NOAA Professional Paper NMFS 12

A guide to the deep-water sponges of the Aleutian Island Archipelago

Robert P. Stone
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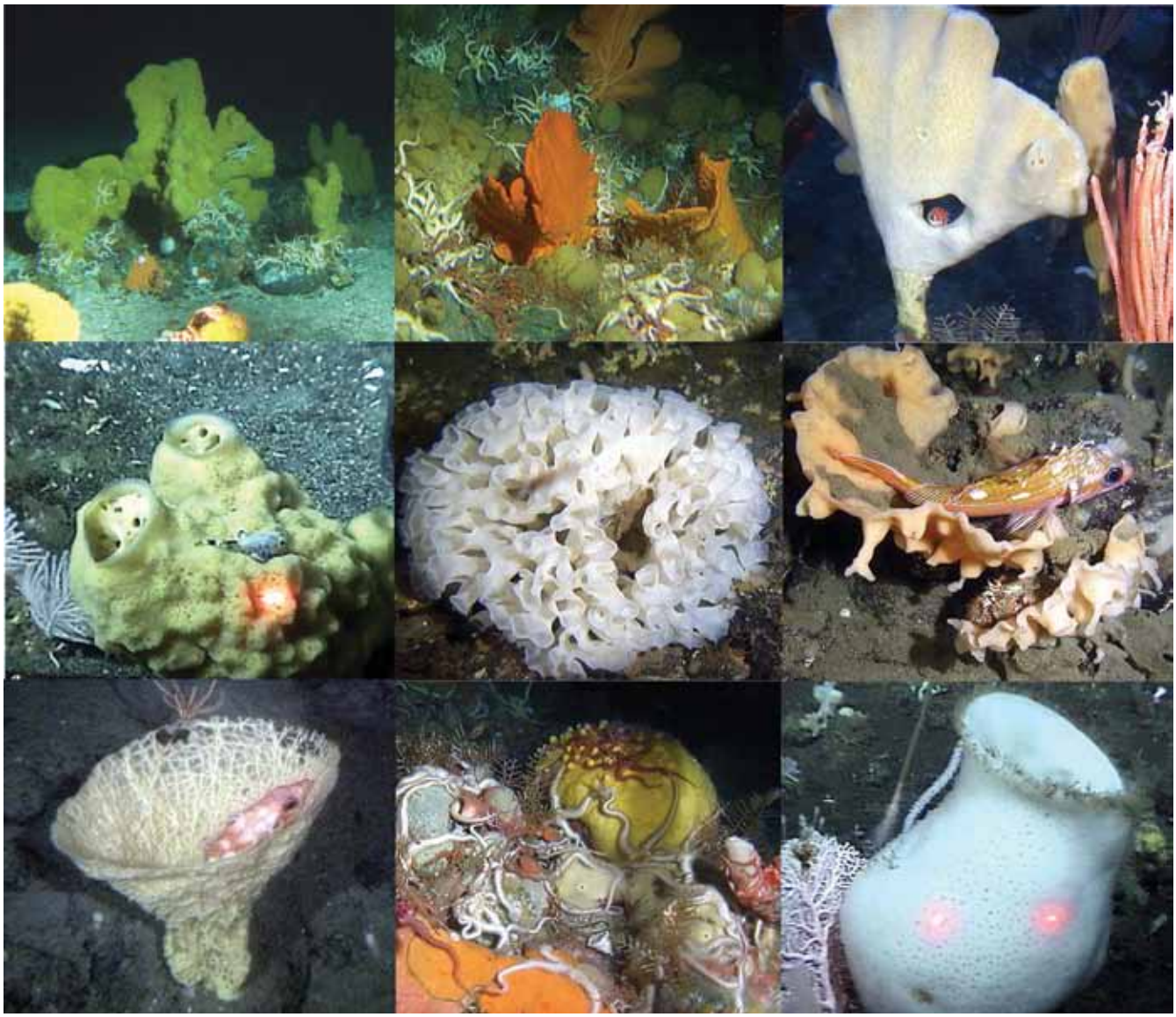
Henry Reiswig



U.S. Department of Commerce
September 2011

NOAA Professional Papers NMFS

The NOAA Professional Paper NMFS (ISSN 1931-4590) series is published by the Scientific Publications Office, National Marine Fisheries Service, NOAA, 7600 Sand Point Way NE, Seattle, WA 98115.
The Secretary of Commerce has determined that the publication of this series is necessary in the transaction of the public business required by law of this Department. Use of funds for printing of this series has been approved by the Director of the Office of Management and Budget.

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Seattle, Washington

Suggested reference
Stone, Robert P., Helmut Lehnert, and Henry Reiswig. 2011. A guide to the deep-water sponges of the Aleutian Island Archipelago. NOAA Professional Paper NMFS 12, 187 p.

Online dissemination
This report is posted online in PDF format at http://spo.nmfs.noaa.gov (click on *Professional Papers* link).

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A guide to the deep-water sponges of the Aleutian Island Archipelago

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Abstract—The first dedicated collections of deep-water (>80 m) sponges from the central Aleutian Islands revealed a rich fauna including 28 novel species and geographical range extensions for 53 others. Based on these collections and the published literature, we now confirm the presence of 125 species (or subspecies) of deep-water sponges in the Aleutian Islands. Clearly the deep-water sponge fauna of the Aleutian Islands is extraordinarily rich and largely understudied. Submersible observations revealed that sponges, rather than deep-water corals, are the dominant feature shaping benthic habitats in the region and that they provide important refuge habitat for many species of fish and invertebrates including juvenile rockfish (*Sebastes* spp.) and king crabs (*Lithodes* sp). Examination of video footage collected along 127 km of the seafloor further indicate that there are likely hundreds of species still uncollected from the region, and many unknown to science. Furthermore, sponges are extremely fragile and easily damaged by contact with fishing gear. High rates of fishery bycatch clearly indicate a strong interaction between existing fisheries and sponge habitat. Bycatch in fisheries and fisheries-independent surveys can be a major source of information on the location of the sponge fauna, but current monitoring programs are greatly hampered by the inability of deck personnel to identify bycatch. This guide contains detailed species descriptions for 112 sponges collected in Alaska, principally in the central Aleutian Islands. It addresses bycatch identification challenges by providing fisheries observers and scientists with the information necessary to adequately identify sponge fauna.Using that identification data, areas of high abundance can be mapped and the locations of indicator species of vulnerable marine ecosystems can be determined. The guide is also designed for use by scientists making observations of the fauna in situ with submersibles, including remotely operated vehicles and autonomous underwater vehicles.

Introduction

The first dedicated collections of deep-water (>80 m) sponges from the central Aleutian Islands revealed a rich fauna comprising 102 species, including 28 species new to science and range extensions for 53 species. Based on these collections and the published literature, we now confirm the presence of 125 species (or subspecies) of deep-water sponges in the central Aleutian Islands. The inventory includes 10 species of calcareous sponges, 20 species of hexactinellid sponges, and 95 species of demosponges. Despite the initial collection efforts, the sponge fauna of this region of the North Pacific is still poorly known. Based on our extensive submersible observations, we estimate that there are several hundred sponge species yet to be inventoried or described from the region. This regional estimate (i.e., total percent known) is consistent with those made for all sponges worldwide (Hooper and Lévi, 1994; Hooper and Van Soest, 2002).

The main purpose of this guide is to promote an awareness and appreciation of the importance of the sponge fauna in the North Pacific Ocean, particularly in the Aleutian Islands where the diversity and abundance of sponges appears to be extraordinary and bycatch in existing fisheries continues to be a major concern for resource managers. Bycatch in fisheries and fisheries-independent surveys is a major source of information on the location of the sponge fauna and also a source of specimens for study. This guide serves the additional purpose of providing fisheries observers and scientists with the information necessary to adequately identify sponge fauna so that the data can be included in existing databases. These data can be used to map areas of high abundance and the locations of indicator species of vulnerable marine ecosystems. The guide is also designed for use by scientists making observations of the fauna in situ with submersibles, including remotely operated vehicles (ROVs) and autonomous underwater vehicles (AUVs).

The protocols used to identify bycatch of sponges, both in commercial fishing operations and in fisheries surveys, have major shortcomings. They are largely restricted by the limited number of personnel dedicated to this task, a general lack of knowledge of the taxonomy of the sponge fauna, and the fact that sponges are particu-

larly fragile and are often highly fragmented at the time of collection.

Current practice aboard commercial fishing vessels in Alaska (note that not all vessels are required to have fishery observers onboard) calls for tasked personnel to identify sponge bycatch to the lowest practical taxa – essentially to Phylum Porifera. The Alaska Fisheries Science Center's Fisheries Monitoring and Analysis Division (FMA) maintains all records, including depth and location data, through its North Pacific Groundfish Observer Program. The accuracy of those data depends foremost on the type of fishing gear, but also varies due to the spatial coverage of the gear (i.e., only start and end positions and depths are recorded). Specimens are typically not retained for specific scientific purposes.

Current practice aboard NOAA survey vessels differs between the two principal surveys. Specimens are retained for further study upon request, but no formal program for the collection and preservation of specimens exists otherwise. The emphasis of both surveys is to gather information necessary for the sustainable management of groundfish species. Monitoring the bycatch of structure-forming invertebrates, such as sponges, has become more of a priority with recent emphasis on managing fisheries with an ecosystem approach. For the NMFS sablefish longline survey, sponges are only identified to the general level of "unidentified sponge." For the NMFS groundfish trawl survey, wet weight of sponges is recorded either completely or by subsampling. Collection data are then coded (NMFS RACE Species Code Book – maintained by the Resource Assessment and Conservation Engineering Division's Groundfish Assessment Program) and entered into a database. Sponges are identified from a guide that was developed specifically for the identification of benthic marine invertebrates collected along Alaska's upper continental slope and shelf (Clark[1]). This guide has been an important first step toward more adequately monitoring sponge bycatch, but it is largely incomplete, contains species that have never been confirmed to occur in Alaskan waters, and lists some species with inaccurate taxonomic nomenclature. Clearly there is a strong need for a guide dedicated to the identification of Alaskan sponges and a continued effort to properly identify the sponge fauna collected from the region.

The sponges contained in this guide were collected principally during two expeditions to the central Aleutian Islands in 2004: one aboard the RV *Velero IV* and the other aboard the RV *Roger Revelle.* A few additional sponge specimens were collected during the pioneering work in the region aboard the RV *Velero IV* in 2002 and 2003. The focus of the research supporting the cruises was on deep-water coral habitat; there was a dedicated effort to collect sponge fauna for formal identification only during the RV *Velero IV* cruise in 2004 and even then it was of secondary importance. We also include collections made in the eastern Gulf of Alaska aboard the RV *Velero IV* in 2005 and in the Bering Sea Canyons (Pribilof and Zhemchug) aboard the RV *Esperanza* in 2007.

We reviewed video footage of the seafloor collected during 31 dives with the submersible *Delta* and 13 dives with the ROV *Jason II.* A total of approximately 127 km of seafloor habitat was examined (35 km and 92 km, respectively) from that video footage for the presence of sponge fauna, with particular focus on taxa included in this guide. Habitat information including depth, substrate, and associated fauna were recorded for sponge observations, often made from multiple camera perspectives.

About this guide

This guide contains detailed species descriptions for 112 sponges collected in Alaska, principally in the central Aleutian Islands. Each species description begins with the scientific name using classical binominal nomenclature. The first name (always capitalized) is the genus. The second name (never capitalized) is the species. Some species may have a third name (never capitalized) for designated subspecies. And for some species a subgenus may have been designated and is placed in parentheses after the current genus. The name(s) of the author(s) of the species description (i.e., the person(s) who described the species) and year of description follow the scientific name. Parentheses placed around the author(s) name(s) indicates that there has been an accepted modification to genus assignment since the original description. For example, *Acanthascus* (*Rhabdocalyptus*) *dawsoni dawsoni* (Lambe, 1893) is represented as Genus (subgenus) species subspecies (Author, year).

Each species description provides information on 1) typical growth form(s), 2) surface morphology, including the presence and description of oscula, 3) consistency and texture, 4) known size range or dimensions, and 5) color in life and under various preservation methods. These characteristics, when used in conjunction with a confirmed photograph, can often provide a fairly accurate identification in the field. Definitive identification of most species, however, requires careful examination of the arrangement of microscopic skeletal structures, particularly the types, sizes, and location of spicules. Note that the identification of each species detailed in this guide has been confirmed by examination of microscopic features. We provide detailed information on the skeletal structure of each species so

[1] Clark, R. N. 2006. Unpubl. manuscript. Field guide to the benthic marine invertebrates of Alaska's shelf and upper slope taken by NOAA/NMFS/AFSC/RACE Division trawl surveys. 302 p.

that readers can definitively confirm specimen identification. For most species, we provide photographs of specimens on deck (shortly after collection) or archived specimens and photographs of specimens in situ. The former will be most useful to fisheries observers and fishers to identify specimens on fishing and survey vessel decks shortly after collection. The latter will be useful to scientists attempting to identify and quantify sponge fauna in situ, with submersibles and remotely operated cameras. We provide the known zoogeographic range and information about the physical habitat and oceanographic habitat (i.e., temperature and salinity), if available (Koltun, 1959), of each species both within Alaskan waters and throughout its known range. Finally, we include for each species special remarks with regard to taxonomic history, biology, and ecology.

We used the following literature to construct the species lists and determine the zoogeography and other published information for each species: Austin (1985), Blake and Lissner (1994), Boury-Esnault and Rützler (1997), Brøndsted (1993), Burton (1934), Dickinson (1945), Hooper and Van Soest (2002), Koltun (1958, 1959, 1970), Lamb and Hanby (2005), Lambe (1900), Laubenfels (1953), Sim and Kim (1988), Van Soest et al. (2008), and de Weerdt (1986a, 1986b).

Appendix I provides a current and comprehensive taxonomic list of all sponges now known to occur in the deep waters (>80 m) of Alaska. Appendix II provides a ranking for all the species included in this guide in terms of their importance as fish habitat and vulnerability to disturbance from fishing activities. The average score for these two factors is used to prioritize species for monitoring as bycatch in commercial fisheries and stock assessment surveys. Appendix III includes a glossary of terms commonly used in the species descriptions. The terminology used in the section on skeletal structure is not included in Appendix III. We refer the reader to the Thesaurus of Sponge Morphology (Boury-Esnault and Rützler, 1997) for a comprehensive glossary of skeletal structure terminology. Appendix IV includes scanning electron microscopy (SEM) images of spicules from select calcareous, hexactinellid, and demosponges found in Alaskan waters. The purpose of Appendix IV is to provide readers with a representative collection of spicule images so that they may gain an understanding of the terms used in the guide and an appreciation for the variation between species and among spicule types. This collection also serves as a source of reference material for those who wish to microscopically examine sponges.

Zoogeography of sponges

All three major groups of sponges—Class Calcarea (calcareous sponges), Class Hexactinellida (hexactinellid or glass sponges), and Class Demospongiae (demosponges)—are well represented in Alaska. Only 12 (6.1%) of the 196 species of sponges now known from Alaskan waters are calcareous sponges. They have skeletons composed entirely of calcium carbonate laid down as calcite and are consequently one of the faunal groups at high risk from increased acidification of North Pacific Ocean waters. They are principally found in shallow water and are very rare at depths below 250 m.

