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Benthic foraminifera from the Albian shallow-marine limestones in the Geyik Dağı area (Central Taurides), southern Turkey

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Abstract.—Cretaceous carbonates in the Geyik Dağı area (Central Taurides, southern Turkey) are represented by two successions with different paleoenvironmental settings: open shelf to slope succession of Cenomanian to Danian age and inner platform succession of Albian to Maastrichtian age, which is interrupted by a post-Cenomanian disconformity. Outcropped lowermost part of the platform-type one is composed of rudistid limestones corresponding to the Urgonian-type carbonates and belongs to the Geyik Dağı Unit (=Anamas-Akseki Carbonate Platform). It contains a rich assemblage of larger benthic foraminifera including orbitolinid, chrysalidinid, cuneolinid, nezzazatid, and miliolid taxa, which has been illustrated and documented here for the first time from the upper Albian of the Tauride Carbonate Platform. The occurrence of such a diversified foraminiferal fauna indicates a prominent high diversity that took place in the Tauride Carbonate Platform during the late Albian time, which corresponds to a major emersion period in some parts of the platform.

Introduction

The Cretaceous platform carbonates in the Geyik Dağı area represent a part of the so-called L'Axe Calcaire du Taurus (Ricou et al., 1975), Anatolide-Tauride Carbonate Platform (ATCP) (Şengör and Yılmaz, 1981), Taurus Carbonate Platform (Koçyiğit, 1981), Menderes-Taurus Platform (Görür and Tüysüz, 2001), Menderes Carbonate Platform (Vlahović et al., 2005). Most previous works on the Geyik Dağları range aim to explain its complex geological and tectonic evolution (e.g., Özgül, 1976, 1997; McPhee et al., 2018), except for Özer and Kahrıman (2019), in which Cenomanian canaliculate rudists were documented. In the Anamas-Akseki area, which is the continuation of the Geyik Dağları range to 65 km northwest, there are few studies on the detailed biostratigraphy and facies of the Cretaceous platform carbonate sequences (e.g., Martin, 1969; Monod, 1977; Altıner et al., 1999; Solak et al., 2017, 2019; Solak, 2019). This study forms part of a broader effort to contribute to the understanding of geologic evolution of the Geyik Dağı area during the Cretaceous.

The Albian Stage is little or poorly known in the ATCP due to emersion of some parts of the platform during the late Aptian (e.g., Farinacci and Köylüoğlu, 1982; Taslı and Solak, 2019; Solak et al., 2020), in addition to the lack of detailed micropaleontologic and biostratigraphic works. This study focuses on documenting and illustrating the Albian benthic foraminifera and on describing stratigraphically important ones. The first micropaleontological results allowed us to recognize a new species of benthic foraminifera from the Albian, *Phenacophragma oezeri* Solak and Taslı, 2020 from the peri-Mediterranean platforms.

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Geologic setting

The Geyik Dağı area is located at the western part of the Central Taurides (Fig. 1.1) consisting of autochthonous and allochthonous rock assemblages (Özgül, 1976). In this area, autochthonous rocks, which were named as the Geyik Dağı Unit by Özgül (1976), are overthrust by the Antalya Nappes (Lefèvre, 1967) or Antalya Complex (Robertson and Woodcock, 1984) to the south and by the Aladağ Unit (Özgül, 1976) to the north. Accretion of these nappes is thought to be the result of continental and oceanic subduction below an oceanic upper plate lithosphere (Şengör and Yılmaz, 1981). The Geyik Dağı Unit includes carbonate and clastic sediments of Cambrian–Ordovician age, unconformably overlain by platform-type sequences of Middle Jurassic–Cenomanian age (Polat Limestone) and Maastrichtian–Paleocene age (Çataloluk Limestone), ending with Lutetian clastics (Özgül, 1997). The Maastrichtian to Lutetian cherty pelagic limestones (Kuşca Limestone) also occur in a separate tectonic slice of the Yıldızlı Dağ Unit (Özgül, 1997). On the other hand, McPhee et al. (2018) called the same rock assemblages the Geyikdağı nappe, which was deformed by a thin-skinned thrust fault imbricate system that affected the uppermost Mesozoic carbonates and by a deeper thrust duplex system that incorporates Ordovician and older basement rocks. During field work in the Geyik Dağı area, we have observed two carbonate successions of different paleoenvironmental settings separated by faults: one of them contains orbitolinid and rudistid bioclastic limestones of Cenomanian age (cf. upper part of the Polat Limestone of Özgül, 1997) and overlying hemipelagic to pelagic limestones of Santonian to Danian age (cf. Kuşca Limestone of Özgül, 1997), while the other consists entirely of an inner platform rudistid limestone succession of Albian to Late Cretaceous age (cf. Polat Limestone plus Çataloluk Limestone of Özgül, 1997), including a post-Cenomanian

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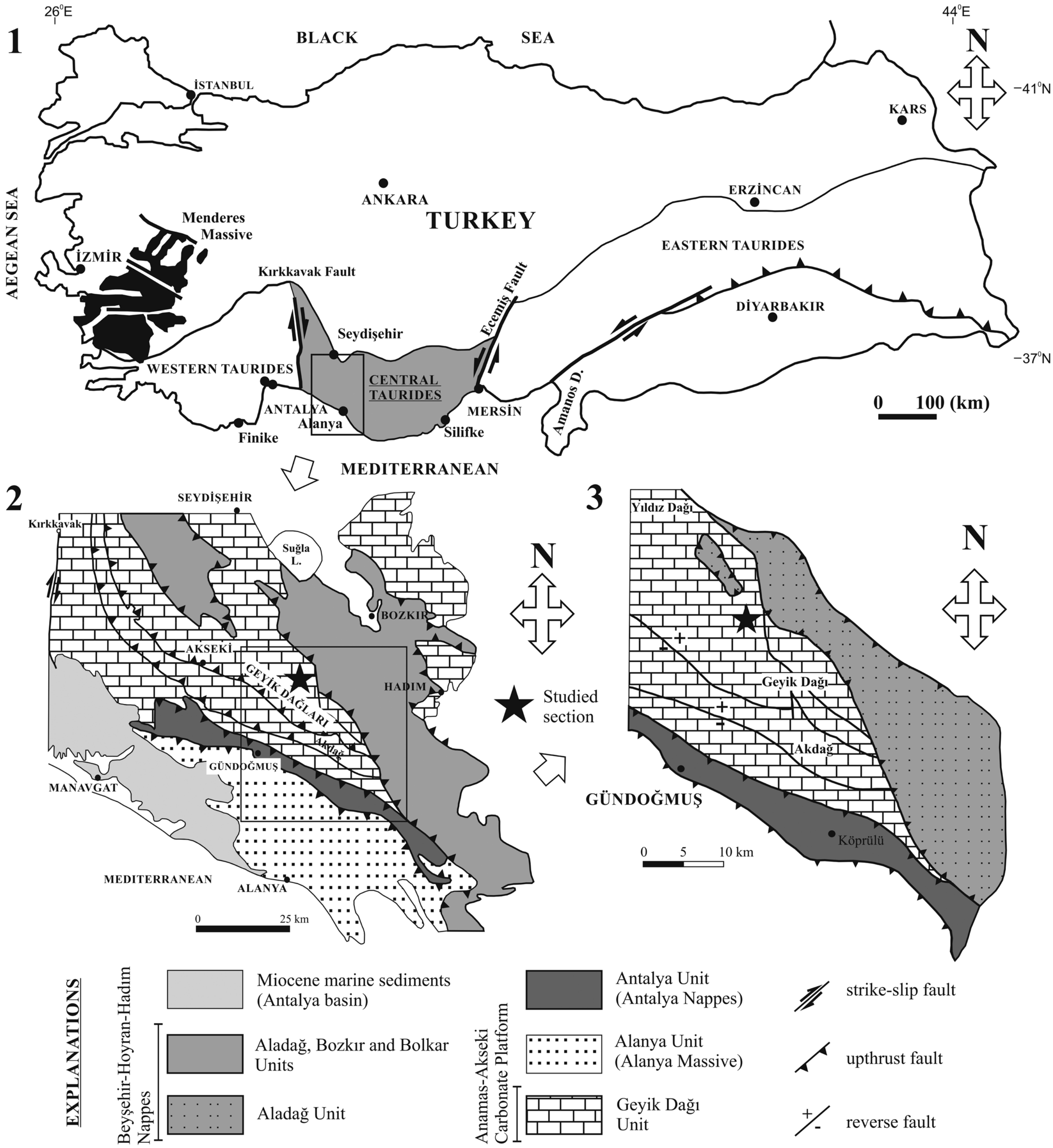

Figure 1. Location and geologic maps of the study area. (**1**) Geographical subdivision of the Taurides (after Özgül, 1984); (**2, 3**) schematic geologic maps of the Geyik Dağları area showing the location of studied section (simplified after Özgül, 1984).

disconformity. The section studied belongs to the Hadim Unit (Özgül, 1997, p. 117, fig. 4), in which the Cretaceous is represented entirely by platform-type carbonates. It corresponds to the upper part of the Middle Jurassic–Cenomanian Polat Limestone of the Hadim Unit, which contains rudist-rich limestones. See Özgül (1997, p. 118, fig. 5) for a generalized section of the Geyik Dağı Unit in the Hadim area.

Materials and methods

The Geyik Dağları is a mountain range lying in the northwest-southeast direction on the Taşeli Plateau in the north of Alanya (Antalya), and accessible by car and hard-surface roads (one lane wide) only in dry weather during the summer. The highest mountain is the Geyik Dağı (2877 m). The Cretaceous platform-

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type carbonate succession (Fig. 1.2, 1.3) is exposed along a rocky ridge, including Göbekçal Hill (2391 m), located 10 km northwest of Geyik Dağı peak. This ridge is limited by faults and Pleistocene glacial sediments. The succession consists of beige- and cream-colored, thick- to very thick-bedded limestones that frequently contain whole and fragmented rudists, gastropods, and large bivalves. Laminae, fenestrae, and emersion/paleokarst breccia/karst infillings are common. Algal-foraminiferal packstone microfacies intercalated with ostracod-miliolid/wackestone/mudstone microfacies indicates peritidal environments in an inner platform setting. Although the succession is interrupted by step faults and karstic depressions, the section is continuous up to a major disconformable surface covering the Cenomanian strata. The section was logged from the lowermost exposed limestone layers (36°58'26.66"N, 32° 6'41.76"E). Micropaleontologic analyses of limestone samples were performed on 62 thin sections and 30 serial acetate-peels obtained from the 23 limestone samples. Determination of the stratigraphic position of the investigated succession that is shown in Figure 2 is based on the identification of benthic foraminifera and on using them as index fossils. The stratigraphic value of taxa identified is discussed in the "Discussion and biostratigraphic remarks" section.

The higher taxonomic classification follows Pawlowski et al. (2013). The lower taxonomic classification follows Kaminski (2014) for the agglutinating taxa and Loeblich and Tappan (1988) for representatives of the Miliolida. The terminology used in the text is defined in Hottinger (2006). The section types passed parallel or perpendicular to the plane of biseriality in biserially arranged forms are variously termed: axial section (Hottinger, 2006, fig. 6B), vertical section (BouDagher-Fadel, 2018, pl. 5.10), longitudinal section (Cherchi et al., 2009, pl. 1; Cvetko Tešović et al., 2011). We preferred to use the terms "longitudinal section perpendicular/parallel to the plane of biseriality" and "transverse section" for sections of biserial forms.

Repository and institutional abbreviation.—The studied Albian thin-sections, which are labeled as A8–A30, are deposited in the collection of Paleontology at the General Geology Laboratory, Department of Geological Engineering, Mersin University, Turkey.

Systematic paleontology

Phylum Foraminifera d'Orbigny, 1826
Class Globothalamea Pawlowski et al., 2013
Order Lituolida Lankester, 1885
Suborder Nezzazatina Kaminski, 2004
Superfamily Nezzazatoidea Hamaoui and Saint-Marc, 1970
Family Nezzazatidae Hamaoui and Saint-Marc, 1970
Subfamily Nezzazatinae Hamaoui and Saint-Marc, 1970
Genus *Nezzazata* Omara, 1956

Type species.—*Nezzazata simplex* Omara, 1956, p. 889, pl. 102, figs. 7–13, text-fig. 6, western Sinai, Egypt.

