LERCARITUBUS PROBLEMATICUS FLÜGEL, SENOWBARI-DARYAN & DI STEFANO AND VANGIA TELLERI (FLÜGEL): TWO PROBLEMATIC ORGANISMS FROM THE PERMIAN JAMAL FORMATION OF SHOTORI MOUNTAINS, NORTHEAST IRAN

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Abstract. Lercaritubus problematicus Flügel, Senowbari-Daryan & Di Stefano and Vangia telleri (Flügel) and enigmatic calcareous fossils, known from the Sicily, Guadalpe Mountains, USA and Oman are described from the Permian Jamal Formation of Shotori Mountains, northeast Iran. The new genus name Vangia is introduced for Uvannella? telleri Flügel. The systematic position of Vangia telleri (Flügel) nov. comb. as possibly cyanobacterium and its relationships with Bacnea irregularis Radioic, an abundant enigmatic fossil in Jurassic–Cretaceous shallow water deposits, is discussed.

Riassunto. Vengono descritti Lercaritubus problematicus Flügel, Senowbari-Daryan & Di Stefano e Vangia telleri (Flügel), fossili calcarei di natura enigmatica conosciuti in Sicilia, Guadalpe Mountains, USA e in Oman e ora rinvenuti nella Formazione Jamal del Permiano delle montagne Shotori, nel nord est dell’Iran. Viene introdotto il nuovo nome generico Vangia per inquadrare la specie Uvannella? telleri Flügel. Sono anche discussi la posizione sistematica di Vangia telleri (Flügel) nov. comb. quale possibile cianobatterio ed i suoi rapporti con Bacnea irregularis Radioic, un fossile enigmatico abbondante nelle rocce giurassico-cretacee di acque basse.

Introduction

Lercaritubus problematicus Flügel, Senowbari-Daryan & Di Stefano, a tube-like organism was originally described as “Microproblematicum A” by Flügel (in Flügel et al. 1984) from the Middle Permian of Slovenia, and later as Lercaritubus problematicus by Flügel et al. (1990), from the Lower Permian reef boulders embedded within the siliciclastic deposits of the Lercara Formation in Sicily. It was reported also from the Middle Permian reefs in Guadalpe Mountains of Texas and New Mexico by Senowbari-Daryan & Rigby (1996) and from the Permian reef limestones of Oman by Weidlich (1992). Lercaritubus occurs within the reef or reeal carbonates of Jamal Formation (Lower and Middle Permian) in the Shotori Mountains, of northeast Iran. It seems to be an index fossil limited to Permian time. The occurrence of Lercaritubus in Sicily, Oman, Iran, and in USA indicates to possibly its cosmopolitan importance.

Vangia telleri nov. comb., originally described as possibly chambered sponge Uvannella? telleri by Flügel (in Flügel et al. 1984) from the Permian of Slovenia, is another problematic and aggregate-building organism (cyanobacteria?). It is composed of numerous irregularly arranged cavities, separated by thin and compact walls. The wall appears dark micritic in transmitted light. Vangia telleri occurs as isolated aggregates in sediment or rarely incrusts other organisms.

Geographic position of studied localities

Permian deposits of central Iran, called the Jamal Formation (Stöcklin et al. 1965), crop out in several localities in the Shotori Mountains, northeast Iran. Lercaritubus problematicus was found in two sections of Permian Jamal Formation, located about 65 km and 45 km north of the town of Tabas (Fig. 1). These localities

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are described briefly below.

1. Deh-e Mohammad locality (Fig. 1, locality 1): this locality lies about 65 km north of the town of Tabas, about 5 km northeast of the small village of Deh-e Mohammad, about 1 km from the road Tabas-Boshruhe, in an area called Agheldun (Fig. 1, 57° 01' 46" E and 33° 59' 46.6" N). Here the Permian deposits are 290 m thick and overlie the Carboniferous Sardar Formation, which is about 26 m thick at this locality.

The lower and middle 247 m of the Permian deposits were sampled. The Upper 43 m of the Formation is dolomitic and was not sampled.

