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A new late Capitanian (Middle Permian) foraminiferal genus (Neodiscidae) from the Elmadağ Olistostrome, Central Anatolia (Ankara, Türkiye)

Yeni bir geç Kapitaniyen (Orta Permiyen) foraminifer cinsi (Neodiscidae) Elmadağ Olistostromu, Orta Anadolu (Ankara, Türkiye)

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Abstract

The upper Cretaceous Elmadağ Olistostrome is characterized by foreland flysch deposits of the Intra–Pontide Ocean, which include numerous blocks of various sizes, types (platform-type carbonate, pelagic-type carbonate and chert) and belong to different periods/series (Carboniferous, Permian and Jurassic–Cretaceous). In this study, a fossiliferous carbonate block, collected from the Elmadağ Olistostrome, was studied for its foraminiferal assemblages. Besides a diverse late Capitanian foraminiferal assemblage, a new genus, *Praeglobidiscus*, is defined and proposed as a possible ancestor of the genus *Globidiscus*. These two genera are morphologically similar, but the sharp triangular protrusions in the last whorls of *Praeglobidiscus* is one-sided, whereas it is two-sided in *Globidiscus*.

Keywords: Permian, Capitanian, Miliolid, Neodiscidae, Elmadağ Olistostrome

Öz

Üst Kretase Elmadağ Olistostromu, çeşitli boyutlarda, tiplerde (platform tipi karbonat, pelajik tip karbonat ve çört) ve farklı periyot/serilere ait (Karbonifer, Permiyen ve Jura-Kretase) çok sayıda blok içeren, İntra-Pontid Okyanusu'nun önülke fliş çökelleriyle karakterizedir. Bu çalışmada, Elmadağ Olistostromu'ndan derlenen bol fosilli bir karbonat bloğu, foraminifer toplulukları açısından incelenmiştir. Çeşitli geç Kapitaniyen foraminifer topluluğunun yanı sıra, *Praeglobidiscus* adlı yeni bir cins tanımlanmış ve *Globidiscus* cinsinin olası atası olarak önerilmiştir. Bu iki cins morfolojik olarak benzerdir, ancak *Praeglobidiscus*'un son sarılımlarındaki keskin üçgen çıkıntılar tek taraflı iken, bu *Globidiscus*'ta çift taraflıdır.

Anahtar kelimeler: Permiyen, Kapitaniyen, Miliolid, Neodiscidae, Elmadağ Olistostromu

1 Introduction

Paleozoic miliolids first appeared in the late Mississippian and achieved a high level of diversity and abundance during the Permian [1-3]. The diversity of Paleozoic miliolids has started to increase in the Cisuralian period, reached a peak during the Guadalupian, and attained its highest level during the Capitanian-Lopingian [2]. One of the families in which this diversity is best observed is the Neodiscidae family. Concerning the composition of the family Neodiscidae, Vachard and Krainer [4] reported four subfamilies (Neodiscinae, Multidiscinae, Baisalininae, ?Septagathammininae) which include eighteen genera. On the other hand, recently Okuyucu and Akbaş [5] revised the family Neodiscidae based on the perforation structure on the wall originally named and shown by Gargouri and Vachard [6] "en dent de peigne" (comb teeth shaped) and newly defined miliolids. According to this recent study of Okuyucu and Akbaş [5] family Neodiscidae comprises five subfamilies (Neodiscinae, Baisalininae, Agathammininae, Multidiscinae, and Globidiscinae) and twenty-four genera.

In light of the last revision of family Neodiscidae offered by Okuyucu and Akbaş [5], this study aims to describe a newly discovered miliolid genus, designated as *Praeglobidiscus* n. gen., found in the Elmadağ Olistostrome near Kutludüğün Yayla (east of Ankara, Türkiye), and to outline its evolutionary patterns, including the possible ancestor of *Globidiscus* [7].

