STUDIA UNIVERSITATIS BABEŞ-BOLYAI, GEOLOGIA, XLVIII, 2, 2003, 113-124

UPPER TRIASSIC (NORIAN-RHAETIAN) NEW THALAMID SPONGES FROM NORTHERN CALABRIA (SOUTHERN ITALY)

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ABSTRACT. Two new "sphinctozoan" sponges, *Calabrisiphonella labyrinthica* nov. gen., nov. sp. and *Calabrispongia globosa* nov. gen., nov. sp., are described from reef boulders derived from Triassic dolomites ("Dolomia principale") of the Argentino valley in Northern Calabria (Southern Italy). *Calabrisiphonella* is an *Amblysiphonella*-type sponge characterized by having a complicated canal system (labyrinth-like) within the chamber walls. The structure of *Calabrispongia* is similar to some Paleozoic or Jurassic „Stromatoporoidea", which are attributed to the sponges. The systemtic position of both sponges, described here, is discussed. The age of the sponge-bearing reefs represented in the boulders is Norian-Rhaetian.

Key word: Sponge, "Sphinctozoa", Reef, Upper Triassic (Norian-Rhaetian), Northern Calabria, Italy.

INTRODUCTION

Coralline sponges are important reef builders in Triassic reefs. Among the sphinctozoid sponges more than 70 genera and 175 species have been described from Triassic reefs (Senowbari-Daryan & Garcia-Bellido, 2002). Most of these sponges come from western Tethyan reefs. Some of these sphinctozoid genera are endemic and are not known from other regions, whereas other genera are known from several localities.

During the last decade, several Norian-Rhaetian reef localities have been discovered by Italian workers in Northern Calabria (Climaco et al., 1997; Cirilli et al., 1999; Zamparelli at al., 1999; Senowbari-Daryan & Zamparelli, 1999; Iannace & Zamparelli, 2002). These new data considerably improved the knowledge on Triassic platform margin facies of the Southern Apennines.

From these researches a dichotomy seems to exist between two basic types of buildups related to different paleogeographic and paleoceanographic settings:

a) Dachstein- type buildups, dominated by highly diversified coral, sponge and algal associations, developed at the margins facing open basins (Iannace & Zamparelli, 2002)

b) Microbial-serpulid buildups flanked intraplatform troughs, with limited water exchange with open seas.

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The microbial-serpulid communities represent a minor, yet significant, bioprovince developed in the shallow western Tethys realm, in contrast with the highly diversified sponge- and coral-dominated communities of the classical Dachstein-type reefs, widespread from the Eastern Alps to Australia (Flügel & Senowbari-Daryan, 1996; Kiesseling et al., 1999; Flügel 2002).

The microbial-serpulid buildps were associated with narrow intraplatform troughs and developed in the outer margin-upper slope area under environmental conditions unsuitable for coralgal reef development

These general conclusions certainly overlook some details, because in Northern Calabria there are several kinds of marginal biofacies, with contrasting ecological characters, that coexisted in close proximity. In particular, in the Monte Montea area and the Argentino valley, parts of the Upper Triassic successions of Verbicaro Unit host a diversified faunal association rich in large sponges, corals, reefal foraminifers, and worm tubes, and abundant microbialites.This association shows intermediate features between the two platforms margin biofacies described above. Only a coupled structural and stratigraphic approach could unravel the details of the margin facies distribution of this region.

In a previous work we reported (Senowbari-Daryan & Zamparelli 1999) the occurrence of three sphinctozoan species - *Deningeria iannacei* Senowbari-Daryan & Zamparelli, *Colospongia* sp. and *Amblysiphonella* sp. from boulders of the same locality (Golfo della Serra, Argentino valley) and documented some other sponges (see Senowbari-Daryan & Zamparelli 1999: pl. 3) to show the organism assemblage of the boulders occurring in Argentino valley. Further investigations in this locality allowed recovery of several new species of sponges, which have not described previously.

