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# *Bolkarina*, new genus (Foraminiferida) and some associated species from the Thanetian limestone (Central Turkey)

By ERCÜMENT SİREL<sup>1)</sup>

## ABSTRACT

*Bolkarina aksarayi* n.gen. n.sp. and associated species (*Lacazina öztemüri* n.sp., *Fabularia donatae* DROBNE) have been studied and described from the Middle Paleocene (Thanetian) of different regions in Turkey: Aksaray (southeast of Tuz gölü), Kırıkkale (southeast of Ankara), Ereğli (northwest of Bolkar mountains) and Örencik, Demircilik (southeast of Sivas). The stratigraphy of these regions is briefly described.

## RÉSUMÉ

*Bolkarina aksarayi* n.gen. n.sp., et les espèces associées (*Lacazina öztemüri* n.sp., *Fabularia donatae* DROBNE) d'âge Paleocène Moyen (Thanetien) ont été étudiés dans différentes régions de Turquie: Aksaray (sud-est du Tuz gölü), Kırıkkale (sud-est d'Ankara), Ereğli (nord-ouest des montagnes Bolkar) et Örencik, Demircilik (sud-est de Sivas). La stratigraphie de ces régions est décrite brièvement.

## Introduction

The study presents the geographic and stratigraphic distribution as well as the description of new genus *Bolkarina aksarayi* n.gen. n.sp. and the other foraminiferal assemblage (*Lacazina öztemüri* n.sp., *Fabularia donatae* DROBNE) of the Paleocene limestone observed in Mahmutlar village (northwest of Kırıkkale), Karandere village (northwest of Aksaray), Sırakayalar gediği (southeast of Ereğli) and Örencik, Demircilik village (southeast of Sivas) area (Fig. 1).

For detailed lithological description of Upper Cretaceous-Lower Tertiary succession in the Kırıkkale, Yahşihan region (see NORMAN 1972). The studied samples were collected by the present author from a locality, approximately 1 km northeast of Mahmutlar village (map reference I30-b<sub>2</sub>).

UYGUN et al. (1978) made a detailed geologic investigation in the Tuz gölü region. The examined samples have been collected by the present author and A. Uygun from the Kocaağıdere, approximately 2 km southwest of Karandere village (map reference K31-a<sub>4</sub>).

DEMİRTAŞLI et al. (1973) studied the geology of the Ereğli region and Bolkar mountains. The examined samples have been collected by the present author and

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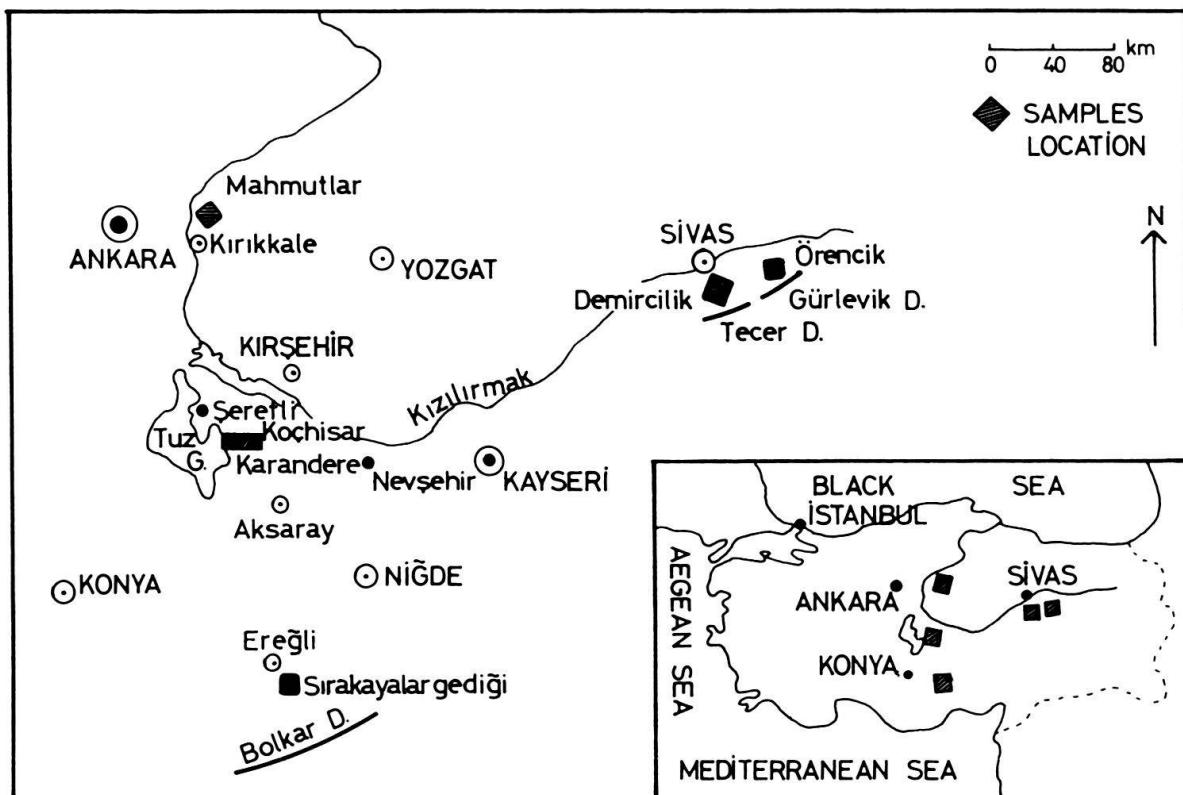


Fig. 1. Location map.

N. Turan from the Sırvakayalar gediği, approximately 2 km southeast of Ereğli town and 35 km north of Bolkar mountains (map reference N32-b<sub>1</sub>).

The southeastern part of Sivas area (Gürlevik, Tecer mountains) was studied by KURTMAN (1973). The first paleontological work in the Sivas region was carried out by DİZER (1962). The studied samples were collected by K. Tütüncü from the locality, approximately 750 m east of Örencik village (map reference I38-c<sub>3</sub>) and 1 km southeast of Demircilik village (map reference J38-a<sub>2</sub>).

The new genus *Bolkarina aksarayi* n.gen. n.sp. and *Lacazina öztemüri* n.sp. have been found in hard, grey-brown-colored Thanetian limestone with a rich microfauna (Foraminiferida) composed of *Fabularia donatae*, *Idalina sinjarica* GRIMSDALE, *Rotalia cf. trochidiformis* LAMARCK, *Keramosphaera* n.sp., *Kathina* sp., *Lacazina* sp., *Miscellanea* sp., *Peneroplidae*, *Miliolidae*.

Due to the hardness of limestone samples, it was not possible to obtain free individuals. The present study of foraminifera is based on thin sections.

