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ENCRUSTING BRYOZOA OF RICHTHOFEN REEF (SAN CASSIANO FORMATION, LOWER CARNIAN, DOLOMITES)

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Abstract - FABRIZIO BIZZARINI - Encrusting Bryozoa of Richthofen Reef (San Cassiano Formation, Lower Carnian, Dolomites)

Encrusting Bryozoa from coral patch – reefs and sponge mounds of Richthofen Reef/Settsass is reported for the first time. Two zoaria encrusting epitheca of the sponge *Ateloracia manon* and one encrusting a coral *Thecosmilia* sp. are interpreted as a new genus and a new species of Cyclostomida (*Laminoporina giampetreei*). *Laminoporina giampetreei* is here considered the oldest Cyclostomida reported in the Triassic and a probable Paleozoic surviving. Four zoaria encrusting epitheca of four corals *Thecosmilia* sp. are ascribed a *Cystitrypa elegans* (MÜNSTER, 1841). This species is here redescribed and placed in the ordo Cystoporida.

Keywords: Briozoa, San Cassiano Formation, Lower Carnian, Triassic, Richthofen Reef/Settsass.

Riassunto - FABRIZIO BIZZARINI - Briozoi incrostanti del Richthofen Reef (Formazione di San Cassiano, Carnico inferiore, Dolomiti)

Viene segnalata per la prima volta la presenza di Briozoi Cyclostomida e Cystoporida incrostanti coralli e spugne delle associazioni di scogliera del Richthofen Reef/Settsass, Formazione di San Cassiano. Si propone per i tre zoaria di Cyclostomida il nuovo genere *Laminoporina* e la nuova specie *L. giampetreei*, considerata una probabile sopravvivenza paleozoica. Sulla base di quattro zoaria incrostanti quattro esemplari di *Thecosmilia* sp. viene ridescritta la specie *Cystitrypa elegans* (MÜNSTER, 1841) confermandone l'appartenenza alle Cystoporida.

Parole chiave: Briozoa, Formazione di San Cassiano, Carnico inferiore, Triassico, Richthofen Reef/Settsass.

INTRODUCTION

The lithological sequence of Carnian in Dolomites consists in the following Formations: San Cassiano Formation

and Cassian Dolomite in the lower Carnian, Heiligkreuz Formation (ex upper San Cassiano Formation or Dürrenstein Formation), Travenanzes Formation and early portion of the Dolomia Principale in the upper Carnian

(NERI *et al.*, 2007). The carbonate platform Richthofen Reef /Settsass - Sass de Stria and adjacent basin system represent the palaeogeographic structure of this area of the Dolomites in the lower Carnian, before the Carnian Pluvial Event. Richthofen Reef carbonate platform developed coral patch - reefs and sponge mounds (BOSELINI, 1984, GIANOLLA *et al.*, 1998, TROMBETTA, 2011). Stratigraphically, this carbonate platform is attributed to lowermost Carnian (Daxatina, Aon and lower Aonoides subzone) (URLICHS, 1974, BIZZARINI, 2012, p. 227).

The Carnian fossil record of Bryozoa is very rare in the Dolomites. However, the orders Cystoporida, Trepostomida and Cyclostomida in San Cassiano Formation and in Heiligkreuz Formation are present. Particularly, are found encrusting Cystoporida, *Cystitrypa elegans* (MÜNSTER, 1841) and *Cystitrypa cassiana* SCHÄFER & FOIS, 1987, in shallow water deposits of the San Cassiano Formation; rigid erect zoaria of Trepostomida, *Dyscritella zardini* SCHÄFER & FOIS, 1987, in shallow water deposit of Forcella Giau, San Cassiano Formation, and in patch - reefs of Misurina and Alpe di Specie - Seeladalpe, Heiligkreuz Formation (SCHÄFER & FOIS, 1987 and ENGESER & TAYLOR, 1989); and the species of Cyclostomida (*Braiesopora voighti* BIZZARINI & BRAGA, 1985 and *Stomatopora illiesi* BIZZARINI & BRAGA, 1994) encrusted corals and sponges in patch - reefs of Heiligkreuz Formation of the Alpe di Specie - Seeladalpe, Alpe di Stolla and Misurina (BIZZARINI & BRAGA, 1985, 1994).

