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Praebullalveolina, a new foraminiferal genus from the Upper Eocene of the Afyon and Çanakkale region (west of Turkey)

By ERCÜMENT SIREL AND ŞÜKRÜ ACAR[1])

ABSTRACT

Upper Eocene reefal limestones discovered in the Taurus belt are characterized by *Praebullalveolina afyonica* n.gen. n.sp., *Nummulites fabianii* (PREVER), *Nummulites fabianii retiatus* (ROVEDA), *Chapmanina gassinensis* (Silvestri), *Halkyardia minima* (LIEBUS), *Gyroidinella magna* (LE CALVEZ), and *Discocyclina* sp. The new genus has to be distinguished from the Oligocene genus *Bullalveolina* by the lack of a second row of alveoles.

ZUSAMMENFASSUNG

Obereozäne, im Taurus-Gürtel entdeckte Riffkalke sind charakterisiert durch *Praebullalveolina afyonica* n.gen. n.sp., *Nummulites fabianii* (PREVER), *Nummulites fabianii retiatus* (ROVEDA), *Chapmanina gassinensis* (SILVESTRI), *Halkyardia minima* (LIEBUS), *Gyroidinella magna* (LE CALVEZ) und *Discocyclina* sp. Die neue Gattung unterscheidet sich von der oligozänen Gattung *Bullalveolina* durch das Fehlen einer zweiten Reihe von Alveolen.

Introduction

All over the Mediterranean region, a shallow water, back-reef environment with abundant porcellaneous Foraminifera is virtually absent in the depositional sequences of Upper Eocene age. The only exception to this rule are shallow-water limestones occurring in the Colli Berici near Vicenza, northern Italy, bearing *Borelis vonderschmitti* (SCHWEIGHAUSER 1951), but no peneroplids. The Upper Eocene porcellaneous Foraminifera discovered in Turkey thus close the gap in the record of the shallowest foraminiferal environments widespread during late Middle Eocene times in southern Europe (Biarritzian sedimentary cycle in the Pyrenees; CAUS 1974) and in Oligo-Miocene times in southern Spain (HOTTINGER 1963) and in the Middle East, particularly in Persia (HENSON 1950).

Up to now, the presence of marine Upper Eocene deposits in the Taurus belt was unknown. It was first recognized by the present authors near the village of Dereköy which is situated to the north of Uluborlu town (south of Afyon, Fig. 1D). In the white coloured, hard limestones a new alveolinid genus and species *Praebullalveoli-*

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na afyonica was found together with a foraminiferal assemblage (Pl. 4, Fig. 1–22, P. 5, Fig. 1–22) permitting to determine its Upper Eocene age and to characterize its environment.

P. afyonica was also found in the Upper Eocene reefal limestone samples which were collected by K. Sentürk from Beybasi village (northeast of Çanakkale). Due to the hardness of the limestone samples, it was not possible to obtain free individuals. The present study is based only on thin sections.

Holotype and figured specimens are deposited in the collection of M.T.A. (Ankara) under the numbers AF-1-69 and Ca-1.

Stratigraphy

In this paragraph the faunal contents of the units over- and underlying the Upper Eocene reefal limestones will be briefly discussed.

Afyon region

At the type locality of the new genus the sedimentary sequence is composed of an alternation of sandstones, sandy limestones, marly limestones and marls containing *Assilina exponens* (SOWERBY), *Nummulites aturicus* JOLY & LEYMERIE, *Fabiania cassis* (OPPENHEIM), *Alveolina* sp., *Lockhartia* sp., *Orbitolites* sp., *Orbulinoides* sp., and *Globorotalia* sp. of Lutetian age. This sequence is overlain conformably by the Upper Eocene reef limestones which are characterized by *Nummulites fabianii* (PREVER), *N. fabianii retiatus* (ROVEDA), *Chapmanina gassinensis* (SILVESTRI), *Halkyardia minima* (LIEBUS), *Gyroidinella magna* (LE CALVEZ) and *Discocyclina* sp. The Upper Eocene reefal limestones are covered unconformably by Neogene conglomerates and tuffites (Fig. 1C). Up to now, the nature of the boundary between Upper Eocene reefal limestones and the widespread sandstone, sandy limestone and conglomerate of Oligocene age has not been clearly established. In the town of Dazkiri (southwest of Afyon), the Oligocene sequence is dated by *Nummulites fichteli* MICHELOTTI (form A, B) and consists of sandy limestones and sandstones. The boundary relations of this sequence with the Upper Eocene reefal limestones can only be demonstrated on a generalized stratigraphic column representing the whole region (Fig. 1B).

Çanakkale region

Near Beybasi village (northeast of Çanakkale), rich algae-bearing Upper Eocene reefal limestones with *P. afyonica* and *G. magna* are interbedded between volcanic tuffs and conglomerates (Fig. 1A).

Systematic descriptions

Family *Alveolinidae* EHRENBERG 1839

Genus *Praebullalveolina* n. gen.

Type species: Praebullalveolina afyonica n. gen. n. sp.

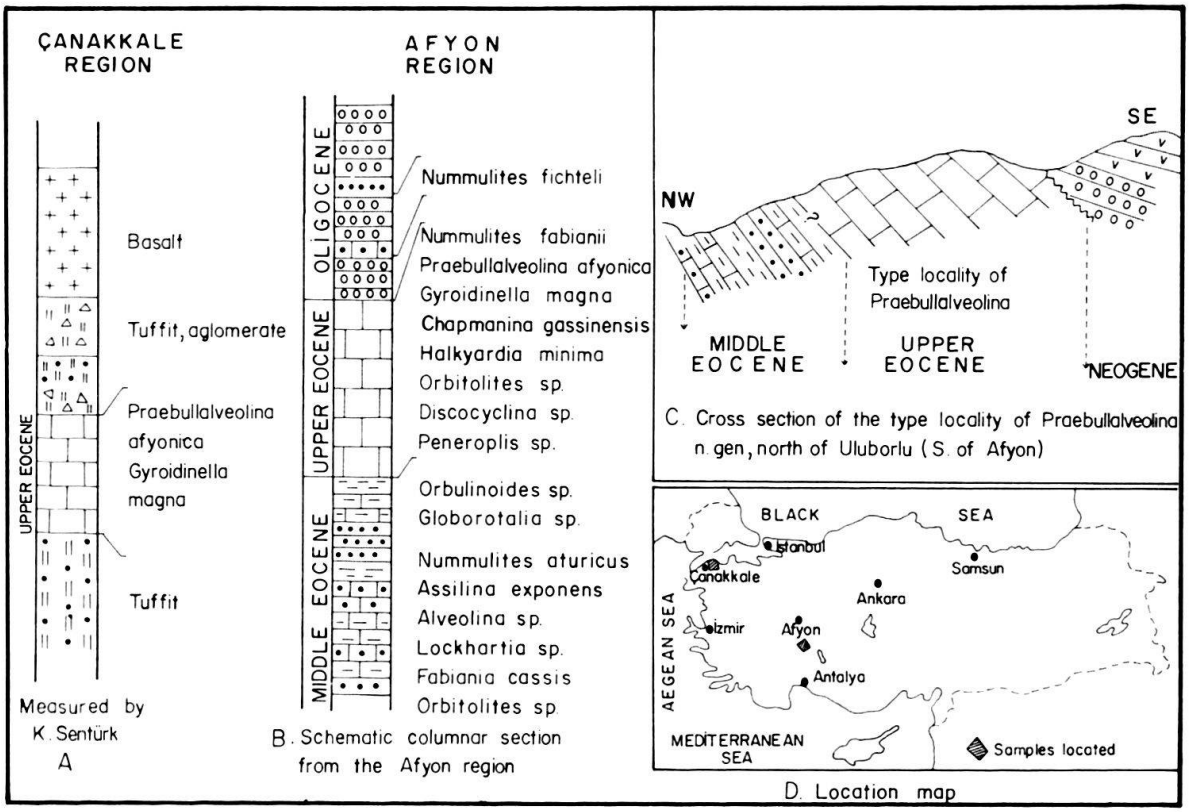

Fig. 1. Columnar sections (A, B), cross section (C) and location map (D) of levels with *Praebullalveolina afyonica* n.gen. n.sp.

