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Upper triassic miliolids of "*Cucurbita* group": aspects of the systematic classification

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11 Text-Figures, 3 Tables, 6 Plates

Foraminifera
Cucurbita
Triassic
Carnian
Norian
Tethys
Sicily
Aggtelek

Contents

Abstract

Miliolid Foraminifera are an abundant group in Upper Triassic reefs and shallow-water carbonates. During the last decades numerous known and new foraminiferal genera, like *Cucurbita*, *Amphorella, Spiriamphorella*, *Urnulinella*, *Pseudocucurbita, Paratintinnina*, *Costifera*, *Siculocosta*, *Hydrania,* and *Tignumparina* were described from several Carnian and Norian-Rhaetian localities. Since the establishing of these genera several authors have tried to revise their systematic positions. The present paper addresses some of the issues of the previous determinations and classifications, adding new data and specimens. Genera *Costifera*, *Siculocosta*, and *Urnulinella* recently considered synonymous with *Cucurbita*, are re-introduced, as well as several species. Two species of the genus *Cucurbita* (*C. minima* and *C. aggtelekensis*) are described as new.

Obertriassische Milioliden der „*Cucurbita*-Gruppe": Aspekte der systematischen Klassifikation

Zusammenfassung

Milioliden sind eine häufige Foraminiferen-Gruppe in der obertriassischen Riffen und Flachwasserkarbonaten. Mehrere neue Gattungen, wie *Cucurbita*, *Amphorella, Spiriamphorella*, *Urnulinella*, *Pseudocucurbita, Paratintinnina*, *Costifera*, *Siculocosta*, *Hydrania* und *Tignumparina*, sind in den letzten Jahrzehnten aus den karnischen und norisch-rhätischen Riffen beschrieben worden. Seit der Aufstellung dieser Gattungen haben wiederholt Autoren versucht, ihre systematische Stellung zu revidieren. Die vorliegende Arbeit diskutiert die Bestimmungskriterien und die Ansichten früheren Autoren bezüglich der Klassifikation. Die Gattungen *Costifera*, *Siculocosta* und *Urnulinella*, die vor kurzem mit der Gattung *Cucurbita* synonymisiert wurden, werden zusammen mit ihren Arten wieder eingeführt. Zwei Arten der Gattung *Cucurbita* (*C. minima* und *C. aggtelekensis*) sind neu beschrieben.

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Introduction

Benthic foraminifers are generally abundant in the Upper Triassic shallow water carbonates. In the reef facies, Miliolina are whereas groups with primary aragonitic test mineralogy (e.g. involutinids) and vagile agglutinated forms (like duostominids) characterise the lagoonal environment (Hohenegger & Lobitzer, 1971; Schäfer & Senowbari-Daryan, 1978; Schäfer, 1979; Dullo, 1980; Flügel, 1981; Senowbari-Daryan et al., 1982; Chablais et al., 2010; Gale et al., 2011).

Affected by the putative end-Carnian (early Norian?) extinction event the faunal composition of the Carnian reefs differs from those of the Norian-Rhaetian reefs (Benton, 1986, 1991; Riedel, 1991; Hallam, 1990; Senowbari-Daryan, 1994; Flügel & Senowbari-Daryan, 2001). Not only the reef builders (e.g. sponges, corals, the majority of microproblematic organisms, and algae) but also the reef dwellers (e.g. foraminifers) of Carnian and Norian reefs are different. Also the foraminiferal associations of the Carnian reefs and among them the Milioliceans, particularly with bell-, amphora- and funnel-shaped chambers of the test (called "*Cucurbita* group" in this paper) and with or without ornamentation of the outer test surface are abundant in Carnian and Norian-Rhaetian reefs. Particularly, miliolids with bell-, amphora- and funnel-shaped chambers, characteristic for the Carnian, largely disappear. Such foraminifers were described first from the West Carpathians as a problematic organism *Cucurbita* by Jablonský (1973). Borza & Samuel (1977a, b, 1978) have described further Carnian forms (also as problematic organisms) of this group as *Amphorella, Spiriamphorella, Urnulinella, Pseudocucurbita*, and *Paratintinnina*. Senowbari-Daryan (1983) described new genera *Hydrania* from the Carnian of the island Hydra Greece, and *Costifera* and *Siphonofera* from the Norian reefs of Sicily. He classified them as most probably foraminifera. Senowbari-Daryan & Zaninetti (1986) added a new genus *Siculocosta* to the already existing genera (see systematic part). Senowbari-Daryan (1993) added a genus *Tignumparina* from the Carnian of Sicily.

The latest attempt to classify this array of genera and species was carried out by Gale et al. (2012a). On the base of similar construction of the test, Gale et al. (2012a) proposed to group the majority of the above mentioned genera under the same genus, namely the *Cucurbita*.

Systematic

Before the description or mention of the individual genera and species a possible complete synonymy-list and the original diagnosis of some genera, higher categories and partly of the species are given.

Order Miliolina Delage & Hérouard, 1896

Family Milioliporidae Brönnimann & Zaninetti, 1971 (in Brönnimann et al., 1971)

Subfamily Pseudocucurbitinae Zaninetti, Altiner, Dager & Ducret, 1982a

Original diagnosis: "*Les Pseudocucurbitinae ont des tests libres, formés de loges en amphores, arrengées en séries rectilignes plus ou moins régullères; le stade initial est enroulè (?); les loges à paroi épaissie distalement se terminent par une lèvre mince s`étalant largement autour de l`ouverture qui est centrée; les loges sont enveloppées (ou supportées?) par une masse thécale secondaire, montrant une communication partielle avec les loges par la base de celles-ci; la paroi est calcaire de texture porcelanée (?), perforée dans la masse thécale comme dans les loges; la lèvre aperturale est imperforée; l´ouverture est simple et terminale, bordée d´une lèvre aplatie, soutenue par la paroi thécale*" (Zaninetti et al., 1982a: 97, compare Loeblich & Tappan, 1988: 367).

Remarks: Senowbari-Daryan & Zaninetti (1986) and Gale et al. (2012a) consider the subfamily Pseudocucurbitinae of Zaninetti et al. (1982a) as independent family Pseudocucurbitidae. Gale et al. (2012a) synonymised the subfamilies Spiriamphorellinae Senowbari-Daryan & Zaninetti (1986), Costiferinae Senowbari-Daryan & Zaninetti (1986), and the family Siculocostidae Zaninetti, Martini & Altiner (1992) with Pseudocucurtitidae.

According to Gale et al. (2012a) the family Pseudocucurbitidae contains the following genera: *Cucurbita* Jablonský (1973), *Hydrania* Senowbari-Daryan (1983), and *Tignumparina* Senowbari-Daryan (1993). Following the definition of Pseudocucurbitinae by Zaninetti et al. (1982a), the genera *Costifera*, *Siculocosta*, and *Urnulinella* are re-described, discussed, and re-established in this paper, adding them to the family Pseudocucurbitidae.

Genus *Cucurbita* Jablonský, 1973

Synonyms: *Paratintinnina* Borza & Samuel 1977b, *Amphorella* Borza & Samuel 1977a (partim), *Pseudocucurbita* Samuel & Borza 1981.

Type species: *Cucurbita infundibuliforme* Jablonský, 1973.

Additional species: *Cucurbita longicollum* Senowbari-Daryan 1983, *C. laticollaris* Senowbari-Daryan 1983, *C. brevicollum* Senowbari-Daryan 1983, *C. minima* nov. sp., *C. aggtelekensis* nov. sp.

Remarks: Gale et al. (2012a: 185) synonymised all species of Borza & Samuel (except *Amphorella subglobosa* = *Cucurbita subglobosa*) with *Cucurbita infundibuliforme*. However, sections of some Norian-Rhaetian *Spiriamphorella* species (Senowbari-Daryan 1983: Pl. 17), as well as some sections in Zaninetti (1977: Fig. 1, group 2 and 4) (see also Altiner & Zaninetti, 1981: Pl. 80, Figs. 1–6) do not agree with the reconstruction presented in Gale et al. (2012a).

For this revision they present a reconstruction with the approach to show the typical forms of all species unified to *C. infundibuliforme* as sections of the same foraminifer. But comparing e.g. different sections of some Norian-Rhaetian *Spiriamphorella* species (Senowbari-Daryan, 1983:

Pl. 17) as well as some other sections reconstructed of GALE et al. (2012a) doesn´t fit the reconstruction (see also discussion later). Therefore, a careful revision of these groups based on investigation of the type and additional material is necessary.

Cucurbita infundibuliforme JABLONSKÝ, 1973, emend

(Pl. 1, Figs. 7–15, Pl. 3, Figs. 6–12, Pl. 5, Figs. 18–20?, Text-Fig. 1)

Selected synonymy:

*1973 *Cucurbita infundibuliforme* n. g. et sp. – JABLONSKÝ, 420, Pl. 2, Figs. 1–4; Pl. 3, Fig. 1–6.

1981 *Galeanella infundibuliforme* (= *Cucurbita infundibuliforme* JABLONSKÝ). – SENOWBARI-DARYAN, Pl. 10, Figs. 4–5.

1981 *Paratintinnina tintinniformis* BORZA & SAMUEL. – SAMUEL & BORZA, Fig. 3.1.

1981 *Paratintinnina tulipaformis* BORZA & SAMUEL. – SAMUEL & BORZA, Fig. 3.2.

1981 *Amphorella bicamerata bicamerata* BORZA & SAMUEL. – SAMUEL & BORZA, Fig. 3.3.

1981 *Amphorella bicamerata intermedia* BORZA & SAMUEL. – SAMUEL & BORZA, Figs. 3.4, 3.6.

1981 *Amphorella bilongicamerata bilongicamerata* BORZA & SAMUEL. – SAMUEL & BORZA, Fig. 3.5.

1981 *Pseudocucurbita campanulafirmis* BORZA & SAMUEL. – SAMUEL & BORZA, Figs. 4.1a–c.

1981 *Pseudocucurbita fusani* BORZA & SAMUEL. – SAMUEL & BORZA, Figs. 4.2a–c; Pl. 21, Fig. 1.

1981 *Pseudocucurbita globosa* BORZA & SAMUEL. – SAMUEL & BORZA, Figs. 4.3a–b.

1981 *Pseudocucurbita subglobosa* BORZA & SAMUEL. – SAMUEL & BORZA, Figs. 4.4a–b, Pl. 21, Fig. 2.

1981 *Cucurbita infundibuliforme* JABLONSKÝ. – SALAJ et al., 156, Pl. 157, Figs. 7–8.

1982a *Pseudocucurbita subsphaerica* (BORZA & SAMUEL, 1978). – ZANINETTI et al., Text-Fig. 1, F–I, J? K, Pl. 1, Figs. 1–3 (4?), 5–6, 8–9.

1983 *Pseudocucurbita infundibuliformis* (JABLONSKÝ). – SENOWBARI-DARYAN, 194, Pl. 12, Figs. 1–8; Pl. 13, Figs. 1–11; Pl. 23, Fig. 11, Text-Fig. 6 (cum syn.).

?1983 *Pseudocucurbita subsphaerica* (BORZA & SAMUEL, 1977). – ZANINETTI & ALTINER, Pl. 1, Fig. 4.

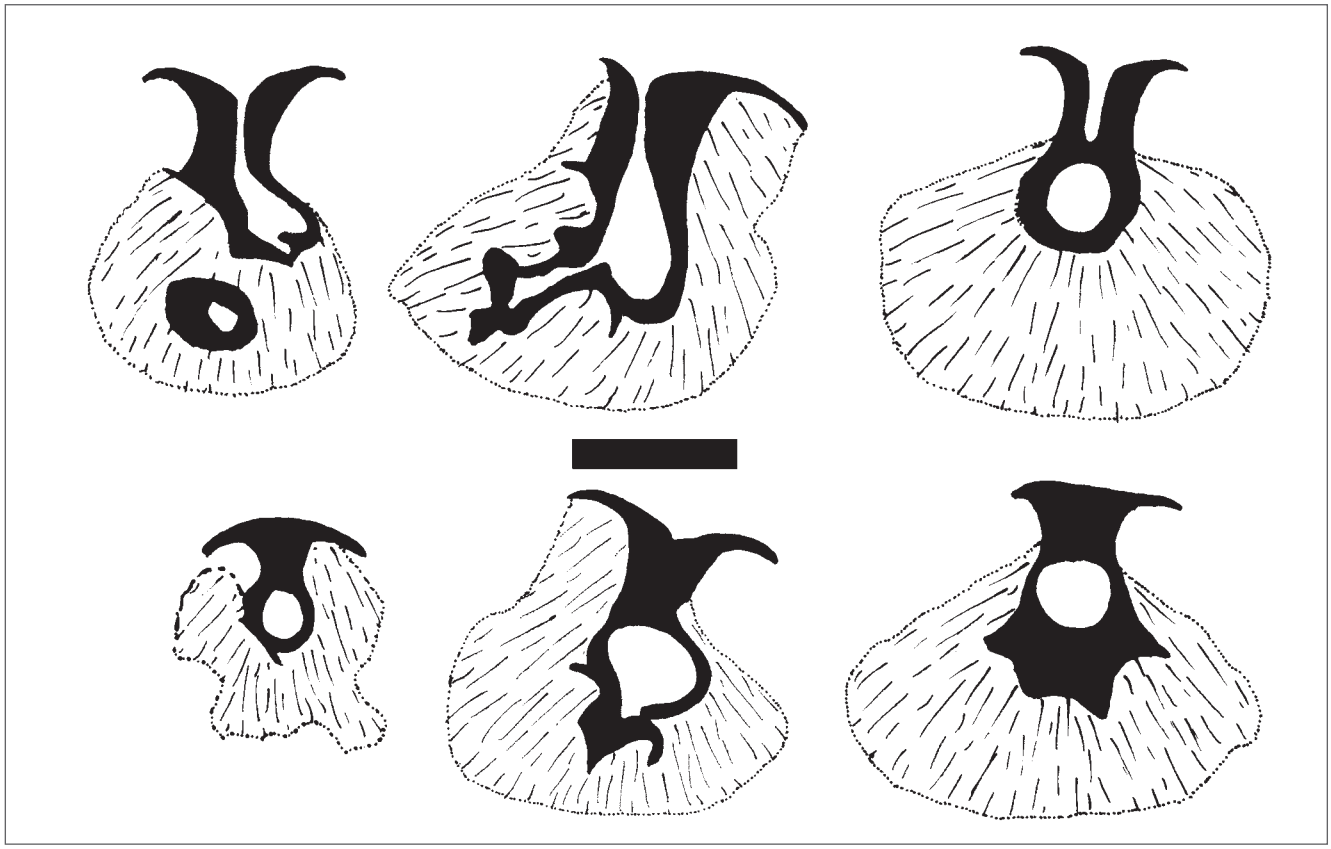
1986 *Pseudocucurbita infundibuliformis* (JABLONSKÝ). – SENOWBARI-DARYAN, Pl. 1, Figs. 2, 3?, 4–5, 7, 9–10; Pl. 2, Fig. 3, Text-Fig. 2.

