

Short communication

Braciana jelaskai n. gen., n. sp., a new larger benthic foraminifer from the Upper Cretaceous (Santonian?–lower Campanian) of the Dinaric–Hellenic realm

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ABSTRACT

A new larger benthic foraminifer is described as *Braciana jelaskai* n. gen., n. sp. from lower Campanian shallow-water foraminiferal wackestones to packstones of the island of Brač, Croatia. The Late Cretaceous *Braciana* is roughly homeomorphic to the Liassic taxa *Lituolipora* (type-species *L. polymorpha* Gušić & Velić) and *Paleomayncina* Septfontaine (type-species *Mayncina termieri* Hottinger). The generic differences to these taxa and other allied forms are discussed. *Braciana jelaskai* was confused with *Pseudocyclammina sphaeroidea* Gendrot in the literature with occurrences in the Santonian(?) of Slovenia and Greece.

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1. Introduction

The Upper Cretaceous shallow-water limestones of the Periadriatic Region (Adriatic, Apenninic, and Apulian carbonate platforms) contain a rich fauna of large-sized benthic foraminifera many of them with biostratigraphic importance (e.g., Torre, 1966; De Castro, 1974; Luperto Sinni, 1976; Cvetko Tešović et al., 2001; Korbar and Husinec, 2003; Velić, 2007; Chioccini et al., 2012; Frijia et al., 2015). In the Croatian part of the Adriatic Carbonate Platform, the Upper Cretaceous shallow-water limestones rich in benthic foraminifera are known as the Gornji Humac (especially its uppermost part) and the Pučišća formations originally described from the island of Brač (Gušić and Jelaska, 1990). Based on Strontium-isotope stratigraphy, the Pučišća Formation is considered to be of middle Santonian to late middle Campanian in age (Steuber et al., 2005). From the Upper Cretaceous (Santonian–Maastrichtian) shallow-water carbonates of Brač Island, already four new foraminifera (including three new genera) have been described: *Neobalkhania bignoti* Cherchi, Radoičić & Schroeder, 1991, *Fleuryana adriatica* De Castro, Drobne & Gušić, 1974, *Reticulinella fleuryi* Cvetko, Gušić & Schroeder, 1997, and

Cretacicolavulina gusici Schlagintweit & Cvetko Tešović, 2016. Another new taxon is here reported as *Braciana jelaskai* n. gen., n. sp. from the Campanian of the uppermost part of the Gornji Humac and from the Pučišća formations (Rasotica and Lorečina members), where it abounds.

2. Geological setting and biostratigraphy

The island of Brač is situated along the central part of the Adriatic–Dinaridic Carbonate Platform (ADCP; cf. Gušić and Jelaska, 1990; Jenkyns, 1991; Pamić et al., 1998; Jelaska, 2002) or Adriatic Carbonate Platform (ACP, cf. Vlahović et al., 2005). Here, an almost complete, relatively undisturbed, and well-exposed Upper Cretaceous succession is outcropping. This succession has served as a representative example for the Late Cretaceous shallow-water carbonate development of the ADCP (Gušić and Jelaska, 1990; Jelaska, 2002). Palaeogene deposits are also present along the northwestern and as scattered outcrops along the southeastern coast of the island (Fig. 1). The Upper Cretaceous platform limestones represent a thick “layer-cake” sedimentary succession (up to 1500 m), consisting predominantly of small-scale shallowing-upward cycles (Gušić and Jelaska, 1990). The succession has been subdivided into six lithostratigraphic units (Pejović and Radoičić, 1987; Gušić and Jelaska, 1990) ranging in age from Cenomanian to Maastrichtian (Fig. 2). The new benthic foraminifer described in

