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Description of Larger Benthic Foraminifera Species from the Bartonian of Yakacık-Memlik Region (N Ankara, Central Turkey)

Yakacık-Memlik bölgesinin Bartoniyen iri bentik foraminiferlerinin tanımı (K Ankara, Merkezi Türkiye)

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ABSTRACT

A. callosa Hottinger, A. fragilis Hottinger, A. fusiformis Sowerby, A. kieli Sirel & Acar, A. nuttalli (Davies), A. stercusmuris Mayer-Eymar and nummulitid species Nummulites malatyensis Sirel are described and figured from the shallow-water marine limestone samples of Yakacık-Memlik region (N-Ankara, Central Turkey). Amongst all these species the presence of A. fragilis, A. fusiformis and N. malatyensis represents the Bartonian stage in the studied area. In addition, stratigraphic range of A. callosa, A. kieli, A. nuttalli and A. stercusmuris are discussed and probably a new Alveolina species A. n.sp are described and figured.

Key Words: Bartonian, benthic foraminifera, Alveolina, Yakacık-Memlik area, central Turkey.

ÖZ

Yakacık-Memlik bölgesinden alınan sığ su denizel kireçtaşı örnekleri içerisinde A. callosa Hottinger, A. fragilis Hottinger, A. fusiformis Sowerby, A. kieli Sirel&Acar, A. nuttalli (Davies), A. stercusmuris Mayer-Eymar ve bir nummulitid olan Nummulites malatyensis Sirel türleri tanımlanmıştır. Tespit edilen bu türler içerisinde A. fragilis, A. fusiformis ve N. malatyensis' in bulunması çalışma alnındaki Bartoniyen katının varlığını temsil etmektedir. Bunlara ek olarak A. callosa, A. kieli, A. nuttalli ve A. stercusmuris' in stratigrafik dağılımları tartışılmış ve muhtemelen yeni bir tür olan A. n.sp. tanımlanmıştır.

Anahtar Kelimeler: *Bartoniyen, bentik foraminifer, Alveolina, Yakacık-Memlik bölgesi, Merkezi Türkiye.*

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INTRODUCTION

So far, the existence of the marine Bartonian sediments with shallow-water foraminiferal species have previously not been reported from the following related localities of the northern Ankara (Fig. 1, 2).

The primary purpose of this paper is to describe and figured the foraminiferal assemblage of the Bartonian shallow water marine limestone samples from the Yakacık-Memlik area, N. Ankara, Central Turkey.

The deformational properties of Upper Cretaceous-Tertiary rocks in the Orhaniye-Memlik area were studied by Kazancı & Gökten (1986). Gökten *et al.* (1988) examined the stratigraphy and tectonics of late Cretaceous-Pliocene units in the Bağlum-Kazan region in detail. A biostratigraphical study based on nannoplankton in the flysch unit from the Cretaceous period near Orhaniye-Memlik area was investigated by Sağurlar & Toker (1990). Ocakoğlu & Çiner (1995) studied the basin geometries of detailed stratigraphic sections from the early Paleocene and Eocene units in order to examine the sedimantary evolution of the Orhaniye-Güvenç region. The paleogeographical and paleoclimatic conditions of the upper Cretaceous-Eocene units were examinied through a study of clay stratigraphy performed by Ocakoğlu (1998). The Tertiary glomalveolinids and alveolinids found in the Orhaniye section northwest of in Turkey were studied by Sirel & Acar (2008). Büyükutku & Sarı (2011) further spent time studying the diagenetic history of the upper Cretaceous sandstone in the vicinity of Yakacık.

The examined samples were collected from the yellowish argillaceous limestone of Gölbayırı hillside. This limestone overlies the red coloured terrestrial lithologic units which consist of conglomerate, sandstone, limestone and lava. The Quaternary aluvion is the youngest unit above all the lithologic units.

Despite some characteristic fossiles like *Nummulites perforatus* de Montford and *N. brogni-anrti* d' Archiac and Haime have been detected, the litostratigraphic units around Orhaniye vicinity were described in Lutetian by Gökten et al (1988). But according to the study made by Serra-Kiel (1998), these fossiles are the indicator benthic foraminiferas of Bartonian (SBZ 17).

Basically this study bases on the benthic foraminiferas in the limestone samples collected from the Gölbayırı section. In these samples, *A. fragilis*, *A. fusiformis*, *A. callosa*, *A.* aff. *kieli*, *A. stercusmuris*, *A. nuttalli,* and *N. malatyensis* were detected but especially *A. fragilis*, *A. fusiformis* and *N. malatyensis* indicates the Bartonian. In addition to these data, a new *Alveolina* species was defined but because of the poor axial thin sections the new name of the species was not given.

All orianted axial and equatorial thin sections were made from both isolated foraminiferal specimens and rock samples. Every specimen from plates 1-4 were subsequently deposited in the collection at Ankara University, Faculty of Engineering, Department of Geological Engineering.

SYSTEMATHIC PALEONTOLOGY

Family Alvolinidae (Alveolinidae) Ehrenberg, 1829

Genus *Alveolina* d'Orbigny, 1826

Type species: *Oryzaria boscii* Defrance, in Bronn, 1825

Alveolina fragilis Hottinger, 1960

(Plate 1, figs. 1, 3; Plate 2, figs. 1-2-5)

1960 *Alveolina fragilis* Hottinger, p. 170, pl. 16, figs. 13, 14; pl. 17, figs. 14-16, 20; pl. 18, figs. 12-14, 20.

2008 *Alveolina fragilis* Hottinger, Sirel & Acar, p. 85, pl. 77, figs. 1-5; pl. 78, figs. 1-13.

