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# *Lovcenipora iranica* nov. sp., an unusually large chaetetid sponge from the Upper Triassic (Howz-e Khan member, Nayband Formation) of northeast Iran

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## Abstract

Sponges are the most important reef builders in the bio-constructions imbedded within the Norian-Rhaetian Nayband Formation at various localities exposed in central Iran. Besides sphinctozoans and inozoans, hypercalcified sponges, i. e. chaetetids and spongiomorphids, are relatively abundant in some biohermal and biostromal reef structures. In these reefs, chaetetids are usually small (<10 cm). However, an unusually large species was found in the reefs near the village Hassan-Abad in the Ferdows area, northeast Iran. This species is described as *Lovcenipora iranica* nov. sp. Associated organisms are usually fragments of small-sized dendroid spongiomorphids.

**Key words:** *Lovcenipora*, chaetetid sponge, Triassic, Nayband Formation, Iran

## Kurzfassung

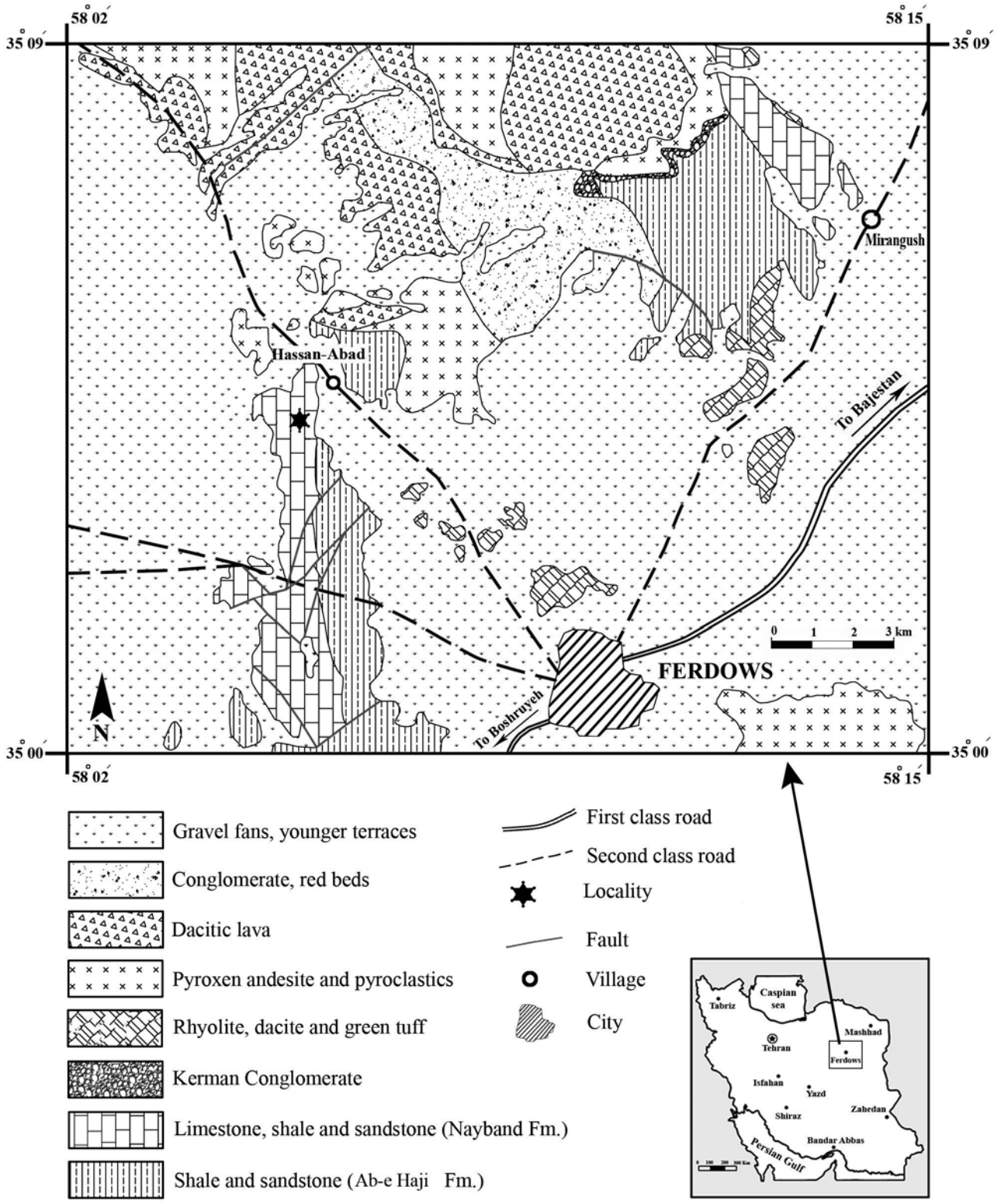
Schwämme sind die wichtigsten Riffbildner in den Biokonstruktionen, die verschiedentlich in die Nayband Formation im Zentraliran eingebettet sind. Neben Sphinctozoen und Inozoen sind in einigen biohermen und biostromen Riffstrukturen hyperkalzifizierte Schwämme (Chaetetiden und Spongiomorphiden) relativ häufig. Die Chaetitiden dieser Riffe sind üblicherweise klein (<10 cm). Allerdings wurde ein ungewöhnlich großes Exemplar in einem Riff nahe des Dorfes Hassan-Abad in der Gegend von Ferdows, NO Iran, gefunden. Dieser Schwamm wird hier als neue Art, *Lovcenipora iranica* nov. sp., beschrieben. Mit dem Fossil assoziiert sind Fragmente von kleinwüchsigen dendroiden Spongiomorphiden.

