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Cretaciclavulina gusici n. gen., n. sp. (?family Valvulinidae BERTHELIN, 1880), a new larger benthic foraminifer from the lower Campanian of Brač Island, Croatia

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Abstract

The larger benthic foraminifera *Cretaciclavulina gusici* n. gen., n. sp. is described from the lower Campanian Pučišća Formation of the Island of Brač, Croatia. With its elongate test, trochospiral to uniserial coiling, simple chambers, paraporous wall structure, and areal aperture provided with a cribrate apertural plate, *Cretaciclavulina* is tentatively placed into the family Valvulinidae BERTHELIN, 1880. Besides *Neobalkhania bignoti* CHERCHI, RADOIČIĆ & SCHROEDER, 1991, *Fleuryana adriatica* DE CASTRO, DROBNE & GUŠIĆ, 1994, and *Reticulinella fleuryi* CVETKO, GUŠIĆ & SCHROEDER, 1997, *Cretaciclavulina gusici* represents the fourth benthic foraminifera newly described from the Upper Cretaceous shallow-water carbonates of Brač Island.

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 special biostratigraphic importance (e.g., TORRE, 1966; LUPERTO SINNI, 1976; DE CASTRO, 1974; CVETKO TEŠOVIĆ et al., 2001; KORBAR & HUSINEC, 2003; VELIĆ, 2007; CHECCONI et al., 2008; FRIJIA et al., 2015). In the Croatian part of the Adriatic-Dinaridic carbonate platform, a shallow-water facies rich in benthic foraminifera known as the Pučišća Formation was originally described from the island of Brač (GUŠIĆ & JELASKA, 1990). The island of Brač is situated along the central part of the Adriatic-Dinaridic Carbonate Platform (ADCP; cf. JENKYNS, 1991; GUŠIĆ & JELASKA, 1990; PAMIĆ et al., 1998; JELASKA, 2002) or Adriatic Carbonate Platform (AdCP; cf. VLAHOVIĆ et al., 2005). During the Mesozoic, several long-lived isolated carbonate platforms existed in the Mediterranean region (the former central Tethys; present-day peri-Adriatic area). The ADCP was the largest of these platforms with relatively well preserved, mainly shallow-marine successions occasionally interrupted by episodes of emersion or drowning.

From the Pučišća Formation of Brač Island, three benthic foraminifera have already been introduced from thin-section material: *Neobalkhania bignoti* CHERCHI, RADOIČIĆ & SCHROEDER, 1991, *Fleuryana adriatica* DE CASTRO, DROBNE & GUŠIĆ, 1994, and *Reticulinella fleuryi* CVETKO, GUŠIĆ & SCHROEDER, 1997. Another new taxon is reported here is *Cretaciclavulina gusici* n. gen., n. sp.

2. GEOLOGICAL SETTING

2.1. Lithostratigraphy

On the Island of Brač, situated along the central part of the Croatian Adriatic coast (Fig. 1), an almost complete, relatively undis-

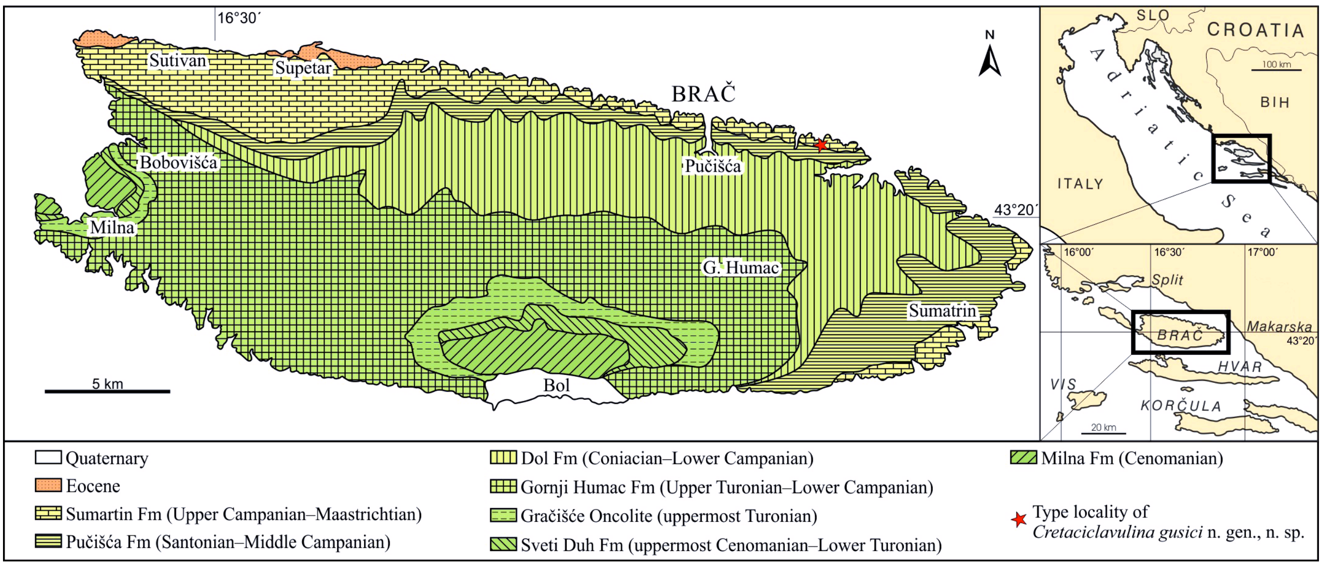

Figure 1. Map showing the location and geology of Brač Island, and type locality of *Cretaciclavulina gusici* n. gen., n. sp. (modified after GUŠIĆ & JELASKA, 1990, CVETKO TEŠOVIĆ et al., 2001 and STEUBER et al., 2005).