Nezzazata isabellae Arnaud-Vanneau and Sliter, 1995
Figure 3.1–3.4

1982 *Nezzazata* sp. C; Altıner and Decrouez, pl. 4, fig. 26.
1995 *Nezzazata isabellae* Arnaud-Vanneau and Sliter, p. 552, text-fig. 7 (A–D), pl. 2, figs. 11–24.
1995 *Nezzazata isabellae*; Arnaud-Vanneau and Premoli Silva, p. 206, pl. 2, figs. 1–3.
2006 *Nezzazata isabellae*; Mancinelli and Chiocchini, p. 92, pl. 4, figs. 11–21.
2012 *Nezzazata isabellae*; Chiocchini et al., pl. 66, figs. 2, 3, 5–7, 9–12, 14.
2019 *Nezzazata isabellae*; Taslı and Solak., fig. 10 (8).

Holotype.—Axial section (USNM 483970) from the Allison Guyot in the Mid-Pacific Mountains (Arnaud-Vanneau and Sliter, 1995, pl. 2, fig. 11).

Remarks.—This species is characterized by a small test with a rounded periphery (Arnaud-Vanneau and Sliter, 1995). It frequently occurs throughout the studied section and is especially abundant in the lower part. The Geyik Dağı specimens, represented by numerous specimens in various section types, have a height (h) of mostly 0.100–0.148 mm (rarely up to 0.162 mm), diameter (d) of 0.175–0.203 mm (rarely up to 0.243 mm), and mostly 2–3 (rare) whorls. Although there are a few larger individuals, they correspond to type specimens of *Nezzazata isabellae* described by Arnaud-Vanneau and Sliter (1995) from the (late?) Aptian to early Albian.

Nezzazata isabellae represents one of the oldest species of the genus *Nezzazata* (Arnaud-Vanneau and Sliter, 1995) and differs from other species by its smaller size—minimum height of 0.2 mm, minimum diameter of 0.3 mm in 7 *Nezzazata* species of Smout (1956) and minimum diameter of 0.51 mm in *Nezzazata simplex* Omara (1956).

Genus *Nezzazatinella* Darmoian, 1976

Type species.—*Nezzazatinella adhami* Darmoian, 1976, p. 525, pl. 1, figs. 1–7, Shat Al Arab Formation, Basrah, southeastern Iraq.

Nezzazatinella sp.
Figure 3.5–3.28

Remarks.—This species differs from the other known species of *Nezzazatinella* in having a widely rounded periphery, fewer numbers of chambers in the last whorl, and small sizes (see Table 1). It resembles *Dobrogelina*? *cartusiana* Arnaud-Vanneau, 1980 in its widely rounded periphery, but the aperture is a single slit (Fig. 3.10, 3.12, 3.13, 3.22, 3.25, 3.27), instead of apertural pores.

Order Loftusiida Kaminski and Mikhalevich in Kaminski, 2004
Suborder Loftusiina Kaminski and Mikhalevich in Kaminski, 2004
Family Spirocyclinidae Munier-Chalmas, 1887
Subfamily Cyclammininae Marie, 1941
Genus *Reissella* Hamaoui, 1963

Type species.—*Reissella ramonensis* Hamaoui, 1963, p. 58, Upper Cretaceous (Cenomanian), Judea Limestone Group, Israel.

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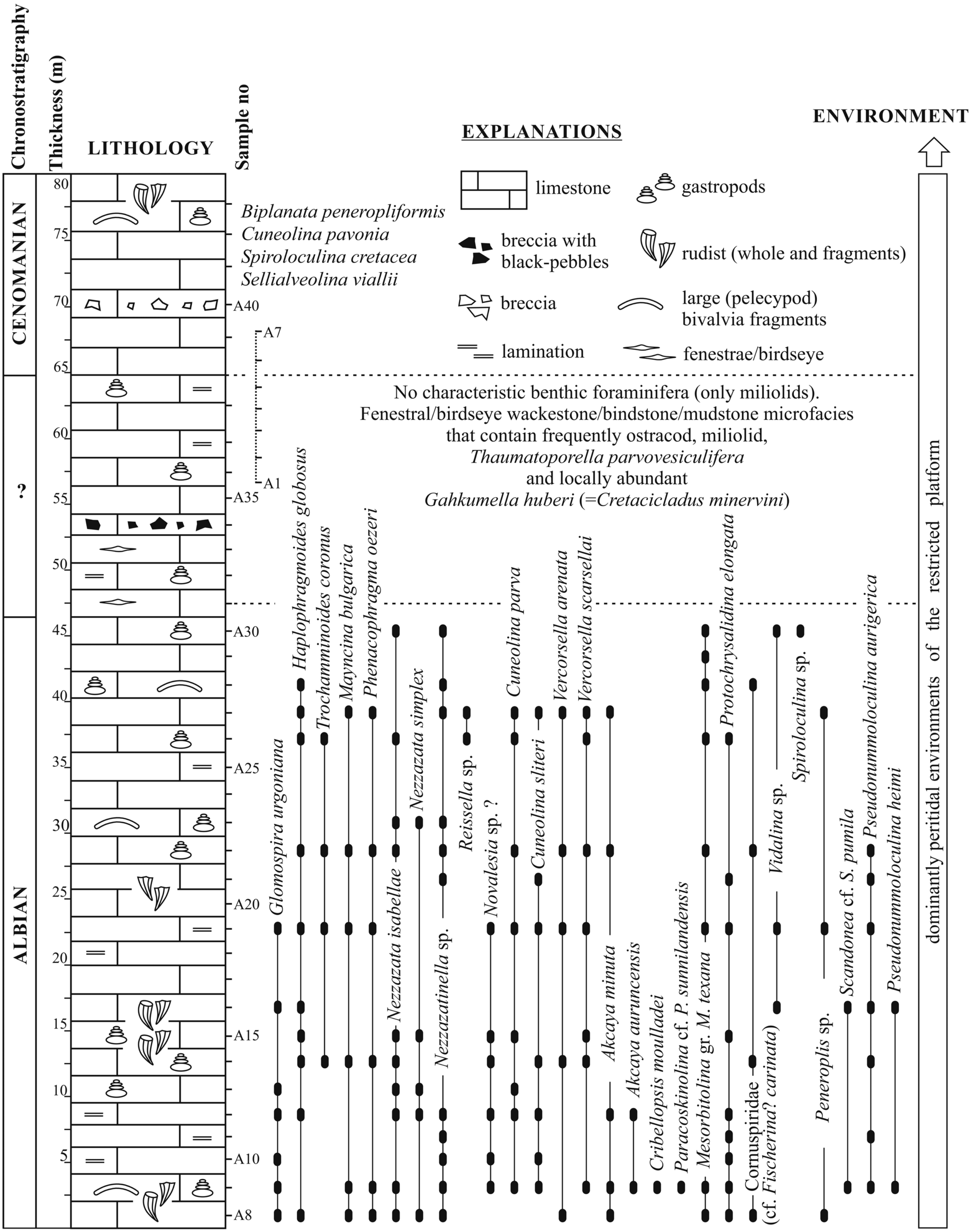

Figure 2. Stratigraphic distribution of the Albian benthic foraminifera in the Göbekçal Hill section.

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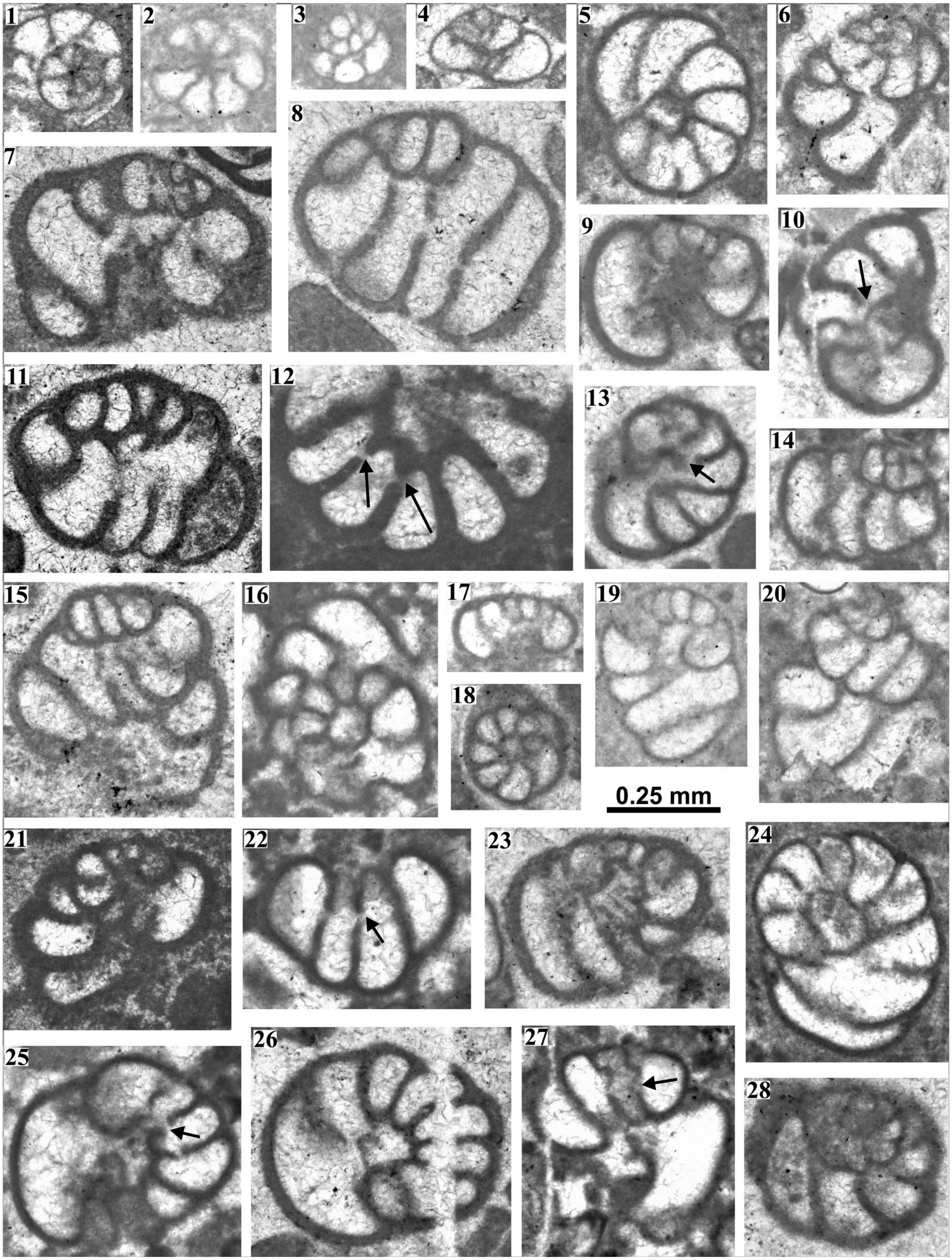

Figure 3. *Nezzazata isabellae* Arnaud-Vanneau and Sliter, 1995 (**1–4**) from the Albian platform limestones, Geyik Dağı area. (**1, 2**) Transverse sections (A12/1, A30/1); (**3**) oblique axial section (A14/1); (**4**) axial section (A26/1). *Nezzazatinella* sp. (**5–28**) from the Albian platform limestones, Geyik Dağı area. (**5, 10, 12, 16, 18, 24, 26**) Nearly transverse sections (A22/1, A9/1, A22/4, A12/1, A9/2, A8/1, A9/1); (**7, 9, 17, 21, 23**) nearly axial sections (A9/3, A9/2, A8/1, A27/9, A9/2); (**6, 13, 19, 25, 28**) oblique transverse sections (A12/1, A9/1, A8/1, A12/2, A9/1); (**8, 11, 14, 15, 20, 22, 27**) tangential sections (A9/1, A9/3, A12/1, A9/1, A8/1, A12/1, A9/1, A12/1); arrows indicate aperture.

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Table 1. Comparative table of *Nezzazatinella* sp. with the other *Nezzazatinella* species and *Dobrogelina*? *cartusiana* Arnaud-Vanneau, 1980.

