

SARSTEINIA BABAI N. GEN., N. SP., A NEW PROBLEMATIC SPONGE (INOZOA?) FROM THE LATE JURASSIC OF THE NORTHERN CALCAREOUS ALPS, AUSTRIA

FELIX SCHLAGINTWEIT & HANS-JÜRGEN GAWLICK

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Abstract. The new problematic sponge *Sarsteinia babai* n. gen., n. sp. is described from the Kimmeridgian to Tithonian Plassen and Lärchberg Formations of the Northern Calcareous Alps of Austria. The type-locality is the Sarsteinalm north of Mount Hoher Sarstein in the Austrian Salzkammergut, other findings come from Mount Sandling, Mount Jainzen, Mount Trisselwand and the Litzlkogel-Gerhardstein-complex west of Lofer. Most findings can be attributed to a fore-reef to upper slope facies or slope-of-toe breccias, small fragments can occasionally also be found in the back-reef facies. The suprageneric systematic position of the new sponge is unknown so far since it shows morphological characteristics known from Inozoa but also from “stromatoporoids”.

Riassunto. Viene descritto il nuovo porifero problematico *Sarsteinia babai* n. gen., n. sp. proveniente dalle formazioni Plassen e Lärchberg delle Alpi Calcareae Settentrionali, di età da Kimmeridgiano a Titonico. La località tipo si trova alla Sarsteinalm, a nord del monte Hoher Sarstein nel Salzkammergut, Austria. Altri ritrovamenti provengono dai monti Sandling, Jainzen, Trisselwand e dal complesso Litzlkogel-Gerhardstein situati a ovest di Lofer. La maggior parte dei ritrovamenti possono essere riferiti a facies da piattaforma esterna sino pendio superiore oppure a breccie del piede del pendio. Piccoli frammenti possono rinvenirsi occasionalmente anche nelle facies di retroscogliera. La posizione sistematica sopragenerica del nuovo porifero è ignota in quanto mostra caratteri morfologici noti negli Inozoa, ma anche negli “stromatoporoidi”.

Introduction

Chambered sphinctozoids along with non-segmented inozoid sponges were abundant reef builders worldwide within Permian and Triassic reefs (e.g. Rigby & Senowbari-Daryan 1996; Senowbari-Daryan et al. 1997; Senowbari-Daryan & Garcia-Bellido 2002) and

are also known from the Northern Calcareous Alps, namely from the Wetterstein and Dachstein Limestones (e.g. Ott 1967; Senowbari-Daryan 1990). In the Late Jurassic the importance of this group of sponges became reduced in comparison to the wide distribution of stromatoporoids (e.g. Turnšek et al. 1981; Leinfelder et al. 2005), some of which were assigned to sponges (e.g. Wood 1987).

The Alpine Upper Jurassic shallow water limestones (Plassen Formation, e.g. Tollmann 1976; Lärchberg Formation, e.g. Ferneck 1962) are, above all, well-known for their rich and diverse assemblages of stromatoporoid demosponges (Fenninger & Hötzl 1965; Leinfelder et al. 2005). In analogy to the barrier reef belt in Slovenia (Turnšek et al. 1981), ellipsactinids and actinostromariids were dominating the platform margin to fore-reef facies, other taxa such as cladocoropsids, burgundiids and milleporiids were restricted to back-reef and lagoonal facies. The metazoan composition, however, did not solely include stromatoporoids and corals, but also coralline sponges such as *Neuropora*, *Consinocodium* or *Murania* (Schlagintweit 2004, 2005). In the framework of recent investigations a new problematic sponge was discovered at the Sarsteinalm north of Mount Sarstein (type-locality), Mount Jainzen, Mount Sandling, Mount Trisselwand and the Gerhardstein-Litzlkogel-complex. The new sponge is described as *Sarsteinia babai* n. gen., n. sp.

Geographical and Geological Setting of the type locality

An overview of the geological research history of the Sarsteinalm region was provided by Mandl (2003)