**Schlüsselwörter:** *Lovcenipora*, chaetetid sponge, Triassic, Nayband Formation, Iran

## 1. Introduction

The problematic Chaetetida were historically attributed to various groups or phyla, including sponges, coelenterates, bryozoans, and even algae (see Sokolov 1955, 1962; West & Clark 1984; West 2011). Hill (1981) classified the Paleozoic chaetetids as tabulate corals, mentioning that the post-Paleozoic chaetetids might be sclerosponges (Hartman & Goreau 1970, 1972, 1975). Chaetetids are composed of small tubes (calicles) that are usually oriented parallel to each other and have a circular, oval or polygonal outline in transverse section. They range from the Ordovician to Miocene (West & Clark 1984; Wood 1990) or Recent (Hartman & Goreau 1972, 1975) and are very common in the late Paleozoic. Chaetetids are – like other groups of hypercalcified sponges – polyphyletic, exhibiting affinities to other groups of sponges (Reitner & Wörheide 2002; Finks & Rigby 2004). The growth forms of chaetetids are laminar, domical, bulbous, columnar, club-shaped or branching (for summary see Kershaw & West 1991).

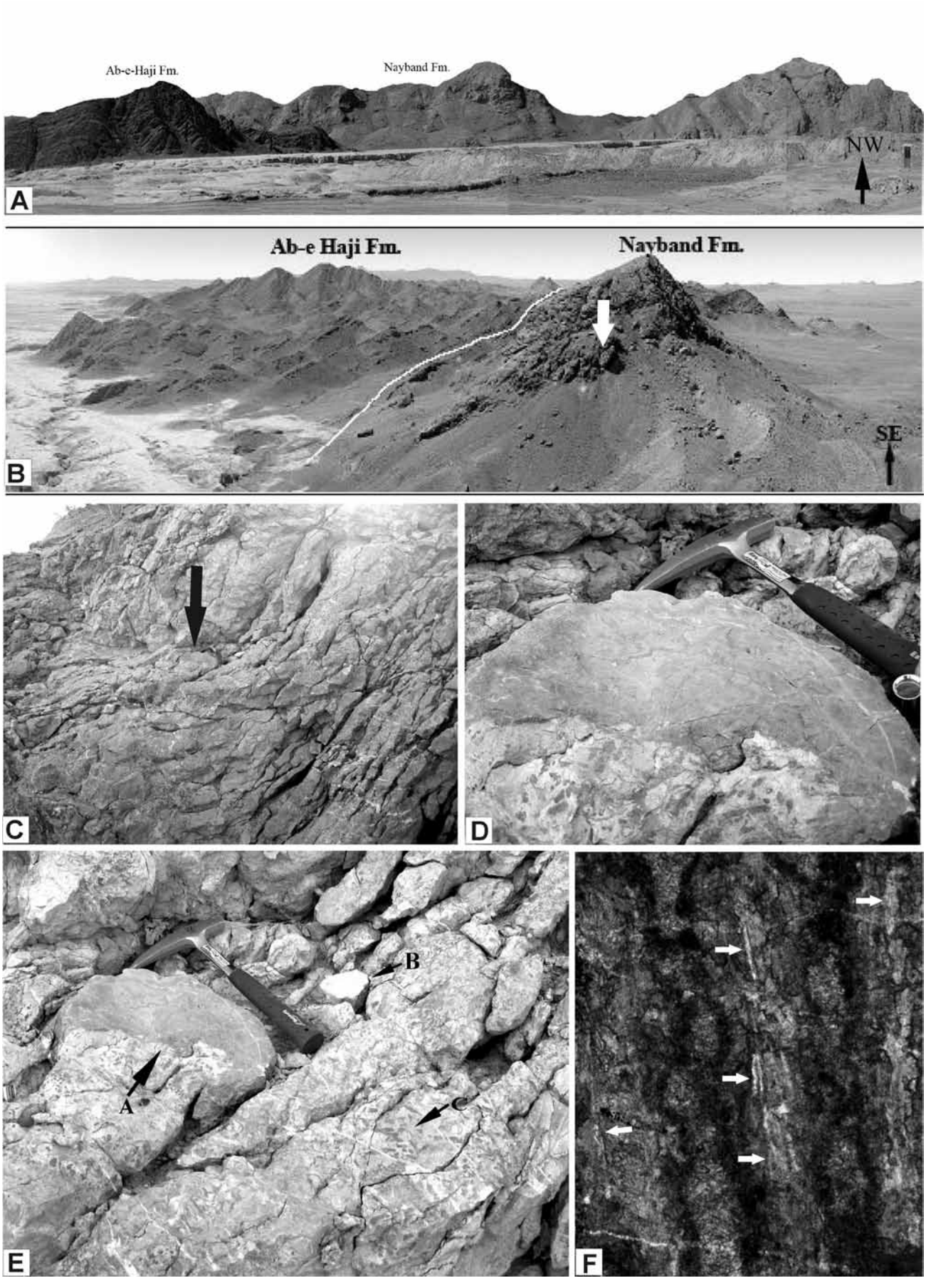
Triassic chaetetids were usuaslly termed “Tabulozoans” (Kühn 1942) in earlier publications, and have been revised by Fischer (1970). They are small organisms (mostly less than 5 cm in diameter) with mushroom-shaped or bulbous growth morphology. Large (up to 15 cm) chaetetids occur in the Late Jurassic (personal observation BSD in Iran) but are rare in the Triassic (Senowbari-Daryan & Maurer 2008). Triassic chaetetids were described by Giattini (1902) from Montenegro, Vinassa de Regny (1908, 1915) from Timor, Cuif et al. (1972), Cuif & Fischer (1974), Dieci et al. (1977), Bizzarini (1987), Bizarini & Braga (1978, 1988), Boiko (1979), Cremer (1994, 1995) and Senowbari-Daryan & Maurer (2008). For additional




**Textfigure 1:** Geographic position of the source locality of *Lovcenipora iranica* nov. sp.

data on the occurrence of chaetetids and their importance in Late Triassic reefs in the Alps refer to Zankl (1969) and Schäfer (1979).

During a field trip to an Upper Triassic section exposed near the village of Hassan-Abad (Ferdows area), an unusually large chaetetid sponge of 34 x 20 cm was discovered that is described in this paper.