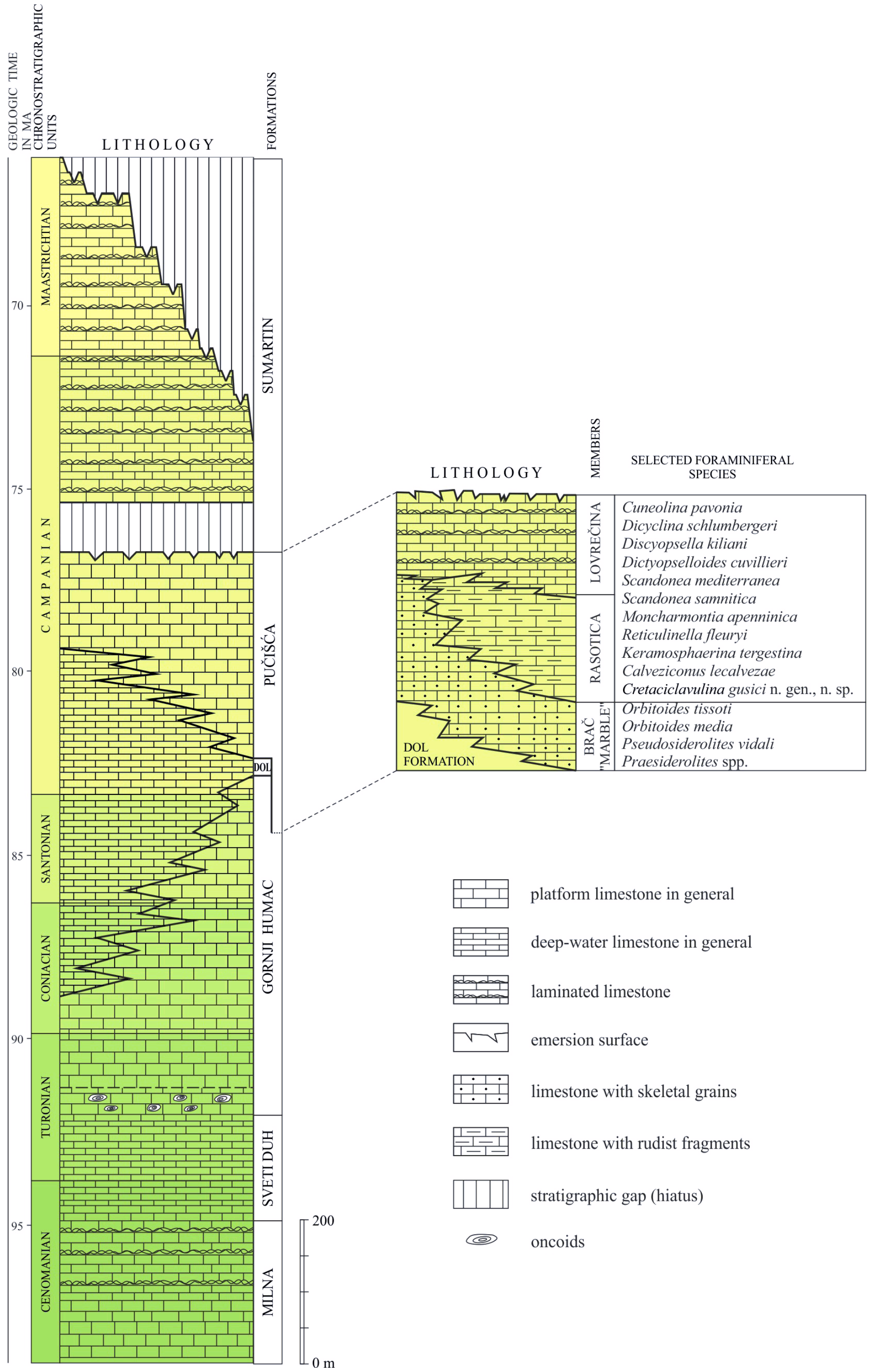

Figure 2. Stratigraphic synthesis of the Upper Cretaceous deposits of Brač Island with detailed lithology and selected foraminiferal assemblage of Pučišća Formation (adapted from GUŠIĆ & JELASKA, 1990, CVETKO TEŠOVIĆ et al., 2001 and STEUBER et al., 2005).

turbed, and well-exposed Upper Cretaceous succession of the ADCP is exposed. This succession has served as a representative example for the Upper Cretaceous shallow-water carbonate development of the ADCP (Figs. 1, 2). 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 & JELASKA, 1990). The succession has been subdivided into six lithostratigraphic units (PEJOVIĆ & RADOIČIĆ, 1987; GUŠIĆ & JELASKA, 1990), ranging in age from Cenomanian to Maastrichtian (Fig. 2):