The study material is deposited in collections of the Dipartimento di Scienze della Terra, University of Napoli “Federico II”, Napoli (collection V. Zamparelli).

GEOLOGICAL SETTING

The collected samples belong to a widely exposed, thick, dolomitic formation generally considered the base of the Verbicaro Unit. (Fig. 1)

This tectonic element lies above two carbonate-platform Units (San Donato and Pollino) and is, in turn, overthrusted by several ophiolitic and basement metamorphic Units (Bousquet and Grandjacquet, 1969; Amodio-Morelli et al., 1976; Bigi et al., 1991). Actually, in the Argentino valley, Norian dolomite overlie well-bedded metalimestones interpreted as belonging to the San Donato tectonic Unit (Bigi et al., 1991). However, the possibility exists that this contact could be a normal stratigraphic superposition, as depicted in previous geological maps (Grandjacquet, 1961; Damiani, 1970) and recently claimed by Iannace et al. (1995) and Iannace (in Zamparelli et al., 1999: 35-37).

Rhaetian megalodontid-bearing limestones are present above the Norian-Rhaetian dolomites. The latter are laterally replaced by thin bedded, dark dolomites, marly dolomites and metalimestones (Grisolia formation, Damiani et al., 1970).

Zamparelli et al.,1999 (and references therein) provides a general account of the facies distribution between Norian and Lower Liassic for the whole of Northern Calabria. They recognized inner margin, algae-rich facies, marginal and upper slope boundstones, as well as middle to lower slope carbonate turbidites. They interpreted these facies as formed in one or more little intraplatform troughs with restricted water circulation and ecologically peculiar marginal bioconstructions dominated by microbialites, serpulids and little sphinctozoans.

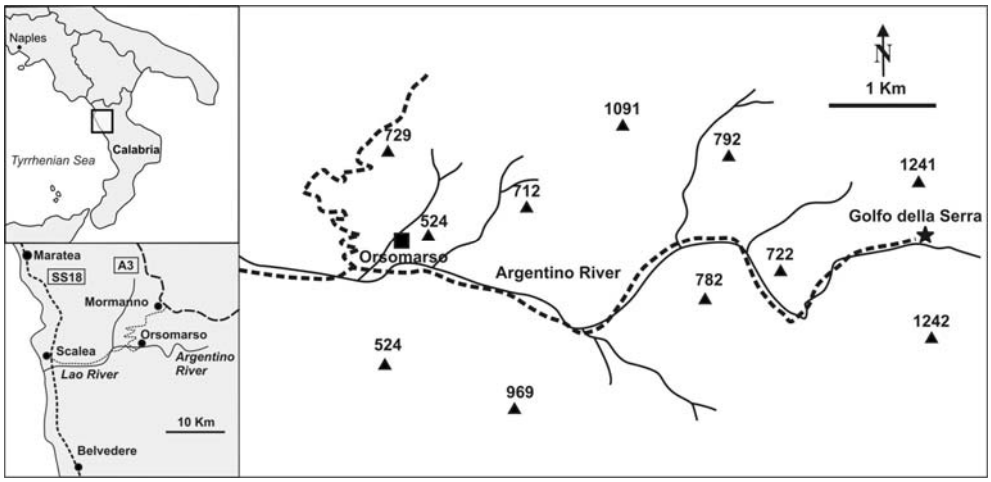

Fig. 1 - *Geographic location of the studied outcrop in southern Italy. The locality at Golfo della Serra is indicated by the star at right center of Fig.C.*

The stratigraphic succession of the Verbicaro Unit (Damiani, 1970) is overlain by Jurassic cherty limestones, Upper Cretaceous-Paleogene calcareous conglomerates, Oligocene-Miocene calcareous turbidites and shales and finally Lower Miocene flysch deposits.