Description:

Megalospheric form: The test has an elongated fusiform with pointed poles and an axial diameter of 8,17-11,9 mm and an equatorial diameter of 1,2-1,85 mm. The index of elongation is between 6,33-9,1. The diameter of the ovoid proloculus ranges from 0,325 mm-0,55 mm. The axial thickening of the fusiform

Figure 1. Location map of the investigation area
Şekil 1. İnceleme alanının yerbulduru haritası.

whorls gradually increase along the axial direction. In the equatorial sector, the whorls have coiled tightly and the size of the chamberlets show gradual growth. In the early section of the whorls, however their cross sections are subcircular-circular, they become upright oval in the later whorls.

Microspheric form: The elongated fusiform test for this specimen has resulted in an axial diameter of 20,6 mm and an equatorial diameter of 1,3 mm at the 16th whorl, an index of elongation measured at 9,8 for the 8th whorl (similar with the holotype of Hottinger, 1960, pl. 17, fig. 14), and 15,84 for the 16th whorl. Elongated fusiform whorls follow the small proloculus. The other features are similar to previously established megalospheric forms.

Stratigraphic and Geographic Distribution: This elongated fusiform species indicates the Bartonian (SBZ 17) according to Serra-Kiel *et al.* (1998, p. 285, fig. 2). *A. fragilis* Hottinger has been firstly described and figured from the Bartonian (Biaritzien) type locality: Collines de Verone (North of Italy). Also this form was described and figured in the Bartonian limestone of Söğüt area (N. Bilecik) by Sirel & Acar (2008). In this study *A. fragilis* was found together with *A. fusiformis*, *A. nuttalli* and *N. malatyensis* in the Bartonian argilaceous limestone of Gölbayırı section (fig 3.) .

Alveolina fusiformis Sowerby, 1850

(Plate 1, fig. 2, 4; Plate 2, figs 3-4)

1850 *Alveolina fusiformis* Sowerby in Dixon, pl. 9, figs. 5a, b.

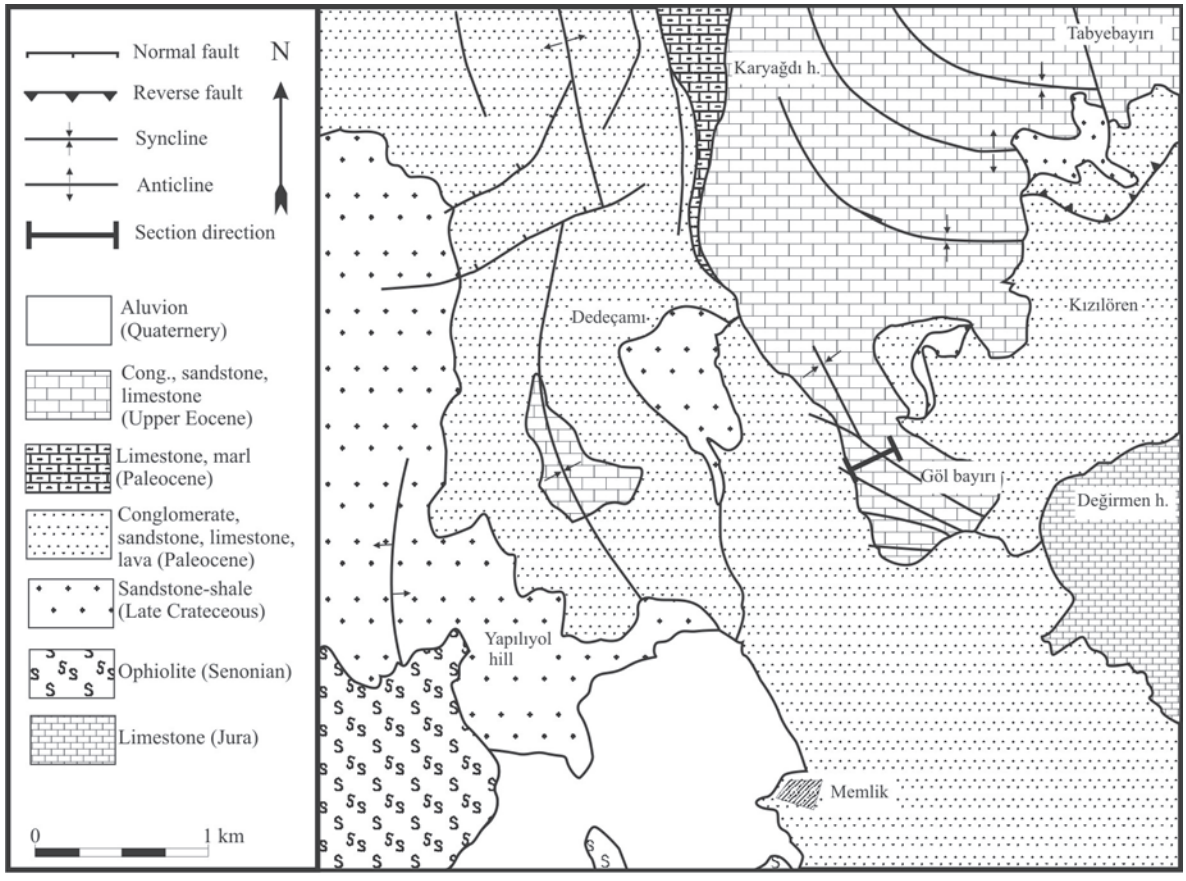

Figure 2. Geologic map of the investigation are (rearranged from Gökten. et al 1988)
Şekil 2. İnceleme alanının jeolojik haritası (Gökten vd. 1988' den düzenlenmiştir)

1960 *Alveolina fusiformis* Sowerby, Hottinger, p. 169, pl. 12, figs. 5-7; pl. 14, figs. 1-4; pl. 17, fig. 17; pl. 18, fig. 11, text fig. 94, figs.a-h.

1962 *Alveolina fusiformis* Sowerby, Adams, p. 48, pl. 1, figs. 1-5; pl. 2, figs. 1-12; pl. 3, figs. 1-7.