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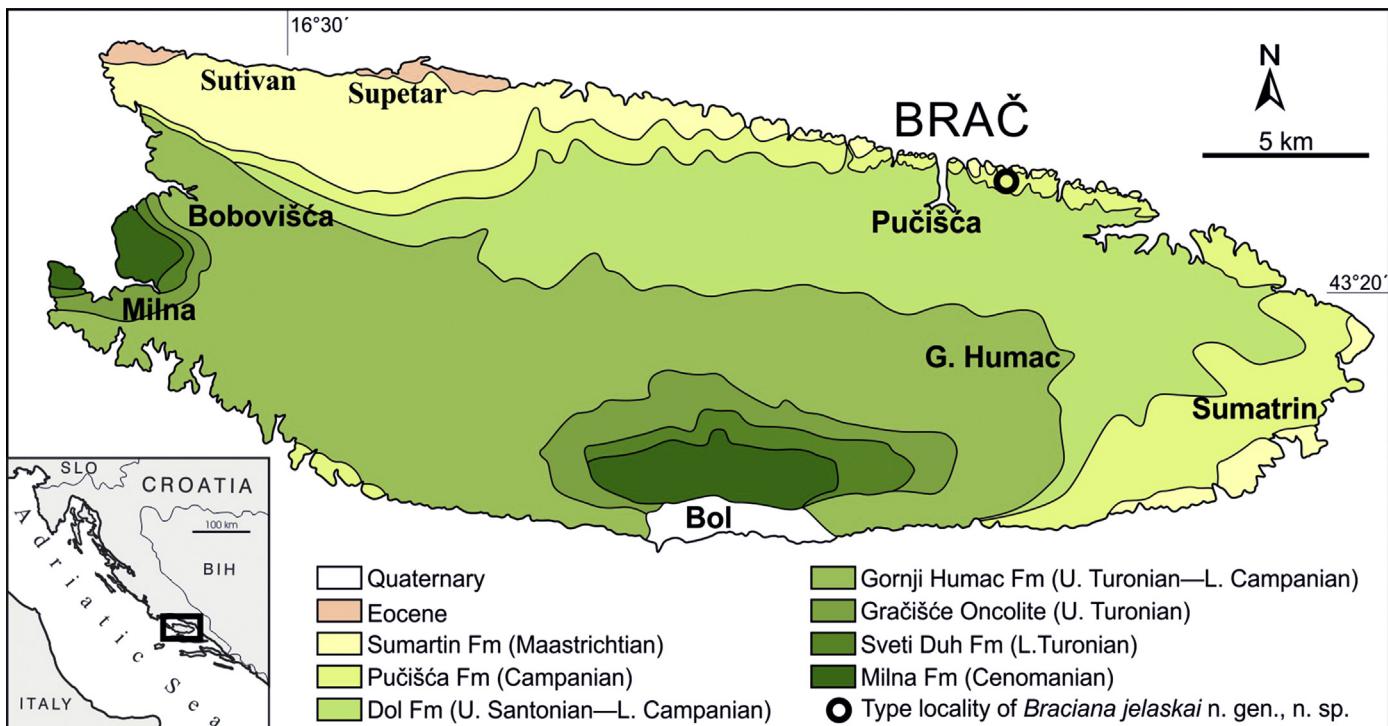


Fig. 1. Maps showing location of Brač Island, its geology and type locality of *Braciana jelaskai* n. sp. n. gen., n. sp. (modified after Gušić and Jelaska, 1990; Cvetko Tešović et al., 2001; Steuber et al., 2005; Jelaska et al., 2015).

the present paper was observed in the Santonian–middle Campanian deposits of the Gornji Humac (uppermost part) and Pučišća formations (Rasotica and Lovrečina members). The Pučišća Formation represents inner platform sediments with rudists in parautochthonous position and shallow-water bioclastic limestones and is subdivided into three superpositional-lateral subunits with the rank of members: (1), the Brač Marble Member (contains two types of facies: grain-supported and mud-supported facies with association of hyaline benthic foraminifera); (2), Rasotica Member (rudist biostromes, bioclastic floatstones to rudstones and foraminiferal wackestones/packstones with rich and diversified assemblages of larger benthic imperforate foraminifera); (3), Lovrečina Member (characterized by regularly developed shallowing-upward sequences with features indicating emergence conditions with subaerial erosion (solution cavities, geopetal infilling, calcite crusts, black pebbles, and desiccation cracks) at the top, probably reflecting a global drop of the sea level in the middle to late Campanian (Gušić and Jelaska, 1990; Cvetko Tešović et al., 2001; Steuber et al., 2005). According to strontium-isotope stratigraphy, the Pučišća Formation is mid-Santonian to late middle Campanian in age (Steuber et al., 2005). Based on benthic foraminifera, especially *Calveziconus lecalvezae* Caus & Cornellà, *Accordiella conica* Farinacci, *Moncharmontia apenninica* (De Castro), *Reticulinella fleuryi* Cvetko et al., *Rotalispira scarsellai* (Torre), *Dicyclina* sp., the samples of the Gornji Humac and Pučišća formations containing *Braciana jelaskai* can be assigned to the lower Campanian (see revised ranges of Frijia et al., 2015).