2 Geological setting

The Ankara region represents a part of the Sakarya Zone [8] or Sakarya Composite Terrane [9], which comprises he remnants of the northern Neotethyan Oceanic branches (the Intra–Pontide (IP) and Izmir–Ankara– Erzincan (IAE) suture zones) (Figure 1a). Although there are many studies on the geology of the Ankara region [e.g., 10-13], the studies by Erol [11] and Akyürek et al. [12] provide a general overview of the regional geology of the Ankara and its surrounding.

The lithostratigraphic units in the Ankara region were subdivided into four main rock units by Erol [11]; Dikmen Greywacke Serie, Elma Dağı Exotic-Block Series, Serpentine-Radiolarite Series and Cover units. Within these rock units, the Elma Dağı Exotic–Block Series forms the lithologies in the study area [11]. Previously, these exotic blocks were mapped as the Upper Karakaya Complex by Akyürek et al. [12]. After the original designation of Erol [11] and the study of Akyürek et al. [12], Tekin et al. [14-15] have reported that the rock units of "Elma Dağı Exotic–Block Series" correspond to a sedimentary mélange that

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originated from the Neotethyan Intra–Pontide realm and is named as Elmadağ Olistostrome (EO). This name was also adopted herein. The EO is mainly composed of platform-type carbonate and rare pelagic-type carbonate/chert blocks of various sizes, bounded by a calcareous clastic-to-clayey carbonate matrix. In general, the ages of the limestone blocks are Carboniferous, Permian and Jurassic–Cretaceous, while the age of the calcareous clastic and clayey carbonate matrix of the EO is Late Cretaceous [14-15].

In this study, one isolated Middle Permian block within the Elmadağ Olistostrome around the Kutludüğün Yayla (east of Ankara, Türkiye, Coordinates: 44.13.484N / 5.08.842E) (Figure 1b), was examined in detail for foraminiferal assemblages.

3 Material and methods

For the systematic paleontological studies, 5 randomly oriented thin sections were prepared from the collected isolated carbonate sample, and a transmitted light microscope was used for the examination of the thin sections and taking microphotographs of the foraminifers.

4 Results

4.1 Biostratigraphy

The studied sample of an isolated beige carbonate block, less than one-half meter in diameter, comprises a diverse foraminiferal assemblage. The assemblage is represented by the following species; *Neoschwagerina craticulifera* Schwager [18], *Globidiscus fragilis* Okuyucu [7], *Globidiscus flexus* Okuyucu [7], *Nankinella orientalis* Miklukho-Maklay [19], *Nankinella acuta* Rui [20], *Charliella rossae* Altıner and Özkan-Altıner [21], *Globivalvulina vonderschmitti* Reichel [22], *Dagmarita chanakchiensis* Reitlinger [23], *Sengoerina argandi* Altıner [24], *Midiella broennimanni* Altıner [25], *Multidiscella langei* Vachard and Krainer [4], *Baisalina* sp., *Agathammina* sp., *Neodiscus* sp., *Reichelina* sp., *Hemigordius* sp., *Cornuspira* sp., *Geinitzina* sp., *Pachyphloia* sp. and *Langella* sp. (Figure 2).

Within the associated foraminiferal fauna, *Neoschwagerina craticulifera* is commonly known in the Wordian rock units [e.g., 26-28], but its presence in the Capitanian rock units is also documented [e.g., 29-31]. *Globidiscus fragilis* and *Globidiscus flexus* were reported from the late Capitanian by [7]. *Nankinella orientalis* has a long rage from the Middle Permian to uppermost Permian [32-34]. *Charliella rossae* is mainly known in the Capitanian [21, 35]. *Sengoerina argandi* first appeared in late Capitanian and ranges up to the latest Changhsingian [24, 36-41]. *Globivalvulina vonderschmitti* is commonly reported from the Capitanian [21, 29, 35 42-47]. *Dagmarita chanakchiensis* is also commonly known from Capitanian [21, 24, 29, 35, 44, 47-50]. *Midiella broennimanni* first appears in Capitanian and ranges up to the latest Changhsingian [43, 51]. The first appearance datum (FAD) of the *Baisalina* and *Neodiscus* genera are late Capitanian [2]. Although the range of the *Agathammina* spans from Artinskian to latest Changhsingian, it is commonly known in Capitanian [2] too.

