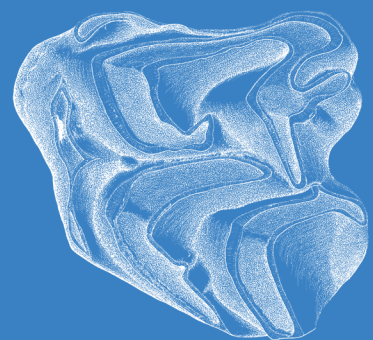
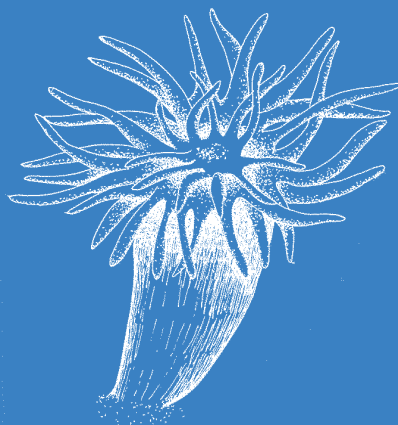


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Cover illustrations: (from left to right) Shell of the gastropod *Loxonema regium* DE KONINCK from the Carboniferous of Belgium (redrawn from DE KONINCK 1881); Solitary coral *Caninia* sp. from the Carboniferous of England (redrawn from RAMSBOTTOM in MCKERROW 1978); Tooth of the rare ruminant *Orygotherium escheri* VON MEYER from the Miocene of Germany (after RÖSSNER & MÖRS 2001). **Back cover:** Atrium of the Munich Palaeontological Museum, view from the main entrance.

Umschlagbilder: (von links nach rechts) Gehäuse der Schnecke *Loxonema regium* DE KONINCK aus dem Karbon von Belgien (neu gezeichnet nach DE KONINCK 1881); Solitärkoralle *Caninia* sp. aus dem Karbon von England (neu gezeichnet nach RAMSBOTTOM in MCKERROW 1978); Zahn des seltenen Wiederkäuers *Orygotherium escheri* VON MEYER aus dem Miozän von Deutschland (nach RÖSSNER & MÖRS 2001). **Rückseite:** Lichthof des Paläontologischen Museums München, Blick vom Haupteingang.

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Amblysiphonella agahensis nov. sp., and *Musandamia omanica* nov. gen., nov. sp. (Porifera) from the Upper Triassic of Oman

By
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Abstract

Two chambered sponges – *A. agahensis* nov. sp. and *Musandamia omanica* nov. gen., nov. sp. – from the Norian reefal limestones of Jebel Agah, southeast of the Musandam Mountains, Oman, are described. Both species are the first reported from the Triassic of the Arabian Peninsula. The fossil association is also mentioned.

Key words: Porifera, “Sphinctozoa”, *Amblysiphonella*, *Musandamia*, Norian, Jebel Agah, Oman.

Kurzfassung

Zwei gekammerte Schwämme – *A. agahensis* nov. sp. und *Musandamia omanica* nov. gen., nov. sp. – werden aus dem norischen Riffkalken des Jebel Agah, südöstlich des Musandam Gebirges (Oman), beschrieben. Beide Arten stellen die ersten Nachweise für die Trias der Arabischen Halbinsel dar. Die Vergesellschaftung der Fossilien wird ebenfalls erwähnt.

Schlüsselwörter: Porifera, “Sphinctozoa”, *Amblysiphonella*, *Musandamia*, Nor, Jebel Agah, Oman.

1. Introduction and geographic position of the locality

Hypercalcified sponges, particularly the “sphinctozoans”, are the most abundant reef builders in Upper Triassic reefs and reefal deposits of Oman. Carnian sponges and other reef organisms from various localities in Oman were described by SENOWBARI-DARYAN et al. (1999) and SENOWBARI-DARYAN & BERNECKER (1997, 2009). Results from microfacies investigations of Norian-Rhaetian reefs of Oman and descriptions of the reef organisms were published by BERNECKER (1996, 2005).

SENOWBARI-DARYAN & YANCEY (2007) and SENOWBARI-DARYAN & MAURER (2008) described the Norian sponges of Musandam Mountains, NW of the Jebel Agah, where *A. agahensis* nov. sp. and *Musandamia omanica* nov. gen. nov. sp., were found.