3. Material and repository

The micropalaeontological analysis of samples from the Pučišća Formation is based on about 200 thin sections. In 10 of them different sections of a new benthic foraminifera were identified. The investigated samples are the property of the Croatian

Geological Survey and their repository is currently in the Geological-Paleontological Department of the Croatian Natural History Museum, Demetrova 1, Zagreb, Croatia. The inventory numbers are 10946–10955.

4. Systematic description

The high-rank classification follows Pawłowski et al. (2013), the low-rank classification Kaminski (2014). For glossary, report to Hottinger (2006), and Rigaud et al. (2013: p.393, strengthenings).

Phylum: Foraminiferida d'Orbigny, 1826

Class: Globothalamida Pawłowski et al., 2013

Order: Loftusiida Kaminski & Mikhalevich in Kaminski, 2004

Suborder: Loftusiina Kaminski & Mikhalevich in Kaminski, 2004

Superfamily: Loftusioidea Brady, 1884

Family: ?Mesoendothyridae Voloshinova, 1958?

Genus *Braciana* n. gen.

Type species: *Braciana jelaskai* n. sp.

Etymology. Referring to the type-locality at the Island of Brač.

Horizon and locality. Lower Campanian Gornji Humac and Pučišća formations.

Diagnosis. Test elongate-compressed, bimarginate, early portion planispirally to slightly oscillating enrolled with numerous chambers disposed in a semi-involute arrangement. Later portion uncoiling rectilinear or peneroplite, with few slightly arched chambers increasing rapidly in breadth as added. Megalospheric forms possess a complex embryo, formed by a spherical protoconch, and a closely attaching hemispherical deutoconch, both connected by a single opening. Foramina in the early stage simple, basal to areal, becoming multiple with several small close-set openings, equal in diameter to the wall alveolae. Interior of adult chambers may have short peristomial rims at the margins of the