– The Milna Formation (Cenomanian) comprises bioclastic (including foraminifera, rudists and other mollusca) wackestones to grainstones alternate with microbial laminites, occasional slump features, and rare intraformational breccias (GUŠIĆ & JELASKA, 1990; KORBAR et al., 2012).
– The Sveti Duh Formation (uppermost Cenomanian–Lower Turonian) comprises pelagic skeletal wackestones with planktonic foraminifera and calcispheres indicate drown-

ing of the ADCP (JENKYNS, 1991; GUŠIĆ & JELASKA, 1990; DAVEY & JENKYNS, 1999; KORBAR et al., 2012).

– The Gornji Humac Formation (Upper Turonian–Lower Campanian) comprises oncoid-bearing beds in the lower part (*e.g.* the „Gračišće Oncolite" Member) during the Late Turonian–Early Coniacian, which cap the underlying pelagic deposits and evidence a shallowing and reinstallation of carbonate platform environments, which were gradually less restrictive and more favourable for populations of shallow-water benthic organisms.

– The Dol Formation (Coniacian–Lower Campanian) comprises micrites with abundant calcispheres and planktonic foraminifera indicating a second Late Cretaceous pelagic episode.

– The Pučišća Formation (Santonian–Middle Campanian): platform sediments with rudists in parautochthonous position and shallow-water bioclastic limestones indicate the gradual infilling of the intraplatform trough, known as the Brač „Marble" Member. With the progradation of the platform, the protected back-margin environments gradually occupied larger areas until they completely overlaid the Brač „Marble" Member. These environments are represented by the two superpositional-lateral subunits of the Rasotica member (rudist biostromes, bioclastic floatstones to rudstones and foraminiferal wackestones/packstones with rich and diverse assemblages of larger benthic imperforate foraminifera) and the Lovrečina member (uppermost member characterized by regularly developed shallowing-upward sequences with features indicating emergence conditions with subaerial erosion at the top, probably reflecting a global drop of sea level in the Middle to Late Campanian).

– The Sumartin Formation (Upper Campanian–Maastrichtian) represents the regressive cycles of the Maastrichtian, above the Late Campanian emersion, which were deposited in peritidal environments.

The new benthic foraminifer described in the present paper was observed in the Campanian deposits of the uppermost part of the Gornji Humac and are more frequent in the Pučišća Formation (Rasotica and Lovrečina members).

2.2. Biostratigraphy

PEJOVIĆ & RADOIČIĆ (1987) subdivided the Upper Cretaceous deposits into six formations mainly based on benthic foraminifera and rudists. Six formations were also recognized by GUŠIĆ & JELASKA (1990), but their litho- and chronostratigraphic interpretation differs from that of PEJOVIĆ & RADOIČIĆ (1987). They emphasized the diachronous character of some formation boundaries (Fig. 2) and subdivided some of them into smaller units. Rudist bivalves and benthic microfossils have been studied comprehensively as biostratigraphic markers for the upper Cretaceous succession of Brač (POLŠAK et al., 1982; GUŠIĆ & JELASKA, 1990; CVETKO TEŠOVIĆ et al., 2001, KORBAR, 2003; STEUBER et al., 2005 and references therein) and the type localities of several taxa are located on the island.

The Pučišća Formation contains especially rich assemblages of larger benthic foraminifera dominated by various imperforate taxa in the Rasotica and Lovrečina members and hyaline foraminifera in the Brač „Marble" Member. These assemblages were used for the interpretation of stratigraphic and palaeoenvironmental features (GUŠIĆ & JELASKA, 1990; CVETKO TEŠOVIĆ et al., 2001). CVETKO TEŠOVIĆ et al. (2001) described these assemblages in detail including taxonomic, phylogenetic, stratigraphic and palaeoecologic aspects. The Late (but not latest) Campanian age of the Pučišća Formation is largely based on the age determination of the Brač „Marble" Member. GUŠIĆ & JELASKA (1990) gave stratigraphic priority to the relevant and well-studied larger benthic foraminifera (orbitoidids and siderolitids). Based on numeric ages derived from strontium-isotope stratigraphy (SIS) of low-Mg calcite of rudist shells, STEUBER et al. (2005) revised the chronostratigraphy of the Coniacian–Maastrichtian platform carbonates of the island of Brač. According to the strontium-isotope stratigraphy, the Pučišća Formation is mid-Santonian to late Middle Campanian in age. Based on benthic foraminifera, especially *Calveziconus lecalvezae* CAUS & CORNELLA, the samples containing *Cretaciclavulina gusici* n. gen. n. sp. 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 was performed on about 200 thin sections. Sections of *Cretaciclavulina gusici* n. gen, n. sp. were only observed in 15 of them. The investigated samples are the property of the Croatian Geological Survey and their repository (inventory numbers: 10807–10815) is currently in the Geological-Palaeontological Department of the Croatian Natural History Museum, Demetrova 1, Zagreb, Croatia.