Jebel Agah is located between the carbonate succession of the Musandam shelf to the northwest and the Semail Ophiolite to the southeast (Textfig. 1). Geology and tectonic development of this area is summarized by ROBERTSON et al. (1990) and recently by MAURER et al. (2008). Microcoprolites of this locality were described by SENOWBARI-DARYAN & BERNECKER (2005).

The studied material, including two rock pieces and one thin section, is stored in the Bayerische Staatssammlung für Paläontologie und Geologie, Munich, under accession numbers BSPG 2009 I 77 and 2009 I 78a & b.

2. Systematic palaeontology

Class Demospongea SOLLAS, 1875
Subclass Ceractinomorpha LEVI, 1953
Order Agelasida VERRILL, 1907
Suborder Porata SEILACHER, 1962
Family Sebargasiidae DE LAUBENFELS, 1955
Subfamily Sebargasiinae SENOWBARI-DARYAN, 1990

Genus *Amblysiphonella* STEINMANN, 1882

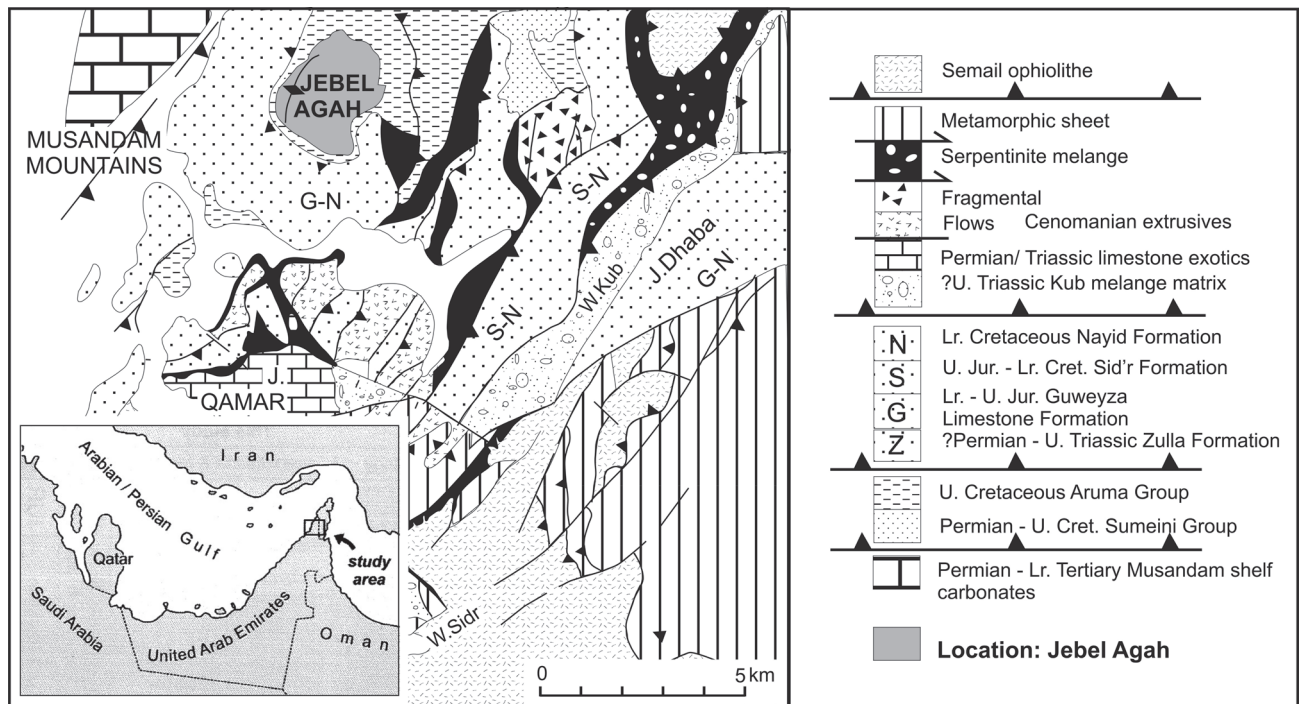
Type species: *Amblysiphonella barroisi* STEINMANN, 1882.

Additional species included: See SENOWBARI-DARYAN (1990) and SENOWBARI-DARYAN & GARCIA-BELLIDO (2002).