Holotype and figured paratypes deposited in the personal collection of E. Sirel: Holotype of *Bolkarina* (Ak-1) (Pl. 1, Fig. 1-2), holotype of *Lacazina öztemüri* (Ak-25) (Pl. 4, Fig. 4).

### Stratigraphy

#### *Tuz gölü region*

The stratigraphy of this region is illustrated by Figure 2A. Lateral and vertical facies changes are abundant in the Maestrichtian sequence. This sequence is

represented by sandy and clayey sandstones and conglomerates; the sandy and clayey limestones of Maestrichtian which are characterized by foraminifers such as *Orbitoides media* D'ARCHIAC, *Omphalocyclus macroporus* LAMARCK, *Hellenocyclina beotica* REICHEL, *Siderolites calcitrapoides* LAMARCK. Lower Paleocene algal limestone conformably overlies a Maestrichtian sequence. The microfauna observed in the algal limestone samples include *Laffitteina mengaudi* (ASTRE), *Planorbulina* sp. and *Rotaliidae*. Thanetian sequence conformably overlies the algal limestone of Lower Paleocene age. It is composed of sandstone, marl, conglomerate and limestone. The Upper part of the Thanetian sequence consists of hard and brown-colored limestone with *Bolkarina aksarayi*, *Lacazina öztemüri*, *Fabularia donatae*, *Idalina sinjarica*, *Keramosphaera* n.sp.; it is conformably overlain by the Ilerdian limestone. This limestone is characterized by foraminifers such as *Alveolina aragonensis* HOTTINGER, *A. cf. globula* HOTTINGER, *A. (Glomalveolina)* sp., *Ranikothalia* sp. and *Orbitolites* sp. The Eocene deposits are mostly marls and thin-bedded sandstones. Eocene marls containing limestone pebbles of Thanetian age with *Bolkarina aksarayi*, *Lacazina öztemüri*, *Fabularia donatae* and *Keramosphaera* n.sp. and limestone pebbles of Ilerdian age with *Alveolina aragonensis*, *A. (Glomalveolina)* sp., *Discocyclina* sp. and *Orbitolites* sp.

#### *Kırıkkale region*

The stratigraphy of Kırıkkale region is illustrated by Figure 2B. NORMAN (1972) reports Santonian, Campanian, Maestrichtian, Paleocene, Eocene and Lower Oligocene rocks of the Kırıkkale Yahşihan region. The upper part of the Maestrichtian strata consists of alternation of sandy, clayey limestone and sandstone. *Orbitoides media*, *Siderolites calcitrapoides* and *Lepidororbitoides* sp., occur predominantly in the sandy and clayey limestone. The Maestrichtian sequence is conformably overlain by the algal limestone of the Lower Paleocene age. The algal limestone contains foraminifers such as *Laffitteina mengaudi*, *Planorbulina* sp. and *Miliolidae*. The Thanetian sequence conformably overlies the algal limestone of Lower Paleocene age; it is composed of sandstone, conglomerate, marl and light brown-colored limestone. The foraminifers observed in the light brown-colored limestone include *Bolkarina aksarayi*, *Lacazina öztemüri*, *Fabularia donatae* and *Miliolidae*. Upper Paleocene–Middle Eocene sediments take place over the Thanetian sequence and they are containing foraminifers such as *Nummulites* sp. and *Discocyclina* sp.

#### *Ereğli region*

The stratigraphy of Ereğli region is illustrated by Figure 2C. Upper Cretaceous (Maestrichtian), Paleocene and Eocene sediments crop out in the southeast of Ereğli region (Sırakayalar gediği). The upper part of the Maestrichtian sequence is composed of clayey limestones and contains foraminifers such as *Orbitoides media*, *Hellenocyclina beotica*, *Omphalocyclus macroporus* and *Globotruncana* sp. Paleocene limestone conformably overlies the Maestrichtian sequence. The lowest levels of this limestone are of the Lower Paleocene? age with *Mississippina* sp., *Discorbis* sp., *Planorbulina* sp. and *Globorotalia* sp. The upper part of Paleocene limestone is of

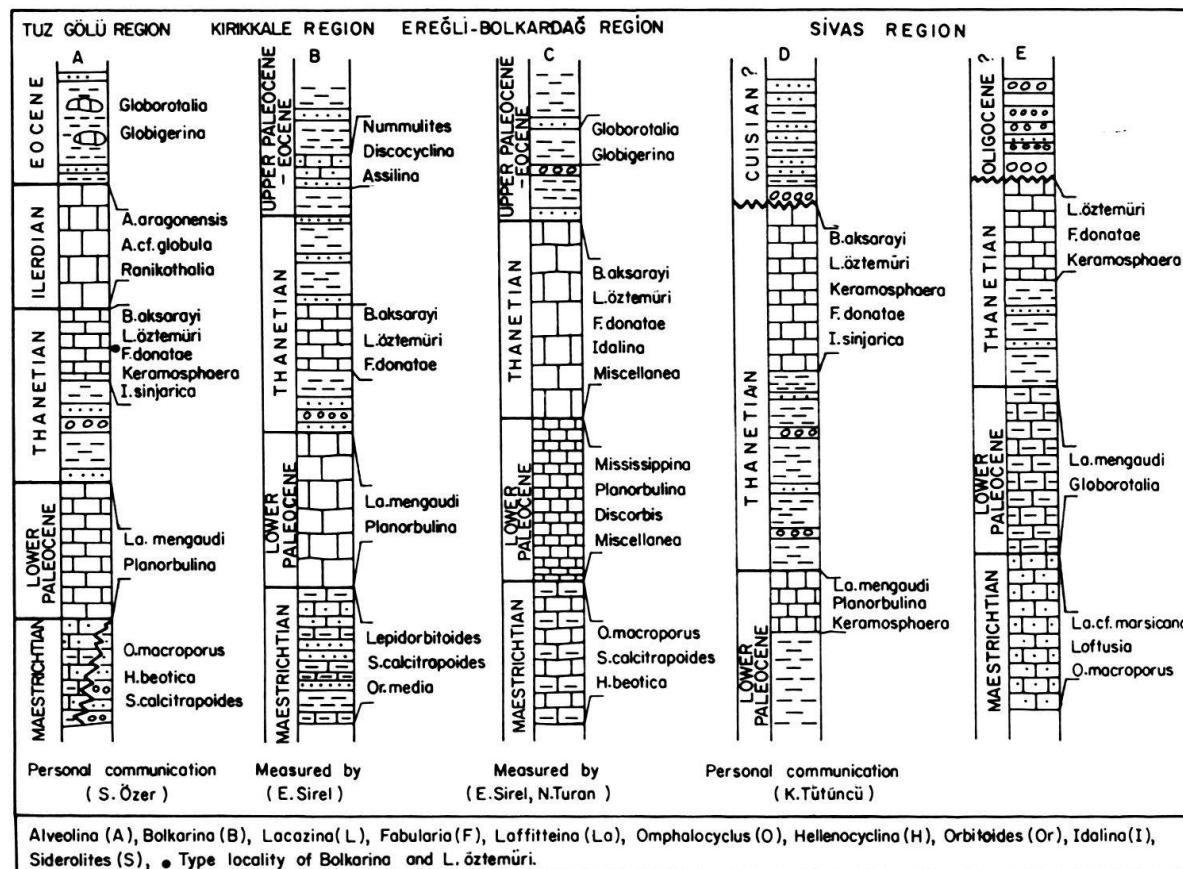


Fig. 2. Schematic columnar sections of the investigated area.

