçb. 2), 1-X50, 2-X40.

Idalina sinjarica Grimsdale, Thanetian

Figure 3- Axial section, megalospheric form (Kirenler section, Nçb.2), X20.

Mississippina binkhorsti (Reuss), Thanetian

Figure 4- Subaxial section (Kirenler section, Nçb.3), X30

Pseudocuvillierina? sp., Thanetian

Figure 5- Axial section, megalospheric form (Kirenler section, Nçb.3), X30

Figure 6- Equatorial section, megalospheric form (Kirenler section, Nçb. 3), X30

Glomalveolina lepidula Schwager, Ilerdian

Figure 7- Axial section, megalospheric form (Kirenler section, Nçb.7), X30.

Glomalveolina karsica Sirel, Early Ilerdian

Figure 8- Axial section, megalospheric form (Kirenler section, Nçb.9), X30.

Alveolina erki Acar, Middle Ilerdian

Figure 9- Axial section, megalospheric form (Kirenler section, Nçb.18), X20.

Alveolina ellipsoidalis Schwager, Early Ilerdian

Figure 10- Axial section, megalospheric form (Kirenler section, Nçb. 12), X20.

Alveolina corbarica Hottinger, Middle Ilerdian

Figure 11- Axial section, megalospheric form (Kirenler section, Nçb. 17), X20.

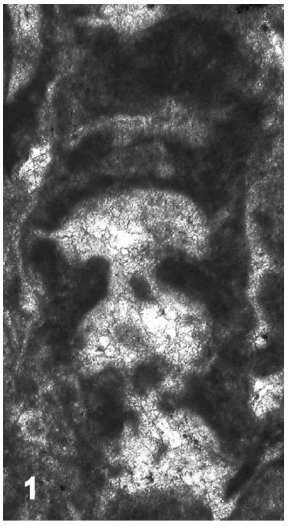
Alveolina ilerdensis Hottinger, Middle Ilerdian

Figure 12- Axial section, megalospheric form (Kirenler section, Nçb. 27), X20.

Alveolina decipiens Schwager, Middle Ilerdian

Figure 13- Axial section, megalospheric form (Akçataş section, Ak.26), X20.

PLATE - I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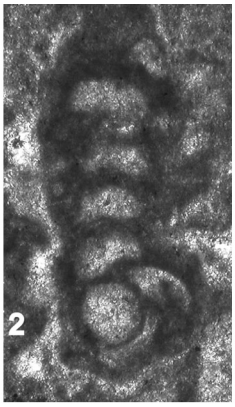
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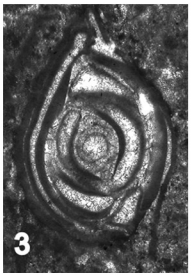
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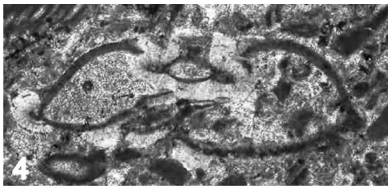
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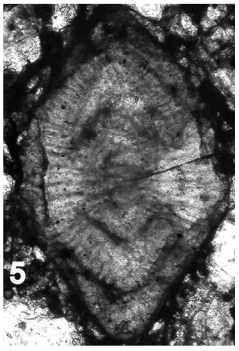
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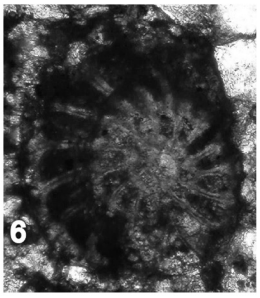
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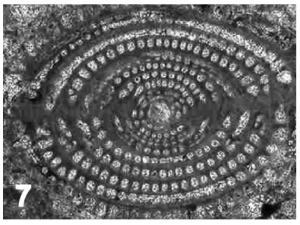
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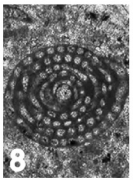
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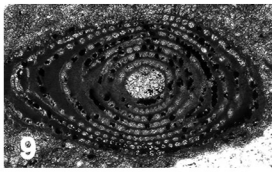
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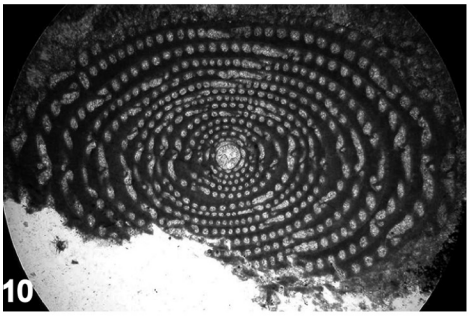
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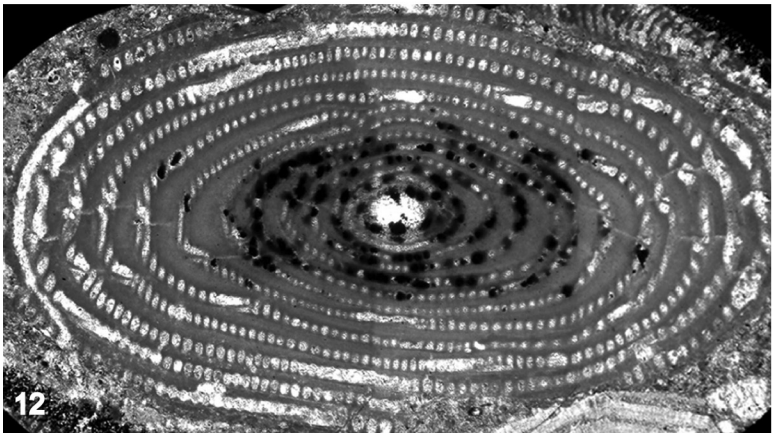
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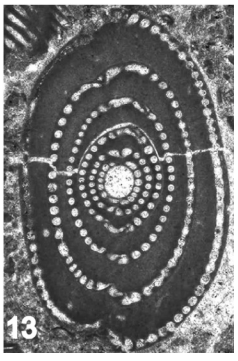
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PLATE II