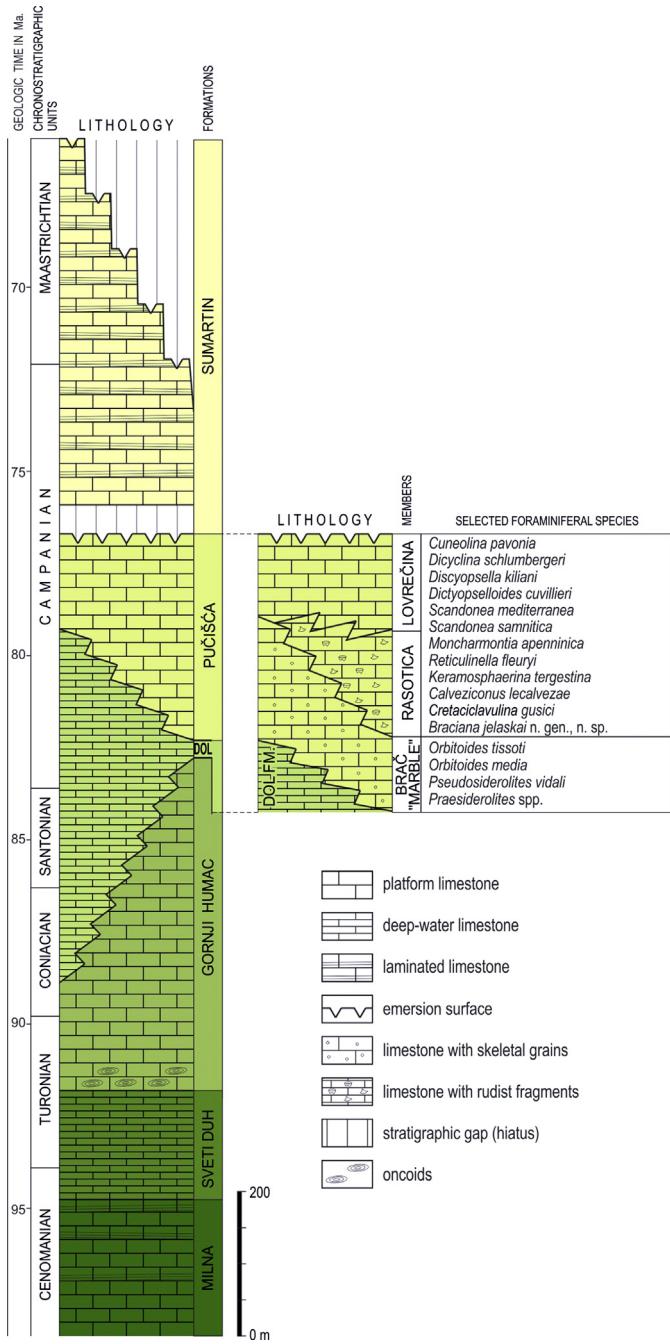


Fig. 2. Stratigraphic synthesis of the Upper Cretaceous deposits of Brač Island with detailed lithology and selected foraminiferal assemblage of Pučišća Formation (adapted from Gušić and Jelaska, 1990; Cvetko Tešović et al., 2001; Steuber et al., 2005).

circular foramina, and sporadically, also interseptal strengthenings at the chamber margins, preferentially of adult chambers. The thick wall is dark-microgranular-like to agglutinated, traversed by numerous simple alveolae with constant diameter throughout their length and covered by a thin, often abraded epiderm. Diameter of alveolae equals the one of the foramina. Aperture multiple.

Differences. The two monotypic Liassic genera *Lituolipora* Gušić & Velić, 1978 (type-species *Lituolipora polymorpha* Gušić & Velić, Middle Liassic of Croatia) (Fig. 3A–D) and *Paleomayncina* Septfontaine in Kaminski, 2000 (type-species *Mayncina termieri* Hottinger, 1967, Liassic of Morocco) (Fig. 3E–F) are similar to almost

homeomorphic to *Braciana* n. gen. *Lituolipora* and *Paleomayncina* are included in the families Lituoliporidae Gušić and Mesendothyridae Voloshinova respectively (see Kaminski, 2014) (for a different taxonomic view see Kabal and Tasli, 2003). The distinction of both taxa displaying alveolar wall structure, is principally related to the ontogenetic development, respectively chamber shape, the mode of coiling, juvenile type of foramina (interio-marginal in *Lituolipora* versus areal in *Paleomayncina*), the presence of wall thickenings in adult *Paleomayncina*, and a complex embryo in *Lituolipora* (Rigaud et al., 2015, fig. 4). It is worth mentioning that according to Rigaud et al. (2015), *Lituolipora* is present also in the Late Triassic (Rhaetian) (e.g., Matzner, 1986, pl. 2, figs. 9, 12).

The Late Cretaceous *Braciana* n. gen. differs from *Lituolipora* and *Paleomayncina* by its coiling mode, foraminiferal features, and partly also the type of embryo as well as internal structures (Table 1). With respect to *Lituolipora*, Gušić and Velić (1978) reported a dimorphism with megalospheric tests displaying complex embryo, and smaller more regular tests. The material of *Braciana* at our disposal is not sufficient for clearly fixing such a dimorphism.

Last but not least, comparisons to *Pseudocyclammina* Yokoyama, 1890 (type-species *P. lituus*, Late Jurassic of Japan) are also included in Table 1, because *Braciana jelaskai* has been confounded with the Late Cretaceous *Pseudocyclammina sphaeroidea* Gendrot in the literature (Fig. 3G–H).

Braciana jelaskai n. sp.

Figs. 4–5

1990 Unidentified and/or unknown foraminifera — Gušić and Jelaska, Pl. 15, Figs. 1–6, ??.

2007 *Pseudocyclammina sphaeroidea* — Zambetakis-Lekkas and Alexopoulos, Fig. 6a.