1987 *Pseudocucurbita infundibuliformis* (JABLONSKÝ 1973). – SENOWBARI-DARYAN, 257, Pl. 1, Figs. 4–8 (cum syn.).

1990 *Pseudocucurbita infundibuliformis* (JABLONSKÝ). – RIEDEL, Pl. 4, Figs. 11–12.

?1990 ?Spiriamphorellinae; CIARAPICA et al., Figs. 6/A–B.

1991 *Cucurbita* cf. *infundibuliforme* JABLONSKÝ. – MARTINI et al., Pl. 15, Figs. 1–8.



Text-Fig. 1.
Cucurbita infundibuliforme JABLONSKÝ. The sections through several specimens exhibit the chambers and the ornamentation (bristles) around the test. Bristles are not well developed, narrower than in *Cucurbita minima* nov. sp. and rarely cover the whole neck and the collar. Scale = 0.2 mm.

1992 *Cucurbita infundibuliformis* JABLONSKÝ, 1973. – ZANINETTI & MARTINI, 29, Pl. 1, Figs. A–F, Pl. 2, Figs. A–I, J, Pl. 3, Figs. B(a–c), Pl. 4, Figs. 1–5, Pl. 5, Figs. 1–6, Pl. 7, Figs. 1–5 (cum syn.).

1993 *Cucurbita infundibulifomis* JABLONSKÝ. – SENOWBARI-DARYAN, Figs. 2–3.

1998 *Cucurbita infundibulifomis* JABLONSKÝ. – DI STEFANO et al., Fig. 7c.

2005 *Cucurbita infundibuliforme* JABLONSKÝ, 1973. – SENOWBARI-DARYAN & BERNECKER, 24, Pl. 7, Figs. A?, B(non)–F. I/A, J (cum syn.).

?2009 *Cucurbita infundibulifomis* JABLONSKÝ. – MARTINI et al., Pl. 2, Fig. 1.

2009 *Cucurbita* cf. *infundibulifomis*. – CARRILLAT & MARTINI, Fig. 4.1-5.

2010 *Cucurbita infudibuliformis*. – CHABLAIS, Figs. 7.3: 31–35; 7.4: 1–19.

Original diagnosis: "*Gehäuse aus mikritischem dunklen Calcit, kolbenförmig. An der oralen Seite befindet sich ein breiter, trichterförmiger und konvex gebogener Kragen, dessen Wand durch Verdoppelung einen Hohlraum bildet*" (JABLONSKÝ, 1973: 420).

Emended diagnosis: Following remarks are added for the description and determination: The bristles or filaments are limited mainly to the globular part and rarely to the neck of the chambers (see SENOWBARI-DARYAN, 1986: Fig. 2). The younger chamber does not overlap the older chamber or overlaps only the preceding chamber on one side (see SENOWBARI-DARYAN, 1983: Fig. 6, 1993: Fig. 2).

Detailed descriptions of *C. infundibuliforme* are found in JABLONSKÝ (1973), SENOWBARI-DARYAN (1983), and ZANINETTI & MARTINI (1992).

Occurrence and stratigraphic range: *Cucurbita infundibuliforme* JABLONSKÝ is known from the western and southern Tethys. CHABLAIS (2010) reported the occurrence from Japan (Panthalassa Domain). The stratigraphic age of all localities is Carnian.

MARTINI et al. (1997) reported the occurrence of *Cucurbita* sp. (may be *C. brevicollum*) from the Norian-Rhaetian of Indonesia.

Cucurbita longicollum (SENOWBARI-DARYAN 1983)

(Pl. 6, Figs. 9–12, Text-Figs. 2–3)

1981 Incertae sedis (*Amphorella*? nov. sp.). – SALAJ & BORZA, Fig. 3.10.

1981 Incertae sedis (*Amphorella*? sp.). – SAMUEL & BORZA, Pl. 22, Figs. 1–4.

1983 *Pseudocucurbita longicollum* sp. n. – SENOWBARI-DARYAN, 196, Pl. 14, Figs. 1–10, Pl. 15, Figs. 1–2, 6, Pl. 16, Fig. 5.

1983 "*Pseudocucurbita" longicollum* SENOWBARI-DARYAN. – MICONNET et al., 137–138, Pl. 10.

1986 *Pseudocucurbita longicollum* SENOWBARI-DARYAN. – SENOWBARI-DARYAN, Pl. 1, Fig. 8.

1986 *Pseudocucurbita longicollum* SENOWBARI-DARYAN. – SENOWBARI-DARYAN & ABATE, Pl. 10, Figs. 4–5.

1987 *Pseudocucurbita longicollum* SENOWBARI-DARYAN. – PIRDENI, Pl. 6, Fig. 17.

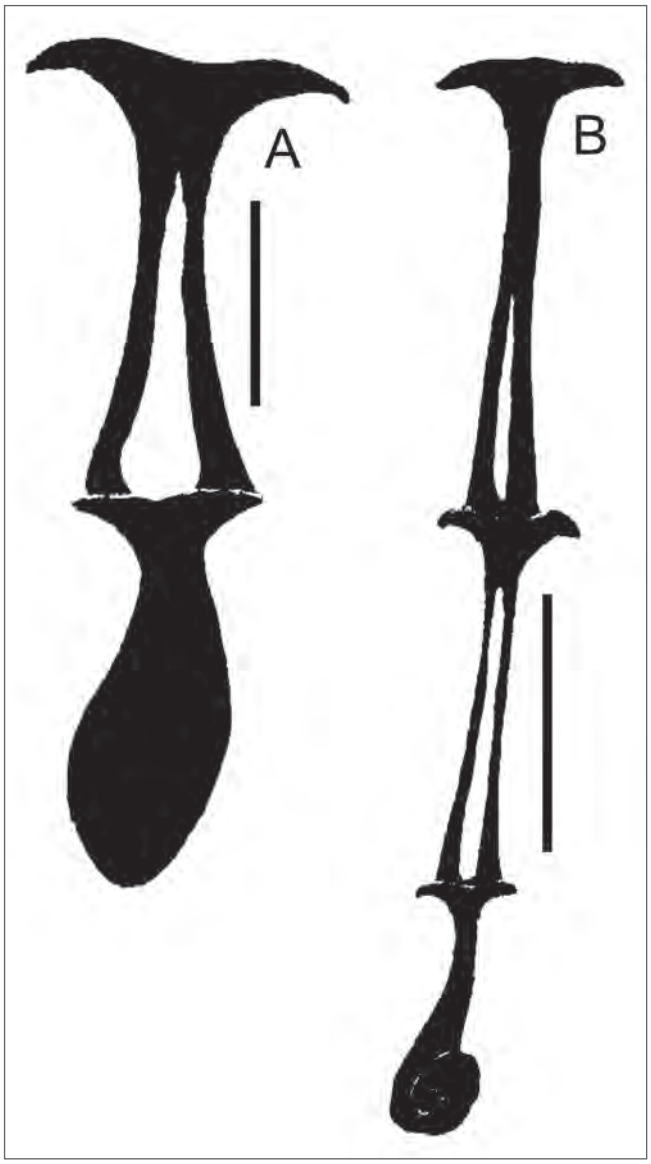
1988 *Pseudocucurbita longicollum* SENOWBARI-DARYAN. – PIRDENI, Pl. 2, Fig. 4.

1990 *Pseudocucurbita longicollum* SENOWBARI-DARYAN. – DI STEFANO et al., Pl. 4, Figs. 7–10.

?1991 *Hydrania dulloi* SENOWBARI-DARYAN. – MARTINI et al., Pl. 17, Figs. 10, 12–13, 15–16.

1996 *Pseudocucurbita longicollum* SENOWBARI-DARYAN. – SENOWBARI-DARYAN & FLÜGEL, 254, Pl. 3, Figs. 7–10, 12 (cum syn.).

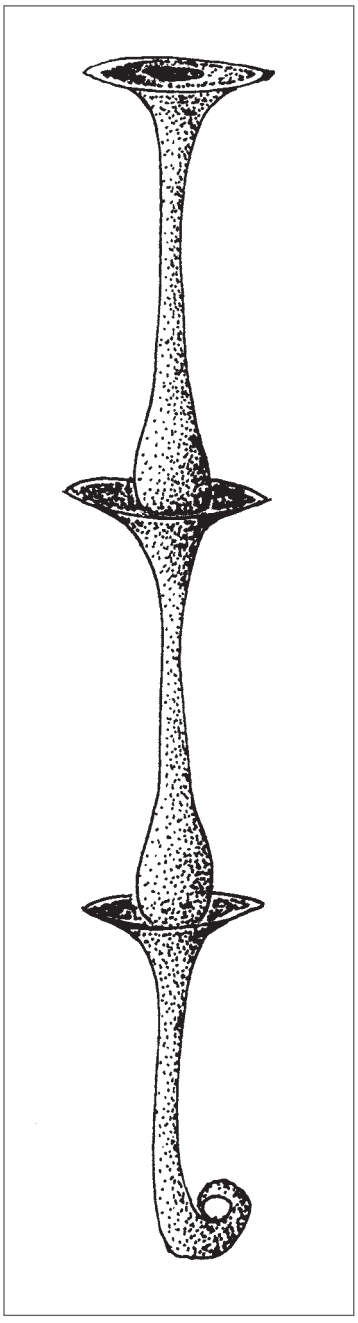
Remarks: *Cucurbita longicollum* was originally described as *Pseudocucurbita longicollum* from the Norian-Rhaetian reefs of Sicily by SENOWBARI-DARYAN (1983). The genus *Pseudocucurbita* SAMUEL & BORZA (1981) is, however, synonym with *Cucurbita* (see above). SENOWBARI-DARYAN (1986: Pl. 1, Fig. 8)



Text-Fig. 2.
Cucurbita longicollum SENOWBARI-DARYAN. Two longitudinal sections from the Carnian reef limestone of Cozzo Paparina, Sicily.
A) section through two chambers. B) section through three chambers (note the involution of the initial part of the specimen, compare Pl. 6, Figs. 9–10). Scale = 0.2 mm.

and SENOWBARI-DARYAN & ABATE (1986: Pl. 10, Figs. 4–5) illustrated from the Carnian of Sicily three specimens as *Pseudocucurbita longicollum*. Some specimens coming from the Carnian of Sicily and determined as *Hydrania dulloi* by MARTINI et al. (1991) could be *Cucurbita longicollum* too. Additional specimens were found from the Carnian reef carbonates within the Mufara Formation in Sicily, which show additional characteristics of the species. At least in two specimens (Pl. 6, Figs. 9–10, Text-Figs. 2–3) the initial part of the test is characterised by the involution of the tube-like part. This characteristic was not observed in the original description of the species. All other characteristics of Carnian specimens correspond to the original description. Based on the new observations the reconstruction of *C. longicollum* is given in Text-Figure 3.

Occurrence and stratigraphic range: *C. longicollum* (SENOWBARI-DARYAN) is known from the Carnian and Norian-Rhaetian reef carbonates of Sicily (SENOWBARI-DARYAN & ABATE, 1986; SENOWBARI-DARYAN, 1983) and Albania (PIRDENI, 1987, 1988). The species occurs also in the Norian reef limestone of Gosaukamm, Austria (SENOWBARI-DARYAN & FLÜGEL, 1996), in Taurus Mountains (southern Turkey), and in the Norian-Rhaetian reef carbonates of Peloponnese, Greece (author´s unpublished material).



Text-Fig. 3.
Spatial reconstruction of *Cucurbita longicollum* based on specimen illustrated in Pl. 6, Fig. 10. Schematic, not to scale.

Cucurbita minima nov. sp.

(Pl. 1, Figs. 1–6, Pl. 3, Figs. 13–17, Text-Fig. 4)

1986 *Spiriamphorella*? sp. – SENOWBARI-DARYAN, Pl. 1, Fig. 1.

1986 *Cucurbita infundibuliformis* (JABLONSKÝ). – SENOWBARI-DARYAN, Pl. 1, Fig. 3, Pl. 2, Figs. 1–2, 3?.

1986 *Pseudocucurbita*? sp. – SENOWBARI-DARYAN, Pl. 1, Fig. 6.

1986 *Pseudocucurbita infundibuliformis*? (JABLONSKÝ). – SENOWBARI-DARYAN, Pl. 2, Figs. 1–2, Text-Fig. 1 (holotyp in this paper).

1986 *Pseudocucurbita infundibuliformis*? (JABLONSKÝ). – SENOWBARI-DARYAN & ABATE, Pl. 10, Fig. 1 (holotype in this paper).

1988 *Pseudocucurbita*. – CIARAPICA et al., 128, Figs. 3, A–B, C?.

?1990 *Pseudocucurbita infundibuliformis* (JABLONSKY). – RIEDEL, Pl. 4, Fig. 10.

1991 *Cucurbita brevicollum* SENOWBARI-DARYAN. – MARTINI et al., Pl. 17, Fig. 19.

Derivatio nominis: Named for the small size of the chambers.

Holotype: Pl. 1, Fig. 3; the holotype is also illustrated in SENOWBARI-DARYAN, 1986: Pl. 2, Fig. 1 and in Text-Fig. 1, and in SENOWBARI-DARYAN & ABATE, 1986: Pl. 10, Fig. 1.

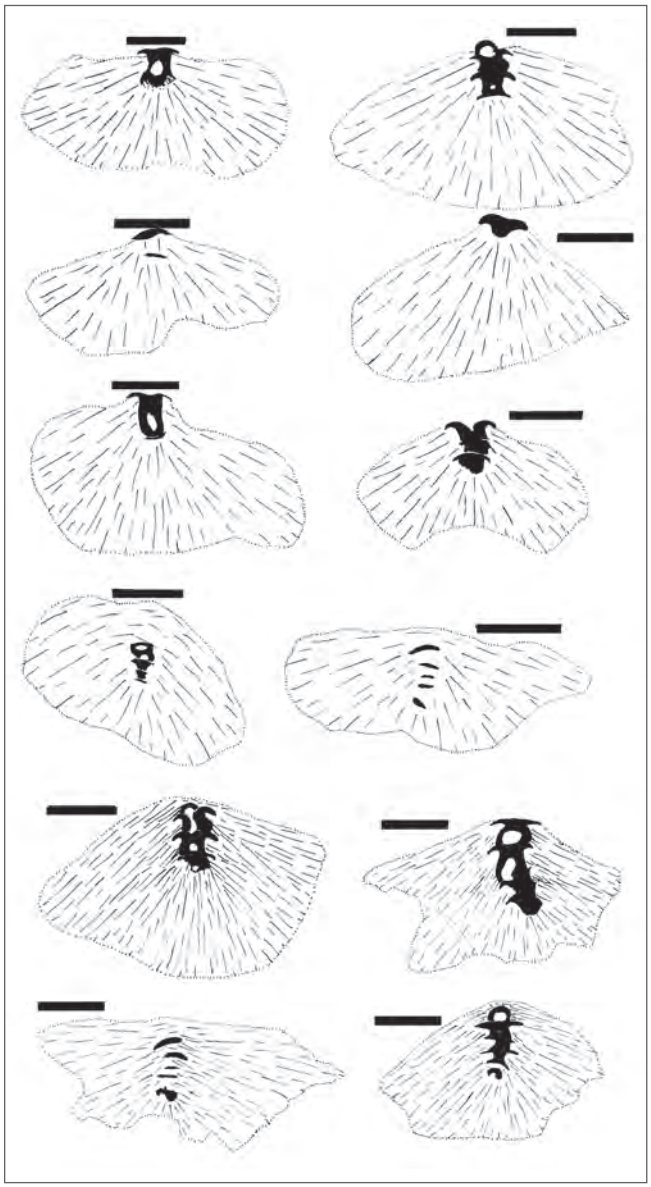
Locus typicus: The slope (Cozzo Paparina) between the small towns of Giacolone and Altefonte, southwest of Palermo, Sicily (Text-Fig. 5).