Systematic Paleontology

Phylum **Porifera** Grant, 1872
Class Demospongia Sollas, 1964
Order Permosphincta Termier & Termier, 1977
Suborder Porata Seilacher, 1962
Family Sebargasiidae Laubenfels, 1955
Subfamily Sebargasiinae Senowbari-Daryan, 1990
Genus ***Calabrisiphonella*** nov. gen.

Derivatio nominis: From Calabria and possession of a siphon (spongocoel) of this thalamid sponge.

Diagnosis: Thalamid sponge of *Amblysiphonella*-type but the chamber walls are composed of reticulate skeleton fibers with a complicated canal system (labyrinth-like) between the fibers. Chamber interiors without filling skeleton. Originally skeletal mineralogy was most probably aragonite.

Type species: *Calabrisiphonella labyrinthica* nov. sp.

Discussion: *Calabrisiphonella* has ring-like chambers with an axial spongocoel like *Amblysiphonella* Steinmann, a common thalamid sponge in Paleozoic and Upper Triassic deposits, but differs from *Amblysiphonella* and other amblysiphonellid sponges in the perforation pattern of chamber walls. In fact, the chamber walls of *Amblysiphonella* are pierced by simple or dichotoumously branched pores whereas *Calabrisiphonella* has a complicated labyrinthic canal system.

Labyrinthic branched pore system are also known in other thalamid sponges, like the Upper Triassic genus *Welteria*. However, in addition to other sponge features - like the spongocoel type - *Welteria* posseses a reticular filling skeleton within the chamber interiors. Chamber interiors of *Calabrisiphonella* are without any filling skeleton. The characteristics and differences between the three mentioned genera with similar external appearance are shown schematically in Fig. 2.

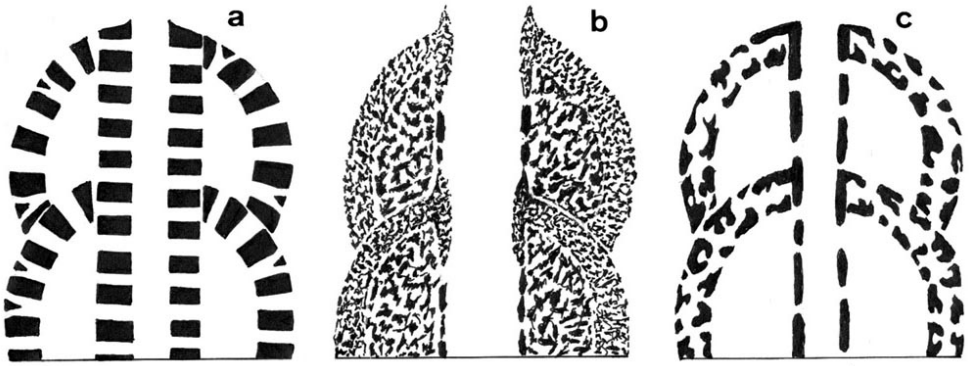

Fig. 2 *-The pattern of canal systems in the chamber walls of three genera Amblysiphonella, Welteria and Calabrisiphonella. a) Amblysiphonella. The chamber walls are pierced by single or dichotomously branched pores. Chamber interiors without secondary sheleton. b) Welteria The chamber walls are pierced by fine labyrinthic branched canal system between the fine skeletal fibers. Chamber interiors contain a secondary coarse reticular skeleton. c) Calabrisiphonella. The chamber walls are pierced by loose labyrinthic branched canal system between the coarse skeletal fibers. Chamber interiors without a secondary skeleton. Schematic, not to scale.*

Calabrisiphonella labyrinthica nov. sp.

(Pl. 1, figs. 1, 3-7, pl. 2, figs. 1-5, pl. 3, fig. 1/L)

1999 „Reef assemblage...".- Senowbari-Daryan & Zamparelli, pl. 3 (several specimens).

Derivatio naminis: Named for the labyrinthic-like complicated canal system within the chamber walls.