The zoaria here examined have been founded in Forcella Settsass area, two zoaria of Cyclostomida encrust the epitheca of the sponge *Ateloraacia manon*, four zoaria of Cystoporida and one of Cyclostomida encrust the epitheca of four specimens of *Thecosmilia* sp. (*sensu* VOLZ, 1894, 1897).

SYSTEMATIC

Phylum Bryozoa EHRENBERG, 1831

Classis Stenolaemata BORG, 1926

Ordo Cyclostomida BUSK, 1852

Cyclostomida bryozoans are not known in lower and middle Triassic (POWERS & PACHUT, 2008, TAYLOR, 2014) and are very rare in upper Triassic. In Dolomites the Carnian in age “Cerioporine” and the questionable bryozoans with rigid erect zoaria are most likely sponges (ENGESER & TAYLOR, 1989, TAYLOR, 2014) and the Carnian genus *Corynotrypoides* has affinity with

serpulid (TAYLOR, 2014). At present, only three genera of Cyclostomida are known in upper Triassic: the phylogenetically problematic genus *Braiesopora*, endemic of Dolomites (BIZZARINI & BRAGA, 1985); the Rhaetian genus *Reptomultisparsa* of the west Carpathian, the first unequivocal Tubuloporina (TAYLOR & MICHALIK, 1991) and the genus *Stomatopora*. Only *Stomatopora* is known in the Permian (*Stomatopora voigtiana* (King, 1850)) in the Upper Triassic (*Stomatopora dubia* PAPP, 1901, *Stomatopora illiesi* BIZZARINI & BRAGA, 1994) and it is reported also in the Jurassic.

The three zoaria of Forcella Settsass are interpreted as a new genus and a new species of Cyclostomida and this species is the oldest Cyclostomida reported in the Triassic and belong to a probable Paleozoic surviving.

Family uncertain

Genus *Laminoporina* n. gen.

Type species: Laminoporina giampetrii

Derivatio nominis: after unilamellar zoarium

Diagnosis: as for the type species

Laminoporina giampetrii n. sp.

Figs 1, 2, 3.

Holotypus: Fig. 2 zoarium encrusting on the epitheca of *Ateloraacia manon* (housed at Museo Civico di Rovereto n. inv. FOS03927)

Paratype: Fig. 1 zoarium on the left and Fig. 3 zoarium encrusting on the epitheca of *Thecosmilia* sp. (housed at Museo Civico di Rovereto n. inv. FOS03928)

Stratum typicum: San Cassiano Formation, Aonoides zone.

Locus typicus: Forcella Settsass - Richthofen Riff, Dolomites.

Derivatio nominis: in honour of Giampietro Braga, famous bryozoologist and great personal friend.

Material: three zoaria.

Diagnosis

Encrusting, disk-shaped zoarium, unilamellar, with only one zooid thick. The ancestrular area is centrally located and in the first growth stage autozooids grow by lateral budding. Distal part of the zoarium developed a lobate basal lamina. The autozooids grow in distal part of the zoarium by basal budding, rare by lateral budding.



Fig. 1 - Epitheca of *Ateloracia manon* with two zoaria of *Laminoporina giampetrii*, on the right the *Holotypus*. Scale bar 2 mm.



Fig. 2 - *Laminoporina giampetrii*, *Holotypus*. Scale bar 1 mm.

Description

Encrusting, disk-shaped zoarium, unilamellar, with only one zooid thick. The colony of holotype grows on the epitheca of *Ateloracia manon* in according to the encrusting substratum. The ancestrular area is centrally located, the ancestrula is not visible in holotype. Paratype (Fig. 3) showing the first growth stage, with growth of autozooids by lateral budding. Distal part of the zoarium developed a lobate basal lamina. The autozooids grow in distal part of the zoarium by basal budding, rare by lateral budding. Tubular zoecia have front wall crossed with small wrinkles. The zoecia of the central area, first growth phase, appear slightly longer than wide, then towards the edges of the colony they increase their length. Maximum diameter observed of zoarium is 4.5 mm.

