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Anatoliacodium gen. nov. (Halimedaceae, Green algae) from the Ilerdian-Cuisian in the Eskişehir region (Western Central Turkey)

NAZIRE ÖZGEN ERDEM[1] and RAJKA RADOICIC[2]

[1]Cumhuriyet University, Department of Geological Engineering, 58140 Sivas, Turkey; nozgen@cumhuriyet.edu.tr
[2]Kralja Petra I 38, 11000 Beograd, Serbia; rradoicic@sezampro.yu

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Abstract: A new genus *Anatoliacodium* (Halimedaceae, Green algae) is described from the Ilerdian-Cuisian shallow-water sediments of Eskişehir region, central-western Turkey. These sequences consist of limestones, clayey limestones, sandy limestones and claystones. *Anatoliacodium* gen. nov. is characterized by erected calcareous segments with well differentiated inner structure: prevailing with large medulla of more or less densely set parallel filaments and cortical zone of prevailing horizontal to subhorizontal cortical filaments, once branching and without constriction. It is supposed that poorly and rarely preserved noncalcareous structures on the skeleton surface could be reproductive structures. The type species of the new genus is *Anatoliacodium xinanmui* gen. nov. sp. nov. A further new species is also described: *Anatoliacodium merici* gen. nov. sp. nov. Finally *Gymnocodium nummuliticum* Pfender, 1966 is emended and transferred to the genus *Anatoliacodium*.

Key words: Tertiary (Ilerdian–Cuisian), Turkey, Anatolia, new taxa (new genus and new species, emended species), green algae, Halimedaceae.

Introduction

The studied area is located southwest and southeast of Seyitgazi town which lays about 40 km to the south of Eskişehir city (western Turkey) (Fig. 1). Petrascheck (1963), Akıncı (1967), Özkaya (1976), Sunder (1980), Gözler et al. (1985), Kulaksız & Philips (1985), Özcan et al. (1989), Kibici (1990), Sarıiz (1990), Özgenç (1993), Çoban (1994), Dağ et al. (1994), Gençoğlu & İrkeç (1994), Kadoğlu (1994), Karakaş & Varol (1994), Kibici et al. (1994), Altunel & Barka (1998) have conducted various studies on the hydrogeology and industrial raw material potential in the vicinity of the study area.

Biostratigraphic studies in successions of the Ilerdian-Cuisian unit of the Eskişehir region focused on larger foraminifers, particularly Alveolinidae (Dizer 1964; Özgen Erdem et al. 2007). Numerous calcareous algae, which previously had not been studied, have been found in some of the analysed foraminiferal limestones. These algal materials, Bryopsidales and Dasycladales, are the subjects of our two-article study. In this paper representatives of the family Halimedacae (Bryopsidales) will be presented.

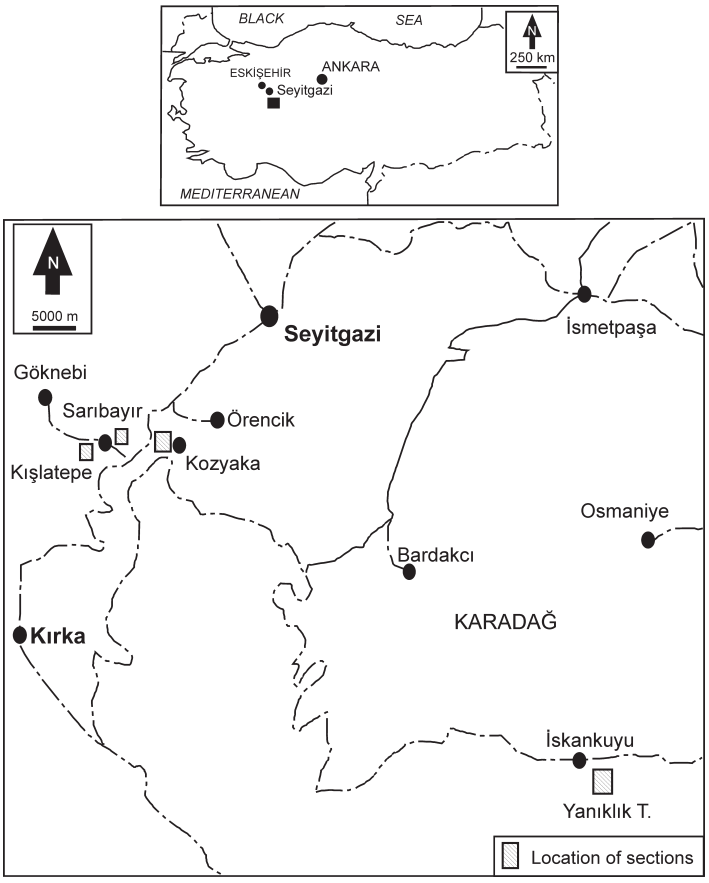

Fig. 1. Location map of the investigated area.

Geological setting

Location and stratigraphy

The studied area is situated on Anatolide-Tauridae Block, south of the İzmir — Ankara Suture Zone. This

region was named the Tavşanlı Zone by Okay (1986) and Kütahya-Bolkardağı Tectonic Belt by Özcan et al. (1989). The basement rocks consist of cherty-dolomitic limestones of Triassic–Cretaceous age. Upper Cretaceous-Lower Paleocene ophiolitic rocks overlie the basement unit tectonically (Özcan et al. 1989).

The ophiolite unit is unconformably overlain by a shallow water Ilerdian-Cuisian unit, which is also unconformably overlain by tuffite and lacustrial limestones of Late Miocene age. The Upper Miocene unit is followed by Lower Pliocene volcano-sediments and Upper Pliocene-Quaternary tuff, agglomerate, basalt and alluvium, respectively.

The Ilerdian-Cuisian unit and stratigraphic sections

The shallow water Ilerdian-Cuisian unit is largely distributed in the southern Eskişehir region, central Anatolia. It is observed as large and widespread outcrops to the southeast of Seyitgazi town and as small and scattered outcrops to the southwest. The unit is formed by limestones, sandy and clayey limestones and claystones. Characteristic components of this unit are foraminiferal and algal limestones with abundant larger foraminifers, particularly *Alveolina* assemblage (Özgen Erdem et al. 2007). In some levels algal flora is also found.

The present Halimedacean inventory is based mainly on limestones outcropping in the Yanıklık and Kozyaka sections. They are also found in the Kışlatepe and Sarıbayır sections (Fig. 1).

Yanıklık section, measured in northeast of Yanıklık hill which is situated southeast of Seyitgazi town (4 343 250 latitude, 318 400 longitude) is the type locality of *Anatoliacodium xinanmui* gen. nov. sp. nov. This section, on which only Early-Middle Ilerdian levels outcrop, is composed of limestones, sandy and marly limestones. The foraminiferal assemblage of the 22 m thick Early Ilerdian consists of *Idalina sinjarica* Grimsdale, *Glomalveolina karsica* Sirel, *G. lepidula* (Schwager), *A. ellipsoidalis* Schwager. The 30 m thick Middle Ilerdian is characterized by *G. lepidula* (Schwager), *A. moussoulensis* Hottinger, *Alveolina decipiens* Schwager and *Orbitolites complanatus* Lamarck. This section is rather poor in algal flora. The type level of *Anatoliacodium xinanmui* gen. nov. sp. nov. falls within the interval 24 to 27 meters. *A. xinanmui* gen. nov. sp. nov. is associated with *G. lepidula* (Schwager), *A. moussoulensis* Hottinger, *Alveolina decipiens* Schwager and *Orbitolites complanatus* Lamarck in its type level (Fig. 2).