Holotype: We designate as holotype the specimen cut in marginal axial section and illustrated in pl. 1, fig. 1 (thin section FS624).

Paratypes: All specimens figured in pl. 1, figs. 3, 5-7, pl. 2, figs. 1-5.

Locus typicus: South of Golfo della Serra at Argentino River (see fig. 1).

Stratum typicum: Norian-Rhaetian.

Diagnosis: See diagnosis of the genus.

Material: Several specimens in polished slabs and in thin sections (holotype is in thin section FS624X).

Description.- This sponge is composed of ring-shaped chambers like representative of the genus *Amblysiphonella*. It reaches a length of more than 40 mm, with a diameter of up to 11 mm. The chambers are low and have almost the same height (approximately 1 mm) as the thickness of the chamber walls. Specimens cut in marginal sections show crescent-like chambers and can be easily mistaken for representatives of the genus *Colospongia* (pl. 1, figs. 5-7, pl. 2, figs. 1). However, the axial sections exhibit a retrosiphonate type of axial spongocoel with a diameter of about 1-2 mm.

The distinctive character of this species and also of the genus *Calabrisiphonella* is the complicated perforation pattern of the chamber walls. The chamber walls are not pierced by single or dichotomously branched pores like in *Amblysiphonella* and other thalamid sponges. They are penetrated by a complicated, labyrinthic-like canal system (pl. 1, figs. 3-7, pl. 2, figs. 1-2) giving the wall a loose reticulate-appearing fibrous skeleton (pl. 1, fig. 5). The chamber interiors lack filling structures.

The holotype (pl. 1, fig. 1) have a length of 40 mm with a maximum diameter of 11 mm and is composed of several low chambers. The axial spongocoel is cut in the lower part of the specimen.

The skeleton is recrystallized in all specimens. The original mineralogy was most probably aragonite. Spicular skeleton is not known.

Sphinctozoida? Stromatoporoidea?
Family Cryptocoeliidae?

Discussion.- The family Cryptocoeliidae Steinmann is characterized by perforated chamber walls and by possession of trabecular filling skeleton within chamber interiors of the chambers. Four genera - *Cryptocoelia* Steinmann 1882, *Rigbyspongia* De Freitas 1987, and dubitatively *Sphinctonella* Hurcewics 1975 and *Zanklithalamia* Senowbari-Daryan 1990 - were attritubed to the family Crypocoeliidae by Senowbari-Daryan (1990: 102).

The genus *Zanklithalamia* was characterized by the following diagnosis: „Riesige, aus sehr flachen Segmenten aufgebaute Schwämme. Mehrere Kanalbündel vom prosiphonaten Typ durchsetzen den Schwamm, die senkrecht oder schräg nach außen münden. Das Segmentinnere ist hohl oder mit vertikal stehenden Elementen versehen, was an die Pfeiler (trabeculäres) Füllskelett bei den thalamiden Schwämmen errinert. Vesiculae sind selten. Die primäre Skelettmineralogie war wahrscheinlich Aragonit. Die Mikrostruktur konnte nicht genau ermittelt werden (primär war sie wahrscheinlich sphärolithisch gewesen)“ (Senowbari-Daryan 1990: 105). (Large sponges composed of very flattened segments. Several bundles of prosiphonate type of canals pass vertically or divergently to the outside through the sponge. Interior of the segments is hollow or contains vertically running elements similar to pillar-like filling skeleton (trabecular) in thalamid sponges. Vesiculae are rare. The primary skeleton mineralogy was probably aragonite. The original microstructure has not been preserved (probably it was spherulitic).