Glass sponges are represented by 52 species (26.5% of the total) in Alaskan waters. Glass sponges have a siliceous skeleton consisting of spicules with a hexactinal or 6-rayed pattern. They are generally more abundant in deeper water but have a very broad depth distribution in Alaska, ranging from 20 m in the fjords of Southeast Alaska to more than 2800 m on the Aleutian Island slope. Hexactinellid sponges are common throughout Alaska but form different habitats depending on geographical region. In the deeper slope habitats of the Aleutian Islands, we have observed large debris fields comprised mainly of glass sponge skeletons that provide attachment substrate for other invertebrates, including gorgonians and hydrocorals. In the Gulf of Alaska, glass sponges are generally solitary but do form low-diversity dense patches in areas of exposed hard substrate (Stone, unpubl. data, 2005). In southern Southeast Alaska, in Portland Canal along the border of Alaska and British Columbia, we have found small sponge reefs, similar in species composition to, but much smaller in size than, the massive bioherms reported farther south in British Columbia (Conway et al., 1991, 2001, 2005; Krautter et al., 2001). Small patches of hexactinellid reef, believed to be biohermal, have also been observed in northern Southeast Alaska near Juneau, possibly indicating that these structures are more common than originally hypothesized and may extend up through the inside waters of the Alexander Archipelago in areas where favorable conditions exist for reef formation.

Demosponges are by far the dominant group of sponges in Alaskan waters, with 132 documented species. Demosponges also have a siliceous skeleton but the spicules are not hexactinal in pattern and the skeleton may be replaced or largely supplemented with an organic collagenous network of spongin. They are found throughout Alaskan waters and over a very broad depth range (intertidal to more than 2800 m). High diversity sponge "gardens" recently discovered in the Aleutian Islands (Fig. 1) are dominated by demosponges but also include some hexactinellid and calcareous sponges.

A few deep-water sponges (e.g., *Guitarra fimbriata*, *Halichondria sitiens*, and *Hymeniacidon assimilis*) are cosmopolitan in distribution (Dickinson, 1945), but recent research indicates that the occurrence of sibling species worldwide might also be common. Deep-water sponges are found throughout Alaska and have been reported

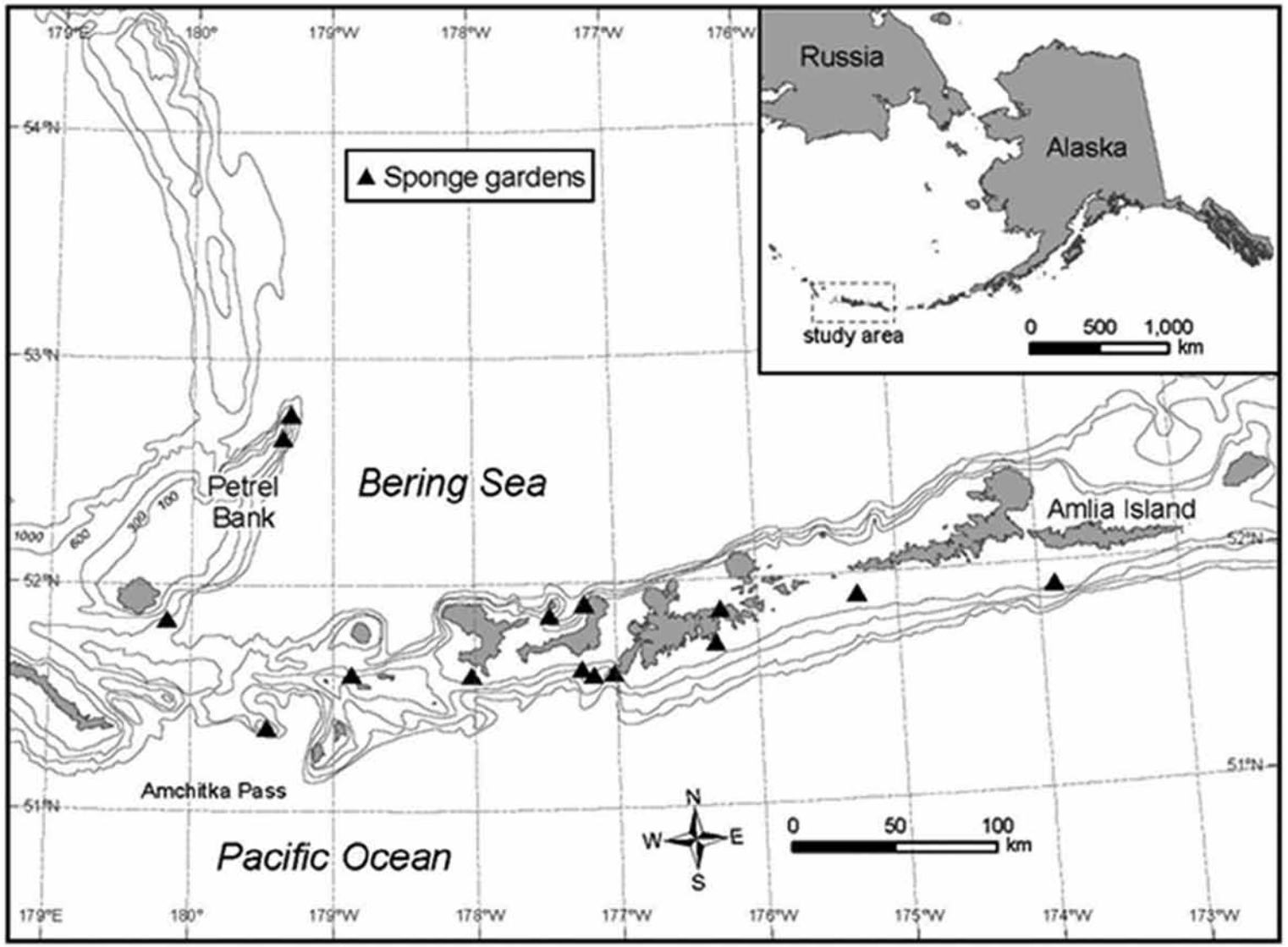


Figure 1

A study area in the central Aleutian Islands showing 15 sites where sponge gardens have been observed. Sponge gardens are areas of high species diversity and abundance and were located from detailed analysis of video footage collected with the *Delta* submersible in 2002–04 and and ROV *Jason II* in 2004. Depth contours are in meters.

as far north as the Beaufort Sea (de Laubenfels, 1953). Sponges inhabit a broad depth range and occur from the intertidal zone to the deep-ocean trenches. About 24% (30 of 125 species) of the sponges known from the Aleutian Islands appear to be endemic to the region.

Deep-water sponges, like deep-water corals, are exceptionally abundant and diverse in the Aleutian Islands (Stone, 2006) and not surprisingly, since both faunal groups have similar habitat requirements. Both groups require stable water currents for feeding and other metabolic processes and most require hard, exposed substrate for attachment. The geology and oceanography of the Aleutian Island Archipelago provide unique conditions to fulfill both requirements. The Archipelago contains more than 300 islands and extends over 1900 km from the Alaska Peninsula to the Kamchatka Peninsula in Russia. The Archipelago is supported by the Aleutian Ridge that forms a semi-porous boundary between the deep North Pacific Ocean to the south and the shallower Bering Sea in the north. The Aleutian Ridge is a volcanic arc, with more than 20 active volcanoes and frequent earthquake activity that was formed along zones of convergence between the North American Plate and other oceanic plates (Vallier et al., 1994). The island arc shelf is very narrow in the Aleutian Islands and drops precipitously on the Pacific side to depths greater than 6000 m in some areas, such as the Aleutian Trench. Deep water flowing northward in the Pacific Ocean encounters the Aleutian Trench where it is forced up onto the Aleutian Ridge and into the Bering Sea through the many island passes (Johnson, 2003). Additionally, coastal water from the Alaska Stream enters through Unimak Pass in the eastern Aleutians and slowly flows northeastward along the Alaska Peninsula. The Aleutian North Slope Current flows eastward on the north side of the Aleutian Islands towards the inner continental shelf of the Bering Sea. This is a swift current and the steep continental slope forces much of the flow into the northwest-flowing Bering Slope Current (Johnson, 2003).

The collections made by Lambe (1900), de Laubenfels (1953), and Koltun (1958, 1959) provide a firm basis to closely examine the zoography of sponges from the region. The sponge fauna of the Aleutian Island Archipelago has strong taxonomic affinities with the sponge fauna of the Sea of Okhotsk (30% of species in common), seas of the Arctic Ocean (22% of species in common), the eastern (18% of species in common) and western Bering Sea (10% of species in common), and the Sea of Japan (17% of species in common). By comparison, only 12% of the sponge fauna from the Gulf of Alaska is common with that of the Aleutian Islands. This zoogeographic pattern has undoubtedly been influenced to some degree by historical sampling effort, but the taxonomic affinities of the Aleutian Island sponge fauna are clearly much greater with the sponge fauna to the west and north than they are with the eastern fauna. Burton (1934) suggested that earlier work by both Lambe and de Laubenfels indicated that the Arctic influence was apparent as far south as Vancouver Island.

Several species are known from areas immediately adjacent to the Aleutian Island Archipelago and, although not yet reported from the region, likely occur there based on geographical proximity. These include species from the eastern Bering Sea (e.g., *Aaptos kanuux*) and the Commander Islands (Russia) in the western Bering Sea (e.g., *Grantia monstruosa*, *Polymastia laganoides*, *Asbestopluma gracilis*, and *Axinella hispida*).

Biology of sponges

Basic diagrams of sponge morphology, spicule types and skeletal structures, and a comprehensive glossary of terminology are available in the Thesaurus of Sponge Morphology by Boury-Esnault and Rützler (1997) and can be accessed via the World Porifera Database (Van Soest et al., 2008).[2]

Sponges are a primitive group of metazoans. They are sedentary animals, but a few species (e.g., *Craniella* spp.) may be free-living (unattached) during part of their life cycle (Lehnert and Stone, 2011). The dominant feature of the typical sponge body plan is the aquiferous system through which massive amounts of water are pumped (e.g., some large sponges are capable of filtering their own volume of water every 20 seconds). Water flow is unidirectional and maintained by flagellated cells (choanocytes) that are usually contained within chambers where oxygen and food particles are taken up by various cell types. Water flows in through inhalent pores or ostia and out through one or more larger exhalent openings or oscula. The oscula may open into a large cavity called an atrium or spongocoel (i.e., the large opening in tube- or vase-shaped sponges).

The sponge body consists of two distinct regions: the outer region (ectosome) and the central or inner region (choanosome) where the choanocyte chambers are located. Each region typically has distinct skeletal structures with a diagnostic complement of spicules. Spicules are grouped into two main categories: megascleres and microscleres. Megascleres are typically larger and provide the primary skeletal support. Microscleres are smaller (i.e., a microscope is required to see them) and generally function as packing and reinforcing

[2] The database can be found online at http://www.marinespecies.org/porifera/. Click on "Sources"; type "Boury-Esnault" in "Sourcename"; type "publication" in "Sourcetype"; check the box to "Limit to sources with full text"; and click on "Search" in lower right corner.

structures. Many sponge cells are highly mobile and can move freely within the extracellular matrix. Some cells are also extremely pluripotent (i.e., capable of differentiating into other cell types) and sponges are capable of easily remodeling cell-cell junctions. These features probably allow sponges to adapt to diverse and extreme habitats and are largely responsible for the extreme phenotypic plasticity displayed by some sponges that makes identification from photographs alone so problematic.

Sponges are generally nonselective filter feeders, feeding principally on bacteria, fungi, diatoms, dinoflagellates, and detritus (Bergquist, 1978; Pile et al., 1996). A recent study, however, has shown that some hexactinellid species do exhibit size independent selective filtration of ultraplankton (Yahel et al., 2006). Carnivorous sponges were recently discovered that lack an aquiferous system altogether and possess structures modified to ensnare and capture larger prey such as zooplankton (Vacelet and Boury-Esnault, 1995; Watling, 2007). Carnivorous species in Alaska are deep-water inhabitants and include *Cladorhiza corona* (Lehnert et al., 2005), *Cladorhiza bathycrinoides*, *Chondrocladia concrescens*, and possibly *Abestopluma ramosa*.

Few studies have been conducted on the growth rate and longevity of sponges, particularly those found in deep-water habitats and high-latitude ecosystems. No studies have been conducted on the growth of sponges in Alaska. In general, the growth rate of temperate-water sponges appears to be seasonal and relatively slow, occurring at rates comparable to those of deep-water corals (Ayling, 1983; Thomassen and Riisgård, 1995; Fallon et al., 2010). Studies on the hexactinellid sponge *Acanthascus* (*Rhabdocalyptus*) *dawsoni* in British Columbia indicate a growth rate of 1.98 cm/yr and a life span of more than 200 years (Leys and Lauzon, 1998). Studies on the hexactinellid sponge *Aphrocallistes vastus* in British Columbia indicate that it may grow considerably faster (10 cm/yr) but still live in excess of a century (Austin et al., 2007). We hypothesize that growth rates for sponges in Alaska are similar to those for British Columbia sponges but note that growth studies, particularly on demosponges, should be a high research priority in Alaska so that recovery rates from disturbance for sponge habitats can be estimated.

Deep-water sponges in the Aleutian Islands appear to have few predators. We have observed blood stars (*Henricia* spp.) displaying a typical feeding posture on several demosponges (e.g., *Artemisina* sp., *Monanchora pulchra*, *Semisuberites cribrosa*, and *Haliclona* sp.) at shallower depths (80 to 300 m). An earlier interpretation of this behavior, however, was that the sea stars were simply taking advantage of the sponges' feeding currents (Anderson, 1960). *Henricia* were generally accepted as suspension feeders (Anderson, 1960), but our additional observation of large numbers of these sea stars present on dead sponges and decaying sponge fragments in debris "windrows" further implicate predation (or scavenging). In deeper water *Hippasteria* spp. sea stars appear to prey on several species of sponges. In the eastern Gulf of Alaska several sea stars (*Hippasteria* spp., *Henricia longispina*, and *Poraniopsis inflata*) prey on glass sponges (including *Acanthascus dawsoni dawsoni*, *A. solidus*, *Aphrocallistes vastus*, and *Heterchone calyx*) and several sea stars (*Hippasteria* spp., *H. longispina*, *P. inflata*, *Pteraster tesselatus*, and *Ceramaster patagonicus*) prey on demosponges (including *Poecillastra tenuilaminaris*, *Halichondria* sp., and *Mycale loveni*). The incidence of predation on deep-water sponges in Alaska, however, appears to be relatively low and limited to only a few species of sea stars.