		Nezzazatinella macovei Neagu, 1979 (Arnaud-Vanneau, 1980)	*Nezzazatinella* n. sp. (Arnaud-Vanneau, 1980)	*Nezzazatinella picardi* (Henson, 1948)	*Dobrogelina*? *cartusiana* (Arnaud-Vanneau, 1980)	*Nezzazatinella* sp. (this study)
Shape of the test	spiral side	flat to convex	slightly conical	flat to slightly convex	flat to slightly convex	nearly flat
	umbilical side	involute, convex with a pseudoumbilicus	very convex, a narrow and deep pseudoumbilicus	strongly convex to conical	slightly convex	convex
	periphery	subrounded	very acute	subrounded	widely rounded	widely rounded
Aperture		narrow and virguliform median slit, replaced by a series of pores	median virguliform slit with a dent in umbilical side	probably a perforation	central apertural pores	median slit with a dent
Shape of the chambers in transverse sections		falciform	trapezoidal	falciform*	falciform	falciform
Maximum diameter		0.42–1.18 mm	0.48–0.90 mm	1.10 mm	0.48–1.00 mm	0.25–0.55 mm
Height		0.33–0.93 mm	0.33–0.63 mm	?	0.43–0.89 mm	0.15–0.30 mm
Number of whorls		2–3.5	2	1–2	2–3.5	2–3
Number of chambers in the last whorl		10–12	~20	11	7–13	8 (9?)
Stratigraphic and geographic distribution		Barremian–lower Aptian, S France	Barremian–Bedoulian, S France	Santonian, Egypt	Lower Bedoulian, S France	Albian, S Turkey

Reissella sp.
Figure 4.17–4.25

Description.—The test is very small, peneropliform, planispirally enrolled, and involute, with one (Fig. 4.18) to two whorls (Fig. 4.22); later, it may tend to uncoil (Fig. 4.19, 4.21) with up to three uniserial chambers (Fig. 4.19). Proloculus spherical to subspherical, probably composed of proloculus and deuteroloculus (Fig. 4.18, 4.19). The last whorl contains 10–13 chambers. There is no significant change in chamber height, while chamber width increases gradually during ontogenesis. Chambers are subdivided by very short beams, aligned in successive chambers, producing quadrangular meshes in the marginal zone of chambers (Fig. 4.24). The wall is thin, simple, and micrograpular, with no agglutinated particles. Aperture is cribrate with numerous pores scattered over the apertural face (Fig. 4.17, 4.23). Proloculus diameter 0.06–0.08 mm (rarely 0.10 mm), equatorial diameter 0.20–0.35 mm, axial thickness 0.20 mm, test height 0.30–0.40 mm.

Remarks.—The type species, described from the Cenomanian of Israel, has a larger test and numerous short rafters in addition to elongate primary and short secondary beams. A slit-like aperture could not be observed in our specimens. This species seems to be a primitive representative of the genus and is probably new. It is very rarely found in numerous thin-sections of two samples (A26 and A27).

Suborder Ataxophragmiina Fursenko, 1958
Family Cuneolinidae Saidova, 1981
Subfamily Cuneolininae Saidova, 1981
Genus *Cuneolina* d'Orbigny, 1839

Type species.—*Cuneolina pavonia* d'Orbigny, 1846, p. 253, pl. 21, figs. 50–52, Upper Cretaceous, Charente, France.

Cuneolina parva Henson, 1948
Figure 5.1–5.3

1948 *Cuneolina pavonia* var. *parva* var. nov. Henson, p. 624, pl. 14, figs. 1–6, pl. 17, figs. 7–12, pl. 18, figs. 12–14.
1995 *Cuneolina parva*; Arnaud-Vanneau and Sliter, p. 554, pl. 4, figs. 6, 7, 9.
2011 *Cuneolina parva*; Cvetko Tešović et al., fig. 12J, K.

Holotype.—Specimen (P.39115) from Egypt; Parker's Monument Section (Henson, 1948, p. 624, not figured holotype).

Remarks.—About 10 specimens that have random sections were examined. Some sections display proloculus covered by a subdivided deuteroloculus (e.g., Fig. 5.1, 5.3). Chambers have one or two rafters (Fig. 5.1, 5.2). The morphological characters and measured values of the Geyik Dağı specimens correspond to the type specimens of *Cuneolina parva* (maximum height of 1.35 mm in our specimens, versus 1.6 mm in Henson, 1948). The biserial stage contains up to nine pairs of chambers. The apical angles of specimens in thin sections are not comparable.

Two large cuneolinids, *Cuneolina pavonia* and *Cuneolina parva*, are frequently reported species. *Cuneolina pavonia* differs from *Cuneolina parva* by its larger test and by having 2–3 rafters in the chambers. *Cuneolina sliteri* Arnaud-Vanneau and Premoli Silva, 1995, which is the smallest species of *Cuneolina*, is distinguished by its smaller, non-flabelliform test and by lack of rafters in the first chambers.

Cuneolina sliteri Arnaud-Vanneau and Premoli Silva, 1995
Figure 5.4–5.5

1995 *Cuneolina sliteri* Arnaud-Vanneau and Premoli Silva, p. 207, pl. 3, figs. 1–9.
2006 *Cuneolina sliteri*; Mancinelli and Chiocchini, p. 94, pl. 4, figs. 1–10.
2012 *Cuneolina sliteri*; Chiocchini et al., pl. 62, figs. 2–12.

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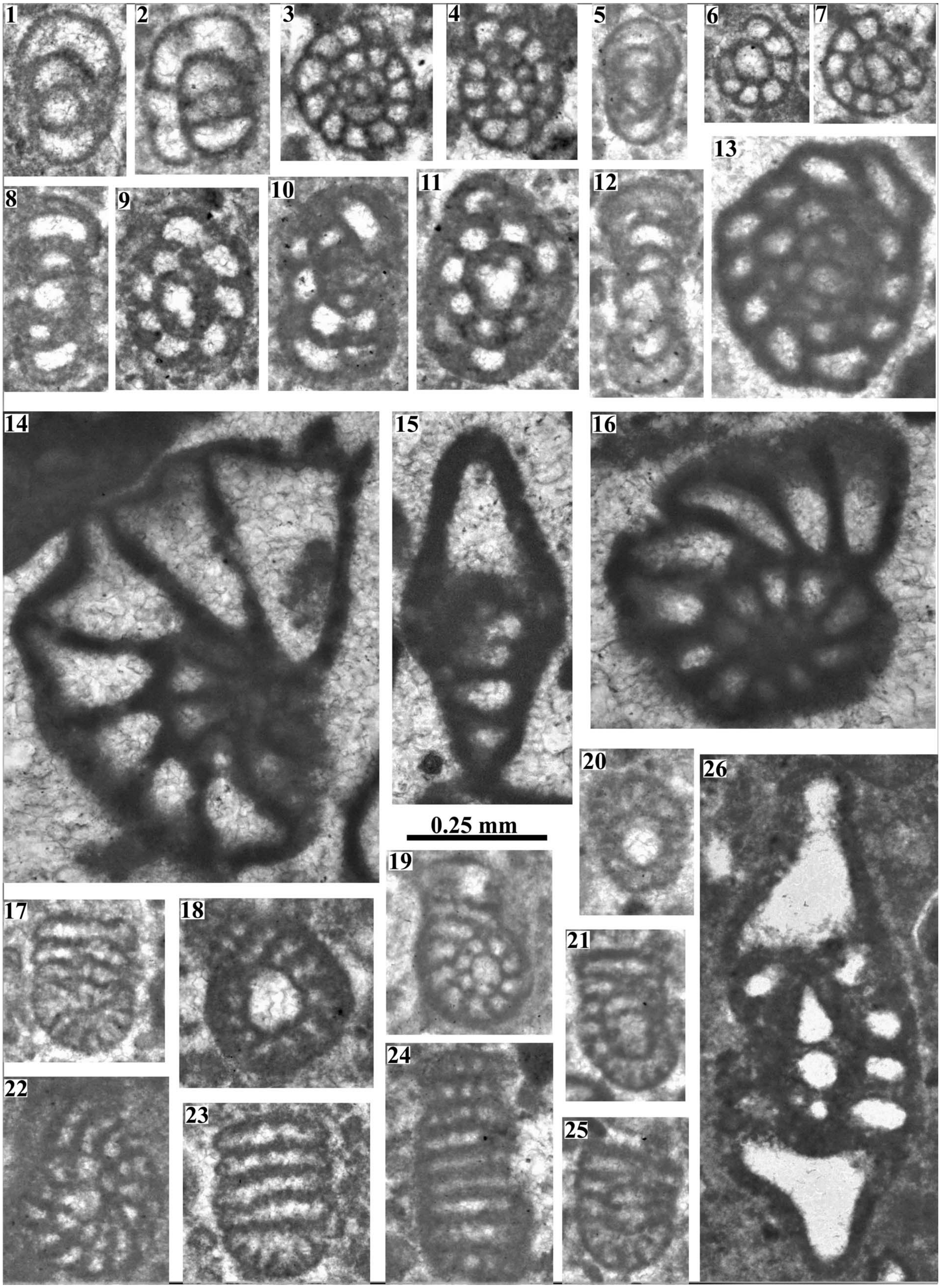

Figure 4. Benthic foraminifera from the Albian platform limestones, Geyik Dağı area. (**1–7**) *Haplophragmoides globosus* Lozo, 1944: (**1, 5**) Axial sections (A26/1, A26/1), (**2**) oblique subequatorial section (A26/1), (**3, 4, 6, 7**) equatorial sections (A12/1, A26/1, A12/1, A19/6). (**8–13**) *Trochamminoides coronus* Loeblich and Tappan, 1946: (**8, 12**) Axial sections (A22/1, A14/1), (**9, 11, 13**) equatorial sections (A26/1, A26/1, A19/6), (**10**) oblique subequatorial section (A14/1). (**14, 15**) *Phenacophragma oezeri* Solak and Taslı, 2020, subequatorial and subaxial sections (A19/1, A19/1). (**16, 26**) *Mayncina bulgarica* Laug et al., 1980, equatorial and oblique axial sections (A19/1, A27/8). (**17–25**) *Reissella* sp., (**17, 23–25**) subaxial sections (A26/1, A26/1, A26/1, A26/1), (**18–21**) equatorial sections (A26/1, A26/1, A26/1, A27/6), (**22**) oblique equatorial section (A26/1).

Holotype.—Longitudinal section in the plane of biseriality from Takuyo-Daisan Guyot, Sample 144-879A-5R-1 (Arnaud Vanneau and Premoli Silva, 1995, pl. 3, fig. 1).

Remarks.—More than 15 specimens in mostly longitudinal sections were examined. They have a height of 0.31–0.90 mm and a maximum basal diameter up to 0.23 mm. Embryonic apparatus made by a proloculus and a deuteroloculus subdivided by a few rafters and beams, followed by a biserial stage with up to mostly five or six pairs of chambers (only one specimen up to 10). The deuteroloculus displays mostly only beams in thin sections (Fig. 5.4, 5.5). These specimens are within the range of morphological characters and biometric values (maximum height of 1.15 mm, maximum diameter of 0.78 mm) of *Cuneolina sliteri* described by Arnaud-Vanneau and Premoli Silva (1995). The comparison with frequently reported other representatives of *Cuneolina* is made in remarks for *Cuneolina parva*.

Genus *Vercorsella* Arnaud-Vanneau, 1980

Type species.—*Vercorsella arenata* Arnaud-Vanneau, 1980, p. 519, pl. 46, figs. 1, 2, pl. 71, figs., 1–7, Western Alps, France.

Remarks.—In the generic diagnosis by Arnaud-Vanneau (1980) and Loeblich and Tappan (1988), the aperture of *Vercorsella* is expressed as to be a basal slit and used as the main criterion to distinguish it from *Cuneolina*, which has a row of pores. Arnaud-Vanneau and Sliter (1995) provided emendations of *Vercorsella* and *Cuneolina* and noted that the aperture of *Vercorsella* consists of a row of pores. Arnaud-Vanneau and Sliter (1995) used a keriothecal test and subdivided deuteroloculus in *Cuneolina* to distinguish it from *Vercorsella*. We distinguish *Cuneolina* from *Vercorsella* by its rafters (*Vercorsella* has fewer well-developed rafters) in the last chambers (e.g., Loeblich and Tappan, 1988; Schlagintweit and Gawlick, 2005), as well as a non-subdivided deuteroloculus.