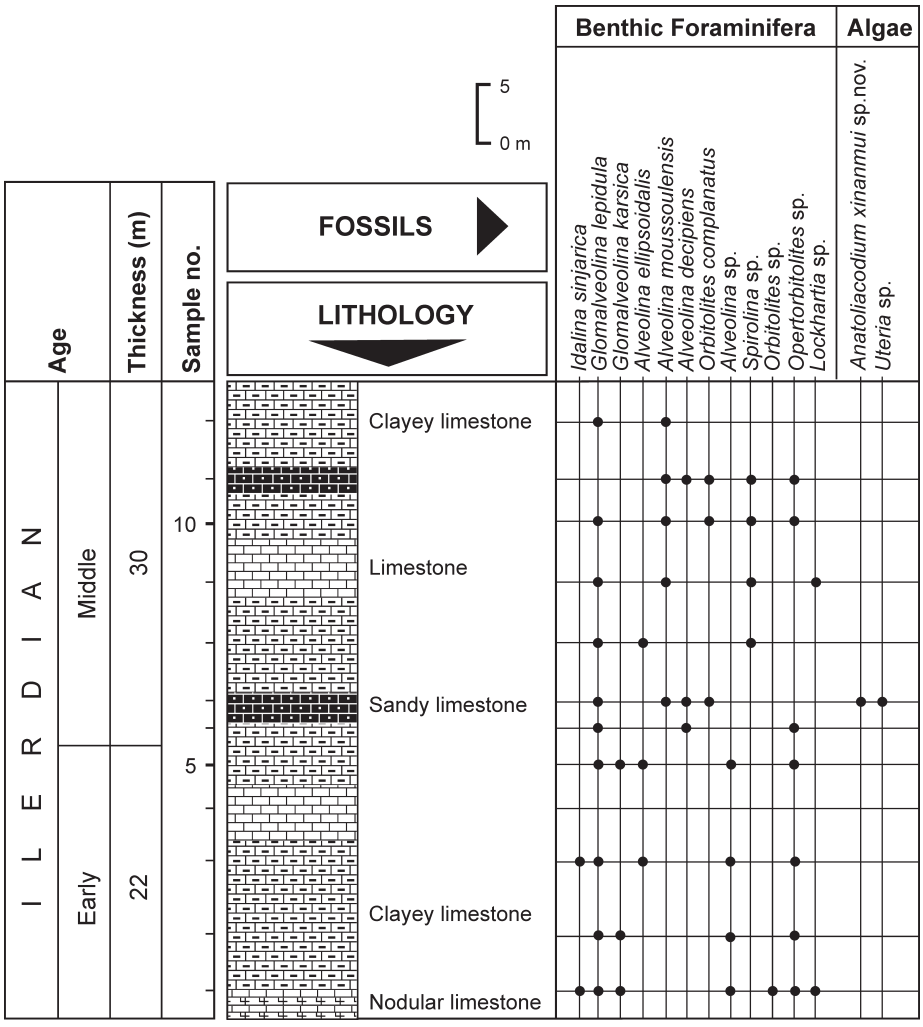

Fig. 2. Yanıklık measured section.

The Kozyaka section, measured 1 km west of Kozyaka village (4 360 900 latitude, 294 200 longitude), is the type locality of *Anatoliacodium merici* gen. nov. sp. nov. In this section, the Early-Late Ilerdian levels are 47 m thick and characterized by *Idalina sinjarica* Grimsdale, *Glomalveolina karsica* Sirel, *G. lepidula* (Schwager), *A. ellipsoidalis* Schwager, *A. moussoulensis* Hottinger, *A. minervensis* Hottinger, *A. laxa* Hottinger, *A. aragonensis* Hottinger. The Early Cuisian is 21 m thick and represented by *G. minutula* (Reichel), *A. canavarii* Checchia-Rispoli and *A. ruetimeyeri* Hottinger. *Anatoliacodium merici* gen. nov. sp. nov. is distributed, at places, through the Ilerdian and also the Early Cuisian levels (Fig. 3).

Material and methods

The algal materials, Bryopsidales and Dasycladales, are collected in four sections (Yanıklık, Kozyaka, Kışlatepe and Sarıbayır) and from some small outcrops of Ilerdian-Cuisian. The foraminiferal assem-

blages are studied on some 239 thin slides while algae were present only in 130 thin slides. N. Erdem (NE) collection is housed in the collection of the Cumhuriyet University, Department of Geological Engineering (Sivas-Turkey). Eight thin slides RR4301-4307 Rajka Radoicic collection from the Kışlatepe (sample K.8) and Sarıbayır (samples Sas. 1 and Sas. 15) sections are deposited in the Geological Institute in Beograd, Serbia.

All algae have been studied in thin sections. In all the Ilerdian-Cuisian limestones analysed, algae are a transported component; some of them are broken and poorly preserved. Therefore many sections remain unidentified.

Systematic paleontology

Order: **Bryopsidales**
Family: **Halimedaceae** Link, 1832

Three species of halimedacean algae, which are present in the Ilerdian-Lower Cuisian algal limestones of the Seyitgazi region, particularly attracted our attention: *Gymnocodium nummuliticum* Pfender and two others are introduced as new species. They all share the same structural characteristics, distinct from those of *Halimeda* genus, giving the reason to introduce the new genus:

Anatoliacodium gen. nov.

Type-species: *Anatoliacodium xinanmui* gen. nov. sp. nov.

Origin of name: Referring to Anatolia, central Turkey. The study area of Seyitgazi region is situated in the central-western part of Anatolia.

Diagnosis: The thallus is formed of erect calcareous segments: elongated cylindrical, stocky or irregular cylindrical, branched or non-branched. The well-differentiated inner segment structure consists of a usually large medulla and the cortical zone. The medulla is formed by more or less densely set parallel filaments; radial filaments of the cortical zone are at right or nearly at right angle, straight, with no constrictions. The organization of filaments in the cortical zone is characterized by single branched filaments. Each branch gives rise to tufts of 3–5 gradually enlarged distal filaments terminating on the skeleton