Diagnosis. - Small, slightly ovoid or subspherical to slightly nautiloid alveolinids with alternating septula and chamberlets. Apertural face with one row of main apertures alternating with secondary apertures of smaller diameter. Postseptal passage absent; preseptal passage well developed and large. One or exceptionally two alternating rows of alveoles communicating through secondary intercameral foramen in the previous septum with the preceding preseptal passage. The nepionts have a very small spherical proloculus followed by streptospirally coiled whorls with undivided chambers; no dimorphism.

Comparisons and remarks. - *Praebullalveolina* with its porcellaneous test and alveolar structure of the chambers shows close similarity with *Globoreticulina* RAHAGHI (1978). In *Globoreticulina* the chambers are divided by incomplete subepidermal partitions (septula). These never reach the floor, whereas those of *Praebullalveolina* are complete and always continuous from the roof to the floor. *Praebullalveolina* has the structural elements of the alveolinid shell (preseptal passage, main and secondary apertures) which are never observed in the test of *Globoreticulina.*

Praebullalveolina shows close similarity to *Bullalveolina* REICHEL (1936/37) by having one or two rows of alveoles, alternating septula and by the presence of a streptospiral nepionic stage; it clearly differs from *Bullalveolina* by having one row of main apertures alternating with secondary apertures (Fig. 4D), whereas *Bullalveolina* has three rows of apertures in the apertural face (Fig. 4B). In *Praebullalveolina*

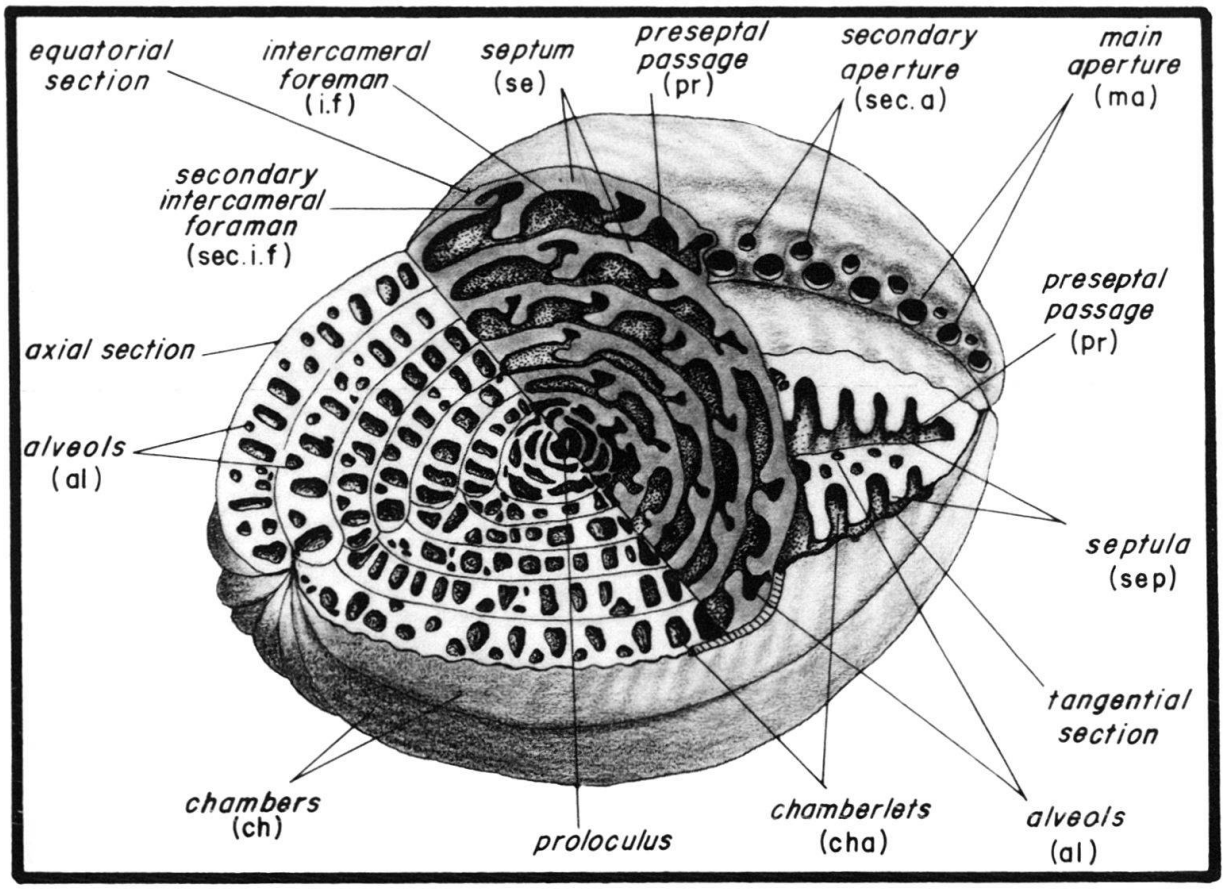

Fig. 2. Schematic model of *Praebullalveolina* n. gen., showing structural elements of the test.

one or two rows of alveoles are connected with the preseptal passage of the preceding chamber by only one secondary intercameral foramen in the septum (Fig. 4C), whereas in *Bullalveolina* two or three rows of alveoles are communicating through two or probably more supplementary intercameral foramina in the previous septum with the preceding preseptal passage (fig. 4A).

The new genus is distinguished from *Alveolina (Alveolina)* D'ORBIGNY 1826 by the presence of one or two rows of alveoles and by the lack of the postseptal passage. *Praebullalveolina* differs from *Borelis* DE MONTFORT 1808 by having two rows of apertures in the apertual face and by having one or two rows of alveoles in the roof of the chambers. It differs from *Flosculinella* SCHUBERT 1910 by the presence of alternating septula, by having one or two rows of alveoles and by the lack of the layer of attics in the adult growth stages.

Praebullalveolina shows close similarity to *Subalveolina* REICHEL 1936/37 by the presence of alveoles and alternating septula but *Subalveolina* clearly differs from our new genus by having supplementary apertures in the polar part of the apertual face and by the presence of secondary chamberlets in the polar region of the shell.

Praebullalveolina afyonica n. sp.

Pl. 1, Fig. 1-6; Pl. 2, Fig. 1-6; Pl. 3, Fig. 1-12; Pl. 4, Fig. 1

Derivation of name. – Afyon, a city in western Turkey.

Holotype. – Equatorial section (coll. No. Af-1) illustrated on Plate 1, Figure 1.

Material. – 80 thin sections from the type locality and 10 thin sections from the Çanakkale region in hard, reefal limestones.

Type locality. – Dereköy village, north of Uluborlu town (south of Afyon).

Type level. – Upper Eocene.