Alveolina subpyrenaica Leymerie, Middle Ilerdian

Figure 1- Axial section, megalospheric form (Akçataş section, Ak.8) X20.

Alveolina aragonensis Hottinger, Late Ilerdian

Figure 2- Axial section, megalospheric form (Kirenler section, Nçb.33) X20.

Alveolina trempina Hottinger, Late Ilerdian

Figure 3- Axial section, megalospheric form (Kirenler section, Nçb.32), X20.

Alveolina aff. *pisella* Drobne, Middle Ilerdian

Figure 4- Axial section, megalospheric form (Akçataş section, Ak.18), X20.

Alveolina minervensis Hottinger, Middle Ilerdian

Figure 5- Axial section, megalospheric form (Akçataş section, Ak.8), X20.

Opertorbitolites lehmanni Montanarii, Middle Ilerdian

Figure 6- Axial section, megalospheric form (Akçataş section, Ak.11), X20.

Orbitolites megasphericus Zhang, Early- Middle Ilerdian

Figure 7- Axial section, megalospheric form (Akçataş section, Ak. 22), X20

Figure 8- Axial section, megalospheric form (Kirenler section, Nçb.6), X20.

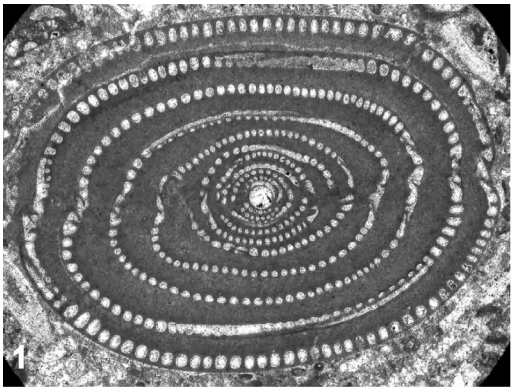
Orbitolites complanatus Lamarck, Ilerdian

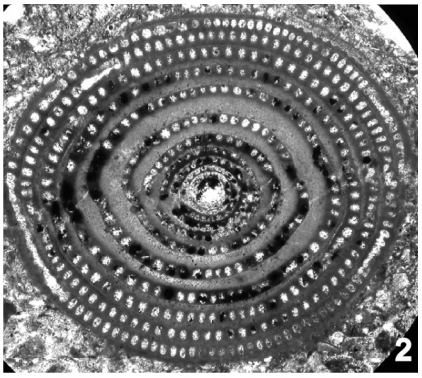
Figure 9- Axial section, megalospheric form (Kirenler section, Nçb.7), X20.