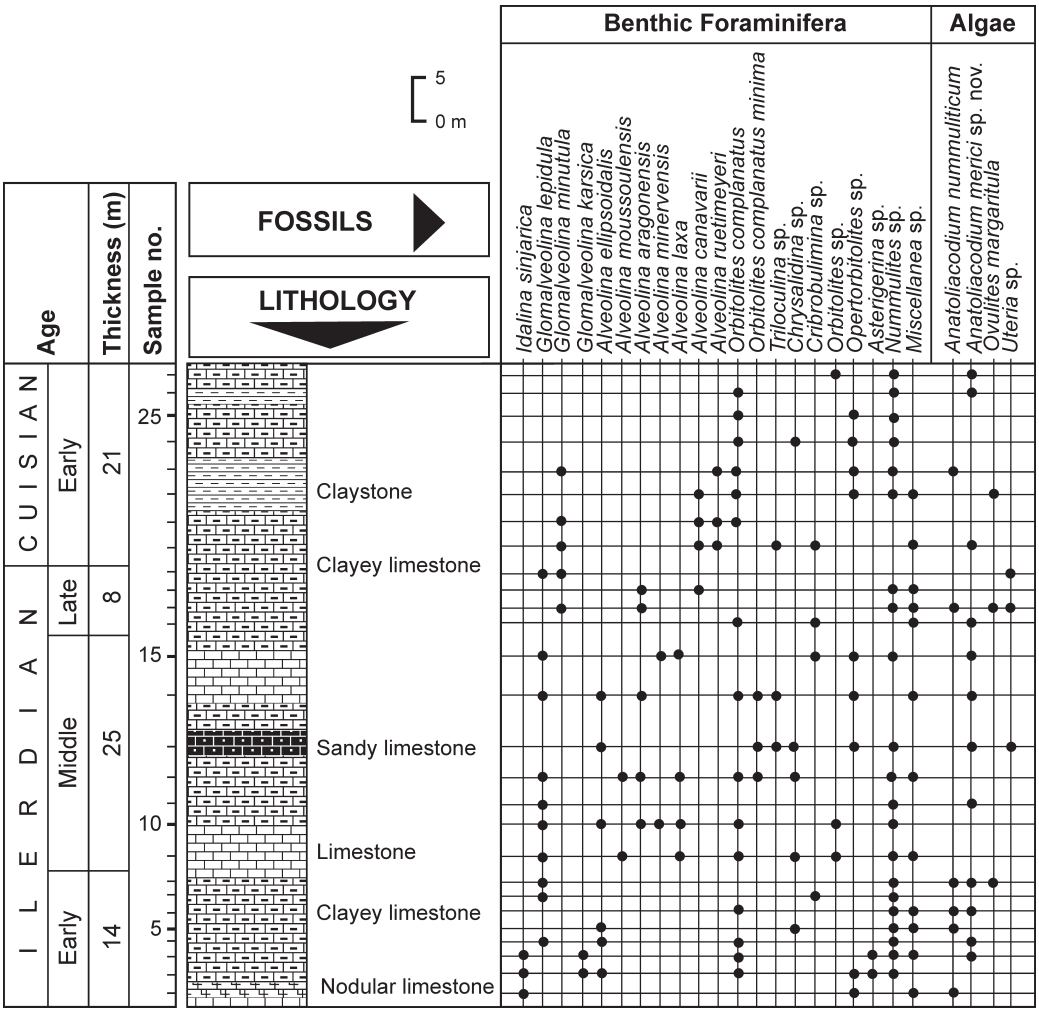

Fig. 3. Kozyaka measured section.

surface in a spherical-subspherical swelling. The uncalcified swellings (reproductive structures?) around the skeleton surface of fertile segments can be, in distinct circumstances, fossilized. The primary calcification of the cortical and the medulla zone can be equal or of different grade. The primary calcification of the medulla is generally weak or even lacking. It depends on the intrafilamentous space i.e. the density of filaments.

Relationships: The genus *Anatoliacodium* gen. nov. differs from the *Halimeda* genus by the inner organization of segments, having a medulla with slightly denser parallel filaments; having the cortical zone with once branching, straight, radial filaments, with no constrictions, gradually enlarged, terminating on the skeleton surface by the more or less pronounced swellings (reproductive structure?).

Discussion: External reproductive structures are not known in fossil *Halimedaceae*. According to Mu (1994, p. 149), they "*have no potential for fossilization*". The reproductive structures of recent species are outside of skeleton position. Late maturity and release stage are both short time processes. In some recent *Halimeda* species it occurs in 36 hours (Hillis 1994, p. 184) followed by the death of the plant. The question is under what circumstances can fossilization of these uncalcified reproductive structures occur?

In the studied Anatolian material we found a few specimens of *Anatoliacodium nummuliticum* bearing, around the skeleton, barely-discernible, uncalcified structures developed gradually from cortical filaments; they form extra-skeletal termination of the cortical filaments. These structures are different from the delicate external reproductive structures (gametangia) of recent Halimeda. The hypothesis of their reproductive function is based on data obtained from the specimens of *Anatoliacodium nummuliticum* illustrated on the part of Fig. 7.1 and 7.3 (gametangia?) and also from the same poorly preserved extra-skeletal structures in *Anatoliacodium xinanmui* gen. nov. sp. nov. (Fig. 8.7 and 8.8). An alternative hypothesis that they are vegetative structures should not be excluded. The available data call for further study.

The preservation of these uncalcified, extra-skeletal structures occurs as follows: the death of the plant as a result of abiotic factors during the brief late-maturity stage, just before the last reproductive structures were released, and favourable postmortem circumstances.

Anatoliacodium xinanmui gen. nov. sp. nov.
Fig. 4.1–4; Fig. 8.7–8

Origin of name: The species is dedicated to Prof. Dr. Xinan Mu, Nanjing Institute of Geology and Paleontology, Chinese Academy of Sciences, Nanjing, for his contribution to knowledge of algal flora, particularly Gymnocodiacean and Udoteacean algae.

Holotype: Transversal slightly-oblique section with numerous well-preserved, densely-set medullary filaments shown in Fig. 4.2, thin slide: NEA7a (sample A7), Nazire Erdem collection, deposited at the Department of Geological Engineering, Cumhuriyet University, Sivas, Turkey.

Isotypes: Longitudinal oblique section shown in Fig. 4.1 and some fragments in the same thin slide.

Type locality and age: Yanıklık hill section, southeast of Seyitgazi, Middle Ilerdian.

Diagnosis: Large calcareous, elongated, cylindrical segments up to 1.5–2 mm in diameter and more than 4.25 mm long, with large medulla and relatively thin cortical zone (d/D to 0.69 %). 100 to 120 densely set parallel medullary filaments, 0.05 mm in diameter, were not primarily calcified. Radial cortical filaments horizontal, straight and distally slightly enlarged, terminating outside the skeleton in swellings approximately 0.045 mm in diameter.

Remarks: In transversal sections of relatively well preserved segments, the medulla zone usually occurs as densely set micrite pores. The minimal intrafilamentous space in the longitudinal sections occurs as thin discontinuous calcite lines. Swellings on the skeleton surface rarely preserved (Fig. 8.7 and 8.8).

Relationships: This is the *Anatoliacodium* gen. nov. with the largest segments consisting of a massive medulla zone with numerous filaments approximately twice the number observed in *Anatoliacodium merici* gen. nov. sp. nov.

Distribution: *Anatoliacodium xinanmui* gen. nov. sp. nov. is also present in the Ilerdian-Middle Cuisian limestones in the Kışlatepe and Sarıbayır sections (Fig. 4.3 and 4.4).

Anatoliacodium merici gen. nov. sp. nov.
Fig. 5.1–7; Fig. 8.1–3

1989 *Halimeda nana* Pia — Kuss & Leppig, fig. 2d, non b, p. 322

Origin of name: This species is dedicated to Prof. Dr. Engin Meriç, for his contribution to micropaleontological research.

Holotype: The subaxial-oblique section of the segment shown in Fig. 5.1, thin slide NES4a (sample S.4), Nazire Erdem collection deposited at the Department of Geological Engineering, Cumhuriyet University in Sivas.

Isotypes: Specimens from the same thin slide, one of them illustrated in Fig. 6.3.

Type locality and age: Kozyaka section, 1 km west of Kozyaka village, Seyitgazi region, western Anatolia, Turkey, Early Ilerdian.

Diagnosis: Stocky subcylindrical calcareous segments, 0.710–1.2 mm in diameter. Internal structure clearly differentiated into large medulla and cortex zone (d/D 0.57 % to 0.62 %); 40 to 60 poorly calcified parallel medullary filaments 0.045–0.055 mm in diameter give rise to straight lateral filaments, horizontal-subhorizontal in the middle part of the segment, slightly oblique at the ends. Short proximal filaments of the cortical zone ramified into tufts of four or five distal filaments. Gradually enlarged distal filaments terminate with swelling which, on the skeleton surface, leave open pores 0.22–0.33 mm in diameter.