Description

External characters. – Test porcellaneous, small, slightly ovoid or subspherical to slightly nautiloid in shape. The apertural face bears one row of main apertures

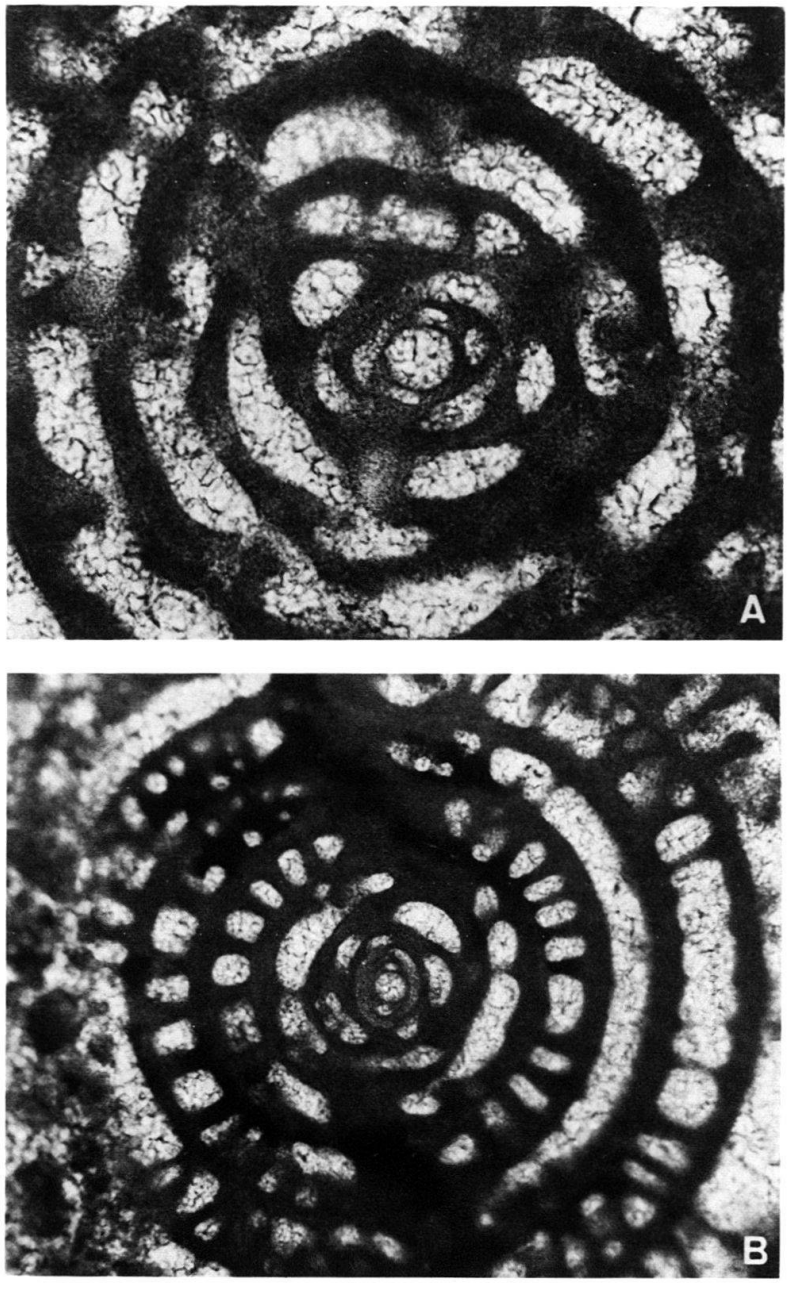

Fig. 3. *Praebullalveolina afyonica* n. gen. n. sp. A = Equatorial section, showing proloculus, undivided nepionic chambers and divided adult chambers; × 185. B = Axial section, showing spherical proloculus followed by undivided nepionic chambers and divided chambers; × 102.

alternating with secondary apertures of smaller diameter (Fig. 2, 4C, D). Index of elongation 0.93–1.2; mean values around 1.1. 10 whorls in an oblique centered section of 1.37 mm in diameter.

Measurements. –

Shape of the test	Number of the whorls	Maximum axial diameter	Maximum equatorial diameter
Slightly ovoid	6–7	1.05 mm	0.9 mm
Subspheric	7–8	1.13 mm	1.15 mm
Slightly nautiloid	9–10	1.25 mm	1.37 mm

Nepiont and dimorphism. – The nepionts have a very small, spherical proloculus followed by streptospirally coiled whorls with 7–10 chambers. The diameter of the proloculus varies from 32 to 47 μm. The first ten chambers of the adult shell are undivided (Fig. 3A, B). The generotypic structure usually appears in the last 4–5 whorls of the adult growth stage. Dimorphism absent or, may be, very faint.

The chambers and its internal vertical subdivision. – The growth spiral of the shell is subdivided by thick septa into more than two broad chambers per whorl; in the last whorl of the adult stage, the shell has 14–15 broad chambers (Pl. 1, Fig. 5). The cavities of the chambers which follow the nepionic stage are subdivided at right angles to the septum by parallel, thick septula into parallel chamberlets. The septula grow out of the basal layer joining the roof of the chamber. The septula are arranged in an alternating pattern from one chamber to the next showing a more or less Y-shaped outline when sectioned (Pl. 2, Fig. 1–3). The arrangement of the septula depends directly on the disposition of the apertures in the septum. The alternating pattern in the arrangement of the septula is best recognized in tangential sections (Pl. 3, Fig. 7, 8).

The cross sections of the chamberlets are generally subrectangular in shape; their height is greater than their width. The basal layer is very thin compared to the height of the chamberlets.

Passages and alveoli. – The cavity of the chamber is subdivided by the septula into parallel chamberlets. The chamberlets are always connected by a large preseptal passage running parallel to and immediately beneath the septum (Fig. 2, Pl. 3, Fig. 7, 11). The preseptal passages are very large occupying about half the chamber's breadth (Pl. 1, Fig. 1, 4). One or two regular rows of "alveoli" (Fig. 4C, Pl. 1, Fig. 1, 4, 5) are connected with the preseptal passage of the preceding chamber by a secondary intercameral foramen (Fig. 4C; Pl. 2, Fig. 4).

Apertures. – On the apertural face two rows of apertures have been observed; the main apertures placed in the axis of the corresponding chamberlets of the previous chamber are arranged in an alternating pattern with secondary apertures of smaller diameter (Fig. 2, 4D, 5). One or two rows of alveoles are communicating through the secondary intercameral foramen in the previous septum with the preceding preseptal passage.

The disposition of the intercameral foramina are best recognized in equatorial and axial sections (Fig. 4C, 5; Pl. 1, Fig. 1, Pl. 2, Fig. 2, 4, 6).