Stratum typicum: Carnian, reef boulders within the Mufara Formation.

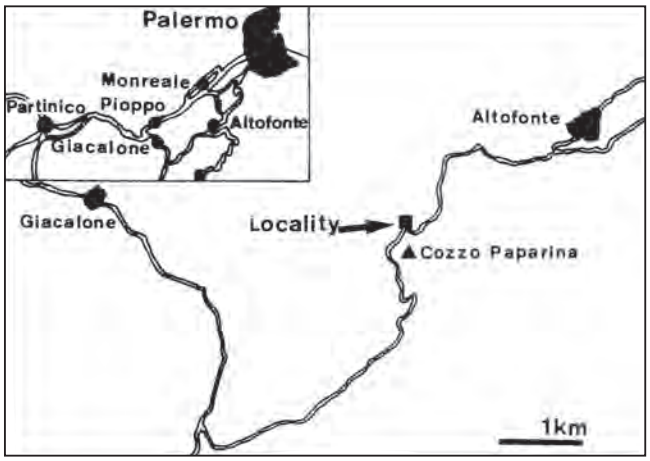
Diagnosis: Multi-chambered test. The test is composed of several amphora-like chambers, arranged one above the other on a straight or curved line. Well-developed filaments or bristles around the test, particularly around the basal part of the chambers. The chaplet of the bristles is several times larger than the test. Width of the collar approximately the same as the width of the basal part of the chamber.

Material: Numerous specimens from the type locality and from the calcareous boulders within the Mufara Formation in Madonie Mountains, Sicily (see MARTINI et al., 1991) and from the Carnian of Alsohegy Mountains, Hungary.

Description: The test of *Cucurbita minima* nov. sp. is composed of several, more or less equally large chambers arranged one above the other in a straight or curved line. The terminally positioned aperture is surrounded by approximately 100 µm collar (Tab. 1). Each collar is connected by a short “neck” to the chamber lumen. The diameter of the collar is about the same as the chamber (Tab. 1). The most



Text-Fig. 4.
Cucurbita minima nov. sp. Several sections through the chambers with well-developed ornamentation (bristles) around the chambers. The bristles are up to ten-time larger than the test and reach up to the collar of previous chambers. Scale = 0.2 mm.



Text-Fig. 5.
Type locality of *Cucurbita minima* nov. sp. in south-western of Palermo, Italy.

GL	BG	HB	KH	KB
750 (5)	1250	100	100	200
		100	80	125
		100	50	125
		50	80	125
		50	40	–
900 (4)	450	80	80	150
		75	75	125
		–	75	100
		–	75	100
620 (4–5?)	1000	100	80	125
(Holotype)		100	50	120
		–	50	100
		–	50	80
450 (5)	450	125	100	175
		–	75	125
		75	60	100
		60	50	100
		–	50	–
450 (6)	450	125	100	125
		–	80	100
		75	80	100
		50	50	75
		–	50	–
		–	50	–

Tab. 1.
Biometric data of the *Cucurbita minima* nov. sp.
GL) length of the test, including the chaplet; GB) width of the test, including the chaplet; HB) width of the chamber; KH) height of the chamber; KB) width of the collar. The numbers in parenthesis give the number of the chambers in the test. All measurements in µm.

characteristic of the species is the chaplet of bristles or filaments which are several times larger than the test (Text-Fig. 4). The filaments seem to cover the basal part of the chambers. Biometric dimensions of the test of *C. minima* nov. sp. are listed in Table 1.

Comparison: *Cucurbita minima* nov. sp. differs from the type species of the genus – *C. infundibuliforme* JABLONSKÝ – by the small dimensions of the test and smaller chambers, and other test parts (see SENOWBARI-DARYAN, 1983: Tab. 3 and Tab. 1 in this paper). The well-developed chaplet of the filaments around the whole test is an additional characteristic of *C. minima*.

According to the biometrical data *C. minima* is similar to *C. brevicollum* (SENOWBARI-DARYAN), described from the Norian-Rhaetian reefs of Sicily. The well-developed chaplet of filaments around the test of *C. minima* is missing in the Norian-Rhaetian Pseudocucurbitidae (author´s unpublished material; see also RIEDEL, 1990: Pl. 5, Fig. 9).

Occurrence and stratigraphic range: *Cucurbita minima* nov. sp. was found in the Carnian reef carbonates of Sicily (SENOWBARI-DARYAN, 1986; SENOWBARI-DARYAN & ABATE, 1986; MARTINI et al., 1991; this paper), in the Carnian of Alsohegy Mountains, Hungary (this paper) and possibly in the Carnian of Taurus Mts., southern Turkey (RIEDEL, 1990).

Cucurbita aggtelekensis nov. sp.

(Pl. 4, Figs. 1–13, Text-Fig. 6)

1990 *Pseudocucurbita*? – RIEDEL, Pl. 4, Fig. 9 (Carnian, Austria).

Derivatio nominis: Named after the type locality Aggtelek in Alsohegy Mountains, Hungary.

Holotype: Pl. 4, Fig. 13.

Paratypes: All specimens in Pl. 4, Figs. 1–12.

Locus typicus: Aggtelek, Alsohegy Mountains, Hungary.

Stratum typicum: Carnian reef limestones.

Diagnosis: Test porcelanous and multi-chambered. Individual chambers are inverse bell- to U-shaped. Chambers are arranged on top of each other in a curved line. The chamber wall is very thick, aperture is terminal. The end of each chamber carries an indistinct and very short collar. Test without filaments or bristles.

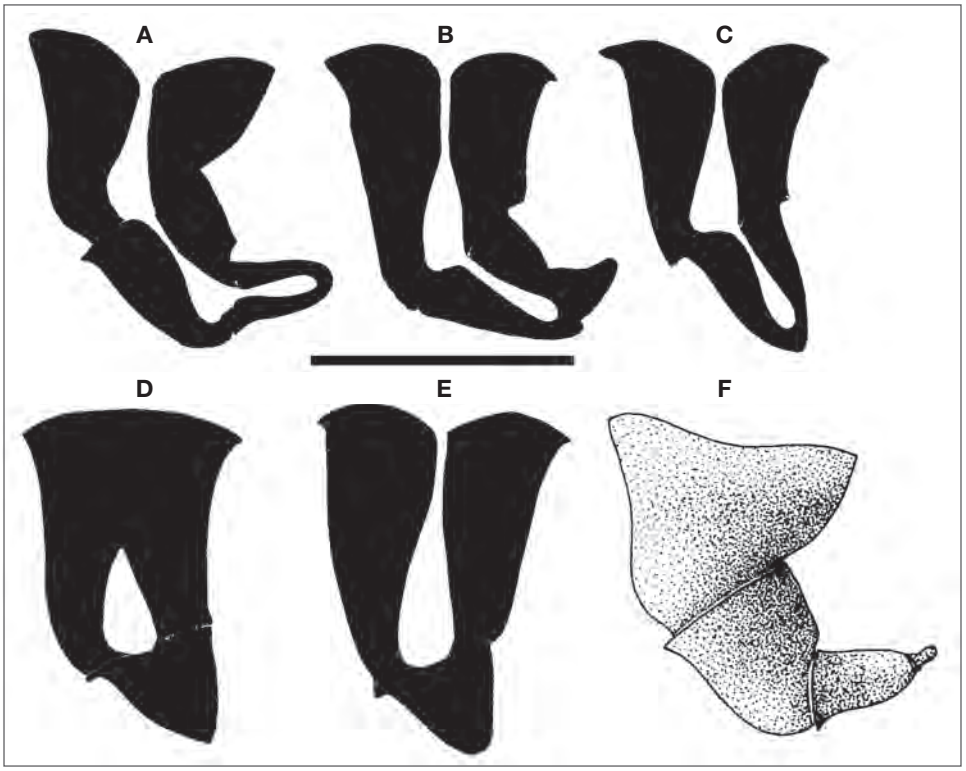
Material: Numerous specimens.

Description: The test of *Cucurbita aggtelekensis* is composed of several (at least four in holotype, Pl. 4, Fig. 13) chambers arranged uniserially in a curved line. The chamber walls are recrystallised into microsparite or neomorphically altered into spar. The chamber lumen is pear-shaped. The distal part of each chamber carries an indistinct and very short collar. The young chambers do not overlap the old chambers. The aperture is terminal and is located in a moderate depression. Test is without bristles, perforations, and other ornamentation. Table 2 shows dimensions of the test and chambers of *Cucurbita aggtelekensis* nov. sp. Text-Figure 6 shows some sections and a spatial reconstruction of *C. aggtelekensis*.

GL	KL	BC
420 (1.5)	250	325
450 (2)	225	275
	225	200
625 (2)	350	275
	275	225
550 (2.5)	325	325
	225	200
650 (3)	380	400
	270	260
	180	120

Tab. 2.
Dimensions of the test and the chambers in *Cucurbita aggtelekensis* nov. sp. GL) length of the test; KL) length of the chamber; BC) diameter (width) of the collar. The numbers in parenthesis give the number of the chambers in the test. All dimensions in µm.

Comparison: The shape of the chambers and their arrangement in *Cucurbita aggtelekensis* nov. sp. is similar to specimens described as *Pseudocucurbita campanulaformis* by BORZA & SAMUEL (1978: 72). The latter was synonymised with *Pseudocucurbita globosa* BORZA & SAMUEL (1978) and attributed to *Galaenella* by ZANINETTI & ALTINER (1981); synonymised with *Cucurbita infundibuliforme* JABLONSKÝ (1973) by SENOWBARI-DARYAN (1983) and later authors (see GALE et al., 2012a). In addition to the chamber dimensions *C. aggtelekensis* differs from *Cucurbita infundibuliforme* (= *C. campanulaformis*) by the thick chamber walls and by the lack of distinct collar around the aperture. The spines (SENOWBARI-DARYAN, 1986) or bristles (GALE et al., 2012a) of *C. infundibuliforme* are missing in *C. aggtelekensis*.



Text-Fig. 6.
Cucurbita aggtelekensis nov. sp.
A) section through three chambers, drawn from Pl. 4, Fig. 13 (holotype); B) drawn from Pl. 4, Fig. 1; C) drawn from Pl. 4, Fig. 9; D) drawn from Pl. 4, Fig. 2; E) drawn from Pl. 4, Fig. 3; F) a reconstruction of the species.

In some aspects the chamber shape of *C. aggtelekensis* is similar to the chamber shape of the Norian species, described as *Costifera cylindrica* by SENOWBARI-DARYAN (1983), which is listed as *Cucurbita cylindrica* nov. com. by GALE et al. (2012a). The massive ribs on the outer surface of the chambers in the *Costifera cylindrica* distinguish it clearly from *Cucurbita infundibuliforme* or *C. aggtelekensis* nov. sp.

?Family Costiferidae SENOWBARI-DARYAN & ZANINETTI, 1986

Genus *Costifera* SENOWBARI-DARYAN, 1983

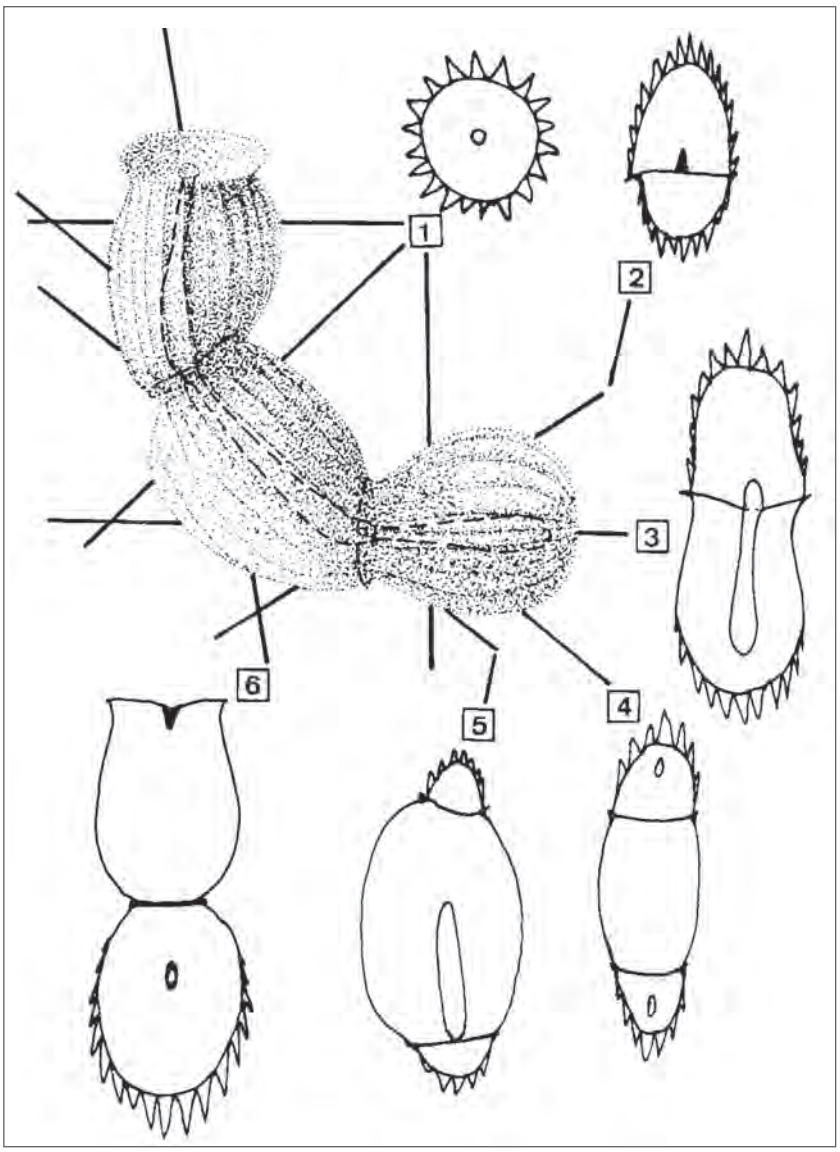
Type species: *Costifera cylindrica* SENOWBARI-DARYAN 1983

Remarks: The presence of costae in *Costifera* and *Siculocosta* distinguish these genera from *Cucurbita* and other genera with bristle (e.g. *Urnulinella*). GALE et al. (2012a: 184) revised the genera *Costifera* SENOWBARI-DARYAN (1983) and *Siculocosta* SENOWBARI-DARYAN & ZANINETTI (1986). According to these authors both genera are synonyms of *Cucurbita*. Their criteria and considerations to unify the three genera are mainly based on a theoretical reconstruction (GALE et al., 2012a: Figs. 1, 2) with proposed sections, which are partly morphologically implausible. In the literature as well as in own observations there is no proof or hint for some sections as postulated in GALE et al. (2012a), e.g. as section D and E for *Cucurbita infundibuliforme* JABLONSKÝ. Therefore, this reconstruction is not a suitable basis for merging three genera with otherwise distinctly different morphological characters.