Description: In the studied material only isolated segments are found, some relatively well preserved. Even, in cases when the internal structure of segments is not completely obliterated by recrystallization, or slightly obliterated, it is possible to distinguish two zones — the large medulla and the cortical zone. In the tangential cut of the lower part of the segment in Fig. 5.1 (holotype) the tufts with

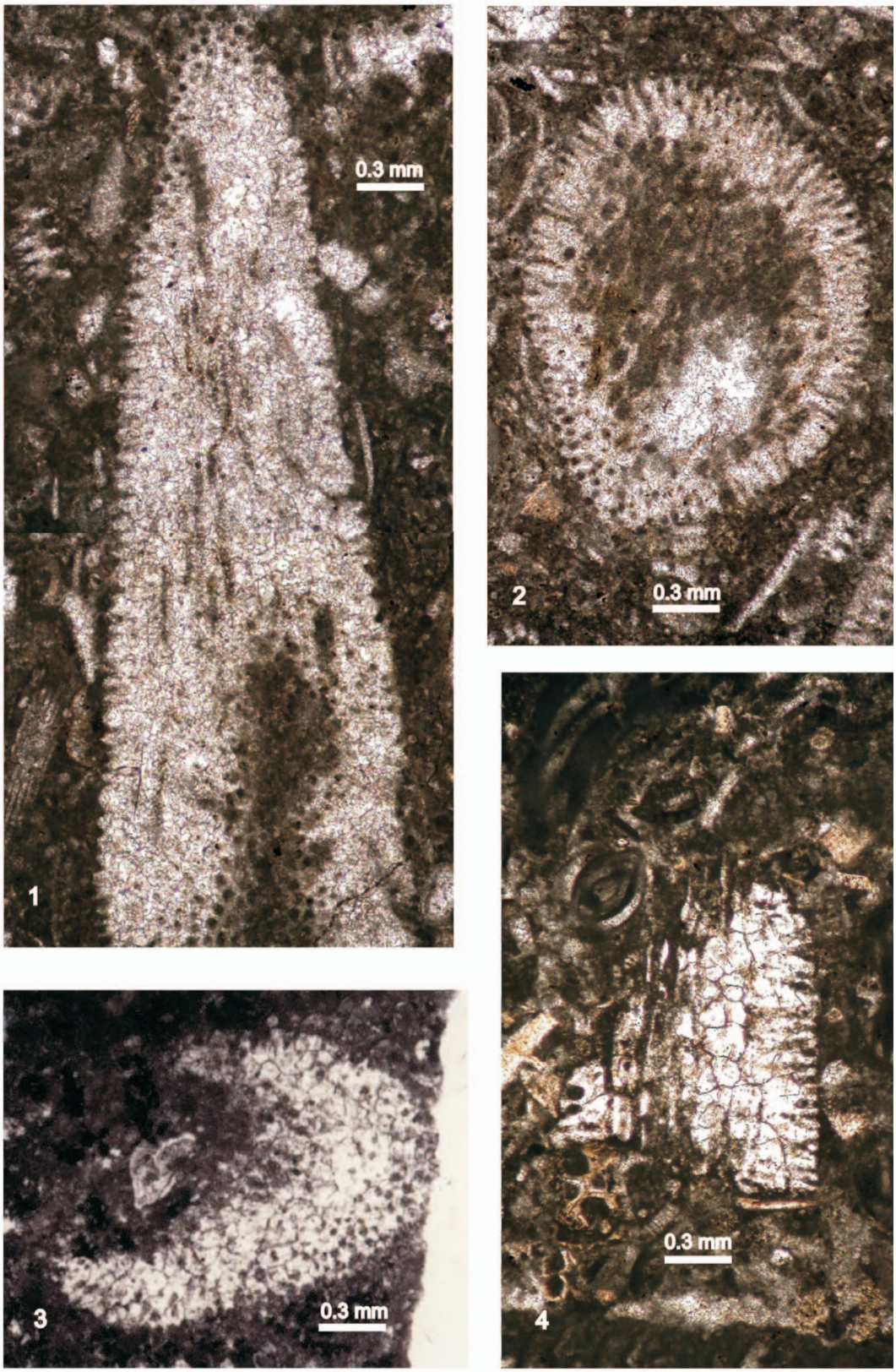

Fig. 4. *Anatoliacodium xinanmui* gen. nov. sp. nov. **1** — Longitudinal-oblique section, isotype. Although partly obliterated by recrystallization the large medulla and relatively thin cortical zone are distinguished, thin slide NEA7a (sample A.7), Yanıklık hill section. **2** — Holotype, slightly oblique transversal section showing the large medulla with densely set numerous filaments and relatively thin cortical zone, thin slide NEA7a (sample A.7), Yanıklık hill section. **3** — Oblique section, fragment, thin slide NEK12 (sample K.12), Kışlatepe section. **4** — Fragment of the longitudinal-tangential section, thin slide NESAS1a (sample Sas. 1), Sarıbayır section.