Amblysiphonella agahensis nov. sp.
Pl. 1, Fig. 1

Derivatio nominis: Occurrence of the species in Jebel Agah.

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Textfigure 1: Geological map of the area with the location of Jebel Agah.

Holotype: Pl. 1, Fig. 1.

Locus typicus: Reefal limestones of Jebel Agah, south of Musandam Mountains (see Fig. 1).

Age: Norian.

Diagnosis: Multi-branched species of the genus *Amblysiphonella* with hemispherical to spherical chambers. Chamber walls pierced with single or branched pores. Wall of spongocoel contains large pores, which continue as small tubes into chamber interiors. Individual chambers clearly visible from outside of sponge. Chamber interiors whole.

Material: One multi-branched specimen (BSPG 2009 I 77).

Description: This dichotomously multi-branched sponge is composed of numerous hemispherical to spherical chambers. After increasing the chamber diameter from the initial stage, at least three individual branches originate from a large chamber. This large chamber reaches a diameter of approximately 50 mm and a height of 13 mm. The diameter of the individual branches is ~30 mm, which corresponds to the diameter of the chambers. The chamber height varies between 8 and 12 mm.

The chamber walls are about 1.4 mm thick, and are pierced by single or dichotomously branched pores of more or less equal distribution. They reach diameters of up to 0.6 mm. A spongocoel of 6-8 mm and assignable to the retrosiphonate type passes through the individual branches. The wall of the spongocoel has the same thickness as the chamber walls. The spongocoel wall is pierced by different large and rimmed pores up to 2 mm in diameter. Several large pores continue into the chamber interiors as small tubes. Chamber interiors are devoid of additional filling skeleton or vesiculae.

Comparison: *Amblysiphonella agahensis* nov. sp. represents the first Triassic species of the genus from the Arabian Peninsula. *A. agahensis* differs from all other Triassic species of that genus listed in SENOWBARI-DARYAN & DI STEFANO (1988) and SENOWBARI-DARYAN (1990) by the branching mode of growth and the size of the chambers.