Thanetian age, it is characterized by *Bolkarina aksarayi*, *Lacazina öztemüri*, *Fabularia donatae*, *Miscellanea* n.sp., *Idalina* sp., *Rotaliidae* and *Miliolidae*. Upper Paleocene-Eocene sediments take place over the Thanetian limestone.

### Sivas region

The rock units of the Lower Paleocene, Middle Paleocene and Eocene crop out in the Örencik (west of Gürlevik mountains) village (Fig. 2D). The lower part of the Paleocene strata consists of red-colored clay and clayey limestone. The latter, containing *Laffitteina mengaudi* and *Planorbolina* sp., can be assigned to the Lower Paleocene; the sequence continues upward conformably with marl, sandstone, conglomerate and limestone. *Bolkarina aksarayi*, *Lacazina öztemüri*, *Fabularia donatae*, *Peneroplidae* and *Miliolidae* occur predominantly in the hard, brown-grey-colored limestone of Thanetian age. The Paleocene sequence is unconformably overlain by the Eocene (Cuisian?) flysch. This flysch is composed of basal conglomerate and alternation of claystone, siltstone and sandstone.

In Demircilik (northwest of Tecer mountains) village (Fig. 2E) the Paleocene sequence takes place over the clayey and sandy limestone with *Omphalocyclus macroporus*, *Laffitteina* sp. and *Loftusia* sp. of the Maestrichtian age. The lower part of the Paleocene sequence consists of clayey limestone with *Laffitteina mengaudi*,

*Globorotalia* sp. can be assigned to Lower Paleocene. The Paleocene sequence continues upward conformably with marl and hard, grey-colored limestone, containing foraminifera (*Lacazina öztemüri*, *Fabularia donatae*, *Keramosphaera* n.sp. and *Peneroplidae*) characteristic for Thanetian. The Thanetian limestone is unconformably overlain by the red-colored Oligocene? sediments, composed of basal conglomerate and alternation of conglomerate, siltstone, sandstone and gypsum.

### Systematic description

Phylum **Protozoa** GOLDFUSS 1817

Class **Rhizopoda** VON SIEBOLD 1845

Order **Foraminiferida** EICHWALD 1830

Family **Miscellaneidae** SIGAL 1952

Genus *Bolkarina* n.gen.

Derivation of name: Bolkar, a mountain from the central Taurus belt of Turkey.

Type species: *Bolkarina aksarayi* n.gen. n.sp.

*Diagnosis.* – Test rather large, thin, discoidal (flat to concavo-convex) and undulated in shape, coarsely perforate hyaline calcareous wall; a monolocular embryo is followed by many chambers forming planispiral involute spire which never exceeds four whorls. This spire has a thick wall and its chambers are subrectangular and connected by a slit form intercameral foramen at the base of septum. By far the greater portion of the test is composed of irregular hexagonal chambers in annular series.

*Comparisons and remarks.* – Because of the similarities of planispiral involute coiled periembryonic chambers, external ornamentation and coarsely perforated hyaline calcareous test, this new genus has been placed in family Miscellaneidae. It resembles *Miscellanea* by its early stage, wall composition, microstructure and outer ornamentation; but it is clearly distinguished from *Miscellanea* by the presence of the annuli of the equatorial chambers. This new genus is considered to have developed from genus *Miscellanea* by the addition of annuli of the postembryonic chambers.

*Bolkarina* n.gen., with its equatorial section shows resemblance with *Archaias* DE MONTFORT (1808), *Helicostegina* BARKER & GRIMSDALE, *Polylepidina* VAUGHAN (1924) and *Discospirina* MUNIER-CHALMAS (1902). In all these genera; the periembryonic chambers are spirally coiled with 1.5–3.5 whorls and following chambers (postembryonic chambers) arranged in annuali.

*Bolkarina* n.gen. differs from *Archaias* by having coarsely perforated hyaline calcareous test and the hexagonal equatorial chambers.

It differs from *Helicostegina* by the following characteristic: 1. The periembryonic chambers of new genus are planispiral, involute and coiled (Pl.2, Fig.2, Pl.3, Fig.5) whereas they are involute trochoid in *Helicostegina* (BARKER & GRIMSDALE 1936, Pl.32, Fig.4, 5, 7). 2. There is difference between the equatorial chambers of

*Helicostegina* and *Bolkarina*, the former having arcuate equatorial chambers and the latter equatorial chambers rather irregularly hexagonal in shape. 3. The shell composition is the same in both genera; but, new genus has more coarsely perforate test (as in *Miscellanea*) than *Helicostegina*.

*Polylepidina* is distinguished from *Bolkarina*. 1. By having bilocular nucleoconch, followed by a trochoid spire of less than two whorl, whereas *Bolkarina* has a monolocular embryo followed by an involute planispiral spire of 2-3.5 whorls. 2. By having arcuate equatorial chambers instead of irregular hexagonal as in new genus. 3. By having finer perforation of the shell than new genus.

*Discospirina* is easily distinguished from the new genus by the presence of the undivided periembryonic chambers and imperforate shell structure.

*Bolkarina aksarayi* n. gen. n. sp.

(Pl. 1, Fig. 1-3; Pl. 2, Fig. 1-4; Pl. 3, Fig. 1-6)

Derivation of name: Aksaray, a town of Niğde.

Holotype: The holotype of *Bolkarina aksarayi* n. gen. n. sp. is the equatorial section of microspheric form from thin section (Ak-1), illustrated by Plate 1 (Fig. 1, 2).

Material: Examined material consists of numerous specimens from the type and the other localities (Kırıkkale, Ereğli and Sivas regions), 100 thin sections from the very hard limestone.

Type locality: Tilkitepe and Kocaağıldıdere, approximately 2 km southwest of Karandere village (northwest of Aksaray), Central Turkey (Fig. 1).

Type level: Thanetian.