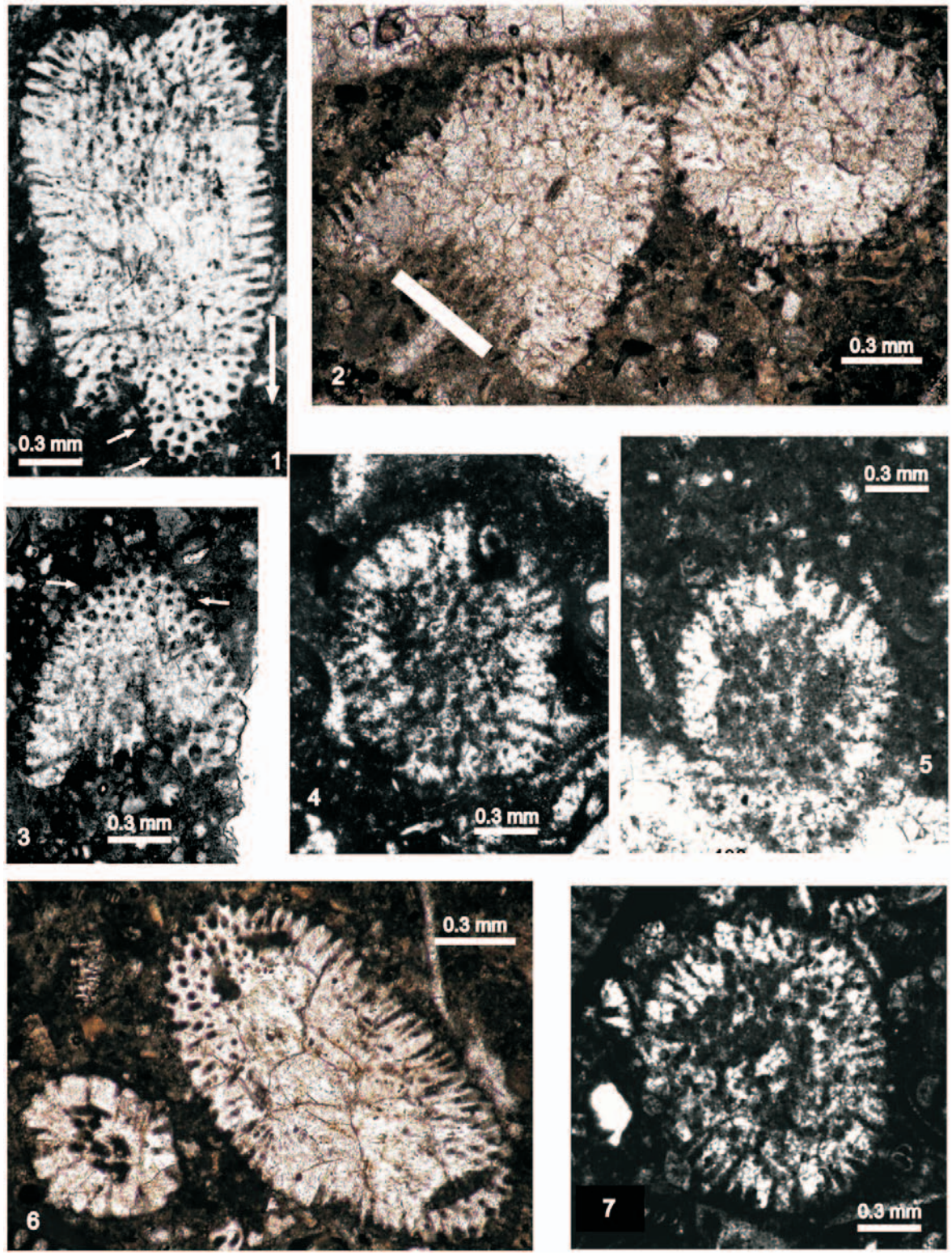

Fig. 5. *Anatoliacodium merici* gen. nov. sp. nov. **1** — Holotype, subaxial-oblique section of the slightly recrystallized segment showing well differentiated medulla and cortical zone. In the tangentially cut part of skeleton (lower part of the figure) tufts of four and five cortical filaments are visible (arrows) and gradually enlarged filaments: from deeper to shallower tangential section (long arrow), thin slide NES8a (sample S.8), Kozyaka section. **2** — Oblique section (left) not completely obliterated by recrystallization and (right) the recrystallized transversal section, thin slide NES4a (sample S.4), Kozyaka section. **3** — Tangential section, arrows: branching of cortical filaments, thin slide RR4302 (sample K.8), Kışlatepe section. **4, 5, 7** — Slightly oblique transversal sections, fig. 5.4 and 5.7: thin slide RR4302 (samples K.8), fig. 5.5: thin slide K13/2 (sample K.13), Kışlatepe section. **6** — Tangential section, branching of cortical filaments and (left) *Anatoliacodium nummuliticum* (= Pl. 1, fig. 2), thin slide NES8a (sample S.8), Kozyaka section.

four and five distal filaments are visible (arrows). Gradual enlargement of distal filaments (pores) is also evident (long arrow, on the right), from deep toward the shallow tangential section.

Distribution of *Anatoliacodium merici* gen. nov. sp. nov. in the Kozyaka section is given in Fig. 3. The species is also present in sediments of the same age in the Kışlatepe section.

Anatoliacodium nummuliticum (Pfender, 1966), comb. nov., emend
Fig. 6.1–8; Fig. 7.1–4

1966 *Gymnocodium nummuliticum* Pfender — Pfender & Massieux, p. 119–121, pl. 4, figs. 1–5, pl. 5, figs. 1, 11, non pl. 4, figs. 6, 7

The species was introduced by Pfender (in Pfender & Massieux 1966) from the Lower Lutetian of Gebel Galala Northern Egypt, as "*forme peu près cylindrique, massive, ne présentant jamais d'étranglement d'article in connection*". The resemblance of the new species to Permian *Gymnocodium bellerofontis* was particularly emphasized. The attribution of these fossils to the genus *Gymnocodium* was not accepted by Massieux (1966b, p. 144). Massieux supposed that *G. nummuliticum* is a poorly preserved example of *Halimeda*. Roux & Deloffre (1990, p. 125), discussing the same matter, considered that "*il n'y a pas, actuellement, de Gymnocodiaceae observées dans le Tertiaire*".

Gymnocodium nummuliticum was not typified by Pfender (1966) or by Massieux (1966b). On this occasion, we propose to lectotype the section in pl. 5, fig. 1 belonging to the collection Cuvillier, housed in the Laboratoire de Micropaléontologie, Université Pierre et Marie Curie, Paris.

Kuss & Lieppig (1989, p. 317) have identified some strongly recrystallized individuals in the "Furcoporella facies" from the Upper Paleocene–Lower Eocene of the Galala Formation in the Eastern Desert of Egypt, as "individuals previously described as *Gymnocodium nummuliticum*". Therefore, this species was transferred in Dasycladales as junior synonym of *Furcoporella duplicata*. Recrystallized individuals of the "Furcoporella facies" are most probably *Furcoporella*.

The species is illustrated in Pfender & Massieux (1966) on pl. 4, figs. 1–7, and on pl. 5, figs. 1 and 11. The specimen in pl. 4, fig. 7 is not the same taxon. This is the longitudinal-oblique section of a fairly recrystallized dasycladalean article, probably of a sterile Cymopolia article. As for figs. 3 and 6, the affiliation to *Anatoliacodium nummuliticum* is dubious.

Original material presented by Pfender and Massieux (Collection Cuvillier) is more or less recrystallized. The internal structure is fairly obliterated throughout, although it is possible to identify two zones, the medullary and cortical. The medullary pores are visible on the specimen in pl. 4, fig. 5 (transversal section, fragment). The section in pl. 5, fig. 1 is a transversal section through the basal parts of two segments — just through the bifurcation area before the medulla division. The Anatolian material is better preserved. The sections in Fig. 6.1 and 6.3, through the basal part of the branching, showing well preserved medullary pores, correspond entirely to those of the original material selected as lectotype.

Diagnosis: The thallus consists of cylindrical, non-branching, dichotomously (common) or trichotomously branched segments with well-differentiated medulla and cortex. In transversal sections, the segments have a circular or irregular-subcircular form. Segment diameter is 0.52–0.62 mm on average, the smallest segments, representing youngest stages, are 0.45 mm in diameter; the largest segments, seemingly belonging to the basal part of the thallus, are up to 0.77 mm. 12–25 medullary filaments (d = 0.20–0.45 mm) are parallel to each other as well as to the segment axis. Filaments of the cortical zone not numerous, three or four in a tuft, subhorizontal to slightly oblique, flaring out gradually and ending with a swelling on the skeleton is outer surface.

The biometric value of the Anatolian material shows good accordance with the Egyptian specimens given by Pfender (in Pfender & Massieux 1966).

Reproductive structures?

The uncommon swelling on the transversal section in Fig. 7.1 (d = 0.012 mm; arrow), different from the other extra-skeletal structures of the same section, is probably not part of this alga. Swellings around this skeleton in the lower part of the figure are barely discernible (in some of them a few "*grains*" are present). The same structures are also preserved around the skeleton in Fig. 7.3 (arrow).

Pervaded entirely by cyanobacteria, the recrystallized skeleton in Fig. 7.2 is in an advanced stage of disintegration. The presence of the same poorly preserved structures around this skeleton cannot be neglected, especially those on the right part of the figure.

Distribution: In the Kozyaka section *Anatoliacodium nummuliticum* is present in the interval of 8–68 meters (between S4 and S27 samples), described as Ilerdian-Early Cuisian (Fig. 3). It is not frequent, occurring predominantly as segment fragments. The observed longest skeleton is 2.8 mm (two connected recrystallized long fragments). The algal association consists of *Anatoliacodium merici* gen. nov. sp. nov., other Halimedacean algae and different dasycladales, predominantly species of the genus *Belzungia*. In the Sarıbayır and the Kışlatepe sections, *Anatoliacodium nummuliticum* occurs in the sediments of the same age.

Remarks: Elliott (1972, p. 359) in a discussion on *Dimophosiphon* Høeg, 1927 writes: "The striking resemblance between the Ordovician *Dimorphosiphon* and the later *Halimeda* (Cretaceous–Recent) was discussed by Høeg in his original description (Høeg 1927) and has been noted by all subsequent researchers (e.g. Johnson 1961). The long straight coarse medullary threads and divergent finer lateral threads of the Ordovician genus are surprisingly reminiscent to those of the more familiar and widely-distributed *Halimeda*". Subsequently, Elliott explains the important points of differences between two genera.