The lack of test ornamentation in or the presence of bristles in some species of *Cucurbita* and the presence of different ornamentation (ribs) in *Costifera* and *Siculocosta* distinguish these genera from *Cucurbita* and other genera (e.g. *Urnulinella*). *Costifera* and *Siculocosta* should be considered as independent genera, based on the following criteria:

a) The different types of costae or ribs on the outer surface of the test of *Costifera* and *Siculocosta* are the main characteristic of these genera. Such costae are missing in *Cucurbita* and other genera, described by BORZA & SAMUEL (1977a, b, 1978). Filaments or bristles, occurring in some Carnian species of *Cucurbita*, were never observed in these genera and nor in the Norian species of *Cucurbita* (e.g. *C. longicollum* SENOWBARI-DARYAN 1983). The different ornamentation types (filaments or costae) of the test outer surface should be considered systematically higher as in species level.

b) The involutions degree of the test, caused by the overlapping of the older chamber(s) by the younger chamber on one or both side in *Siculocosta* should be also considered (see also the remarks for *Siculocosta*).



Text-Fig. 7.
Spatial reconstruction of *Costifera cylindrica* and some sections trought the test (re-illustrated from SENOWBARI-DARYAN, 1983: Fig. 11). Note lines at the base of the ribs. Schematic, not to scale.

Costifera cylindrica SENOWBARI-DARYAN, 1983

(Pl. 6, Figs. 1–4, 8/C, Text-Fig. 7)

1982a *Galeanella* sp. – ZANINETTI et al., Pl. 1, Figs. 7(?), 10–11, 12(?).

1982b *Galeanella* sp. nov. – espèce qui sere décrite prochainement pa B. SENOWBARI-DARYAN. – ZANINETTI et al., Pl. 2, Figs. 1–4, 5?–6?, 7–8.

1983 *Costifera cylindrica* sp. n. – SENOWBARI-DARYAN, 208, Pl. 19, Figs. 1–11, Pl. 20, Figs. 1–2, 10–11, Text-Fig. 11 (plates are erroneously confused with plates explanations!).

1983 *Costifera cylindrica* SENOWBARI-DARYAN. – MICONNET et al., 137, Pl. 2, Figs. 1–2, 3? (cum syn.).

1990 *Costifera cylindrica* SENOWBARI-DARYAN. – DI STEFANO et al., Pl. 4, Figs. 2–3.

1996 *Costifera cylindrica* SENOWBARI-DARYAN. – BERNECKER, 68 (without illustration).

Description: The test of *Costifera cylindrica* is composed of several barrel-like chambers with indistinct collar on the oral side of the chambers. Chambers are arranged one above the others in straight or curved line. The younger chambers do not overlap the preceding chamber(s). The chamber surface is covered by longitudinal ribs, recognisable in cross section of the chambers. Characteristic is the wall between the ribs and the test (Pl. 6, Figs. 1–4). This character is documented in specimens from different localities, e.g. Apennines, South Italy (e.g. Pl. 6, Fig. 1: re-illustrated from MICONNET et al., 1983: Pl. 2, Fig. 2). A detail description with biometrical data of the test and chambers is given by SENOWBARI-DARYAN (1983). Text-Figure 7 shows some possibly sections through the test of *C. cylindrical*.

Occurrence and stratigraphic range: *Costifera cylindrica* is known from the Norian-Rhaetian reefs of Sicily, Apennines (South Italy) and from Taurus Mountains (South Turkey: as *Galeanella* n. sp. by ZANINETTI et al., 1982b, author´s unpublished materials from southern Turkey and Greece). The species is also reported (as *Cucurbita cylindrica*, without documentation) from the Late Norian-Rhaetian deposits of the Julian Alps, Slovenia by GALE et al. (2012b). BERNECKER (1996) reported the occurrence of the genus in Norian-Rhaetian reef carbonates of Oman.

?Family Siculocostidae ZANINETTI, MARTINI & ALTINER, 1992

Genus *Siculocosta* SENOWBARI-DARYAN & ZANINETTI, 1986

Type species: *Costifera battagliensis* SENOWBARI-DARYAN, 1983

Additional species: *Siculocosta floriformis* ZANINETTI & ALTINER (in ALTINER et al., 1992)

Remarks: GALE et al. (2012a: 183) argue, that "*the body plan of the genera Costifera and Siculocosta is the same as that of the genus Cucurbita*". This argument is in general acceptable compared with the body plan of e.g. most Ammonites. However, based on other internally and externally characteristics of the shell numerous genera of Ammonites are differentiated.

The most significant characteristic of the genus *Siculocosta* is the formation of costae (ribs) by the folding of the test wall (see SENOWBARI-DARYAN, 1983: Text-Fig. 12). There is not a thin wall (dark line in section) between the test and ribs. This characteristic was observed in the type material from Sicily (SENOWBARI-DARYAN, 1983), in specimens from other Norian-Rhaetian reef localities in Sicily (DI STEFANO et al., 1990: Pl. 4, Fig. 2, 1996), Greece (Pl. 6, Figs. 7–8), and the Apennines (MICONNET et al., 1983: Pl. 2, Figs. 5–7, 9–10). The massive and unequivocal costae on the test surface of *Costifera* are known also from well preserved material and corresponding sections of other localities (e.g. from the Taurus Mountains in southern Turkey, ZANINETTI et al., 1982b: Pl. 2, Figs. 1–8) and from the Apennines (MICONNET et al., 1983: Pl. 2, Fig. 2). Based on these characters ZANINETTI et al. (1992, see also ALTINER et al., 1992) established the new family Siculocostidae for the genus *Siculocosta* (but an independent family for the genus *Siculocosta* does not seem to be justified). According to GALE et al. (2012a: 183) the "*line between the costae*" in *Costifera* specimens may or may not "*display the diagnostic*" characteristic. This point is invalidated by numerous observations in other specimens (SENOWBARI-DARYAN, 1983: Pl. 19, Figs. 4, 6, 9–11, Pl. 20, Fig. 2, because of errors see the plates, not the plate explanations in opposite!). The diagnostic line is also clearly visible and recognisable in specimens from other localities. SADATI (1981: Pl. 63, Figs. 3–25) illustrated from the Hohe Wand in the Northern Calcareous Alps, Austria numerous specimens determined as *Spiriamphorella districta* BORZA & SAMUEL. Some of his specimens (Pl. 63, Figs. 7–8, 16) show clearly the costae formed by the folding of the test wall. Costae or ribs are not known from the genus *Spiriamphorella* and therefore these specimens should be attributed to the genus *Siculocosta*. The longitudinal sections of some illustrated specimens by SADATI and his illustration in Text-Figure 7 shows the involution degree of these species similar to the type species of the genus *Siculocosta*. Therefore, the opinion of GALE et al. (2012a: 183), "*that absence/preservation of the line (in Siculocosta) is due to neomorphic change of the wall*" is not acceptable. *Costifera* and *Siculocosta* represent two independent genera and the unification of both is not comprehensible.

Also the species *Siculocosta floriformis* ZANINETTI & ALTINER (in ALTINER et al., 1992) exhibits clearly the formation of the costae by the folding of the test wall. Therefore, attribution of this species to the genus *Siculocosta* by ZANINETTI & ALTINER is justified, although the chamber arrangement of this species is similar to *Costifera cylindrica* SENOWBARI-DARYAN (1983), and the lines between the costae and chamber interiors are not known from the type species. The costae on the test surface of this species are similar to *Siculocosta battagliensis* (SENOWBARI-DARYAN, 1983).

In addition to the different types of the costae or ribs on the test surface, the two genera are also differentiated by the shape of the chambers (barrel-like in *Costifera*, pear-like in *Siculocosta*), the different widths of the collars on the oral side of the chambers, and finally by the involution degree (without involution in *Costifera*, with weakly involution in *Siculocosta*).

Siculocosta battagliensis (SENOWBARI-DARYAN), 1983

(Pl. 6, Figs. 5–7, 8/S, 13–14, Text-Fig. 8)

1973 *Galeanella panticae*. – BRÖNNIMANN & ZANINETTI, Pl. 3, Fig. 6 (in BRÖNNIMANN et al., 1973).

1982b *Galeanella* sp. – ZANINETTI et al., Pl. 5, Fig. 11.

1983 *Costifera battagliensis* sp. n. – SENOWBARI-DARYAN, 211, Pl. 20, Figs. 4, 8, Pl. 21, Figs. 1–14, Text-Fig. 12.

1983 *Costifera battagliensis* SENOWBARI-DARYAN. – MICONNET et al., 137, Pl. 2, Figs. 4–10, Pl. 3, Figs. 1–7.

1990 *Siculocosta battagliensis* (SENOWBARI-DARYAN). – DI STEFANO et al., Pl. 4, Figs. 12–14.

1992 *Galeanella* sp. nov. – ZANINETTI et al., Pl. 2, Figs. 1–4, 5?, 6?, 7–8.

1996 *Siculocosta battagliensis* (SENOWBARI-DARYAN). – DI STEFANO et al., Pl. 30, Fig. 6.

1996 *Siculocosta* cf. *floriformis* ZANINETTI et al. – DI STEFANO et al., Pl. 30, Fig. 5.

1996 *Costifera cylindrica* SENOWBARI-DARYAN. – DI STEFANO et al., Pl. 30, Fig. 1.

1996 *Siculocosta battagliensis* (SENOWBARI-DARYAN, 1983). – SENOWBARI-DARYAN & FLÜGEL, 255, Pl. 3, Fig. 11 (cum syn.).

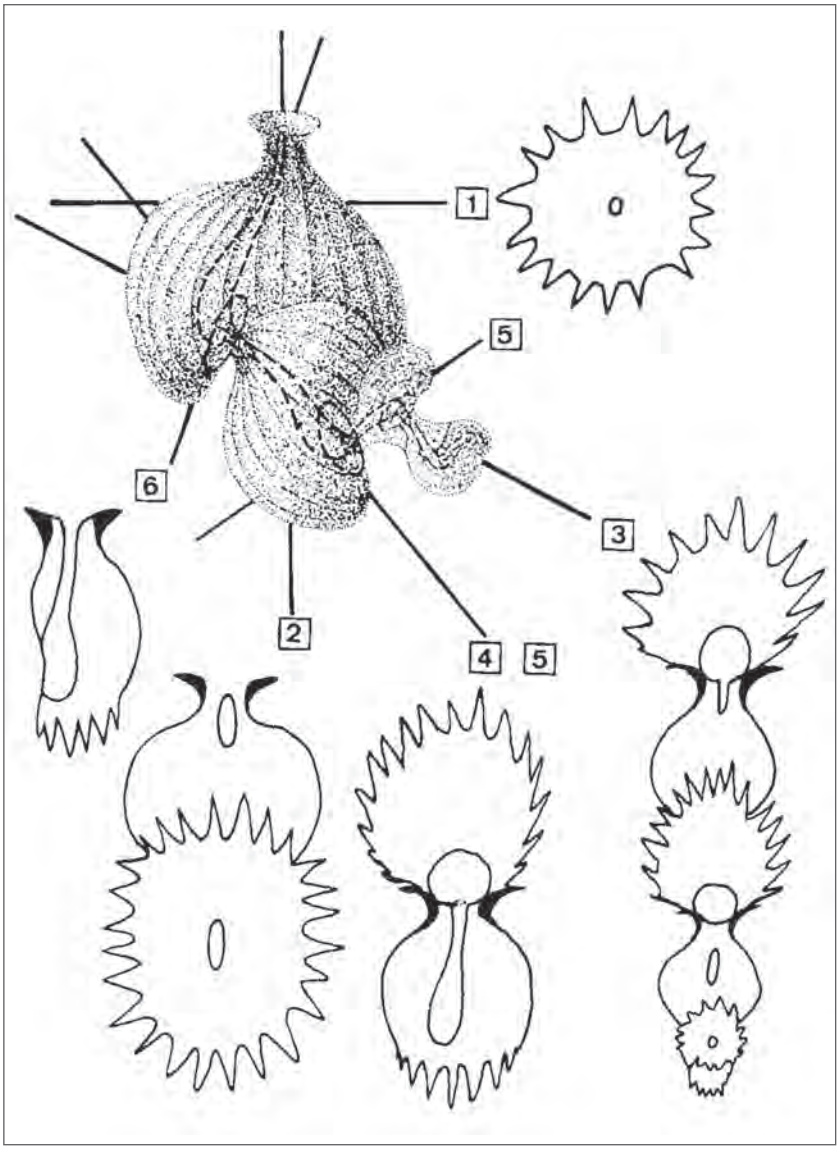
non 1996 *Costifera battagliensis* SENOWBARI-DARYAN. – MARTINI et al., Pl. 11, Fig. 9.

1996 *Siculocosta battagliensis* (SENOWBARI-DARYAN). – BERNECKER, 68, Pl. 17, Fig. 2.

Description: *Siculocosta battagliensis* is composed of several, continuously increasing chambers (Pl. 6, Figs. 7, 13–14). The individual chambers are pear-like (pyriform) in shape. The young chambers overlap the old chamber(s) on one side (Pl. 6, Figs. 7, 14). Characteristic for the genus and species are the hollow longitudinal ribs formed by folding of the chamber wall (Pl. 6, Figs. 5–6, 8/S, 13). The chambers are arranged at an angle of 90 degrees. The collar of each chamber is well developed. The longitudinal sections (Pl. 6, Figs. 7, 13–14) and cross sections (Pl. 6, Figs. 5–6) through the chambers exhibit different appearance of the test. For detail description and the biometrical data see SENOWBARI-DARYAN (1983). Text-Figure 8 shows some possibly sections through the test of *Siculocosta battagliensis*.

Occurrence and stratigraphic range: *Siculocosta battagliensis* is known from the Norian-Rhaetian reef carbonates of several localities (see synonymy list).