Ab-e-Haji Fm.
Nayband Fm.
NW
A
Ab-e Haji Fm.
Nayband Fm.
SE
B
C
D
B
A
C
E
F

## 2. Geological setting

The type locality of the chaeteid described in this paper is situated in an area exposing deposits of the Late Triassic Nayband Formation and the Jurassic Ab-e Haji Formation. This section is called Hassan-Abad section in this paper. The section is located ~3 km northwest of the town of Ferdows, near the village of Hassan-Abad in northeast Iran (Textfig. 1; Pl. 1, Figs. A-B). The oldest rocks in this area are the deposits of the Nayband Formation that are exposed in the core of an anticlinal structure with north–south depping. The strata of the Nayband Formation are overlain by sandstones and shales, containing plant fossils suggestive of a Jurassic age (Eftekhar-Nejad et al. 1977; Purlatifi 2001). The thickness of the Late Triassic deposits of the Hassan-Abad section range is ~120 m. The section shows an alternating sequence of reef carbonates including massive and bedded carbonates and well as greenish shales. The reef carbonates contain a rich macro- and micro-fauna such as hypercalcified sponges (including sphinctozoans, inozoans, chaetetids and spongiomorphids), scleractinian corals, sphaerical hydrozoans (*Heterastridium*), foraminifers, algae, gastropods, bivalves etc. A considerable part of the section consists of grey reef carbonates containing abundant small dendroid spongiomorphids (Pl. 1, Fig. E) that are mostly fragmented. They seem to represent the most important reef organisms in this part of the section. Small chaetetids and other hypercalcified sponges are the most important contributors to the reef carbonates. The lower contact of the Nayband Formation exposed at the Hassan-Abad section remains unknown.

Approaching to the younger part of the Nayband Formation, the carbonate rocks decrease while intercalations of green shales increase gradually. The uppermost beds of the measured section are composed of well-sorted red sandstones with iron oxides. The boundary of the Nayband Formation with the Early Jurassic sandstones representing the Ab-e Haji Formation is continous (Pl. 1, Fig. B).

Based on the abundant occurrence of *Heterastridium coglobatum* and *H. lobatum*, the index fossils of the Late Triassic (Norian-Rhaetian?), the section has been dated as Norian in age (Bidestan Member). However, based on the stratighraphic position (continuous transition to the Jurassic Ab-e Haji Formation) and lithology (carbonates and sandstones), this section corresponds to the Howz-e Khan Member, which is known from its type locality on the southern flank of the Kuh-e Nayband (geol. map J8 of Naybandan: Kluyver et al. 1983). This discrepancy perhaps reflects a different depositional environment of the Hassan-Abad section, which belonged to the Lute Block during the Late Triassic. As a result, Aghanabati (2004, 2010) suggested to use the informal name “Ferdows Member” for this part of the Nayband Formation.

Specimen repository: All illustrated thin-sections are from the holotype and paratype. Specimens and thin sections are deposited in the collection of the Bayerische Staatssammlung für Paläontologie und Geologie (BSPG), Munich, Germany, under accesion number BSPG 2011 I 140–143.

## 3. Systematic paleontology

Class Demospongea Sollas, 1885
Order and Family uncertain

Genus *Lovcenipora* Giattini, 1902

Remarks: As noted by Senowbari-Daryan & Maurer (2008), *Lovcenipora* had been regarded as a genus of uncertain systematic position by Hill & Wells (1956: 88). Fischer (1970) excluded the taxon from the chaetetids. Following Hill & Wells (1956), Fischer (1970) and Balters (1973) listed *Lovcenipora dobrogiaca* Simionescu (1926) from the Upper Cretaceous of Romania as incertae sedis. According to Senowbari-Daryan & Maurer (2008: 451), the skeletal elements of *Lovcenipora* and the definition of this genus by Vinassa de Regny (1915) justify classification as a chaetetid.