Halimeda? sp.
Fig. 8.4–6

A few stick-like segments, partly obliterated by recrystallization, found in the Sarıbayır and Kışlatepe section, de-

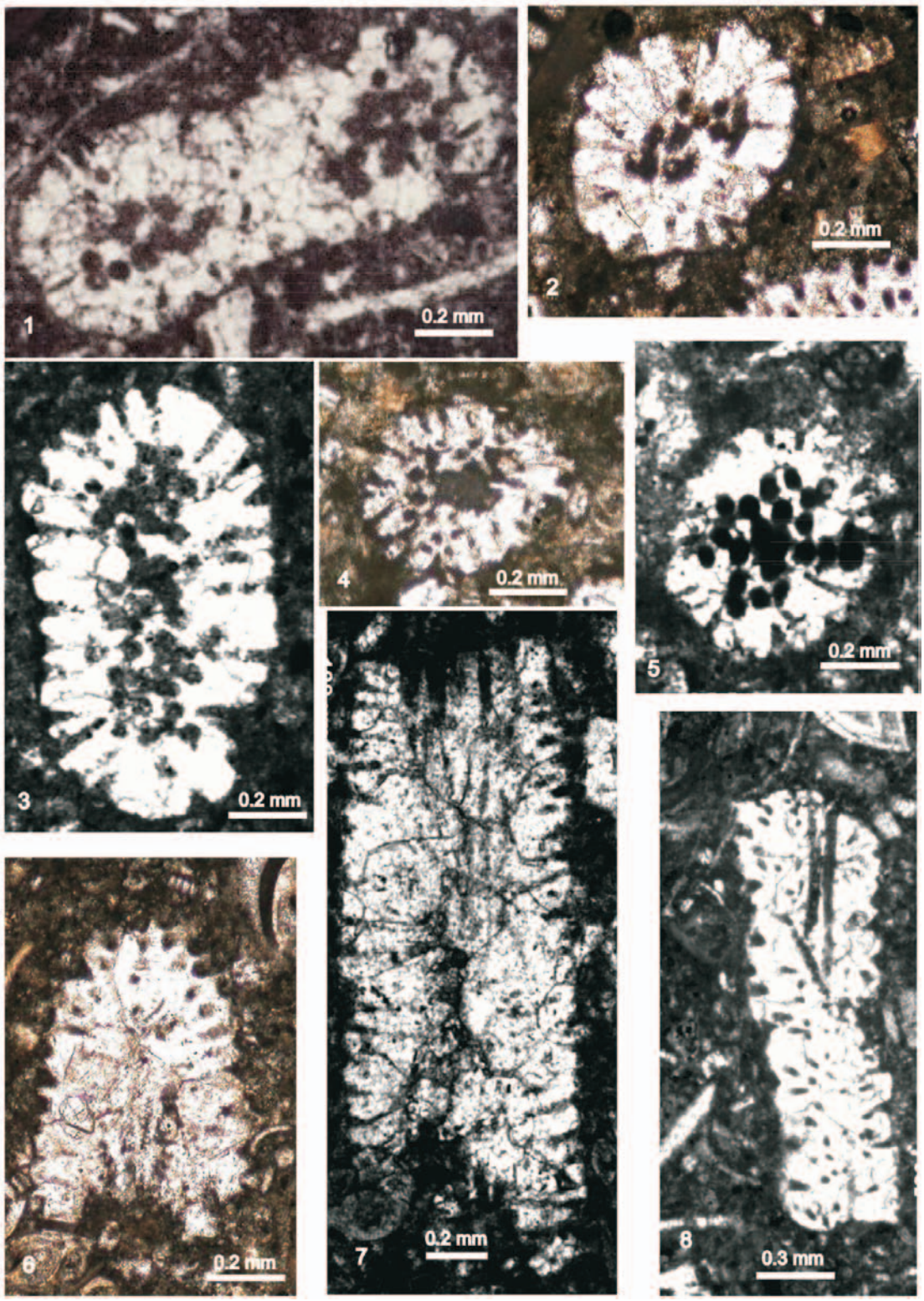

Fig. 6. *Anatoliacodium nummuliticum* (Pfender, 1966, in Pfender & Massieux 1966) emend. **1** — Transversal section through the lower part of dichotomous branching, thin slide NES23a (sample S.23), Kozyaka section. **2** — Slightly oblique section, thin slide NES8a (sample S.8), Kozyaka section. **3** — Transversal section through the initial stage of branching: the beginning of the medulla separation in three groups of filaments, thin slide NEK8a (sample K.8), Kışlatepe section. **4, 5** — Slightly oblique and transversal sections, thin slide NES6a, NES1a (samples S.6 and S.1), Kozyaka section. **6** — Oblique section of the topmost (?) thallus segment, thin slide NET4y (sample T.4), Sarıbayır section. **7** — Longitudinal section, the structure of the skeleton partly obliterated by recrystallization (segment of the lower part of thallus?), thin slide NESAS1a (sample Sas.1), Sarıbayır section. **8** — Tangential oblique section of the slightly fractured skeleton, thin slide NESAS18a (sample Sas.18), Sarıbayır section.