2008 *Alveolina fusiformis* Sowerby, Sirel & Acar, p. 84, pl. 76, figs. 2-5.

Description: The megalospheric generation with a fusiform test has an axial diameter of 6,65-19,6 mm and an equatorial diameter of 0,97-1,6 mm. The index of elongation is between 4,34-6,5. The subspherical proloculus (0,325-0,65 mm in a diameter for the largest specimens) is followed by fusiform to elongated whorls. The axial thickening of the basal layer is greater than that of the equatorial spirals and increases gradually. The cross sections of closely arranged chamberlets are spheric-subspheric in shape.

Remark: *A. fusiformis* was first described by Sowerby in 1850 as a new alveolinid species from the type locality (Bracklesham, England) by having only an external view of free specimen of holotype. This species has been emended the specimens of topotype by Adams (1962). According to Hottinger (1960), Adams (1962), Drobne (1977), Serra-Kiel et al (1998) and Sirel-Acar (2008) *A. fusiformis* is an indicator species of Bartonian. In comparison to the samples form the Gölbayırı section, they both resemble the Adam's specimens.

Distrubution: The distrubution of this species was given in *A. fragilis* part.

Alveolina callosa Hottinger, 1960

(Plate 3, figs. 1-4)

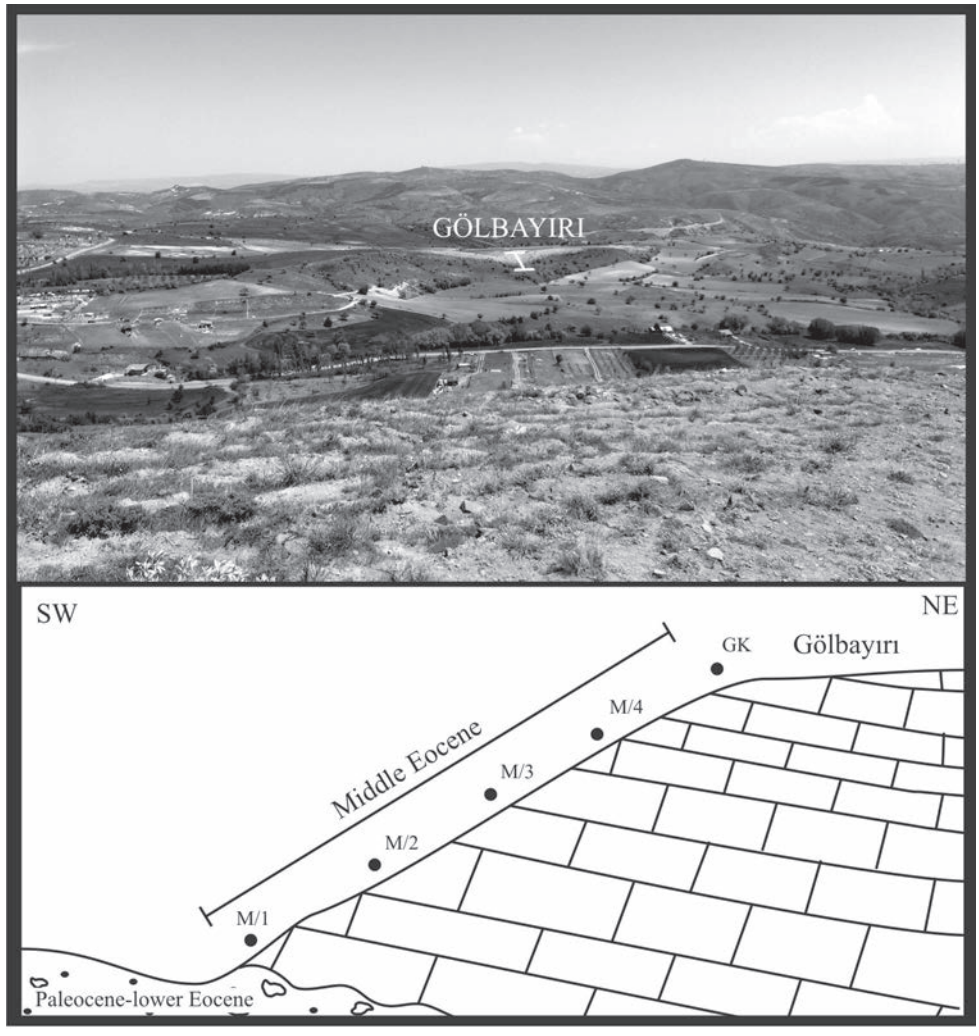

Figure 3. Cross section of Gölbayırı section (not-to-scaled)
Şekil 3. Gölbayırı kesitinin yatay kesiti (ölçeksizdir)

1960 *Alveolina callosa* Hottinger, p. 160, pl. 14, figs. 18, 19; pl. 15, figs. 7-10.

2008 *Alveolina callosa* Hottinger, Sirel & Acar, p. 82, 83, pl. 75, figs. 7, 8.

Description: The megalospheric generation has large, elongated subcylindrical test with an axial diameter of 11-16,5 mm and equatorial diameter of 2,2-2,85 mm. The index of elongation is between 3,96-6,6. The spheric to subspheric proloculus (0,5-0,65 mm in diameter) is followed by elongated whorls. The axial thickening increases gradually from the proloculus to the last whorl. The basal layer of the equtorial sector remains thin with respect to the axial thickening. Closely arranged chamberlets are very small and their cross sections change from circular to subcircular.

Distribution: According to Serra-Kiel *et al.* (1998) the subcylindirical form *A. callosa* is an indicator alveolinid of SBZ 13 (early Lutetian). In the argillaceous limestone of the Göl bayırı section, however, this species was found together with Bartonian characteristic benthic foraminiferal forms, such as *A. fragilis*, *A. fusiformis*, *N. malatyensis* and *Fabiania* sp. (pl 4, fig. 11) . As a result of this biostratigraphic data the age of *A.callosa* has been as a Bartonian.