*Description of microspheric form*

*External characters.* – The description of the exterior ornamentation of the form B of *Bolkarina aksarayi* is based on the fairly well preserved tangential sections. The external surface of the test is undulated and ornamented by (coarse granules?). The wall is hyaline calcareous with coarsely perforate similar to genus *Miscellanea*. The test is relatively large, thin and discoidal (flat to concavo-convex). The periphery of the test is slightly rounded. The diameters of the adult microspheric form range from 12.2 mm to 18 mm and the thickness from 0.7 mm to 1 mm; average specimens have a diameter of 15 mm and a thickness of 0.85 mm, the radius of the holotype is 9 mm. The forms B are abundant compared to the forms A.

*Equatorial section.* – The proloculum is relatively small for this species, commonly about 65  $\mu$  in diameter, nearly subspherical in shape and has exceptionally thick walls. The proloculum is followed by 49-50 periembryonic chambers, planispirally arranged in 3-3.5 whorls (Pl. 1, Fig. 3; Pl. 3, Fig. 3). The diameter of planispirally stage ranges from 0.45 mm to 1.27 mm. The periembryonic chambers are generally subrectangular in shape; the septa have double layers and are gently arched backward. The intraseptal channels are present, the planispirally coiled chamber communications are made by a slit in the intercameral foramen at the base of the septum. The planispirally coiled stage is followed by about 64 irregular annuli of the equatorial chambers (in holotype); they are divided by radial partitions, resulting in

numerous irregular hexagonal chambers (Pl.1, Fig.2). The width of the annuli increases toward the periphery. The width of the equatorial chamber near the center is about the same as the height of the equatorial chamber; but near the periphery their height are greater than their width.

*Axial section.* – In axial section, it is apparent that the central part of the test is rather inflat compared to the periphery. The margin is well rounded. The first and second planispirally involute whorls which follow the proloculum cannot be distinguished very easily in the axial section, the equatorial chambers are always developed and arranged in irregular horizontal plane from center to periphery; their shapes are generally hemispherical, subspherical and arcuate. In some of the axial sections, the spherical alveolar structure (probably lateral chambers) within the spire, near the periphery can be observed (Pl.3, Fig.6).

#### *Description of macrospheric form*

*External characters.* – The macrospheric form is found very rarely compared to the microspheric form. The description of the exterior ornamentation of form A of new genus is the same as of form B (Pl.3, Fig.2). The test is small, thin, lenticular and has slightly elevated umbo over the planispirally coiled chambers. The largest specimen observed has a diameter of 3.2 mm and thickness of 0.9 mm.

*Equatorial section.* – The proloculum is small, spherical and its diameter is about  $80\ \mu$ . The planispirally involute stage is well developed and has 22 chambers in 2.5 whorls. The shape of the planispirally coiled chambers are irregular subrectangular; their tops are mostly rounded and their heights exceed always their widths. The diameter of the planispiral stage is about 0.5 mm, in the first whorl, the spire interval is almost constant; but in the second and the third whorls it suddenly becomes wider. The equatorial chambers (postembryonic chambers) cannot be well observed in the equatorial section.

*Axial section.* – It is rather rare, however we were able to find three subaxial sections of form A. The planispirally involute stage can be easily observed in these sections. The test is built of hyaline carbonate and is coarsely perforated as *Miscellanea*. The coarse pores can be seen on these sections and continue inwards as tubes. The equatorial chambers are generally arranged in a horizontal plane from center to periphery; their shapes are subspherical and hemispherical.

#### *Stratigraphic level and geographic distribution*

*Type locality.* – *Bolkarina aksarayi* n.gen. n.sp. is abundant in hard, brown-colored, Thanetian limestone with a rich microfauna (foraminifers) composed of *L. öztemüri*, *F. donatae*, *I. sinjarica*, *Keramosphaera* n.sp., *Lacazina* sp., *Miliolidae*, *Peneroplidae* and *Rotaliidae*. Holotype (Ak-1) and paratypes (Ak-2, 4, 6, 9, 20, 39, 40) have been collected from the type locality; Tilkitepe and Kocaağıldıdere approximately 2 km southwest of Karandere village (northwest of Aksaray; Tuz gölü region).

*Kırıkkale region.* Locality approximately 1 km northeast of Mahmutlar village (northwest of Kırıkkale) in brown-colored, Thanetian limestone with *L. öztemüri*,

*F. donatae*, *Peneroplidae* and *Miliolidae*. The paratypes of *Bolkarina aksarayi* (Kir-1, 2, 4) have been collected from the same locality.

*Ereğli region*. Sırakayalar gediği, approximately 2.5 km southeast of Ereğli town and 35 km north of Bolkar mountains in light brown-colored, Thanetian limestone with *L. öztemüri*, *F. donatae*, *Miscellanea* n. sp., *Idalina* sp., *Rotaliidae* and *Miliolidae*. The paratype (Bol-1) has been collected from the same locality.

*Sivas region*. Örencik village, west of Gürlevik mountains in grey, brown-colored, Thanetian limestone with *L. öztemüri*, *F. donatae*, *Keramosphaera* n. sp., *Peneroplidae* and *Miliolidae*.

Family ***Miliolidae*** EHRENBURG, 1839

Subfamily ***Fabulariinae*** EHRENBURG, 1839

Genus ***Lacazina*** MUNIER-CHALMAS, 1882

*Lacazina öztemüri* n. sp.

(Pl. 4, Fig. 1-6, Pl. 5, Fig. 1-6)

Derivation of name: This species is dedicated to my colleague Mr. Cemal Öztemür who has made many valuable works on micropaleontology.

Holotype: The holotype of *L. öztemüri* n. sp. is the vertical section of microspheric form (Ak-25) from thin section, illustrated by Plate 4, Figure 4.

Material: The examined material consists of numerous specimens from the type and the other localities (Kırıkkale, Ereğli and Sivas region), 50 thin sections from the very hard limestone.

Type locality: Tilkitepe and Kocaağıldıdere, approximately 2 km southwest of Karandere village (northwest of Aksaray), Central Turkey (Fig. 1). Type level: Thanetian.

*Diagnosis*. – Test oblate to subspheric, the vertical diameter up to 4.2 mm; horizontal diameter up to 3.5 mm, index of elongation (ratio of the vertical diameter to the horizontal diameter) 1.18. The wall is calcareous, porcellaneous imperforate. The proloculum is unknown, as only microspheric forms were observed. The first 4–5 chambers being low and are arranged in biloculine manner. All later chambers completely embracing, the trematophore plate alternating from one pole to the other in successive chambers. The cavities of the chambers are subdivided by the thick septula in parallel chamberlets. From one chamber to the next, the septula are arranged in continuous rows. Aperture cibrate possibly a trematophore plate at one end of the vertical axis.