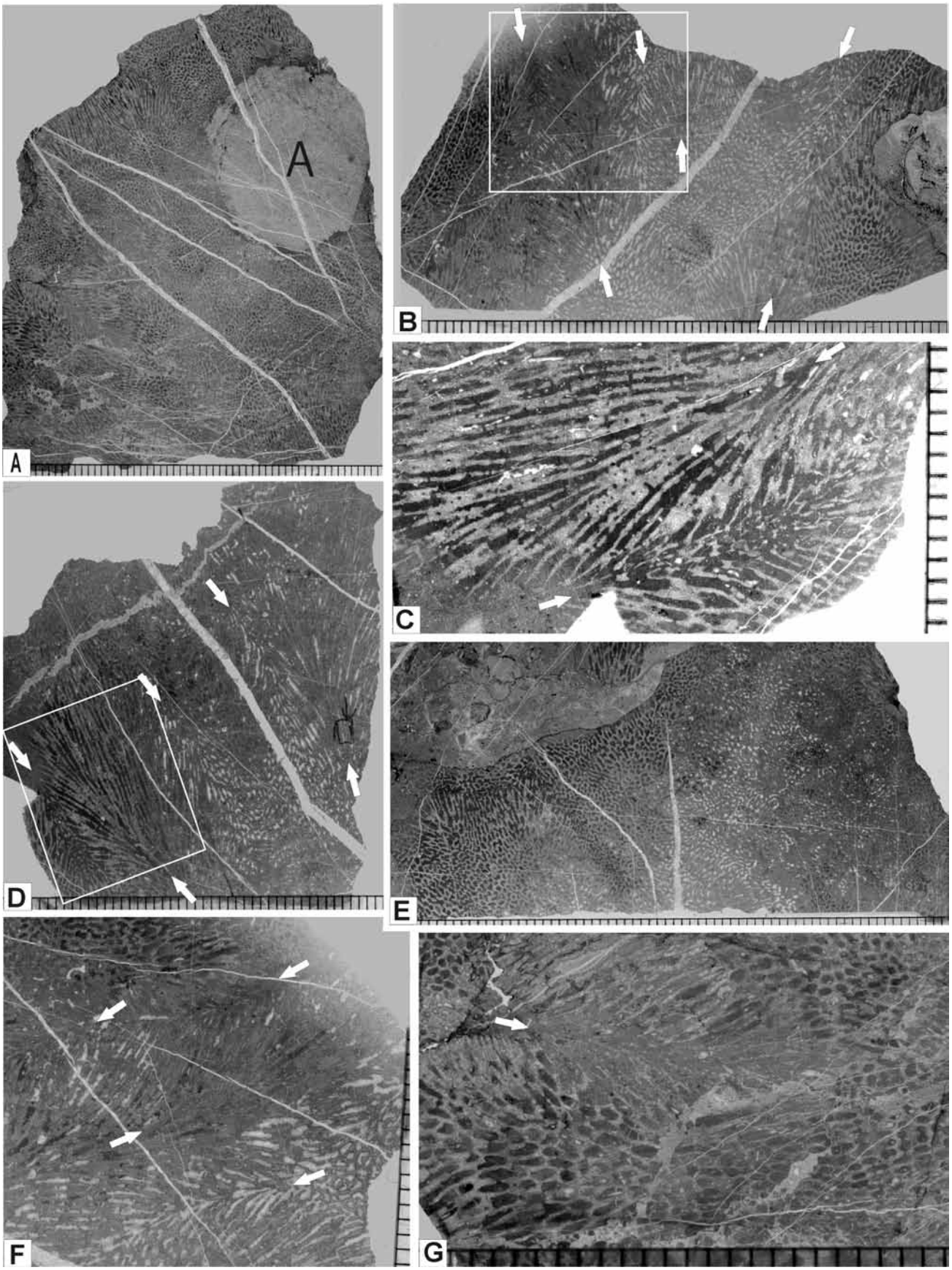
*Lovcenipora iranica* nov. sp.
Pl. 1, Figs C–F; Pl. 2, Figs A–G

Derivatio nominis: Named for the occurrence of this sponge in Iran.