In addition to the type species *Z. multisiphonata* two additional species (*Z. alpina* and *Z. gigantea*) were attributed to this genus by the same author and were separated because of differences in the structure of their skeletons (see Senowbari-Daryan 1990: 107). E. g. the canal bundles of *Z. multisiphonata* are lacking in *Z. alpina,* and the pillar-like elements of *Z. alpina* are lacking in *Z. gigantea* or they are

rudimentary in *Z. multisiphonata*. More abundant and better preserved material could reveal that the three species of *Zanklithalamia* described by Senowbari-Daryan (1990) should be attributed to different genera. *Zanklithalamia* was questionably placed in the family Cryptocoeliidae by Senowbari-Daryan (1990).

Wu Y. Sh. (1991) introduced the new family Zanklithalamiidae with the following definition: „It includes the members of the suborder (Polyvasculata Wu) composed of series of chambers stacked, with a zanklisiphonate exhalant canal system, with chamber walls perforated or imperforated" (Wu 1991: 80). Only the genus *Zanklithalamia* was attributed to this family by Wu (1991).

The general architecture of new sponge *Calabrispongia globosa* described here is very similar to *Zanklithalamia alpina*. Both species are characterized by horizontal elements (segment roofs) and vertically pillar-like filling skeletons. Therefore *Z. alpina* could be attributed to the genus *Calabrispongia*.

Calabrispongia, however does not represents a „typical" sphinctozoid sponge like *Amblysiphonella* or *Colospongia*. The major features of *Calabrispongia* correspond to those organisms described as „Stromatoporoidea" from Paleozoic or Mesozoic (mostly Jurassic) deposits. Such organisms may secrete skeletons homologous to the chambers of sphinctozoans (Stearn & Pickett 1994). Stromatoporoidea (both Paleozoic and Mesozoic) were attributed to the hydrozoans in the past but now they are attributed to sponges (e. g. Wood 1987, Stearn 1988, Stearn et al. 1999, Stock 1991, for more discussion see Cook 2002). *Calabrispongia* is questionably included in the sphinctozoid or stromatoporoid sponges

Diagnosis: Genus ***Calabrispongia*** nov. gen. Asiphonate, massive, globular to dome-like or irregular sponge with crescentic flattened segments in longitudinal sections. Segment walls very thin and coarsely perforated. Interior of segments filled with trabecular (pillar-like) to reticular filling skeleton. Primary skeleton mineralogy was probably aragonite. Spicules and microstructure are not known.

Type species: *Calabrispongia globosa* nov. sp.

Calabrispongia globosa nov. sp.

(Pl. 1, fig. 2, pl. 2, fig. 6, pl. 3, figs. 1/H, 1/P)

1999 „Reef assemblage...".- Senowbari-Daryan & Zamparelli, pl. 3 (at the left part of the photo).

Derivatio nominis: From the globular shape of the scheleton.

Holotype: Pl. 3, fig. 1H. Specimen in sample FS 624. From the holotype were made three thin sections (FS 624/1-3). Thin sections FS 624/1 is figured in Pl.3, fig.1/H

Paratypes: Pl. 1, fig. 2, pl. 2, fig. 6, pl. 3, fig. 1/P.

Locus typicus: South of Golfo della Serra at Argentino River (see fig. 1).

Stratum typicum: Norian-Rhaetian reef boulders.

Material: Several specimens in 10 thin sections and rock remains.

Description: This massive, globular, dome-like or irregularly shaped sponge usually shows alternating, well preserved (dark appearing in thin sections) and recrystallized (white appearing in thin sections), crescentic segments, having an average diameter of 25 mm. Because of the crescentic segments, outer segmentation of the sponge is poorly or not developed.

Heights of segments range 1.5-3.0 mm in axial parts and decrease in peripheral parts. The segment walls are very thin, having thicknesses of 0.08-0.3 mm. Walls are pierced by coarse openings. Interiors of segments are filled by reticular-pillar internal structures. Fibers of filling skeleton exhibit distinct orientation running parallel in axial parts of the segments and oblique in peripheral portions. Primary skeletal mineralogy was most probably aragonite. Spicular skeleton and microstructure are not known.