Alveolina aff. *kieli* Sirel, 2008

(Plate 3, figs. 5-6)

2008 *Alveolina kieli* Sirel, p. 81, pl. 74, figs. 1-3.

Description: Two megalospheric generations have a medium sized ovate test. The axial diameter ranges from 4,77-5,35 mm and has an equatorial diameter of 3,075-3,55 mm. The index of elongation is 1,507-1,55. The spheric proloculus (0,15-0,16 mm in diameter) is followed by 3-4 subspheric whorls of nepionic stage. The complete axial section figured in (pl. 3, fig. 5) has 5 ovoid whorls of adult stage followed by the 7 whorls of senile stage. The basal layer becomes thicker from proloculus to the pole and and in the axial sector it is more thicker than the equatorial sector. The size of the chamberlets increase gradually to the last whorl. The cross section of chamberlets are spheric to subspheric and become upright ovals in the last 4 whorls.

Remark: Although this form differs from *A. kieli* Sirel&Acar with its thinner basal layer and more ovate form, there are too many similarities between two of them. For this reason this form is named as *A.* aff. *kieli*.

Distribution: *A. kieli* was first described and figured by Sirel & Acar (2008) after being discovered in the Lutetian limestone of the Orhaniye region. In this study, this ovate form was found with the indicator benthic foraminiferas like *A. fragilis*, *A. fusiform* and *N. malatyensis* from the Bartonian , and such as, its age should range from the Lutetian to Bartonian Age.

Alveolina stercusmuris Mayer-Eymar, 1886

(Plate 4, fig. 10)

1886 *Alveolina stercusmuris* Mayer-Eymar, (in Hottinger, 1960a, p. 147; in Drobne, 1977, p. 50).

1977 *Alveolina stercusmuris* Mayer-Eymar, Drobne, p. 50, pl. 10, figs. 12-14.

2008 *Alveolina stercusmuris* Mayer-Eymar, Sirel & Acar, p. 83-84, pl. 76, fig. 1.

2010 *Alveolina stercusmuris* Mayer-Eymar, Deveciler, p. 194, pl. 3, fig. 1.

Description: Only one well oriented axial section sample was obtained. Subcylindiric and medium sized test has 4,975 mm in axial diameter and 2,75 mm in equatorial diameter. The index of elongation is 1,88 at the 13 th whorl. The subspheric proloculus with a diameter of 0,148 mm is followed by five tightly coiled subspheric to ovoid shaped whorls. The axial thickening of the following 3-4 whorls is rather thick when compared with the thickening of the equatorial sector. The axial thickening becomes more narrow at the last 6 whorls of the senile stage. The size of the chamberlets shows regular increasing from the first to the last whorl. Their cross sections vary from the subsphaeric to upright oval.

Distribution: This form was detected by Drobne in lower Lutetian of Pican-Slovenia (1977). Therefor Sire&Acar (2008) found it in the limestone of the Akçadağ area, W Malatya with some important indicator benthic foraminiferas of Bartonian. Also *A. stercusmuris* was described and figured by Deveciler (2010) in the Bartonian limestone of Çayraz section with *Nummulites perforatus* De Montford. In this study this alveolinid was found with *A. fragilis*, *A. nuttalli*, *A. fusiformis* and *N. malatyensis* of Bartonian age.

Alveolina nuttalli (Davies, 1940)

(Plate 4, figs. 1-3)

1940 *Alveolina elliptica nuttalli* Davies, p. 219-220, pl. 12, figs. 1-4.

1954 *Alveolina elliptica flosculina* Silvestri, Smout, p. 82-83, pl. 14, figs. 8-12.

1977 *Alveolina (Alveolina) elliptica nuttalli* Davies, Drobne, p. 50, pl. 10, figs. 9-11.

1993 *Alveolina nuttalli* (Davies), Samanta, p. 65-72, pl. 10, figs. 1-5; pl. 11, figs. 2-3.

2010 *Alveolina nuttalli* (Davies), Deveciler, p. 194-195, pl. 3, figs. 2-5.

Description: Three well preserved axial sections of megalospheric forms have medium sized test with ovoid and rounded poles in shape. Axial diameter ranges from 4,32 mm to 4,82 mm, equatorial diameter from 2,75 mm to 2,87mm and index of elongation from 1,7 to 1,76. Obviously three growth stages of the shell can be observed. The small spheric proloculus (0,135 mm-0,15 mm in diameter) is followed by 4-5 ovoid whorls of nepionic stage, 2-3 ovoid flosculine of adult stage, and, finaly, 4-7 ovoid whorls of senile stage. The size of the

chamberlets increase gradually from the begining of the coiling to the last whorl. Their cross sections changes from subspheric to ovoid.

Remark: This flosculinized alveolinid, which is a well known and a common species of the Bartonian, was described as *A. elliptica nuttalli* by many autors in the past. Later, as claimed in Deveciler (2010, p. 194-195) *A. elliptica* and *A. nuttalli* are not the same in terms of different growth stages and coiling features. As such, the specimen in this study are described as *A. nuttalli* for their the three growth stages and the ovoid test.

Distrubution: This flosculine *Alveolina* was described and figured by Drobne (1977) in the lower Lutetian sediments of Pican-Slovenia. Also the topotypes of this from was defined by Samanta (1993) in the lithostratigraphic units of the upper middle Eocene of Pulrada-India. Later on it has been found in Bartonian limestone of Çayraz section (Haymana-Turkey) with *N. perforatus* de Montford by Deveciler (2010). In this study *A. nuttalli* was found with the *A. fragilis*, *A. fusiformis* and *N. malatyensis* of Bartonian.

Alveolina n.sp.