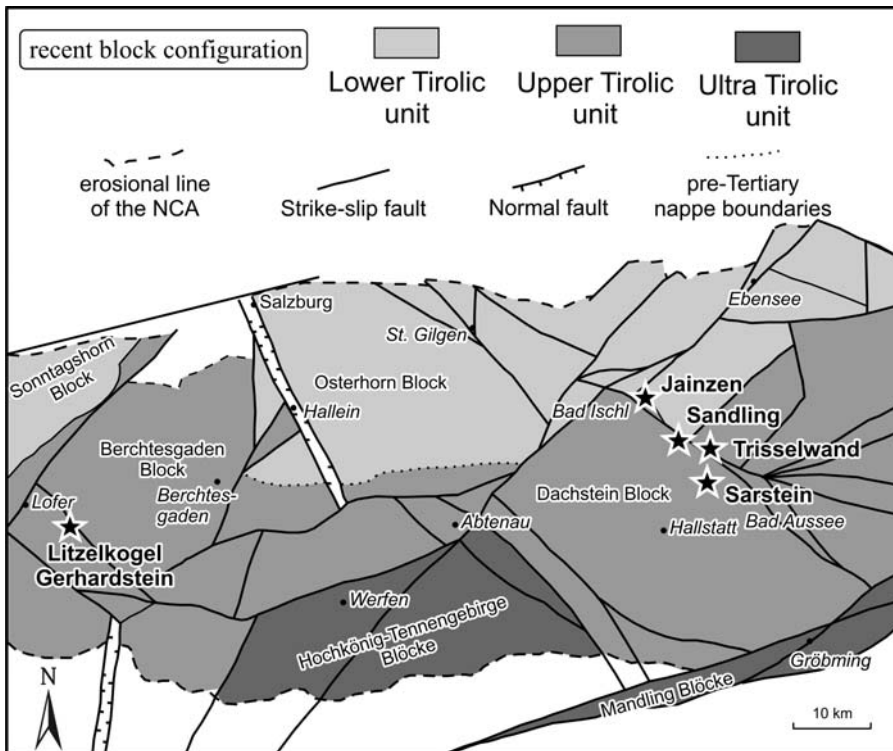


Fig. 1 - Occurrences of *Sarsteinia bairi* n. gen., n. sp. and their geological-tectonical framework (after Frisch & Gawlick 2003).

and Gawlick et al. (2006). The Sarsteinalm north of Mount Hoher Sarstein (altitude 1975 m) is located in the Austrian Salzkammergut half way between the towns Altaussee in the east and Hallstatt in the west (topographic map of Austria 1: 50.000 no. 96 Bad Ischl) (Fig. 1). Tectonically, the Sarsteinalm is part of the Dachstein Block sensu Frisch & Gawlick (2003), the former Dachstein Nappe (see Tollmann 1985 – cum lit.) separated from Mt. Hoher Sarstein by an east-west striking fault (Gawlick et al. 2006). In the area of the Sarsteinalm the condensed Lower to early Upper Jurassic sediments (red nodular limestones, radiolarites) underlying the Upper Jurassic shallow water carbonates show a thickness of just a few meters.

Above the Rhaetian Dachstein Limestone a condensed red limestone succession of the ?Adnet and Klaus Formations were deposited. “*Protoglobigerina*” limestones (? Bathonian) that are exposed north of the Sarsteinalm are overlain by cherty limestones and variously coloured radiolarites of different lithofacies belonging to the Ruhpolding Radiolarite Group (see Schäffer 1976, 1982: ÖK 96 Bad Ischl and Gawlick et al. 2006). By means of the radiolarian fauna, these siliceous rocks were dated as Middle Callovian to Lower Oxfordian (U.A.-Zone 8, Suzuki & Gawlick 2003a, b; Gawlick et al. 2006).

Upper Jurassic platform carbonates of the Plassen Formation are restricted to a small area of the Sarsteinalm plateau, even smaller than formerly assumed (samples DD 5c, DD 64–67, DD 78 and DD 85–93, Fig. 2). These carbonates cannot be referred to the Tressenstein

Limestone, as previously recorded in the literature (Schäffer 1982), since the latter represents mass-flow deposits and calciturbidites intercalated within calpionellid limestones at its type-locality (Schlagintweit & Ebli 1999; Schlagintweit et al. 2005). Whether these Plassen Formation occurrences of the Sarsteinalm are autochthonous or they represent large sliding blocks, intercalated within slope facies, is unclear and not solvable due to poor outcrop conditions.

The samples of the Plassen Formation can be ascribed to the slope and platform margin facies. The former is represented mainly by packstones with small benthic foraminifera, “*Tubiphytes*”, remains of echinoids, and bryozoans. The direct transition from basin to slope deposits is not exposed; in sample DD 66 re-sedimented shallow water debris occurs together with remains of *Saccocoma*. Thus, it can be assumed that *Saccocoma* limestones follow the cherty basin sediments due to the successive increase in calcareous input. The platform margin facies is represented by bioclastic packstones to rudstones with debris of stromatoporoids and corals. The reconstructed succession clearly documents that the Plassen Formation of the Sarsteinalm evolved from basinal deposits in a shallowing-upwards manner in the same way as it was evidenced at Mt. Plassen (Schlagintweit et al. 2003), Mount Krahstein (Gawlick et al. 2004) or Mount Falkenstein (Kügler et al. 2003). Based on the occurring microfossils and the stratigraphic data from the base, a Kimmeridgian age was assumed for the Plassen Formation of the Sarsteinalm (Gawlick et al. 2006, for discussion).

The new sponge *Sarsteinia babai* n. gen., n. sp. was detected in samples DD 91 and DD 92 (see Fig. 2 B) within a rudstone with the stromatoporoid *Cylicopsis verticalis* Turnšek, the in-certa sedis *Radiomura cautica* Senowbari-Daryan & Schäfer and “*Tubiphytes*” *morroneensis* Crescenti, echinoid debris and serpulids.

Geographical and Geological Setting of the other localities

1. *Mount Sandling* (Fig. 1). Mount Sandling (1717 m altitude) is exposed north of the Sarstein area in the central Salzkammergut west of the city Altaussee. The sedimentary succession at Mt. Sandling consists of cherty sediments of the Strubberg Formation (Callovian to Late Oxfordian – dated by means of radiolarians, e.g., Wegerer et al. 2001, Gawlick et al. in review) which are overlain by wackestones, probably of Kimmeridgian age. From latest Kimmeridgian onwards progradation of shallow water carbonates started resulting in the deposition of a Tithonian shallow water carbonate sequence with reefal debris.