Vercorsella arenata Arnaud-Vanneau, 1980
Figure 5.6–5.7

1980 *Vercorsella arenata* Arnaud-Vanneau, p. 519, pl. 71, figs. 1–3.
1994 *Vercorsella arenata*; Chiocchini et al., pl. 9, figs. 11, 12.

Holotype.—Longitudinal section (ID 20 768) cutting the proloculus from the Urgonian platform, France (Arnaud-Vanneau, 1980, pl. 71, fig. 1).

Remarks.—Six specimens were examined in tangential sections. The biserial stage ranges from 5–7 pairs of chambers. Chambers are divided by 1–3, rarely 4 beams. Proloculus diameters are between 0.097 mm and 0.138 mm, which is similar to measurements (0.09–0.13 mm in Arnaud-Vanneau, 1980) of the original description. The maximum height of the test (hmax.) is 0.73 mm in our specimens versus 0.725 mm in Arnaud-Vanneau (1980). Rafters are not observed in thin sections. The morphology and biometric parameters of these specimens correspond to the type specimens of *Vercorsella arenata* Arnaud-Vanneau, 1980. The comparisons with other representatives of the genus *Vercorsella* are made in remarks for *Vercorsella scarsellai* (De Castro, 1963).

Vercorsella scarsellai (De Castro, 1963)
Figure 5.8–5.13

1963 *Cuneolina scarsellai* De Castro, p. 71, pl. 1, figs. 2–10, pl. 2, fig. 1.
1968 *Pseudotextulariella*? *scarsellai*; Brönnimann and Conrad, p. 96, pl. 1, figs. 1–8, pl. 2, figs. 1–10.
1982 *Pseudotextulariella*? *scarsellai*; Altıner and Decrouez, pl. 3, figs. 15, 16.
2011 *Vercorsella scarsellai*; Cvetko Tešović et al., fig. 11J.
2012 ?*Cuneolina scarsellai*; Chiocchini et al., p. 68, pl. 46, figs. 1, 7.

Holotype.—Specimen (767.33) in from the S. Maria la Face, Sarno, Italy (De Castro, 1963, pl. 1, fig. 1a–d).

Remarks.—More than 25 specimens in mostly longitudinal, tangential, and a few transverse sections were examined. Test morphology and the absence of beams in the first chambers following the proloculus correspond to the types of *Vercorsella scarsellai* described from the Lower Cretaceous of Italy (De Castro, 1963). Beams are thicker (0.015–0.019 mm versus 0.006–0.013 mm in De Castro, 1963). The height of the test measured from longitudinal sections is up to 1.26 mm. While the last three or four pairs of chambers in most specimens are subdivided by beams (Fig. 5.10, 5.13), some specimens seem to have up to eight pairs of chambers subdivided by well-developed beams because tangential sections (e.g., Fig. 5.9) passed through both complete and incomplete (rudimentary) beams in the marginal zone of the test. In transverse sections passing through the adult stage, complete and incomplete beams are evident (Fig. 5.11, 5.12). The spiral initial stage is rarely observed (Fig. 5.10), followed by a biserial stage with up to 12 pairs of chambers. Some specimens (Fig. 5.10) may show a change from biserial to apparently uniserial chamber arrangement due to twisting of the test, as stated in Brönnimann and Conrad (1968, p. 97).

Vercorsella scarsellai differs from *Vercorsella arenata* Arnaud-Vanneau, 1980 by its larger size (hmin. 0.7 mm in our specimens versus hmax. 0.72 mm in Arnaud-Vanneau, 1980) and by having rare and incomplete beams. *Vercorsella laurentii* (Sartoni and Crescenti, 1962) and *Vercorsella camposaurii* (Sartoni and Crescenti, 1962) are distinguished from *V. scarsellai* by more flaring test shape and more regular beams. Velić and Gušić (1973) stated that *V. laurentii* has very thick interchamber bands. *Vercorsella tenuis* (Velić and Gušić, 1973) can be distinguished easily from *V. scarsellai* by its very thin septa and beams. *Vercorsella wintereri* Arnaud-Vanneau and Sliter, 1995 and *Vercorsella halleinensis* Schlagintweit and Gawlick, 2005 have smaller tests, with maximum heights are 0.30 mm and 0.72 mm, respectively.

Subfamily Sabaudiinae Brönnimann et al., 1983
Genus *Akcaya* Özdikmen, 2009

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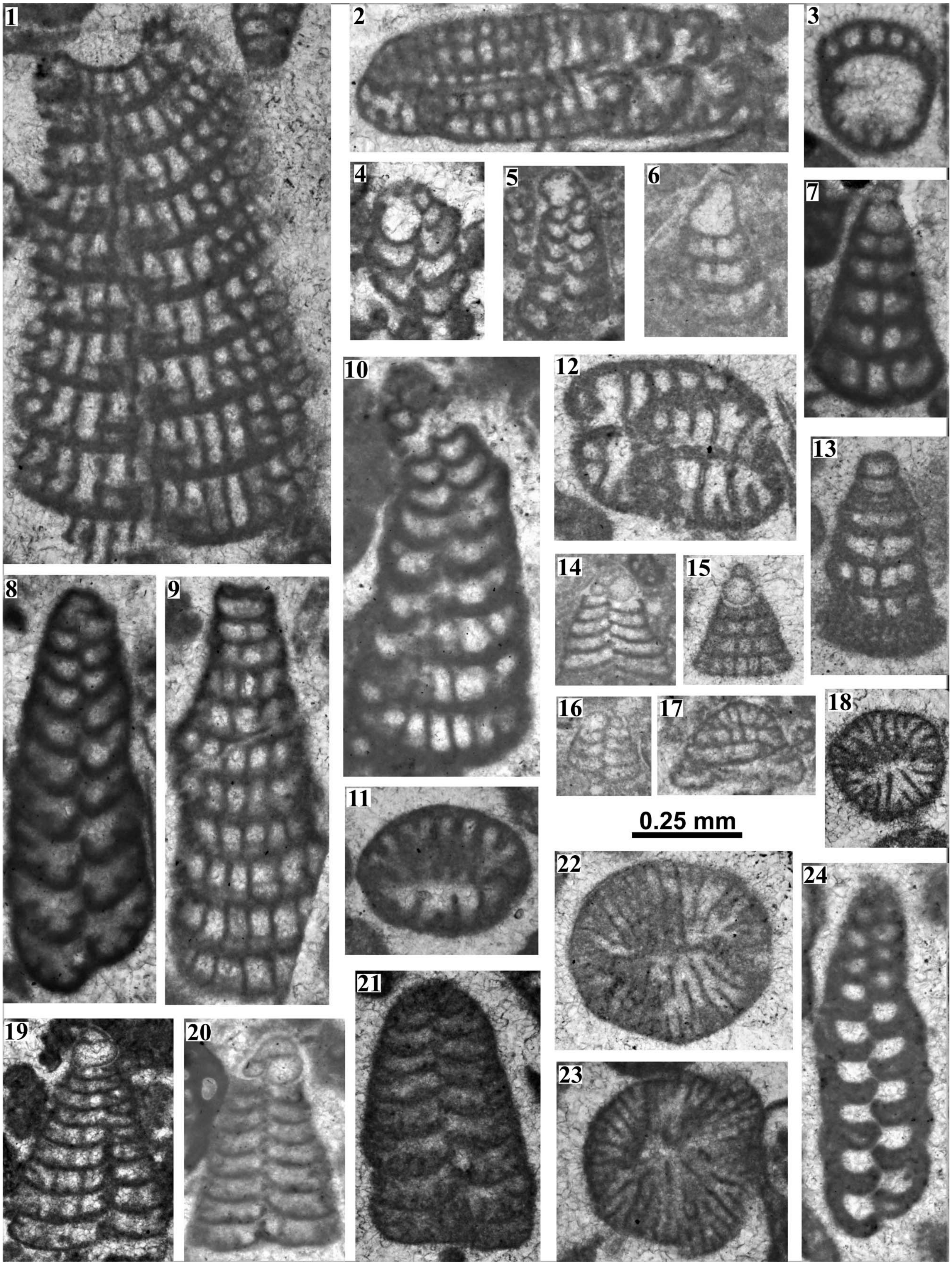

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Figure 5. Cuneolinid foraminifera from the Albian platform limestones, Geyik Dağı area. (**1–3**) *Cuneolina parva* Henson, 1948: (**1**) tangential section oblique to the plane of biseriality (A9/4), (**2**) oblique transverse section (A9/1), (**3**) tangential section showing beams in embrionic apparatus (19/2). (**4, 5**) *Cuneolina sliteri* Arnaud-Vanneau and Premoli Silva, 1995, longitudinal sections perpendicular to the plane of biseriality (A12/1, A14/1). (**6, 7**) *Vercorsella arenata* Arnaud-Vanneau, 1980, tangential sections (A8/1, A19/1). (**8–13**) *Vercorsella scarsellai* (De Castro, 1963): (**8**) longitudinal section perpendicular to the plane of biseriality (A19/6), (**9, 13**) tangential sections (A19/1, A9/4), (**10**) longitudinal section of a specimen revealing that the plane of biseriality is twisted (A9/1), (**11**) transverse section (A19/2), (**12**) oblique transverse section (A9/1). (**14–18**) *Akcaya minuta* (Hofker, 1965): (**14, 16**) longitudinal sections perpendicular to the plane of biseriality (A27/6, A8/1), (**15, 17**) tangential sections (A9/3, A12/1), (**18**) transverse section (A9/3). (**19–23**) *Akcaya auruncensis* (Chiocchini and Di Napoli-Alliata, 1966): (**19, 20**) longitudinal sections perpendicular to the plane of biseriality (A12/1, A9/1), (**21**) sublongitudinal section perpendicular to the plane of biseriality (A19/2), (**22, 23**) transverse sections (A9/3, A19/3). (**24**) *Novalesia*? sp., longitudinal section perpendicular to the plane of biseriality (A9/1).

Type species.—*Textulariella minuta* (Hofker, 1965), p. 186, pl. 3, figs. 5, 6, pl. 4, figs. 1–9, Province of Santander, Puerto de Las Alisas, Spain.

Akcaya minuta (Hofker, 1965)
Figure 5.14–5.18

1965 *Textulariella minuta* Hofker, p. 186, pl. 3, figs. 5, 6, pl. 4, figs. 1–9.
1980 *Sabaudia minuta*; Arnaud-Vanneau, p. 525, pl. 16, figs. 6–13.
1982 *Sabaudia minuta*; Altıner and Decrouez, pl. 3, figs. 3, 4.
1985 *Sabaudia minuta*; Arnaud-Vanneau and Chiocchini, p. 29, pl. 10, figs. 1–14.
1994 *Sabaudia minuta*; Chiocchini et al., pl. 10, figs. 3, 4.
2009 *Akcaya minuta*; Özdikmen, p. 243.
2012 *Sabaudia minuta*; Chiocchini et al., pl. 38, figs. 2–6, 9, 10, 12.
2016 *Akcaya minuta*; Schlagintweit et al., p. 124, fig. 6J.

Holotype.—Longitudinal section oblique to the direction of the apertural slit (Nr. 115178) from Province of Santander, Puerto de Las Alisas, Spain (Hofker, 1965, pl. 3, fig. 5).

Remarks.—The genus name *Sabaudia* Charollais and Brönnimann, 1965 (type species: *Textulariella minuta* Hofker, 1965) preoccupied by *Sabaudia* Ghigi, 1909 (type species: *Sabaudia liguriae* Ghigi, 1909) was renamed as *Akcaya* by Özdikmen (2009) and included in the classification of Kaminski (2014). A new name, Akcayinae, for the subfamily Sabaudiinae was proposed by Özdikmen (2009) owing to the invalid type genus *Sabaudia*, however, the name Sabaudiinae was retained by Kaminski (2014).

About 15 specimens in longitudinal and transverse sections were examined. These specimens are similar to the types of Hofker (1965) and Chiocchini et al. (2012), with the exception of their thinner beams. The maximum height of the test measured from the longitudinal sections is 0.264 mm, and the maximum diameter measured from the circular/subcircular transverse sections is 0.281 mm, except for a few specimens (hmax = 0.328 mm). Juvenarium composed of a proloculus followed by two or rarely three globular chambers and surrounded by a layer of hyaline calcite is clear (Fig. 5.14, 5.15). Biserial arranged adult test in these specimens consists of mostly four or five pairs of chambers subdivided by beams.