2013 *Pseudocyclammina sphaeroidea* Gendrot — Jurkovsek et al., Pl. 17, Fig. 6.

Etymology. The new species is dedicated to Vladimir Jelaska (Zagreb) for his contributions to the geology of Brač Island.

Holotype. Slightly oblique subequatorial section, illustrated in Fig. 4A, thin-section 10916.

Paratypes. Different oriented sections illustrated in Fig. 4B–K.

Type material. ~20 specimens in 10 thin-sections.

Type locality. East side of the Duboka cove (northeast coast of Brač island), approximate coordinates: 43.358158°N, 16.764427°E (Fig. 1).

Type level. Lower Campanian; the uppermost levels of the Gornji Humac Formation and the Rasotica and Lovrečina members of the Pučišća Formation.

Diagnosis. See diagnosis of the monotypic genus.

Description. Test with short early somewhat oscillating planispiral part, semi-involute and biumbilicate, later uncoiling, with rounded test outline. The coiled stage consists of a large globular protoconch and a closely attaching deutoconch, semilunar in outline, followed by up to seventeen chambers that increase regularly during ontogeny, arranged in 1.5 to two whorls. Later portion uncoiled, peneropline, with up to nine, low, slightly arched chambers rapidly increasing in width. Foramina in the early stage simple, basal to areal, becoming multiple with several small close-set openings. Foramina are narrowing upwards. At the chamber entrance, the foramina may be surrounded by peristomal rims (Figs. 4A, 4H, 5). Rare, mostly rather thin strengthenings (sensu Rigaud et al., 2013) can be observed at the chamber margins (Figs. 4A–B, 4I, 5). The thickness of the wall equals that of the septa. The wall is dark-microgranular-like to agglutinated (rare optically visible agglutinated particles) transversed by numerous subparallel alveolae