A fragment of *Sarsteinia babai* n. gen., n. sp. has been detected in a slope wackestone that is overlain erosively by a poorly washed out packstone (resediment layer!) (Pl. 2, fig. 1). Sample D 205 contains pharetronid sponges, “*Tubiphytes*” *morroneensis* Crescenti and *Radiomura cautica* Senowbari-Daryan & Schäfer. The age of this sample, originating from the northern side of the Sandling at an altitude of approximately 1680 m, is not clear (Kimmeridgian or Tithonian).

2. *Mount Jainzen*. Mount Jainzen (834 m altitude) is located close to Bad Ischl in the Austrian Salzkammergut. According to own observations, the Plassen Formation of the Jainzen predominantly comprises slope and platform margin facies with corals (mainly

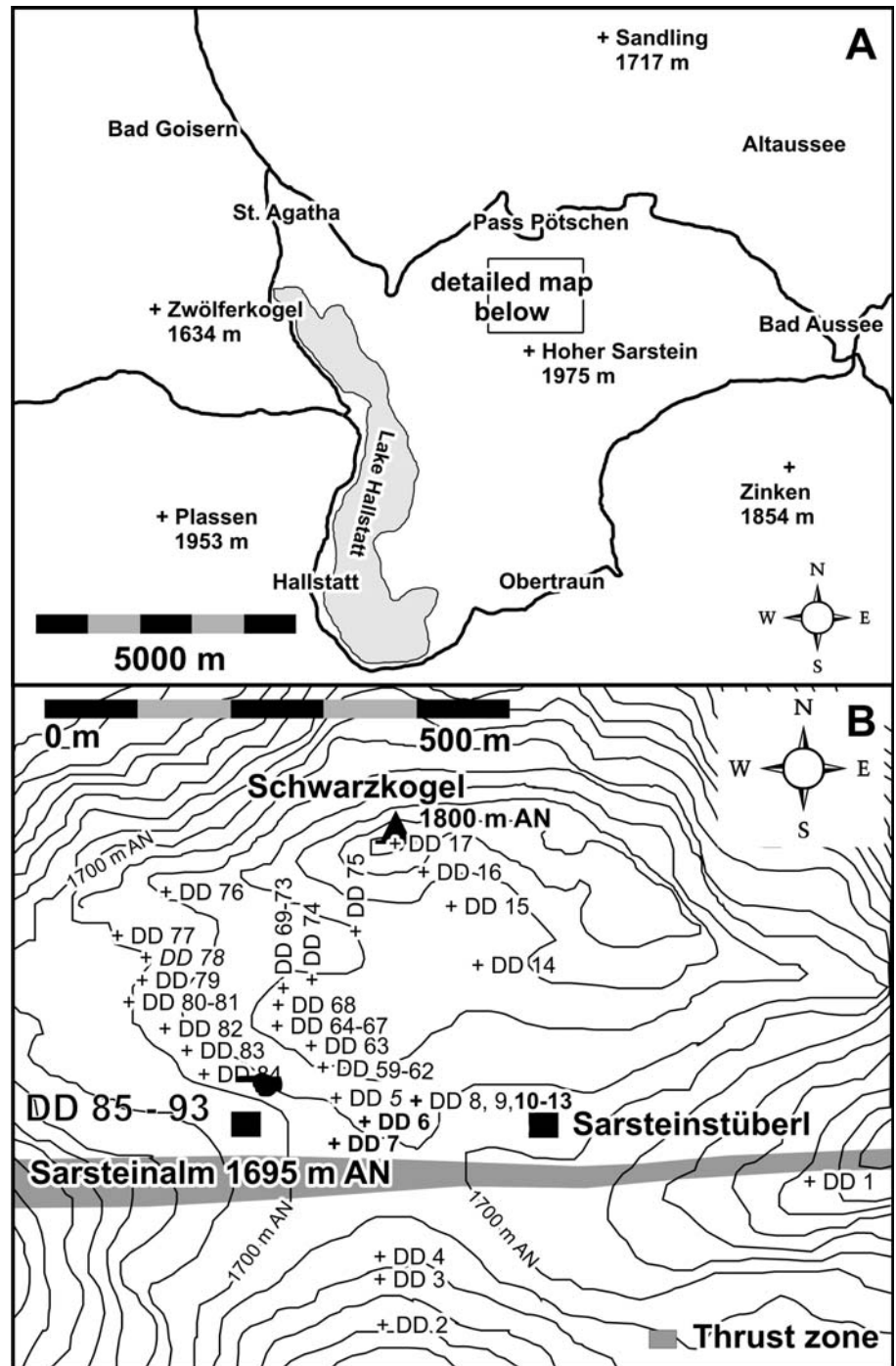


Fig. 2 - A) Topographic sketch map of the Sarsteinalm in the area of the northern Dachstein block region. B) Sampled localities in the area of the Sarsteinalm in the northern part of the Dachstein Block. Scale 1:10.000. Sample location with the holotype is highlighted by bold letters.

microsolenids) and stromatoporoids such as ellipsactinids or representatives of *Cylicopsis* or *Astrostylopsis*. A short introduction into the geology is given by Fenninger & Holzer (1972). The sample figured with *Sarsteinia babai* n. gen., n. sp. comes from the southern part of the Jainzen at about 610 m above sea level.

3. *Mount Trisselwand*. The Trisselwand is situated near Lake Altaussee in the Styrian Salzkammergut and is part of the large karst plateau of the Tote Gebirge.

The Late Jurassic to Early Cretaceous Plassen Formation of the Trisselwand was studied by Schlagintweit & Ebli (1999). On the northern side of the saddle between the Trisselwand to the east and Mt. Tressenstein to the west *Sarsteinia babai* n. gen., n. sp. was detected within (upper) slope facies clasts occurring in slope-of-toe breccias.