Akcaya minuta differs from *Akcaya capitata* (Arnaud-Vanneau, 1980) and *Akcaya briacensis* (Arnaud-Vanneau, 1980) by the absence of rafters, as stated by Arnaud-Vanneau (1980, p. 525). It has a smaller test than *Akcaya capitata* and a less-flared cone test shape than *Akcaya briacensis*. *Akcaya capitata* also has a shape/section compressed perpendicularly to the plane of biseriality versus the nearly circular basal section of *Akcaya minuta*. *Akcaya dinapolii* (Chiocchini, 1984) from the upper Aptian of the Aurunci Mountains, Italy, is an infrequent form and has a less-pointed cone shape than *Akcaya minuta*. It also has constant quadrilocular embryos, whereas *Akcaya minuta* rarely has quadrilocular embryos (e.g., Arnaud-Vanneau and Chiocchini, 1985; Schlagintweit et al., 2016). *Akcaya auruncensis* (Chiocchini and Di Napoli-Alliata, 1966) is distinguished from *Akcaya minuta* by its more elongated and larger conical test and by the presence of rafters in the last chambers.

Akcaya auruncensis (Chiocchini and Di Napoli-Alliata, 1966)
Figure 5.19–5.23

1966 *Textulariella auruncensis* Chiocchini and Di Napoli-Alliata, pl. 4, figs. 1, 3, 5–7, pl. 5, figs. 3–6.
1984 *Sabaudia auruncensis*; Chiocchini, p. 16, text-fig. 2, pl. 1, figs. 1–6, 11, 12.
1994 *Sabaudia auruncensis*; Chiocchini et al., pl. 10, figs. 5, 6.
2012 *Sabaudia auruncensis*; Chiocchini et al., pl. 57, figs. 2, 3, 5–7.

Holotype.—Longitudinal section (Chiocchini and Di Napoli-Alliata, 1966, pl. 4, fig. 1) and schematic reconstruction of the longitudinal section of the holotype, Aurunci Mountains, Southern Latium, Italy (Chiocchini, 1984, text-fig. 2).

Remarks.—*Akcaya auruncensis* was described as *Textulariella auruncensis* by Chiocchini and Di Napoli-Alliata (1966). Chiocchini (1984) then revised the description of *Akcaya auruncensis* after it was regarded as synonymous with *Akcaya minuta* by some authors (e.g., Arnaud-Vanneau, 1980). The measurements were made from ∼10 specimens in longitudinal and transverse sections. These specimens exactly correspond to the Form A specimens of Chiocchini (1984) in test diameters (height of 0.625–0.486 mm, from the subcircular/ovoid transverse sections and basal diameter of 0.468–0.421 mm). The rafters, which are rarely found in the last chambers of Chiocchini's (1984) specimens, are more numerous in our specimens and observed in the last four or five pairs of chambers (Fig. 5.19–5.21). The juvenarium appears to be made up of a proloculus and two postembryonic chambers in some longitudinal sections (Fig. 5.20). The first larger postembryonic chamber may have been formed as a result of the melting of the wall between the two postembryonic chambers. Biserial arranged adult test consists of mostly eight or nine pairs of

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chambers. Comparison with other representatives of genus *Akcaya* is made in remarks for *Akcaya minuta*.

Suborder Orbitolinina Kaminski, 2004
Superfamily Orbitolinoidea Martin, 1890
Family Orbitolinidae Martin, 1890
Subfamily Dictyoconinae Moullade, 1965
Genus *Cribellopsis* Arnaud-Vanneau, 1980

Type species.—*Orbitolinopsis*? *neoelongata* Cherchi and Schroeder, 1978, p. 162, Lower Cretaceous, France.

Cribellopsis moulladei (Saint-Marc, 1974)
Figure 6.1–6.4

1974 *Simplorbitolina moulladei* Saint-Marc, p. 225, pl. 2, figs. 3–8.
2012 *Cribellopsis arnaudae*; Chiocchini et al., pl. 69, figs. 2–10.
2020 *Cribellopsis moulladei*; Schlagintweit, p. 37, fig. 1a–s.

Holotype.—Thin section view of the specimen from Albian, Dlebta Chenan Aaïr, Ghâzir, Lebanon (Saint-Marc, 1974, pl. 2, fig. 5).

Remarks.—The Geyik Dağı specimens (height ~0.73 mm, basal diameter 0.53–0.58 mm, adult chamber height 0.04–0.05 mm) are slightly larger than the *Simplorbitolina moulladei* specimens of Saint-Marc (1974), but they are within the range of morphological variation of *Cribellopsis moulladei* revised by Schlagintweit (2020) in test diameters. Triangular or inverted cone-shaped pillars in the central zone alternate in successive chambers (Fig. 6.3) and form an irregular and coarse central network (Fig. 6.1, 6.2). A specimen with rafter-like structures (Fig. 6.3) is tentatively included in this species.

Subfamily Dictyorbitolininae Schroeder in Schroeder et al., 1990
Genus *Paracoskinolina* Moullade, 1965

Type species.—*Coskinolina sunnilandensis* Maync, 1955, p. 106, pl. 16, figs. 1, 2, 5–7, pl. 17, figs. 1–9, 12, southern Florida, USA.

Paracoskinolina cf. *P. sunnilandensis* (Maync, 1955)
Figure 6.5–6.9

?1955 *Coskinolina sunnilandensis* Maync, p. 106, pl. 16, figs. 1, 2, 5–7, pl. 17, figs. 1–9, 12.
1995 *Paracoskinolina* sp. cf. *P. sunnilandensis*; Arnaud-Vanneau and Premoli Silva, p. 208, pl. 5, figs. 5, 6.

Holotype.—External view of the specimen from Humble Oil and Refining Company's No. 16 Gulf Coast Realties, core No. 23, Florida, USA (Maync, 1955, pl. 16, fig. 1).

Remarks.—This species is represented by subaxial and transverse sections of 10 specimens in only one sample (A9). They have a height of 0.35–0.67 mm and a basal diameter of 0.40–0.67 mm. The ratio of test height/diameter (h/d) is 1/1 (three specimens) or 1.5/1 (one specimen). Chamber height in the adult stage is 0.05–0.06 mm. *Paracoskinolina sunnilandensis*, originally described from the Albian of Florida and Venezuela, is the type of the genus. The Geyik Dağı specimens have a comparably reduced central zone and the boundary between central and marginal zones is not pronounced as in typical specimens of *Paracoskinolina sunnilandensis*. It is also difficult to distinguish the initial spire (Fig. 6.5), as Maync (1955, p. 107) stated.

Previously, the species was found in the northern margin of the Tethys and central America (Arnaud-Vanneau and Premoli Silva, 1995), later in the *Mesorbitolina subconcava* (Leymerie, 1878) taxon-range zone and "*Valdanchella*" *dercourti* Decrouez and Moullade, 1974 partial-range zone assigned to the upper-middle Albian of the Adriatic Carbonate Platform (Velić, 2007). This species is associated with *Cribellopsis moulladei*, *Pseudonummoloculina aurigerica* Calvez, 1988, *Vercorsella scarsellai*, *Akcaya minuta*, and *Glomospira urgoniana* Arnaud-Vanneau, 1980. This is the first record of the species from the Taurides.

Paracoskinolina fleuryi Decrouez and Moullade, 1974 was described from the upper Albian of the Gavrovo-Tripolitza Platform, Greece, and is differentiated from *P. sunnilandensis* (Maync, 1955) by its smaller size (height of 0.4–0.5 mm) and shape of central pillars (Decrouez and Moullade, 1974). Later, it was recorded in the upper Albian limestones of the Adriatic Carbonate Platform (Husinec and Sokač, 2006; Velić, 2007; Husinec et al., 2009). The central zone of our specimens is divided by "hemipillars" aligned in successive chambers, which is one of the diagnostic characteristics of the genus *Paracoskinolina* (Granier et al., 2013), instead of alternated triangular pillars (Decrouez and Moullade, 1974, pl. 4, figs. 5–10).

Subfamily Orbitolininae Martin, 1890
Genus *Mesorbitolina* Schroeder, 1962

Type species.—*Orbitulites texanus* Roemer, 1849, p. 392, not figured, Cretaceous, Texas, USA.

Mesorbitolina gr. *M. texana* (Roemer, 1849)
Figure 6.10–6.16

1849 *Orbitulites texanus* Roemer, p. 392, not figured.
1852 *Orbitulites texanus*; Roemer, p. 86, pl. 10, fig. 7a–d.
1964 *Orbitolina* (*Mesorbitolina*) *texana texana*; Schroeder, p. 471; text-fig. 4b.
1985 *Orbitolina* (*Mesorbitolina*) *texana*; Moullade et al., pl. 1, fig. 9.
1985 *Orbitolina* (*Mesorbitolina*) *texana*; Schroeder, p. 77, pl. 36, figs. 1–13.
2010 *Mesorbitolina texana*; Schroeder et al., fig. 8(5).
2012 *Orbitolina* (*Mesorbitolina*) *texana*; Chiocchini et al., pl. 59, figs. 2–6.

Holotype.—Specimen(s) not designated as a holotype by Roemer (1849, 1852) (p. 392) from Texas, USA. Several specimens were illustrated in Roemer (1852) (pl. 10, fig. 7a–d).

Remarks.—According to measurements from nearly axial sections of eight specimens, excluding juvenile ones, height

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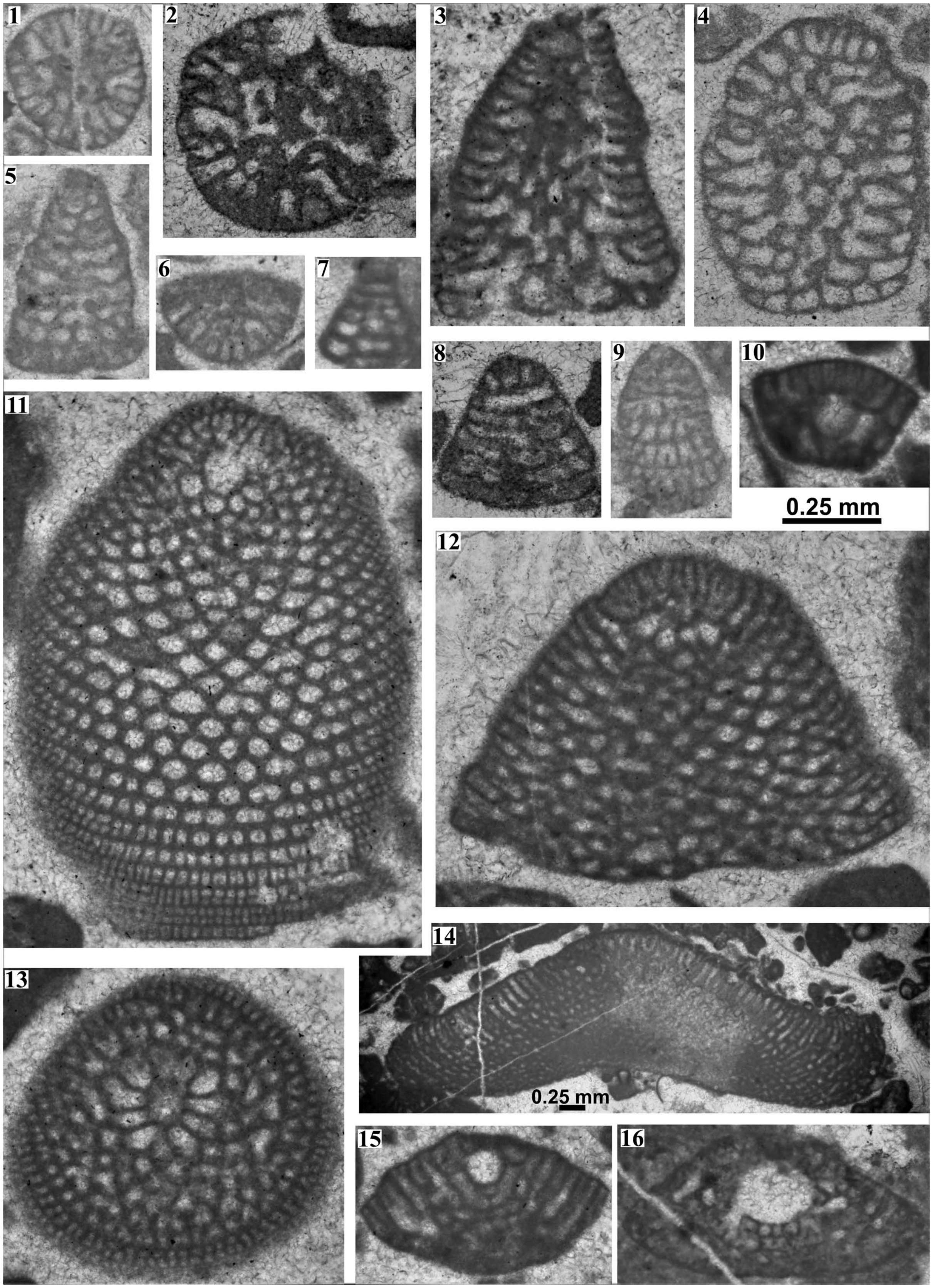