*Description*. – Vertical section: It is oblate in the vertical section, 12 chambers have been counted for a vertical diameter of 3.5 mm (in holotype, Pl. 4, Fig. 4). The proloculum cannot be seen; the first 4–5 chambers which follow the proloculum are arranged biloculine in pattern and coiled very tightly. The basal layer of the first 5–6 chambers are thick compared to the chambers spaces. All later chambers completely enveloping, the trematophore plate alternating from one pole to the other in

successive chambers. The thickening of the basal layer of the last 7 chambers is 3 times thicker than the thickening of the basal layer of the first 4 chambers.

Horizontal section: It is circular in horizontal section and its diameter up to 3 mm. The first 4–5 chambers are arranged biloculine in pattern whereas all later chambers are coiled monoloculine. The cavities of the chambers are subdivided by the septula into parallel chamberlets. The septula join the outer wall of the chamber together with the septum; they are arranged in continuous rows from one chamber to the next. The continuous pattern in the arrangement of the chamberlets and septula is recognized best in tangential sections (Pl. 5, Fig. 2, 3).

*Comparisons and remarks.* – *L. öztemüri* n. sp. is distinguished from *Lacazina blumenthali* REICHEL & SIGAL and *Lacazina blumenthali gracilis* DROBNE by its external shape and coarser internal texture, and because holotype of *L. öztemüri* has 12 chambers in vertical of 3.5 mm while cotype of *L. blumenthali* has 20 chambers in oblique sections of 2.75 mm (REICHEL et al. 1969, Pl. II, Fig. 8). Oblique centered section of *L. öztemüri* has 13 chambers of 3.8 mm (Pl. 4, Fig. 5) whereas *L. blumenthali gracilis* has 19 chambers in tangential section of 3.75 mm (DROBNE 1974, Pl. 9, Fig. 8). One the other hand, septula of *L. öztemüri* are arranged in continuous rows from one chamber to the next but are arranged in open work pattern in the tangential section of *L. blumenthali*. The new species occurs in a lower stratigraphical level than *L. blumenthali*, which has been found in the lower part of the Upper Paleocene (Lower Ilerdian) associated with *Nummulites* sp., *Alveolina* sp., *Ranikothalia* sp. and *Miscellanea* sp. at type locality (REICHEL et al. 1969, p. 318). It has been found in Lower Ilerdian of Kars region (Eastern Turkey), associated with *Alveolina globula* HOTTINGER, *A. aramaea* HOTTINGER, *Fabularia alpani* SIREL, *Saudia labyrinthica* GRIMSDALE, *Miscellanea miscella* (D'ARCHIAC), *Kathina subsphaerica* SIREL, *Ranikothalia* sp., *Dictyoconus* sp. SIREL (1972).

*L. öztemüri* n. sp. is distinguished from the *Lacazina wichmanni* SCHLUMBERGER (1894) by the following characters: 1. *L. öztemüri* is oblate to subspheric in shape whereas *L. wichmanni* is ovoid and very prolate spheroid. 2. The septula and the basal layer of the new species are much thicker compared to *L. wichmanni*. 3. *L. öztemüri* has less chamberlets per chamber of similar horizontal lenght (CRESPIN 1962, Pl. 2, Fig. 4, 7) and its chamberlets are greater size than the chamberlets of *L. wichmanni*. 4. It has a smaller index of elongation in comparison with *L. wichmanni*.

#### *Stratigraphic level and geographic distribution*

*Type locality.* – Holotype (Ak-25) and paratypes (Ak-19, 21), (Aks-18, 29, 40) have been collected from type locality, Tilkitepe (Kocaağıldıdere), approximately 2 km southwest of Karandere village (northwest of Aksaray; Tuz gölü region). This new species of *Lacazina* is very abundant in hard, brown-colored, Thanetian limestone with rich microfauna; *B. aksarayi*, *F. donatae*, *I. sinjarica*, *Keramosphaera* n. sp., *Lacazina* sp.

*Kırıkkale region.* Locality approximately 1 km northeast of Mahmutlar village (northwest of Kırıkkale) in brown-colored, Thanetian limestone with *B. aksarayi*, *F. donatae*, *Peneroplidae* and *Miliolidae*.

*Ereğli region.* Sırakayalar gediği approximately 2.5 km southeast of Ereğli, in light brown-colored, Thanetian limestone with *B. aksarayi*, *F. donatae*, *Miscellanea* n. sp., *Idalina* sp. and *Rotaliidae*. The paratype (Bol-1) has been collected from the same locality.

*Sivas region.* Örencik village (west of Gürlevik mountains) in grey-colored, Thanetian limestones with *B. aksarayi*, *F. donatae*, *Keramosphaera* n. sp., *Peneroplidae* and *Miliolidae*.

Demircilik village (northwest of Tecer mountains) in grey-colored, Thanetian limestone with *F. donatae*, *Keramosphaera* n. sp. and *Peneroplidae*.

#### *Fabularia donatae* DROBNE

(Pl. 5, Fig. 7-11)

*Fabularia donatae* n. sp., DROBNE 1974, p. 129-184.

##### *Description of form B*

The test is ellipsoidal, being more or less circular in horizontal section. Maximum vertical diameter observed is 2.4 mm, horizontal diameter is up to 2.1 mm. There are 10-11 chambers in a horizontal section of 1.45 mm. The proloculum is very small and spherical with a diameter of about 80  $\mu$ . The first and second chambers which follow the proloculum show a milioline (*Triloculina*) stage (Pl. 5, Fig. 8, 10). The following 4 chambers are coiled in biloculine pattern; the basal layer of all chambers gradually increase from center to periphery, the later chambers being monoloculine. All chambers are divided into a single row of chamberlets by radially arranged partitions. The shape of the cross section of the chamberlets is generally subspheric (Pl. 5, Fig. 7, 8).

##### *Description of form A*

The test is ellipsoidal, being circular or subcircular in horizontal sections. The maximum horizontal diameter observed is 1.3 mm, the vertical diameter is up to 1.8 mm. There are 10 chambers in a horizontal section of 1.15 mm. The proloculum is very large and spherical with a diameter of about 275  $\mu$ . All of the chambers which follow the proloculum are tightly coiled biloculine in pattern. The biloculine chambers are subdivided into a single row of chamberlets by radially arranged partitions. The shape of chamberlet cross sections is generally subspheric (Pl. 5, Fig. 7).

##### *Stratigraphical level*

This species is very abundant in Thanetian limestone from the Tuz gölü, Kırıkkale, Ereğli and Sivas region (Fig. 2).