According to these common Capitanian foraminiferal assemblages and especially for the FAD of *Sengoerina argandi*, *Midiella broennimanni*, *Baisalina* and *Neodiscus* the age of the studied isolated sample is assigned as late Capitanian.

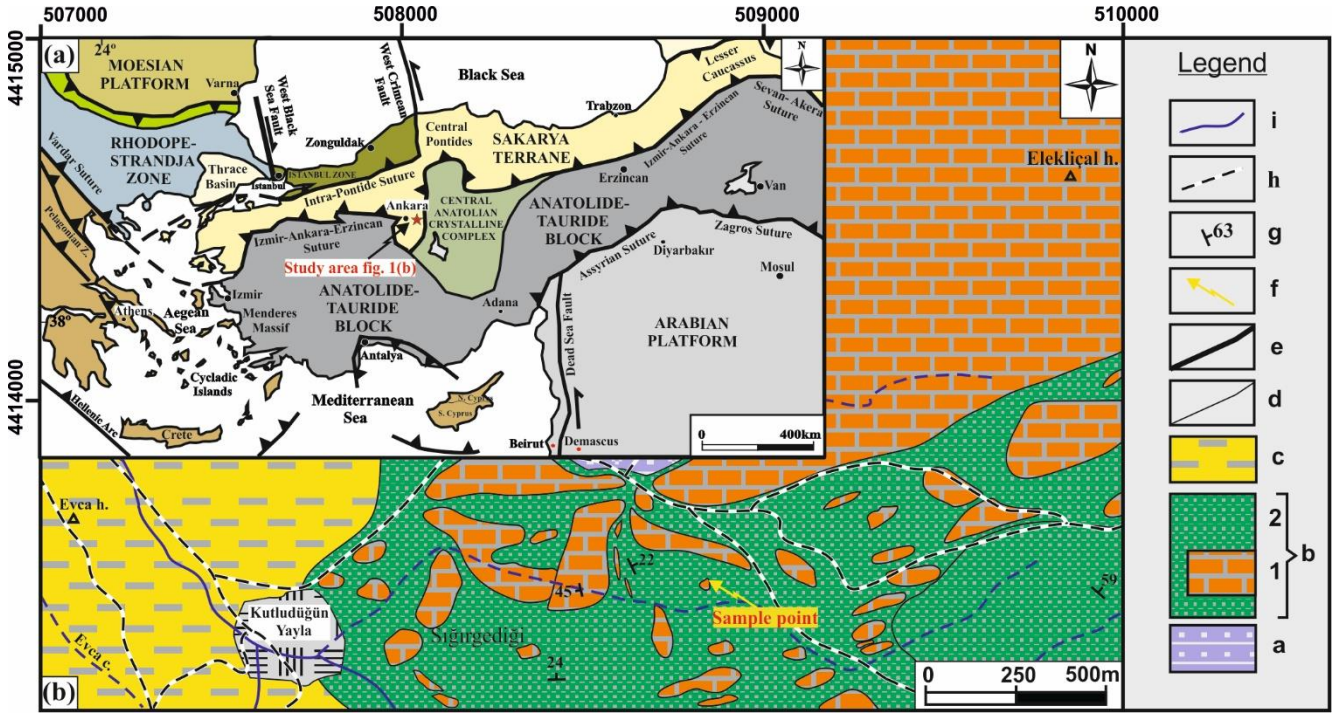

Figure 1. (a) Tectonic map of Türkiye and surrounding areas within major suture zones/terranes and location of the studied region to the SE of Ankara city center (slightly revised after Okay and Tüysüz [16], Okay and Göncüoğlu [17]). (b) Geological map of the area around the Kutludüğün Yayla, showing the locations of the studied individual samples. Legend: a. Middle