(Plate 4, figs. 4-9)

Description: The megalospheric form has a small sized ovoid test with rounded poles. The axial diameter ranges from 2,075-3,1 mm and equatorial diameter from 1,025-1,85 mm. The index of elongation is 1,67-2,02. The subspheric proloculus (0,25-0,3 mm in diameter) is followed by 6 tightly coiled whorls of nepionic stage. The thickness of basal layer increases gradually to the last whorl of adult stage. There are 12 whorls in an axial diameter of 3,1 mm in diameter. The cross section of the chamberlets are spheric and subsperic, and their size increases gradually in proximity to the last whorls.

Remark: *A.* n.sp. is distinguished from all other *Alveolina* species of the Bartonian because of smaller ovoid test and the tightly coiled first 3-4 whorls. This form differs from the *A. archiaci* Sirel and Acar (Sirel & Acar 2008; p. 59, pl. 46, figs. 11-14) of middle Cuisian in its rounded poles and the different nepionic stage. Also, it differs from the *A.* aff. *colatiensis* Drobne (Sirel & Acar 2008, p. 72-72, pl. 54, figs. 2-5) in having ovoid test. Certanly this form is a new species of *Alveolina* but some features of the test can not be seen clearly due to incomplete axial sections. So that for the present this species was described ad *Alveolina* n. sp.

Distribution: This form can be found together with *A. fragilis*, *A. fusiformis*, *A. nuttalli*, *A. stercusmuris* and *N. malatyensis* of the Bartonian in the yellow argilaceous limestone of the Gölbayırı hill.

Order Foraminiferida Eichwald, 1830

Family Nummulitidae de Blainville, 1827

Genus: *Nummulites* Lamarck, 1801

Type species: *Camerina laevigata* Brugiere, 1792

Nummulites malatyensis Sirel, 2003

(Plate 1, figs. 5-12)

2003 *Nummulites malatyensis* Sirel, p. 288-289, pl. 1, figs. 1-8.

Description: The megalospheric form has a inflated lenticular test with strongly rounded periphery. A large central knob can be clearly observed in the axial sections and radial septal filaments cover the surface of the test. The diameter of the test is between 2,4-3,4 mm and the thickness ranges from 1,5 mm to 1,75 mm. The spheric-subspheric proloculus has a diameter of 0,25-0,3 mm. The subspheric deuteroconch (0,275 mm in diameter) is observed in an one equatorial section (pl. 1, fig. 6). The spire is thick in all whorls. The spire interval increases gradually in 4 whorls than stays constant till the last whorl (pl. 1, fig. 6). The very small chambers are aranged tighly and their heights are similar with respect to their widths. The septa are straight or slightly curved throughout the ontogeny. There are 6 whorls in an axial section measuring 3 mm in diameter (Fig. 4/6).

Septa	Whorl
15	1
18	2
28	3

35 4

36 5

Distrubution: This typical *Nummulites* species was first described and figured by Sirel (2003) in Bartonian limestone of Develi section (Malatya). In this study this form was found with *A. fragilis* and *A. fusiformis* of Bartonian.

DISCUSSION AND CONCLUSIONS

The current benthic foraminiferal zones presented by Serra-Kiel *et al.* (1998) were took in to consideration for this study. According to the authors, *A. fragilis* and *A. fusiformis* indicate the SBZ 17 (early Bartonian). In addition, the inflated lenticular species *N. malatyensis* is described by Sirel (2003) as from the Bartonian and obtained from the Develi section of the Malatya region. In this study, subcylindirical alveolinid is called *A. stercusmuris*, and was found in the Darende section (Sirel & Acar, 2008) with *A. fusiformis* and *A. elongata* d'Orbigny and also in the Çayraz section with *N. perforatus* (de Montfort) and *A. nuttalli* from the Bartonian by Deveciler (2010). Up to now present, *A. callosa* and *A. kieli* has been reported amongst the Lutetian alveolinids by Serra-Kiel *et al.* (1998) and Sirel & Acar (2008). In this study the biostratigraphic range of *A. callosa* and *A. kieli* are now shown to extend to the Bartonian.

As a result of foregoing data, the samples of argillaceous limestone containing *A. fragilis*, *A. fusiformis*, *A. callosa*, *A. kieli*, *A. nuttalli*, *A. stercusmuris*, *A.* n.sp, and *N. malatyensis* form the Göl bayırı section is attributed to the Bartonian Age.

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PLATE 1

Bartonian, all figures from Gölbayırı section, fig. 1 x 18,8; figs. 2-4 x 20; figs. 5-12 x 10. Alveolina fragilis Hottinger: fig. 1- Axial section of A form, M/4/28/2; fig. 2- Axial section of A form, M/4/22/1; fig. 3- Axial section of A form, showing subspheric megalosphere, M/4/27/1; Alveolina fusiformis Sowerby: fig. 4- Axial section of A-form, Gk/5/1; Nummulites malatyensis Sirel: fig. 5- Tangential section of A-form showing septal filaments, M/4/13/1; fig. 6- Equatorial section of A-form showing proloculus and the spire, M/4/28/2; fig 7- Equatorial section of A-form, M/4/19/3; fig. 8- Axial section of A-form, M/4/32/2; fig. 9- Axial section of A-form, M/4/19/4; Fig 10- Axial section of A-form, M/4/15/3; fig 11- Axial section of A-form showing proloculus and thick pillar in the center of the test, M/4/15/2; fig 12- Axial section of A-form, M/4/32/1.