Advances are now being made in the study of the reproductive biology of sponges, but our current knowledge is based on studies of a small fraction of the species described to date worldwide; none from Alaska (Maldonado and Berquist, 2002). Sponges display highly diverse mechanisms of embryogenesis, larval differentiation, and reproduction that include both sexual and asexual processes (Berquist, 1978; Leys and Ereskovsky, 2006; Ereskovsky, 2010). Sexes are either temporarily or permanently separate and some species are hermaphroditic (Blake and Lissner, 1994). Many species are capable of regenerating viable adults from fragments, and additional asexual processes include the formation of gemmules and reduction bodies, budding, and possibly formation of asexual larvae (Maldonado and Berquist, 2002). Some species are oviparous while others are viviparous and brood larvae. Release of propagules (gametes, zygotes, or early embryos) is highly synchronous in oviparous species, but asynchronous in viviparous species that release fully brooded flagellated larvae (Maldonado and Berquist, 2002). Several species of Geodiidae are gonochoristic and oviparous and this is assumed to be the general condition for the family (Cárdenas et al., 2009). Some species are viviparous, such as *Stylocordyla,* which has the added peculiarity that larvae are retained alive in the body until they have fully developed (Bergquist, 1972). Gemmules, reproductive structures that can survive adverse conditions such as desiccation or extreme cold, are not typically produced by marine sponges. Their common occurrence in hermit crab sponges may represent an adaptation to help counter the consequences of stranding on shore.

Many sessile marine fauna, including sponges, have evolved the ability to produce or accumulate from associated microorganisms a diversity of unique chemical compounds or secondary metabolites that they utilize in predator defense, competition for resources, and as physiological adaptations to living in extreme environments (Haefner, 2003). More than 12,000 novel

compounds have been isolated from sessile marine invertebrates, algae, and microorganisms worldwide (Faulkner, 2002). Many of the compounds are currently in early clinical or late preclinical development for use as treatments for cancer, tuberculosis, HIV, asthma, and many other diseases and ailments (Newman and Cragg, 2004). Deep-water sponges show particular promise in this emerging research area, and several species collected from the Aleutian Islands as part of a pilot program in 2004 exhibited near 100% inhibition during primary screening for *M. tuberculosis* (Hamann[3]). Only a handful of sponge species from the Aleutian Islands have been examined for the presence of secondary metabolites (e.g., Na et al., 2010), but so far "hit rates" for biomedically active compounds are on the order of 10%, rather than 1% which is typical for samples collected elsewhere (Hamann[3]).

Ecology of sponges

Importance as fish habitat

Deep-water sponges provide important habitat to many species of fish and invertebrates, mostly as a source of refuge from predation and adverse conditions (e.g., strong currents) and as focal sites for foraging on prey species that aggregate in sponge habitat. Some fish use sponges (e.g., *Aphrocallistes vastus* and *Acanthascus dawsoni dawsoni*) as spawning substrate (Busby[4]) and others likely use sponge habitat as breeding sites. In Alaska, many commercial and non-commercial fisheries species are associated with deep-water sponges. Most associations are believed to be facultative rather than obligatory. Sponges provide important refuge habitat for juvenile rockfish (*Sebastes* spp.) in the Gulf of Alaska (Freese and Wing, 2003) and juvenile golden king crabs (*Lithodes aequispina*) in the central Aleutian Islands (Stone, 2006). Sponges also contribute to the biodiversity of deep-water habitats by providing spawning substrate for many species that are important trophic links to larger consumers (Fiore and Jutte, 2010).

Deep-water sponges are really no different than deep-water corals in the degree to which they provide structure; it depends on their maximum size, growth form, abundance, intraspecific fine-scale distribution (i.e., patch size and density), and interaction with other structure-forming invertebrates. In general, large arborescent species (e.g., *Axinella blanca*) and those with vase-like or barrel-like morphologies (e.g., *Acanthascus dawsoni dawsoni* and *Mycale loveni*) provide much surface area and consequently refuge space. Large sponges such as *Mycale loveni* have high value as fish habitat due to their size (up to 1 m high and wide) and abundance (up to 11 sponges per m^2 in the eastern Gulf of Alaska). Adult sharpchin rockfish (*Sebastes zacentrus*) and juvenile *Sebastes* spp. frequently use the cone-shaped sponges as perches in the eastern Gulf of Alaska. Smaller sponges at high densities may also provide important habitat. For example, finger sponges (*Axinella rugosa*) are small (maximum dimensions only 2 cm wide by 17 cm high), but are used as perches by juvenile rockfish (*Sebastes* spp.) when present at high densities (up to 63 individuals per m^2) in steep bedrock habitats (Stone, unpubl. data, 2005). Species such as *Artemisina stipitata* have several attributes that make them important as fish habitat, including large size, tendency to occur in dense patches (contagious distribution), and interaction with other emergent epifauna. Encrusting species such as *Plakina tanaga*, *P. atka*, and *Bubaris vermiculata* have little value as fish habitat. The degree to which sponges provide fish habitat also depends greatly on their depth distribution relative to that of shelter-seeking fishes. In the Aleutian Islands, for example, sponges found at depths greater than about 1200 m are less important as refuge habitat because most of the fish species at those depths appear to be less structure-oriented.

In general, calcareous sponges are not of sufficient size or adequately abundant to provide important fish habitat. *Leucandra tuba* may be important for juvenile fish that use the easily accessible cavernous interior of this species to escape from larger predators. In contrast, demosponges are often quite large and form dense "gardens" in some areas of the Aleutian Islands (Fig. 1). Hexactinellid sponges are extremely important as fish habitat. Their skeletons are persistent after death and consequently provide the framework for the building of reefs or bioherms. Intact skeletons, and to some degree detached and fragmented skeletons, also provide attachment substrate for other sedentary structure-providing fauna, including hydrocorals, octocorals, and demosponges (Stone, unpubl. data, 2004).

Vulnerability to disturbance

Bycatch observations in the Aleutian Islands and other regions of Alaska clearly support our submersible observations, indicating that sponges are far more abundant than corals in deep-water habitats. Sponges, particularly demosponges, appear to be the most abundant emergent epifauna in the Aleutian Islands. Approximately 352 metric tons (t) of sponges are removed from the seafloor by commercial fishing in the Aleutian Islands and

[3] Hamann, M. 2009. Personal commun. Unpubl. data. University of Mississippi, P.O. Box 1848, University, MS 38677.

[4] Busby, M. 2010. Personal commun. Alaska Fisheries Science Center, NOAA, NMFS, 7600 Sand Point Way N.E., Seattle, WA 98115.

Bering Sea each year – more than four times the weight of corals landed there as fisheries bycatch (NMFS[5]).

All emergent epifauna are susceptible to disturbance from fishing gear (Stone, 2006) and most species of deep-water sponges are to some degree vulnerable to disturbance (also see Hogg et al., 2010, for a recent review). Fishing operations affect the seafloor from depths of 27 m to about 1200 m in the Aleutian Islands, with most effort at depths shallower than 200 m (Stone, 2006). The degree to which a particular gear type affects sponge habitat depends on its configuration (i.e., physical area of contact), operation (i.e., physical forces on the seafloor), spatial and temporal intensity of operation, seafloor bathymetry and substratum type, and the resiliency of sponges to disturbance. Both direct and indirect effects from fishing activities on sponges likely occur. Direct effects include removal as bycatch, damage caused by physical contact, or detachment from the seafloor and translocation to unsuitable habitat. Indirect effects include increased vulnerability to predation, especially for sponges detached from the seafloor, and habitat alteration. Furthermore, there is some evidence that reproduction is suppressed in damaged shallow-water scleractinian corals due to a reallocation of energy reserves to tissue repair and regeneration (Wahle, 1983), and similar effects may occur in sponges.

Most of the factors that control the degree to which sponges provide habitat structure are the same factors that control the degree to which they are vulnerable to disturbance. For example, large species with arborescent growth forms are more likely to be contacted by passing fishing gear. Species such as *Plakina tanaga* have low vulnerability to disturbance due to their encrusting habitus and absence in areas where bottom trawling is known to occur. Some species such as *Poecillastra tenuilaminaris* are highly vulnerable to disturbance due to their large size and high relative abundance. *Artemisina stipitata* is moderately vulnerable to disturbance due to its large size, erect form, and presence in areas where bottom trawling and longline fishing are known to occur. Some sponges, for example those with holdfast structures rather than root-like attachment systems, may be more vulnerable to detachment, and it is unknown if intact but otherwise undamaged sponges detached from the substrate (e.g., roller sponges; Reiswig, unpubl. data, 2010) can survive.

The recovery rate of disturbed benthic ecosystems in Alaskan waters is of keen interest to fisheries managers but is still little more than conjecture due to limited knowledge of species distribution and basic life history processes. Rates of recovery will depend on growth rates and rates of sexual and asexual reproduction or speed of regeneration, which are unknown for most species. Two key components of ecosystem persistence are resistance (i.e., the ability to resist changes from disturbance) and resiliency (i.e., the ability to absorb changes and the speed with which it returns to its original condition) (Holling, 1973). In the case of sponges, resistance to disturbance depends largely on their physical size, morphology, and distribution relative to the disturbance. We know from studies in the Aleutian Islands and Gulf of Alaska that benthic emergent epifauna, especially sponges, have low resistance to fishing gear disturbance (Freese et al., 1999; Stone, 2006; Heifetz et al., 2009; Stone, unpubl. data, 2004–2005). We know little about the resiliency of emergent epifauna, however.

Resiliency depends on several factors, including growth rate, recruitment rate, and reproductive ecology. Like deep-water corals, sponges have life history attributes such as slow growth rates and high longevity (Dayton, 1979), indicating that long periods of time would be necessary for habitats dominated by sponges to recover from disturbance (Freese, 2001). Growth rates for deep-water sponges are generally slow (see above) and therefore inherently difficult to study. Reference sites, such as undersea cables that provide a known time-line for recruitment and subsequent growth, show promise in studies of sponge habitat recovery (Levings and McDaniel, 1974) but have not yet been identified or targeted for such study in Alaska. The only known study to address the recovery dynamics of sponges in Alaska reported no visually detectable growth or regeneration one year post-disturbance with a bottom trawl (Freese, 2001). Due to the opportunistic nature of that study (observations were subjective, not quantifiable; not repeatable since specimens were not georeferenced; and made in an area subjected to high background disturbance), the findings are questioned. Contrastingly, a study conducted off the southeastern coast of the U.S. indicated that some sponges were capable of recovering completely within one year from damage caused by a research trawl (Van Dolah et al., 1987).

Monitoring bycatch of sponges

Appendix II provides a list of all sponges for which we have provided species descriptions in this guide. For each species, the importance as fish habitat and the vulnerability to disturbance from fishing activities is ranked from low (1) to high (3). Ranks for the two measures are averaged to provide a score. We recommend that species with scores greater than 2.0 be considered a

[5] National Marine Fisheries Service. 2004. Final programmatic supplemental groundfish environmental impact statement for Alaska groundfish fisheries. Alaska Region, NOAA, NMFS, P.O. Box 21668, Juneau, AK 99802-1668.

high priority for monitoring as bycatch in commercial fisheries and stock assessment surveys and that species lists used to record bycatch in fisheries and stock assessment surveys be appropriately updated to include these taxa. Subsequent mapping of these taxa should be undertaken in an effort to identify the location of vulnerable marine ecosystems. The actual or estimated weight of sponge bycatch should also be recorded since it is also a valuable indicator of rich sponge habitat.

Collection and preservation of sponge specimens

The collection protocols outlined by Etnoyer et al. (2006) for deep-water corals are generally appropriate for the collection of deep-water sponges. Shortly after collection, specimens should be photographed with an appropriate scale and the following information should be recorded: 1) growth form, 2) general surface information (roughness, presence, and description of oscula), 3) consistency, 4) size (dimensions), and 5) color. Color should preferably be recorded immediately after collection since the color of some specimens may change shortly after removal from seawater and exposure to ambient light. Observations made in situ should pay particular attention to the presence and description of oscula, color, type of attachment (i.e., holdfast or root-like system), substrate type, the presence of associated fauna, and if collected, whether the specimen appears to be whole or only a fragment of the whole specimen. The specimen should be photographed or recorded on video prior to collection. Collection data should be written with pencil on waterproof paper that will be packaged with the specimen, and include date, location of collection (station number and GPS coordinates), name of collector, cruise number or vessel name, depth of collection, and gear type. Sponge specimens may be frozen (preferably at temperatures below –10°C) or stored in an 80–90% ethanol solution. Demosponges and hexactinellid sponges (but never calcareous sponges) to be used for histological purposes may be fixed in a buffered 5% formaldehyde solution for 24 hours prior to storage in ethanol solution. Specimens to be used for biomedical research or molecular genetic analyses should preferably be frozen to –10°C or colder unless they will be processed otherwise immediately. For museum archiving, specimens should preferably be stored in an 80–90% ethanol solution. Very large specimens may be dried but a fragment of the specimen should be stored in ethanol solution.

Laboratory identification of sponge specimens

Calcareous sponges and demosponges

For light microscopy and scanning electron microscopy (SEM) investigations of the spicules, small fragments of sponges (containing both ectosome and choanosome) are boiled in nitric acid or hypochlorite, and in several steps the spicules are sequentially transferred through distilled water to 95% ethanol with the aid of a centrifuge (Rützler, 1978; Lehnert and Van Soest, 1998). For light microscopy, small drops of the spicule-ethanol suspension are transferred onto glass slides and, after evaporation of the ethanol, embedded in Canada balsam. Semi-thin sections obtained with a razor blade are also embedded in balsam. For SEM studies, the spicule-ethanol suspension is transferred directly onto stubs and coated with gold-palladium after ethanol evaporation (Lehnert and Van Soest, 1998). Finally, data of spicule types and their dimensions are compared to the literature descriptions to assign the specimens to their proper genus and species.

Hexactinellid sponges

Individual specimens are first triaged to assign them to order and family by making temporary microscope preparations of surface spicules with commercial bleach. Specimens are then processed by family groups. Permanent picks or peels of surface spicules are mounted in Canada balsam and pieces (about 1 cm diameter) of body wall are digested in hot nitric acid to obtain a suspension of cleaned spicules. Smaller spicules are filtered onto 0.2 µm pore-size membrane filters and mounted in Canada balsam for microscopic examination. Very large spicules are picked from the suspension with forceps, cleaned, and mounted in balsam. Remaining medium-size spicules are washed, spread on slides, and mounted in balsam. Samples of individual spicule types are photographed by digital camera and, when necessary, dimensions (e.g., length, diameter) are measured by digitizer-interfaced microscopy. Data of spicule types and their dimensions are finally compared to the literature descriptions to assign the specimens to their proper genus and species.

CLASS CALCAREA

1. *Clathrina* sp.

Description. Conical tubes have thin walls laid in folds. Viewed with a hand-lens, the walls consist of a mesh of tissue with many open inhalant pores, round to oval, 300–600 µm in diameter. The osculum at the top of the cone has no spicule crown. Consistency is soft and elastic. Height of cones is to 3–5 cm; several basally fused cones may cover larger areas. Color in life is creamy white to pale yellow.