Anisian to upper Ladinian (Middle Triassic) Dikmen Graywacke consisting of clastics and volcanoclastics/volcanic breccia, b. Upper Cretaceous Elmadağ Olistostrome composed of foreland flysch deposits of the Intra–Pontide Ocean: 1. Blocks of Permian detrital and platform limestones, 2. Upper Cretaceous calcareous clastic and clayey carbonate matrix of the Elmadağ Olistostrome, c. Neogene clastics, d. Stratigraphic contact, e. Structural contact, f. Sampling point, g. Dip and strike, h. Main roads, i. Drainage system, (simplified after Tekin et al. [15]).

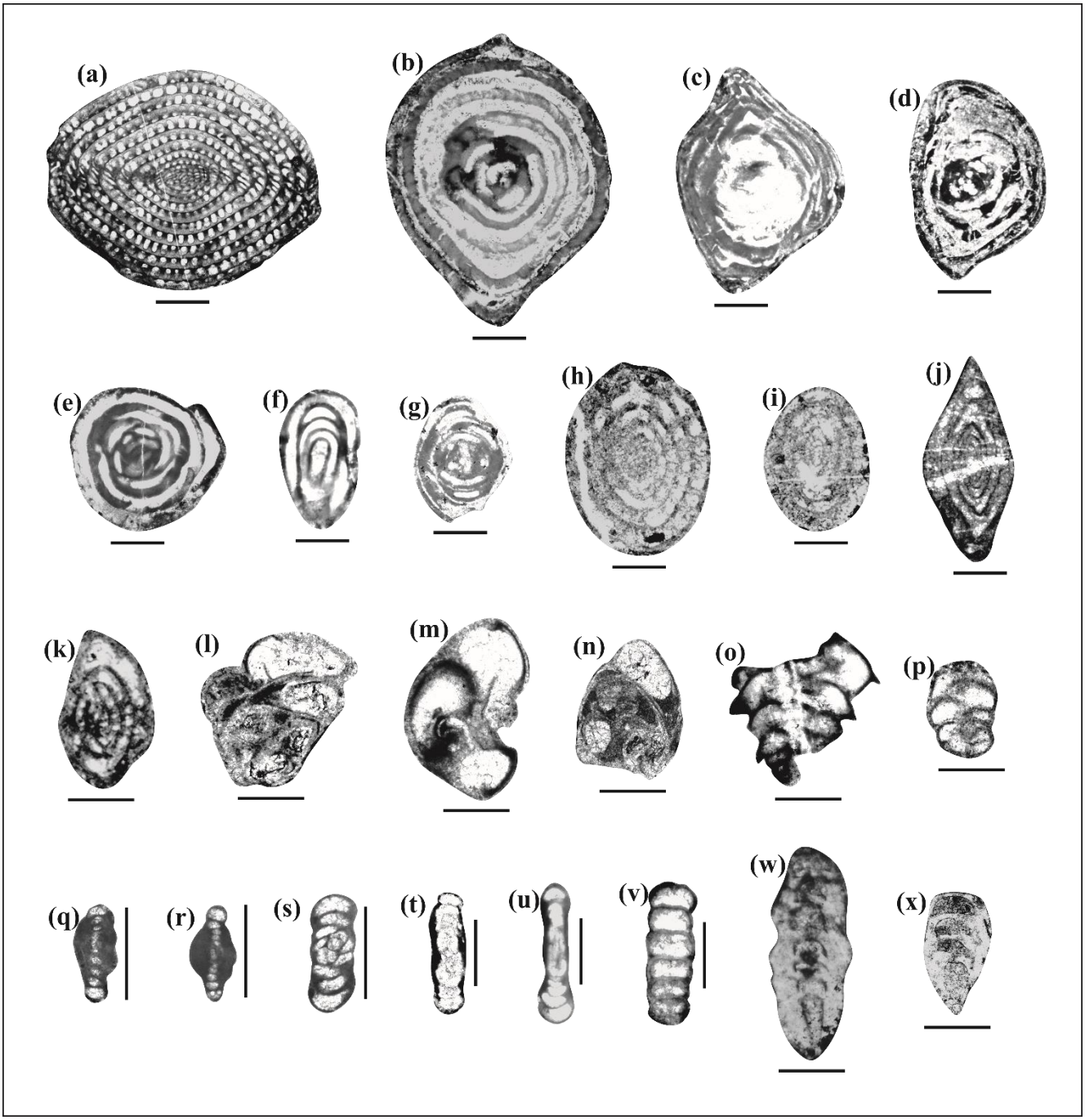

Figure 2. Microphotographs of associated foraminiferal fauna identified in the studied Middle Permian (late Capitanian) block. (a) *Neoschwagerina craticulifera*, (b) *Globidiscus fragilis*, (c-d) *Globidiscus flexus*, (e) *Baisalina* sp., (f) *Agathammina* sp., (g) *Neodiscus* sp., (h-i) *Nankinella orientalis*, (j) *Nankinella acuta*, (k) *Reichelina* sp., (l-m) *Charliella rossae*, (n) *Globivalvulina vonderschmitti*, (o) *Dagmarita chanakchiensis*, (p) *Sengoerina argandi*, (q-r) *Midiella broennimanni*, (s) *Hemigordius* sp., (t) *Multidiscella langei*, (u) *Cornuspira* sp., (v) *Geinitzina* sp., (w) *Pachyphloia* sp., (x) *Langella* sp. Scale bars: a–j = 0.5 mm; k-x= 0.25 mm.

4.2 Systematic paleontology

The systematic paleontology of foraminifers used in this paper is based on the classification of the Paleozoic foraminifera proposed by Vachard [2] and Vachard and Le Coze [52].

Phylum FORAMINIFERA [53] emend. [54]
Class MILIOLATA [55]
Order CORNUSPIRIDA [56]
Suborder CORNUSPIRINA [57]
Superfamily CORNUSPIROIDEA [58]
Family NEODISCIDAE [59] nom. translat. emend. [44]
Subfamily GLOBIDISCINAE [5]

Genus *Praeglobidiscus* n. gen.