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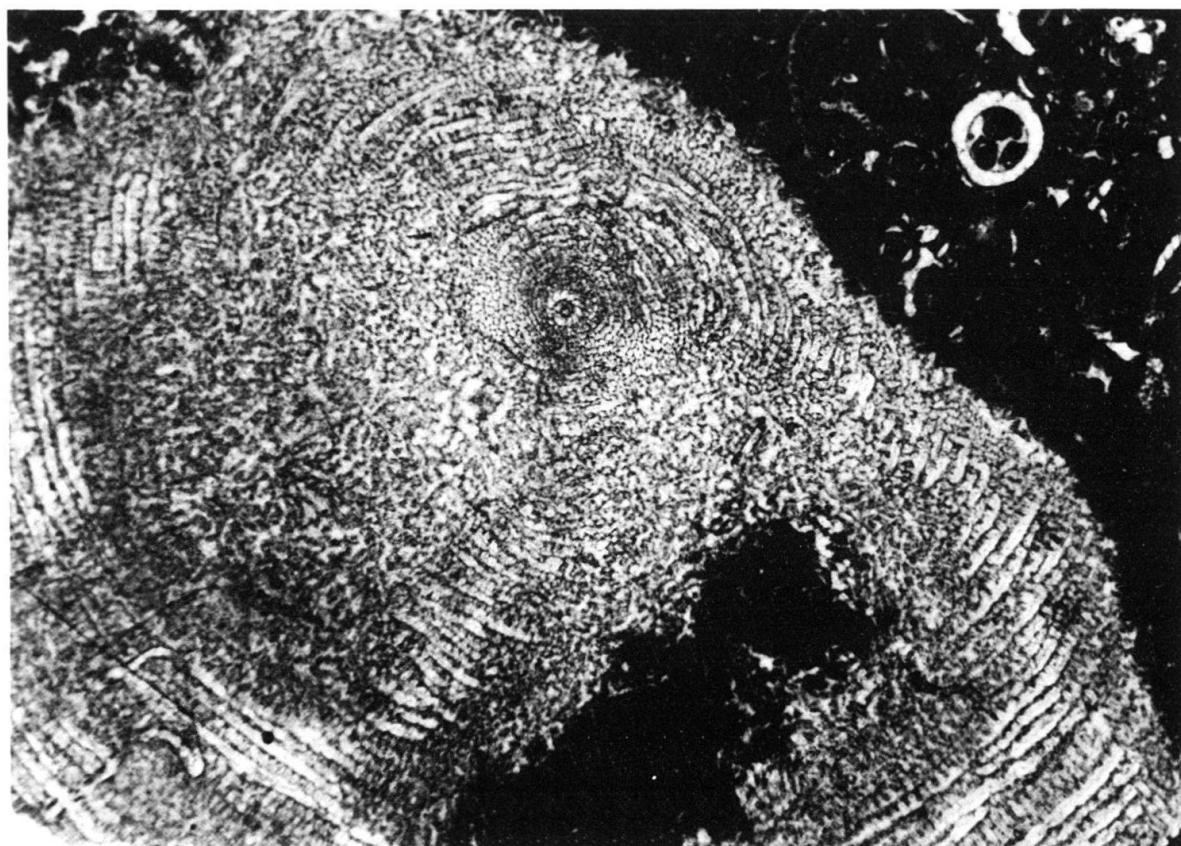
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**Plate 1***Bolkarina aksarayi* n. gen. n. sp.

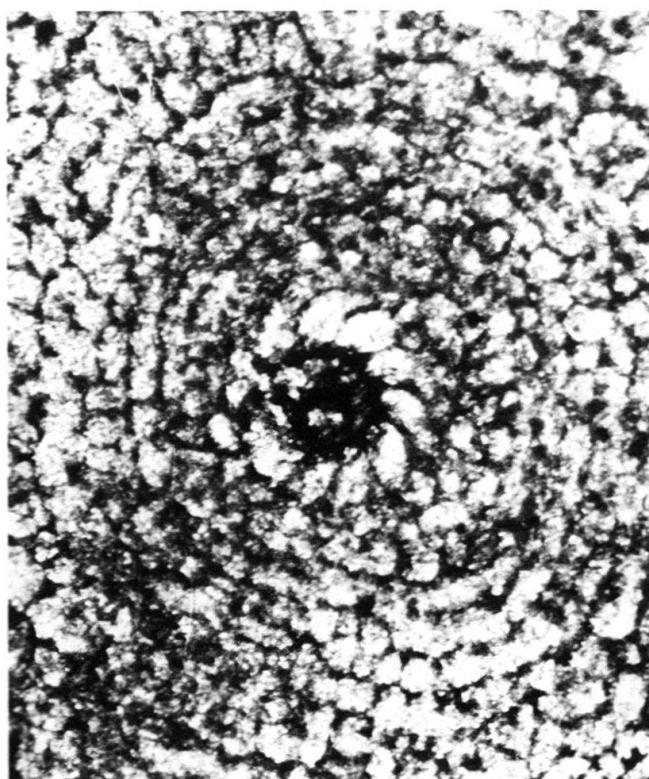
Fig. 1 Equatorial section of form B, holotype (Ak-1), Thanetian, Karandere (northwest of Aksaray).  $\times 10$ .

Fig. 2 Central portion of holotype, to illustrate the microspheric embryo, planispiral chambers and equatorial chambers.  $\times 57$ .

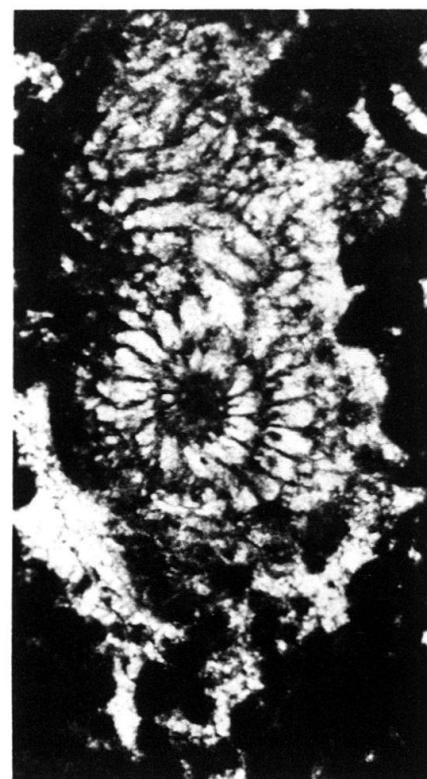
Fig. 3 Equatorial section of young specimen of form B, to illustrate the microspheric embryo, planispiral chambers and few annuli of postembryonic chambers, paratype (Ak-20), Thanetian, Karandere (northwest of Aksaray).  $\times 27$ .