General observations and organism association. The state of preservation of this association is very poor due to strong recrystallization. However, it is possible to recognize the great abundance of microbial crusts, together with some foraminifers (*Aulotortus* sp., *Planinivoluta* sp., Duostominidae, Endotebidae), fragments of dasyclad algae, worm tubes and fragment of "microproblematica" like to *Porpheritubus buseri* and ?*Uvanella tegimentopora*. In adddition to the sponges described in this paper, the following sponge taxa were earlier reported from this locality by Senowbari-Daryan and Zamparelli (1999): *Deningeria iannacei* Senowbari-Daryan & Zamparelli, *Deningeria* sp., *Colospongia* sp., and some indeterminable inozoan sponges.

The age of this association, earlier referred to the Norian-Rhaetian, is confirmed.

Acknowlegments

We express our sincere thanks to the "Triassic research group of Napoli", especially to Prof. A. Iannace and Dr. M. Parente. These investigations have been funded by a PRIN grant 2000 to Valeria Zamparelli. We also thank J. Keith Rigby and Franco Russo for reviewing the manuscript and improving the English text.

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PLATES

Plate I

Fig. 1, 3-7: *Calabrisiphonella labyrinthica* nov. gen., nov. sp.

Fig. 1: Holotype. Oblique longitudinal section through several chambers, with spongocoel cut in the lower part of sponge. FS624, x2,5.

Fig. 3: Oblique section. The spongocoel is cut in the middle. FS624, x4,5.

Fig. 4: Magnification of part of fig. 1 shows chamber walls with complicated canal system. x7,5.

Fig. 5: Magnification of part of fig. 6 shows chamber walls with complicated canal system. x10.

Fig. 6: Marginal longitudinal section from a well preserved specimen shows the low chambers with complicated canal system in the segment walls. FS624, x4,5.

Fig. 7: Section through some chambers. FS624, x8.

Fig. 2: *Calabrispongia globosa* nov. gen., nov. sp. Longitudinal section through several segments. FS624, x4,5.

Plate II

Fig. 1-6: *Calabrisiphonella labyrinthica* nov. gen., nov. sp.

Fig. 1: Longitudinal section through several crescentic flattened chambers. Chamber walls in upper part show the complicated canal system. FS624/4, x3.

Fig. 2: Sections through one (curved) or two specimens shows the low flattened chambers and the spongocoel. The chamber walls partly show the complicated canal system. *Calabrispongia globosa* grew on a specimen of *Calabrisiphonella labyrinthica* (see also Senowbari-Daryan & Zamparelli 1990: pl. 3). Thin section FS624a, x2.5.

Fig. 3: Sections through several specimens (see also Senowbari-Daryan & Zamparelli 1990: pl. 3). The spongocoel in one specimen is marked with „S“. Thin section FS624a, x2.5.

Fig. 4: Sections through two specimens. “S” points to the spongocoel in one specimen. Thin section FS624/6, x2.5.

Fig. 5: Section through two specimen. „S“ points to the spongocoel. Thin section FS624a, x2.5.

Fig. 6: *Calabrispongia globosa* nov. gen., nov. sp. Oblique section. FS624/2, x2.

Plate III

Organism assemblage with different sponges and microbial crusts. H) *Calabrispongia globosa* nov. gen., n. sp. (Holotype). Longitudinal section through several crescentic segments with thin segment walls. The interior of the segments contains pillar-like (upper part) or reticular (right and lower part) filling structures. Segment walls are recrystallized. The sponge grew on a specimen of *Calabrisiphonella labyrintica* (L) nov. gen., n. sp., which is cut in marginal section exhibiting several chambers. P) Oblique section of a paratype of *Calabrispongia globosa*. I) Cross section of an inozoid sponge gen. et sp. indet. exhibits an axial spongocoel and exhalant canals piercing the thick sponge wall. FS624/3, Scale 8 mm.