Holotype: BSPG 2011 I 140, 141. It was not possible to extract the complete holotype illustrated in Pl. 1, Figs C–E/A (remains left in the field). From the holotype, two pieces were broken off and three thin-sections were prepared (Pl. 2, Figs A, C, D, G).

Paratype: BSPG 2011 I 142, 143. Like with the holotype, it was impossible to recover the paratype

← **Plate 1: (A)** Panorama of the Hassan-Abad section from southeast to northwest, showing the Upper Triassic Nayband Formation in the background and darker-appearing Jurassic Ab-e Haji Formation in the front. **(B)** Panorama of the Nayband Formation with massive reef carbonates in the front, overlain by the Jurassic Ab-e Haji Formation. The Triassic/Jurassic-boundary is marked by a thin line. The white arrow indicates the spot from which *Lovcenipora iranica* nov. sp. was collected. **(C)** Field photograph of the holotype of *Lovcenipora iraninca* and surrounding massive rocks of the Nayband Formation. **(D)** Detail of Pl. 1, Fig. E, showing the mushroom-shaped holotype of *L. iranica*. **(E)** Position of the holotype (A) and paratype (B) of *L. iranica* and the surrounding rocks with fragments of dendroid spongimorphids (C). **(F)** Holotype (BSPG 2011 I 141); longitudinal section through three white-appearing tube walls exhibiting small, white appearing rod-like elements (arrows) arranged more or less parallel to the tube axis.


A
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from the field intact. We took three pieces from the paratype (Pl. 1, Fig. E/B). The corresponding thin-sections of the paratype are illustrated in Pl. 2, Figs B, E, F.

Locus typicus: Nayband Formation near the village of Hassan-Abad (Textfig. 1; Pl. 1, Fig. B). The spot from which both specimens were collected is marked with a white arrow in Pl. 1, Fig. B.

Stratum typicum: Late Triassic, Nayband Formation (Norian/Rhaetian).

Diagnosis: Unusually large chaetetid sponge with repeated changes of direction of the fan-shaped groups of tubes; tubes oriented parallel to each other within a fan, but converse to the tubes forming neighbouring fans; tubes within a fan showing a water-jet-like pattern originating from a single tube at the base of fan; tube interiors lack tabulae.

Material: Two specimens were discovered, but it was not possible to remove them from the surrounding rocks intact. Several pieces were therefore broken off from the specimens and used for microscopic analysis. These rock pieces and the thin-sections represent type material.

Description: The holotype specimen (Pl. 1, Figs C–E) is 200 mm high, with a diameter of 340 mm, and has grown on and around a coral colony of *Astraemorpha* sp. The main part of the second specimen (paratype) is embedded in the surrounding rocks, and only a part of it was visible in the field (Pl. 1, Fig. E). Both specimens are composed of numerous tubes with a diameter of 0.4–0.5 mm. The tubes are circular to oval in cross section. In some parts of the skeleton, the tubes show a meandroid appearance. Tube walls possess small openings 0.14–0.20 mm in diameter. The distribution of these openings and the distance between two pores are variable. In some of the tube walls, three pores were counted in a distance of 2 mm, but in other tube walls or other portions of the walls, the walls are imperforate over a distance of about 5 mm. The most characteristic feature of the new species is the fan-shaped (water-jet-like, trabecular) arrangement of the tubes originating from a single tube at the base. Within each fan, tubes are parallel to each other, but tubes of neighbouring fans show an oblique orientation (not parallel). The tubes lack cross partitions or tabulae. For comparison, biometric measurements of tubes and other characteristic skeletal elements of *L. iranica* nov. sp. and three other comparably large Triassic chaetetid sponges are compiled in Table 1.

The main part of the second specimen (paratype) is embedded in the surrounding rock and only a part of about 10 cm was visible in the field (Pl. 1, Fig. E/B). The diameter of the tubes, the orientation of the tube-fans and other biometric data of the paratype correspond to the holotype.