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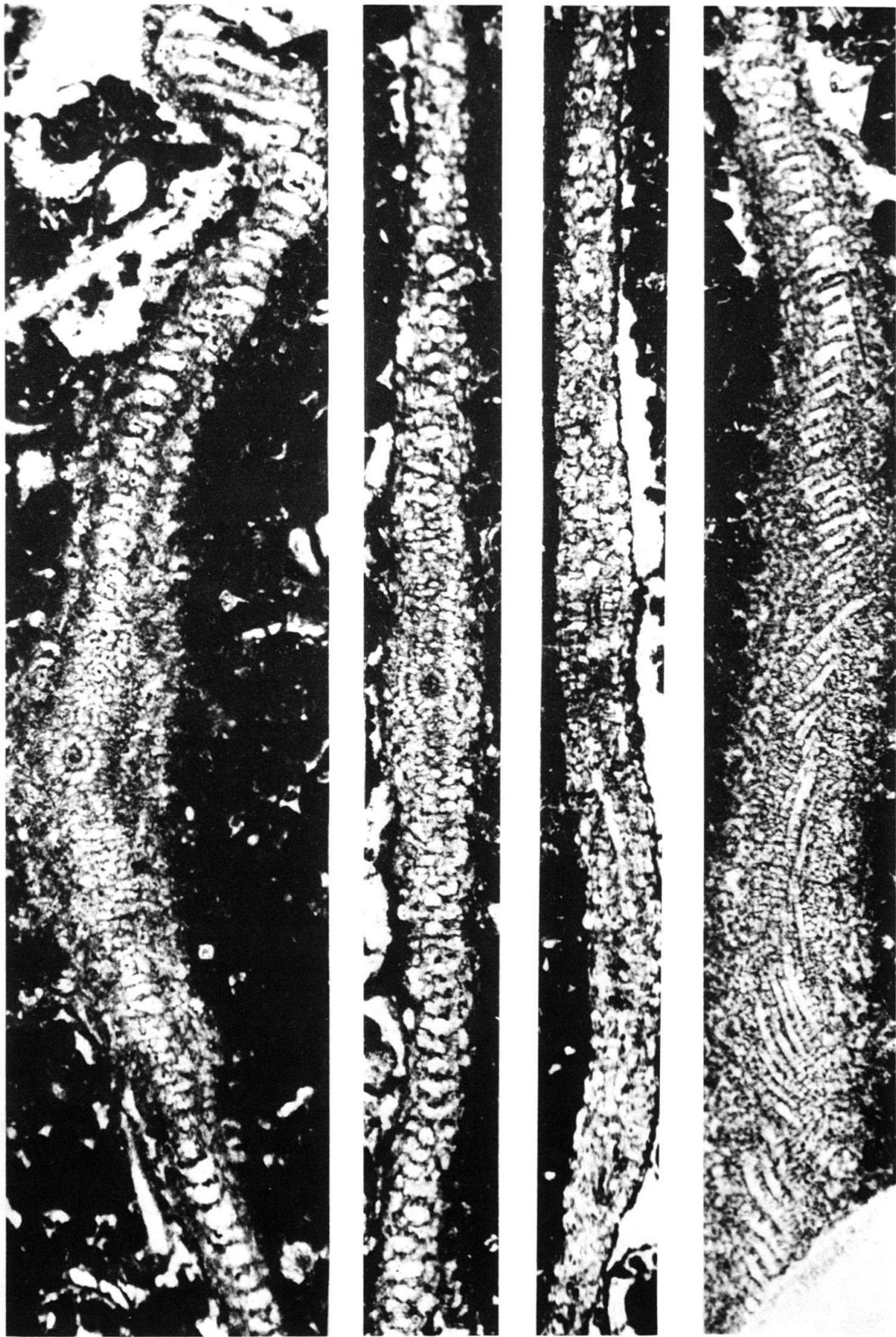
**Plate 2***Bolkarina aksarayi* n. gen. n. sp.

Fig. 1 Axial section of form B, slightly oblique through equatorial plane, paratype (Kır-1), Thanetian, Mahmutlar village (northwest of Kırıkkale).  $\times 17$ .

Fig. 2 Axial section of form B, paratype (Kır-2), Thanetian, Mahmutlar village (northwest of Kırıkkale).  $\times 17$ .

Fig. 3 Subaxial section of form B, paratype (Ak-4), Thanetian, Karandere (northwest of Aksaray).  $\times 16$ .

Fig. 4 Oblique section through equatorial plane, paratype (Ak-9), Thanetian, Karandere (northwest of Aksaray).  $\times 13$ .



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**Plate 3***Bolkarina aksarayi* n. gen. n. sp.

Fig. 1 Subaxial section of form B, paratype (Ak-2), Thanetian, Karandere (northwest of Aksaray).  $\times 11$ .

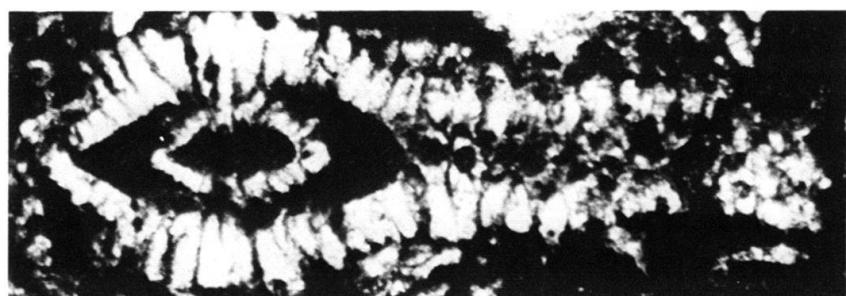
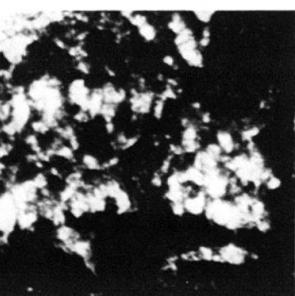
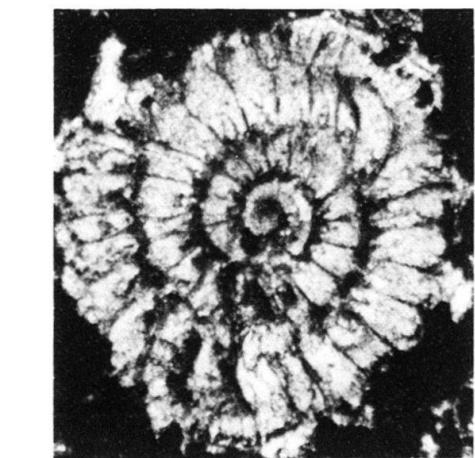
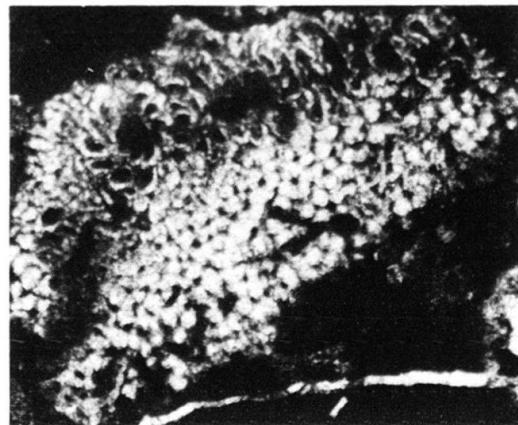
Fig. 2 Oblique equatorial section of form A, to illustrate the macrospheric embryo, planispiral chambers, equatorial chambers, external ornamentation, paratype (Bol-1), Sıra-kayalar gediği (north of Bolkar mountains).  $\times 27$ .