Remarks: The folding of the chamber walls in *Siculocosta floriformis*, described by ZANINETTI & ALTINER (in ALTINER et al., 1992) is similar to *S. battagliensis* and the attribution of the species to this genus by the authors is correct. *S. floriformis* is known only from the Norian-Rhaetian of the Taurus Mountains, southern Turkey.



Text-Fig. 8.
Spatial reconstruction of *Siculocosta battagliensis* and some sections through the test (re-illustrated from SENOWBARI-DARYAN, 1983: Fig. 12). Note the faulted wall without the lines at the base (compare Text-Fig. 6). Schematic, not to scale.

Genus *Hydrania* SENOWBARI-DARYAN, 1983

Type species: *Hydrania dulloi* SENOWBARI-DARYAN, 1983.

Hydrania dulloi SENOWBARI-DARYAN, 1983

(Pl. 4, Figs. 14–17, Pl. 5, Figs. 1–14, 15?–17?, Text-Figs. 9–10)

1981 ?*Galeanella* (= ?*Spiriamphorella* sp. BORZA & SAMUEL). – SENOWBARI-DARYAN, Pl. 3, Fig. 6.

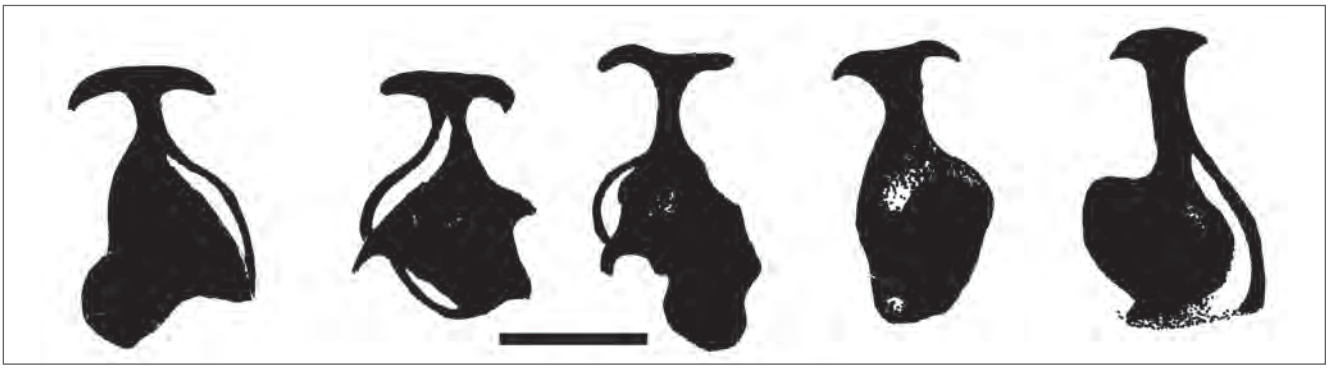
1981 ?*Galeanella* sp. (= *Spiriamphorella* sp. BORZA & SAMUEL). – SENOWBARI-DARYAN, Pl. 10, Figs. 7–9.

1981 Incertae sedis (nov. gen. et nov. sp. 1). – SAMUEL & BORZA, Pl. 22, Figs. 1–2.

1982a *Paraophthalmidium* sp. aff. *P. carpathicum* SAMUEL & BORZA. – ZANINETTI et al., Pl. 5, Fig. 10.

1983 *Hydrania dulloi* gen. n. sp. n. – SENOWBARI-DARYAN, 206, Pl. 18, Figs. 5–11, Pl. 23, Figs. 3–10, Pl. 24, Figs. 1–13, Text-Fig. 10.

1983 ?*Hydrania dulloi* SENOWBARI-DARYAN. – MICONNET et al., 138, Pl. 12, 13?.



Text-Fig. 9.
Some longitudinal sections of *Hydrania dolloi*. Scale = 0.2 mm.

1987 *Hydrania dulloi* SENOWBARI-DARYAN. – PIRDENI, Pl. 6, Figs. 9–16.

1888 *Hydrania dulloi* SENOWBARI-DARYAN. – PIRDENI, Pl. 2. Figs. 1–3.

1990 *Hydrania dulloi* SENOWBARI-DARYAN. – RIEDEL, Pl. 4, Fig. 5.

1991 *Hydrania dulloi* SENOWBARI-DARYAN. – MARTINI et al., Pl. 16, Figs. 1–19, Pl. 17, Figs. 1–18.

1997 *Hydrania dulloi* SENOWBARI-DARYAN. – RÜFFER & ZAMPARELLI, Pl. 31, Fig. 19.

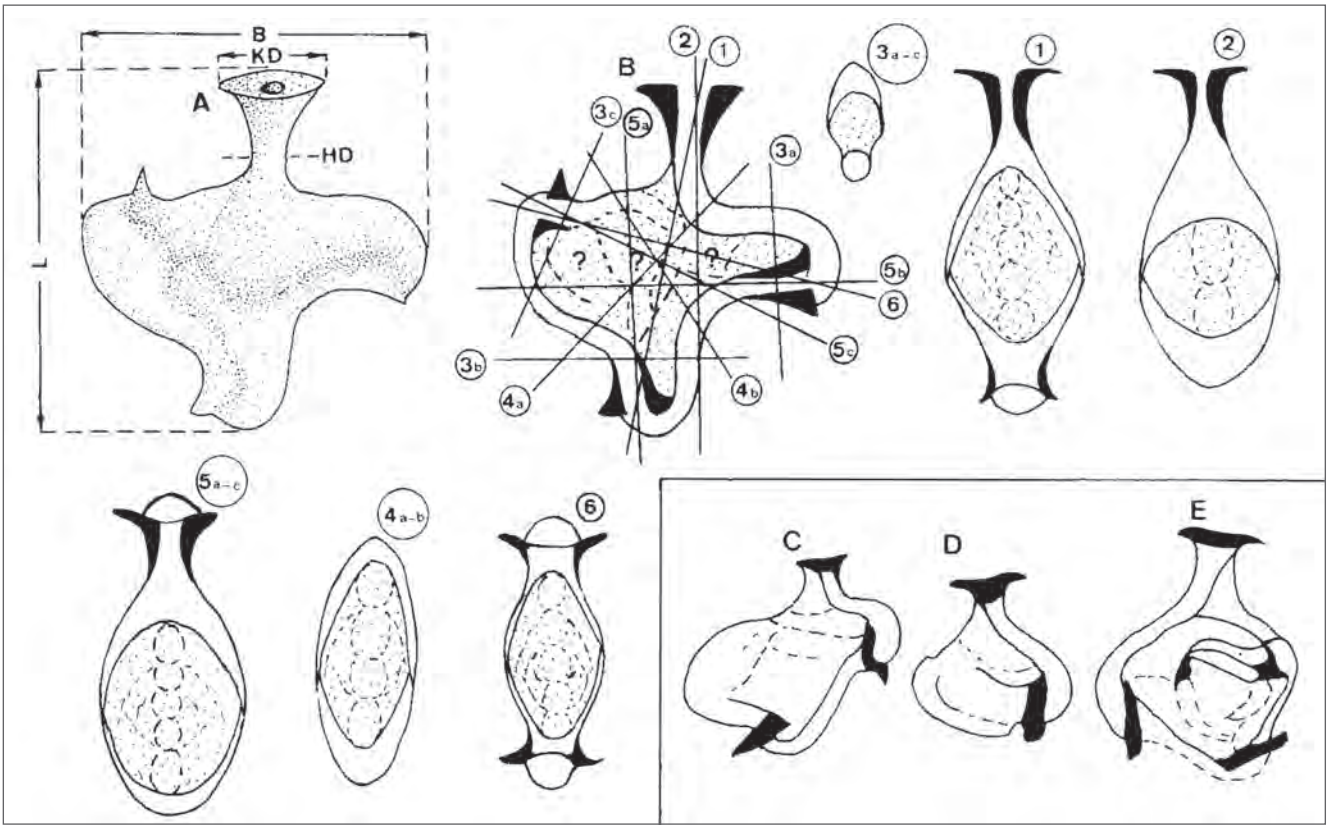
2009 *Hydrania dulloi* – CARRILLAT & MARTINI, Figs. 4.6–4.9.

2009 *Hydrania dulloi* SENOWBARI-DARYAN. – MARTINI et al., Pl. 1, Figs. 6–10.

2012 *Hydrania dulloi* SENOWBARI-DARYAN – SENOWBARI-DARYAN et al., Figs. 5g–h.

Description: The enrolled test of *Hydrania dulloi* is composed of several tube-like chambers. Successive chambers are positioned at almost 90° displaced (Text-Fig. 7). A circular aperture is surrounded by a broad collar. For the detailed description see SENOWBARI-DARYAN (1983).

Occurrence and stratigraphic range: *Hydrania dulloi* is known from several Carnian reef localities in the world (see SENOWBARI-DARYAN, 1983 and synonymy in this paper). The species is very abundant in the Carnian reef boulders imbedded within the Mufara Formation in Sicily (MARTINI et al., 1991; CARRILLAT & MARTINI, 2009). The occurrence of the species from the Panthalassa domain (Japan) is reported by SENOWBARI-DARYAN et al. (2012). Text-Figure 9 shows some typical longitudinal sections and Text-Figure 10 some possibly sections through the test of *Hydrania dulloi*.



Text-Fig. 10.
Some possibly section through the test of *Hydrania dolloi.* Not to scale.

Genus *Urnulinella* Borza & Samuel, 1977a

Type species: *Urnulinella andrusovi* Borza & Samuel, 1977a

Urnulinella andrusovi Borza & Samuel, 1977a

(Pl. 2, Figs. 1–15, Pl. 3, Figs. 1–5, Text-Fig. 11)

1977a *Urnulinella andrusovi* n. g. n. sp. – Borza & Samuel, 118, Pl. 7, Figs. 1–6.

1977 Groupe 5, 6, 7 (*Galeanella panticae*) – Zaninetti, Pl. 1.

1981 *Urnulinella andrusovi* Borza & Samuel. – Samuel & Borza, Fig. 5.2, Pl. 21, Fig. 4.

1981 *Urnulinella andrusovi* Borza & Samuel. – Salaj et al., 162, Pl. 154, Figs. 1–6, Pl. 155, Figs. 1–6.

1982a *Galeanella irregularis* (Borza & Samuel, 1977). – Zaninetti et al., Text-Fig. 1, Figs. A–E, Pl. 2, Figs. 1–5, 7–8 (non 6).

1983 *Galeanella irregularis* (Borza & Samuel, 1977). – Zaninetti & Altiner, Pl. 1, Figs. 3, 5, 6?, 7.

1983 *Urnulinella andrusovi* Borza & Samuel 1977. – Senowbari-Daryan, 203, Pl. 18, Figs. 1–4, Pl. 23, Figs. 1–3, Text-Fig. 9.

?1986 *Urnulinella andrusovi* Borza & Samuel 1977. – Pomoni-Papaioannou et al., Pl. 5, Fig. 3.

1987 *Urnulinella andrusovi* Borza & Samuel 1977. – Senowbari-Daryan, 257, Pl. 1, Figs. 1–3, 9–10.

1987 *Urnulinella* sp. aff. *Urnulinella andrusovi* Borza & Samuel. – Pirdeni, Pl. 7, Figs. 1–5.

1988 *Urnulinella*? sp.: Pirdeni, Pl. 2, Figs. 5–6.

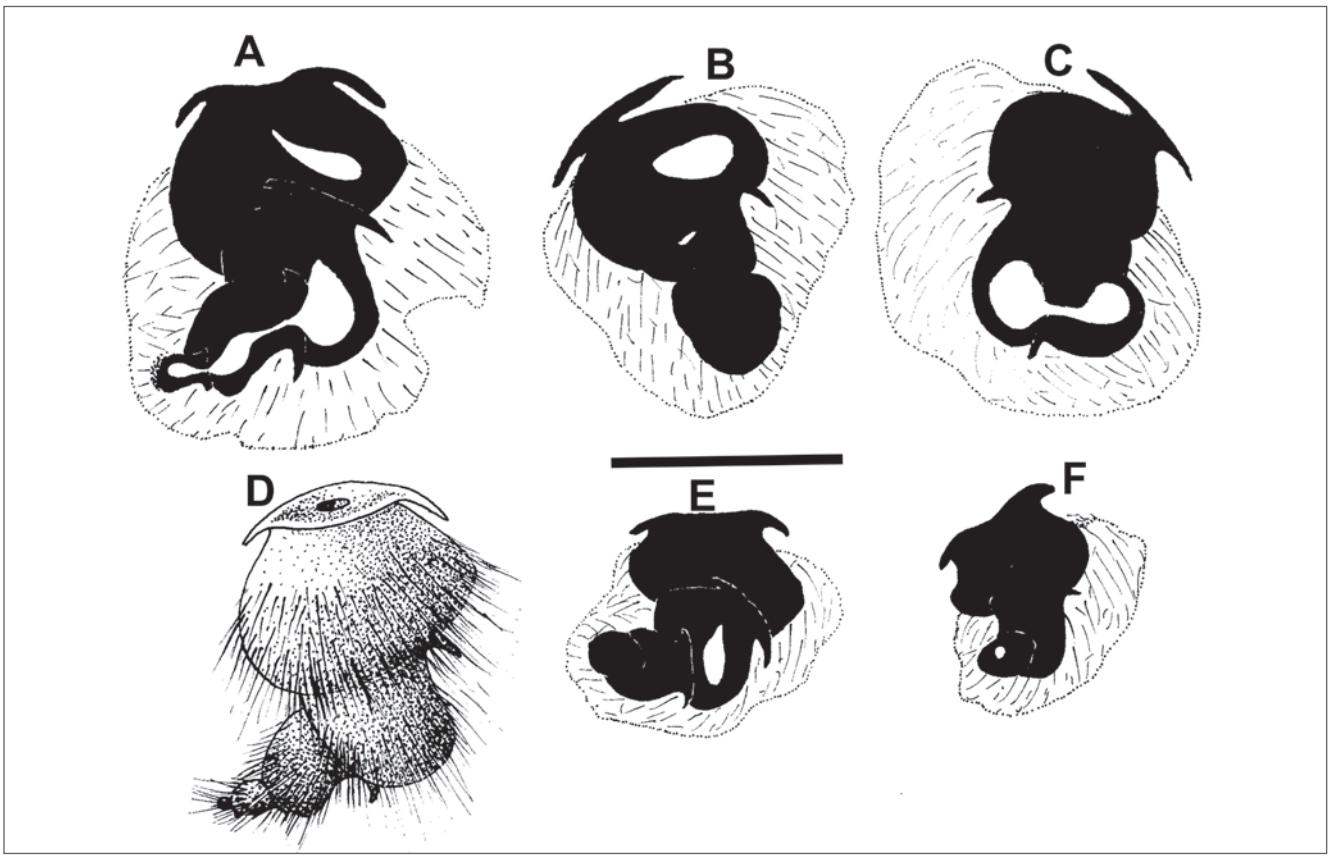
1992 *Urnulinella andrusovi* Borza & Samuel. – Zaninetti & Martini, 32, Pl. 2, Fig. K; Pl. 3, Figs. A(a–c); Pl. 7, Fig. 6 (cum syn.).