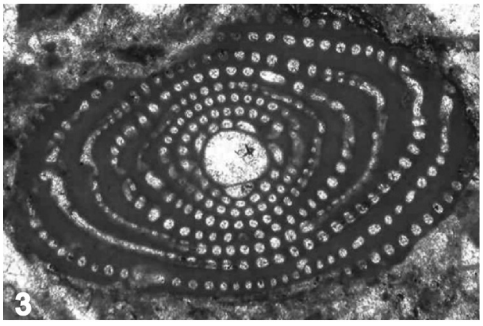
Discocyclina sp., Middle Ilerdian

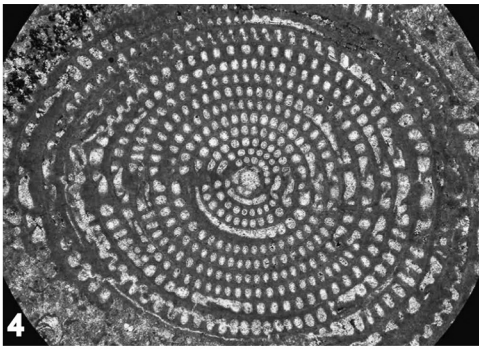
Figure 10- Axial section, megalospheric form (Akçataş section, Ak.25), X20.

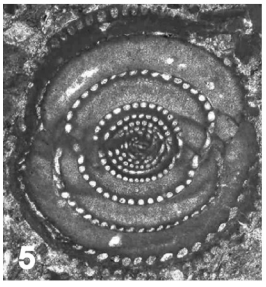
PLATE - II

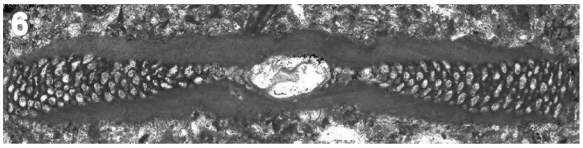


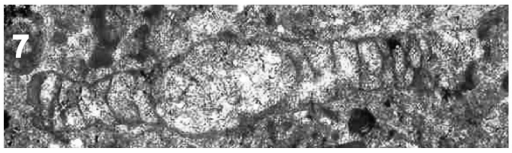


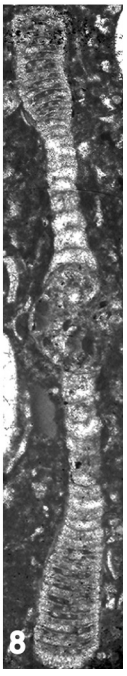


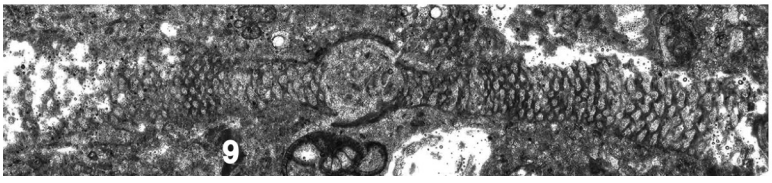


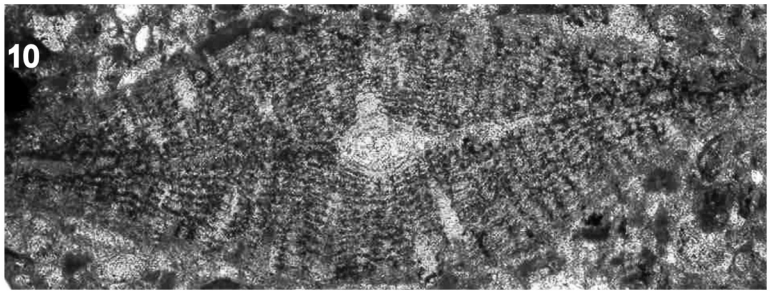












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