Fig. 3 Equatorial section of form B, showing planispiral chambers without the annuli of the equatorial chambers, paratype (Ak-6), Thanetian, Karandere (northwest of Aksaray).  $\times 33$ .

Fig. 4 Subaxial section of form A, paratype (Ak-40), Thanetian, Karandere (northwest of Aksaray).  $\times 35$ .

Fig. 5 Subaxial section of form A, slightly oblique, to illustrate the planispiral involute stage, paratype (Ak-39), Thanetian, Karandere (northwest of Aksaray).  $\times 51$ .

Fig. 6 Subaxial section of form B, near the periphery, showing spherical alveolar structure, paratype (Kır-4), Thanetian, Mahmutlar village (northwest of Kırıkkale).  $\times 24$ .



**Plate 4***Lacazina öztemuri* n. sp.  
(Form B)

Fig. 1 Vertical section, slightly oblique, paratype (Ak-19), Thanetian, Karandere (northwest of Aksaray).  $\times 16$ .

Fig. 2 Vertical section, slightly oblique, paratype (Ak-25), Thanetian, Karandere (northwest of Aksaray).  $\times 18$ .

Fig. 3 Horizontal section, slightly oblique, paratype (Aks-40), Thanetian, Karandere (northwest of Aksaray).  $\times 13$ .

Fig. 4 Vertical section, holotype (Ak-25), Thanetian, Karandere (northwest of Aksaray).  $\times 18$ .

Fig. 5 Oblique centered section, paratype (Ak-21), Thanetian, Karandere (northwest of Aksaray).  $\times 15$ .

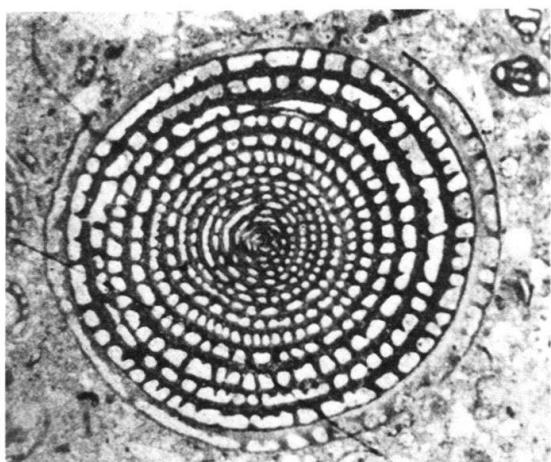
Fig. 6 Horizontal section, paratype (Aks-29), Thanetian, Karandere (northwest of Aksaray).  $\times 14$ .



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**Plate 5***Lacazina öztemüri* n.sp.  
(Form B)

Fig. 1 Vertical section, slightly oblique, paratype (Bol-1), Thanetian, Sırakayalar gediği (north of Bolkar mountains).  $\times 13$ .

Fig. 2-3 Tangential section showing the thicker septula, and chamberlets from one chamber to the next, paratype (Ak-24, Ak-37), Thanetian, Karandere (northwest of Aksaray). Fig. 2:  $\times 18$ ; Fig. 3:  $\times 17$ .

Fig. 4 Vertical section, paratype (Ak-21), Thanetian, Karandere (northwest of Aksaray).  $\times 16$ .

Fig. 5 Vertical section, paratype (Ak-24), Thanetian, Karandere (northwest of Aksaray).  $\times 20$ .

Fig. 6 Subhorizontal section near apertural opening at one pole, passing close to the trematophore of an early chamber, paratype (Ak-11), Thanetian, Karandere (northwest of Aksaray).  $\times 20$ .

*Fabularia donatae* DROBNE

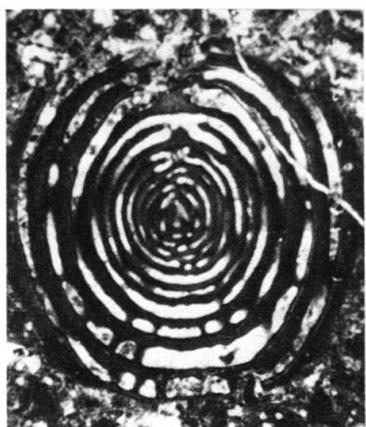
Fig. 7 Horizontal section of form A (Siv-1), Thanetian, Örencik (west of Gürlevik mountains).  $\times 20$ .

Fig. 8 Horizontal section of form B (Aks-38), Thanetian, Karandere (northwest of Aksaray).  $\times 27$ .

Fig. 9 Vertical section of form B (Aks-61), Thanetian, Karandere (northwest of Aksaray).  $\times 24$ .

Fig. 10 Oblique centered section of form B (Aks-15), Thanetian, Karandere (northwest of Aksaray).  $\times 19$ .

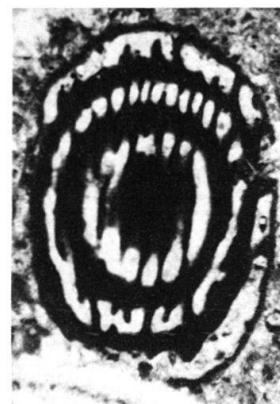
Fig. 11 Vertical section, slightly oblique, form A (Siv-5), Thanetian, Örencik (west of Gürlevik mountains).  $\times 20$ .



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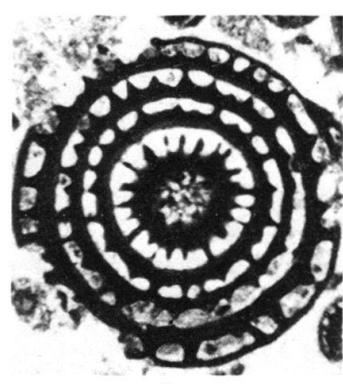
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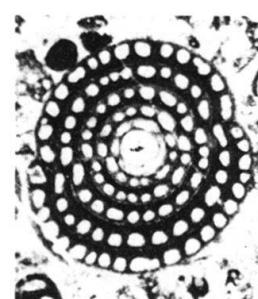
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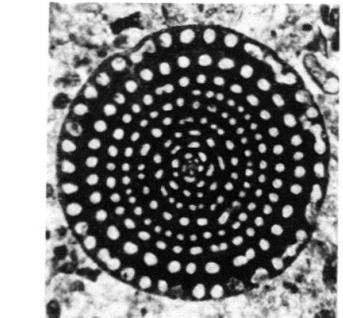
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