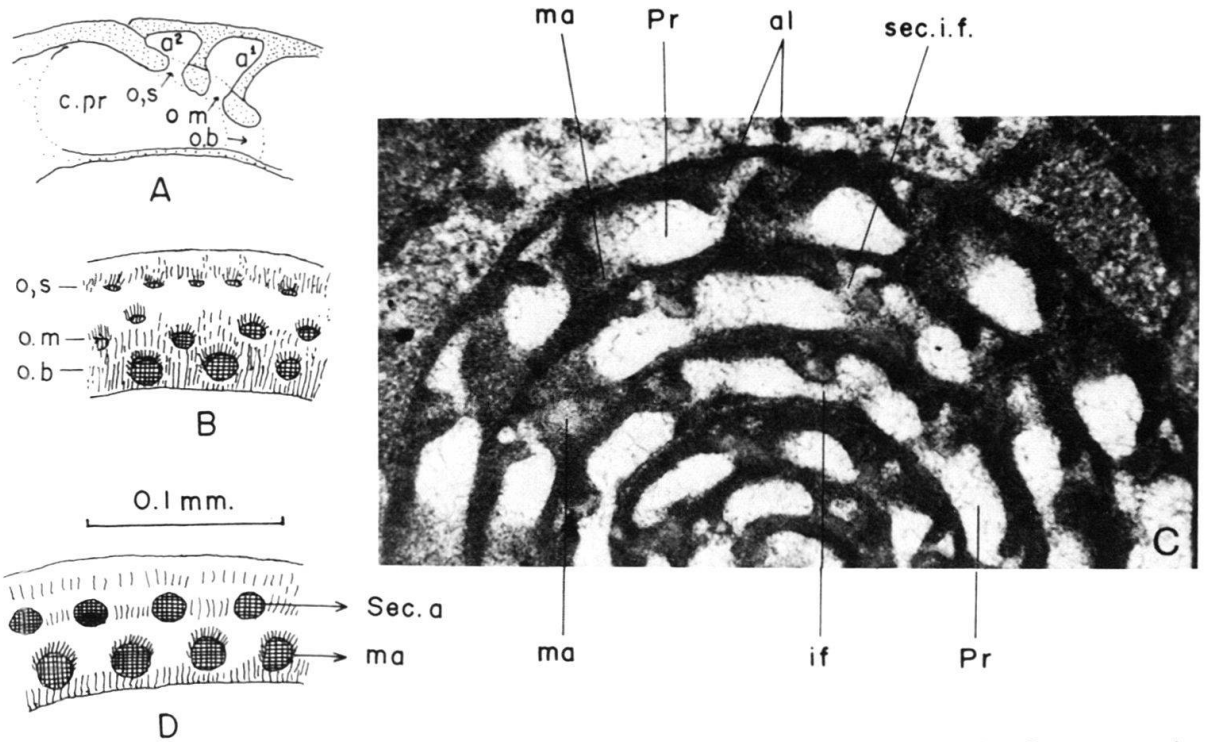

Fig. 4. A, B = The disposition of the intercameral foramina and apertures of *Bullalveolina* REICHEL on the equatorial section (4A) and the septum (apertural face) (4B); from REICHEL (1936–37, p. 100, Fig. 19): a^1 = "première rangée d'alveoles"; a^2 = "2e rangée"; C. pr = "canal préseptal"; o.b = "ouvertures basales"; o.m = "ouvertures moyennes"; o.s = "ouvertures supérieures".

C = The disposition of the intercameral foramina and apertures of *Praebullalveolina* n. gen. on equatorial section (in holotype); × 94; main aperture (ma), Secondary aperture (Sec. a), intercameral foramen (i. f), secondary intercameral foramen (sec. i.f), preseptal passage (Pr), alveoles (al).

D = Schematic picture of the apertural face on the septum (in *Praebullalveolina)*

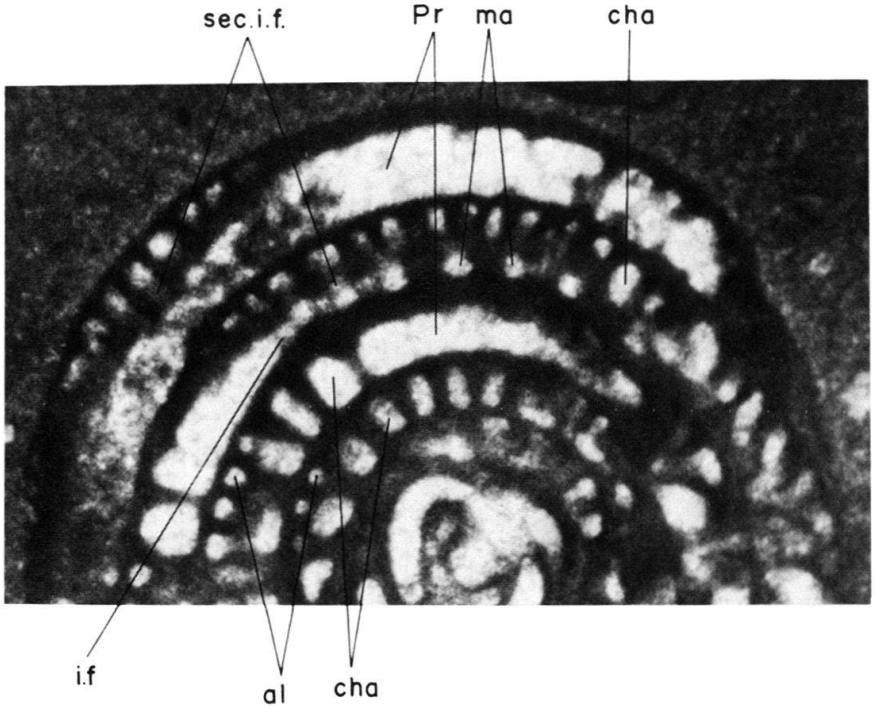

Fig. 5. The aspects of the septa on the axial section of *Praebullalveolina afyonica* n. gen. n. sp. (Af-12); main aperture (ma), intercameral foramen (i.f), secondary intercameral foramen (sec.i.f), preseptal passage (Pr), chamberlets (cha), alveoles (al); × 122.

Comparisons and remarks on the species

Praebullalveolina afyonica is easily distinguished from *Bullalveolina bulloides* (D'ORBIGNY) by its delicate internal structure, its higher number of chamberlets per chamber and its higher number of chambers per whorl; the equatorial section of *Praebullalveolina afyonica* shows 11-12 undivided nepionic chambers and 22-24 divided chambers within three whorls whereas in the equatorial section of comparable size *Bullalveolina bulloides* has nine undivided nepionic chambers and eleven divided chambers within two whorls.

Distribution

Paleontological studies carried out so far in Turkey indicate that *Alveolina (Alveolina)* species disappear at the end of Middle Eocene. In the Hatay region (southern Turkey), above *Nummulites millecaput* and *Alveolina* bearing limestones, a marly horizon with *Orbulinoides* and *Globorotalia* occurs. It is overlain conformably by Upper Eocene reefal limestones with *Borelis* sp., *Nummulites fabianii, Silvestriella* sp., *Fabiania cassis, Gyroidinella magna, Linderina* sp., *Pellatispira* sp. and *Discocyclina* sp. The type level of *Praebullalveolina afyonica* represents a corresponding facies of the same age. Thus *Praebullalveolina* and *Borelis* are the two alveolinid genera substituting *Alveolina (Alveolina)* in Upper Eocene times in the shallow water environment.

In the Afyon region *P. afyonica* is abundant in restricted shelf, back-reef environments where it is accompanied (compare Pl. 4, 5) by *Gypsina* aff. *mastelensis* BURSCH, *Gypsina* sp., *Peneroplis* aff. *glynnjonesi* HENSON, *P.* aff. *damesini* HENSON, *P.* n. sp.?. *Orbitolites* sp., *Rotalia* sp., *Halkyardia minima, Chapmanina gassinensis,* Miliolidae and algae. In reef shoals and fore-reef environments it is rather rare. It is associated there with *C. gassiensis, C.* n. sp?, *N. fabianii, N. fabianii retiatus, G. magna, H. minima, H.* sp., *Discocyclina* sp. and *Linderina* sp.

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Plate 1

Praebullalveolina afyonica n.gen. n.sp.

Fig. 1 Equatorial section, not centered. Holotype (Af-1), × 58.

Fig. 2 Oblique section, nearly centered (Af-2), × 60.