4. MICROPALAEONTOLOGY

4.1. Description of the new taxon

Phylum: Foraminifera D'ORBIGNY, 1826
Class: Globothalamea PAWLOWSKI et al., 2013
Order: Ataxophragmiina FURSENKO, 1958
Superfamily: Textulariacea EHRENBERG, 1838
Family:?Valvulinidae BERTHELIN, 1880

Remarks: With its elongate test, trochospiral later becoming uniserial, the simple chambers, a paraporous wall structure, and probable cribrate apertural plate, *Cretaciclavulina* is tentatively placed into the family Valvulinidae BERTHELIN, 1880. According to LOEBLICH & TAPPAN (1987, p. 181), the Valvulinidae range in age from the Palaeocene to the Holocene.

***Cretaciclavulina* n. gen.**

Type species: ***Cretaciclavulina gusici*** n. gen., n. sp.

Origin of the name: Composite name referring to the Cretaceous and the genus *Clavulina* D'ORBIGNY.

Diagnosis: Test elongate, trochospiral (most likely triserial) to uniserial, with a short intermediate biserial stage between these. Chambers simple, broad low, enlarging in the triserial stage and of nearly constant width in the uniserial stage. Wall thick agglutinating, and canaliculate (paraporous), possibly with an inner calcareous (?aragonitic) layer. Foramen single interiomarginal in the trochospiral and areal in the uniserial part. Aperture areal, provided with a cribrate apertural plate.

Remarks: The wall structure combined with the elongate test and its trochospiral to uniserial chamber arrangement allow a comparison of *Cretaciclavulina* with some representatives of the family Palaeotextulariidae GALLOWAY, 1933, Valvulinidae BERTHELIN, 1880, and partly also the Ataxophragmiidae SCHWAGER, 1877, Verneuilinidae CUSHMAN, 1911 as well as Pseudogaudryinidae LOEBLICH & TAPPAN, 1985 (Fig. 3A).

The wall of *Cretaciclavulina* displays closely spaced, fine and more or less parallel, more rarely bifurcating canaliculi or parapores that are not open to the exterior, but end blindly shortly

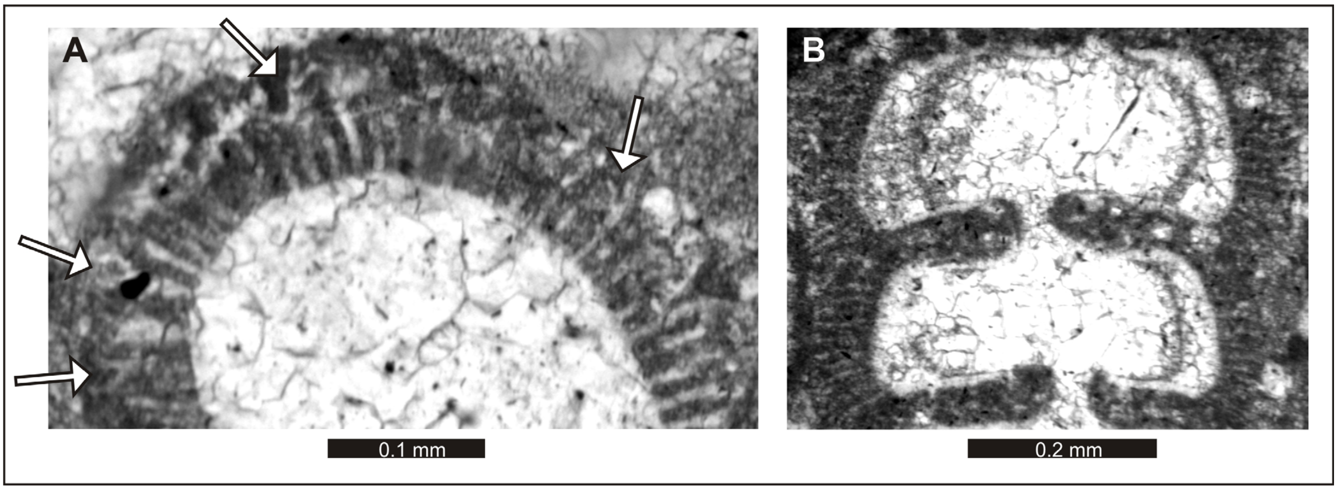

Figure 3. Details of the wall structure of *Cretaciclavulina gusici* n. gen., n. sp. A) Detail from Pl. 1D showing rare distal pore bifurcations (arrows). Thin-section S2N124. B) Detail from the holotype specimen of Pl. 1A showing the inner recrystallized calcareous layer. Thin-section 514 K3V71/5.

before the outer test surface (see BANNER et al., 1991; HOTTINGER et al., 1990; HOTTINGER, 2006, for details) (Fig. 3A). This thin outer „pavement" is commonly eroded. Canaliculi appear scarcer to absent in the septa. The phylogentic relationship concerned with the appearance of such „false keriothecae" (VACHARD et al., 2004) is still poorly understood and requires further study (see also RIGAUD et al., 2015).

