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ORIGINAL ARTICLE

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A new species of *Polymastia* (Porifera, Hadromerida, Polymastiidae) from the Aleutian Islands, Alaska, USA

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Abstract *Polymastia fluegeli* n. sp. is described from deep water off the Aleutian Islands (Alaska, USA). *P. fluegeli* is disc-shaped and lives partly buried in the sediment, with only the papillae protruding above the surface. This new species has a basal layer of agglutinated sediment particles occurring between the choanosome and the ectosomal lower layer. This conspicuous sediment layer is not described for other species of *Polymastia*. Occurring spicule types and sizes are different from known species of the area.

Keywords Porifera · Hadromerida · *Polymastia* · New species · Taxonomy · Aleutian Islands

Introduction

The family Polymastiidae Gray, 1867 has a worldwide distribution and, according to Boury-Esnault (2002), 14 valid genera and approximately 100 species are now recognized. The genus *Polymastia* Bowerbank, 1864, with approximately 50 described species, is characterized by an "ectosomal skeleton composed of at least two layers. The superficial one is a palisade of small tylostyles, the lower layer is made of intermediary spicules, tangential to the surface. The principal spicules can be tylostyles, subtylostyles, styles, and strongyloxeas. Intermediary spicules are most often tylostyles and, ectosomal spicules are always tylostyles" (Boury-Esnault 2002:203). Polymastiidae of the Arctic area were summarized by Plotkin (2004) and he recorded six genera with 12 different species in the Arctic. Ten species have a wide distribution, while two are restricted to the Arctic area.

The new species described here was collected on a cruise of the vessel *Velero IV* along the Aleutian Islands in June and July 2004.

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Methods

The holotype was collected with the submersible *Delta*. On board the vessel *Velero IV*, a fragment of the holotype was transferred into 95% ethanol, the remaining part was frozen at −18°C. Procedures for identification followed the usual routines described earlier (Lehnert and Van Soest 1996). Spicule preparations and hand-made thin sections were embedded in Canada balsam for light microscopy. For SEM, the spicules were sputtered with gold and investigated with a Hitachi S 800 at the Institut für Zoologie I in Erlangen, Germany.

Systematics

Order: **Hadromerida** Topsent, 1894

Family: **Polymastiidae** Gray, 1867

Genus: ***Polymastia*** Bowerbank, 1864

Type species: *Spongia mamillaris* Müller, 1806

Polymastia fluegeli n. sp

Figs. 1A–F

Material

One specimen was collected during the expedition of the vessel *Velero IV* from Adak Island (Alaska) to Dutch Harbor