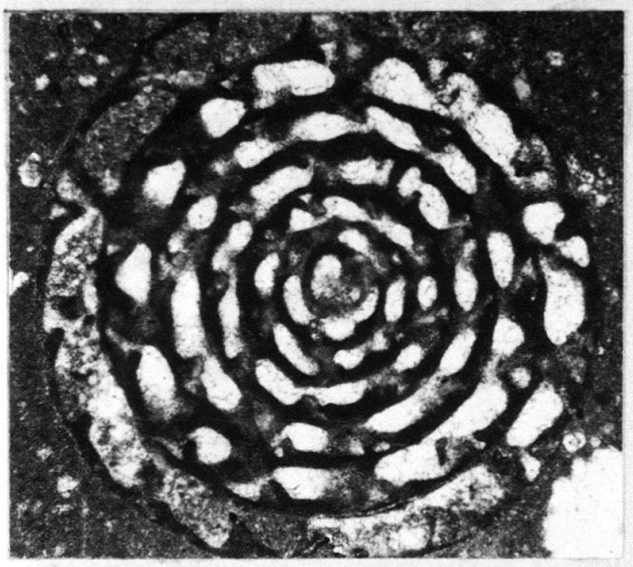
Fig. 3 Oblique section, nearly equatorial, showing proloculus, streptospirally coiled nepionic stage with undivided chambers and divided adult chambers, paratype (Af-3), × 75.

Fig. 4 Equatorial section, slightly oblique, almost centered, paratype (Af-4), × 65.

Fig. 5 Equatorial section, slightly oblique, paratype (Af-5), × 52.

Fig. 6 Oblique section, showing alveolar structure (Af-6), × 56.

All specimens from the Upper Eocene of Dereköy village (south of Afyon).



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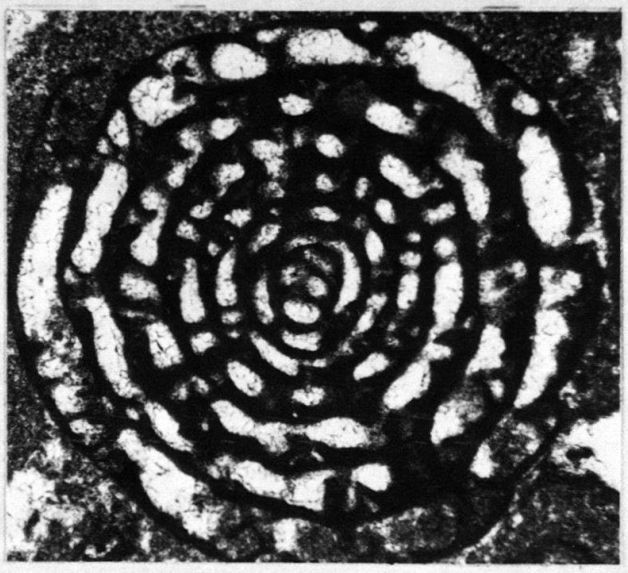

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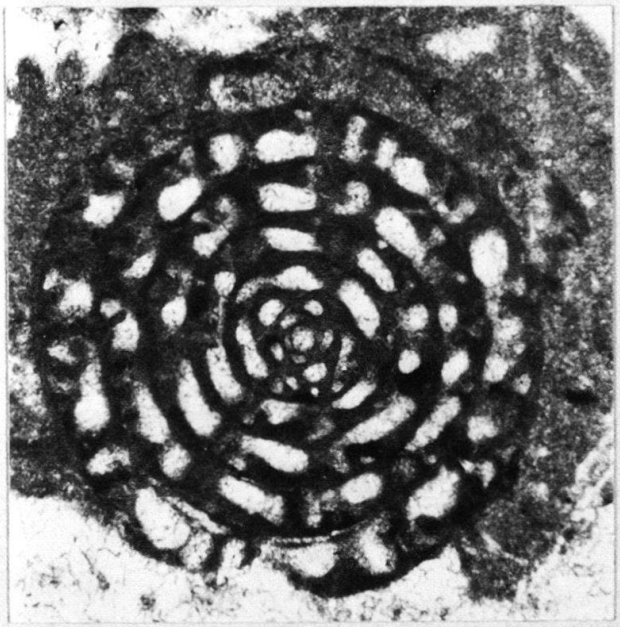

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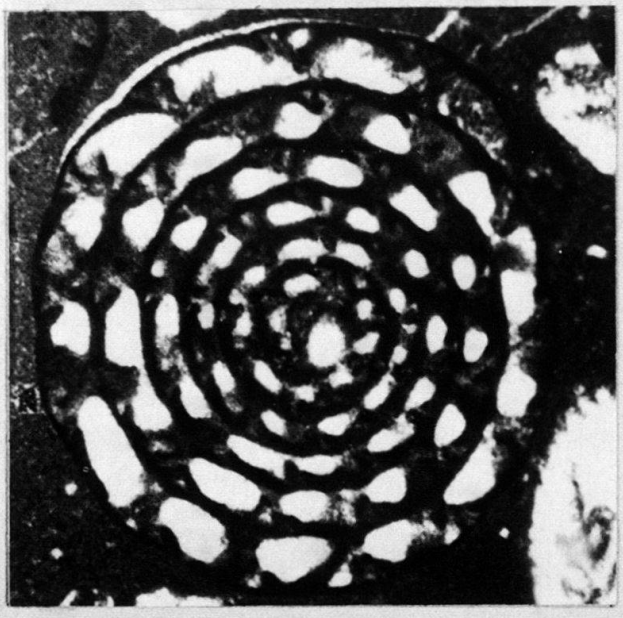

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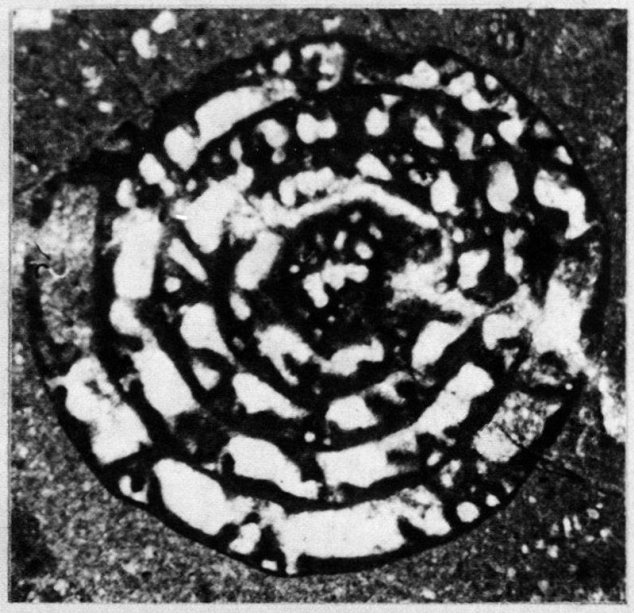

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Plate 2

Praebullalveolina afyonica n.gen. n.sp.

Fig. 1 Axial section of oval specimen, not quite centered, paratype (Af-7), × 59.

Fig. 2 Axial section of oval specimen, slightly oblique, almost centered, paratype (Af-8), × 81.