Length of the zoecia from 0.20 to 0.45 mm

Width (max.) of the zoecia 0.19 mm

Thickness zoecial-walls about 0.05 mm

Diameter of zoecial apertures about 0.18 mm

Ordo Cystoporida ASTROVA, 1964

POWERS & PACHUT (2008) reported only three genera of Cystoporida in Triassic period: *Cystitrypa* (*C. cassiana* SCHÄFER & FOIS, 1987), *Cydotrypa* (*Cydotrypa* sp. SCHÄFER 1994) and *Cassianopora* (*C. hei* XIA 1999). SCHÄFER & FOIS (1987) and SCHÄFER (1994) placed *Cystitrypa cassiana* and *Cydotrypa* sp. into the Fistuloporidae ULRICH, 1882. The third genus *Cassianopora* is a questionable Bryozoa. BOARDMAN (1984, pp. 22 and 24) considered *Cassianopora* a probable trepostome: "Extrazoidale vesiculäre Struktur... zwischen Wänden von Fütterungszooiden könnte als modifizierte vesiculäre Struktur von Cystoporaten oder modifizierte tabulierte Mesozoecien von Trepostomaten interpretiert werden. Die kreisförmigen Querschnitte von Fütterungszooiden und die Anwesenheit von Stielen... sind typisch für die Trepostomata und legen eine Zuordnung zu dieser Ordnung nahe", but for ENGESER & TAYLOR (1989, p. 50): "*Cassianopora* BIZZARINI & BRAGA, 1978 ist identisch mit dem "hydrozoen" Genus *Tubuloparietes* Schnorf, 1960". At last, XIA (1999) placed *Cassianopora* "in the family Fistuliporidae, suborder Fistuliporina of the order Cystoporida because it possesses the following three most important features:

1) extrazoidale vesiculäre Struktur, die isoliert, hauptsächlich zwischen autozoocialen Aperturen, und in einer Reihe oder in mehr als zwei Reihen be-



Fig. 3 - *Laminoporina giampetvii* first growth stage of a colony. Scale bar 500 μ m.

tween autozoocial walls...;

- 2) autozoocial walls with granular-prismatic microstructure... that is common in many fistuliporids...;
- 3) small stiles mostly in vesicular walls that were found commonly also in costellariids of the suborder Fistuliporina...".

Only *Cystitrypa* and *Cassianopora* are present in Carnian of Dolomites, *Cystitrypa* in the San Cassiano Formation and *Cassianopora* in the Heiligkreuz Formation. However, the first Bryozoa reported in the Carnian of Dolomites was *Flustra elegans* MÜNSTER, 1841 considered a Cystoporida in BIZZARINI & BRAGA (1994, p. 51, Fig. 7a) and ANNOSCIA *et al.* (2001, p. 4).

MÜNSTER (1841, p. 32) described "*Flustra elegans*": "Das einzige vorliegende Exemplar bildet einen sehr zarten Überzug auf ein *Achilleum obscurum*. Die flachen, weit geöffneten Zellen verlaufen in schrägzeitliche Reihen und haben glatte ovale Mündungen, welche mit kleinen feinen Löchern regelmässig umgeben sind." The zoarium of "*Flustra elegans*" (Fig. 4) grows on surface of *Achilleum obscurum* encrusting a *Cidaridorsata*. MÜNSTER (1841, p. 27) considered *Achilleum*