In the adult chambers of some *Cretaciclavulina* the outline of an inner calcareous layer, morphologically close to that of the Palaeotextulariidae (Fig. 3B), is preserved. In Palaeotextulariidae, however, the inner layer is clearly yellowish and fibrous whereas that observed in *Cretaciclavulina* is recrystallized into sparite (?originally aragonitic). It is worth mentioning here that a yellowish inner fibrous calcitic layer was reported recently from the Upper Cretaceous (Coniacian) genus *Siphodinarella* (SCHLAGINTWEIT et al., 2014). Axial sections (that usually do not allow biserial to be distinguished from the triserial forms) of *Cretaciclavulina* show morphological resemblance to large-sized palaeozoic Palaeotextulariid genera such as *Climacammina* BRADY (Fig. 4A), *Deckerella* CUSHMAN & WATERS (Fig. 4B), and *Palaeobiginerina* GALLOWAY. These taxa are biserial becoming uniserial in the adult part. The wall structure is originally described as „calcareous, microgranular, commonly with an inner radial fibrous layer" (LOEBLICH & TAPPAN, 1987, p. 218). This view was corrected by PILLER (1990) evidencing the agglutinating character of the outer layer.

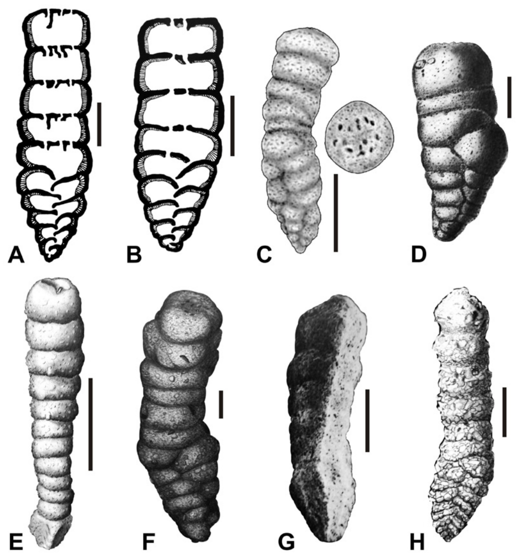

Figure 4. Foraminiferal genera that are compared with *Cretaciclavulina* n. gen. A) *Climacammina antiqua* (BRADY), early Carboniferous of Scotland (from LOEBLICH & TAPPAN, 1987, pl. 228, fig. 11). B) *Deckerella clavata* CUSHMAN & WATERS, late Carboniferous of Texas (from LOEBLICH & TAPPAN, 1987, pl. 229, fig. 3).) *Gerochella cylindrica* NEAGU, Valanginian of Romania (from NEAGU, 1997, Fig. 1/40–41). D) *Goesella rotundata* (CUSHMAN), Holocene of Philippine Islands (from LOEBLICH & TAPPAN, 1987, pl. 200, fig. 6). E) *Clavulina parisiensis* d´ORBIGNY, Middle Eocene of France (from LOEBLICH & TAPPAN, 1987, pl. 200, fig. 3). F) *Cribrogoesella robusta* (BRADY), Holocene of Pernambuco, Atlantic (from LOEBLICH & TAPPAN, 1987, pl. 201, fig. 3), G) *Clavulinopsis hofkeri* BANNER & DESAI, Upper Cretaceous (Campanian) of Texas, USA (from LOEBLICH & TAPPAN, 1987, pl. 196, fig. 3). H) *Bigenerina nodosaria* D´ORBIGNY, Holocene of France (from LOEBLICH & TAPPAN, 1987, pl. 191, fig. 1). Scale bars = 0.3 mm.

The uniserial stage in *Cretaciclavulina* does not abruptly follow the trochospiral (triserial) stage, but with a mediating short biserial stage. Examples of such triserial-biserial-uniserial tests are for example the agglutinated Lower Cretaceous *Spiroplectinata* CUSHMAN, 1927 of the Verneuilinidae (TYSZKA & THIES, 2001; KAMINSKI et al., 2011) and *Gerochella* NEAGU, 1997 (Fig. 4C) of the Ataxophragmiidae, the Eocene to Holocene *Goesella* CUSHMAN, 1933 of the Valvulinidae (Fig. 4D), as well as the Late Cretaceous (Campanian) *Rectogerochammina* KAMINSKI, CETEAN & NEAGU, 2010 of the family Prolixoplectidae LOEBLICH & TAPPAN, 1985. The four mentioned genera exhibit a solid (non-canaliculate) wall different from that of *Cretaciclavulina*.

Forms with a serial and later uniserial test as well as a canaliculate wall structure are reported from the various representatives of the family Valvulinidae BERTHELIN, with the genera *Clavulina* D´ORBIGNY, 1826, *Cribrogoesella* CUSHMAN, 1935, and *Gyrovalvulina* LOEBLICH & TAPPAN, 1985 as well as of the family Pseudogaudryinidae LOEBLICH & TAPPAN, 1985, with the genera *Clavulinopsis* BANNER & DESAI, 1985, and *Pseudoclavulina* CUSHMAN, 1936. The differences between these genera and *Cretaciclavulina* can be roughly summarized as follows (only the main differences are stressed; ages and generic features acc. to LOEBLICH & TAPPAN, 1987):

– *Clavulina* D'ORBIGNY, 1826 (Palaeocene to Holocene) (Fig. 4E): triangular early and uniserial adult stage (3-1 chamber arrangement opposed to 3-2-1 in *Cretaciclavu-*

lina; see also the comparative table in WEIDICH, 1988); finely bifurcating pores are sealed internally by an organic lining (that may simply not be preserved in *Cretaciclavulina*?); aperture with an imperforate toothplate; toothplates of successive chambers oriented 120 degrees apart.