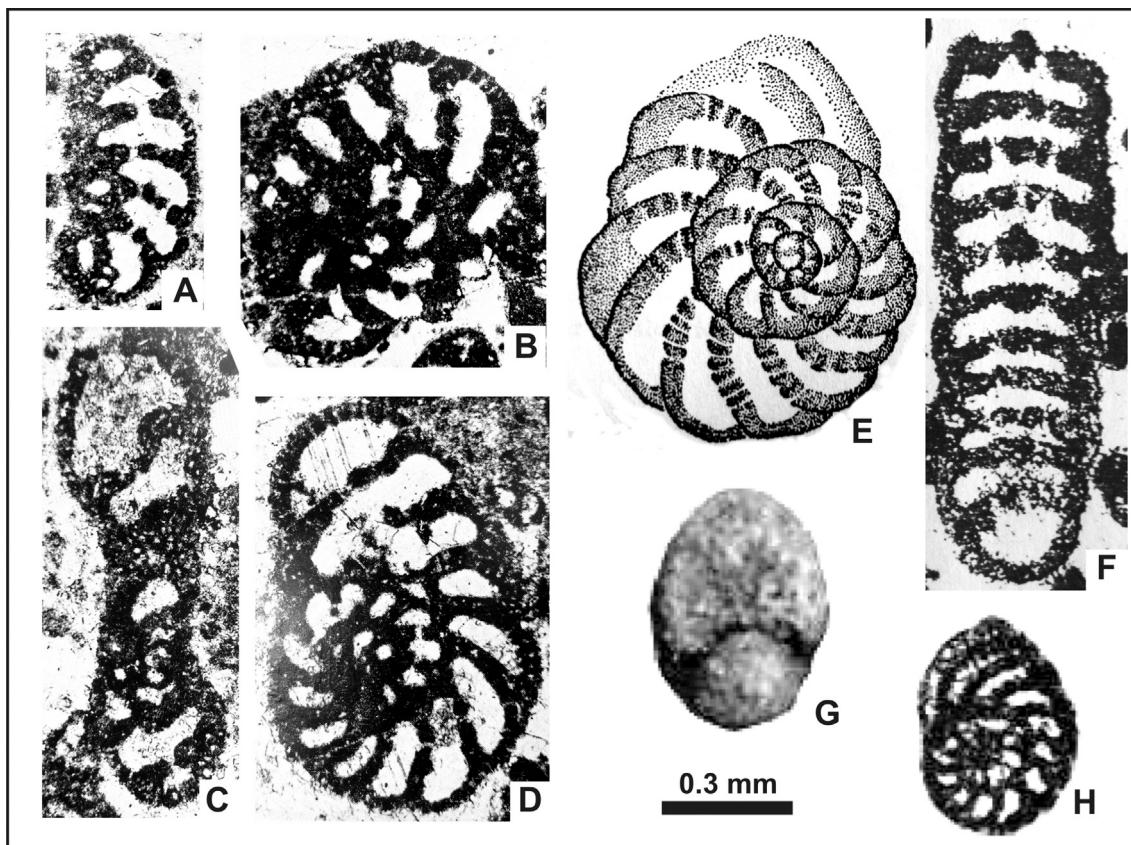


Fig. 3. A–D *Lituolipora polymorpha* Gušić & Velić, 1978, lower Jurassic (middle Liassic) of Croatia (re-illustrations from Gušić and Velić, 1978, pl. 8, figs. 5–6, pl. 5, fig. 2, pl. 3, fig. 3). E–F *Paleomayncina termieri* (Hottinger), lower Jurassic of Morocco (re-illustrations from Hottinger, 1967, text-fig. 14, pl. 3, fig. 1). G–H *Pseudocyclammina sphaeroidea* Gendrot, late Santonian of France (re-illustrations from Gendrot, 1968, pl. 4, figs. 2–3).

Table 1

Comparative summary table of main features of *Braciana* n. gen., and allied taxa (based on Rigaud et al., 2015).

Genus	<i>Braciana</i> n. gen.	<i>Lituolipora</i> Gušić & Velić	<i>Paleomayncina</i> Septfontaine	<i>Pseudocyclammina</i> Yokoyama
Stratigraphy	Santonian–early Campanian	Late Triassic–Liassic		
Wall/structure	Microgranular to finely agglutinated, alveolar		Liassic	Late Jurassic–Santonian/Campanian Coarsely agglutinated, irregular arranged alveoles
Exoskeleton	Without differentiated exoskeleton			With irregular polygonal network
Endoskeleton	Thickenings	Absent	Thickenings	Absent
Mode of coiling	Planispiral-flattened, slightly oscillating, semi-involute (J) Uncoil, straight (A) Planispiral part less developed than uncoiled stage	Planispiral-streptospiral-compressed (J) Irregular uncoiling (A)	Planispiral-compressed (J) May uncoil (A) Planispiral part more developed than uncoiled stage	Regular planispiral, involute (J) May uncoil (A) Planispiral part more developed than uncoiled stage
Foramina/aperture	Basal to areal (J), becoming multiple (with aligned openings, may have short peristomal rims) (A)	Basal to areal (J) becoming multiple (with simple, not perfectly aligned openings) (A)	Areal (J) becoming multiple (with simple, not perfectly aligned openings) (A)	Multiple
Embryo	Complex (protoconch-deutoconch)		Simple	

Abbreviations: J = juvenile stage, A = adult stage.

constant in diameter throughout their length. They are covered by a thin wall (epiderm) (e.g. Fig. 4K), often abraded. The diameter of the alveolae is equal to the width of the foramina. Aperture multiple.

Dimensions.

Test height: up to 1.2 mm

Axial test diameter: up to 0.3 mm

Equatorial test diameter: up to 0.65 mm

Diameter of protoconch: 0.07–0.13 mm

Chamber height (incl. septum, adult stage): 0.1–0.15 mm

Thickness of septa (adult stage): ~0.08 mm

Diameter of alveolae: ~0.008–0.015 mm

Comparison. Due to monotypy, the specific differences to the Liassic *Lituolipora polymorpha* Gušić & Velić and *Paleomayncina termieri* (Hottinger) were already treated in the remarks to the new genus *Braciana*. As can be depicted from the synonymy list, *Braciana jelaskai* has been confounded with *Pseudocyclammina sphaeroidea*,