LEVHA1

Bartoniyen, bütün şekiller Gölbayırı kesitindendir, şek. 1 x 19,8; şek 2-4 x20; şek. 5-12 x 10. Alveolina fragilis Hottinger: şek. 1- A formunun eksenel kesiti, M/4/28/2; şek. 2- A formunun eksenel kesiti, M/4/22/1; şek 3- Yarı küresel ilklocayı gösteren A formunun eksenel kesiti, M/4/27/1; Alveolina fusiformis Sowerby: şekç 4- A formunun eksenel kesiti, Gk/5/1; Nummulites malatyensis Sirel: şek. 5- A formu üzerindeki ağ şebekesini gösteren eksenel kesit, M/4/13/1; şek. 6- A formunun ilk loca ve spirini gösteren ekvatoryal kesit, M/4/28/2; şek. 7- A formunun ekvatoryal kesiti, M/4/19/4; şek. 8- A formunun eksenel kesiti, M/4/32/2; şek. 9- A formunun eksenel kesiti, M/4/19/4; şek. 10- A formunun eksenel kesiti, M/4/15/3; şek. 11- A formunun ilk locasını ve merkezinde bulunan kalın sütunu gösteren eksenel kesit, M/4/15/2; şek. 12- A formunun eksenel kesiti, M/4/32/1.

PLATE 2

Bartonian, all figures from Gölbayırı section, figs. 1-3, 4 x 20; fig. 5 x 10. Alveolina fusiformis Sowerby: fig. 1- Axial section of A-form, M/4/18/1; fig. 3- Axial sectio of A-form, Gk/6/1; fig. 4- Axial section of A-form, M/4/11/2; Alveolina fragilis Hottinger: fig. 2- Axial section of A-form, showing egg shape megaloshere, Gk/6/1; fig 5- Axial section of B-form, M/4/5/1.

LEVHA 2

Bartoniyen, bütün şekiller Gölbayırı kesitindendir, şek. 1-3, 4 x 20; şek. 5 x 10. Alveolina fusiformis Sowerby: şek. 1- A formunun eksenel kesiti, M/4/18/1; şek. 3- A formunun eksenel kesiti, Gk/6/1; şek. 4- A formunun eksenel kesiti, M/4/11/2; Alveolina fragilis Hottinger: şek. 2- A formunda yumurta-şekilli ilk locayı gösteren eksenel kesit, Gk/6/1; şek 5- B formunun eksenel kesiti, M/4/5/1.

PLATE 3

Bartonian, all figures from Gölbayırı section, figs. 1-4 x 10; figs. 5-6 x 20. Alveolina callosa Hottinger: fig. 1- Axial section of A-form, showing subspheric megalosphere and the axial thickening, M/4/6/1; fig. 2- Axial section of A-form, M/4/20/1; fig. 3- Axial section of A-form, M/4/8/1a; fig. 4- Axial section of A-form, M/4/29/1; Alveolina kieli Sirel: fig. 5- Axial section of A-form showing spheric megalosphere, M/4/2/1; fig. 6- Axial section of A-form, M/4/6/1.

LEVHA 3

Bartoniyen, bütün şekiller Gölbayrı kesitindendir, şek. 1-4 x 10; şek. 5-6 x20. Alveolina callosa Hottinger: şek. 1- A formunuda eksenel kalınlaşmayı ve megalosiferi gösteren eksenel kesit, M/4/6/1; şek. 2- A formunun eksenel kesiti, M/4/20/1; şek. 3- A formunun eksenel kesiti, M/4/8/1a; şek. 4- A formunun eksenel kesiti, M/4/29/1; Alveolina kieli Sirel: şek. 5- Küresel megalosiferi gösteren eksenel kesit, M/4/2/1; şek. 6- A formunun eksenel kesiti, M/4/6/1.