Type species: *Praeglobidiscus nestellae* n. gen. n. sp.

Etymology: Latin *prae*, previous, because of the similarity and a possible ancestor of the genus *Globiduscus* [7].

Diagnosis: Test free and large in size, bilocular, involute and inflated lenticular in shape with one side sharp triangular protrusions in last whorls. Coiling initially glomospiral and planispiral in the terminal part. Flosculinisation well–developed. Wall thick and porcelaneous with perforations (comb-teeth-shaped) related to neosparitization. Aperture simple and terminal.

Comparison: *Pareglobidiscus* n. gen. is similar to the *Globidiscus* but it differs by larger test and one side ogival shape of last whorls. It differs from the other genera of the Neodiscidae by the long glomospiral initial stage, which is followed by planispiral involute coiling and well-developed flosculinisation. It differs from the Hemigordiopsis by a great number of tight glomospiral volutions at initial stage, inflated median region and one side pointed periphery in apical ends in axial sections.

Composition: *Praeglobidiscus nestellae* n. gen. n. sp.

Occurrences: Middle Permian (late Capitanian) of the Elmadağ Olistostrome, Ankara city, central Türkiye.

Praeglobidiscus nestellae n. gen. n. sp.

Etymology: This genus is named after Prof. Dr. Galina Nestell in honour of her contributions to the knowledge of Foraminifera biostratigraphy.

Holotype: Sample 25-1.1 (Figure 3a)

Material: Holotype and five paratypes are illustrated (Figure 3).

Type locality: Southeast of Kutludüğün village, Kutludüğün Yayla, Ankara, central Türkiye.

Type level: Late Capitanian (Middle Permian).

Repository of the material: Konya Technical University, Paleontology Laboratory with collection number: MA-25ANKR.