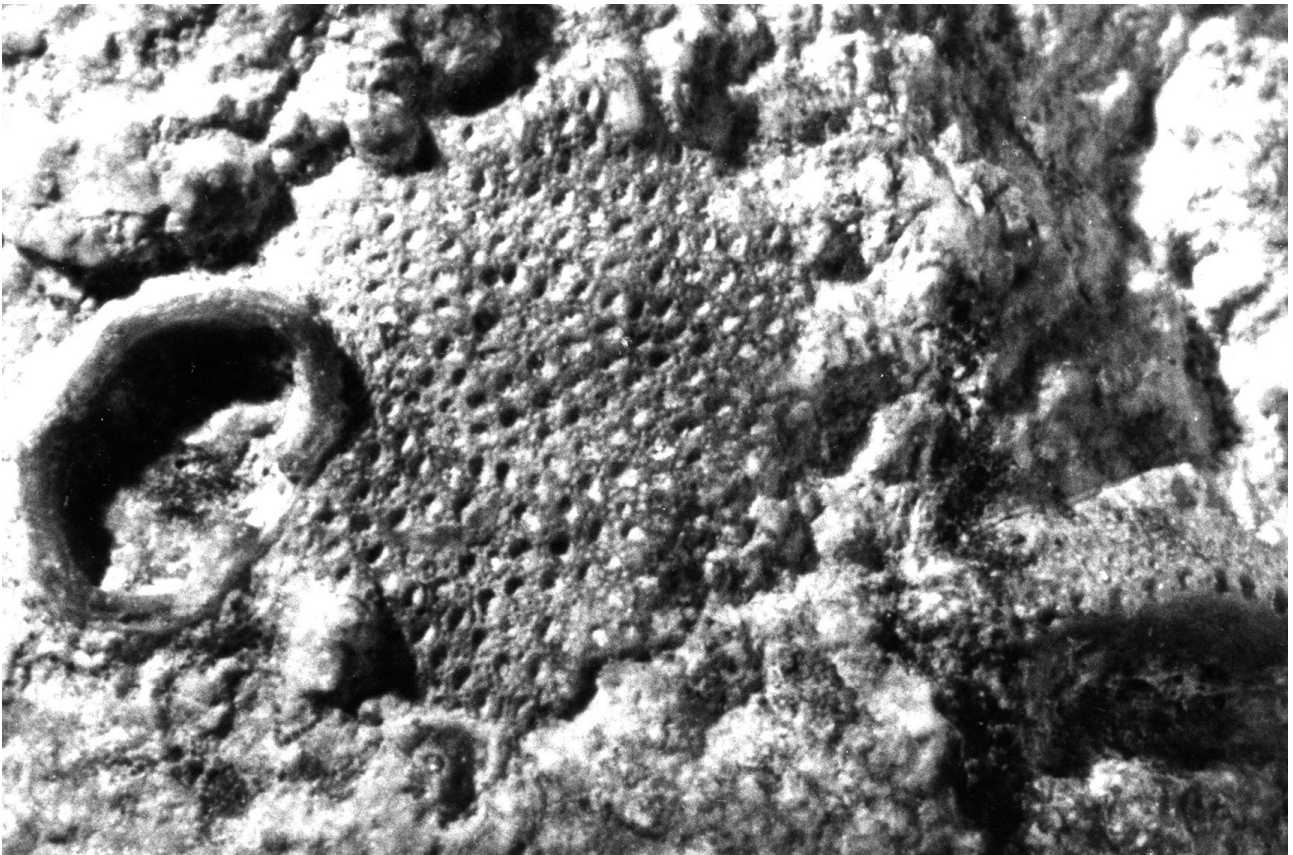


Fig. 4 - Holotypus of *Cystitrypa elegans* encrusting a spine of *Cidaris dorsata* housed at Bayrische Staatssammlung für Paläontologie und historische Geologie of München.

obscurum a sponge frequently encrusting: “Unter diesen Namen glaube ich noch eine sehr häufig vorkommende spongienartige Masse erwähnen zu müssen, welche in den verschiedensten Formen vorkommt, bald ganz frey, bald fremdartige Körper umziehend, bald wieder aufgewachsen an Conchilien, Radiarien, Corallen und besonders an den Stacheln von *Cidarites dorsatus*. Beim Anschleifen erkennt man durch Vergrößerung ein undeutliches Fasergewebe wie bei andern Achilleen. Sie kommen bis zur Dicke eines Hühnereies vor, und zeigen auf der Oberfläche mehr oder weniger gerundete oder zackige Erhöhungen”.

FLÜGEL (1963, p. 232) placed “*Flustra elegans*” into Cyclostomida: “Nach Untersuchung des Originals (Bayrische Staatssammlung Paläont. Histor. Geol. München) kann die Art möglicherweise der Gattung *Heteropora* BLAINVILLE zugeordnet werden (große Autoporen, zahlreichen kleine Mesoporen)”.

BIZZARINI & BRAGA (1979, p.117) placed “*Flustra elegans*” into Trepostomida “... a causa dell’impossibilità di effettuare sezioni, sia longitudinali che trasversali, ... non siamo in grado di esprimere una esatta determinazione. Noi riferiamo con molte riserve la colonia alla

famiglia delle *Stenoporidae* Waagen & Wentzel, 1886... Tale famiglia raggruppa numerosi generi incrostanti, con aperture irregolari, circondate da mesopori”.