Figure 6. Orbitolinid foraminifera from the Albian platform limestones, Geyik Dağı area. (**1–4**) *Cribellopsis moulladei* (Saint-Marc, 1974): (**1, 2**) transverse sections (A9/1, A9/3), (**3**) subaxial section (A9/2), (**4**) oblique subaxial section (A9/4). (**5–9**) *Paracoskinolina* cf. *P. sunnilandensis* (Maync, 1955): (**5, 7, 8**) subaxial sections (A9/1, A9/1, A9/3), (**6**) oblique transverse section (A9/2), (**9**) oblique subaxial section (A9/1). (**10–16**) *Mesorbitolina* gr. *M. texana* (Roemer, 1849): (**10**) axial section of a juvenile specimen in the embryonic stage (A19/5), (**11**) oblique subaxial section (A19/8), (**12, 15, 16**) axial sections (A19/6, A19/12, A22/1), (**13**) transverse section passing through the megalospheric embryo (A19/8), (**14**) axial section of a microspheric specimen (A19/1). Bar scale except for 14.

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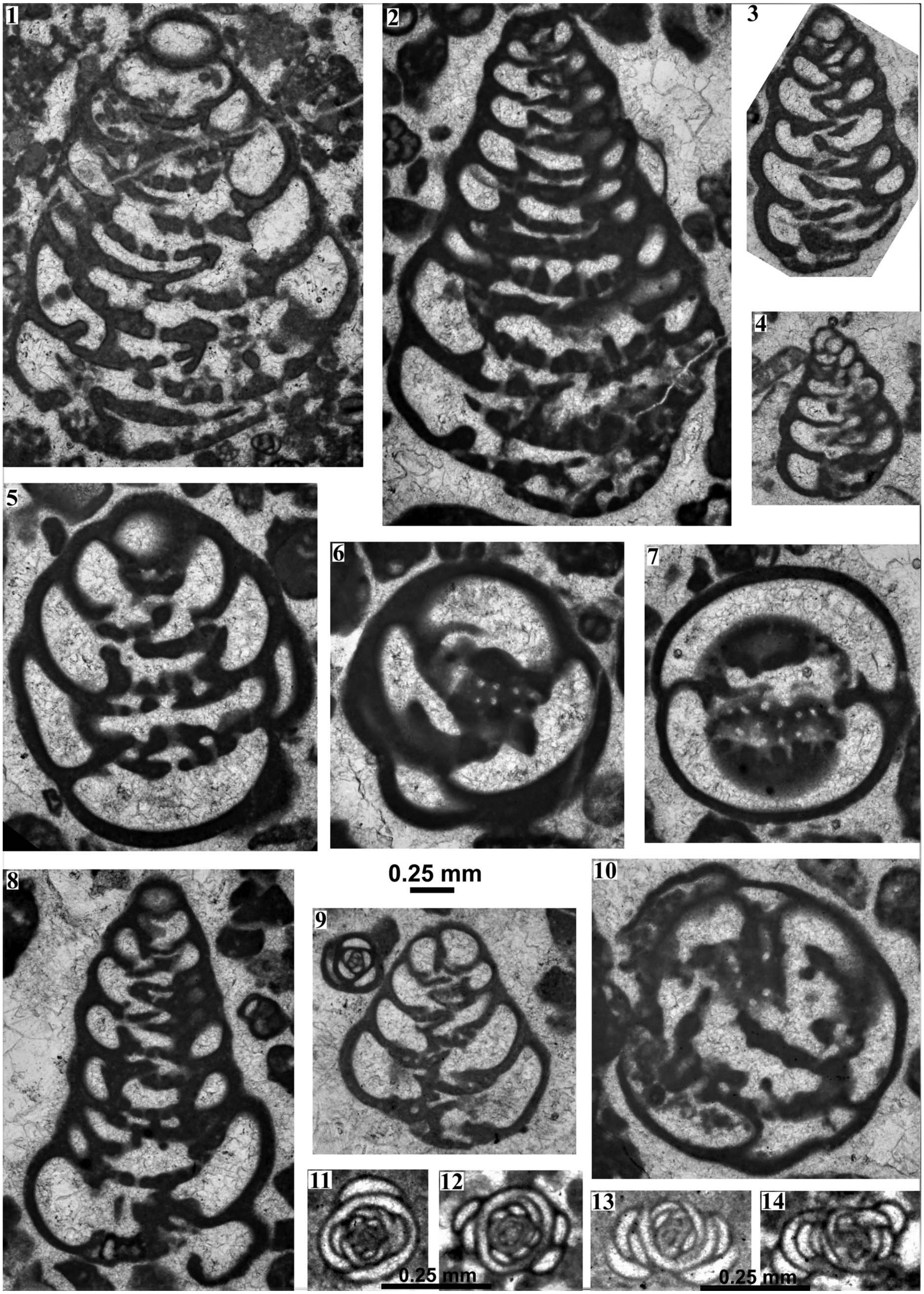

Figure 7. Benthic foraminifera from the Albian platform limestones, Geyik Dağı area. (**1–10**) *Protochrysalidina elongata* Luperto-Sinni, 1999: (**1, 2, 5, 8, 9**) subaxial sections (A12/2, A19/1, A19/1, A19/1, A9/1), (**3, 4**) axial sections (A19/2, A19/2), (**6, 7, 10**) transverse sections (A19/3, A19/1, A19/4). (**11–14**) *Glomospira urgoniana* Arnaud-Vanneau, 1980, transverse sections (A8/1, A12/1, A8/1, A12/1). Bar scale except for (**11–14**).

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and basal diameter of the test range between 0.75–2 mm and 1.70–4.55 mm, respectively. The embryonic apparatus is composed of an oval proloculus (0.12–0.20 mm, N = 6) capped by a deuteroloculus (0.4–0.5 mm) subdivided by beams and rafters and an equally developed subembryonic zone (Fig. 6.10–6.12). Despite their smaller size corresponding to *Mesorbitolina texana*, some of our specimens (Fig. 6.16) are compatible with *Mesorbitolina subconcava* described by Schroeder (1985) in size and shape of embryonic apparatus. Therefore, we have identified the *Mesorbitolina* association as a group.

Order Textulariida Delage and Hérouard, 1896
Suborder Textulariina Delage and Hérouard, 1896
Superfamily Chrysalidinoidea Neagu, 1968
Family Chrysalidinidae Neagu, 1968
Genus *Protochrysalidina* Luperto-Sinni, 1999

Type species.—*Protochrysalidina elongata* Luperto-Sinni, 1999, p. 251, pl. 1, 2, Puglia, Italy.

Remarks.—This genus was not included in the classification of Loeblich and Tappan (1988), Mikhalevich (2004), or Kaminski (2014). *Protochrysalidina* was assigned to Family Chrysalidinidae Neagu, 1968 by Luperto-Sinni (1999).

Protochrysalidina elongata Luperto-Sinni, 1999
Figure 7.1–7.10

1999 *Protochrysalidina elongata* Luperto-Sinni, p. 251, pl. 1, 2.
2007 *Protochrysalidina elongata*; Megza et al., p. 143, fig. 5 (E, F).
2019 *Protochrysalidina elongata*; Taslı and Solak, p. 203, fig. 10 (1–3).

Holotype.—Subaxial section (GT3) from the Casino Chieco well, Puglia, Italy (Luperto-Sinni, 1999, pl. 1, fig.1).

Remarks.—Various oriented sections of >50 specimens were examined. Based on measurements from axial and subaxial sections of 27 specimens, they have a height of 1.0–2.91 mm and a basal diameter of 0.70–2.0 mm. The ratio of test height/diameter (h/d) is 1–2.09. The population of *Protochrysalidina elongata* composed of macrospheric specimens is characterized by low-conical forms (h/d = 1–1.16, eight specimens, and slightly above 1.27–1.45, six specimens) as well as the typical elongate conical forms (h/d = 1.5–2.09, 13 specimens). The pillars (forming endoskeleton) used as a distinguishing criterion do not exist in the early stage (at least in the first whorl). Incomplete pillars develop in the later stage, and complete pillars appear rarely in the last stage. The incomplete pillar development can be seen in earlier whorls (e.g., in the second whorl, Fig. 7.5, 7.9) in low-conical specimens compared to typical elongate-conical forms. The canaliculate (or pseudokeriothecal) wall microstructure is not evident. Aperture consisting of an interiomarginal slit in the juvenile stage, which is covered by a cribrate apertural plate in the later stages (also called 'trematophore'), is distinct (Fig. 7.1, 7.5–7.7, 7.10). Proloculus spherical, followed by three chambers in a spiral coil (Fig. 7.4). We rarely observed in some sections that the triserial test then becomes biserial in the late ontogenic stage (Fig. 7.7).

These specimens are comparable to specimens of *Protochrysalidina elongata* illustrated by Luperto-Sinni (1999) from the Albian–lower Cenomanian of southern Italy and to specimens illustrated by Taslı and Solak (2019) from the late Albian of the Bey Dağları, Turkey. We checked the accuracy of the dimensions (given in mm) by measuring the illustrations in Luperto-Sinni (1999) and noticed that the dimensions in centimeters are accidentally given in millimeters, as well as small deviations in the measurements of the shell diameter. The typical and low-conical specimens are similar in morphology and size (even if somewhat larger, hmax. = 2.91 mm versus 2.6 mm and 2.3 mm, respectively) to specimens of Luperto-Sinni (1999) (h/d = 1.5–2) and Taslı and Solak (2019) (h/d = 1.6–2.25 of typical elongate-conical and 1–1.3 of low-conical forms). A specimen in Taslı and Solak (2019) (fig. 10/1) is interpreted as a microspheric form (height 2.3 mm, diameter 1.96 mm). Banner et al. (1991) described some specimens with complete and incomplete pillars from the Albian–Cenomanian of Iraq and Oman as "morphologically intermediate forms between *Praechrysalidina infracretacea* Luperto-Sinni, 1979a and *Chrysalidina gradata* d'Orbigny, 1839" (Banner et al., 1991, p. 110, 112, figs. 9, 12, 16, high-conical) and as "morphologically intermediate forms between *Praechrysalidina infracretacea* and *Dukhania conica* Henson, 1948" (Banner et al, 1991, p. 110, 112, figs. 13, 14, low-conical), which are similar to the Geyik Dağı specimens.

Protochrysalidina elongata is distinguished from *Praechrysalidina infracretacea*, which can be found in a similar stratigraphic position (Albian), by its incomplete pillars in the adult stage and complete pillars in the final stage. *Chrysalidina gradata*, which is well known from the Cenomanian (e.g., De Castro, 1981, 1985; Banner et al., 1991) differs by its stratigraphical position, its developed endoskeleton, and its higher and larger test. De Castro (1981) stated that the height and diameter of *Chrysalidina gradata* specimens from Ile Madame (France) are between 2.4 and 4.5 mm; a limited number of specimens exceed 3.8 mm and 1.55–2.35 mm, respectively. De Castro (1981) also noted that a specimen figured by Neumann (1967) from Audignon (France) was 5 mm in height and the type specimen of Cushman (1937) was 7 mm in height and 3 mm in diameter. The biseriality observed in sections of some specimens resembles *Dukhania conica* Henson, 1948, but it has a more inflated and low-conical test (not elongate and high-conical), and better-developed pillars. *Dukhania arabica* Henson, 1948 differs from *Protochrysalidina elongata* by its labyrinthic area.