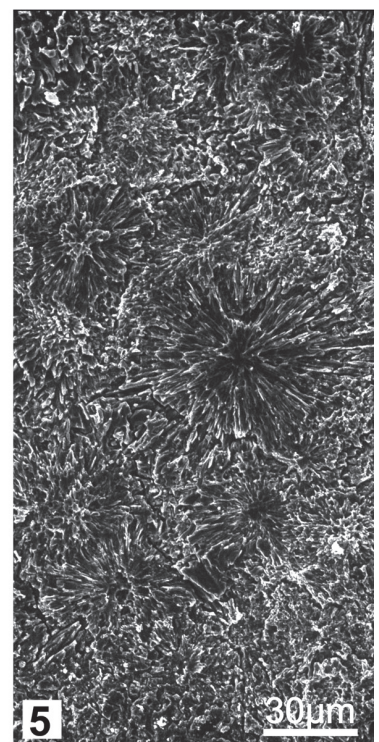
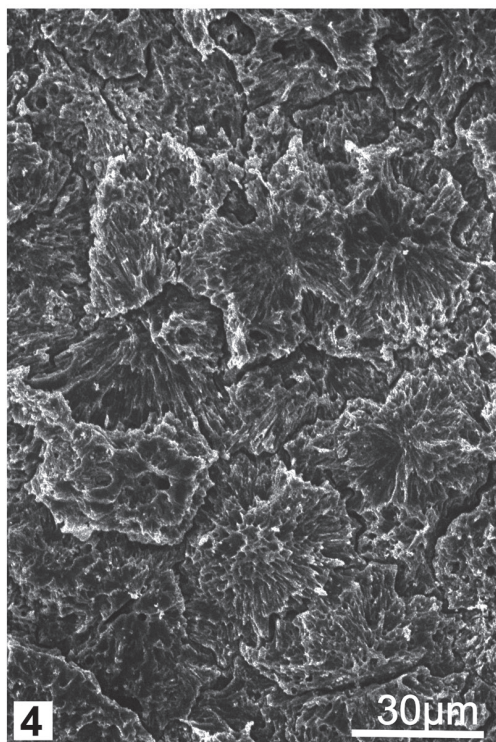
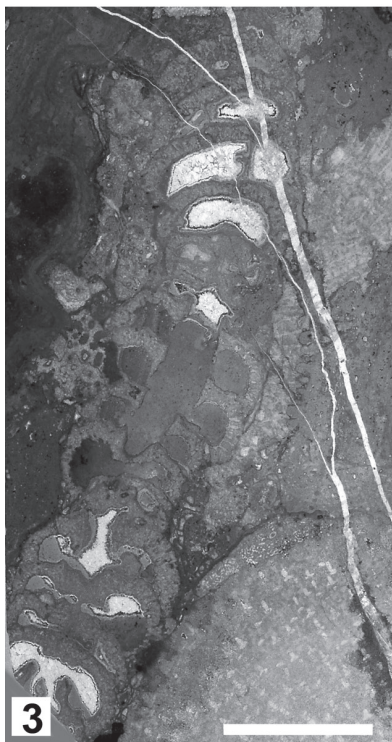
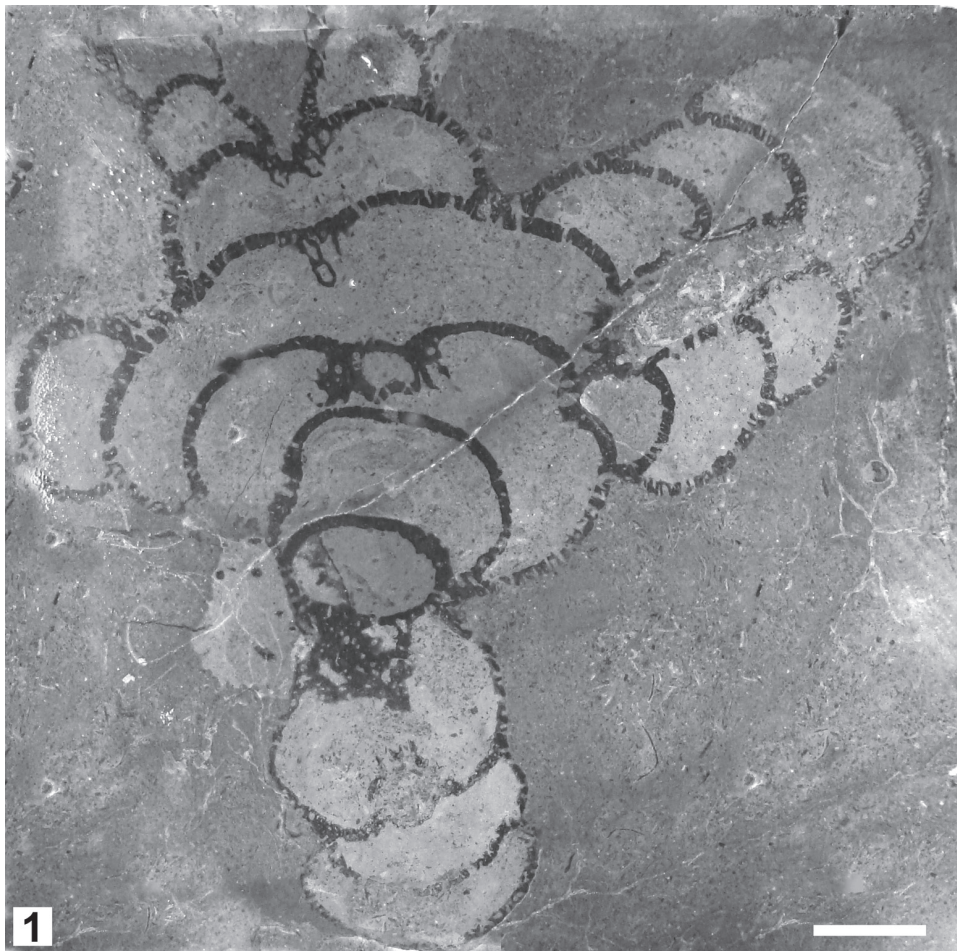
Genus *Musandamia* nov. gen.

Derivatio nominis: Named after the occurrence of the sponge in Musandam Mountains.

Diagnosis: *Amblysiphonella*-like perforate thalamid sponge with spongocoel of ambisiphonate type. Primary

Plate 1: *Amblysiphonella agahensis* nov. sp. and *Musandamia omanica* nov. gen., nov. sp. from the Norian of Jebel Agah, Oman. Scale bars in Figs 1-3 = 10 mm.