1996 *Urnulinella andrusovi* Borza & Samuel. – Bérczi-Makk, 251–252, Pl. 7, Figs. 1–7 (cum syn.).

non 2010 *Urnulinella andrusovi*. – Chablais, Fig. 7.3: 27–30.

Description: The calcareous test of *U. andrusovi* is composed of several globular to barrel-shaped chambers, arranged one above the other along straight or curved line. The successive chambers overlap the old chamber(s) on one or both sides. The chamber walls are imperforated and thick. An indistinct to wide collar, usually down turned on the oral side of the chambers is recognisable. For detailed description see Borza & Samuel (1977a), Senowbari-Daryan (1983), and Zaninetti & Martini (1992). Text-Figure 11 shows some sections of *U. andrusovi* with a spatial reconstruction of the species.

Occurrence and stratigraphic range: *Urnulinella andrusovi* is known from several Carnian reef localities (see synonymy list of Zaninetti & Martini, 1992 and this paper). The species is reported from the Carnian of Sicily and also from the Carnian of Aggtelek karst, Alsohegy Mountains, Hungary in this paper.



Text-Fig. 11.
Some sections through the test of *Urnulinella andrusovi* Borza & Samuel.
A) drawn from Pl. 2, Fig. 1; B) drawn from Pl. 2, Fig. 3; C) drawn from Pl. 2, Fig. 13; D) a spatial reconstruction based on section A; E) drawn from Pl. 2, Fig. 14; F) drawn from Pl. 2, Fig. 4. Scale = 0.2 mm.

Discussion: ZANINETTI (1977) was the first author to discuss systematic position of the genus *Urnulinella* and other genera described by BORZA & SAMUEL (1977a, b, 1978). She considered *Urnulinella adrusovi* as synonym of *Galeanella panticae* ZANINETTI & BRÖNNIMAN (in BRÖNNIMAN et al., 1973). It is remarkable that the specimen illustrated in Pl. 3, Fig. 6 in BRÖNNIMANN et al. (1973) is not *Galeanella panticae*, but *Siculocosta battagliensis*.

SALAJ et al. (1981) considered *Urnulinella* as a valid genus. The problem of the validity of *Urnulinella* was discussed by SENOWBARI-DARYAN (1983) again. He accepted the validity of three genera of these groups (*Cucurbita* JABLONSKÝ, *Spiriamphorella* BORZA & SAMUEL, and *Urnulinella* BORZA & SAMUEL, for the synonymy of these genera see SENOWBARI-DARYAN 1983: 193).

ZANINETTI & MARTINI (1992) revised the genera of BORZA & SAMUEL (1977a, b, 1978) one more, considering *Cucurbita* and *Urnulinella* as valid genera. These authors considered *Amphorella*, *Pseudoamphorella,* and *Paratintinnina* as juveniles either of *Cucurbita* or *Urnulinella*. The systematic status of *Spririamphorella* with several species of BORZA & SAMUEL and SALAJ et al. (1981) as a valid genus (SENOWBARI-DARYAN, 1983) or as invalid is not mentioned by (ZANINETTI & MARTINI 1992).

In contrast, GALE et al. (2012a) considered *Urnullinella* a younger synonym of *Cucurbita* JABLONSKÝ. Contrary to this, the critical examination of the published and the new material support the validity of the following genera: *Costifera* SENOWBARI-DARYAN (1983), *Siculocosta* SENOWBARI-DARYAN (1986), and *Urnullinella* BORZA & SAMUEL (1977a).

The validity of individual species synonymied by GALE et al. (2012a) with *Cucurbita infundibuliforme* JABLONSKÝ needs more detailed investigations. For example, the type species of *Amphorella subspherica* is only a part (one chamber) of *Urnulinella andrusovi* and not a species of *Cucurbita*. The reconstruction of GALE et al. (2012a: Fig. 2) as *Cucurbita subsphaerica* (BORZA & SAMUEL) shows in fact an *Urnulinella subsphaerica* (BORZA & SAMUEL). ZANINETTI & MARTINI (1992) listed *Amphorella subsphaerica* also as junior synonym of *Urnulinella andrusovi*. Concerning the revision of other species, listed as species of *Cucurbita* by GALE et al. (2012a) a detailed investigation based on the type material of BORZA & SAMUEL and possibly additional material from the type locality is needed. The majority of sections of the species of BORZA & SAMUEL, 1977a (e.g. *Spiriamphorella carpathica*) or other species of *Spiriamphorella* (compare e.g. ALTINER & ZANINETTI; 1981: Pl. 80, Figs. 1–20) cannot be derived from *Cucurbita*.

Conclusing remarks

Generally, the representatives of the family Pseudocucurbitidae ZANINETTI et al. (1982a) exhibit several diagnostic characters. In addition to the presence or absence of bristles or filaments around the test, the ribs on the outer surface, the arrangement of the chambers, and the involution degree of the test should be considered for the determination and systematic categorisation. GALE et al. (2012a) suggested the test construction as the main criterion to distinguish among genera, which subsequently led them to the reduction of the number of genera. We do not agree with their opinion and rather keep genera *Costifera* SENOWBARI-DARYAN, *Siculocosta* SENOWBARI-DARYAN & ZANINETTI, *Urnulinella* BORZA & SAMUEL and possibly *Spiriamphorella* BORZA & SAMUEL in validity, until the revision of type material of BORZA & SAMUEL (maybe also additional material) is made. Until then, representatives of the family may be subdivided into three groups, based on the lack or presence of ornamentation (filaments or bristles, costae or ribs and their characteristic) on the outer test of the surface (Tab. 3).

Based on the lack or the presence of an ornamentation (filaments or bristles, costae or ribs) on the outer test surface the representatives of the family may be subdivided into three groups:

a: The test is without any ornamentation. Examples of this group are *Cucurbita longicollum* SENOWBARI-DARYAN (1983) (Norian) and *Cucurbita aggtelekensis* nov. sp. (Carnian).

	Chamber shape	Chamber arrangement	Occurrence	Author
Cucurbita	amphora-like	one above other on straight or curved line, with or without bristles, younger chambers overlap the preceding chamber only on one-side or not.	Carnian, Norian-Rhaetian	JABLONSKÝ, 1973
Costifera	barrel-shaped (flaskli-ke)	one above the other on straight, curved line or at 90°, with longitudinal ribs, distinct line between the ribs and the test, indistinct collar, test without indistinct collar, test without involution.	Norian-Rhaetian	SENOWBARI-DARYAN, 1983
Siculocosta	pear-like (pryform)	ribs formed by folding of the chamber wall, Chambers arranged at 90°, younger chambers overlap the old chamber(s) causing the involution.	Norian-Rhaetian	SENOWBARI-DARYAN & ZANINETTI, 1986
Urnulinella	globular	rectilinear or irregularly one above the other, collar distinctly curved, younger chambers overlap the preceding chamber, no involution.	Carnian	BORZA & SAMUEL, 1977
Hydrania	tube-like	planispirally enrolled, chambers arranged in planes at 90°, chamber ends with broadly distinct collar, chamber wall thin.	Carnian	SENOWBARI-DARYAN, 1983

Tab. 3.
Some important diagnostic features of the briefly described genera in this paper. For more information, see the original diagnosis of the genera and LOEBLICH & TAPPAN (1988).

b: The outer surface of the test possesses spine-like prolongations, filaments (CIARAPICA et al., 1988) or bristles (GALE et al., 2012). *Cucurbita infundibuliforme* JABLONSKÝ (1973) and *Cucurbita minima* nov. sp. are examples for this group. Representatives occur in the Carnian.

c: The test has ribs (costae) on the outer surface. *Costifera* SENOWBARI-DARYAN (1983) is an example for this group. Representatives are limited to the Norian-Rhaetian.

In addition to the treated groups other types of foraminifera with bristles or filaments occur in the Norian-Rhaetian (e.g. *Hirsutospirella* ZANINETTI et al., 1985 or *Foliotortus* PILLER & SENOWBARI-DARYAN, 1980), which are not considered in this paper, but they are summarised by CIARAPICA et al. (1988).

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Plate 1

***Cucurbita minima* nov. sp. and *Cucurbita infundibuliforme* JABLONSKÝ.**

Figs. 1–6: *Cucurbita minima* nov. sp.; Figs. 1–2, 5–6 from the Carnian limestone of Aggtelek karst, Alsohegy Mountains, Hungary; Figs. 3–4 from the Carnian Mufara Formation, Madonie Mountains, Sicily.

Fig. 1: Longitudinal section through several chambers arranged chain-like one above the others.
Thin section 13F1, x 70.

Fig. 2: Similar section like Fig. 1. Only the collars of some chambers and the bristle are visible.
Thin section 13F1, x 70.

Fig. 3: *Cucurbita minima* nov. sp., holotype (magnification from Fig. 4, right in photograph). Section through several small chambers. Apparently the base of the chambers carries the bristles.
Thin section S6/16, x 70.

Fig. 4: Section through the holotype (right in photograph) and several other specimens recognisable by the bristles.
Thin section S6/16, x 30.

Fig. 5: Section through a specimen of *Cucurbita minima* nov. sp. with several chambers and through two chambers of *Cucurbita aggtelekensis* nov. sp.
Thin section 13F1/1, x 70.

Fig. 6: Thin section 13F1/2, x 110.

Figs. 7–15: *Cucurbita infundibuliforme* JABLONSKÝ from the the Carnian limestone of Aggtelek karst, Alsohegy Mountains, Hungary.

Fig. 7: Section through one chamber with broad collar. The bristles are mainly around the chamber lumen and not well recognisable.
Thin section 13F1a, x 110.

Fig. 8: Thin section 13F1, x 110.

Fig. 9: Similar like Fig. 8. Thin section unknown.

Fig. 10: Section through two amphora-like chambers with broad collar.
Thin section 13F1a, x 130.

Figs. 11–12: Sections similar to Fig. 7. Thin section 13F1, x 110.

Figs. 13–14: Thin section 13F1, x 110.

Fig. 15: ?x 110.

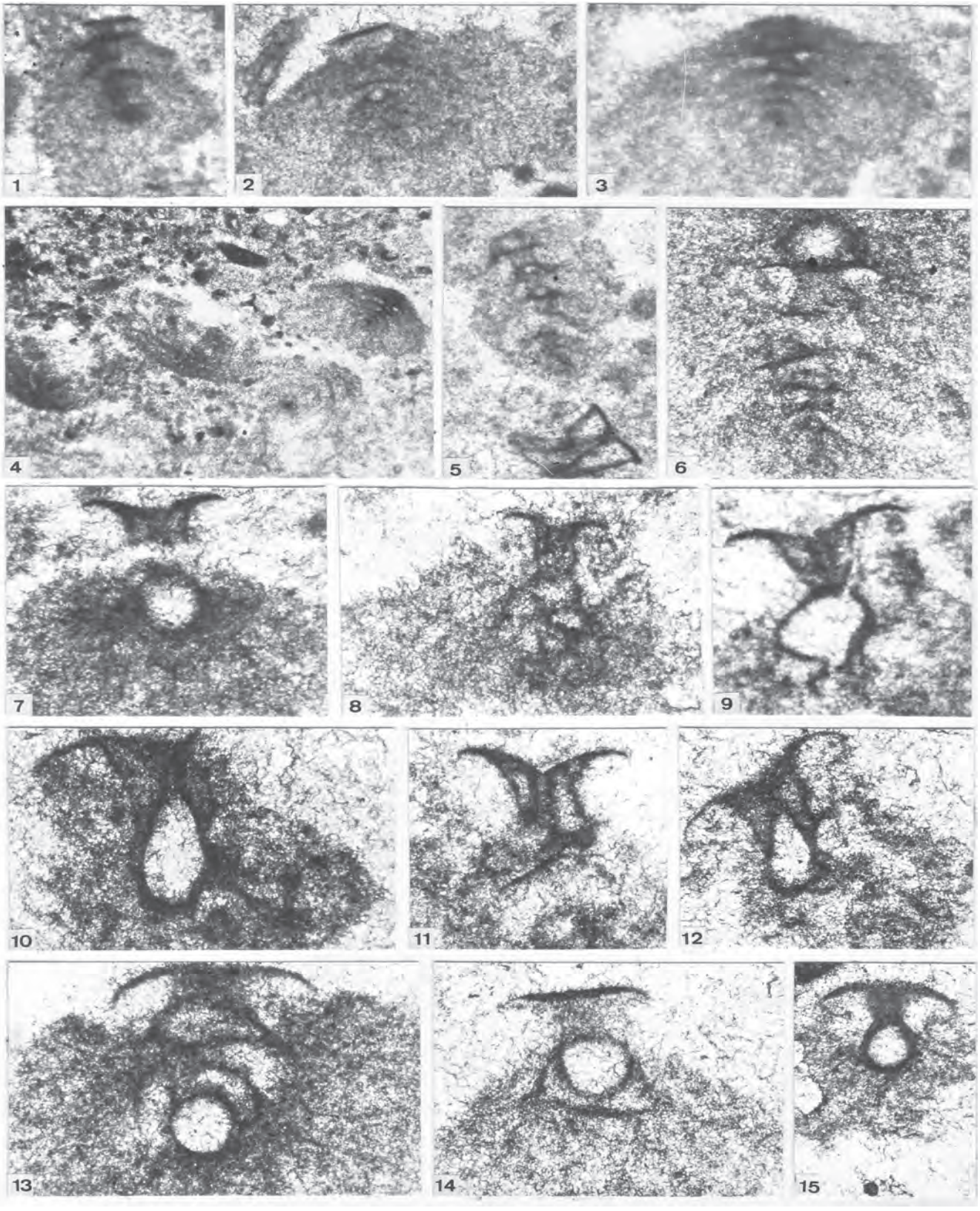
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Plate 2

Urnulinella androsovi BORZA & SAMUEL.

Figs. 1–15: *Urnulinella androsovi* BORZA & SAMUEL from the Carnian of Aggtelek karst, Alsohegy Mountains, Hungary

Fig. 1: Section through three chambers. The younger chambers overlap the preceding chamber(s) usually on one side. Thin section 13F1a, x 110.

Fig. 2: Similar section to Fig. 1. Some bristles around the test. Thin section 13F50, x 70.

Fig. 3: Similar to Fig. 1. Note the bristles (filaments) around the test, but the collar of the young chamber is free from filaments. Thin section 13F1, x 110.

Fig. 4: Section through two chambers. Thin section 13F50, x 70.

Fig. 5: Similar to Fig. 4. Thin section 13F1, x 110.

Fig. 6: Marginal section through the last chamber, corresponding the species described as *Amphorella subsphaerica* by BORZA & SAMUEL 1977a (= *Cucurbita subsphaerica* according to GALE et al., 2012a). Thin section 13F50, x 70.