Preservation of the internal skeleton (microstructure) is poor in both specimens. Relics of an upward-diverging structure within the tube walls are indicative of a fascicular fibrous (water-jet, clinogonal, trabecular: Boury-Esnault & Rützler 1997) microstructure of the skeleton (probably primary aragonite). Investigation of a single small piece by SEM was not successful and no spicules were found. Under the microscope, however, in two small areas a few putative monaxonid spicules were observed (Pl. 1, Fig. F).

## 4. Comparison

The biometric data of all the known species of *Lovcenipora* are listed in Senowbari-Daryan & Maurer (2008). As noted previously, large chaetetids such as *L. iranica* nov. sp. were unknown from reefs of the Nayband Formation prior to the present study. Senowbari-Daryan & Maurer (2008) described large chaetetids (60 x 50 mm) from the Norian of Musandam Peninsula (United Arab Emirates and Oman) as *Lovcenipora musandamensis* and *Lovcenipora* sp. *L. chaetetiformis* from the same locality reaches dimensions of 100 x 60 mm and, according to Senowbari-Daryan & Maurer (2008), *L. vinassai* may grow up to 40 x 80 mm. Nevertheless, these species all are much smaller than *L. iranica* nov. sp. (Tab. 1).

The most significant character of the new species is the orientation of fan-shaped groups of tubes. This feature has not been observed in any other Triassic chaetetid. Fan-shaped tubes seem to occur in *Lovcenipora* sp. described by Senowbari-Daryan & Maurer (2008: fig. 11/g) from the Norian carbonates of Musandam Mountains (Emirates and Oman), but the change of direction of the fans was not observed in this species. It is possible that *Lovcenipora* sp. from Musandam Mountains is identical (because of fan-shaped orientation of the tubes) with the present Iranian species *L. iranica* nov. sp.

← **Plate 2: (A–G)** *Lovcenipora iranica* nov. sp., Nayband Formation near Hassan-Abad; scales in all figures in mm; (A, C-D, G) holotype, (B, E, F) paratype. **(A)** Holotype specimen growing on *Astraeomorpha* sp. (indicated with A); BSPG 2011 I 140. **(B)** Paratype, similar section as in Pl. 2, Fig. A, showing several tube-fans; white arrows indicate directions of fans; BSPG 2011 I 142. **(C)** Detail of Pl. 2, Fig. D, showing two tube fans (indicated with small white arrows), with the pores in the walls clearly recognizable. **(D)** Holotype; section showing tube-fans with almost the different orientation as in Pl. 2, Fig. B; arrows indicating growth direction of fans; BSPG 2011 I 141. **(E)** Paratype; section oriented more or less perpendicular to the tubes showing them in cross and oblique section; BSPG 2011 I 143. **(F)** Detail of Pl. 2, Fig. B (rectangle); white arrows indicate growth direction of the tube-fans. **(G)** Oblique section perpendicularly to some of the fans, showing tubes in cross and oblique sections; BSPG 2011 I 140.

**Table 1:** Measurements of skeletal elements of *Lovcenipora iranica* nov. sp. and three other Triassic *Lovcenipora* species. HS) height of colonies, DS) diameter of colonies, DT) diameter of individual tubes, DTB) diameter of tubes at base of fans, TTW) thickness of tube wall, DP) diameter of pores in tube walls, OT) outline of tubes in cross section, T) tabulae within tubes. *) Large-scaled species of *Lovcenipora* listed in Senowbari-Daryan & Maurer (2008). All data in mm.

| Species | HS/DS | DT | DTB | TTW | DP | OT | T |
|---|---|---|---|---|---|---|---|
| *L. iranica (holotype)* | 200/340 | 0.4-0.5 | 0.8-1.2 | 0.14-0.20 | 0.2-0.3 | circular-oval | No |
| * *L. vinassai* | 40/80 | 0.5-0.7 | -- | ? | ? | polygonal | Rare |
| * *L. chaetetiformis* | 100/60 | 0.7-1.0 | -- | 0.02-0.2 | 0.1-0.2 | polygonal | No |
| * *L. musandamensis* | 60/50 | 0.6 | -- | 0.01-0.02 | 0.1-0.2 | polygonal | Rare |

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