Microfossil Association: The *Praeglobidiscus nestellae* n. gen. n. sp. is associated with *Neoschwagerina craticulifera* [18], *Globidiscus fragilis* [7], *Globidiscus flexus* [7], *Nankinella orientalis* [19], *Nankinella acuta* [20], *Charliella rossae* [21], *Globivalvulina vonderschmitti* [22], *Dagmarita chanakchiensis* [23], *Sengoerina argandi* [24], *Midiella broennimanni* [25], *Baisalina* sp., *Agathammina* sp., *Neodiscus* sp., *Reichelina* sp., *Hemigordius* sp., *Multidiscella langei* [4], *Cornuspira* sp., *Geinitzina* sp., *Pachyphloia* sp. and *Langella* sp.

Diagnosis: Large globular Globidiscinae, with numerous flosculinised whorls and single-sided pointed periphery.

Description: Test large, involute, globular with single-sided pointed periphery. Spherical proloculus, 0.05–0.1 mm in diameter, followed by tubular chamber with glomospiral coiling at initial and planispiral at outer whorls with slowly enlarging in height. The initial part consists of an average of 14–17 whorls, thin–walled and tightly coiled. In the last planispiral 4–6 whorls, the height of the chamber increases gradually. Adult specimens measure: Diameter (D): 2.33–3.75, weight (w): 2.10–3.10 mm, the ratio w/D= 0.8–0.92, number of whorls (n.w.): 18–23. Wall calcareous, porcelaneous with perforations (comb-teeth-shaped). The lumen of the tube is relatively high with some well-developed flosculinisation in adult stage. Aperture simple, terminal.

Comparison: *Praeglobidiscus nestellae* n. gen. n. sp. is similar to the *Globidiscus fragilis* and *Globidiscus flexus* but it differs by larger test and one-sided ogival shape of last whorls.

Occurrences: Type level and type locality.

5 Discussion and conclusion

In concern of phylogenetic considerations of the genera within the family Neodiscidae, Okuyucu [7] and Okuyucu and Akbaş [5] suggest more possible phylogenetic lineage in terms of the shape of the test and type of the coiling as follow; 1) *Praeneodiscus*, 2) *Neodiscus* and 3) *Globidiscus*. According to authors the genus *Neodiscus* was derived from *Praeneodiscus* in the early Capitanian, and it is the most comparable miliolid to genera of the subfamily Globidiscinae. The genus *Neodiscus* appears in the early Capitanian, and gave rise to the genera belonging to the subfamily Globidiscinae in the late Capitanian [5, 7].

The most similar genus in the family Neodiscidae to the *Praeglobidiscus* n. gen. is *Globidiscus* in terms of initially numerous tight glomospiral, finally planispiral involute to semi-involute coiling and pointed periphery, but *Praeglobidiscus* n. gen. is differentiated from *Globidiscus* by the large globular test shape and one-sided sharp triangular protrusions in the last whorls. The undivided tubular chamber with initially tight glomospiral and then planispiral involute coiling and sharp triangular protrusions in the last whorls indicates an evolutionary stage between the *Praeglobidiscus* n. gen. and *Globidiscus*. The new genus *Praeglobidiscus* is probably the ancestor of *Globidiscus*, especially based on one-sided sharp triangular protrusions in the last whorls which are developed on two sides of *Globidiscus*. The new genus *Praeglobidiscus* and *Globidiscus* are restrict in late Capitanian based on present studies [5, 7, this study] and are not known from older or younger strata yet.