Fig. 7: Section through a chamber. Thin section 13F21, x 110.

Fig. 8: Section similar to Fig. 2. Thin section 13F50, x 110.

Fig. 9: Thin section 13F39, x 70.

Fig. 10: Sections through the last chamber of two specimens. Thin section 13F50, x 70, 13F21, x 30.

Fig. 11: Thin section 13F39, x 30.

Fig. 12: Thin section 13F1, x 30.

Fig. 13: Section through three chambers. The first two chambers are arranged at an angle of 90 degrees. Note the bristles around the chambers. Thin section 13F50, x 110.

Fig. 14: Section similar to Fig. 13. Thin section 13F50, x 70.

Fig. 15: Section through three chambers with well-developed bristles around the test. Thin section 13F1a, x 110.

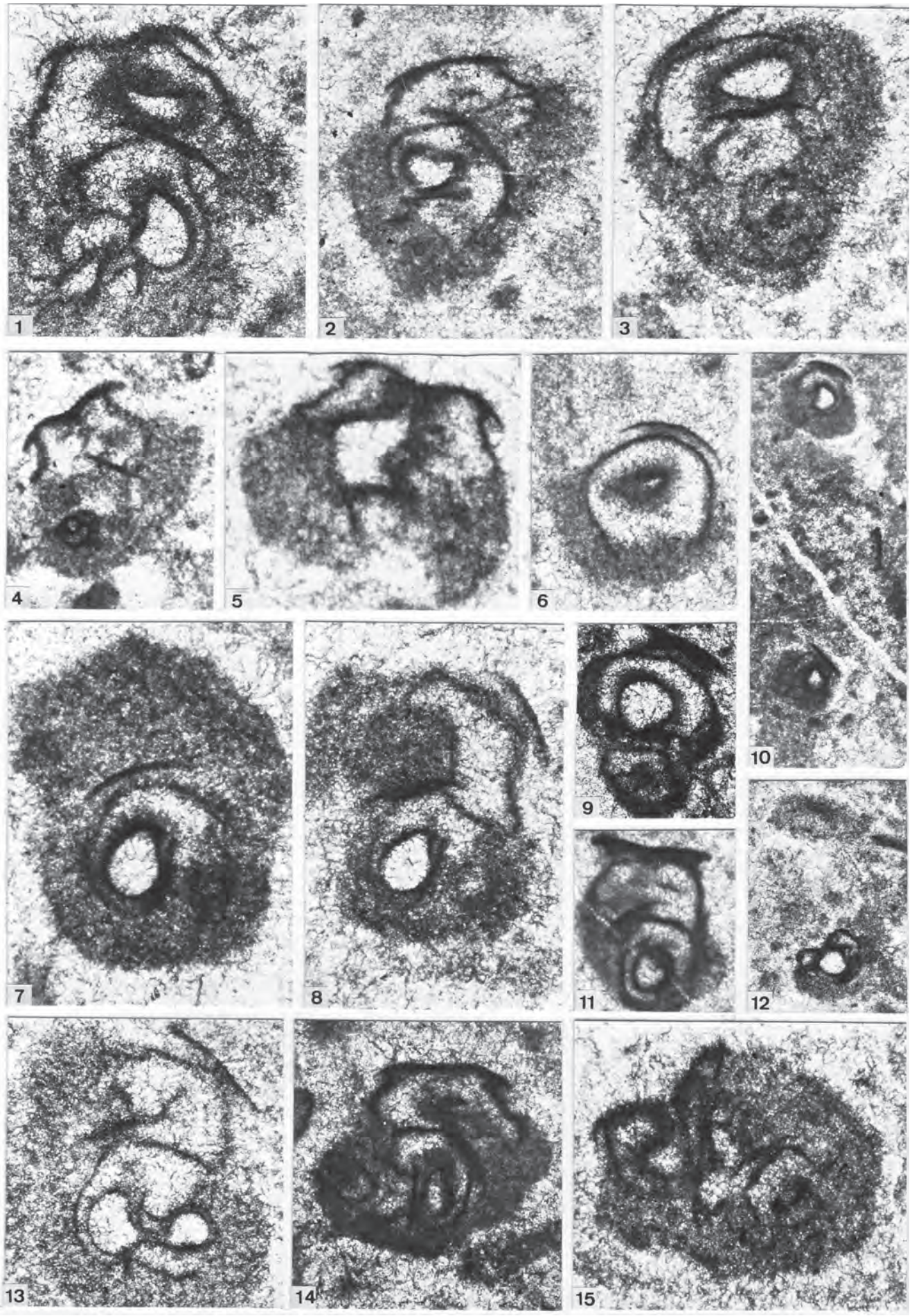
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Plate 3

Urnulinella andrusovi **BORZA & SAMUEL, *Cucurbia infundibuliforme* JABLONSKÝ and *Cucurbita minima* nov. sp.**

Figs. 1–5: *Urnulinella andrusovi* BORZA & SAMUEL from the Carnian reef boulders within the Mufara Formation in Sicily.

Fig. 1: Section through four chambers. Thin section Mu31/6, x 70.

Fig. 2: Sections through two chambers of two specimens. Thin section Mu31/5, x 50.

Fig. 3: Similar section as in Fig. 1. Thin section Mu5/1, x 70.

Fig. 4: Similar to Fig. 2. Thin section S6/170/1, x 60

Fig. 5: Similar to Fig. 3. Thin section Mu30/2, x 70,

Figs. 6–12: *Cucurbita infundibuliforme* JABLONSKÝ from the Carnian reef boulders within the Mufara Formation in Sicily.

Fig. 6: Section through three chambers (the old chamber is cut only through the collar). Thin section S6/170/1, x 120.

Fig. 7: Similar to Fig. 6. Thin section S6/170/1, x 200.

Fig. 8: Similar to Fig. 7. Thin section Mu/4, x 70.

Fig. 9: Section through the last chamber of a specimen. Thin section S6/170, x 120.

Fig. 10: Similar to Fig. 9. Thin section Mu3/1, x 70.

Fig. 11: Section through two chambers. Thin section Mu71/6, x 70.

Fig. 12: Similar to Fig. 10. Thin section Mu3/1, x 70.

Figs. 13–17: *Cucurbita minim*a nov. sp. from the Carnian reef boulders within the Mufara Formation in Sicily.

Fig. 13: Section through a specimen with well-developed long bristles. The last chamber is recognisable. Thin section Mu32, x 50.

Fig. 14: Similar section to Fig. 13. Thin section Mu32, x 60.

Fig. 15: Section through several chambers surrounded by well-developed and long bristles (filaments). Thin section Mu32, x 30.

Fig. 16: Similar section as in Fig. 13. Thin section Mu4, x 30.

Fig. 17: Section through the bristles of a specimen. Thin section Mu16, x 30.

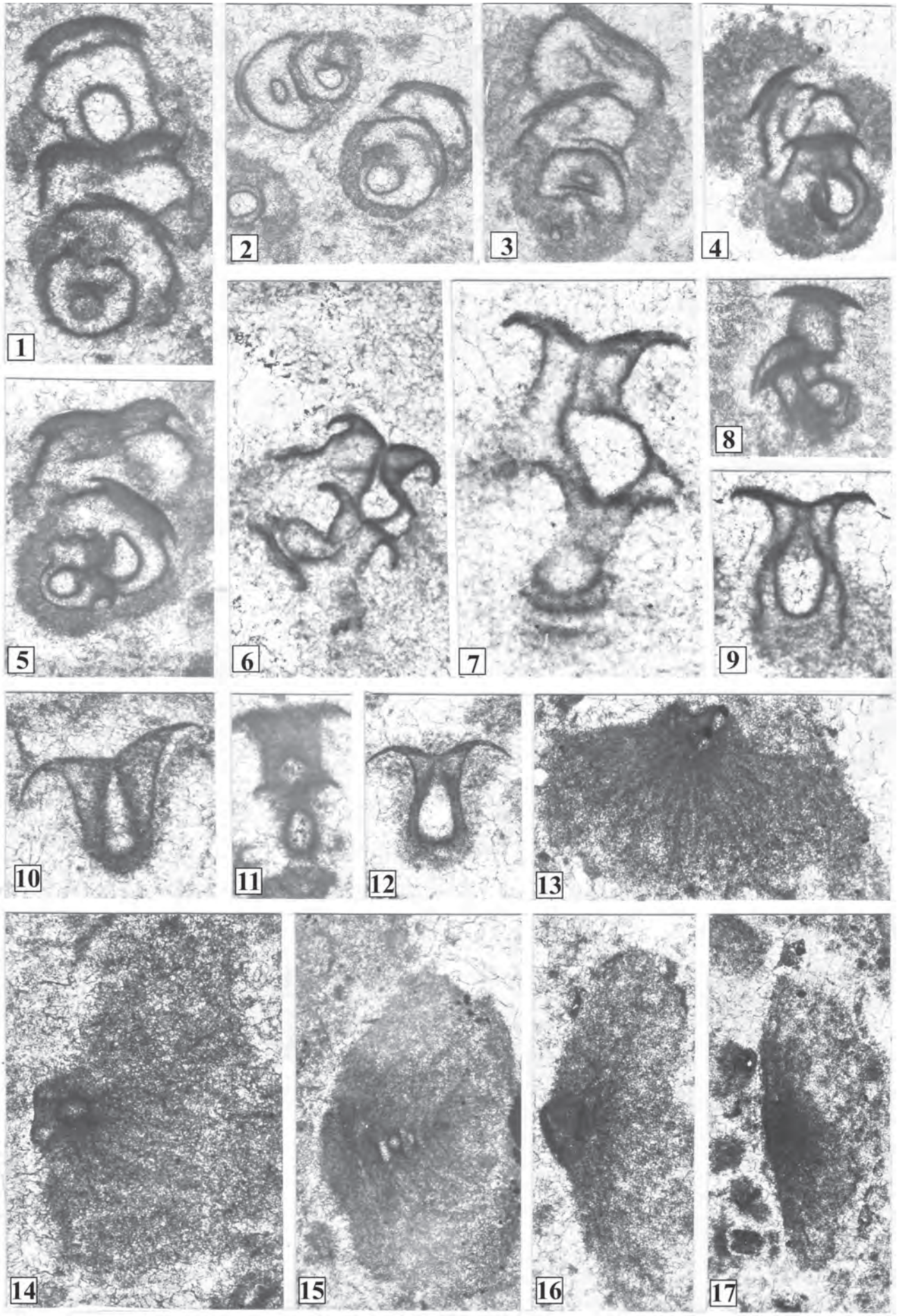
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Plate 4

***Cucurbita aggtelekensis* nov. sp. and *Hydrania dulloi* SENOWBARI-DARYAN.**

Figs. 1–13: *Cucurbita aggtelekensis* nov. sp. from the Carnian limestones of the of Aggtelek karst, Alsohegy Mountains, Hungary. Note the thick chamber walls and the indistinct collar on the distal part of the chambers in all specimens.

Fig. 1: Longitudinal section through three chambers. Thin section 13F21, x 110.

Fig. 2: Marginal section through two chambers. Thin section 13F1a, x 110.

Fig. 3: Similar section as in Fig. 2. Thin section 13F1, x 110.

Fig. 4: Section through two specimens. Thin section 13F21, x 30.

Fig. 5: Similar section as in Fig. 2. Thin section 13F1, x 110.

Fig. 6: Similar section as in Fig. 5. Thin section 13F1a, x 110.

Fig. 7: Marginal section through two chambers. Thin section 13F1a, x 110.

Fig. 8: Section through a single chamber. Thin section 13F1a, x 60.

Fig. 9: Similar as Fig. 3. Thin section A999/1, x 110.

Fig. 10: Marginal section through two chambers. Thin section 13F1, x 110.

Fig. 11: Similar as Fig. 10. Thin section 13F1, x 110.

Fig. 12: Section through a specimen of *Cucurbita infundibuliforme* JABLONSKÝ (at the top) and *Cucurbita aggtelekensis* nov. sp. (at the base). Thin section 13F50, x 40.

Fig. 13: *Cucurbita aggtelekensis* nov. sp., holotype. Section through four chambers arranged on a curved line. Note the thickness of the chamber walls and the indistinct collar at the distal part of chambers. Thin section 13F1, x 110.

Figs. 14–17: *Hydrania dulloi* SENOWBARI-DARYAN from the Carnian of Mufara Formation, Sicily.

Fig. 14: Longitudinal section. Thin section S6/27, x 250.

Fig. 15: Similar to Fig. 14. Thin section S6/28/3, x 250.

Fig. 16: Section through the last chamber. Thin section S6/28/3, x 250.

Fig. 17: Similar to Fig. 14. Thin section S6/27, x 250.