2. Bagh-e Vang locality (Fig. 1, locality 2): This section of the Kuh-e Bagh-e Vang is located 45 km north of the town of Tabas, near the town of Shirgesht (geological map 1:100,000 of Shirgest completed by Ruttner et al. 1968). A section of the Permian Jamal Formation crops out on the western and southern flank of the Kuh-e Bagh-e Vang (33° 58’ 60” N, 56° 47’ 66” E, Fig. 1). Also in this section the Permian sediments overlie the Carboniferous Sardar Formation, which includes siltstones, shales and sandstones. The Permian deposits are overlain by the Lower Triassic Sorkh-e Shale Formation.

The Permian section of the Jamal Formation in the Bagh-e Vang locality reaches a thickness of 293 m (Ruttner et al. 1968) to 300 m (Leven & Vaziri Mohaddam 2004), but one of the authors (KR) measured it on the south flank of this mount as about 320 m thick. Generally the Jamal Formation in this locality is composed of sandy limestone with some olistoliths, dark shales, and medium- to thin-bedded marly limestones. Partoazar (1995) introduced the name Bagh-e Vang member for the 60 m of the lower part (being Asselian–Sakmarian in age) of the Jamal Formation of this section. The middle part of the section is characterized by medium-bedded limestone intercalated with chert layers. The summit of the section is covered by massive carbonates (Fig. 2), which is overlain by the Lower Triassic Sorkh-e Shale Formation. Based on Fusulinids, Leven & Vaziri Mohaddam (2004) recognized 10 units within the Jamal Formation in Kuh-e Bagh-e Vang. The sponges of this locality were studied by Senowbari-Daryan et al. (2005, 2006) and the bryozoans by Ernst et al. (2006, 2009).

Thin sections, containing the described specimens of Lercaritubus problematicus and Vangia telleri (Flügel) nov. comb. are deposited in “Geozentrum Nordbayern, Department of Paleontology, University Erlangen-Nürnberg” (“material: Senowbari-Daryan: Permian Iran, Bagh-e Vang”).

**Systematic Paleontology**

**Family uncertain**

**Genus** Lercaritubus Flügel, Senowbari-Daryan & Di Stefano, 1990

**Type species:** Lercaritubus problematicus Flügel, Senowbari-Daryan & Di Stefano, 1990

**Original diagnosis:** “Sessile, tube-like, multi-branched organism with a calcareous skeleton, composed of thick wall segments put into one another. The aperture of the tubes widens distally and is
characterized by a distinct collar. The outer surface of skeleton shows small polygonal depressions. The interior of the tubes is subdivided by perforated “tabulae” and shows an additional calcareous tissue. Some specimens show small pores within the outer wall of the tubes” (Flügel, Senowbari-Daryan & Di Stefano 1990: 361).

Lercaritubus problematicus Flügel, Senowbari-Daryan & Di Stefano, 1990

Pl. 1, figs 1-6


1992 Lercaritubus problematicus Flügel et al.- Weidlich, p. 44-45, pl. 16, fig. 3.


Material: Numerous specimens in thin sections from the Bagh-e Vang section and from the section near the town of Deh-e Mohammed. For the number of illustrated thin sections see explanation of plates.

Description. Sessile, tube-like, single or branched organism composed of several segments inserted into one another. Each individual segment shows a distinct collar around the aperture of that segment. This feature was observed only in some Iranian specimens.

Tube walls of Iranian specimens, like specimens from Sicily and Guadalupe Mountains, are strongly re-crystallized. Individual crystals appear light to yellow-brown in transmitted light and are relatively large. Flügel (in Flügel et al. 1984) gives the size of the crystals as up to 750 µm. Strong re-crystallisation of the tube walls suggests the primary aragonite skeletal mineralogy.