4. *Litzlkogel-Gerhardstein-complex*. The Litzlkogel-Gerhardstein-complex is situated in the southwestern Berchtesgaden Alps east of Lofer. Its Middle Jurassic to Early Cretaceous sedimentary succession is rootless since it was thrust over Tithonian to Berriasian marly sediments outcropping at the northern slope of the complex. Callovian to Oxfordian cherty sediments of the Ruhpolding Radiolarite Group dated by radiolarians make up the base of the Litzlkogel-Gerhardstein-complex. The overlying Late Jurassic Lärchberg Formation displays a typical shallowing-upward trend, with different slope lithologies widespread around the whole mountain massif. Whereas the youngest sediments at the top of Mount Gerhardstein are of latest Kimmeridgian or earliest Tithonian age, sedimentation in the Litzlkogel profile continues up to the Jurassic/Cretaceous boundary or even the Early Berriasian.

Sarsteinia babai n. gen., n. sp. was found at both, Litzlkogel and Gerhardstein mostly in micritic slope deposits. Occasionally, fragments of *Sarsteinia babai* n. gen., n. sp. can also occur in typical back-reef facies, bioclastic packstones with remains of corals, *Pinnatiporidium* ssp., the benthic foraminifera *Coscinophragma* aff. *cribrosa* (Reuss) and the Dasycladale *Campbelliella striata* (Carozzi) (Pl. 2, fig. 5-6). At the Litzlkogel-Gerhardstein complex, *Sarsteinia babai* n. gen., n. sp. was found in Kimmeridgian and Tithonian strata. With the occurrence of *Protopenneroplis ultragranulata* (Gorbachik), a late Tithonian age (?early Berriasian) can be assumed for the youngest finding of *Sarsteinia babai* n. gen., n. sp.

Systematic Paleontology

The systematics used follows Rigby & Senowbari-Daryan (1996). For discussion see also Senowbari-Daryan et al. (1997).

Phylum **Porifera** Grant, 1872

Class **Calcarea**? Bowerbank, 1864

Order **Aspiculata** Rigby & Senowbari-Daryan, 1996

?Suborder **Inozoida** Rigby & Senowbari-Daryan, 1996

Family?

Genus *Sarsteinia* gen. n.

Type species: *Sarsteinia babai* n. sp.

Origin of the name: named after the type locality Sarsteinalm north of Mount Sarstein.

Diagnosis: massive-encrusting growth forms with irregular body. Surface covered by irregular ridges and tubercles. The sponge body lacks a central spongocoel; interior with several large and nearly straight to slightly sinuous tubes (?exhalant canals) with short branches. Each tube with own wall, pierced by openings, not showing a definite distribution within the sponge interior. Incurrent canals are not evident. Skeleton composed of irregular vermiform micritic fibres (? former Mg-Calcite) embedded within a slightly yellowish radial-fibrous layer or cement (? former organic mucus). The reticular pore system is completely filled with the latter, whereas in the exhalant canals, it makes up a distinct cement layer; the remaining pore space is either filled up by light sparry calcite or internal sediment. Spicules unknown.

Discussion. Only non-spiculated sponges which do not show any segmentation and lack a single central spongocoel, but instead possess a series of tubes that pass through the sponge body (exhalant canals) are closer comparable to *Sarsteinia* n. gen. This general morphological plan for example, is reported from some representatives of the Inozoa (or inozoid sponges). The Inozoa which were originally introduced by Steinmann (1882) represent a group of sponges whose systematics is still considered ambiguous in literature (e.g. Rigby & Senowbari-Daryan 1996; Senowbari-Daryan et al. 1997; Pickett 2002). The inozoid genera having the tubes located as a bundle in the axial part, however, can be excluded for comparison purposes (see list in Senowbari-Daryan et al. 1997: 312). From the Late Triassic Nayband Formation of Central Iran, Senowbari-Daryan et al. (1997) established the inozoid genus *Marawandia* showing several exhalant tubes in the sponge interior. In *Marawandia*, however, the skeletal fibres are loosely distributed and the outer sponge wall has a labyrinthic canal system. The microstructure in *Marawandia* is unknown. Another inozoid sponge that can be compared with *Sarsteinia* n. gen. is *Grossotubenella* Rigby & Senowbari-Daryan, 1996 (type-species *Grossotubenella parallela*) from the Late Permian of Tunisia. In *Grossotubenella* the tubes may branch out, a feature that has not been observed in *Sarsteinia* n. gen. yet. On the other hand, due to the lack of longitudinal sections, this feature can of course not be excluded. Main differences, however, are the wall structure of *Grossotubenella*, which is not of the radial-fibrous type (see below), and the unlined canals in the latter.