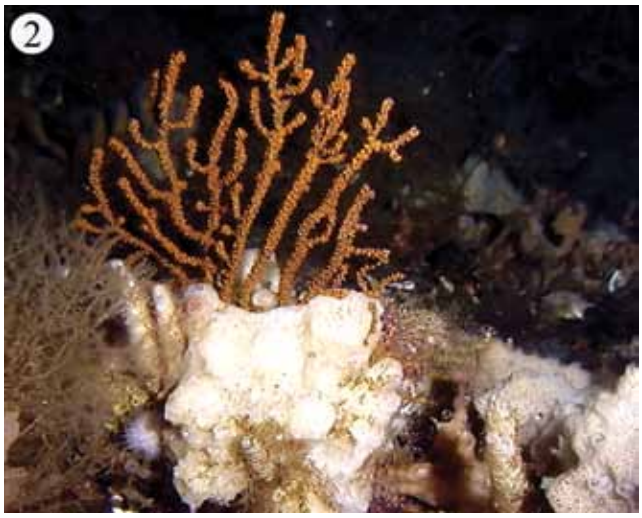
Skeletal structure. Triactines are arranged tangentially; large triactines (50–150 × 7–10 µm/ray), small triactines (20–30 × 3–6 µm/ray).

Zoogeographic distribution. Cosmopolitan. In Alaska – central Aleutian Islands. Elsewhere – the genus *Clathrina* presently contains 87 nominal species and has a worldwide distribution.

Habitat. In Alaska – sometimes grows around and partially encrusts the gorgonian *Muriceides nigra* at depths near 119 m.

Remarks. The genus *Clathrina* was erected by Gray (1867) and is in desperate need of revision at the species level.

Photos. Fragment of *Clathrina* sp. collected in the central Aleutian Islands at a depth of 119 m. Grid marks are 1 cm^2. 2) The same specimen as in photo 1 (center) in situ encrusting the gorgonian *Muriceides nigra*.



2. *Leucandra poculiformis* Hozawa, 1918

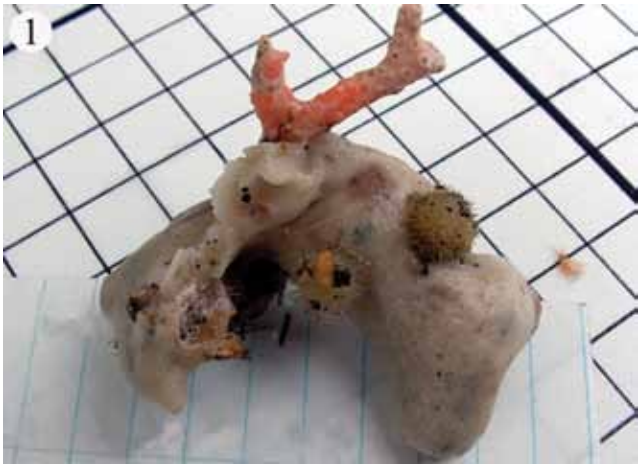
Description. Sponge is thickly encrusting. The surface is smooth to the unaided eye but rough to the touch due to large protruding spicules. Consistency is stiff, slightly compressible, and elastic. Individuals may reach a size of approximately 6 × 2 × 1 cm. Color in life is white to creamy white.

Skeletal structure. SEM images of spicules are shown in Appendix IV. There are large triactines (50–170 × 5–15 µm/ray) and occasionally tetractines of the same dimensions. Small oxeas (60–85 × 3–6 µm) have unequal ends, most with a characteristic bend near one end. Small oxeas are only at the surface of inner and outer walls, equiangular and sagittal triactines are in-between. Outer surfaces are covered by a mesh of small diactines, mesh-size approximately 25 µm in diameter; tracts form the mesh 20–40 µm in diameter.

Zoogeographic distribution. Rare. In Alaska – central Aleutian Islands. Elsewhere – previously known only from the Sea of Japan.

Habitat. Grows around and encrusts *Stylaster* hydrocorals at depths near 175 m. Species of *Craniella* may be attached to it (see photo 1).

Photos. 1) Whole specimen collected at a depth of 175 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) The same specimen as in photo 1 in situ encrusting a *Stylaster* hydrocoral.



3. *Leucandra tuba* Hozawa, 1918

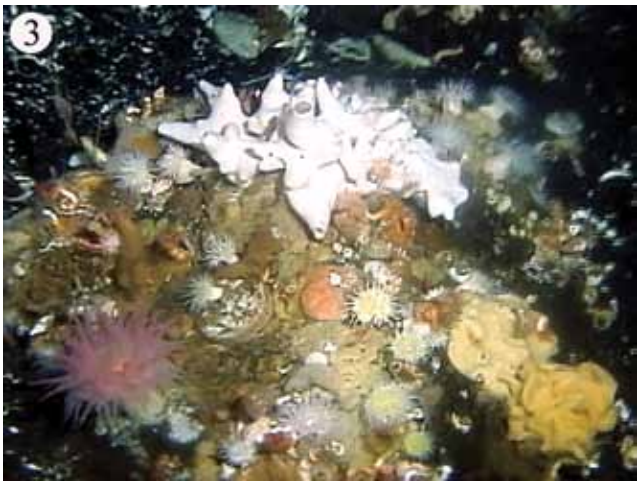
Description. Sponge has thin-walled (0.5 mm) tubes. Up to 17 individual tubes surround large internal areas. Surface is smooth to the unaided eye, irregularly undulating (i.e., wavy or sinuous) oxeas, and rough to the touch due to large protruding spicules. Walls are compressible and only slightly elastic. Diameter is to 30 cm. Color in life is light grey to creamy white.

Skeletal structure. SEM images of spicules are shown in Appendix IV. Walls consist of giant tri- and tetractines (200–1200 × 20–100 µm/ray), one ray usually shorter than the others. Irregularly distributed and undulating oxeas (95–140 × 3–5 µm) are very abundant and are scattered in between the giant tri- and tetractines without obvious orientation. Ectosomal areas with inhalant pores have an outer layer of special spicules called pugioles (18–35 µm long) which form meshes, leaving open pores of about 50 µm diameter, with pugiole-tracts of approximately 25 µm in diameter. The mesh of the pugioles is underlain by a mesh of microdiactines of the same dimensions.

Zoogeographic distribution. Locally common. In Alaska – Aleutian Islands and Bering Sea canyons. Elsewhere – previously known only from the Sea of Japan.

Habitat. In the Aleutians Islands – depths between 112 and 250 m on exposed bedrock, boulders, cobbles, and pebbles in generally low-relief (i.e., flat-bottomed) habitats. In the Bering Sea – known from Pribilof Canyon at depths between 203 to 220 m on pebbles and cobbles. Elsewhere – the holotype was described from the Sea of Japan near Okinoshima and collected at a depth of 106 m.

Photos. 1) Whole specimen collected at a depth of 145 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) The same specimen as in photo 1 in situ. 3) Specimen (center, top) at a depth of 120 m in the central Aleutian Islands.



CLASS HEXACTINELLIDA

4. *Farrea kurilensis* ssp. nov. Reiswig and Stone, in preparation

Description. Lace-like mass has large-caliber (2-cm diameter), short, branching, and anastomosing tubes increasing in size (of the mass) by lateral growth, conforming, and attaching at multiple sites to the hard substrate and not growing erect. Surface of the mass is labyrinthic, but that of individual tube elements is smooth. Open terminal ends of tubes are effectively oscula. Consistency is flexible but brittle due to fusion of the very thin primary skeleton. Individuals observed in situ have a diameter of 170 cm. Color in life is translucent light blue to white.

Skeletal structure. The primary framework is a fused farreoid lattice of hexactins forming a network of square meshes with sides 439–750 µm long; it is continuous throughout the specimen. Loose megascleres include dermal and atrial pentactins, often with knobs or very short distal rays (170–375 µm tangential ray length, 211–422 µm proximal ray length); very large anchorate clavules with completely smooth shafts (302–1243 µm length); moderate-sized uncinates (1.03–2.99 mm length); very rare choanosomal hexactins (208–239 µm ray length). Microscleres consist of two size classes of stellate discohexasters (30–89 µm and 91–293 µm in diameter).

Zoogeographic distribution. Locally common and abundant in some areas. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to bedrock, mudstone, boulders, cobbles, and hexactinellid sponge skeletons at depths between 300 and 2249 m.

Remarks. *Farrea kurilensis* presently has two subspecies: *F. k. kurilensis,* which occurs near the Kuril Islands and in the Sea of Okhotsk, has smooth pileate clavules, while *F. k. beringiana,* which also occurs near the Kuril Islands, has all clavules with spines. The new Aleutian subspecies differs from these in having anchorate clavules with smooth shafts and an alternate microsclere combination.

Photos. 1) Preserved (frozen then dried) fragment of a specimen collected at a depth of 2105 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) The same specimen as in photo 1 in situ.

5. *Farrea occa occa* Bowerbank, 1862

Description. Lace-like hemispheric mass has large-caliber (1.5 to 2-cm diameter), short, branching and anastomosing tubes increasing in size (of the mass) by lateral growth, attached to hard substrate at central origin and at multiple lateral contact sites. Surface of the mass is labyrinthic with open ends of tubes functioning as oscula, but external and internal surfaces of individual tube elements are smooth. Consistency is flexible but brittle and fragile due to breakage of the very thin fused primary skeleton. An individual mass from a single settled larva may reach 3 m in diameter and over 1 m in height. Color in life is translucent white to pale yellow.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The primary framework is a fused farreoid lattice of hexactins forming a network of square meshes with sides 79–494 µm long; it is continuous throughout the specimen. Loose megascleres include dermal and atrial pentactins (190–305 µm tangential ray length, 78–280 µm proximal ray length); pileate and anchorate clavules usually with smooth shafts, rarely with one or two large spines (196–308 µm length); moderate-sized uncinates (0.89–2.64 mm length). Microscleres are mainly oxyhexasters with relatively long primary rays (57–111 µm in diameter). There may be a very few discohexasters or onychohexasters.

Zoogeographic distribution. Locally common and abundant in some areas. In Alaska – eastern Gulf of Alaska. Elsewhere – cosmopolitan, but the previous known northern limit of the subspecies was 55.4°N in northern British Columbia; the new Alaska collections extend the northern limit to 58.2°N.

Habitat. In Alaska – attached to bedrock, boulder, and cobbles at depths between 91 and 238 m. Elsewhere – attached to cobbles, bedrock, shell, coral skeletons, and hexactinellid sponge skeletons at depths between 86 and 1360 m.

Remarks. This may be the largest species of sponge in the North Pacific Ocean, with a diameter reaching 3 m. This sponge provides much refuge habitat for small fish and micro-invertebrates that may be forage species for larger fish and crabs.

Photos. 1) Fragment of a specimen collected at a depth of 168 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 2) Specimen at a depth of 165 m in the eastern Gulf of Alaska.

6. *Farrea* sp. nov. Reiswig and Stone, in preparation

Description. Erect bush of small-caliber (8-mm diameter), relatively long, branching tubes increasing in size (of the entire specimen, not the tube elements) by terminal growth of the constituent tubes; attached to hard substrate at a small original base. Surface of the mass consists of the terminal tube apertures as oscula, but both inner and outer surfaces of individual tube elements are smooth. Consistency is stiff and brittle due to fusion of the thin primary skeleton. Size of the original specimen from which the fragments were collected was not recorded, but it must have been at least 10 cm tall. Color in life is white; preserved fragments are light brown.

Skeletal structure. The primary framework is a fused farreoid lattice of hexactins forming a network of rectangular meshes with longitudinal sides 269–720 µm long and lateral sides 534–778 µm long; it is continuous throughout the specimen. Loose megascleres include dermal and atrial pentactins, often with knobs as rudiments of the sixth distal rays (159–361 µm tangential ray length, 206–452 µm proximal ray length); pileate clavules without shaft thorns (333–490 µm length); moderate-size uncinates (1.02–2.98 mm length). Microscleres include oxyhexasters and hemioxyhexasters (62–117 µm in diameter); oxyhexactins (83–130 µm in diameter); discohexasters and hemidiscohexasters (48–76 µm in diameter); discohexactins (58–98 µm in diameter).

Zoogeographic distribution. In Alaska – a rare species, known only from a few locations in southern Amchitka Pass and near Bobrof Island in the central Aleutian Islands. Elsewhere – not reported.

Habitat. In Alaska – attached to small boulders, cobbles, and pebbles at depths between 529 and 905 m.

Remarks. Our Aleutian specimen was compared with the four other species of *Farrea* that lack anchorate clavules. It differs from each of them in its microsclere complement. Its description as a new species of *Farrea* is now in progress.

Photos. 1) Preserved (frozen then dried) fragments of a specimen collected at 887 m in the central Aleutian Islands. 2) The same specimen as in photo 1 (indicated by the white arrow) in situ. The separation between the red laser marks is 10 cm.

7. Family Euretidae; Genus nov., sp. nov. Reiswig and Stone, in preparation

Description. Tall, circular, rigid funnel is attached to hard substrate, with small hollow digitate processes projecting from all lateral surfaces. In life the lateral processes are closed distally by tissues and loose spicules, but the fused skeletal framework is open at the ends. The single large circular osculum at the distal end has a crenulate margin. All surfaces are smooth to the naked eye, but under low magnification they are seen to be ornamented with fine hairs of projecting uncinate spicules. Consistency is hard and rigid. Height is to 29.2 cm and diameter to 13.7 cm; lateral processes 6–12 mm in diameter and up to 24 mm long are distributed rather evenly without pattern and commonly divide into two or three short branches in larger specimens. Color in life is yellow-orange to light orange.

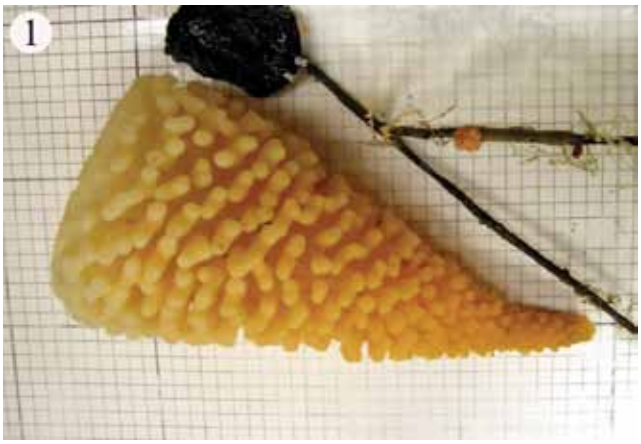
Skeletal structure. The primary rigid skeleton of fused hexactine spicules has elongate meshes with longitudinal strands and radial septa, similar to the primary framework of *Chonelasma*. That framework curves smoothly out into and continues through the digitate processes. Slight indications of irregular dermal and atrial cortices are present, but they are usually only one dictyonalium in thickness. There are several types of loose megascleres: pinular hexactins on inner and outer surfaces of wall and processes, with thorned pinulus (67–287 µm long); tangential rays spined at the tips (88–196 µm long); proximal ray (79–954 µm long); simple hexactins and pentactins in subatrial position of wall and processes (106–518 µm ray length); tauactins only in spicule pads at tips of processes (158–479 µm ray length); diactins in atrial surface of wall and processes (88–196 µm ray length); discoscopules on both surfaces of wall and processes (234–480 µm long); tyloscopules only echinating atrial surface of processes (619–952 µm long); uncinates echinating both surfaces of wall and processes (656–2785 µm long). Microscleres are mainly discohexactins (76%; 52–98 µm in diameter), moderately common oxyhexactins (20%; 34–94 µm in diameter), and few hemidiscohexasters (4%; 46–100 µm in diameter).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Occurs singly or in small patches on exposed bedrock, mudstone, boulders, and cobbles at depths between 773 and 2084 m.