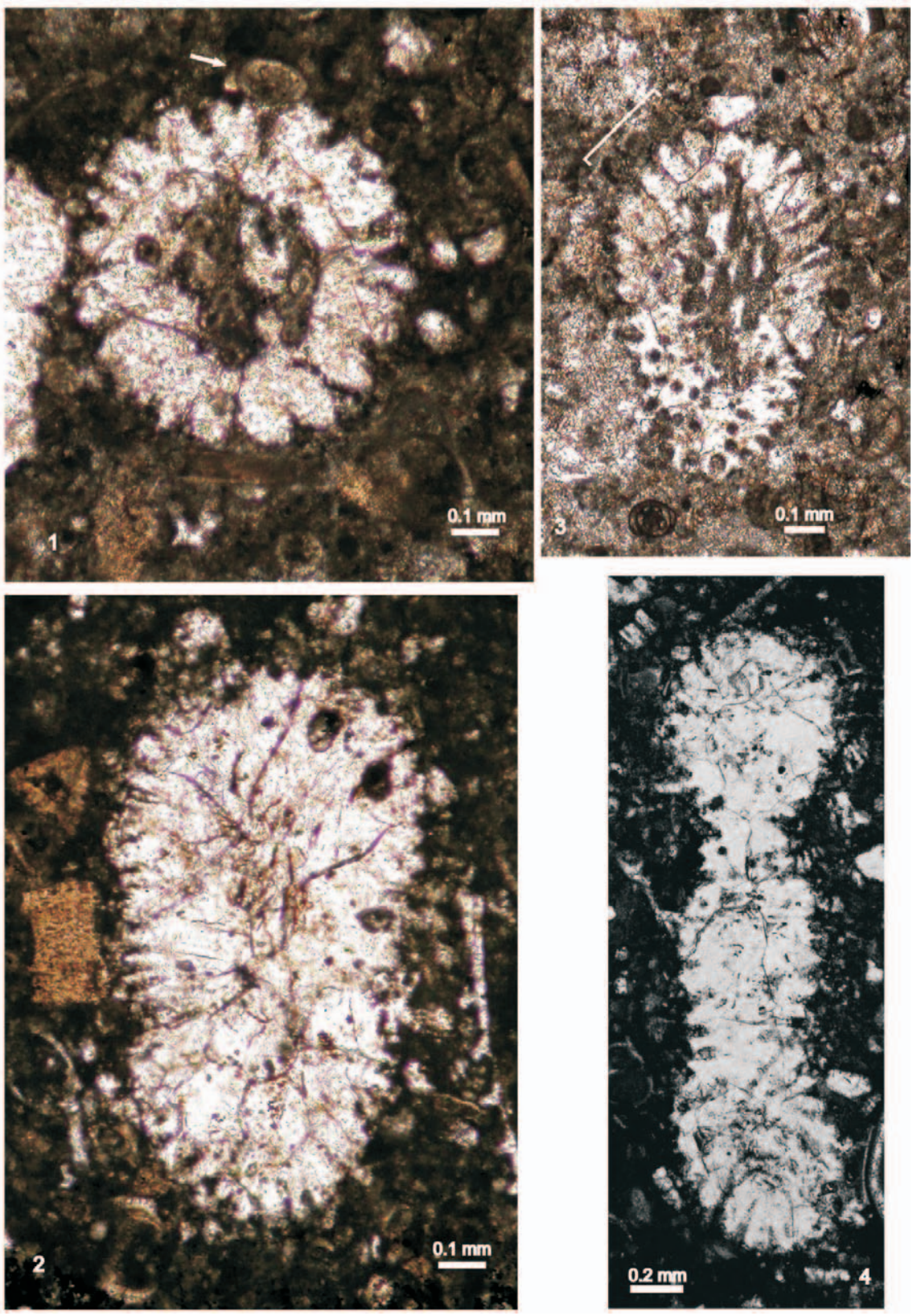

Fig. 7. *Anatoliacodium nummuliticum* (Pfender, 1966) in Pfender & Massieux (1966), emend. **1** — Transversal section, arrow: reproductive structures? Thin slide NET4e (sample T.4), Sarıbayır section. **2** — Oblique section of the recrystallized skeleton in advanced stage of disintegration. Note: barely discernible structures (reproductive structures?) around the skeleton, thin slide NESAS15a (sample Sas.15), Sarıbayır section. **3** — Oblique section, arrow: reproductive structure? Thin slide NET4f (sample T.4), Sarıbayır section. **4** — Transversal section through the recrystallized skeleton of trichotomous branching, thin slide NEK8a (sample K8), Kışlatepe section.

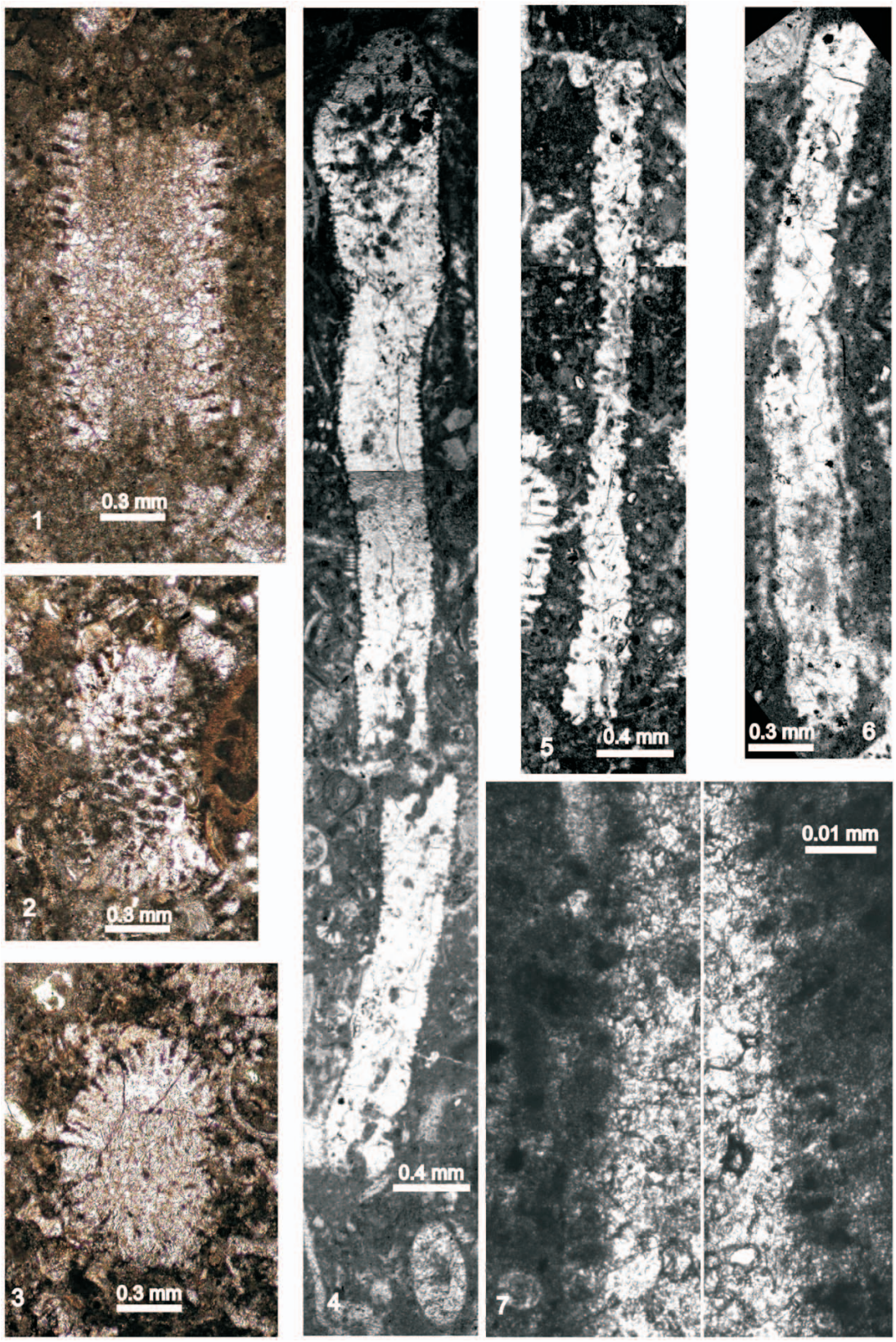

Fig. 8. 1–3 — *Anatoliacodium merici* gen. nov. sp. nov. 1 — Slightly oblique subaxial section, thin slide NES20a (sample S.20), Kozyaka section. 2 — Transversal section, the fragment, NES15a (sample S.15), Kozyaka section. 3 — Deformed transversal section, thin slide NES6a (sample S.6), Kozyaka section. **4–6** — *Halimeda*? sp. 4, 6 — Longitudinal section, thin slide RR4304 (sample Sas. 1), Sarıbayır section. 5 — Longitudinal section, thin slide RR4302 (sample K.8), Kışlatepe section. **7–8** — *Anatoliacodium xinanmui* gen. nov. sp. nov. Detail of structures around of skeleton, thin slide RR4306 (sample Sas.1), Sarıbayır section.

scribed in *Halimeda* are the same species illustrated in pl. 2, fig. 3 by Massieux (1966b) from the Egyptian Eocene with *Belzungia silvestrii*. In the text to fig. 3, this fossil is not mentioned, but in fig. 6 (designs by Pfender) similar stick-like segments are described in *Halimeda*.

Halimeda? sp. occurs in algal association with *Anatoliacodium nummuliticum*, *Anatoliacodium merici* gen. nov. sp. nov. and *Cymopolia* sp.

Genus: *Ovulites* (Lamarck, 1801) Lamarck, 1816

Ovulites margaritula (Lamarck, 1801) Lamarck, 1816

1966a *Ovulites margaritula* (Lamarck, 1801) Lamarck, 1816 — Massieux, pl. 1, figs. 1–4, p. 241, text 1

1983 *Ovulites margaritula* (Lamarck, 1801) Lamarck, 1816 — Bassoullet et al., pl. 12, figs. 3, 5, 9, p. 543–544

Rare mostly recrystallized *Ovulites* segments up to 2.870 mm in diameter, found in Kozyaka and Kışlatepe sections, are attributed to this species. *Ovulites margaritula* occurs in association with *Anatoliacodium merici* gen. nov. sp. nov. and *A. nummuliticum*.