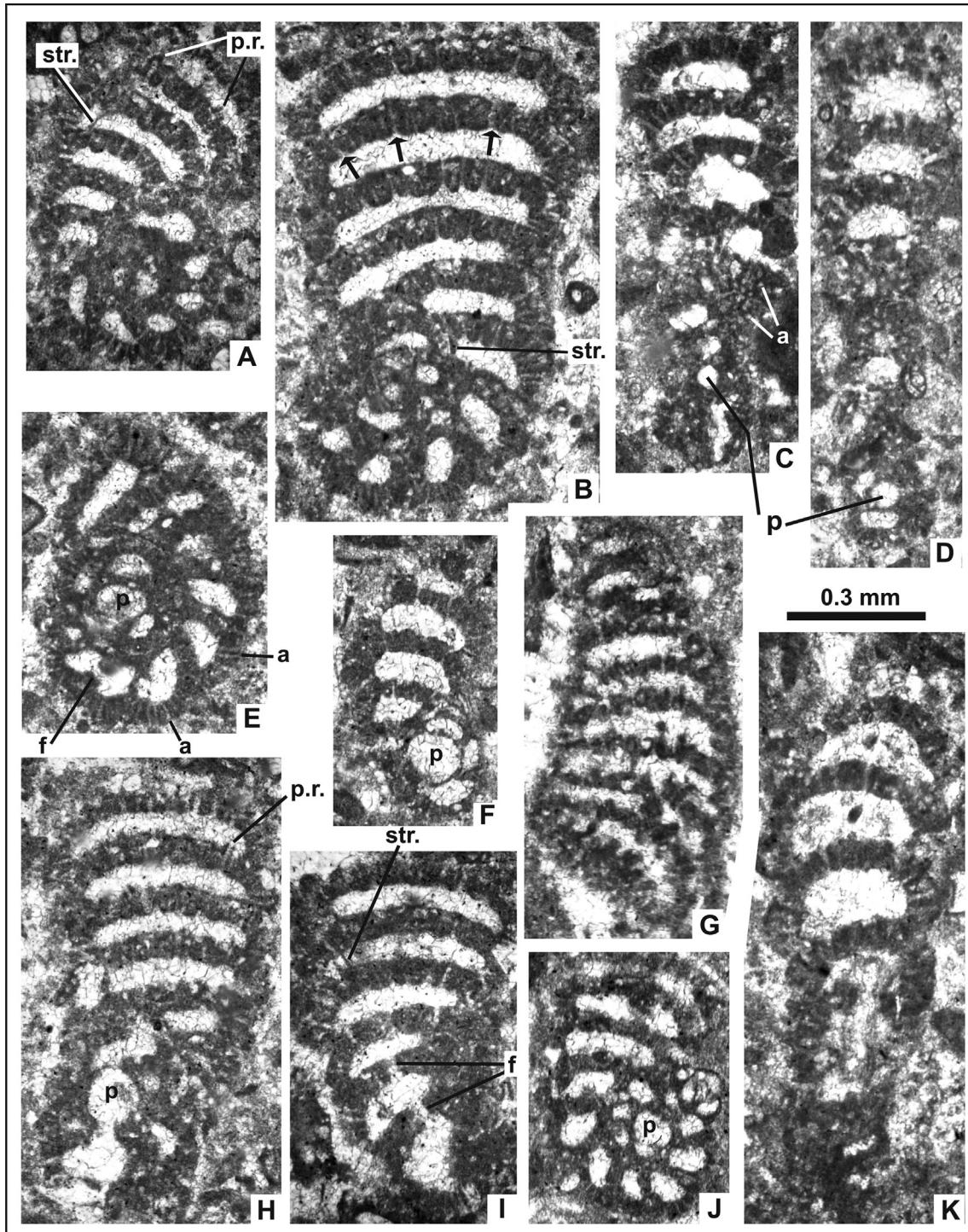


Fig. 4. *Braciana jelaskai* n. gen., n. sp., early Campanian of Island of Brač. **A–B, E, J** Equatorial sections, in parts slightly oblique. Holotype specimen in **A**. **C–D** Axial to subaxial sections, in parts slightly oblique. **F, H** Centred oblique section. **G, I, K** Oblique sections. In **I** three chambers of the coiled part (below) with single foramina are sectioned. Abbreviations: a = alveolae, f = foramen, p = protoculus, p.r. = peristomal rim, str. = strengthening. Arrows in **B**: cibrate foramina in the uncoiled part. Thin-section no. 10946 (A), 10951 (B, E, H), 10947 (C), 10949 (D), 10955 (F), 10950 (G), 10952 (I), 10953 (J), 10948 (K).