Remarks. Juvenile Verrill's *Paralomis* crabs (*Paralomis verrilli*) use the spongocoel as refuge habitat (Stone, unpubl. data, 2004).

Photos. 1) Whole specimen collected at a depth of 1256 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.



8. *Tretodictyum* sp. nov. Reiswig and Stone, in preparation

Description. This sponge has a thin-walled flaring funnel or trumpet that attaches to hard substrate by a short narrow stalk ending in a small basal disc. The outer dermal surface is smooth with a thin transparent spicule lattice covering a system of radiating ridges (average 1.1 mm wide) and grooves (average 0.8 mm wide) visible to the naked eye. The internal atrial surface, also smooth, is thoroughly and evenly pocked by openings of small exhalant canals (average 1.5 mm diameter). Under low magnification all surfaces appear furry due to projecting ends of uncinate and scopule spicules. Consistency is stony hard but crumbly and quite brittle. Only a single partial specimen was collected and measured 25.4 cm tall by 20.6 cm wide at the margin; wall thickness was 5–6 mm. Color in life is white; specimens dried or preserved in ethanol are brownish orange.

Skeletal structure. The main skeleton is a rigid framework of fused hexactins with grooves and septa typical of the genus. Loose megascleres include rough pentactins to hexactins with short distal ray (19–164 µm long), tapered tangential rays (106–473 µm long), and proximal rays (94–896 µm long); small rough regular hexactins (84–177 µm long rays); scopules with rounded tine tips (294–965 µm total length); uncinates (437–1480 µm long). Microscleres are mostly oxyhexasters and hemioxyhexasters (93%) with 1–4 nearly smooth, robust terminal rays (53–73 µm diameter); stellate discohexasters (7%) with 4–10 finely rough terminal rays (50–75 µm diameter); a very few oxyhexactins (>1%) similar in size to oxyhexasters.

Zoogeographic distribution. Locally abundant. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Occurs singly on bedrock, mudstone, boulders, and cobbles at depths between 704 and 1264 m.

Photos. 1) Preserved (frozen) specimen collected at a depth of 866 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. The separation between the red laser marks is 10 cm.

9. *Aphrocallistes vastus* Schulze, 1886

Description. Basic form is a hollow, thin-walled cone, but larger, older specimens add lateral mitten-like outgrowths becoming highly variable; overall it is similar to *Heterochone calyx* with which it is often confused. Surface is smooth, usually with a single large terminal osculum. Consistency is rigid and brittle. Size is up to 2 m high and 3 m laterally. Color in life varies from white to light yellow and orange.

Skeletal structure. SEM images of spicules are shown in Appendix IV. Rigid skeleton of fused hexactinal spicules has distinctive honeycomb pattern of 1 mm wide channels. Several types of loose megascleres include dermal pinular hexactins with pinulus (109–185 µm long), tangential rays (38–142 µm long), proximal ray (53–232 µm long); small hexactins (85–201 µm/ray); scopules on both surfaces (262–497 µm long); atrial spiny diactins (262–722 µm long); uncinates (890–3440 µm long). Microscleres are oxyhexasters (126–252 µm in diameter) and two types of discohexasters (16–25 and 30–56 µm in diameter).

Zoogeographic distribution. North Pacific Ocean; locally common and abundant in some areas. Alaska – Bering Sea to Southeast Alaska. Elsewhere – Japan to Baja Mexico.

Habitat. Aleutian Islands – attached to cobbles and pebbles (low-relief habitat) and sometimes bedrock (high-relief habitat) at depths between about 100 and 756 m. Bering Sea – attached to cobbles and pebbles at depths between 373 and 522 m. Gulf of Alaska – principally on bedrock, but also boulders and cobbles on the continental shelf and upper slope at depths between 140 and at least 228 m. Observed in the glacial fiords of Southeast Alaska growing on bedrock at depths as shallow as 20 m. Elsewhere – Lamb and Hanby (2005) provide a worldwide depth range of 10 and 1600 m.

Remarks. This is one of the most ecologically important sponges in Alaska and perhaps the most thoroughly studied sponge species in the North Pacific Ocean. Due to its rigid skeleton, this species is an important structural component of the sponge reefs reported along the Pacific Coast of Canada (Conway et al., 1991, 2005; Krautter et al., 2001) and more recently in southern Southeast Alaska. Juvenile golden king crabs (*Lithodes aequispina*) use the spongocoel as refuge habitat in the Aleutian Islands (Stone, 2006) and in the Bering Sea Canyons (Stone, unpubl. data, 2007). The bigmouth sculpin (*Hemitripterus bolini*) deposits its eggs in the spongocoel in the Bering Sea and Gulf of Alaska (Busby[3]). This species is preyed upon by the sea stars *Hippasteria* spp. and *Poraniopsis inflata* in the eastern Gulf of Alaska. *Aphrocallistes vastus* can be distinguished from the very similar *Heterochone calyx calyx* by the lack of pinular hexactins on the inner (atrial) surface and by the possession of very robust oxyhexasters with primary rays subsumed in the swollen centrum.

Photos. 1) Specimen collected at a depth of 168 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 2) Specimen with a juvenile golden king crab (*Lithodes aequispina*) in pre-molt condition at a depth of 190 m in the central Aleutian Islands. 3) Specimen with a swarm of euphasiids at a depth of 170 m in the eastern Gulf of Alaska. Photo by J. Lincoln Freese (AFSC). 4) Specimen at a depth of 190 m in the central Aleutian Islands. 5) Specimen at a depth of 20 m with *Eualas* sp. shrimp in Glacier Bay National Park, Southeast Alaska.

9. *Aphrocallistes vastus* Schulze, 1886 (continued)

10. *Heterochone calyx calyx* Schulze, 1886

Description. This sponge is polymorphic and similar to *Aphrocallistes vastus,* with which it is often confused. Sponge is cup or funnel shaped, and is up to at least 30 cm in height and 40 cm in diameter. It forms bowls or plates in areas of low current. Lateral walls are often with hollow finger-shaped processes. Color is bright gold or pale yellow in the Aleutian Islands and Bering Sea. It displays two typical color morphs in the Gulf of Alaska – white and golden yellow.

Skeletal structure. It has a rigid skeleton of fused hexactinal spicules with a poorly delineated honeycomb pattern of 1 mm wide channels passing vertically through the walls. Several types of loose megascleres include pinular hexactins on inner and outer surfaces, with thorned pinulus (48–150 µm long), tangential rays spined at the tips (100–302 µm long), and proximal ray (69–1265 µm long); scopules on both surfaces (242–630 µm long); spined hexactins (80–204 µm/ray); uncinates (500–1540 × 14–54 µm); rough centrotylote diactins (308–786 µm/ray) are apparently absent in some specimens. Microscleres are discohexactins and discohexasters (44–100 µm in diameter) with 1–4 secondaries and terminal discs; oxyhexactins and oxyhexasters (53–100 µm in diameter).

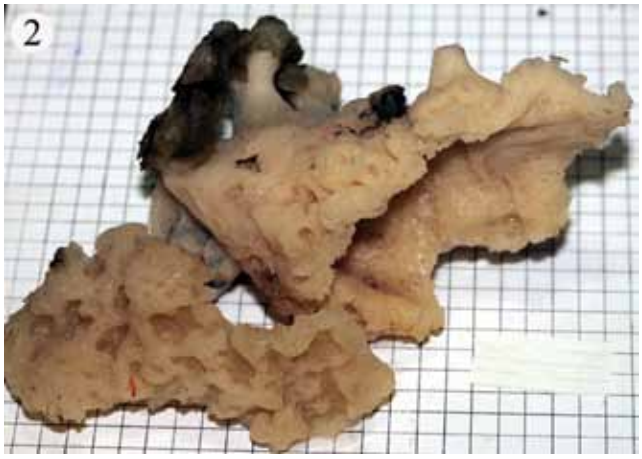
Zoogeographic distribution. North Pacific Ocean; locally common and abundant in some areas. In Alaska – Bering Sea to Southeast Alaska. Elsewhere – Japan, Kuril Islands, Sea of Okhotsk, British Columbia to Panama.

Habitat. Aleutian Islands – attached to bedrock, cobbles, and pebbles, usually in low-relief habitats, at depths between 112 to 740 m. Bering Sea – attached to pebbles and hexactinellid skeletons at depths between 375 and 522 m. Gulf of Alaska – on the continental shelf and upper slope at depths between 70 and at least 259 m. Observed in the glacial fjords of Southeast Alaska growing on bedrock at depths as shallow as 21 m. Elsewhere – reported at depths between 23 and 1103 m.

Remarks. This is one of the most ecologically important sponges in Alaska. Juvenile golden king crabs (*Lithodes aequispina*) use the spongocoel as refuge habitat in the Aleutian Islands (Stone, 2006). Due to its rigid skeleton, this species is an important structural component of the sponge reefs reported along the Pacific coast of Canada (Conway et al., 1991, 2005; Krautter et al., 2001) and recently in southern Southeast Alaska. We have not been able to confirm the presence of the other subspecies (*H. calyx schulzei*) in Alaskan waters. This species may be preyed upon by the sea star *Henricia longispina* in the eastern Gulf of Alaska. *Heterochone calyx calyx* can be distinguished from the very similar *Aphrocallistes vastus* by the presence of pinular hexactins on the inner (atrial) surface and by the lack of robust oxyhexasters with primary rays subsumed in a swollen centrum.

Photos. 1) Specimen collected at a depth of 172 m in the central Aleutian Islands. A small stalked demosponge grows from inside the specimen. Grid marks are 1 cm^2. 2) Specimen collected at a depth of 520 m in Zhemchug Canyon, Bering Sea. Grid marks are 1 cm^2. 3) Specimen at a depth of 180 m with a juvenile rosethorn rockfish (*Sebastes helvomaculatus*) and juvenile brown box crab (*Lopholithodes foraminatus*) in the eastern Gulf of Alaska. 4) Specimen at a depth of 181 m in the eastern Gulf of Alaska. 5) Specimen at a depth of 190 m with a sharpchin rockfish (*Sebastes zacentrus*) and squat lobsters (*Munida quadrispina*) in the eastern Gulf of Alaska. Photo by J. Lincoln Freese (AFSC).

10. *Heterochone calyx calyx* Schulze, 1886 (continued)



11. *Regadrella okinoseana* Ijima, 1896

Description. This tube or sac sponge attaches basally to hard substrate. Lateral walls bear distinctive smooth depressions, each with a small (1–3 mm diameter) central hole (parietal osculum) connecting to the atrial cavity; edges around depressions often project several millimeters as parietal ledges; the large terminal osculum is normally covered by a coarse sieve plate and bordered by a flaring marginal cuff. Consistency is slightly compressible and rubbery. The partially collected Alaskan specimen lacked an oscular sieve plate, marginal cuff, and parietal ledges. Its atrial cavity was subdivided by longitudinal wall fusions. It is estimated to have been 25 cm long by 13 cm diameter, but elsewhere incomplete specimens 48 cm long have been reported. Color in life is white; drab when dried or preserved in ethanol.

Skeletal structure. While the Aleutian specimen may have unusual morphology, its spiculation is typical for the species. Its skeleton consists mainly of loose spicules; spicule fusion is present only in the lower parts collected and is assumed to have been extensive in the basal part left on the attachment site. Megascleres include thick principal diactins with rounded tips (5–16 mm long); thin diactins with pointed tips (1.3–7.5 mm long); sword-shaped dermal hexactins with short, tapered, pointed distal rays (89–369 µm length), tapered and pointed tangential rays (156–318 µm length), and long tapered proximal rays (232–807 µm length); regular hexactins (134–292 µm ray length); atrial pentactins with sharp tapered tangential rays (122–295 µm ray length) and longer proximal rays (137–563 µm ray length); a few atrial triactins and stauractins of similar shape and size; short, thick atrial diactins (347–1047 µm length); small diactins around parietal oscula (42–197 µm length). Microscleres include mainly oxystauraster (61–107 µm diameter); a few oxyhexasters (70–129 µm diameter); dermal floricomes (78–113 µm diameter) with 10–14 terminal rays ending in heads with 2–3 teeth; remnants of graphiocomes are common, with central (25–43 µm diameter) and terminal rays as dispersed thin raphides (141–237 µm long).

Zoogeographic distribution. Widespread but uncommon. In Alaska – central Aleutian Islands. Elsewhere – reported from Indo-West Pacific Region including from near India, Northwest and South Australia, New Zealand, New Caledonia, Indonesia, Japan.

Habitat. In Alaska – occurs singly on mudstone, bedrock, and possibly hexactinellid skeletons at depths between 1071 and 1395 m. Elsewhere – reported at depths between 390 and 1264 m.

Remarks. The new record of this species in the Aleutian Islands represents a range extension of over 3700 km from the nearest previous known site near Japan.

Photos. 1) Fragment of preserved (frozen) specimen collected at a depth of 1386 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. The separation between the red laser marks is 10 cm.

12. *Acanthascus* (*Acanthascus*) *profundum* ssp. nov. Reiswig and Stone, in preparation

Description. This soft barrel sponge, attached basally, has very large surface conules lacking prostal spicules. Occasionally two tubes are attached near the base. The outer surface is smooth, its large canals covered by a very delicate spicule lattice. The large atrial canals are uncovered and the atrial surface is reflected out of the large terminal osculum; there are no marginal spicules. Height and diameter is to 25 cm. Color in life is white to creamy white.

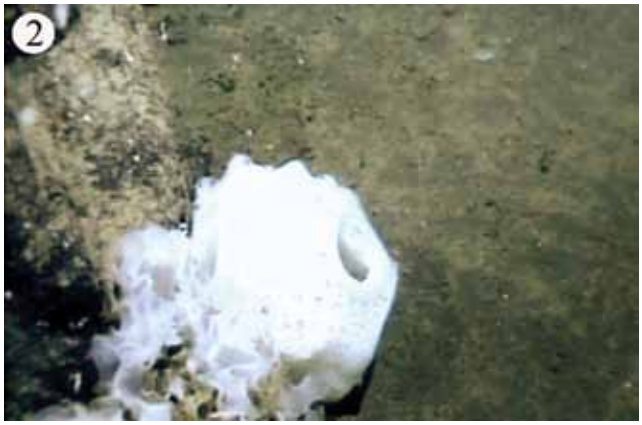
Skeletal structure. Skeleton is composed entirely of loose spicules. Megascleres are thin diactins with rough tips (0.94–19.8 mm); dermal finely rough pentactins with cylindric rays ending in rounded tips (113–271 µm ray length); similar but hexactine atrial spicules (125–239 µm ray length). Microscleres are discoctasters (119–234 µm diameter), each primary ray bearing 5–10 slightly curved terminals; oxyhexactins, hemioxyhexasters, and oxyhexasters (98–199 µm diameter). Microdiscohexasters are absent.

Zoogeographic distribution. In Alaska – central Aleutian Islands. Known with certainty only from the single specimen collected southwest of Adak Island, but analysis of video records indicate that it is a relatively rare species in this area. Elsewhere – not reported.