In cross sections, the tube interior is circular, but the outer surface is distinctly wavy (Pl. 1, figs 3-6) to spiny (Pl. 1, figs 1-2). Internal surfaces of the tubes are smooth, but outer surfaces are honeycomb, appearing wavy or with spine-like elements in sections. These elements are the edges of polygonal depressions of the tube surface. A construction of the tube is given by Flügel et. al. (1990).

Tube interiors of the Iranian specimens are usually without any internal infilling structure, but some specimens, like most specimens of the type material from the Lower Permian of Sicily and specimens from the Middle Permian of Upper Capitan Limestone of the Guadalupe Mountains in New Mexico, USA, contain “tabulae”-like or concentric structures. In some specimens in the type material from Sicily (Flügel et al. 1990: pl. 1, fig. 7) the “tabulae” are perforated, but perforation was not observed in the Iranian material.

Tubes reach lengths of up to 30 mm, with an outer diameter of up to 10 mm, an inner diameter up to 6
mm, and thicknesses of the walls up to 1 mm. Weidlich (1992) gives the wall thickness of up to 1.7 mm in material from Oman.

Associated organisms. Lercaritubus problematicus occurs in reef or reeval biotopes, like other reef builder (e.g. sponges). It is associated with hypercalcified sponges (Senowbari-Daryan et al. 2005, 2006), rarely corals, abundant bryozoans (Ernst et al. 2009), rare green algae such as Anchicodium sp., Epimastoporella sp., and Imperiella sp. Associated problematic organisms include: Tubiphytes obscureus Maslov and Tubiphytes carinthiacus Flügel. Fusulinids of the locality were described by Leven & Vaziri Mohaddam (2004). Almost all specimens of Lercaritubus were imbedded in Archaeolithoporella, or different types of other microbial crusts.

Discussion. The systematic position of Lercaritubus is uncertain. Flügel et al. (1990) compared Lercaritubus with bryozoans, annelids, crinibricateans, and the Jurassic problematic alga “Bankia” (Campbelliella), but because of different morphological features the affiliation of Lercaritubus to these groups of organisms seems to be questionable. The systematic position of Lercaritubus is still uncertain.

Occurrence and stratigraphical range. Lercaritubus problematicus is known from the Lower and Middle Permian reef boulders of Sicily (Flügel et al. 1990, 1991), Middle Permian of Guadalupe Mountains (Senowbari-Daryan & Rigby 1996), Upper Permian of Oman (Weidlich 1992, 2001), and now from the Jamal Formation (Lower and Middle Permian) in the Shotori Mountains, of northeast Iran. It is restricted to the tropical reef or reeval deposits and seems to be an index fossil of Permian age.

Vangia nov. gen.

Type species: Uvanella? telleri Flügel (in Flügel et al. 1984)

Derivatio nominis: Named from the type locality Kuh-e Bagh-e Vang (Bagh-e Vang Mount) in the Shotori Mountains, northeast Iran.

Diagnosis: Nodules of aggregates, which are composed of irregularly chambers. Chamber walls are thin and imperforate, appearing dark micritic in submitted light. Some chambers contain vesicular-like structures.

Comparison: See discussion after description of the species.

Vangia telleri (Flügel in Flügel et al. 1984), nov. comb.

Pl. 1, figs 7-9; Pl. 2, figs 1-8; Text-fig. 3

1981 Racinella sp.- Vachard & Montenat, p. 33, pl. 2, figs 11-12.
1991 Tubiphytes forming a net-like structure - Flügel et al., pl. 40, fig. 5.
1992 Uvanella telleri Flügel - Weidlich, pl. 16, fig. 2.
2002 Spider-web-like microproblematicum - Wahlman, Fig. 15.
2005 “Aggregates or lumps”- Senowbari-Daryan et al., Fig. 8.7.

Material: Numerous specimens in several thin sections. For the number of thin sections containing the illustrated specimens see plate explanations.