Class Tubothalamea Pawlowski et al., 2013
Order Miliolida Delage and Hérouard, 1896
Suborder Miliolina Delage and Hérouard, 1896
Superfamily Milioloidea Ehrenberg, 1839
Family Hauerinidae Schwager, 1876
Genus *Pseudonummoloculina* Calvez, 1988

Type species.—*Pseudonummoloculina aurigerica* Calvez, 1988, p. 393, pl. 1, figs. 1–18, central Pyrenees, France.

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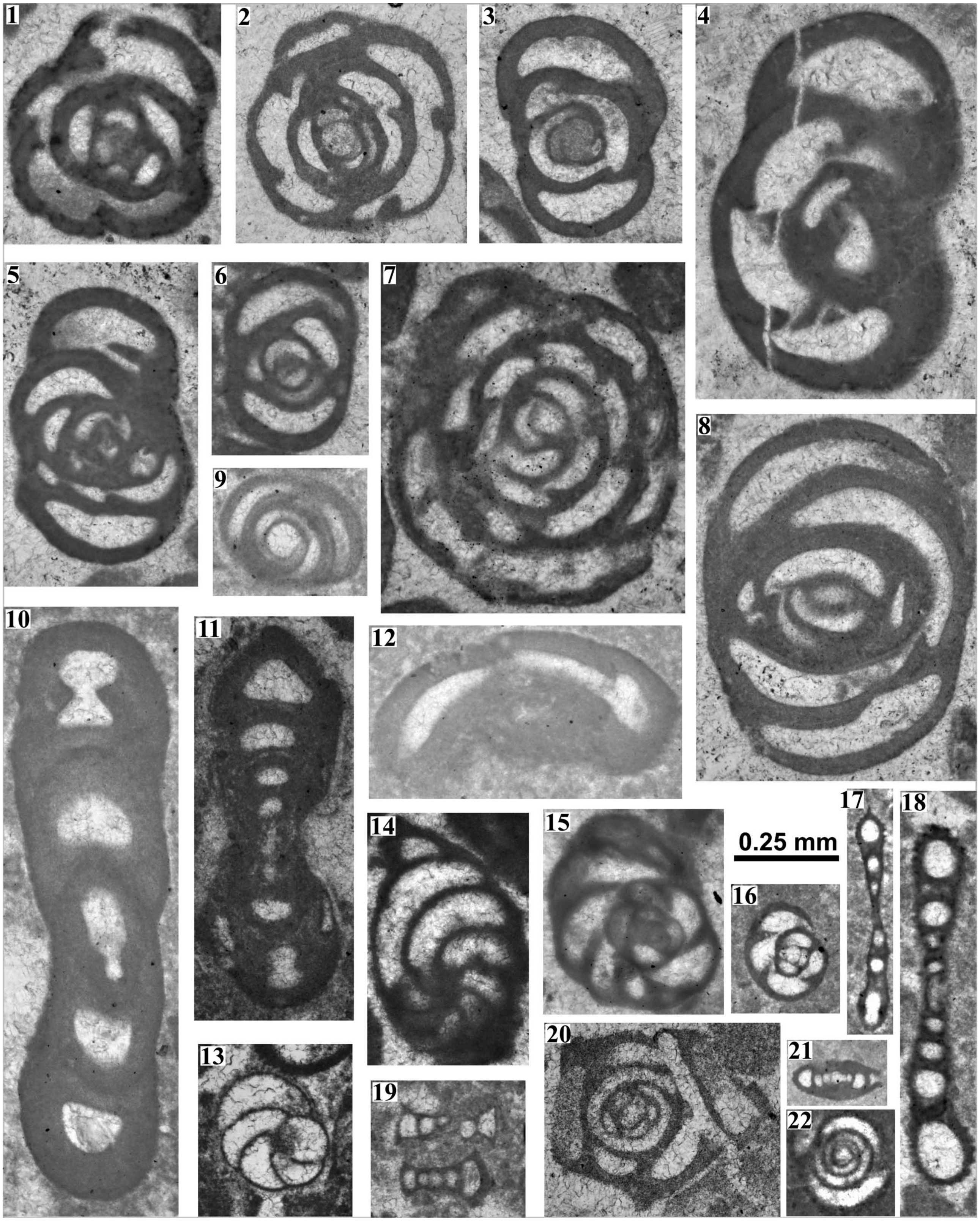

Figure 8. Miliolid foraminifera from the Albian platform limestones, Geyik Dağı area. (**1–6**) *Pseudonummoloculina aurigerica* Calvez, 1988: (**1, 2**) equatorial sections (A9/1, A9/1), (**3**) oblique subaxial section (A9/1), (**4, 5**) oblique subequatorial sections (A9/1, A9/1), (**6**) axial section (A9/2). (**7, 8**) *Pseudonummoloculina heimi* (Bonet, 1956), equatorial and axial sections (A9/2, A9/1). (**9–12**) *Paleocornuloculina* sp.: (**9**) equatorial section showing the early cornuspirine stage (A30/1), (**10, 11**) subaxial sections (A30/1, A30/1), (**12**) tangential section oblique to the equatorial plane showing long and narrow chambers in the adult stage (A30/1). (**13, 14**) *Peneroplis* sp., subequatorial sections (A19/13, A27/1). (**15, 16**) *Scandonea* cf. *S. pumila* Saint-Marc, 1974, equatorial sections (A9/3, A16/1). (**17, 18**) Cornuspiridae (cf. *Fischerina*? *carinata*), axial sections (A14/1, A8/1). (**19**) *Spiroloculina* sp., axial sections (A30/1). (**20**) Miliolidae, section perpendicular to the apertural axis (A9/3). (**21, 22**) *Vidalina* sp.: (**21**) axial section (A16/1), (**22**) equatorial section (A16/2).

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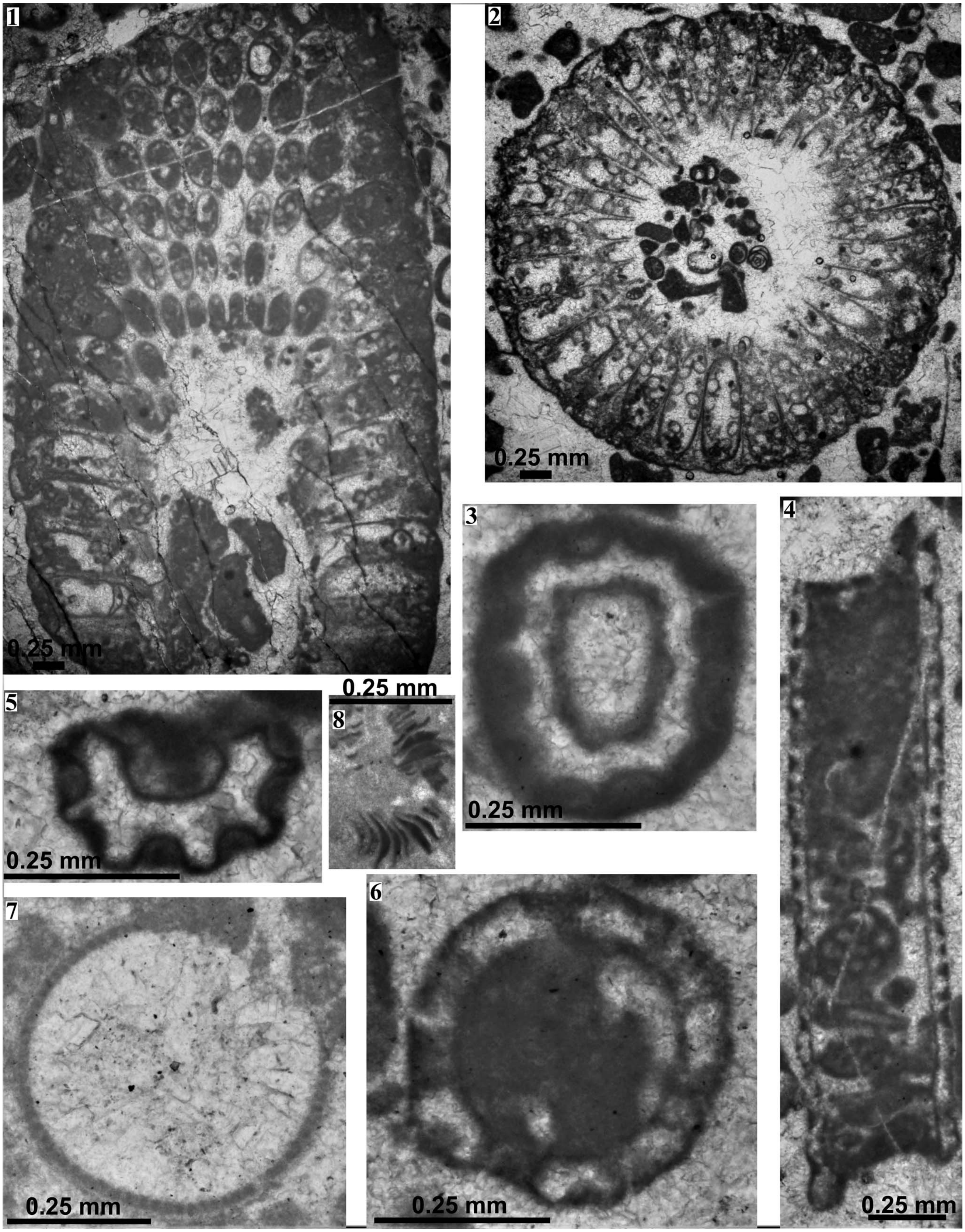

Figure 9. (**1–6, 8**) Dasycladalean algae and (**7**) incertae sedis from the Albian platform limestones, Geyik Dağı area. (**1, 2**) *Triploporella* cf. *T. marsicana* (Praturlon, 1964) in Chiocchini et al. (2012) (A19/3, A19/2), (**3–6**) (A19/6, A19/y5, A19/1, A19/y1), (**8**) *Gahkumella huberi* Zaninetti, 1978 (=*Cretacicladus minervini* Luperto-Sinni, 1979b) (A31); (**7**) incertae sedis *Thaumatoporella* sp. (A8/1).