Habitat. Attached to bedrock, mudstone, and large boulders at depths between 1446 and 2245 m.

Remarks. This specimen is in the process of being described so data are incomplete; it differs from all named species of the genus in several characters, and from *A. platei* in particular, in lack of both prostalia and microdiscohexasters, and lack of loose spicule lattice over atrial canal apertures.

Photos. 1) Fragment of preserved (frozen) specimen collected at a depth of 2105 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ growing just behind *Farrea kurilenis* ssp. nov.



13. *Acanthascus* (*Rhabdocalyptus*) *dawsoni dawsoni* (Lambe, 1893)

Description. Soft straight or curved tube or barrel-like sac, occasionally partially divided into two or three conjoined tubes, is attached basally to hard substrate. Surface is smooth but usually bearing a 1-cm tall veil of pentactins and diactins which may be clean but usually covered with small epizoans and sediment; large single terminal osculum has marginal fringe. Consistency is soft and compressible. Height is to 1 m and diameter to 30 cm. Color in life is white but often coated with sediment, epizoic organisms, and flocculent material, giving it a brown to greenish brown appearance.

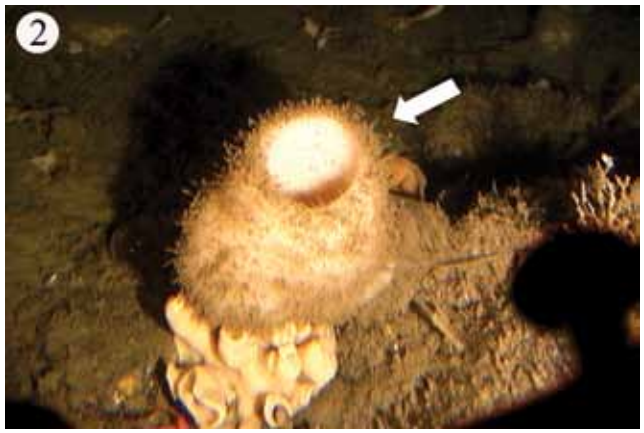
Skeletal structure. Skeleton is composed entirely of loose spicules. Megascleres are thick prostal diactins to 6 cm long; hypodermal pentactins with some smooth and some thorned tangential rays (0.9–4.1 mm long) and smooth proximal rays (0.9–4.1 mm long); principal diactins (4.2–11.4 mm long); thin short diactins (0.35–1.62 mm long); dermal stauractins (50–101 mm ray length), dermal pentactins with tangential rays (54–99 mm long) and proximal rays (44–100 mm long); atrial hexactins (55–177 mm ray length). Microscleres are oxyhemihexasters (48–104 mm in diameter); small discoctasters with straight terminals (56–82 mm in diameter); microdiscohexasters (17–28 mm in diameter).

Zoogeographic distribution. Locally common and abundant. In Alaska – eastern Gulf of Alaska. Elsewhere – British Columbia to southern California.

Habitat. In Alaska – attached to bedrock, cobbles, and pebbles at depths between 82 and 255 m. Elsewhere – attached to bedrock, cobbles, and pebbles on flat, inclined, or vertical surfaces (e.g., fjord walls), and following detachment may survive loose as roller sponges (Reiswig, unpubl. data, 2010) at depths between 10 and 437 m.

Remarks. The species presently contains three subspecies: *A.* (*R.*) *d. dawsoni* (reviewed here); *A.* (*R.*) *d. alascensis* Wilson and Penney, 1930 (known only from Cape Spencer, Gulf of Alaska); and *A.* (*R.*) *d. horridus* Koltun, 1967 (from the Bering Sea). *A.* (*R.*) *d. dawsoni* can be distinguished from *A. solidus* by the presence of at least some heavily thorned hypodermal pentactins; the latter species possesses only smooth hypodermal pentactins. *A.* (*R.*) *d. dawsoni* is similar in appearance to *A. mirabilis* but likely differs in depth distribution and can be distinguished by its much smaller discoctasters (56–82 vs. 144–180 µm diameter). We have observed a very similar species in the central Aleutian Islands at depths between about 400 and 1238 m attached to cobbles and hexactinellid skeletons. This species is preyed upon by the sea star *Poraniopsis inflata* and possibly by the sea star *Henricia longispina* in the eastern Gulf of Alaska.

Photos. 1) Whole specimen collected at a depth of 168 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 2) Specimen (indicated by the white arrow) at a depth of 165 m in the eastern Gulf of Alaska.



14. *Acanthascus* (*Rhabdocalyptus*) *mirabilis* (Schulze, 1899)

Description. This species was known previously only from the holotype, which was the distal portion (about 1/3 of total specimen) of a soft saccate sponge. Surface is overtly smooth but evenly covered with small conic protuberances and bears a veil of pentactins and diactins; large single terminal osculum with marginal fringe. Consistency is soft and compressible. From the holotype fragment, the original specimen was thought to be ca. 30 cm in length and 15 cm in diameter with a 1-cm thick wall; a new Aleutian specimen is 15.5 cm in length and 10.1 cm in diameter. Color in life is white; light brown when preserved in ethanol.

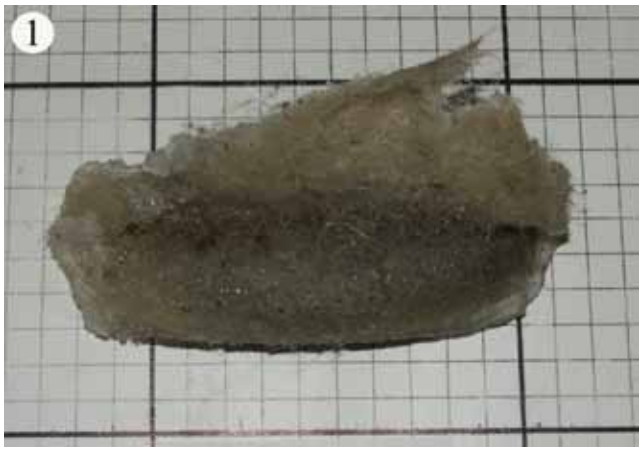
Skeletal structure. Skeleton is composed entirely of loose spicules. Megascleres are thick prostal diactins to 2 cm long; hypodermal pentactins with mostly thorned paratropal tangential rays to 1 cm long; principal diactins (11.7–21.0 mm long); dermal diactins (plus a few stauractins and hexactins) (204–462 mm long); atrial hexactins (free ray 249–447 µm long, tangentials and parenchymal rays 153–316 mm long). Microscleres are oxyhexactins and a few oxyhexasters and hemioxyhexasters (72–232 mm in diameter with 33–87 mm long terminal rays); discoctasters (144–180 mm in diameter) with very short primary rays (20–28 mm long), each bearing 8–12 straight or s-curved, divergent terminal rays; microdiscohexasters mainly near or in the dermal surface (21–40 mm in diameter).

Zoogeographic distribution. Rare. Known only from Alaska – central Aleutian Islands and Gulf of Alaska. Elsewhere – not reported.

Habitat. Central Aleutian Islands – occurs singly on bedrock at depths between 1984 and 2790 m. Southern Alaska – attached to cobbles at depths near 1143 m.

Remarks. Our specimen recently collected in the Aleutian Islands is only the second known verified specimen of this species. It is very likely that *A.* (*R.*) *unguiculatus* Ijima, 1904 is a junior synonym of *A.* (*R.*) *mirabilis.* This species is similar in appearance to *A. dawsoni* but likely differs in depth distribution and can be distinguished by its much larger discoctasters (144–180 vs 56–82 µm diameter).

Photos. 1) Fragment of preserved (frozen) specimen collected at a depth of 2311 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. The separation between the red laser marks is 10 cm.



15. *Acanthascus* (*Staurocalyptus*) *solidus* (Schulze, 1899)

Description. This compressible but very spiny sac or vasiform sponge attaches basally to hard substrate. External surface is covered by a dense veil of projecting pentactins in amongst the long prostal diactin needles, with a single large terminal osculum bordered by a marginal fringe of diactins. Consistency is soft but spiky. Height is to 24 cm, diameter to 15 cm, and 23 mm in wall thickness. It may be found in clusters of up to nine individuals. Color in life is white but sometimes coated with sediment, epizoic organisms, and flocculent material, giving it a brown to greenish brown appearance; drab when preserved.

Skeletal structure. Skeleton is composed entirely of loose spicules. Megascleres are thick prostal diactins to 4 cm long; hypodermal pentactins all have smooth or shagreened (never thorned) tangential rays (1.8–6.6 mm long) and smooth proximal rays (5.5–9.6 mm long); principal diactins (2.0–8.4 mm long); dermal stauractins (75–180 mm ray length), dermal pentactins with tangential rays (88–193 mm long) and proximal rays (88–163 mm long); atrial hexactins (89–134 mm ray length). Microscleres are oxyhexasters and oxyhemihexasters (113–179 mm in diameter); discoctasters with straight terminals (134–225 mm in diameter); microdiscohexasters (16–22 mm in diameter).

Zoogeographic distribution. North Pacific Ocean. Locally abundant. In Alaska – eastern Gulf of Alaska. Elsewhere – British Columbia to southern California (Santa Maria Basin).

Habitat. In Alaska – attached to bedrock, cobbles, and pebbles at depths between 82 and 255 m. Elsewhere – reported at depths between 91 and 1373 m.

Remarks. *Acanthascus solidus* can be distinguished from the sometimes similar *A. (R.) dawsoni dawsoni* by its complete lack of thorned hypodermal pentactins that are always present and heavily thorned in the latter species. In the central Aleutian Islands a very similar species (possibly *Acanthascus solidus* but not confirmed) occurs at depths between 399 and 463 m. This species is preyed upon by the sea stars *Hippasteria* spp., *Poraniopsis inflata,* and possibly *Henricia longispina* in the eastern Gulf of Alaska.

Photos. 1) Mostly intact specimen collected at a depth of 167 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 2) Specimen (indicated by the white arrow) at a depth of 165 m in the eastern Gulf of Alaska.

16. *Acanthascus* (*Staurocalyptus*) sp. nov. 1 Reiswig and Stone, in preparation

Description. This species grows from a narrow attached base to either a thick massive or thick funnel-shaped form. External surface has small rounded protuberances from each of which project several short diactin prostalia; there is a single large terminal osculum. Consistency is soft and easily torn. Height is up to 24 cm and diameter to 17 cm. Color in life is brown to golden brown.

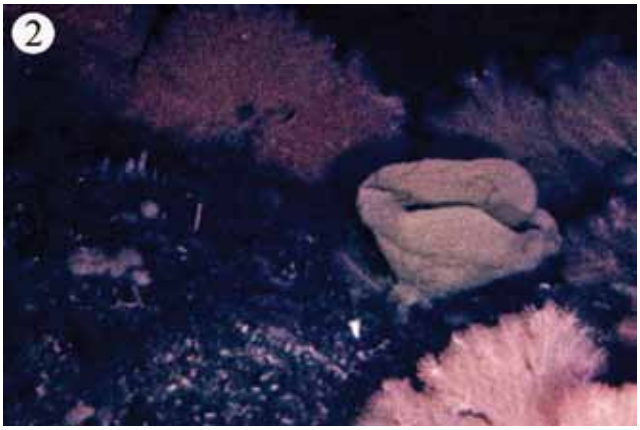
Skeletal structure. Skeleton is composed entirely of loose spicules. Megascleres are thick prostal diactins (4.3–10.1 mm long), a few rough, but not thorned, hypodermal pentactins (0.21–1.09 mm tangential ray length); principal diactins (1.11–6.84 mm long); dermal hexactins with some pentactins and stauractins (40–139 mm ray length); atrial hexactins (43–218 mm ray length). Microscleres are oxyhexactins and a few hemioxyhexasters (86–175 mm in diameter); very small discoctasters with terminals strongly curved outward (56–87 mm in diameter); microdiscohexasters are absent.

Zoogeographic distribution. Locally abundant. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to cobbles and pebbles at depths between 139 and 183 m.

Remarks. This species is distinguished from all other species of *Acanthascus* (*Staurcalyptus)* by the small size and shape of its discoctasters. A complete description is in preparation.

Photos. 1) Partially fragmented specimen collected with a trawl at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen at a depth of 165 m in the central Aleutian Islands.



17. *Acanthascus (Staurocalyptus)* sp. nov. 2 Reiswig and Stone, in preparation

Description. Soft tube or sac sponge attaches basally to hard substrate. Lateral surface has low conules 15 mm apart and 3–5 mm high from which small groups of thin, short, prostal diactin spicules project; there is no veil of pentactins. The single terminal osculum is sharp-edged and without a marginal fringe. Both external and internal surfaces (and thus canal openings) are covered by tight spicule lattices. Consistency is soft and pliable; internal aspect is wooly. The type specimen is 30 cm tall by 20 cm diameter (at the widest point). Color in life is white.

Skeletal structure. It is composed entirely of loose spicules excepting a small fused basal attachment structure. Megascleres are prostal diactins 9.3–16.2 mm long; principal diactins 1.8–10.4 mm long; dermal pentactins with spiny tangential rays (72–201 µm long) and proximal rays (65–172 µm long); atrial spiny hexactins (65–172 µm ray length). Microscleres include two classes of discoctasters (124–382 and 112–167 µm diameter); stout oxyhexactins (94–139 µm diameter); oxy- and hemioxyhexasters (88–133 µm diameter); microdiscohexasters (13–22 µm diameter).

Zoogeographic distribution. Locally common. In Alaska – known only from the central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to cobbles in low-relief habitat at a depth of 711 m. Video records suggest it is also locally common on bedrock, mudstone, and cobbles in moderate-relief habitat at depths between 190 and 1556 m.

Photos. 1) Whole specimen collected at a depth of 711 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 showing the detail of the osculum. 3) Same specimen as in photos 1 and 2 in situ. The separation between the red laser marks is 10 cm.

18. *Aulosaccus pinularis* Okada, 1932

Description. Vase-shaped sponge attaches basally to solid substrate, thickest near its upper end. External surface is smooth and completely lacking large projecting spicules; both external and internal surfaces are lined by a lattice of loose spicules; there is a single large terminal osculum without a marginal spicule fringe. Consistency is very soft and easily torn. Height is to 24 cm, diameter to 15 cm, and 23 mm in wall thickness. Color in life is white; drab when preserved.

Skeletal structure. Skeleton is composed entirely of loose spicules. Megascleres are thick diactins (4.4–5.6 mm long); thin diactins (1.3–5.5 mm long); pinular dermal hexactins with projecting pinular ray (109–175 mm long), tangential rays (103–150 mm long) and proximal ray (86–140 mm long); pinular atrial hexactins with projecting pinular ray (93–300 mm long), tangential rays (109–214 mm long), and proximal rays (83–192 mm long). Microscleres include very large discasters, often called "solasters" (193–438 mm in diameter) with fused primary rays recognizable as six hemispherical bosses; oxyhexasters and hemioxyhexasters (99–140 mm in diameter); oxyhexactins (83–166 mm in diameter); small spherical discohexasters (26–36 mm in diameter).

Zoogeographic distribution. Rare. In Alaska – central Aleutian Islands. Elsewhere – western Bering Sea, Kuril Islands and off the southern tip of the Kamchatka Peninsula.