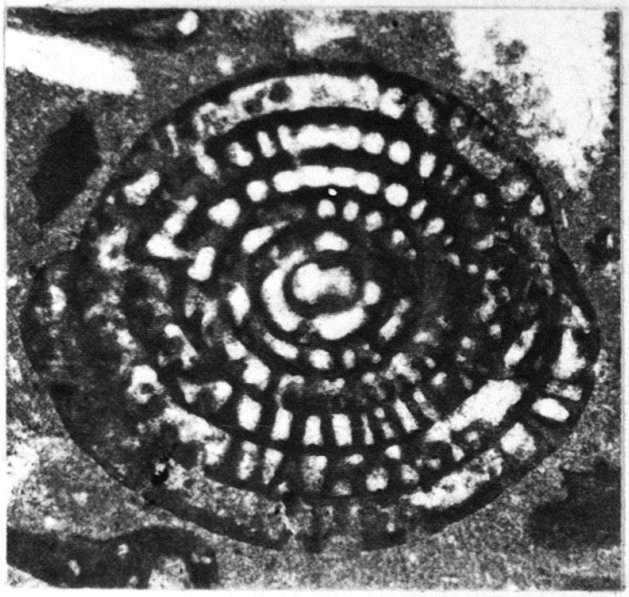
Fig. 3 Axial section of nautiloid specimen, paratype (Af-9), × 58.

Fig. 4 Equatorial section, internal whorls, paratype (Af-10), × 113.

Fig. 5 Oblique centered section near the axial plane (Af-11), × 50.

Fig. 6 Axial section of subspherical specimen, slightly oblique, paratype (Af-12), × 72.

All the specimens from the Upper Eocene of Dereköy village (south of Afyon).



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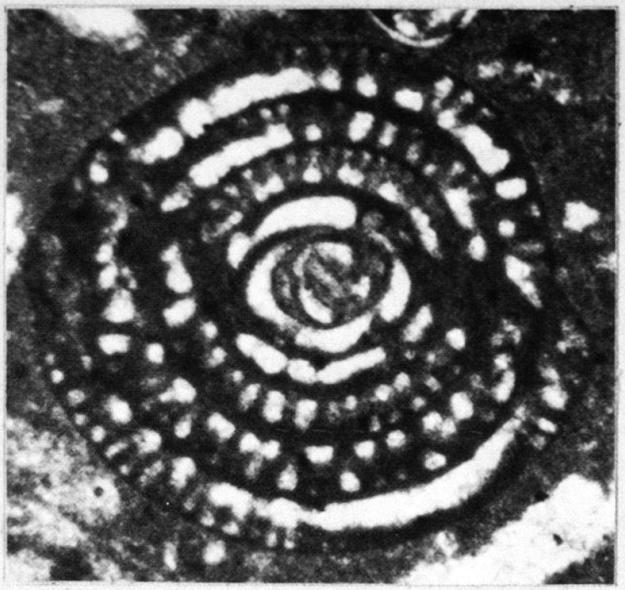

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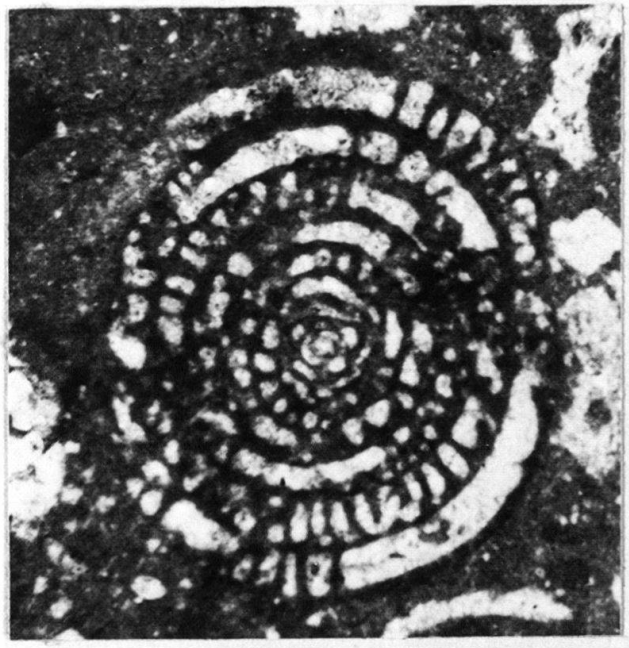

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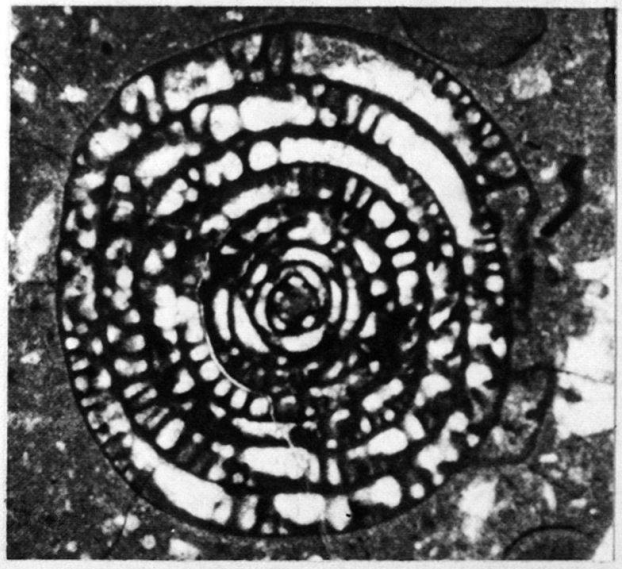

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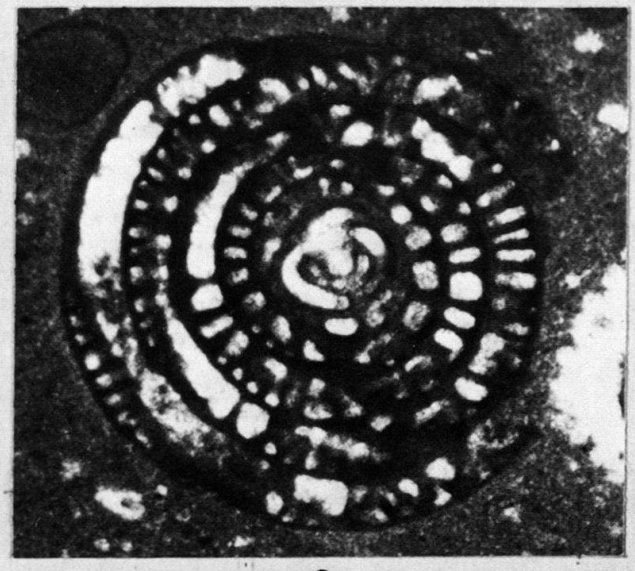

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Plate 3

Praebullalveolina afyonica n. gen. n. sp.

Fig. 1 Oblique centered section (Af-13), × 39.

Fig. 2 Axial section of slightly nautiloid specimen, slightly oblique (Af-14), × 33.

Fig. 3 Oblique section, near the equatorial plane (Ça-1), × 52.

Fig. 4 Axial section of young specimen, paratype (Af-15), × 70.

Fig. 5 Axial section of young specimen, slightly oblique (Af-16), × 76.

Fig. 6 Oblique centered section (Af-17), × 54.

Fig. 7 Tangential section, showing alveolar structure, alternating chamberlets and septula, paratype (Af-18), × 80.

Fig. 8 Tangential section (Af-19), × 82.

Fig. 9 Tangential section, showing alveolar structure (Af-20), × 76.

Fig. 10 Tangential section, showing alveolar structure and alternating septula (Af-21), × 59.

Fig. 11 Tangential section, showing two rows of alveoles and alternation of septula (Af-22), × 83.

Fig. 12 Oblique section (Af-23), × 38.

Specimens of Figures 1-2, 4-12 from Upper Eocene, Dereköy village (south of Afyon).
Specimen of Figure 3 from Upper Eocene, Beybaşı village (northeast of Çanakkale).