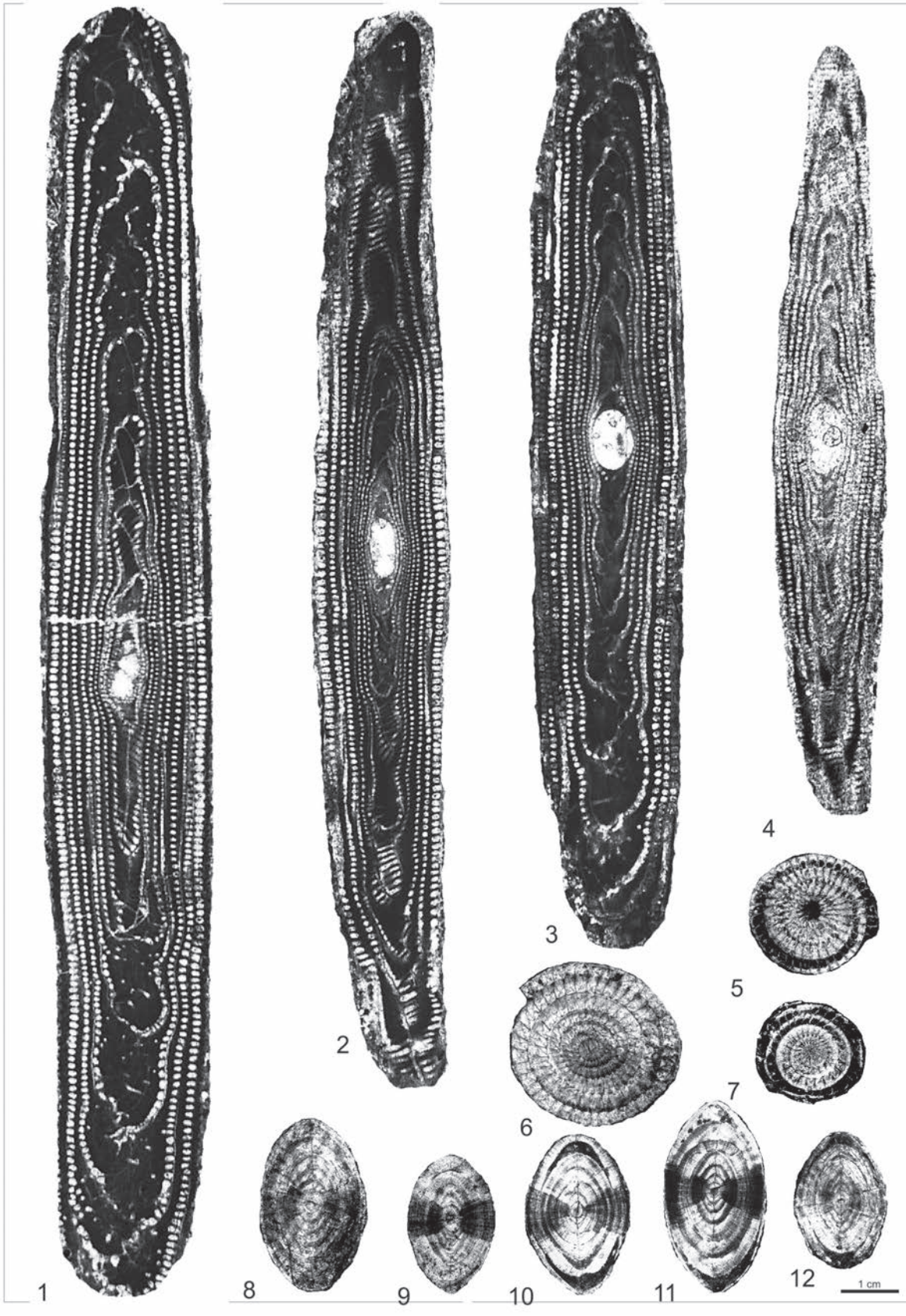
PLATE 4

Bartonian, all figures from Gölbayırı section, figs. 1-10 x 20; fig. 11 x 10; fig 12 x 30. Alveolina nuttalli (Davies): fig. 1- Axial section of A-form, showing three growth stages, M/4/9/2; fig. 2- Axial section of A-form, M/4/14/1; fig. 3- Incomplate axial section of A-form, M/4/28/1; Alveolina n.sp.: fig. 4- Nearly axial section of A-form, showing spheric megalosphere and thight early whorls, M/4/12/1; fig. 5- Nearly axial section of A-form, M/4/19/2; fig. 6- Incomplate axial section of A-form, M/4/4/1; fig. 7- Incomplate axial section with deformated proloculus of A-form, M/4/18/3; fig. 8- Incomplate axial section of A-form, M/4/5/2; fig. 9- Incomplate axial section of A-form, M/4/26/1; Alveolina stercusmuris Mayer-Eymar: fig. 10- Axial section of A-form, M/4/1/1; Fabiania sp.: fig. 11- Vertical section of A-form?, M/4/15/1; Linderina sp.: Axial section of A-form, Gk/5/2.

LEVHA 4

Bartoniyen, bütün şekiller Gölbayrı kesitindendir, şek. 1-10 x20; şek. 11x 10; şek 12 x30. Alveolina nuttalli (Davies): şek. 1- Üç büyüme evresini de gösteren A formunun eksenel kesiti, M/4/9/2; şek. 2- A formunun eksenel kesiti, M/4/14/1; şek. 3- A formunun tamamlanmamış eksenel kesiti, M/4/28/1; şek. 6- A formunun tamamlanmamış eksenel kesiti, M/4/4/1; şek. 7- A formunun bozulmuş ilk locasının göründüğü tamamlanmamış eksenel kesiti, M/4/18/3; şek. 8- A formunun tamamlanmamış eksenel kesiti, M/4/5/2; şek. 9- A formunun tamamlanmamış eksenel kesiti, M/4/26/1; Alveolina stercusmuris Mayer-Eymar: fig. 10- A formunun eksenel kesiti, M/4/1/1; Fabiania sp.: şek. 11- A ? formunun düşey kesiti, M/4/15/1; Linderina sp.: A formunun eksenel kesiti, Gk/5/2.

PLATE 1 / LEVHA *1*



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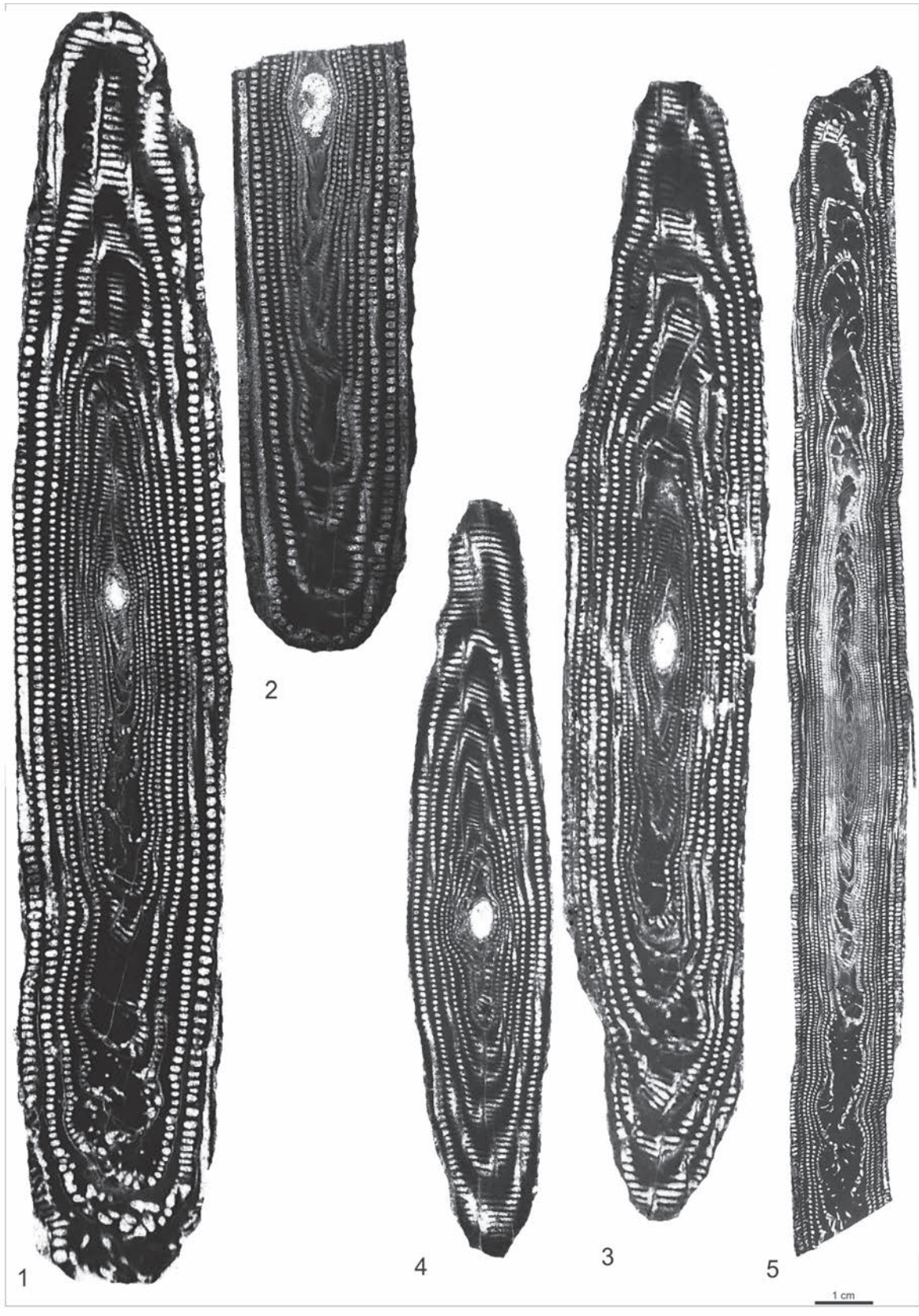