Habitat. In Alaska – attached to bedrock, mudstone, or boulders at depths between 843 and 1715 m. Elsewhere – reported at a depth of 117 m but most collections do not report depth.

Photos. 1) Mostly intact specimen collected at a depth of 843 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. Note that the specimen has been torn on the left side (prior to collection) and the osculum is directed to the right.

19. *Aulosaccus schulzei* Ijima, 1896

Description. Vase-shaped sponge attaches basally to solid substrate, thickest near its upper end. External surface is smooth, completely lacking large projecting spicules, and lined by a lattice of loose spicules. The internal atrial surface has a network of diactin bundles crossing the exhalant apertures, but a lattice of atrialia is absent. There is a single large terminal osculum lacking a marginal spicule fringe. Consistency is very soft and easily torn. Height is up to 45 cm, diameter to 22.5 cm, and 34 mm in wall thickness. Color in life is creamy white; drab when preserved.

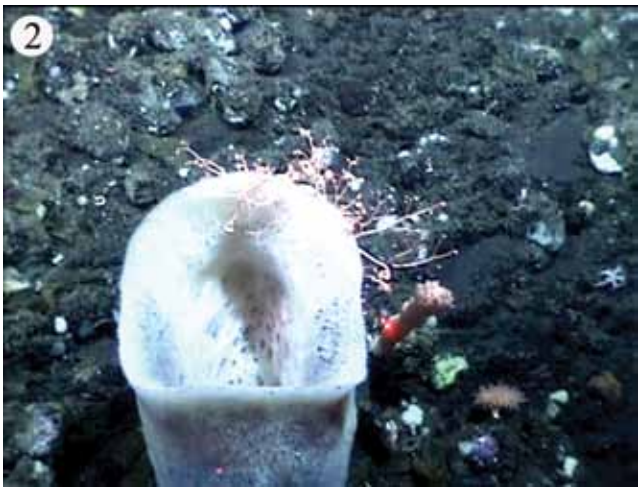
Skeletal structure. Skeleton is composed entirely of loose spicules. Megascleres are hypodermal pentactins and a few triactins and tetractins (0.6–3.4 mm long tangential rays; 0.9–4.4 mm long proximal rays); thick diactins (3.3–17.7 mm long); thin diactins (1.4–6.7 mm long); short atrial diactins (0.4–1.5 mm long); dermalia are a mixture of stauractins, pentactins, and hexactins (89–181 mm ray length); atrialia are mainly very large hexactins with some pentactins (224–1186 mm ray length). Microscleres include very large discasters, often called "solasters" (513–1389 mm in diameter), with primary rays fused into a slightly irregular sphere; very thin oxyhexactins, with irregular variants, and hemioxyhexasters (87–165 mm in diameter); small spherical discohexasters (20–39 mm in diameter).

Zoogeographic distribution. Apparently a rare species. In Alaska – central Aleutian Islands and Bering Sea (Pribilof Canyon). Elsewhere – Japan, Kuril Islands, Okhotsk Sea, and off southern California.

Habitat. In Alaska – in the central Aleutian Islands it occurs on bedrock, boulders, and cobbles at depths between 1270 and 1350 m. In Pribilof Canyon it occurs at a depth of 300 m. Elsewhere – reported at depths between 117 and 419 m.

Remarks. Associated fauna include juvenile lithodid crabs (*Paralomis verrilli* and *Lithodes couesi*), pandalid shrimps, and the large ophiuroid *Gorgonocephalus eucnemis*.

Photos. 1) Whole specimen collected at a depth of 300 m in Pribilof Canyon, Bering Sea. Grid marks are 1 cm^2. 2) Specimen collected at a depth of 1320 m in the central Aleutian Islands. 3) Same specimen as in photo 2 in situ. Two pairs of red lasers each separated by 10 cm.



20. *Bathydorus* sp., description by Reiswig and Stone, in preparation

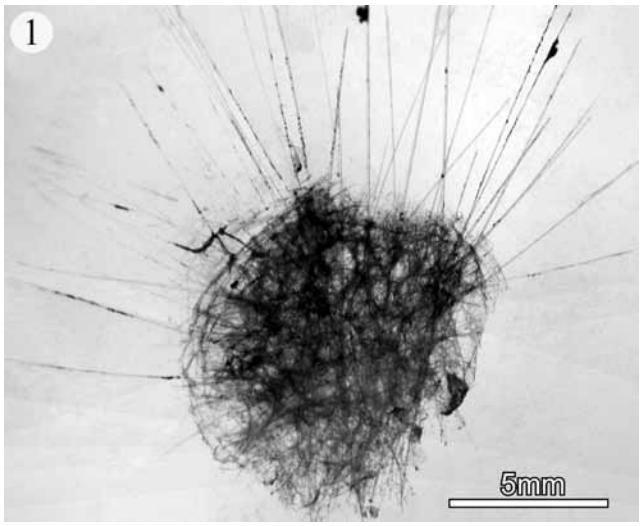
Description. Very small flattened ovoid sponge attaches to a cobble. External surface is smooth and covered by a lattice of mainly stauractin dermalia; about one-half of the surface is profusely spined by long diactins and sports a veil of raised pentactins. An osculum and atrial cavity could not be distinguished. Consistency is soft and delicate. The specimen is 11 by 8 by 2 mm. It is transparent and colorless.

Skeletal structure. Skeleton is composed entirely of loose spicules, but parts of the fused basidictyonal skeleton remain attached. Megascleres are hypodermal pentactins (0.26–1.4 mm long tangential rays; 0.47–1.55 mm long proximal rays); thick prostal diactins (3.2–16.8 mm long); thin diactins (0.96–6.82 mm long); dermal stauractins and diactins (81–381 mm ray length). Microscleres consist only of hemioxyhexasters (112–181 mm in diameter) and oxyhexactins (124–204 mm in diameter).

Zoogeographic distribution. Rare. In Alaska – central Aleutian Islands. Elsewhere – small incompletely identifiable *Bathydorus* spp. have been reported worldwide.

Habitat. In Alaska – occurs on cobble but probably also on boulders and bedrock; collected from 494 m but may have a broad depth range. Elsewhere – small *Bathydorus* spp. are reported from depths of 446 to 1625 m.

Photo. 1) Whole specimen collected at a depth of 494 m in the central Aleutian Islands.



21. *Caulophacus* (*Caulophacus*) sp. nov. Reiswig and Stone, in preparation

Description. A very large mushroom-shaped body on a long cylindrical stalk attaches basally to hard substrate. The inhalant surface occupies the upper stalk and underside of the body; the exhalant surface on the upper body is reflected around the edges to the sharp margin on the under edges of the body; there is no distinct osculum. All surfaces are macroscopically smooth with large canals covered by lattices of loose spicules. Consistency of the body is compressible but firm; the stalk is stony hard due to fusion of the internal spicules and is hollow, with two main internal longitudinal canals. The specimen, measured dry, is 75 cm in total height, the body is 31 by 40 cm transversely, and the stalk is 68 cm long and 2.1 cm in diameter (narrowest point, 1.8 cm). Color in life is white to creamy white; drab when preserved.

Skeletal structure. Spicules in the main body remain loose, but the principal diactins in the stalk are fused to form a hard, rigid, and long-lasting structure. Megascleres include pinular hexactine dermalia (132–337 µm pinular ray length, 90–163 µm tangential ray length, 102–158 µm proximal ray length); supported by hypodermal pentactins (315–862 µm tangential ray length, 312–1054 µm proximal ray length); atrialia are slightly thinner pinular hexactins (131–379 µm pinular ray length, 80–167 µm tangential ray length, 88–142 µm proximal ray length); supported by hypoatrial pentactins similar to those of the dermal side; choanosomal diactins are mainly in loose bundles (1.65–4.06 mm long); large choanosomal oxyhexactins are common (678–1579 µm ray length). Microscleres are all coarsely spined, including hemidiscohexasters and discohexasters (82–177 µm diameter) and discohexactins (90–185 µm diameter).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Occurs singly on bedrock and large boulders at depths between 1326 and 2680 m.

Remarks. The Aleutian *Caulophacus* (*Caulophacus*) specimen has been compared to the 18 known species of the subgenus and found to be unassignable to any of them. Its description as a new species is in progress. It is used as a perch by several species of lithodid crabs, including *Paralomis verrilli.*

Photos. 1) Whole specimen collected at a depth of 1806 m in the central Aleutian Islands. 2) Same specimen as in photo 1. 3) Same specimen as in photos 1 and 2 in situ with *Paralomis verrilli* crabs. The separation between the red laser marks is 10 cm.

CLASS DEMOSPONGIAE

22. *Plakina atka* Lehnert, Stone and Heimler, 2005

Description. Sponge is encrusting. Surface is convoluted but less distinctively so than *Plakina tanaga*. Single strands have a smooth surface, not microtuberculate. This sponge may cover large areas (up to 30 cm^2) with a thickness of approximately 0.3 to 0.8 cm. The ectosome is reddish brown (Aleutian Islands), beige, or light brown (eastern Gulf of Alaska).

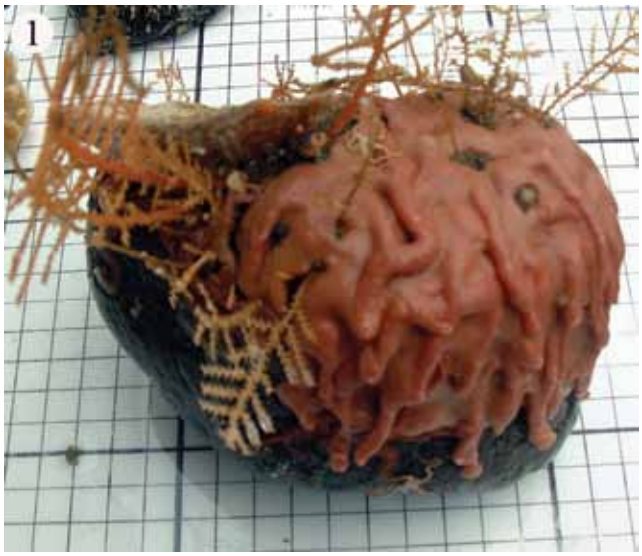
Skeletal structure. SEM images of spicules are shown in Appendix IV. Ectosomal dense spicule crust averages 100 µm in thickness. Choanosome is somewhat less densely packed with spicules, roughly arranged in tracts of varying orientation and with many spicules in between. Characteristic plakinid oxeas are slightly bent and thickest in the center (70–108 × 3–6 µm). A thicker category of diods, always with relatively long spines at the center, is probably derived from the spined category of triods (82–95 × 8–10 µm). Triods also occur in two distinct types: relatively rare simple triaxons (28–33 µm/ray) and much more abundant, robust triaxons with a row of large spines on each ray close to the center of the spicule (23–40 × 3–6 µm/ray). Calthrops are rare and have a reduced fourth ray only. Tetralophose calthrops have tetrafurcate, occasionally pentafurcate rays, with microfurcate ends (18–23 µm in total length).

Zoogeographic distribution. Locally abundant. In Alaska – central Aleutian Islands, eastern Gulf of Alaska (continental shelf off Cape Ommaney, Baranof Island), and southern Southeast Alaska (Portland Canal). Elsewhere – northern British Columbia (Portland Canal).

Habitat. Encrusts bedrock, boulders, cobbles, pebbles, and hexactinellid skeletons at depths between 82–180 m (Aleutian Islands) and 95–253 m in the eastern Gulf of Alaska. May cover relatively large areas (up to 30 cm^2).

Remarks. *Plakina atka* can be distinguished from the similar *P. tanaga* by its relatively smooth surface compared to the strongly convoluted and microtuberculated surface of the latter species, and by the presence of tetralophate lophocalthrops compared to the trilophose lophocalthrops of *P. tanaga*.

Photos. 1) Specimen collected at a depth of 118 m in the central Alautian Islands. Grid marks are 1 cm^2. 2) Specimen collected at a depth of 167 m in the eastern Gulf of Alaska. 3) Specimen at a depth of 118 m in the central Aleutian Islands.



23. *Plakina tanaga* Lehnert, Stone and Heimler, 2005

Description. Sponge is encrusting. Convoluted surface has deep grooves between strands with a microtuberculated surface. Consistency is cheese-like. Circular oscula flush with the surface are visible in situ. This sponge may cover large areas (up to 1 m^2) with a thickness of approximately 1 to 1.5 cm. Color in life is beige to light brown.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome is packed with lophocalthrops with a layer 20–250 µm thick. Spicules are characteristically bent diods, often centrotylote or with a reduced third ray in the form of a spine (85–97 × 2–4 µm); two categories of triaxons, smooth, thinner triods (24–50 × 2–5 µm/ray) and thicker triods, often with one short, slender spine near the base of each ray (22–38 × 7–9 µm). Rare smooth calthrops have rays of the same dimensions as those of the triods. There are abundant trilophose calthrops with each ray tetrafurcate and, again microfurcate at the points, somewhat smaller than the triods and concentrated in the ectosome. Total length of lophocalthrops is 28–42 µm. Non-lophose rays are sometimes bifurcate.

Zoogeographic distribution. Uncommon. In Alaska – known only from the type locality in Little Tanaga Strait, central Aleutian Islands. Elsewhere – not reported.

Habitat. Encrusts vertical and overhanging surfaces of bedrock and boulders at depths between 140 and 383 m. May cover relatively large areas (up to 1 m^2).

Remarks. *Plakina tanaga* can be distinguished from the similar *P. atka* by its strongly convoluted and microtuberculated surface compared to the relatively smooth surface of the latter species, and by the presence of trilophose lophocalthrops compared to the tetralophate lophocalthrops of *P. atka*.

Photo. 1) *P. tanaga* encrusting a bedrock scarp at a depth of 146 m in the central Aleutian Islands.

24. *Craniella arb* (de Laubenfels, 1930)

Description. Sponge is globular to subglobular. Oscula are occasionally present but not obvious. Spicules radiate from the center to the surface and protrude above it. Consistency is hard, cartilaginous, and only slightly elastic due to the high spicule density. With a diameter of 8 to 10 cm, this is one of the largest species of *Craniella*. The cortex is white; the interior of the sponge is orange-gold.

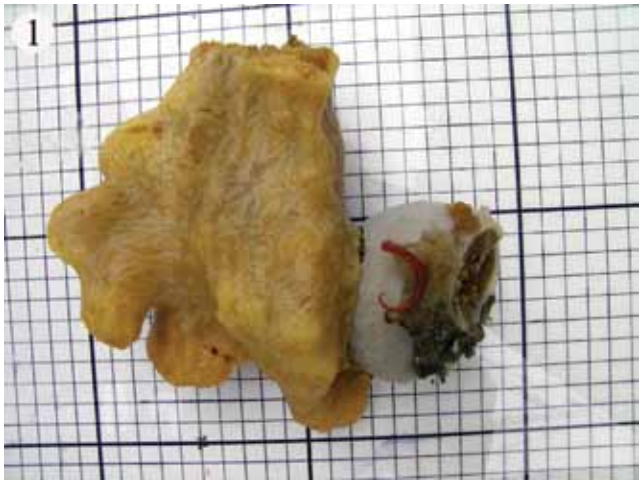
Skeletal structure. Protriaenes may reach a length of more than 3 cm. Protriaenes and anatriaenes have relatively small clads; protriaenes, rhabd greater than 3 cm × 3–11 µm, clad 20–30 µm; anatriaenes, rhabd up to 10 mm × 3–11 µm, clads, 40–85 µm, oxeas, up to 3 cm × 10–40 µm, commata, 7–10 µm.