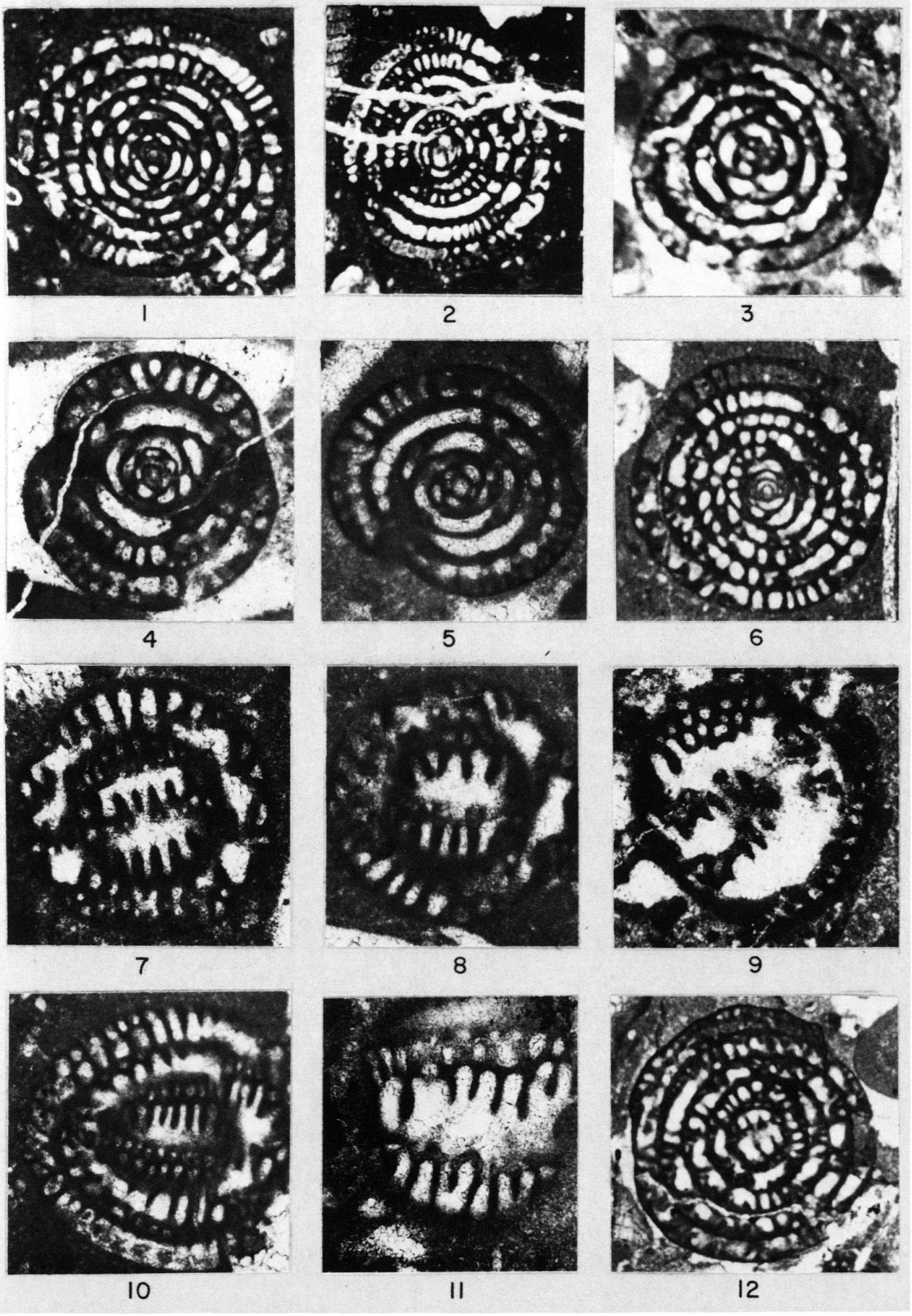
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Plate 4

Fig. 1-6 *Nummulites* fabianii retiatus (ROVEDA)
1 = Equatorial section, form A (Af-24), × 11. 2 = Subequatorial section, near the equatorial plane, form A (Af-25), × 9. 3 = Subequatorial section, slightly oblique (Af-27), × 10. 4 = Subaxial section, form B (Af-28), × 14. 5 = Tangential section, form B? (Af-29), × 10. 6 = Axial section, form A (Af-30), × 16.

Fig. 7 *Nummulites fabianii* (PREVER), form A (Af-31), × 15.

Fig. 8-10 *Chapmanina* n. sp.?
8 = Vertical section (Af-32), × 46. 9 = Vertical section (Af-33), × 45. 10 = Vertical section, slightly oblique (Af-34), × 36.

Fig. 11 *Gypsina* aff. *mastelensis* BURSCH, vertical section (Af-35), × 46.

Fig. 12-15 *Chapmanina gassinensis* (SILVESTRI)
12 = Vertical section (Af-36), × 25. 13 = Vertical section (Af-37), × 32. 14 = Vertical section (Af-38), × 38. 15 = Vertical section (Af-39), × 26.

Fig. 16 *Linderina* sp., vertical section (Af-40), × 40.

Fig. 17-20 *Halkyardia minima* (LIEBUS)
17 = Axial section (Af-41), × 66. 18 = Axial section (Af-42), × 62. 19 = Axial section (Af-43), × 53. 20 = Axial section (Af-44), × 78.

Fig. 21 *Halkyardia* sp., axial section (Af-45), × 40.

Fig. 22 *Halkyardia* sp., axial section (Af-46), × 49.

Fig. 23 *Gypsina* sp., vertical section (Af-47), × 24.

Fig. 24 *Gypsina* sp., vertical section (Af-48), × 28.

All specimens from the Upper Eocene of Dereköy village (south of Afyon).

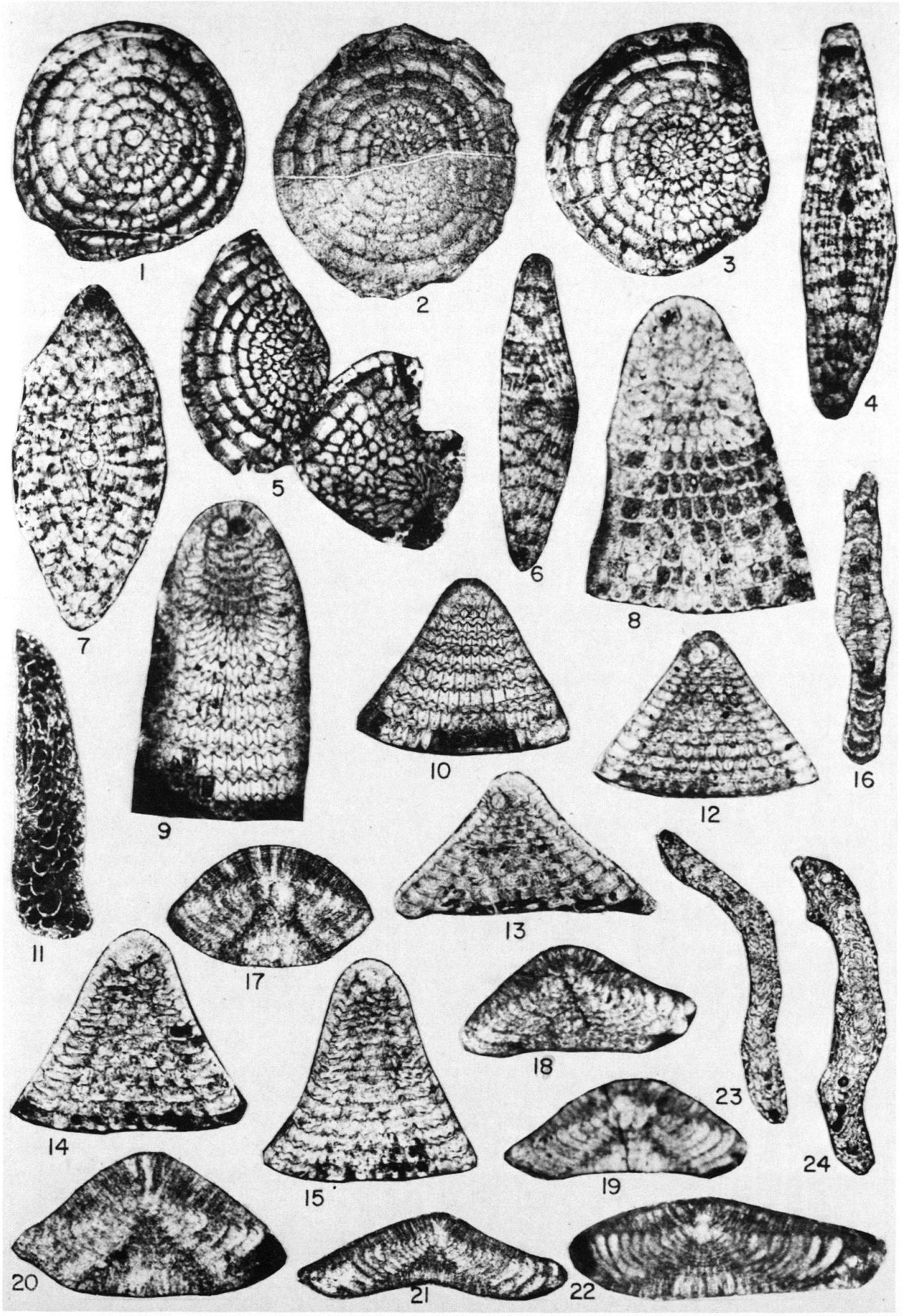
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Plate 5