PLATE 3 / LEVHA *3*

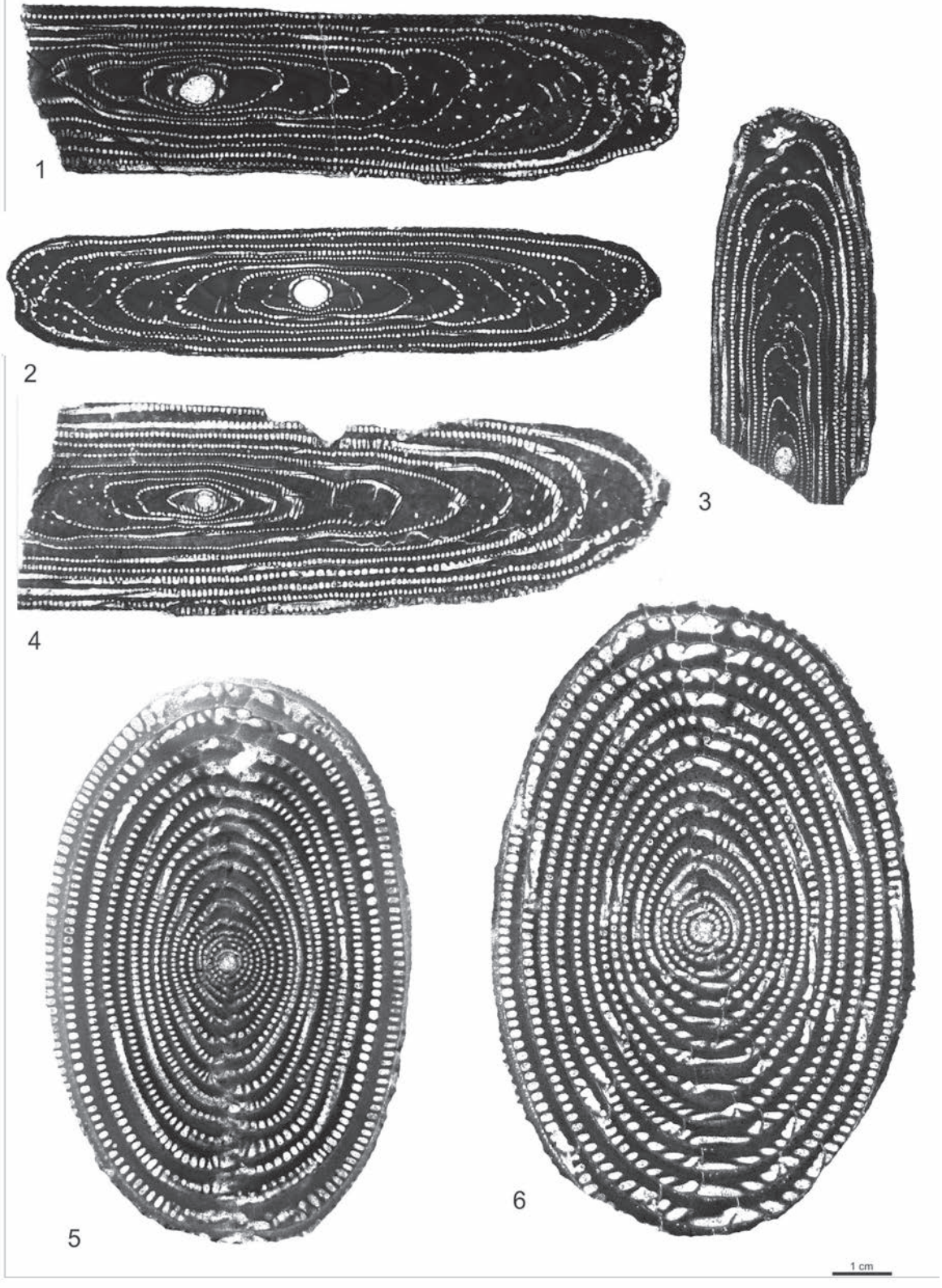

PLATE 4 / LEVHA *4*