Plate I

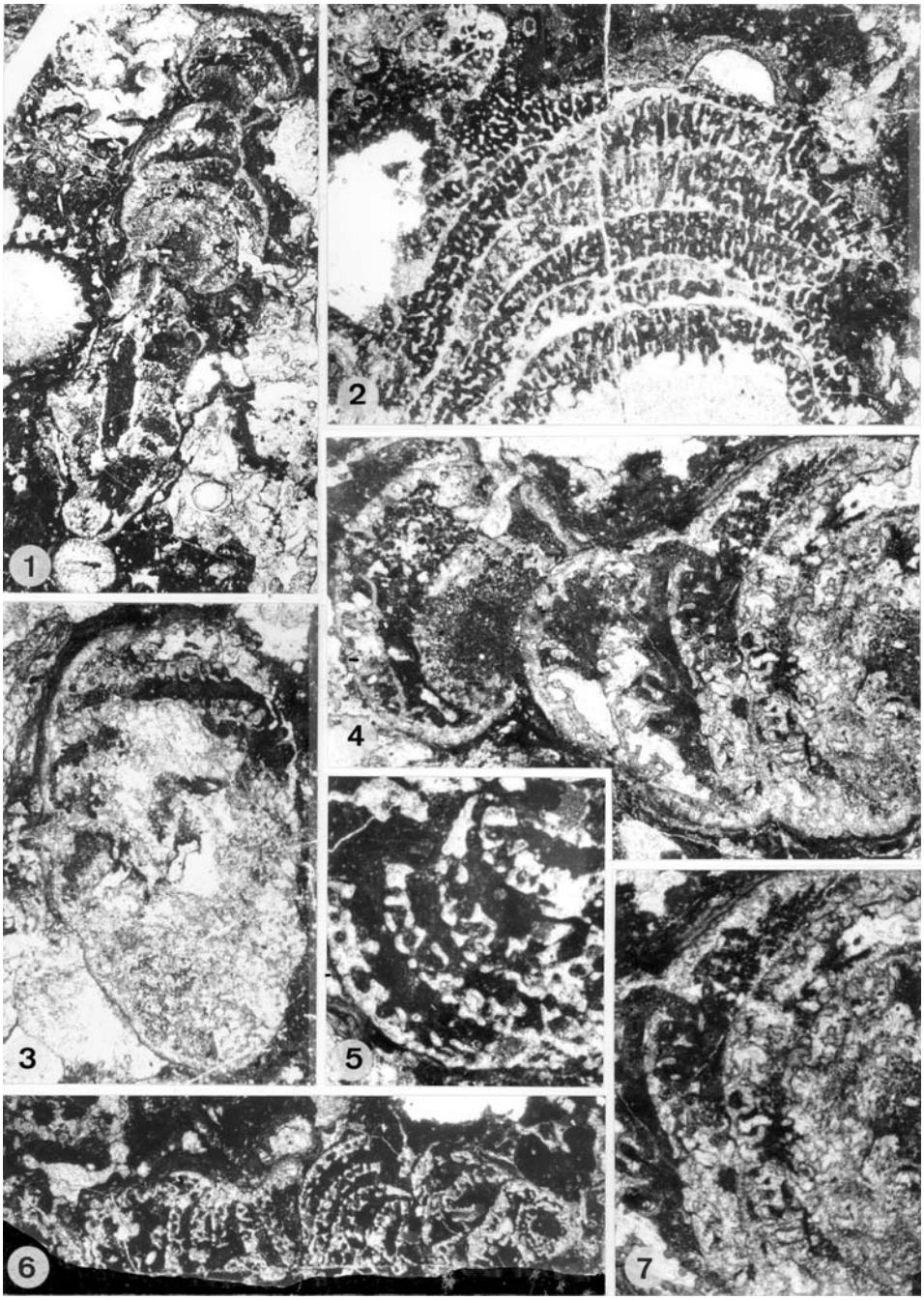