Due to the skeletal microstructure with a central micritic part surrounded by an outer radial fibrous cement layer, comparisons can also be drawn to some stromatoporoid genera such as *Astrostylepsis* Germovšek, *Sporadoporidium* Germovšek or *Cylicopsis* Germovšek and others (e.g. Germovšek 1954; Turnšek 1966). This type of microstructure, with a central dark "line" or "axis" ("zone centrale granuleuse", Steiner 1932) and an outer mostly slightly yellowish calcitic layer with perpendicular arrangement to the former

was named “structure radiale” (Steiner 1932), “radial fibrous structure with a median dark line” (Yabe & Sugiyama 1935) or just “orthogonal fibrous” (Wood 1987). According to Wendt (1979), the dark inner part can be termed as “primary calcareous skeleton” and the fibrous rim as “secondary calcareous skeleton”. The observation that horizontal laminae (tabulae) were found “across the pore spaces, starting from the orthogonal fibrous rim”... “suggests that the fibrous rim is also of organic origin” (Wood 1987: 14). Hence, the skeletal microstructure of *Sarsteinia* n. gen. can be ascribed a stromatoporoid character (e.g. *Actinostromaria* typus). According to Reitner (1992: 265), only the organic skeletal fibres were calcified primarily leading to a micritic structure. Upon these calcified fibres, an orthogonal cement as typical extradermal formation within a organic mucus layer was precipitated (“synvivodiagenetic cement layer”). With respect to *Sarsteinia* n. gen., an originally Mg-calcitic mineralogy can be assumed (pers. comm. Prof. Senowbari-Daryan). But, in conclusion, only the skeletal microstructure can be compared with some non-spiculate stromatoporoid taxa whereas the general appearance is different lacking elements more or less parallel and perpendicular to the surface. In addition, most stromatoporoids have a distinct aquiferous system (“astrorhizae”) composed of small radially arranged canals that converge towards a centre and are distinctly smaller than the tubes of *Sarsteinia* n. gen. Worth mentioning is a “stark-like spongoecol” that has been reported by Senowbari-Daryan et al. (1997) from the inozoid sponge *Enaulofungia? triassica* from the Late Triassic of Central Iran, showing striking similarities to the astrorhizae of the stromatoporoids.

Occurrences. The monotypic type species occurs in the Plassen Formation of Mount Sarstein, Mount Jainzen, Mount Sandling, Mount Trisselwand; Lärchberg Formation of Litzlkogel-Gerhardstein-complex (Fig. 1).

***Sarsteinia babai* n. sp.**

(Pl. 1, figs 1-8; Pl. 2, figs 1-6)

Origin of the name: Named after Prof. Baba Senowbari-Daryan for his numerous contributions on fossil siphonozoan and inozoid sponges.

Holotype: Specimen figured on Plate 1, fig. 1. Details of the holotype are figured on Plate 1, figs. 2-7.

Paratypes: Pl. 1, fig. 8, Pl. 2, Fig. 3-4.

Type horizon: Kimmeridgian.

Type locality: In the surrounding of the Sarsteinalm at an altitude of about 1700 m, topographic map of Austria 1: 50.000, ÖK 96 Bad Ischl. Coordinates: longitude 13° 41', latitude 47° 36'. Sample DD 91 and DD 92 (Fig. 2).

Material: Two thin-sections (samples DD 91 and DD 92) from the Sarsteinalm containing the holotype (DD 91). One thin-section from Mount Sandling (sample D 205), 3 samples from Mt. Jainzen

(samples DD 520, 562, 589), 1 sample from Mt. Trisselwand (D 486) and about 20 thin-sections (20 samples) of the Gerhardstein-Litzlkogel-complex all of which contain mostly fragments of *Sarsteinia babai* n. gen., n. sp. The whole material figured is stored at the “Bayerische Staatssammlung für Paläontologie und historische Geologie, München” under the inventory numbers 2005 I 97 – 2005 I 102.

Diagnosis: See diagnosis of the genus.

Description. Massive-encrusting growth with irregular shapes. The sponge surface is not smooth but covered by irregular ridges and tubercles (e.g. Pl. 2, fig. 4). The skeleton reaches a size of several centimetres; e.g. the size of the holotype figured in Pl. 1, fig. 1, is 3.0 x 3.5 cm. The skeleton lacks a prominent central spongoecol but is penetrated by numerous coarse canals (probably exhalant canals). Canals mostly 1.2 mm to 1.6 mm apart (from centre to centre) throughout sponge. Diameter of the canals with a roundish shape (Pl. 1, fig. 3-4), varies between 0.55 and 1.05 mm. The canals may occupy up to one-third of the sponge interior volume. The canals exhibit short branches (Pl. 2, fig. 4). Skeletal fibres are irregularly vermiform (or vermiculated), meaning that a distinction into vertical and horizontal elements is not possible. In cross-sections, the pores display a round to slightly polygonal shape (Pl. 1, fig. 3). The microstructure shows micritic fibres (thickness: 0.03 – 0.06 mm) with an outer slightly yellowish calcitic layer arranged perpendicularly to the former (“radial fibrous structure”). The space between the micritic fibres is completely filled by the fibrous calcite. Towards the canals, the fibrous calcite may be thicker ending with a thin micritic layer (Pl. 1, fig. 3-4). The interior of the canals may be completely filled either with light coarse calcite or fine-grained, muddy sediment from outside that invaded the sponge body (Pl. 1, figs. 3-4, 8).

Discussion. See discussion for the genus.

Stratigraphy. *Sarsteinia babai* n. gen., n. sp. has been found in Kimmeridgian to Tithonian strata. It seems unlikely that this interval represents the total range of the taxon, because in Oxfordian times there was widespread deposition of cherty basin sediments and during the Berriasian the Plassen carbonate platform drowned again resulting in pelagic facies in the late Berriasian (Schlagintweit et al. 2004).