Description. Aggregates of this organism reach dimensions of several mm and are composed of numerous circular, oval, tube-shaped or irregularly cavities or “chambers”, separated from each other by thin walls. Not only the shape of cavities, but also their size is very variable. Tube-shaped cavities were observed in almost all specimens. Aggregates of Vangia telleri occur either...
as isolated “lumps” within the micritic matrix (Pl. 1, figs. 7; Pl. 2, figs. 1-2, 7-8) or they rarely incrust other reef organisms (Pl. 1, fig. 8; Pl. 2, figs. 4, 6). The abundant occurrence of Vangia telleri in micritic matrix indicates such to be its growth position, possibly on the sediment surface. It also occurs as a nodular organism that was rarely grown around other organisms and stabilized them to form larger and compacted aggregates. Large cavities (e. g. Pl. 1, fig. 7C, 9C; Pl. 2, figs. 3, 5, 6), filled with sparry calcite cement occur with aggregates of Vangia telleri and were formed by the activity of this organism, but do not belong to it.

Discussion. Aggregates of Vangia telleri which are composed of chambers with thin, compact and micritic walls, were described as Uvanella? telleri from the Middle Permian of Slovenia by Flügel (in Flügel et al. 1984). Uvanella - with the type species U. irregularis Ott - is a sphinctozoan sponge with Mg-calcite skeletal mineralogy and was originally described from the Ladinian-Carnian of the Northern Calcareaous Alps (Austria) by Ott (1967). Detail descriptions of all Uvanella species, with their stratigraphic ranges and geographic distributions are given by Senowbari-Daryan (1990). The following characteristics of Vangia telleri (Flügel) do not justify an affiliation of this fossil with the sphinctozoan sponge Uvanella:

a) Wall of cavities or chambers. The chamber walls in Uvanella are distinctly thick and pierced by opening or pores. The wall in Vangia telleri is much thinner without any openings or pores. The “very scarce connecting pores”, noted by Flügel (in Flügel et al. 1984: 203) were not observed within the wall in Iranian materials. Some small and white-appearing points within the wall of Vangia telleri are interpreted, in agreement with Flügel (in Flügel et al. 1984), as sedimentary particles or grains.

b) Small, circular cavities within the walls of Vangia telleri (see Flügel et al. 1984: pl. 37, fig. 7: arrows), which are also present in Iranian material, are not known in specimens of Uvanella species.

c) Large cavities indicated with C in Pl. 1, figs 7, 9, Pl. 2, figs 3, 5, 6 and produced by the activity of Vangia telleri were not observed in specimens of the Triassic genus Uvanella.

d) The skeleton of Uvanella is composed of Mg-calcite (Senowbari-Daryan 1990). Sphinctozoan sponges with Mg-calcite mineralogy appeared in the Middle Triassic (Anisan) and became extinct at the end of Triassic (Senowbari-Daryan & Rigby in press). Sphinctozoan sponges with Mg-calcite mineralogy are not known in the Permian record.

e) Uvanella seems to be limited to the Middle and Upper Triassic and is not known from the Lower Triassic and Permian time.

General shape and the morphology of Vangia telleri are similar to that fossil named Bacinella irregularis by Radoicic (1959) and which is known from the Upper Triassic? Jurassic to the Tertiary of numerous localities on the world. The validity of Bacinella as an independent genus or its synonymy or consortium with Lithocodium Elliott (1956) has been discussed by numerous authors, and finally by Banner et al. (1990) who synonymized Bacinella with Lithocodium. Bacinella was accepted as a synonymous of Lithocodium by later workers (e. g. Neuweiler & Reitner 1992). Koch et al. (2002) accept not only the synonymy of both genera, but they presume that other genera (e. g. Bacinellacodium Dragastan, 1985 or Radoicicinellopsis Banner, Finch & Simmons 1990) are also synonymous with Lithocodium. Most authors (e. g. Schmid & Leinfelder 1996; Cherchi & Schröder 2006; Védrine et al. 2007, and Schlagentweit 2010) do not accept that Bacinella and Lithocodium are synonymous.