The four zoaria found in Forcella Settsass enable a better study on this Briozoa and “*Flustra elegans*” is here safely placed into Cystoporida and into the genus *Cystitrypa*.

Family Fistuliporidae ULRICH, 1882

Genus *Cystitrypa* SCHÄFER & FOIS, 1987

Cystitrypa elegans (MÜNSTER, 1841)

Figs. 4, 5, 6, 7, 8

1841 *Flustra elegans* MÜNSTER, p. 32;

1841 *Flustra elegans* MÜNSTER, p. 148, plate II, Fig. 1

1963 *Flustra elegans* FLÜGEL p. 232

1976 *Flustra elegans* BIZZARINI & BRAGA, p. 62

1979 *Flustra elegans* BIZZARINI & BRAGA, p. 116 - 118, Figs 3 and 4

1994 Cystoporata BIZZARINI & BRAGA Fig. 7a

2001 *Flustra (Cystitrypa?) elegans* ANNOSCIA, BRAGA & FINOTTI, p. 4



Fig. 5 and Fig. 6 - Zoaria of *Cystitrypa elegans* encrusting the epitheca of two specimens of *Thecosmilia* sp. (Fig. 5 Scale bar 1 mm, Fig. 6 Scale bar 2 mm).

Description

Zoaria encrusting with endozona restricted to region immediately above the basal wall. The budding of autozooids occurs from basal wall in endozona, but also in exozona develop almost perpendicular to the endozone zoarial plane. In exozona the budding of autozooids is within the vesicular skeleton. In the surface of zoarium the autozoecia are separated from one, rarely two, cystopores (Fig. 5 and Fig. 6). Small areas of surface show only cystopores. In tangential section autozoecial apertures have an oval to subcircular shape. Autozoecia with lunaria are common on surface of zoaria and the zoecial apertures with lunaria show a variable orientation on colony surface. In tangential section (Fig. 7) lunaria show a radius of circumference shorter than that of zoecial apertures. In longitudinal section of the exozona the autozoecial tubules have diaphragms with variable frequency (diaphragms distance from 0.05 to 0.10 mm) and one or two cystopores are interposed between the autozoecial tubules. Small acanthostyles are present in zoecial walls.

Diameter of autozoecial apertures from 0.13 to 0.19 mm, more frequently 0.15 mm

Length max. autozoecia with lunaria from 0.17 to 0.25 mm

Diameter max. of lunaria from 0.07 to 0.10 mm

Diameter cystopora from 0.03 to 0.06 mm

Diaphragms distance in autozoecia from 0.05 to 0.10 mm

Remarks

MÜNSTER named this species *Flustra elegans* in the description of the species (MÜNSTER & WISSMANN, 1841, p. 32), but named *Flustra elegans* in "Erklärung der Figuren" p. 148, plate II, Fig. 1. I consider *elgans* a misprint and use the specific name *elegans* as the previous authors.

The typical site and the typical layer of this species is not sure. The holotype of *Cystitrypa elegans* was found in the Pralongià area, an area between Rio Picol/Picol Bach and Forcella Settsass. URLICHS (1974) identified 23 horizons in this area: 1 - 18 in Aon subzone, 19 - 23 in Aonoides subzone.

Cystitrypa elegans is an encrusting bryozoan with membraniporiform zoarial habit (BIZZARINI & BRAGA, 1994). These bryozoans live in shallow waters of the photic zone with a low sedimentation rate: Forcella Settsass (Aonoides subzone) has these characteristics, but also have a low sedimentation rate some horizons of Rio Picol and horizons 8 - 18 (Aon subzone) and 23 (Aonoides subzone) in Prati di Stuares (URLICHS, 1974).

The holotype of *Cystitrypa elegans* encrusts a spine of a Cidaridae, *Cidaris dorsata* BRAUN. This species is common in Forcella Settsass and often is fouling, but this species is commonly found in Pralongià area too. Therefore, I am unable to indicate with certainty the typical site and the typical layer of holotype of *Cystitrypa elegans* (MÜNSTER, 1841).