Paleoenvironment. *Sarsteinia babai* n. gen., n. sp. has been detected in various microfacies types reflecting a comparable wide bathymetric range. At the Litzlkogel-Gerhardstein-complex, a few fragments were found in back-reef packstones together with dasycladacean green algae such as *Campbelliella striata* (Carozzi) (Pl. 2, fig. 5). Also the overgrowth with *Lithocodium aggregatum* Elliott (Pl. 1, fig. 6) indicates a shallow-water environment within the photic zone as the upper border of the bathymetric range of *Sarsteinia babai* n. gen., n. sp. (see discussion in Schmid & Leinfelder 1996). In the reefal facies remains of *Sarsteinia* are rare, too, becom-

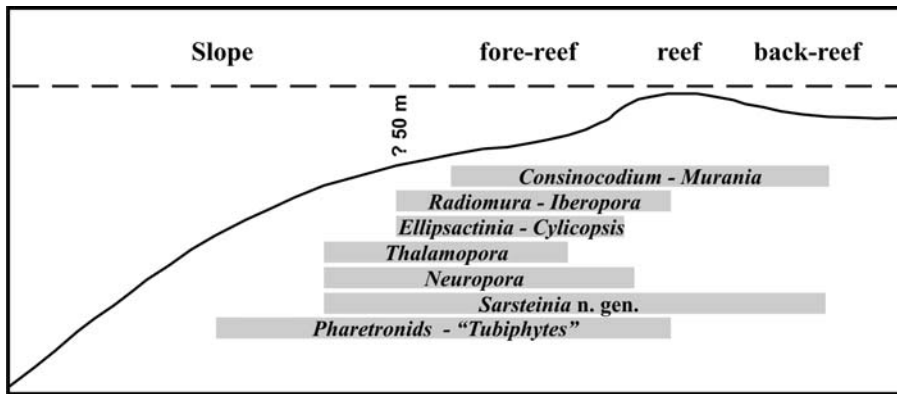


Fig. 3 - Assumed paleobathymetric and facies distribution of *Sarsteinia babai* n. gen., n. sp. and other taxa from the reefal, fore-reefal and upper slope facies realms.

ing more abundant in the fore-reef and upper slope depositional realm as the dominating paleohabitat. Fragments could be found resedimented in a more down-slope position.

In Figure 3, a schematic bathymetric interpretation of different groups of sponges (*Thalamopora* cf. *lusitanica*, *Neuropora lusitanica*, *Murania reitneri*, *Consinocodium japonicum*) and some associated microproblematica (*Iberopora bodeuri*, "*Tubiphytes*" *morronensis*, *Radiomura cautica*) is presented. It is based on the analysis of more than 1.000 thin-sections from numerous localities of Upper Jurassic shallow-water limestones of the Northern Calcareous Alps. The preferred depth range of *Ellipsactinia*, approximately below the fair-weather wave base, has been adopted from Morsilli & Bosellini (1997). Other data involved are from Werner et al. (1994) and Schmid (1996). In conclusion, Fig. 3 clearly shows that, in contrast to some other taxa of this facies association, *Sarsteinia* n. gen. is not of much depth-diagnostic value.

Conclusions

Stromatoporoid dominated platform margin reefs are particularly widespread in the southern Tethyan domain (e.g. Turnšek et al. 1981; Leinfelder et al. 2005). In the Northern Calcareous Alps, these stromatoporoid-coral limestones, especially from the fore-reef area contain diverse micro-encrusters (Schlagintweit & Gawlick 2003) and coralline sponges. Also the discovery of the problematic inozoid sponge *Sarsteinia babai* n. gen., n. sp. gives evidence that this characteristic facies is surely dominated by stromatoporoids and corals but also associated with other, mainly calcareous, sponges. The bathymetric range of *Sarsteinia babai* n. gen., n. sp., however, exceeds those of the encountered stromatoporoids. The whole inventory of these other metazoans is not fully known up to now. It can be expected that these accessory taxa could be useful in the future for further definition, characterization and zonation of Late Jurassic reef types (see Leinfelder et al. 2002).

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PLATE 1

Holotype specimen, Sarstein sample, sample DD 91 (Fig. 1-7)

- Fig. 1 - Reticulate skeletal structure and numerous cross- and oblique sections of the exhalant canals.
- Fig. 2 - One cylindrical, slightly undulating exhalant canal filled with sparry calcite
- Fig. 3 - Detailed view; transverse section of one exhalant canal with thin inner wall. Note the polygonal shape of the skeletal pores.
- Fig. 4 - Detailed view showing several excurrent canals in transverse and oblique sectioning filled either with light-sparry inorganic calcite or invaded matrix sediment from the sponge exterior.
- Fig. 5, 7 - Detailed view of the reticulate pore system. Note the complete infilling of the interspaces with slightly yellowish calcite (? calcified original organic mucus).
- Fig. 6 - Incrustation of *Lithocodium aggregatum* Elliott. Sarstein, sample DD 91.
- Fig. 8 - Longitudinal section of a fragment with one canal. Litzelkogel, sample A 124.