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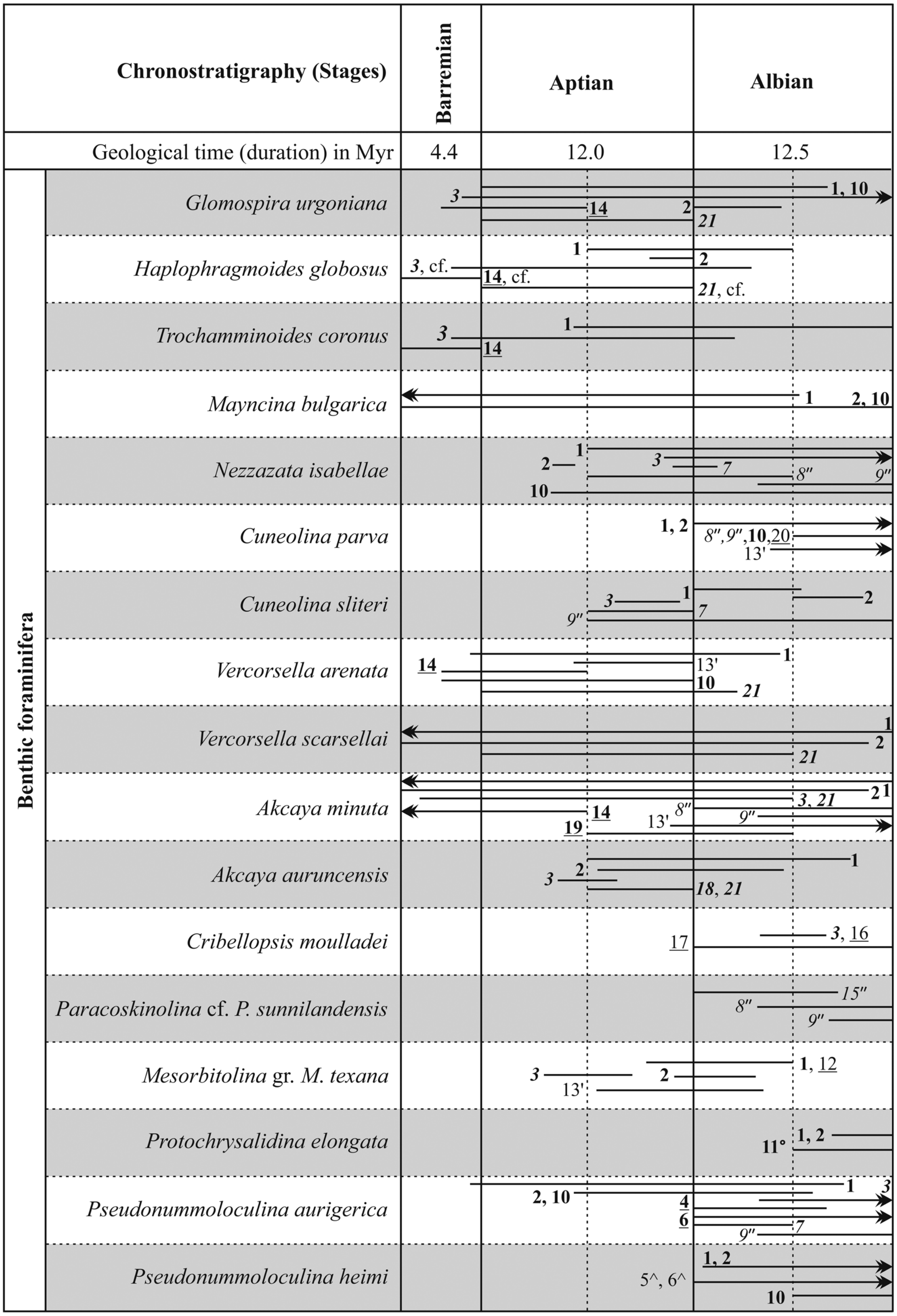

Adriatic Platform (**1, 2, 10**), Apennine Platform (***3, 7, 18, 21***); Spain and French Pyrenees (**4, 14, 19**); Mexico (5^, 6^); Central America (*8″, 9″, 15″*); Tauride Platform (**11°**); Arabian Platform (12, 16, 17, 20); Tibetan Plateau (13').

Figure 10. Stratigraphic distribution of some Early Cretaceous benthic foraminifera examined in this paper, from the literature. References: (**1**) Velić, 2007; (**2**) Husinec et al., 2009; (**3**) Chiocchini et al., 2012; (**4**) Calvez, 1988; (**5**) Conkin and Conkin, 1958; (**6**) Hottinger et al., 1989; (**7**) Mancinelli and Chiocchini, 2006; (**8**) Arnaud-Vanneau and Sliter, 1995; (**9**) Arnaud-Vanneau and Premoli Silva, 1995; (**10**) Cvetko Tešović et al., 2011; (**11**) Taslı and Solak, 2019; (**12**) Schroeder et al., 2010; (**13**) BouDagher-Fadel et al., 2017; (**14**) Arnaud-Vanneau, 1980; (**15**) Maync, 1955; (**16**) Saint-Marc, 1974; (**17**) Schlagintweit, 2020; (**18**) Chiocchini, 1984; (**19**) Hofker, 1965; (**20**) Henson, 1948; (**21**) Chiocchini et al., 1984. The geologic time duration in Myr is after Walker et al. (2018).

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Remarks.—Loeblich and Tappan (1988) included *Pseudonummoloculina* in foraminiferal genera of uncertain status.

Pseudonummoloculina aurigerica Calvez, 1988
Figure 8.1–8.6

1988 *Pseudonummoloculina aurigerica* Calvez, p. 393, pl. 1, figs. 1–18.
2006 *Pseudonummoloculina aurigerica*; Mancinelli and Chiocchini, p. 100, pl. 6, figs. 8–15.
2012 *Pseudonummoloculina aurigerica*; Chiocchini et al., pl. 68, figs. 2–9.

Holotype.—Oblique subaxial section (CLP 3) from the Cluse de Pereille, Pech de Foix, Central Pyrenees, France (Calvez, 1988, pl. l, fig. 5).

Remarks.—The genus *Pseudonummoloculina* was distinguished from the genus *Nummoloculina* Steinmann, 1881, with the type species *N. contraria* (d'Orbigny, 1846) from the Miocene of the Vienna Basin, by a slit-like aperture bordered by a series of notches (Calvez, 1988). Based on this structural difference between the two genera, the widespread Cretaceous species *Nummoloculina heimi* Bonet, 1956, with a clear notched aperture (De Castro, 1987; Hottinger et al., 1989), was transferred to *Pseodonummoloculina*. Piuz and Vicedo (2020) reviewed the other Cretaceous species of "nummoloculinas." We could not observe the notched aperture due to the lack of available sections, however our specimens correspond to those of the type species (Calvez, 1988) in terms of the diameters and shape of the test, and the disposition and number of chambers per whorl.

Discussion and biostratigraphic remarks

In addition to the foraminiferal taxa discussed above (Figs. 3–8), the Albian platform limestones of the Geyik Dağı area contain *Haplophragmoides globosus* Lozo, 1944 (Fig. 4.1–4.7); *Trochamminoides coronus* Loeblich and Tappan, 1946, (Fig. 4.8–4.13); *Phenacophragma oezeri* Solak and Taslı, 2020 (Fig. 4.14, 4.15); *Mayncina bulgarica* Laug, Peybernès, and Rey, 1980 (Fig. 4.16, 4.26); *Reissella* sp. (Fig. 4.17–4.25); *Novalesia*? sp. (Fig. 5.24); *Glomospira urgoniana* (Fig. 7.11–7.14); *Pseudonummoloculina aurigerica* (Fig. 8.1–8.6); *Pseudonummoloculina heimi* (Bonet, 1956) (Fig. 8.7, 8.8); *Paleocornuloculina* sp. (Fig. 8.9–8.12); *Peneroplis* sp. (Fig. 8.13, 8.14); *Scandonea* cf. *S. pumila* Saint-Marc, 1974 (Fig. 8.15, 8.16); Cornuspiridae (cf. *Fischerina*? *carinata* Peybernès, 1984) (Fig. 8.17, 8.18); *Spiroloculina* sp. (Fig. 8.19); Miliolidae (Fig. 8.20); *Vidalina* sp. (Fig. 8.21, 8.22); *Nezzazata simplex* Omara, 1956; Dasycladalean algae (Fig. 9.1–9.6), including *Triploporella* cf. *T. marsicana* (Praturlon, 1964) (Fig. 9.1, 9.2); *Thaumatoporella* sp. (Fig. 9.7); and *Gahkumella huberi* Zaninetti, 1978 (=*Cretacicladus minervini* Luperto-Sinni, 1979b; e.g. Schlagintweit et al., 2015) (Fig. 9.8). As seen in Figure 10, most of the benthic foraminifera identified range down into the Barremian–Aptian. Nevertheless, there is a consensus that *Cuneolina parva* and *Pseudonummoloculina heimi* do not exist at levels older than the Albian.

Pseudonummoloculina aurigerica was first described from the Albian of the French and Spanish Pyrenees (Calvez, 1988). It was found in lower Albian of the Colle Santa Lucia succession (Mancinelli and Chiocchini, 2006), and in Albian (to lower Cenomanian) strata of the Monte Cairo area, Central Italy (Chiocchini et al., 2012). It appears to be restricted to Albian, except for the Adriatic Carbonate Platform (Fig. 10) and the Southern Tibetan Plateau (BouDagher-Fadel et al., 2017).

Protochrysalidina elongata was first described from the Albian–lower Cenomanian of southern Italy (Luperto-Sinni, 1999), and has been used as an index taxon for the latest Albian in the Adriatic Carbonate Platform (e.g., Velić, 2007; Husinec et al., 2009) and in the Bey Dağları Platform (Taslı and Solak, 2019; Solak et al., 2020). Nevertheless, it is not a widely accepted taxon, probably due to difficulties in distinction among the chrysalidinid taxa.

There are a few studies on benthic foraminiferal biostratigraphy of the Lower–middle Cretaceous platform successions in the Tauride Carbonate Platform. Altıner et al. (1999) described the K3 *Cuneolina* gr. *C. pavonia*-Miliolidae Zone, which is upper Aptian to Cenomanian, from the Seydişehir, Akseki, and Hadim areas (Central Taurides) (Fig. 1.2). The studied benthic foraminiferal assemblage contains few species in common with the *Protochrysalidina elongata*-*Cuneolina pavonia* assemblage zone, which was defined by Taslı and Solak (2019) from the upper Albian shallow-marine carbonate sequence of the Bey Dağları (Western Taurides) (e.g., *Protochrysalidina elongata*, *Nezzazata isabellae*, *Nezzazata simplex*, *Pseudonummoloculina heimi*, *Peneroplis* sp.). It can be correlated with the "*Valdanchella*" *dercourti* Taxon-Range Zone (Husinec and Sokač, 2006) and Microfossil Assemblage VI (Cvetko Tešović et al., 2011), described from the Adriatic Carbonate Platform and dated as late Albian. It fits well with the late Albian benthic foraminiferal assemblage of Husinec et al. (2009). An important exception is the absence of *Mesorbitolina texana* in the latter (Adriatic assemblages). Orbitolinid foraminifers are used for high-resolution biozonation of Early to mid-Cretaceous carbonate platform sediments (e.g., Simmons et al., 2000; Schroeder et al., 2010). Although mesorbitolinids are of variable abundance, they occur frequently through the Geyik Dağı Albian succession (Fig. 2). The last occurrence of *Mesorbitolina* gr. *M. texana* is 20 m below the first occurrence of *Sellialveolina viallii*, indicative of Cenomanian. The stratigraphic range of *Mesorbitolina* species is extended up to middle Albian in numerous works (e.g., Velić, 2007; Husinec et al., 2009; Schroeder et al., 2010), while an uppermost Aptian–upper Albian range of *Orbitolina* (*Mesorbitolina*) *texana* is given by Arnaud-Vanneau (1998). Consequently, the studied succession can be dated as late Albian based on the presence of *Protochrysalidina elongata* and on its stratigraphic position.

It seems that some taxa have not been reported previously from the Albian strata. *Triploporella* cf. *T. marsicana* (Fig. 9.1, 9.2) is a dasycladalean alga known from the lower Aptian (Arnaud-Vanneau, 1980; Chiocchini et al., 2012) or Barremian–lower Aptian (Husinec et al., 2009). If the taxon is confirmed, this will be its first record from younger strata. Some specimens (Fig. 8.17, 8.18) comparable with *Fischerina*? *carinata* have been described from the upper Albian of the Spanish Pyrenees (Peybernès, 1984), in association with *Mayncina bulgarica*.

Conclusions

Although intervening unfavorable microfacies (e.g., ostracod-miliolid wackestones and mudstones) are present, the Urgonian-type limestones of the Geyik Dağı area are rich in rudists and benthic foraminifera. In this paper, the following taxa are identified: *Nezzazata isabellae*, *Nezzazatinella* sp., *Cuneolina parva*, *Cuneolina sliteri*, *Vercorsella arenata*, *Vercorsella scarsellai*, *Akcaya minuta*, *Akcaya auruncensis*, *Cribellopsis moulladei*, *Paracoskinolina* cf. *P. sunnilandensis*, *Mesorbitolina* gr. *M. texana*, *Protochrysalidina elongata*, and *Pseudonummoloculina aurigerica*. Most of these taxa are commonly known from the Barremian–Albian of the peri-Mediterranean platforms. The recently described *Phenacophragma oezeri*, a mayncinid taxon, seems to be restricted to the Albian and may be stratigraphically important. A spirocyclinid (*Reissella* sp.) and an ?ophthalmiidid (*Paleocornuloculina* sp.) are unknown benthic foraminifera from the Albian strata and probably new species. The late Albian age is based on the co-occurrence mainly of *Protochrysalidina elongata*, and *Cuneolina parva*, *Cuneolina sliteri*, *Cribellopsis moulladei*, *Paracoskinolina* cf. *P. sunnilandensis*, *Pseudonummoloculina aurigerica*, and *Pseudonummoloculina heimi*.

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