Conclusion

This paper is the first record on algal flora in the Ilerdian-Cuisian of the Seyitgazi (Eskişehir) region in central Anatolia. The unit is mainly formed by limestones and sandy-clayey limestones. Halimedacean and dasycladalean algae are the common component in foraminiferal limestones in this area. While halimedaceans are characteristically dominated by *Anatoliacodium* species, dasycladaleans show a predominance of *Belzungia* species. Anatolian algae flora is closely comparable (seven common genera) to those of the Egyptian Eocene.

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References

Akıncı Ö. 1967: Meerschaum deposits and geology of Eskişehir I-24 c1 map. *Miner. Res. Explor. Bull.* 68, 82–97 (in Turkish).

Altunel E. & Barka A. 1998: Neotectonic activity of Eskişehir fault zone between İnönü and Sultandere. *Geol. Bull. Turkey* 41, 2, 41–52 (in Turkish).

Bassoullet J.P., Berniert P., Deloffre R., Genot P., Poncet J. & Roux A. 1983: Les Algues Udoteacees du Paleozoic au Cenozoic. *Bull. Cent. Rech. Explor. Production Elf-Aquitaine* 7, 2, 449–621.

Çoban F. 1994: Mineralogical characteristics of Mihalgazi (Eskişehir) bentonite. *Abstracts of the Geological Congress of Turkey*, 1–21 (in Turkish).

Dağ N., Kibici Y. & Özgenç İ. 1994: The mineralogy and geochemistry of central Sakarya region (Eskişehir-Bilecik) pegmatites. *Abstracts of the Geological Congress of Turkey*, 1–144 (in Turkish).

Dizer A. 1964: Sur quelques Alvéolines de L'Eocène de Turquie. *Rev. Micropaléontologie* 7, 4, 265–279.

Elliott G.F. 1972: Lower Paleozoic Green Algae from southern Scotland and their evolutionary significance. *Bull. British Mus. (Natur. Hist.) Geol.* 22, 4.

Gençoğlu H. & İrkeç T. 1994: Facial interpretation of the sedimentary sepiolite occurrences around Eskişehir-Sivrihisar. *Abstracts of the Geological Congress of Turkey*, 1–18 (in Turkish).

Gözler M.Z., Cevher F. & Küçükayman A. 1985: Geology and hot water spring of Eskişehir region. *Miner. Res. Explor. Bull.* 103–104, 40–55 (in Turkish).

Hillis L. 1994: Recent calcified Halimedaceae. In: Riding R. (Ed.): Chapter 10. *Springer–Verlag*, 167–188.

Høeg O.A. 1927: Dimorphosiphon rectangulare. Preliminary note on a new Codiacea from the Ordovician of Norway. *Avhandlinger utgitt av Del Norske Videnskaps-Akademi i Oslo, Matemattikk-Naturvilenskap Klasse*. 4, 1–15. (In Elliott G.F. 1972: Lower Paleozoic Green Algae from southern Scotland and their evolutionary significance. *Bull. British Mus. (Natur. Hist.) Geol.* 22, 4.)

Johnson J.H. 1961: Limestone building algae and algal limestones. *Colorado School of Mines*, Golden, 1–297. (In Elliott G.F. 1972: Lower Paleozoic Green Algae from southern Scotland and their evolutionary significance. *Bull. British Mus.* (*Natur. Hist.*) *Geol*. 22, 4.)

Kadıoğlu Y.K. 1994: Evidence showing the magma mixing of Kaymaz (Eskişehir) granites. *Abstracts of the Geological Congress of Turkey*, 1–143 (in Turkish).

Karakaş Z. & Varol B. 1994: Petrographic and isotopic characters of lacustrine dolomite and sepiolite-bearing dolomite in the central Anatolian Neogene basin (Sivrihisar-Eskişehir). *Abstracts of the Geological Congress of Turkey*, 1–146 (in Turkish).

Kibici Y. 1990: Petrology and genetical interpretation of the Sarıcakaya (Eskişehir) volcanics. *Geol. Bull. Turkey* 33–2, 69–78 (in Turkish).

Kibici Y., Özgenç İ. & Dağ N. 1994: Geochemical properties and genetic interpretation of the Sivrihisar (Eskişehir)-Günyüzü granitoid belt. *Abstracts of the Geological Congress of Turkey*, 1–61 (in Turkish).

Kulaksız S. & Philips W.R. 1985: Preliminary study about radiometric age of south metamorphites in the Kaymaz-Sivrihisar region. *Abstracts of the Geological Congress of Turkey*, 1–4 (in Turkish).

Kuss J. & Leppig U. 1989: The early Tertiary (Middle-Late Paleocene) limestones from the western Gulf of Suez, Egypt. *Neu. Jb. Geol. Paläont. Abh.* 177, 3, 289–332.

Massieux M. 1966a: Presence d'*Ovulites* dans le "Calcaire Yprésien" des Corbieres Septentrionales et discussion sur la nature de l'algue *Griphoporella arabica* Pfender. *Rev. Micropaléontologie* 8, 4, 240–248.

Massieux M. 1966b: Les algues du Nummulitique Ëgyptien et des terrains Crétacés-Eocénes de Quelques régions Mésogeennes, Deuxieme partie, Etude critique. *Rev. Micropaléontologie* 9, 3, 135–146.

Mu X. 1994: Fossil Udoteaceae and Gymnocodiaceae. In: Riding R. (Ed.): Chapter 9. *Springer Verlag*, 146–164.

Okay A.I. 1986: High pressure/low temperature metamorphic rocks of Turkey. In: Evans B.W. & Brown E.H. (Eds.): Blueschists and Eclogites. *Geol. Soc. Amer. Mem.* 164, 333–348.

Özcan A., Goncuoğlu M.C. & Turhan N. 1989: General geology of Kütahya-Çifteler-Bayat-İhsaniye regions. *Miner. Res. Explor. Rep.* 8974 (in Turkish).

Özgen Erdem N., Akyazı M. & Karabaşoglu A. 2007: Biostratigraphic interpretation and systematics of *Alveolina* assemblages from the Ilerdian-Cuisian limestones of Southern Eskişehir, Central Turkey. *J. Asian Earth Sci.* 29, 911–927.

Özgenç İ. 1993: Geology and REE geochemistry of carbothermal

bastnaesite-flourite-barite deposit of Kızılcaören (Sivrihisar-Eskişehir). *Geol. Bull. Turkey* 36, 1, 1–12.

Özkaya İ. 1976: Origin of asbestos occurrences in Mihallıçık (Eskişehir) region. *Geol. Bull. Turkey* 19, 1, 53–58 (in Turkish).

Petrascheck W.E. 1963: Meerschaum beds in the Eskişehir region. *Miner. Res. Explor. Bull.* 61, 10–13 (in Turkish).

Pfender J. & Massieux M. 1966: Les algues du Nummulitique Ëgyptien et des terrains Crétacés-Eocénes de Quelques régions Mésogeennes. Premiere partie. *Rev. Micropaléontologie* 9, 2, 121–132.

Roux A. & Deloffre R. 1990: Revision of the Gymnocodiaceae (Red Algae, Permian–Cretaceous), Taxonomy, Biostratigraphy, Paleobiogeography. 1st part: General consideration on the family. *Rev. Micropaléontology* 33, 2, 123–137.

Sarıiz K. 1990: Genesis of magnesite deposits of Türkmentokat-Karatepe (Eskişehir). *Miner. Res. Explor. Bull.* 110, 77–96 (in Turkish).

Sunder M.S. 1980: Geochemistry of borate deposits in the Sarıkaya (Kırka-Eskişehir). *Abstracts of the Geological Congress of Turkey*, 19–34 (in Turkish).