a tiny species described by Gendrot (1968) from the Santonian of southern France (Fig. 3G–H). Above all, *Pseudocyclammina sphaeroidea* is much smaller, and displays a different type of coiling (globular involute, with reduced tendency to uncoil versus flattened, biumbilicate, and uncoiling in *Braciana jelaskai*) (see also Table 1). Moreover, peristomial rims as well as strengthening structures have so far not been reported from *Pseudocyclammina*

sphaeroidea (Gendrot, 1968; Schlagintweit, 1992; Arriaga et al., 2016).

Occurrences and stratigraphy. *Braciana jelaska* is reported from the following localities (see synonymy)

- Island of Brač, Croatia (type-locality)
- Kras Plateau, Slovenia, in the hinterland of Trieste. From here, *Braciana jelaskai* was illustrated by Jurkovšek et al. (2013) as

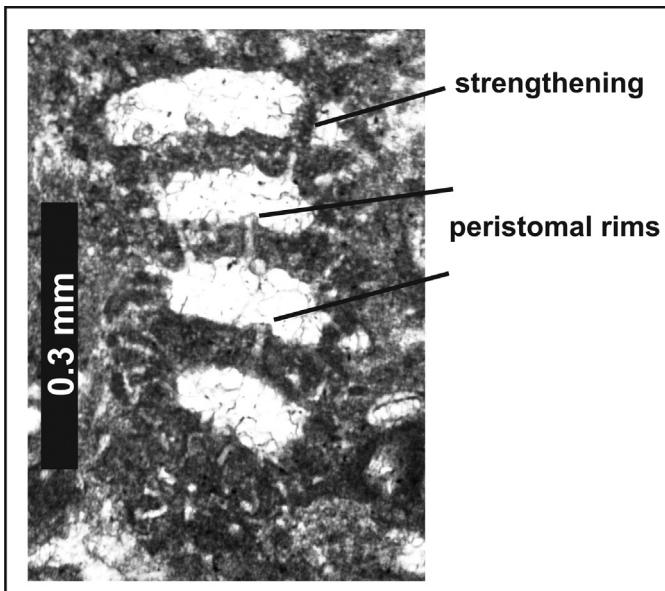


Fig. 5. *Braciana jelaskai* n. gen., n. sp., early Campanian of Island of Brač. Section cutting four chambers of the uncoiled part with single strengthening sensu Rigaud et al., 2013 at the margin of the last chamber and short peristomal rims surrounding foramina (two chambers before last). Thin-section no. 10955.

Pseudocyclammina sphaeroidea Gendrot from peloidal-foraminiferal wackestones of the upper part of the Sežana Formation. Associated with *Scandonea samnitica* De Castro and *Scandonea mediterranea* De Castro, this part of the formation was assigned to the Santonian.

- Gavrovo-Tripolitza platform, Greece. *Braciana jelaskai* was illustrated by Zambetakis-Lekkas and Alexopoulos (2007) as *Pseudocyclammina sphaeroidea* Gendrot from a brecciated level (Santonian?).

5. Conclusions

The study of the Upper Cretaceous shallow-water carbonates of the island of Brač, Croatia has led to the description of a new taxon of larger benthic foraminifera, *Braciana jelaskai* n. gen., n. sp. It has been recognized in the literature from other areas of the Dinaric-Hellenic realm where it has been confounded with *Pseudocyclammina sphaeroidea* Gendrot. So far *Braciana jelaskai* has been discovered in Santonian-early Campanian strata concluding it as a potential useful taxon for biostratigraphic dating of these carbonates in case when other forms are lacking.

Acknowledgements

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