Plate II

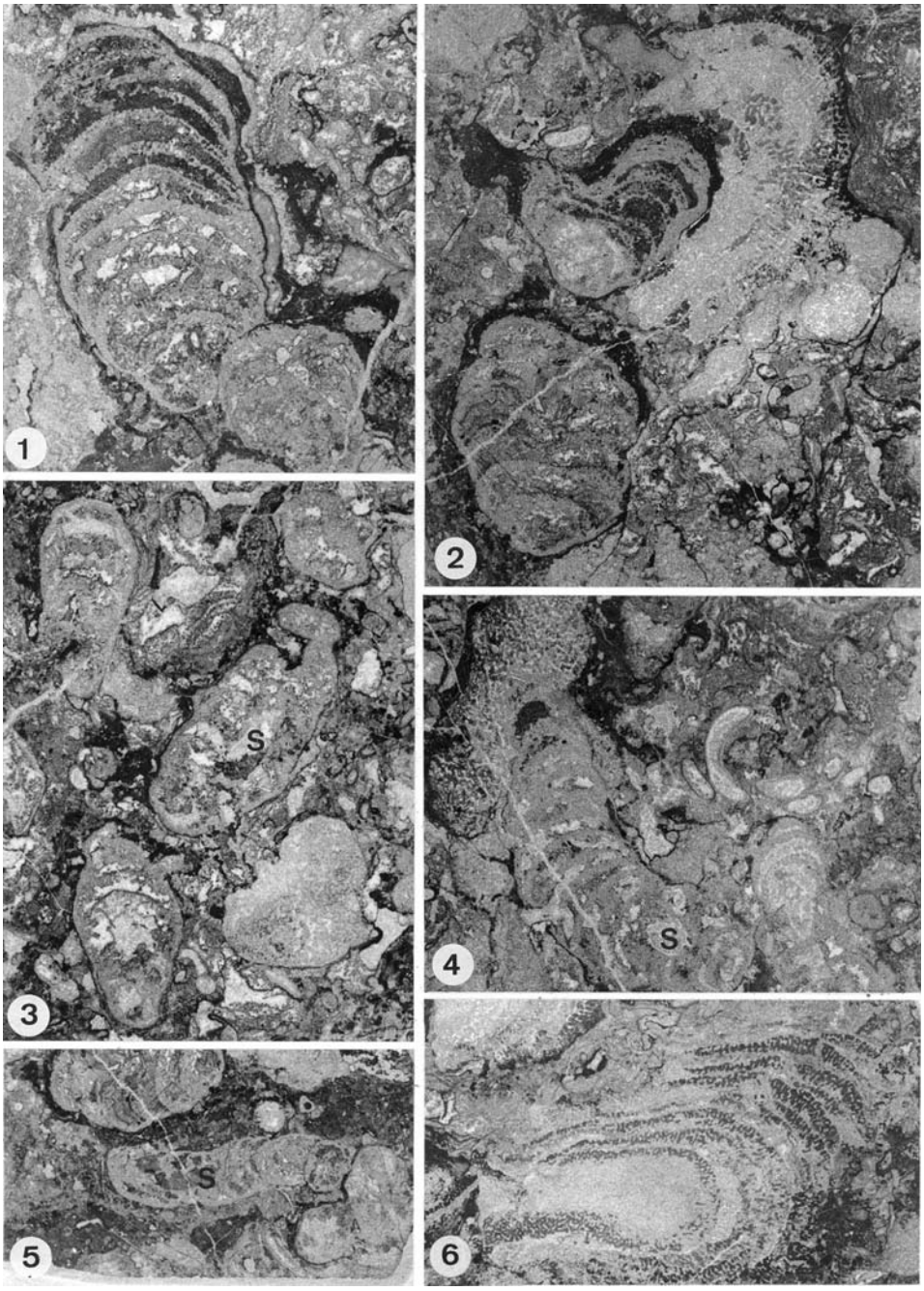

Plate III