Cystitrypa elegans (MÜNSTER, 1841) differs from *Cystitrypa cassiana* SCHÄFER & FOIS, 1987 in shorter diameter of autozoecial apertures and of cystopores. *Cystitrypa elegans* has always autozoecial tubules with diaphragms, *Cystitrypa cassiana* has rare diaphragms in autozoecia.

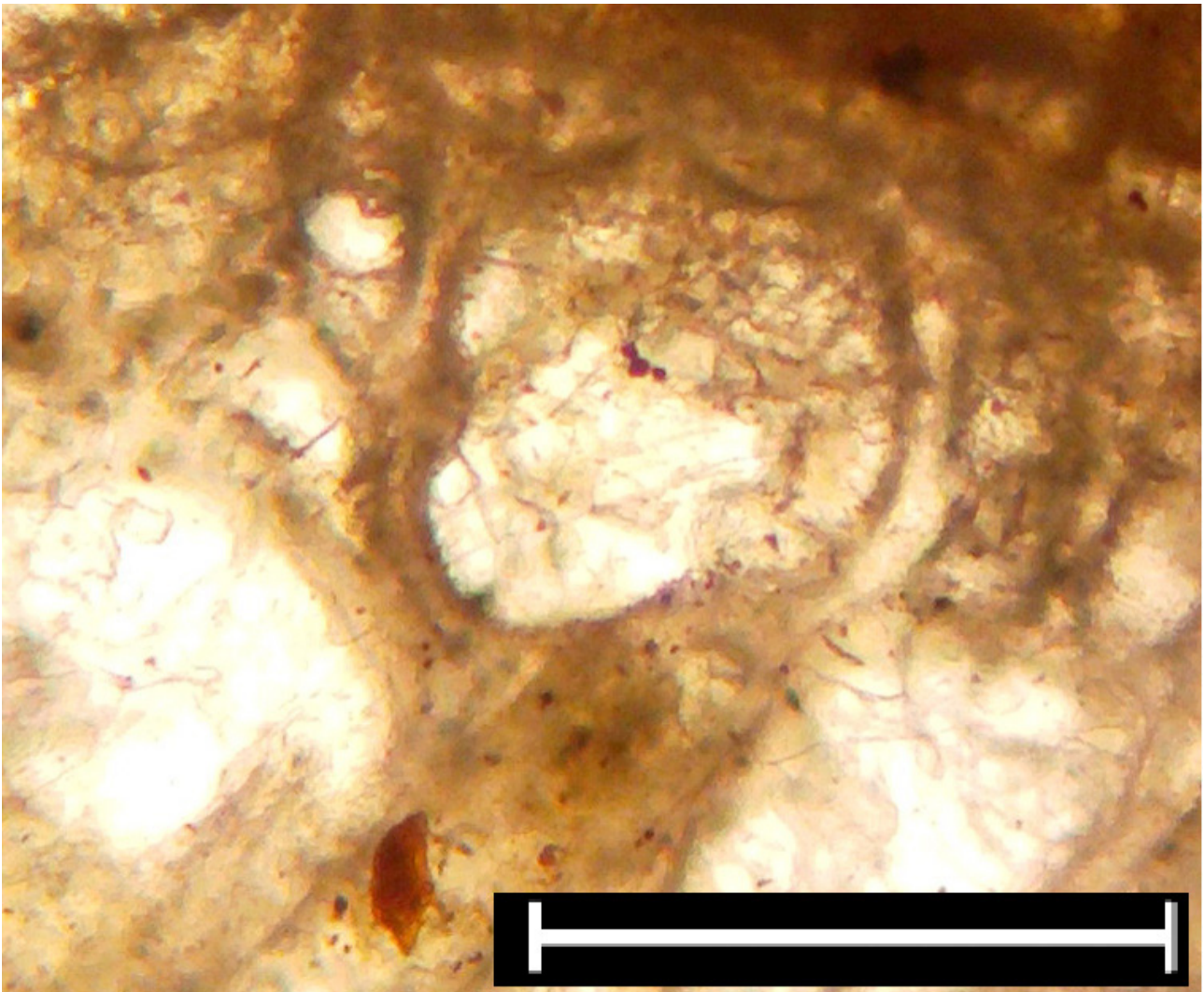


Fig. 7 - Tangential section showing a zoecial tube with lunarium. Scale bar 0.2 mm.