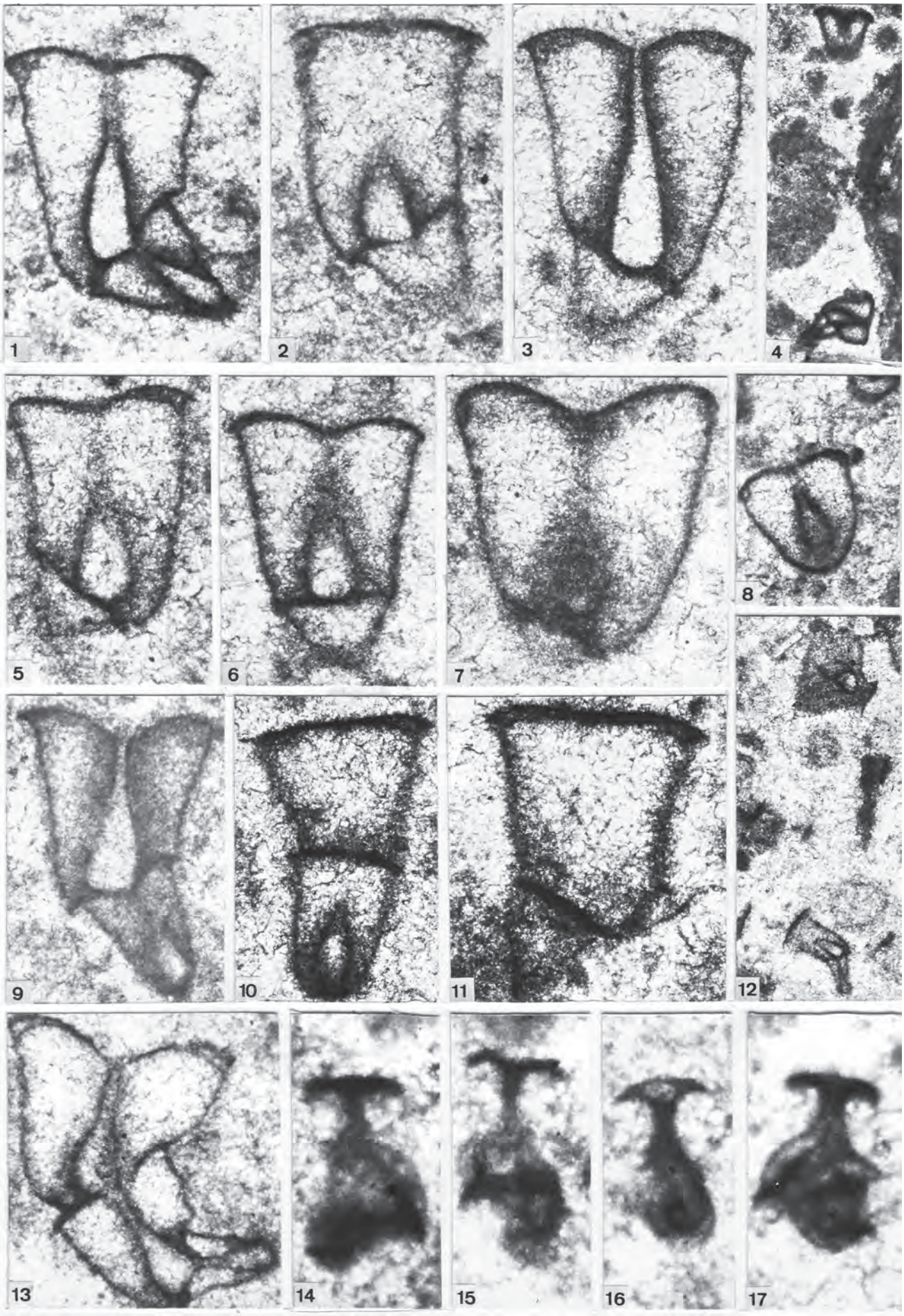
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Plate 5

***Hydrania dulloi* SENOWBARI-DARYAN and *Cucurbita infundibuliforme* JABLONSKÝ.**

Figs. 1–14, 15?–17?: *Hydrania dulloi* SENOWBARI-DARYAN; Figs. 1–6, 8–14 from the Carnian reef boulder within the Mufara Formation in Cozzo Paparina, Sicily; Figs. 7, 15–17 form the Carnian limestones of the Aggtelek karst, Alsohegy Mountains, Hungary (Material: RIEDEL, 1990).

Fig. 1: Thin section S6/72/6, x 250.

Fig. 2: Thin section S6/15, x 250.

Fig. 3: Thin section S6/26, x 250.

Fig. 4: Thin section S6/68/2, x 250.

Fig. 5: Thin section S6/15, x 250.

Fig. 6: Thin section S6/16, x 250.

Fig. 7: Thin section 13/F1/1, x 250.

Fig. 8: Thin section S6/67, x 250.

Fig. 9: Thin section S6/28/3, x 250.

Fig. 10: Thin section S6/68/2, x 250.

Fig. 11: Thin section S6/16, x 250.

Fig. 12: Thin section S6/26, x 250.

Fig. 13: Thin section S6/67, x 250.

Fig. 14: Thin section S6/17, x 150.

Fig. 15: Thin section Ag/56/2, x 240.

Fig. 16: Thin section 13/F1/1, x 160.

Fig. 17: Thin section 13F1/1, x 200.

Figs. 18–20?: *Cucurbita infundibuliforme* JABLONSKÝ from the Carnian reef boulder within the Mufara Formation in Cozzo Paparina, Sicily.

Fig. 18: Thin section S6/16, x 130.

Fig. 19: Thin section S6/16, x 150.

Fig. 20: Thin section S6/26, x 110.

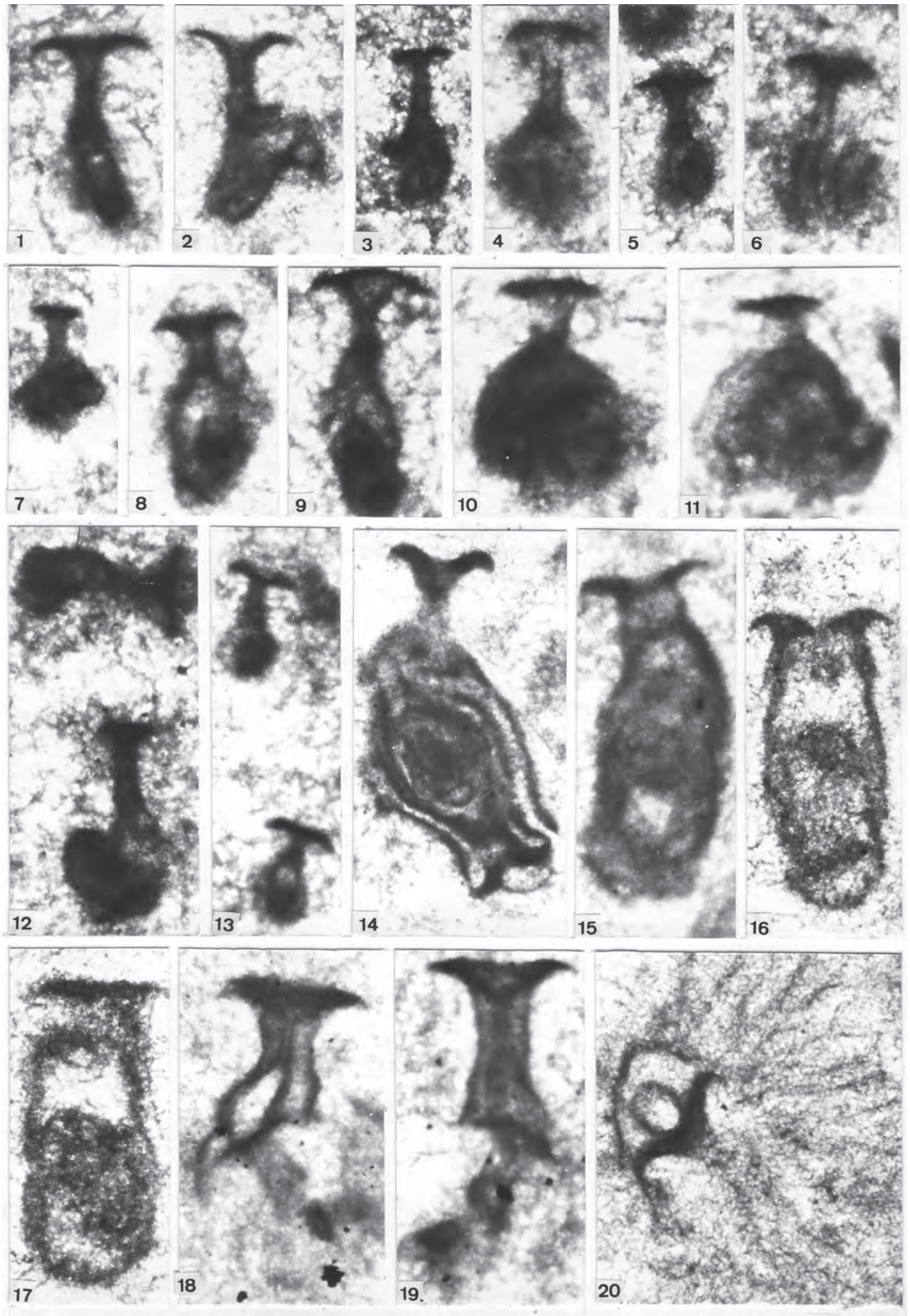
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Plate 6

Costifera cylindrica **SENOWBARI-DARYAN, 1983, *Siculocosta battagliensis* (SENOWBARI-DARYAN, 1983) and *Cucurbita longicollum* SENOWBARI-DARYAN, 1983.**

Figs. 1–4: *Costifera cylindrica* SENOWBARI-DARYAN, 1983.

Fig. 1: Cross section of a chamber exhibiting the costae (ribs) and the well preserved line between the costae and test. Re-illustrated from MICONNET et al. (1983: Pl. 2, Fig. 2), about x 110.

Fig. 2: The section through a specimen shows cross- and longitudinal sections of two chambers. The cross section (upper part) clearly exhibits very well the ribs arranged around the line, similar to Fig. 1. The lower chamber is cut in a longitudinal section, therefore the (longitudinal) ribs are not visible. Re-illustrated from DI STEFANO et al. (1990: Pl. 4, Fig. 2), about x 150.

Fig. 3: Section through two chambers. The lower chamber is cut almost perpenticularly, showing the ribs around the line similar to Fig. 1 or 2. The upper chamber is cut longitudinally and does not show the ribs as in Fig. 2. Re-illustrated from SENOWBARI-DARYAN (1983: Pl. 19, Fig. 4), about x 200.

Fig. 4: The cross section through a chamber shows similar characteristics as Fig. 1. Re-illustrated from SENOWBARI-DARYAN (1983: Pl. 20, Fig. 2), about x 100.

Figs. 5–8, 13–14: *Siculocosta battagliensis* (SENOWBARI-DARYAN, 1983); Figs. 7–8 from a Norian-Rhaetian reef near Sarmaika in Peloponnese, Greece.

Fig. 5: Longitudinal section through a specimen showing four chambers. The youngest chamber distinctly shows the ribs, which are formed by the folded chamber wall. The ribs of the second oldest chamber are not well recognisable. The third chamber, which is cut longitudinally, does not show the ribs. Re-illustrated from SENOWBARI-DARYAN (1983: Pl. 21, Fig. 1), about x 40.

Fig. 6: Similar section like Fig. 1. Re-illustrated from SENOWBARI-DARYAN (1983: Pl. 21, Fig. 2), about x 70.

Fig. 7: Section through a specimen exhibiting four chambers. All chambers are cut longitudinal. Chambers are arranged above the other at 90° and overlap the preceding chambers. Shape of the chambers is pear-like (pyriform), GO14, x 100.

Fig. 8: S) *Siculocosta battagliensis* (SENOWBARI-DARYAN) and *Costifera cylindrica* SENOWBARI-DARYAN (C). The first species (S) shows the ribs, formed by the folded chamber wall, GO14, x 100.

Figs. 9–12: *Cucurbita longicollum* SENOWBARI-DARYAN, 1983.

Fig. 9: Longitudinal section through two chambers arranged one above the other. Note the involution of the initial part of the first chamber, S6170/4, x 180.

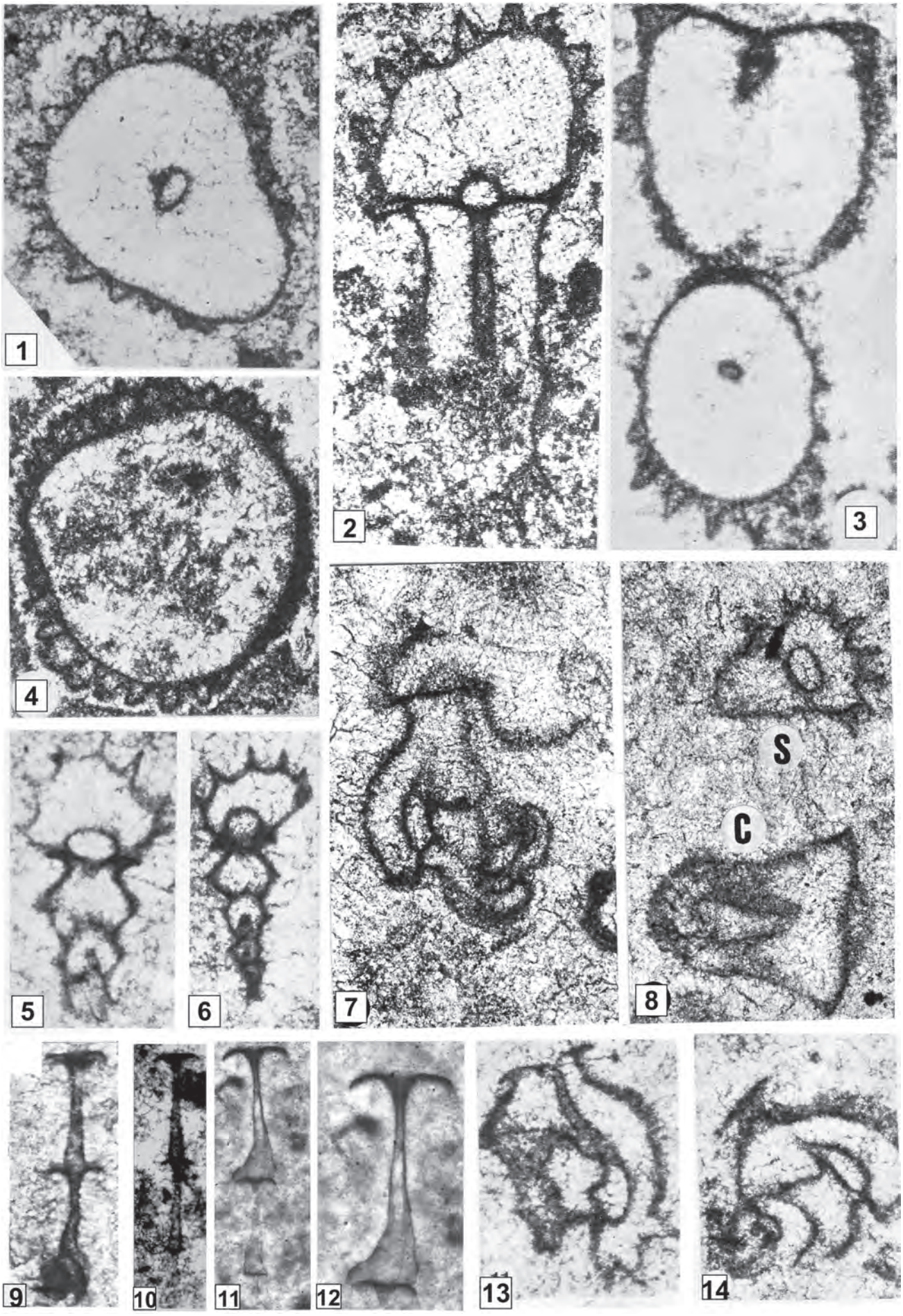
Fig. 10: Longitudinal section through three chambers arranged one above the others. Note the involution of the initial part of the first chamber (compare Text-Fig. 3), S6/28/3, x 60.

Fig. 11: Longitudinal section through three chambers. The oldest chamber is cut only through its collar, S6/170/3, x 80.

Fig. 12: Longitudinal section exhibiting a whole chamber on the collar of the preceding chamber, S6/170/3, x 120.

Fig. 13: Section through two chambers of a specimen exhibiting the ribs of the younger chamber (oblique section), formed by the folded chamber wall. The younger chamber overlaps the old chamber on one side. Note the well-developed collar of the youngest chamber. Re-illustrated from SENOWBARI-DARYAN (1983: Pl. 21, Fig. 11), about x 60.

Fig. 14: Section from a specimen showing the pear-like (pyriform) chambers. The youngest chamber overlaps at least two older chambers on one side. Re-illustrated from SENOWBARI-DARYAN (1983: Pl. 21, Fig. 9), about x 100.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