Radoicicinellopsis was established by Banner et al. (1990) designating Bacinella? sterni Radoicic (1972) as type species. Other known species of Bacinella, including B. ordinata Pantic (1972), B. bicellularis Sadati (1981), and B. crispa Eliasova (1981) were not treated by Banner et al. (1990). Bacinella crispa is similar to Lithocodium/Bacinella irregularis, but B. bicellularis and B. ordinata are different and may be erroneously assigned to Bacinella. All three species are different and a comparison with Vangia telleri (Flügel) is urgent.

Lithocodium was interpreted as a codiacean alga by Elliott (1956). Following this idea, Banner et al. (1990) classified Lithocodium as a green alga (Chlorophyceae family Codiaceae, subfamily Lithocodiacea). Lithocodium was interpreted as association of cyanobacteria/microbes/porostromata by Maurin et al. (1985) and Camoin & Maurin (1988), cyanobacteria/algae/foraminifera (Leinfelder et al. 1993), as foraminifer by Schmid & Leinfelder (1995, 1996) or as possibly “colonies of calcified cyanobacteria” by Cherchi & Schröder (2006).

Recently Schlagentweit et al. (2010) discussed the systematic position of Lithocodium attributing it to “filamentous-septate heterotrichale ulvophycean alga”. Assigning to “endolithic ulvophycean alga” these authors separate Bacinella from Lithocodium, which was synonymed by Banner et al. (1990). With separation of Lithocodium and Bacinella the systematic classification proposed by Schlagentweit et al. (2010) is followed here to describe the Permian species from Bagh-e Vang in Iran (see above).

Vangia telleri occurs always separate and never together with Lithocodium like the type species of Bacinella – B. irregularis Radoicic - in Mesozoic deposits. Because of the compact wall of the “chambers” a sponge interpretation for Bacinella is urgent. An
interpretation of Bacinella as a foraminifer – interpretation of some worker for Lithocodium/Bacinella – seems to be also unlikely. Most probably Bacinella should be classified as cyanobacteria. The systematic position of Lithocodium/Bacinella, however, as an animal (e.g. possibly sponge: Koch et al. 2002 or hydrozoa: Turnsek & Buser 1966), foraminifer (Schmid & Leinfelder 1995, 1996) or plant (algae: Elliott 1956; Radiocic 1959; Slaglantwe et al. 2010; Lithocodium as juvenile stage of Bacinella irregularis: Fenninger 1972, Bacinella irregularis as juvenile stage of Lithocodium: Segonzac & Marin 1972), cyanobacteria; Cherchi & Schroeder 2006) remains still uncertain.

This mentioned difference justifies the establishment of a separate genus for this Permian organism, named Vangia nov. gen. The twice mass extinctions (at the boundaries of Permian/Triassic and Triassic/Jurassic) and their strong influence during the time interval of Permian and Jurassic-Cretaceous supports the separation of Bacinella-like organism of Permian time as Vangia. Because of the compact wall of the “chambers” a sponge interpretation for Vangia is uncertain.

Occurrence. Vangia telleri (Flügel) is known from the Permian of Karawank (Kochsany-Devidé 1970), Slovenia (Flügel in Flügel et al. 1984), Oman (Weidrich 1992, 2001), Sicily (Flügel et al. 1990, 1991: pl. 40, fig. 5) and now also from the Permian Jamal Formation of northeast Iran. It was first reported as “aggregate or lumps” from Iran by Senowbari-Daryan et al. (2005).

Wahlman (2002: fig. 15) described Vangia telleri from the Lower Permian (Wolfcampian) of west Texas as “Spider-web-like microproblematicum”. In fact, the irregular aggregate of his “microproblematicum” or of Vangia is similar to some fistuliporid bryozoans colonies, but details of bryozoans, like apertures lack in Vangia.

Vachard & Montenat (1981: pl. 2, figs. 11-12) described from the Upper Permian of Afghanistan an organism as Bacinella sp. which is similar or almost identical to V. telleri (Flügel).

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Two problematic organisms from the Permian Jamal Formation of Shotori Mountains, Northeast Iran
PLATE 2
REFERENCES