(1) *Amblysiphonella agahensis* nov. sp., holotype; section through several branches showing the hemispherical to spherical chambers. Several large pores of the spongocoel continue into the chamber interiors as small tubes (BSPG 2009 I 77). (2) *Musandamia omanica* nov. gen., nov. sp., holotype, longitudinal section showing the sponge with moderately flattened chambers with relatively thick chamber walls. The wall of the spongocoel is thin and pierced by a single large pore. The sponge serves as a substrate for an inozoan sponge. Polished rock surface (BSPG 2009 I 78a). (3) Same as Pl. 1, Fig. 2., holotype specimen (thin section photograph in transmitted light) (BSPG 2009 I 78b). (4) *Musandamia omanica* nov. gen., nov. sp. SEM-microphotograph showing the spherulites of the rigid skeleton. (5) Similar to Pl. 1, Fig. 4.



aragonitic mineralogy of rigid skeleton with spherulitic microstructure. Spiculae lacking.

Discussion: The general appearance of the genus *Musandamia* with ring-chambers and perforated chamber walls is similar to the genus *Amblysiphonella*. Both genera also have a spherulitic microstructure. The spongocoel of *Amblysiphonella* is of retrosiphonate type, but in *Musandamia* it is clearly ambisiphonate. Sphinctozoans with ambisiphonate spongocoel types are known from the Jurassic-Cretaceous calcisponges *Barroisia* STEINMANN or *Spharocoelia* STEINMANN, as well as from the Cambrian heteractinid sponge genus *Nucha* PICKET & JELL (PICKET & JELL 1983; PICKET 2002; see SENOWBARI-DARYAN 1991; SENOWBARI-DARYAN & GARCIA BELLIDO 2002). Perforated thalamid sponges characterized by ambisiphonate spongocoels are not known among the possibly demospongid thalamid sponges from the younger Paleozoic and Triassic time interval. The only sponge with a possibly ambisiphonate type of spongocoel is the Triassic genus *Enoplocoelia*, but this genus is defined as aporate, in contrast to the porate *Musandamia*.

Musandamia omanica nov. sp.
Pl. 1, Figs 2–5

Derivatio nominis: Occurrence of the sponge in Oman.

Holotype: Pl. 1, Figs 2 & 3, showing the same specimen.

Locus typicus: See Textfigure 1.

Age: Norian.

Diagnosis: Chambered sponges with spongocoel of ambisiphonate type and perforated chamber walls. Chambers flattened with thick chamber exo- and interwalls. Ring-chambers connected with spongocoel by a large opening.

Material: One specimen; BSPG 2009 I 77 and 2009 I 78a & b.

Description: The sole specimen of this sponge is cut in a longitudinal section. The sections reveal that the organism is composed of numerous ring-like and moderately flattened chambers of rectangular appearance. The internally chambered construction, reflecting the outer segmentation, is clearly recognizable also from the outside. The diameter of the sponge, corresponding to the diameter of the chambers, is approximately 12 mm. The height of the individual chambers is usually ~1 mm, but may reach a maximum of 1.3 mm. Chamber walls are perforated by the evenly distributed pores, each of which is approximately 0.2 mm in diameter. A spongocoel of the ambisiphonate type (*sensu* SEILACHER 1962) with a diameter of 4 mm passes through the whole sponge. The communication of the chamber interior with the spongocoel is established by a large opening 0.6–1.0 mm in diameter. The chamber interior is devoid of a secondary skeleton and vesiculae. After obtaining a thin section, which is illustrated in Pl. 1, Fig. 3, the remains of the sponge were analysed under SEM. The investigation shows the spherulitic microstructure of the rigid skeleton. Spheru-

lites are of different sizes, reaching diameters of up to 100 µm (Pl. 1, Figs 4–5). Spherulites indicate the primary aragonitic mineralogy of the skeleton. Spicules have not been observed.

Fossil association: The following organisms associated with the sponge were identified in one thin section: *Heterastriidium* sp., *Microtubus communis* FLÜGEL, and chaetetid sponges gen. and sp. indet. The organisms are encrusted with microbial crusts (“Spongiostromata” *sensu* PIA in HIRMER 1927). The index fossil *Microtubus communis* and the foraminifer *Hirsutospirella pilosa*, illustrated by SENOWBARI-DARYAN & BERNECKER (2005), are suggestive of a Norian-Rhaetian (most probably Norian) age of the investigated material and described sponges.

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