– *Cribrogoesella* CUSHMAN, 1935 (Miocene to Holocene) (Fig. 4F): early trochospiral stage with up to five chambers; rapidly reducing to three, then biserial and finally uniserial; both lateral walls and septa strongly canaliculate; aperture cribrate in the uniserial stage (opposed to single, and areal in *Cretaciclavulina*).
– *Gyrovalvulina* LOEBLICH & TAPPAN, 1985 (Eocene): „triserial and triangular early stage and later chambers in a loose spiral, with progressively fewer chambers per whorl, until the final chamber nearly completely encircles the axis" (LOEBLICH & TAPPAN, 1985, p. 213).
– *Clavulinopsis* BANNER & DESAI, 1985 (Campanian to Maastrichtian) (Fig. 4G): test triangular (throughout!); early stage triserial, later abruptly becoming uniserial (3-1 chamber arrangement opposed to 3-2-1 in *Cretaciclavulina*).
– *Pseudoclavulina* CUSHMAN, 1936 (Upper Cretaceous to Lower Eocene): early stage triangular, then uniserial (3-1 chamber arrangement) thereby reducing abruptly test diameter; aperture terminal, but without a distinct tooth.

Last but not least, the genus *Bigenerina* D'ORBIGNY, 1826 (Eocene to Holocene acc. to LOEBLICH & TAPPAN; 1987) shows an early biserial stage, later becoming abruptly uniserial, and an agglutinating, canaliculate wall (Fig. 4H).

It is worth mentioning here that the Mesozoic-Cenozoic taxa that were compared with *Cretaciclavulina* were all described from isolated specimens recovered from deeper water marly lithologies. *Cretaciclavulina* instead is reported from typical shallow-water platform carbonates.

Cretaciclavulina gusici n. sp.

Fig. 3, Pl. 1

1990 Unidentified or unknown foraminifera – GUŠIĆ & JELSKA, pl. 15, figs. 8, 9.

Origin of the name: Dedicated to Ivan Gušić (Zagreb) for his contributions to the taxonomy of benthic foraminifera. The new taxon was also illustrated for the first time by GUŠIĆ & JELASKA (1990) (see synonymy).

Holotype: Subaxial section illustrated in Pl. 1, Fig. A, and details in Pl. 1, Fig. G, and Fig. 3B, thin-section inv. no. 10807 (514 K3V71/5).

Paratypes: Specimens illustrated in Pl. 1, Figs. B–F, H–O (inv. no. 10808–10815).

Type-locality: On the east side of the Otočac cove (northeast coast of the Brač island). Approximate coordinates: 43.352294ºN, 16.796578º (Fig. 1).

Type-level: Lower Campanian; the highest levels of the Gornji Humac Formation, (Upper Turonian–Lower Campanian), and the Rasotica and Lovrečina Members (Lower–Middle Campanian) in the Pučišća Formation) (Fig. 2).

Diagnosis: Being monospecific see diagnosis of genus.

Description: Test elongate, trochospiral to uniserial. The early stage, rounded triangular (with concave sides), is most likely triserial as visible in transverse sections (Pl. 1B) becoming increasingly rounded. In the specimen shown in Pl. 1A, this stage amounts about ~40 % of the total test. The rounded void at the

Table 1. Benthic foraminifera (selection) co-occurring with *Cretaciclavulina gusici*.

Taxa / Thin-sections	*Acordiella conica* FARINACCI	*Antalyna korayi* FARINACCI & KÖYLÜOGLU	*Calveziconus lecalvezae* CAUS & CORNELLA	*Calveziconus?* sp.	*Cuneolina* gr. *pavonia parva* HENSON	*Dicyclina* sp.	*Dictyoconus?* sp.	*Lituonella?* sp.	*Lituolipora?* n. sp.	miliolids	*Minouxia* sp.	*Montcharmontia apenninica* (DE CASTRO)	*Murgella lata* LUPERTO SINNI	*Nezzazatinella* cf. *adhami* DARMOIAN	*Reticulinella fleuryi* CVETKO et al.	*Rotalispira scarsellai* (TORRE)	*Scandonea mediterranea* DE CASTRO	*Scandonea samnitica* DE CASTRO	*Voloshinovella?* sp.
514 K3V71/5		X	X		X					X		X							
251 $^{5}18_{4}$			X		X					X	X	X							
208 18/1S4	X	X	X	X	X	X		X	X	X	X						X	X	
223 ^{18}7/1 S4	X		X		X					X	X				X				
1Kr1 ^{13}15	?		?							X	X		X						
S2N124					X	?			X	X									
209 18/2S4			X		X	X			X	X									
132 $_{9}$18 Ku3			X			X				X		?							
21 $^{42}{}_{13}$15KR1			X		X				X	X					X				
212 $^{7}{}_{2}$8 S4	X				X	X			X	X		X			X	X			
528 K213 ^{46}15						X				X	X	X							
Mu 3K 606/20	X		X		X	X	X			X	X	X	?	X					X