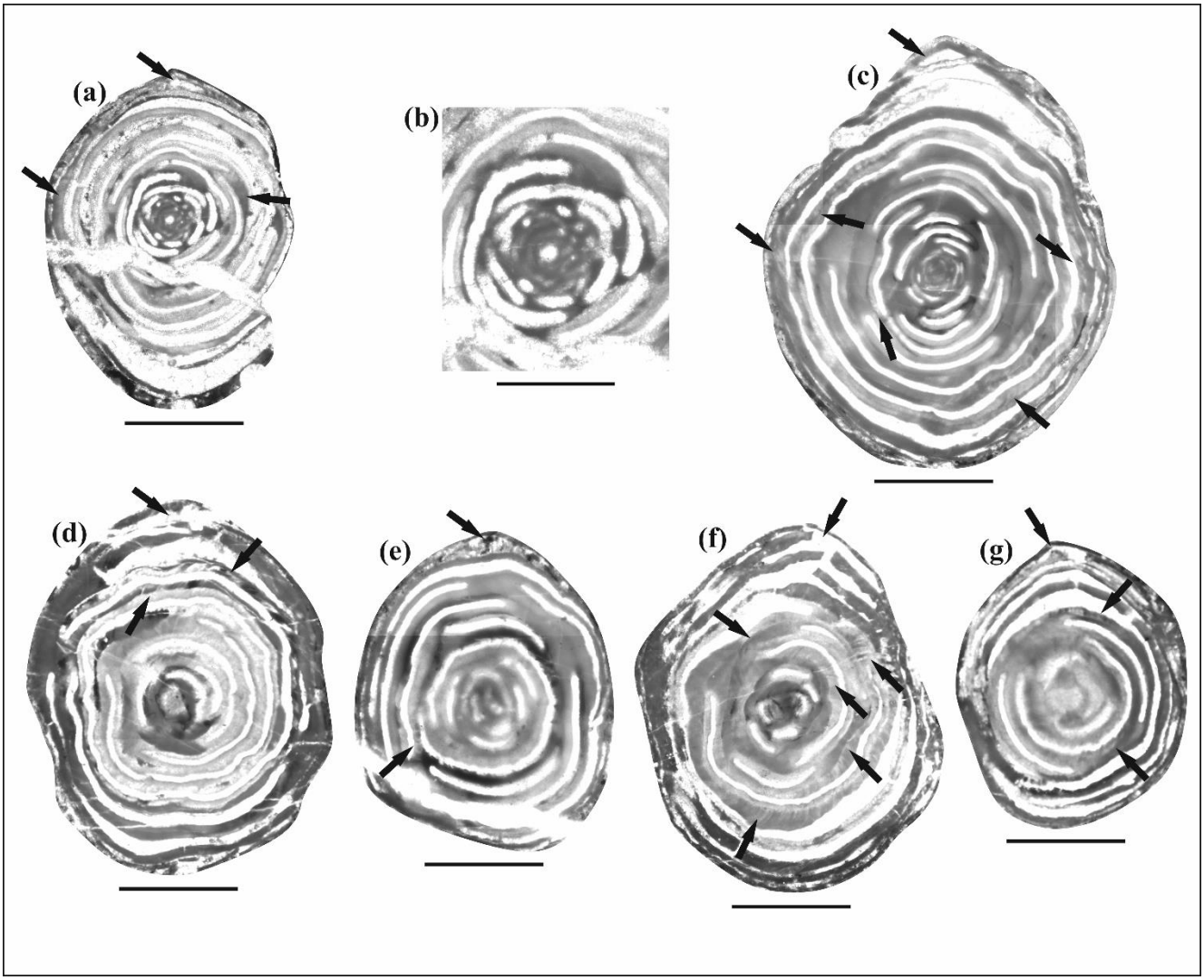

Figure 3. Microphotographs of the *Praeglobidiscus nestellae* n. gen. n. sp. (a) Holotype, axial section, 25_1.1, (b) Detail view of the inner volutions of the Figure 3a (Holotype) showing the proloculus. (c-g) Paratypes; (c) axial section, 25_1.2, (d) subaxial section, 25_1.3, (e) tangential section, 25_1.4, (f) subaxial section, 25_1.5, (g) tangential section, 25_1.7. Scale bars: a, c-g= 1 mm; b= 0.5 mm. The outermost arrows on the test show sharp triangular protrusions in last whorls, the arrows inside the test showing the wall structure with perforations (comb teeth shaped).

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Conflict of interest

The author declares that there is no conflict of interest.

Similarity rate (iThenticate): 15%

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