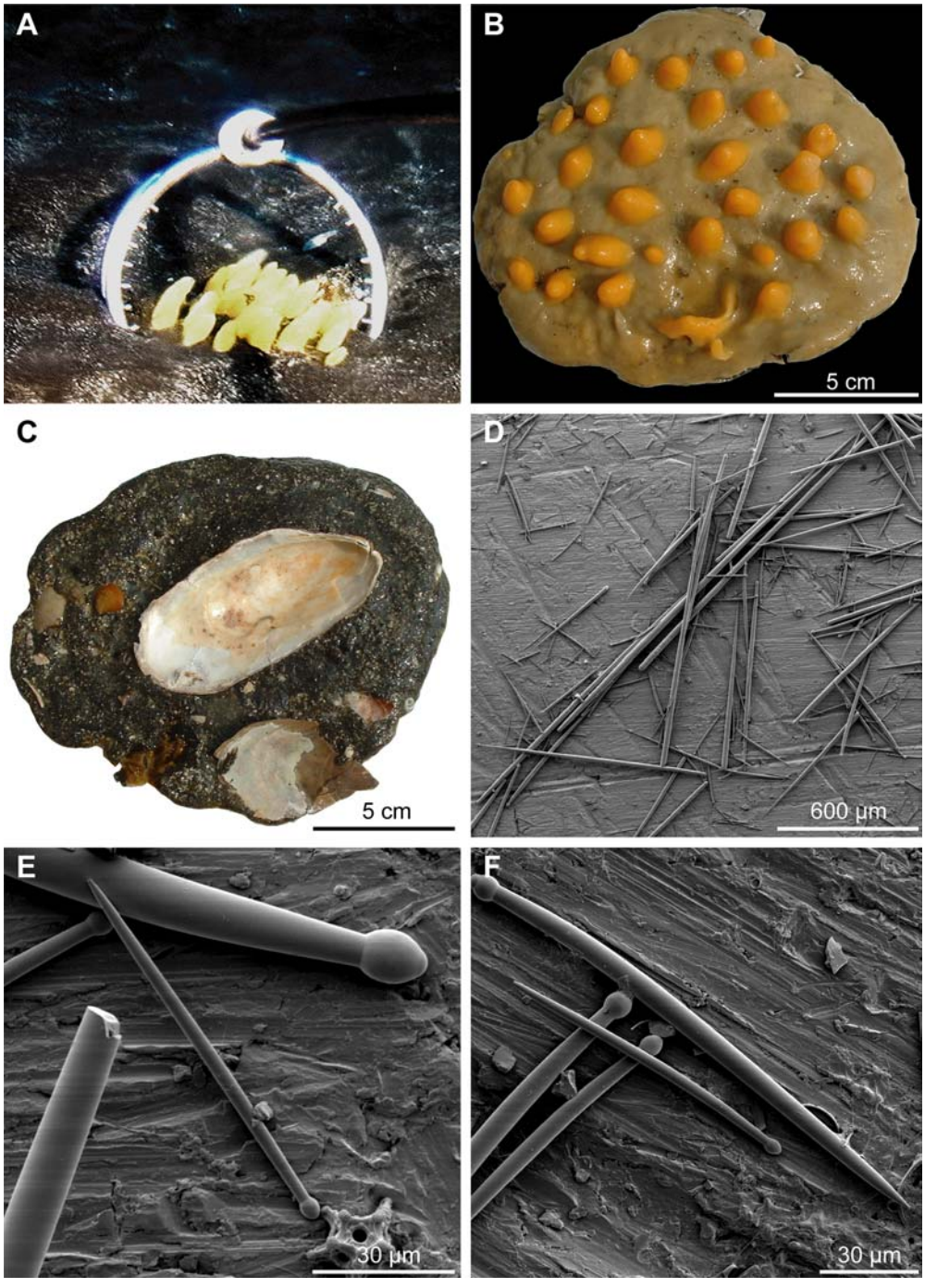

Fig. 1 *Polymastia fluegeli* n. sp. from the Aleutian Islands, Alaska, USA. **A** *Polymastia fluegeli* just before collection. Only the papillae are protruding above the sediment. **B** Holotype of *Polymastia fluegeli*. **C** Bottom side of the holotype of *Polymastia fluegeli* with attached shells and dark-coloured sediment layer. **D** Large and small tylostyles of *Polymastia fluegeli*. **E** Small category of tylostyle and tyle of large tylostyle; note radiolarian shell on *lower right*. Radiolarians and diatoms were found frequently in spicule preparations. **F** Small and intermediate sizes of tylostyles

(Alaska) in June and July 2004. The collection was made with the help of the submersible *Delta* by Dave Carlile on July 3, 2004. This specimen, originally labelled 6214-6E-5, is consequently the designated holotype. A small fragment of the holotype was preserved in 95% ethanol shortly after collection. The main part was frozen at −18°C and later transferred to ethanol.

Type locality: South off Tanaga Island, Aleutian Islands, Alaska, USA at 82 m water depth. Coordinates: 51°36.07′N, 178°00.64′W.

The holotype and the fragment are deposited at the Senckenberg Museum, Frankfurt am Main, Germany, under the registration number: SMF 9762.

Etymology

Named in honour of the late Prof. Dr. Erik Flügel for his contributions to marine paleontology, in recognition of his interest in interdisciplinary science and in encouraging HL to study sponges.

Distribution

Known from the type locality only. Found on homogeneous, coarse sand shelves at depths between 80 and 90 m.