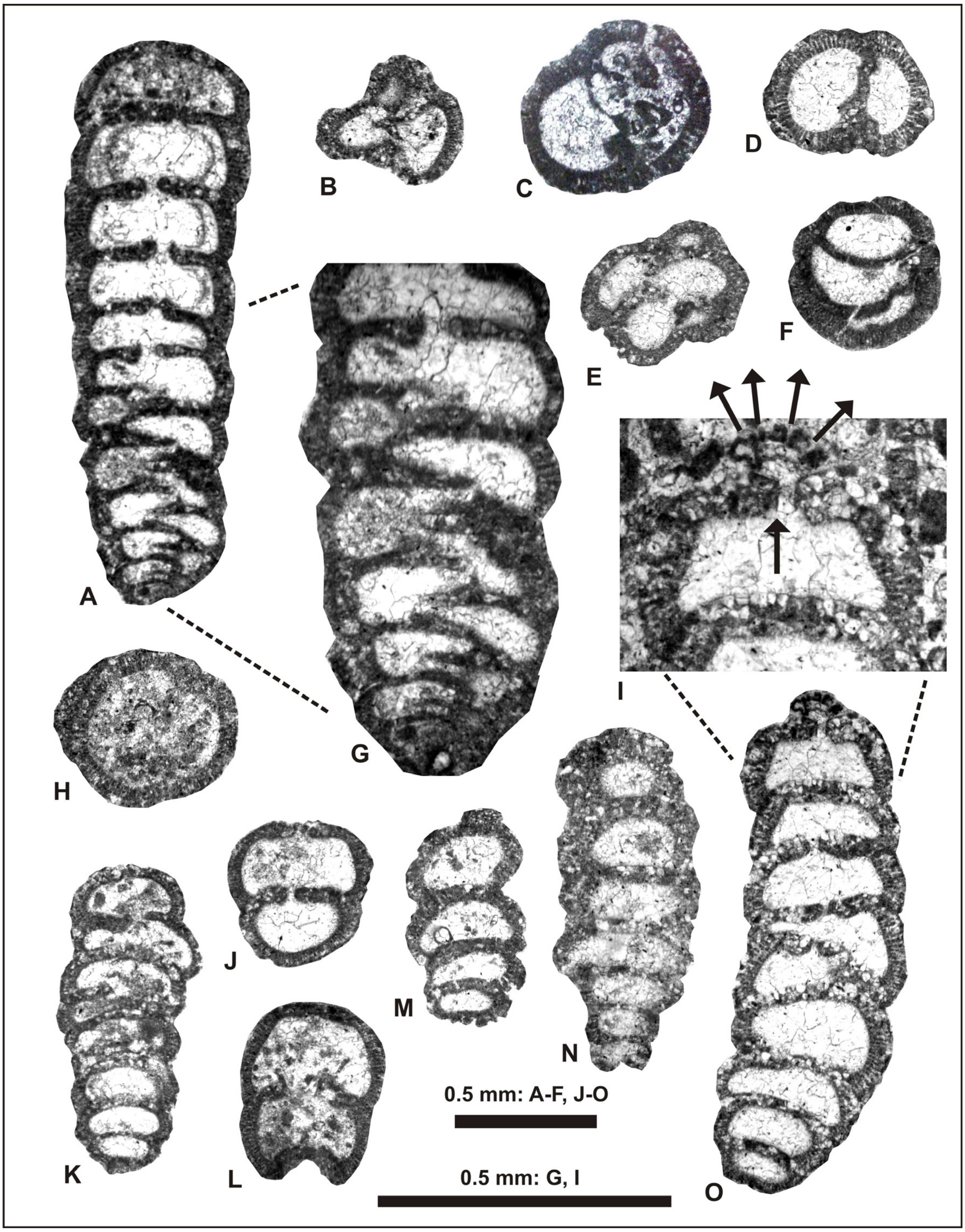

Plate 1. *Cretaciclavulina gusici* from the early Campanian of Brač Island.

A Subaxial section, holotype specimen. Thin-section inv. no. 10807 (514 K3V71/5).

B Slightly oblique transverse section showing triangular outline with concave sides, lower part of the triserial stage. Thin-section inv. no. 10808 (223 ^{18}7/1 S4).

C Slightly oblique transverse section in the upper part of the trochospiral stage (see GUŠIĆ & JELASKA, 1990, Pl. XV, Fig. 9). Thin-section inv. no. 10809 (213 $^{7}{}_{2}$18/2 S4).

D Slightly oblique section of the biserial stage. Thin-section inv. no. 10810 (S2N124).

E Oblique section of the triserial stage. Thin-section inv. no. 10811 (132 $_{9}$18$_{4}$ Ku3).

F Oblique section of the trochospiral stage. Thin-section inv. no. 10812 (209 18/2S4).

G Detail from A, showing the transition of the triserial to the uniserial stage. Note the pseudo-keriothekal wall structure. Thin-section inv. no. 10807 (514 K3V71/5).