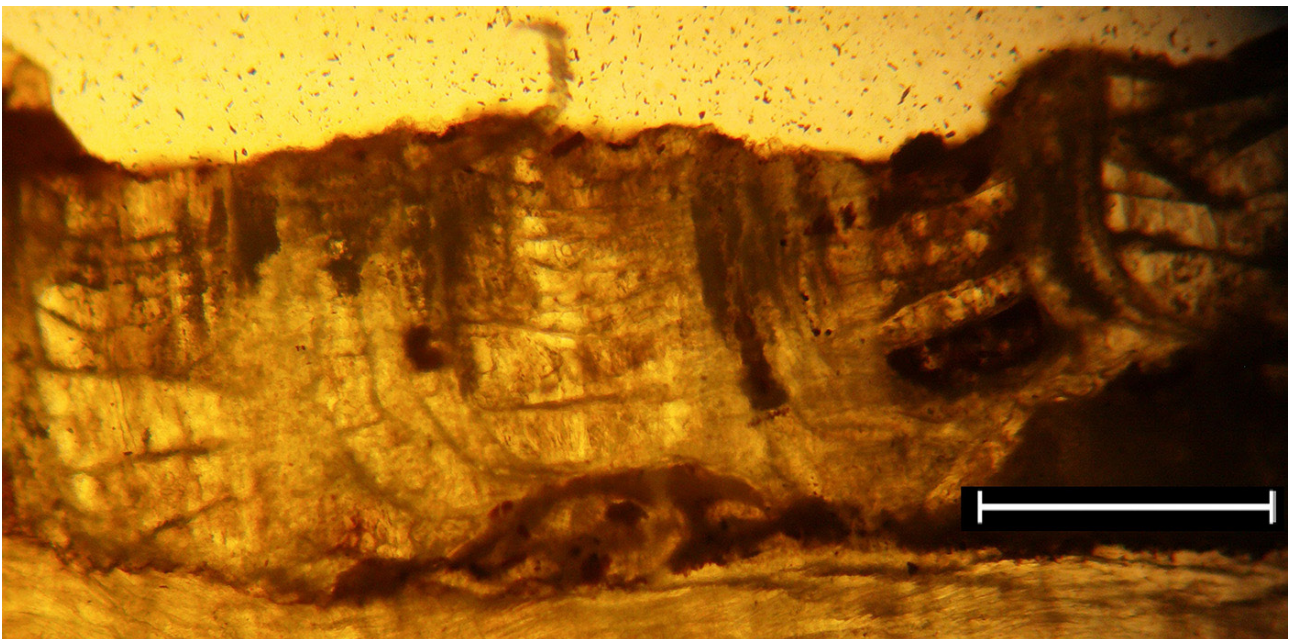


Fig. 8 - Longitudinal section showing autozoecial tubules with diaphragms and cystopores interposed between the autozoecial tubules. Scale bar 0.2 mm.

Tab. 1 - Carnic Bryozoa found in the Dolomites.

	JULIAN		JULIAN - TUVALIAN
	San Cassiano Fm.		Heiligkreuz Fm.
	Aon subzone	Aonoides subzone	Austriacum subzone and post Austriacum subzone
Cystoporata			
<i>Cystitrypa elegans</i> (MÜNSTER, 1841)	Pralongia	F.lla Settsass	
<i>Cystitrypa cassiana</i> (SCHÄFER & FOIS, 1987)		Cianzoppè	
<i>Cassianopora giulini</i> (BIZZARINI & BRAGA, 1978)			Alpe di Specie, Alpe di Stolla
Trepostomata			
<i>Dyscritella zardini</i> (SCHÄFER & FOIS, 1987)		F.lla Giau	Misurina, Alpe di Specie
<i>Leioclema?</i> sp.		Prati Stuoers	
Cyclostomatida			
<i>Stomatopora illiesi</i> (BIZZARINI & BRAGA, 1994)			Alpe di Specie, Alpe di Stolla, Misurina-Rimbianco
<i>Braiesopora voigti</i> (BIZZARINI & BRAGA, 1985)			Alpe di Specie, Alpe di Stolla
<i>Laminoporina giampetreei</i> n. gen. n. sp.		F.lla Settsass	
encrusting Cyclostomida inc. sedis			Alpe di Specie, Alpe di Stolla

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