PLATE 2

- Fig. 1 - Erosional contact between resedimented grain- to packstone (above) and a micritic slope sediment (below) with remains of *Sarsteinia babai* n. gen., n. sp. (S), pharetronid sponges (P) and a dome-shaped microbial crust (M). Sandling, sample D 205.
- Fig. 2 - *Sarsteinia babai* n. gen., n. sp. within slope-of-toe breccia. Trisselwand, sample D 486.
- Fig. 3 - Specimen of *Sarsteinia babai* n. gen., n. sp. with fixation of a brachiopod (B). Gerhardstein, sample A-133.
- Fig. 4 - Oblique longitudinal section showing a canal with short branches. Jainzen, sample DD 562.
- Fig. 5, 6 - Debris of *Sarsteinia babai* n. gen., n. sp. within a bioclastic packstone (platform margin to back-reef facies). Note the transverse section of the dasycladale *Campbelliella striata* (Carozzi) on the left side in figure 5. Litzelkogel, sample A-196.

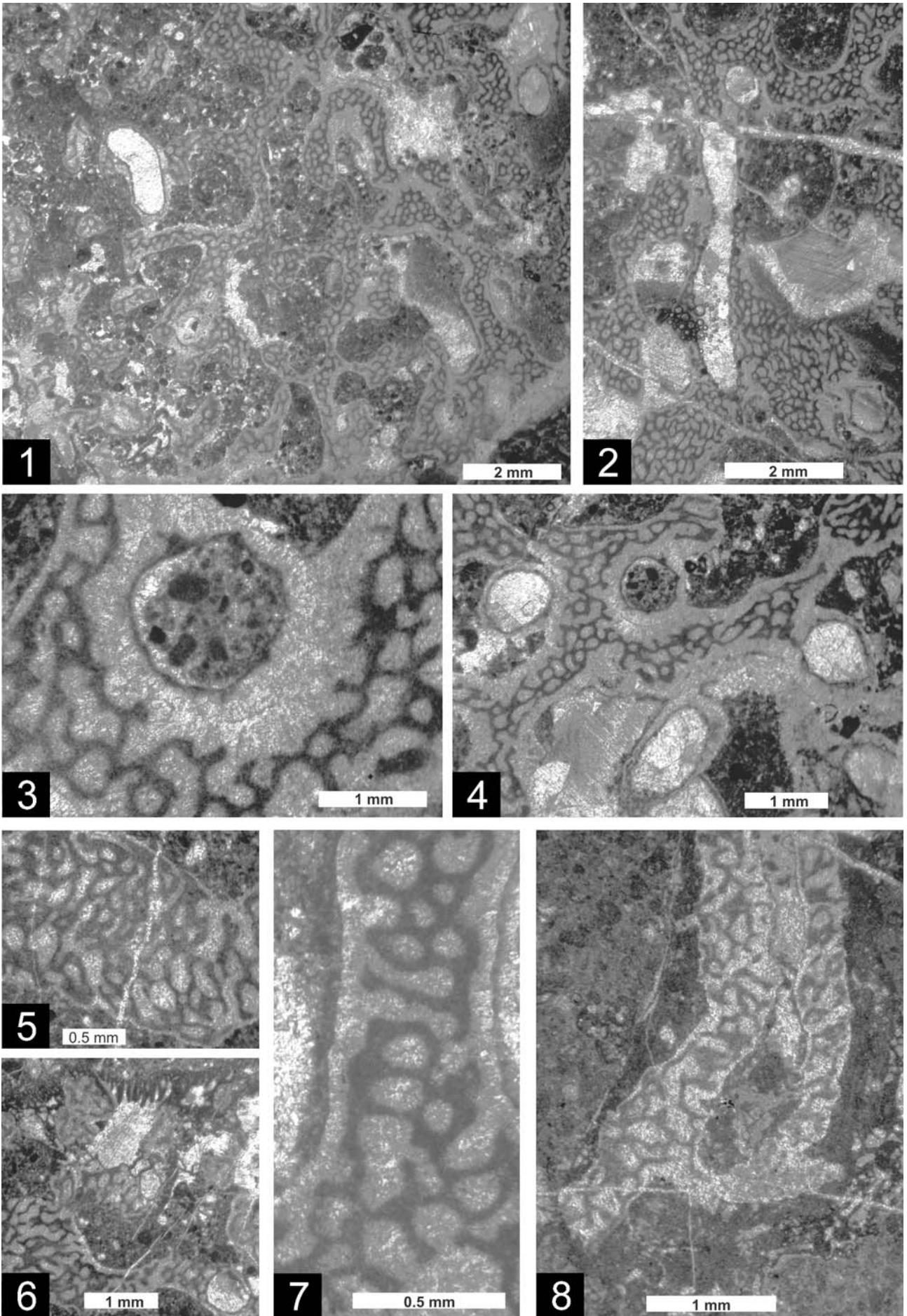
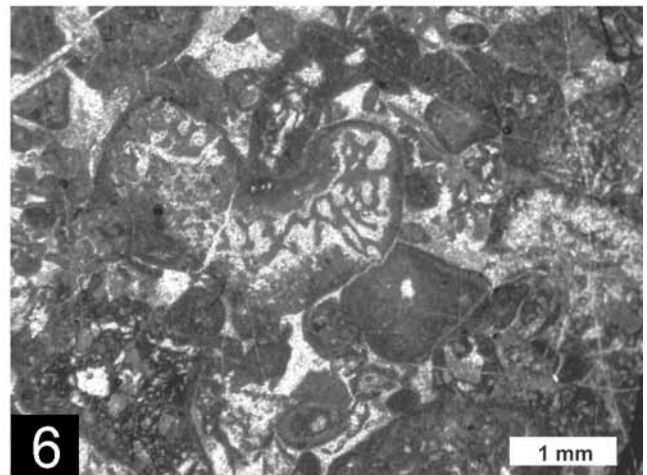
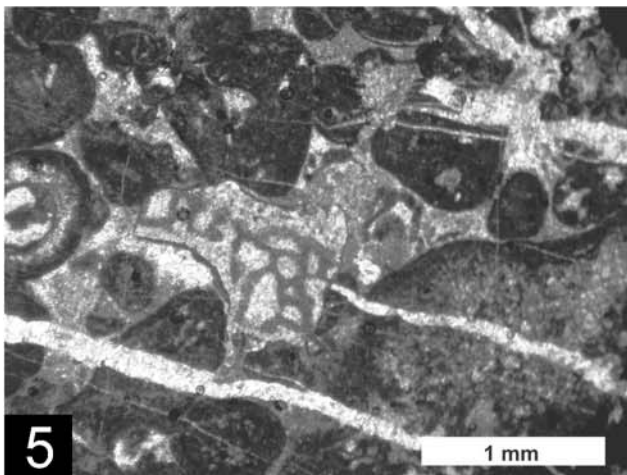
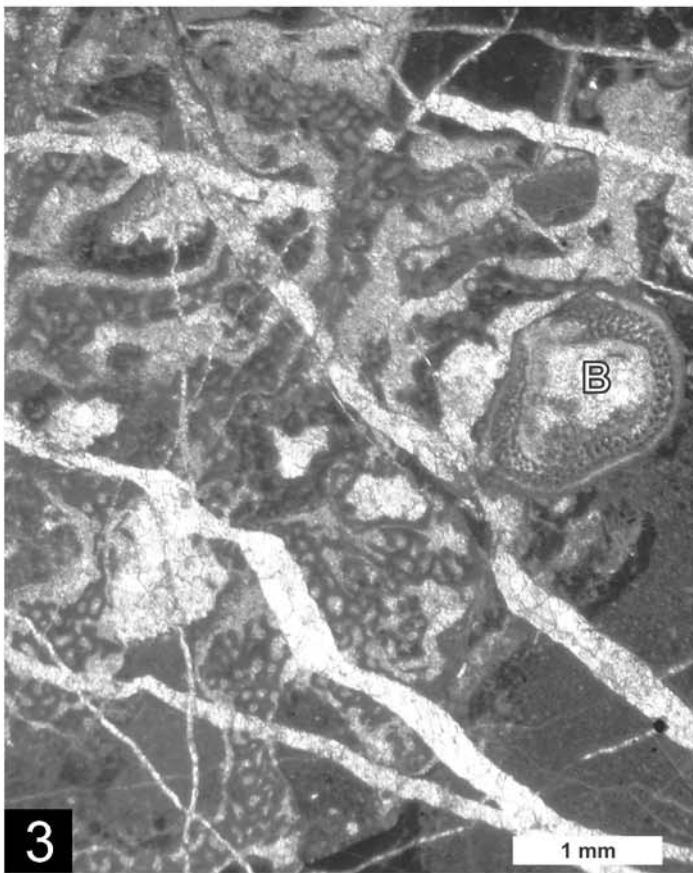
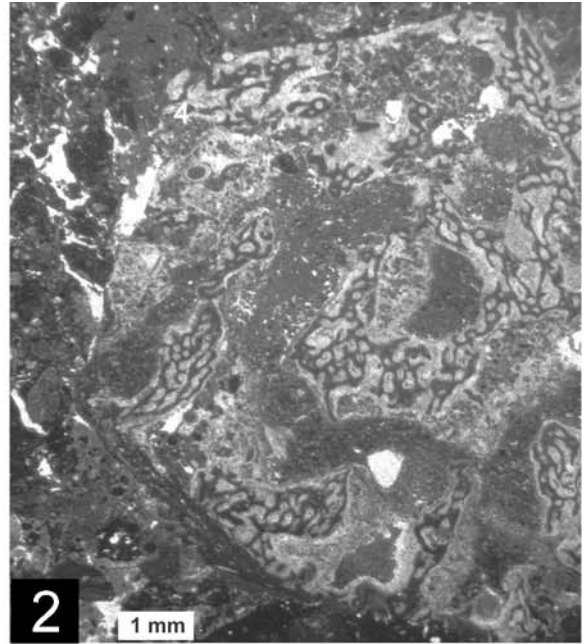
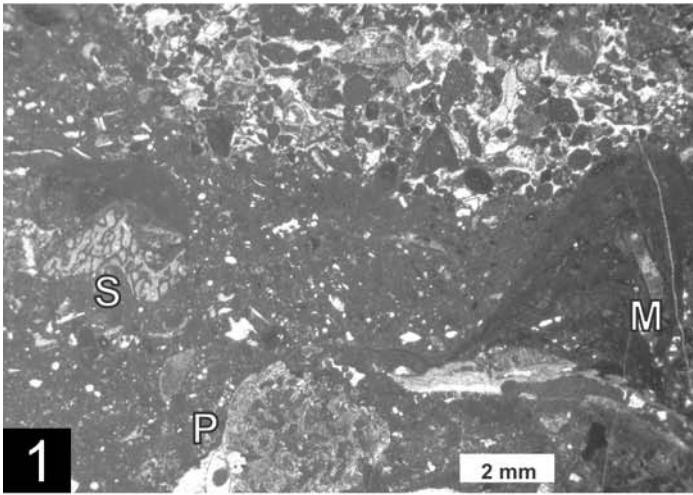


PLATE 1



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