Fig. 1 — *Praebullalveolina afyonica* n. gen. n. sp., axial section (Af-24), × 60.

Fig. 2, 3, 5, 10 — *Peneroplis* aff. *glynnjonesi* HENSON
2 = Equatorial section, slightly oblique (Af-49), × 29. 3 = Axial section (Af-50), × 27.
5 = Axial section (Af-51), × 25. 10 = Axial section (Af-52), × 34.

Fig. 6, 11 — *Peneroplis* sp.
6 = Axial section (Af-53), × 38. 11 = Equatorial section (Af-54), × 37.

Fig. 4, 7–9 — *Peneroplis* aff. *damesini* HENSON
4 = Equatorial section (Af-55), × 51. 7 = Axial section (Af-56), × 32.
8 = Equatorial section (Af-57), × 61. 9 = Axial section (Af-58), × 31.

Fig. 12 — *Gyroidinella magna* (LE CALVEZ), vertical section (Af-59), × 30.

Fig. 13 — *Gyroidinella magna* (LE CALVEZ), vertical section (Af-60), × 30.

Fig. 14 — *Gypsina* sp., centered section, slightly oblique (Af-61), × 28.

Fig. 15 — *Gypsina* sp., vertical section (Af-62), × 27.

Fig. 16 — *Orbitolites* sp., equatorial section (Af-63), × 62.

Fig. 17 — *Orbitolites* sp., equatorial section (Af-64), × 54.

Fig. 18 — *Orbitolites* sp., subequatorial section (Af-65), × 28.

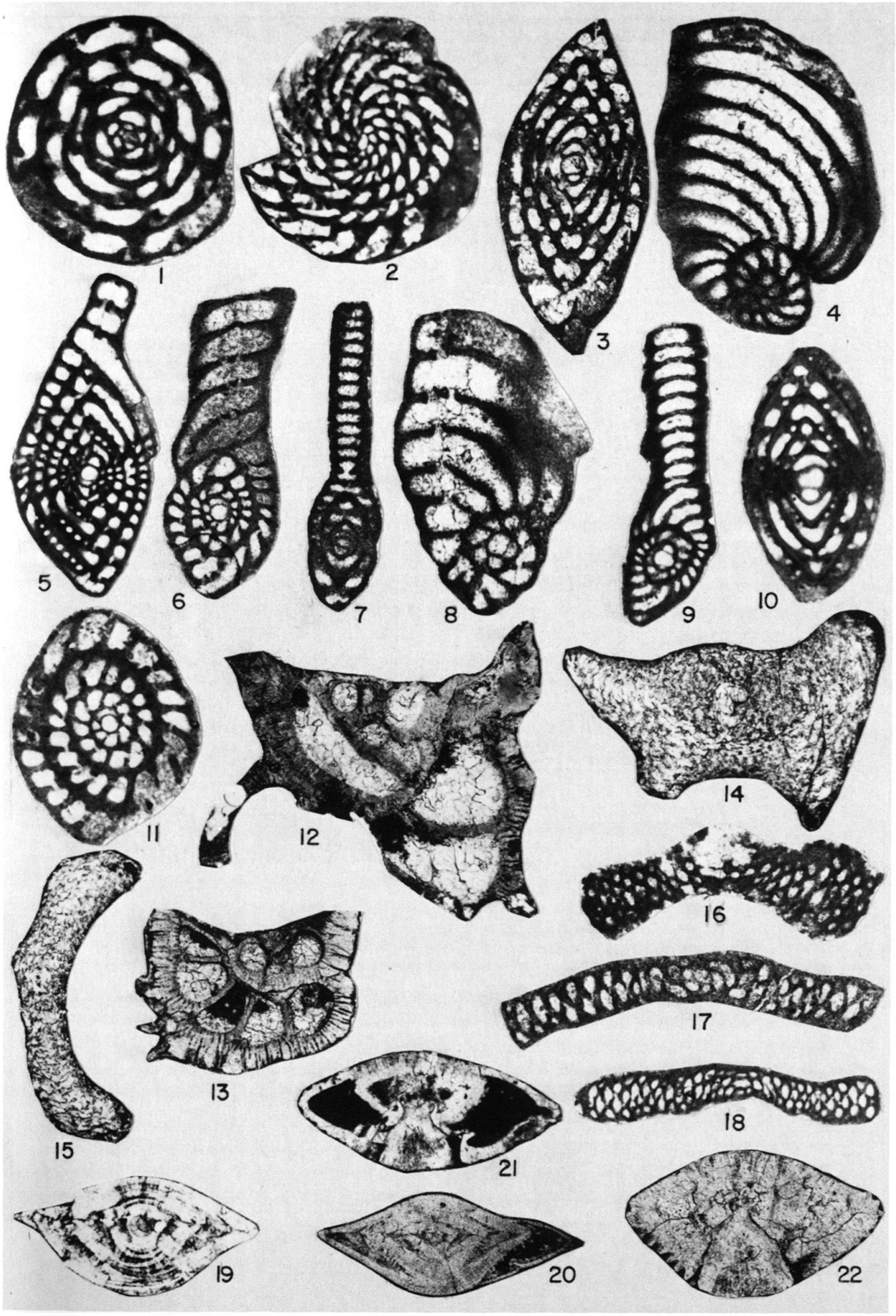
Fig. 19 — *Amphistegina* sp., axial section (Af-66), × 46.

Fig. 20 — *Amphistegina* sp., axial section (Af-67), × 25.

Fig. 21 — *Rotalia* sp., axial section (Af-68), × 40.

Fig. 22 — *Rotalia* sp., axial section (Af-69), × 43.

All specimens from the Upper Eocene of Dereköy village (south of Afyon).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