H Slightly oblique transverse section of the uniserial stage. Thin-section inv. no. 10807 (514 K3V71/5).

I Detail from O, showing the cribrate apertural plate. Thin-section inv. no. 10813 (^{13}15/1Kr1).

J Oblique section of the uniserial stage cutting two chambers. Thin-section inv. no 10808 (223 ^{18}7/1 S4).

K Subaxial section of a broken specimen cutting 8 chambers of the uniserial stage. Thin-section inv. no. 10808 (223 ^{18}7/1 S4).

L Broken fragment consisting of two chambers of the uniserial stage, axial section. Thin-section inv. no. 10814 (208 18/1S4).

M Oblique or tangential section of a broken specimen cutting 4 chambers of the uniserial stage. Thin-section inv. no. 10813 (^{13}15/1Kr1).

N Oblique section. Thin-section inv. no. 10815 (21 $^{42}{}_{13}$15KR1).

O Longitudinal, non-centered section of the uniserial stage, notably 9 chambers, of a specimen. The apertural detail is shown in I. Thin-section inv. no. 10813 (^{13}15/1Kr1).

apex of the holotype specimen possibly refers to the proloculus (Fig. Pl. 1G). Altogether, the information on the initial stage is poor as most random sections are beyond the uniserial stage. Further towards the following uniserial stage, transverse sections of the test become more and more rounded in outline (Pl. 1B–E, G). A short biserial part occurs between the triserial and uniserial stages (Pl. 1D).

The adult stage is represented by a series of at least six uniserial chambers. This stage is roughly cylindrical, rectilinear to slightly bent, with chambers that only slightly increase in breadth and height. This accounts for the slender, sometimes slightly bent cylindroconical test morphology. Transverse sections are either circular or slightly elliptical in outline. The solid septa are almost planar (so that the chambers are not overlapping) and pierced by a single foramen in a central to slightly eccentric position. In axial sections, the appressed chambers have a low rectangular shape with rounded margins. Wall agglutinating, with a large amount of microgranular or microagglutinated calcareous material, thick and canaliculate (or paraporous) with fine pores (or canaliculi) ending blindly shortly before the outer test surface (Fig. 3A). This thin outer layer (or „pavement", see HOTTINGER, 2006) is mostly eroded. The pores are straight and more or less parallel (radial arrangement), but may branch in the outer part. In the adult uniserial chambers of the holotype specimen, remnants of an inner calcitic layer are discernible. The thickness of this layer is about 0.04 mm at the lateral walls and is decreasing/tapering upon the septa towards the foramina (Fig. 3B). Foramen single interiomarginal in the trochospiral and areal in the uniserial part. Aperture (last chamber) areal, provided with a cribrate apertural plate (Pl. 1I).

Dimensions:

Test length: up to 2 mm

Test diameter: up to 0.7 mm

Number of chambers last mm axial length: 5

Adult chamber height: ~0.18 to ~0.2 mm

Wall thickness (without calcitic inner layer): ~0.065 to ~0.1 mm

Diameter caniculi: ~7 µm

Remarks: *Cretaciclavulina gusici* has been illustrated by GUŠIĆ & JELASKA (1990, pl. 15, figs. 8, 9) as an „unidentified or unknown foraminifera". The two illustrations presented are a longitudinal section of the uniserial final part cutting nine chambers (op. cit., pl. 15, fig. 8, refigured here on Pl. 1A, and detail in G). The other one represents an oblique transverse section of the triserial early portion (op. cit. Pl. 15, fig. 9, refigured here on Pl. 1C). Based on these sections GUŠIĆ & JELASKA (1990) summarized the characteristics of this taxon comprising „a well-developed keriothecal wall structure, in addition to a comparatively simple morphology and lack of endoskeleton". In fact, this material was insufficient for recognizing the new character of the form based on the combination of the different coiling modes in the early and late test portions.

Transverse sections of the chrysalidinid *Praechrysalidina infracreatcea* LUPERTO SINNI, 1979 (Aptian of south Italy) (e.g., LUPERTO SINNI, 1985, pl. 6, fig. 5–6) are very similar to those of *Cretaciclavulina gusici*. *P. infracretacea* differs from the latter mostly by having a triserially coiled test throughout. Moreover, the early part of the test with its foramina are said to be most likely simple with broad apertural flaps situated at the inner margin, later becoming pierced by numerous areal pores (cribrate) opposed to the single areal foramina in *Cretaciclavulina* (see also BANNER et al., 1991).

The species *Gerochella cylindrica* NEAGU (Lower Valanginian of Romania, Fig. 4C) can be considered homeomorphic to *Cretaciclavulina gusici*, but is more slender (test length up to 1.4 mm; width between 0.24 to 0.29 mm). As already remarked, the wall of *G. cylindrical* is compact, finely agglutinated, whereas in *Cretaciclavulina* the wall is canaliculate (paraporous).

Microfacies: *Cretaciclavulina gusici* has been observed in packstones and grainstones containing a diverse association of benthic foraminifera: cuneolinids, orbitolinids, soritids and other miliolids, nezzazatids, coxitids, spirocyclinids, nautiloculinids, textulariaceans, rare rotaliids and others (Tab. 1).

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