Description

Disc-shaped, brown sponge with numerous yellow coloured fistules (Fig. 1A and B). In ethanol the sponge is uniformly beige coloured. In life, the plate was buried in the sediment with only the papillae protruding (Fig. 1A). The sponge was attached to several bivalve shells (Fig. 1C), the largest one in the center and most probably the origin of the sponge. The fistules are cone-shaped with no recognizable opening. The disc is 16 cm at its largest diameter and about 1 cm thick. The surface is optically smooth and microscopically hispid but there are some areas with scattered long spicules protruding. The consistency of the sponge is firm, slightly elastic, cartilaginous. In cross sections, the sponge is clearly divided in a whitish, yellow-coloured upper layer and a black-coloured lower layer. The lower layer is 3–4 mm in thickness, of hard consistency and only slightly elastic. It mainly consists of agglutinated sediment particles with many spicules without any orientation in between. On the bottom side, a thin, whitish ectosomal layer is present with a palisade of small tylostyles and below intermediary tylostyles arranged tangentially. From the upper surface of the sediment layer polyspicular tracts arise, widen and sometimes branch towards the surface and fan out in the cortical layer. Between the spicule tracts, many loose spicules occur. Polyspicular tracts are 350–500 μm in diameter. The ectosomal layer is 500–700 μm in thickness and consists of more or less tangentially arranged spicules and a palisade of small tylostyles above. The ectosome is densely packed with spicules and considerably more resilient than the relatively soft choanosome. The papillae appear to be almost solid in sections. A central canal is visible in the center of the papillae but there are no apertures visible, which might be due to contraction after collection. The ectosomal layer of the papillae is identical to other parts of the sponge. Polyspicular tracts in the papillae run towards their tip.

Spicules

Large fusiform tylostyles (Fig. 1D), in a wide size-range, longest ones often with one or several subterminal rings, 180–1,750×8–22 μm. Small category of tylostyles (Fig. 1E, F) are 65–110×3–6 μm.

Discussion

Assignment of the new species to *Polymastia* was made because spicules are exclusively tylostyles and the ectosomal layer consists of a palisade of small tylostyles with tangential tylostyles below. The ectosomal skeleton is the same at all surfaces. However, the choanosomal spicule tracts are not radiating but consist of polyspicular tracts of tylostyles ascending from the sediment layer to the sponge surface. *Polymastia fluegeli* differs from all other species of *Polymastia* in having a basal layer of agglutinated sediment and in sizes of tylostyles present. Ectosomal tylostyles of *P. fluegeli* are the shortest reported for any *Polymastia* of the Arctic area. *Polymastia grimaldi* (Topsent, 1913) is somewhat similar in growth form but, in contrast to our species, it has a spicule fringe between the basal and upper layer and it has leaf-like papillae and a central osculum. The spicule fringe of *P. grimaldi* is constituted of very long spicules (up to 7 mm), which are not present in *P. fluegeli*. The principal and ectosomal tylostyles of *P. grimaldi* are much longer than in *P. fluegeli* such that conspecificity can be excluded. *Polymastia arctica* (Merejkowsky, 1878) is thickly encrusting, cushion-shaped and therefore different in growth form but it has a similar simple spiculation. However, the principal tylostyles of *P. arctica* are shorter, while the ectosomal tylostyles are longer than in *P. fluegeli*, and therefore conspecificity can be excluded, too. *Polymastia pacifica* Koltun 1966 co-occurs with our species in the same area. This is a semispherical small sponge, about 16 mm in diameter that was found between 3,857–6,065 m (Plotkin 2002). This species further differs from *P. fluegeli* in having a spicule fringe of long spicules (3–5 mm) and in having longer ectosomal spicules. It does not live buried in the sediment but rather on the surface of pebbles and gravel. *Polymastia agglutinans* Ridley and Dendy, 1886 recorded off the Azores, is also known to agglutinate sediment. It differs from *P. fluegeli* in agglutinating the particles on the sponge surface in a much thinner layer. It is irregularly globular in growth form and has styles to subtylostyles of a much narrower size-range. For more detailed descriptions and spicule measurements of Arctic Polymastiidae, we refer to Plotkin (2004).

The basal layer of agglutinated sediment particles might be an important adaptation for a species living in an unstable habitat of coarse sand where sand waves indicate the presence of strong and steady benthic currents. The empty bivalve shells attached to the sponge are likely insufficient to stabilize the position of the sponge, especially as it continues to grow. Adjustment of the density of the sponge through the amount of relatively heavy volcanic sediment agglutinated to the basal plate would allow the sponge to maintain an optimal position within the sediment. Without the anchorage provided by the basal layer, the sponge

could easily be washed to the sediment surface or "fly-out" where it could be more susceptible to damage by currents or predation.

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