Zoogeographic distribution. Uncommon, but locally patchy. In Alaska – Aleutian Islands. Elsewhere – central California to the Gulf of California.

Habitat. In Alaska – found at depths between 88 and 272 m in boulder and cobble habitats. Typically epizoic on calcareous sponges (e.g., *Leucandra poculiformis*) and various demosponges, including *Tedania dirhaphis*, *Mycale jasoniae,* and *M. loveni*. Elsewhere – reported at depths between 11 and 214 m.

Remarks. Reproduction in this group of sponges is oviparous without a larval stage, or viviparous with production of young adults within the parent (Van Soest and Rützler, 2002).

Photos. 1) Specimen collected at a depth of 100 m in the central Aleutian Islands. Specimen is attached to the demosponge *Tedania dirhapsis*. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 showing radial arrangement of large spicules in the interior and the presence of orange-colored eggs or young adults. 3) Specimen at a depth of 170 m in the central Aleutian Islands.



25. *Craniella sigmoancoratum* (Koltun, 1966)

Description. Body is globular with very long tracts of protruding spicules. Typically is attached to other sponges via these tracts which terminate in anchor-like, long-shafted triaenes. Internal bundles of spicules radiate from the center of the globular body to well beyond the surface of the sponge. The surface consists of a layer of dermal oxeas occurring only there and oriented perpendicular to the surface. The diameter of the body is 7 to 8 mm (without protruding spicules). Spicule tracts protrude 6–8 mm above the surface, giving the sponge a spiny appearance. Color in life is white or creamy white.

Skeletal structure. Large oxeas have unequal ends (3000–8000 × 45–72 µm), cortical oxeas (460–1340 × 26–76 µm), protriaenes (1600–7300 µm long with clads 13–34 µm), anatriaenes have rhabds (2300–8700 µm with clads 19–40 µm). The sigmaspires are unique among the known species of *Craniella* in that they are relatively large and resemble isochelae (22–34 µm). These sigmaspires are abundant and densely present in the cortical layer.

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands, Bering Sea (Pribilof Canyon). Elsewhere – previously known only from the original description in the Kuril Islands, Russia.

Habitat. In Alaska – a cryptic species; epizoic on hexactinellid sponges and other demosponges, including *Erylus aleuticus,* at depths between 190 and 275 m. Elsewhere – no information available.

Remarks. Previously known as *Tetilla sigmoancoratum* Koltun, 1966, but recently transferred to the genus *Craniella* since it possesses both a cortex and the special cortical oxeas that are lacking in the genus *Tetilla.*

Photo. 1) Specimen collected at a depth of 208 m in Pribilof Canyon, Bering Sea. Specimen is growing on an unidentified hexactinellid sponge.

26. *Craniella spinosa* Lambe, 1893

Description. Sponge is globular with many short, sharp spines. It typically attaches to other sponges via the spines. Characteristic of the genus, the internal arrangement of spicule bundles is strictly radial with bundles supporting the ectosomal conules, which are less than 1 mm in height. The surface is formed by a special cortex. Dermal oxeas form a palisade perpendicular to the surface. Spicule bundles protrude through the conules and diverge. Diameter is to 16–18 mm. Color in life is white or creamy white.

Skeletal structure. There are large oxeas (2300–4800 × 23–42 µm) with unequal ends, both ends acute but one end filiform, cortical oxeas (685–1230 × 35–47 µm), protriaenes (3400–5700 µm long), anatriaenes (up to 8000 µm long rhabdomes). Microscleres are c- and s-shaped sigmaspires with a maximum diameter of 11–14 µm.

Zoogeographic distribution. Uncommon. In Alaska – Bering Sea (Pribilof Canyon). Elsewhere – originally described from Vancouver Island. Reportedly occurs from the Aleutian Islands to British Columbia (Austin, 1985).

Habitat. In Alaska – a cryptic species; epizoic on *Myxilla pedunculata* and probably other sponges at a depth of 236 m. Elsewhere – depths ranging from 36 to 76 m (Vancouver Island).

Photo. 1) Specimen collected at a depth of 236 m in Pribilof Canyon, Bering Sea. Specimen is attached to the demosponge *Myxilla pedunculata*.

27. *Craniella sputnika* Lehnert and Stone, 2011

Description. Sponge is globular with numerous acute spines distributed over the surface. The surface between the spines is smooth, without any visible apertures. Characteristic of the genus, the internal arrangement of spicule bundles is strictly radial with bundles supporting the ectosomal conules. The sponge is rather hard, only slightly elastic. Diameter including the spines is to 30 mm (16 mm without the spines). Color in life is white to creamy white.

Skeletal structure. Spicules are anatriaenes (3430–8820 × 12–21 μm), clads (48–154 × 17–22 μm per ray), and protriaenes (4520–8960 × 12–40 μm). There are clads (50–250 × 5–17 μm per ray); choanosomal oxeas (4530–5425 × 50–75 μm); two categories of cortical oxeas: small, centrotylote oxeas (97–372 × 8–17 μm), tyle in the center more like a ring than a tyle, and larger ones (540-987 × 28–63 μm). Sigmaspires or similar sigmoid spicules are absent.

Zoogeographic distribution. Uncommon. In Alaska – known only from the type locality in Amchitka Pass, central Aleutian Islands. Elsewhere – not reported.

Habitat. Patchy distribution. A cryptic species; epizoic on demosponges, including *Myxilla* sp., and occasionally gorgonian corals (Primnoidae) in boulder, cobble, and sand habitats at depths between 115 and 199 m.

Photos. 1) Specimens collected at a depth of 115 m in the central Aleutian Islands. 2) Two specimens (indicated by the white arrows) at a depth of 191 m in the central Aleutian Islands.

28. *Erylus aleuticus* Lehnert, Stone and Heimler, 2006

Description. Lobate sponge consists of several flattened lobes (oval to circular). The surface is hard due to an ectosomal crust of aspidasters about 0.5 mm in thickness. Numerous uniporal orifices are scattered over the surface at intervals of 0.5–1.0 mm. The orifices are circular, 0.5–1.0 mm in diameter, and slightly (<0.5 mm) raised above the surface. Individual lobes measure as large as 17 × 12 × 3.5 cm. Color in life is creamy white.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The choanosome is softer and choanosomal megascleres are extremely variable with many malformed and distorted spicules, irregularly bent or straight. Spicule shapes range from oxeas, styles, tylostyles, strongyles to tylotes, some with irregular diameters, some club-shaped, size range 520–1728 × 18–42 µm, orthotriaenes, also with variable rays, blunt or pointed, rays of cladome often bent in one direction, rhabds (615-790 × 23-42 µm), clads (270-380 × 24-35 µm), aspidasters (200–225 × 160–175 × 28–62 µm), dermal centrotylote microstrongyles (30–47 × 4–6 µm), and oxyasters (9–12 µm in diameter).

Zoogeographic distribution. Rare. In Alaska – known from only two locations north of Amlia and Atka Islands, central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to pebbles or shell hash in cobble, pebble, and sand habitats at depths between 127 and 190 m.

Remarks. Some species of *Erylus* reportedly contain bioactive compounds with antitumor, antifungal, and antiviral properties, especially against retroviruses such as human immunodeficiency virus (HIV) (Adams and Hooper, 2001). *E. aleuticus* has not yet been examined for the presence of bioactive compounds and is a high priority for collection for that purpose.

Photos. 1) Specimen collected at a depth of 190 m in the central Aleutian Islands. 2) Specimen observed at a depth of 127 m in the central Aleutian Islands.

29. *Geodia lendenfeldi* nomen novum

Description. Small, cylindrical sponge has an ectosomal hard cortex of sterrasters and a softer choanosome. Lendenfeld (1910) described the species as encrusting, cushion-shaped, or irregularly finger-shaped. The specimen collected in the Aleutian Islands was a single cylinder approximately 5 cm in height and 1 cm in width. Color in life is white to creamy white.

Skeletal structure. There are sterrasters (170–200 × 130-140 µm), choanosomal styles and oxeas (1200–1760 × 30–40 µm), diaenes of the same size as oxeas, and tylasters (10 µm). Triaenes are absent.

Zoogeographic distribution. Rare. In Alaska – Aleutian Islands and Southeast Alaska. Elsewhere – previously known from the west coast of North America from Southeast Alaska to southern California.

Habitat. In Alaska – found in cobble, pebble, and sand habitat at a depth of 190 m. Epizoic on the demosponge *Erylus aleuticus*. Elsewhere – no information available.

Remarks. Triaenes are absent in *G. robusta,* which prompted Lendenfeld (1910) to erect the genus *Geodinella* that is now regarded as synonymous with *Geodia*. This specimen is the same as *Geodia robusta* (Lendenfeld, 1910). *G. robusta* (Lendenfeld, 1910) is a junior homonym of *G. robusta* (Lendenfeld, 1907) however, and according to the World Porifera Database (Van Soest et al., 2008) it has no valid name. Thus, we suggest renaming *G. robusta* (Lendenfeld, 1910) as *Geodia lendenfeldi.*

Photo. 1) Fragments of specimen collected at a depth of 190 m in the central Aleutian Islands. Grid marks are 1 cm^2.

30. *Poecillastra tenuilaminaris* (Sollas, 1886)

Description. This sponge is polymorphic but typically has a plate-like or lamellar growth form. The surface of the sponge is smooth to the unaided eye but microscopically hispid. Small oscula occur on one side only. The consistency is firm, incompressible, and fragile. Size is highly variable but attains a length and height exceeding more than 1 m. Color in life is whitish to light brown, often with a dark fringe at the distal edge.

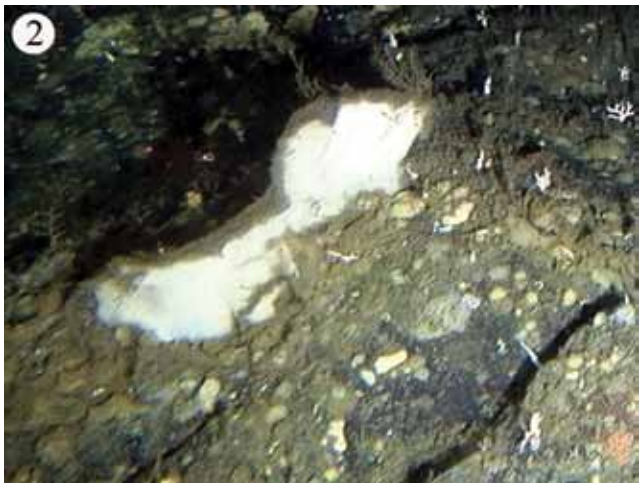
Skeletal structure. The choanosome consists of an unorganized mix of calthrops and oxeas: calthrops (320–540 × 35–48 µm per ray), occasionally triods with rays of the same size, oxeas (1240–2650 × 32–47 µm). Microscleres are streptasters (14–28 µm) and acanthose microxeas (117–157 × 3–5 µm) that are always bent in the middle.

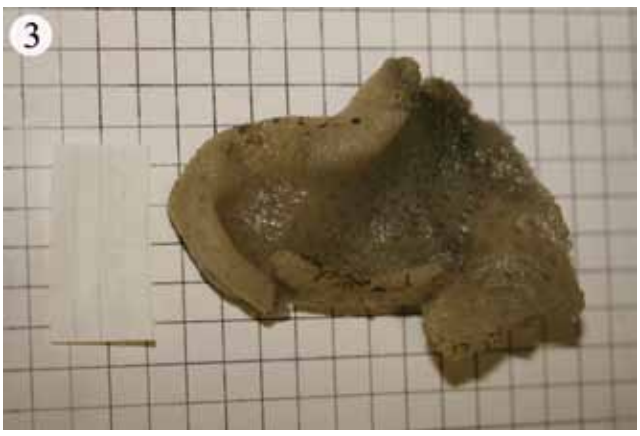
Zoogeographic distribution. Common. In Alaska – Bering Sea (Zhemchug Canyon) and eastern Gulf of Alaska. May reach densities up to 19 per m^2 in eastern Gulf of Alaska habitats. Elsewhere – holotype described from Sea of Japan, also reported from along the California Coast and the Gulf of California. Present records strongly suggest a circumboreal distribution in the North Pacific. However, morphological differences do exist between populations, suggesting some genetic isolation (see Remarks).

Habitat. In Alaska – attached to bedrock at depths between 149 and 486 m in the Bering Sea and attached to bedrock, boulders, and cobbles at depths between 71 and 255 m in the eastern Gulf of Alaska. Elsewhere – reported at depths to 74 m.

Remarks. Previously known as *Normania tenuilaminaris* Sollas 1886, *P. tenuilaminaris* was originally described as having straight acanthose microxeas. The microxeas we examined from the Bering Sea specimens were consistently bent but this is the only difference between the specimens and in our opinion not sufficient to separate the specimens at the species level. However, it is probable that the Bering Sea population is genetically isolated and may have developed different morphological characters, such as the bent microxeas. This species is preyed upon by the sea stars *Hippasteria* spp., *Poraniopsis inflata*, *Pteraster tesselatus*, *Ceramaster patagonicus*, and possibly *Henricia longispina*. We have observed a very similar sponge in the central Aleutian Islands at depths between 142 and 1386 m but we would need to collect a specimen to confirm conspecificity.

Photos. 1) Fragments of specimen collected at a depth of 175 m in the eastern Gulf of Alaska. Note the hydroids growing on the fringe. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. 3) Specimen collected at a depth of 486 m in Zhemchug Canyon, Bering Sea. Grid marks are 1 cm^2.





31. *Polymastia fluegeli* Lehnert, Stone and Heimler, 2005

Description. This sponge is endopsammic and disc-shaped with numerous fistules on the upper surface. The surface is smooth with long protruding spicules scattered about. The cortical layer is cartilaginous and more resilient than the relatively soft choanosome. The bottom side of the sponge is very firm and slightly elastic and consists of a layer of spongin-cemented sediment. In situ the plate is buried in the sediment; only the fistules protrude. The fistules are cone-shaped with no obvious opening. The disc is up to 52 cm in diameter and about 1 cm in thickness (3–4 mm of the thickness is due to the basal sediment layer). Color in life is light yellow with bright yellow fistules; disc is light brown after freezing.

Skeletal structure. SEM images of spicules are shown in Appendix IV. Polyspicular tracts arise from the basal sediment layer then widen, branch towards the surface, and fan out in the cortical layer. Polyspicular tracts are 350–500 µm in diameter. The cortical layer is 500–700 µm in thickness and, except for the ends of the ascending polyspicular tracts, consists of a mass of spicules without orientation. The outermost layer is a palisade of small tylostyles, oriented outward creating the microscopically hispid surface. The papillae also show the outermost palisade and the unorganized spicule mass below, but differ insofar as the polyspicular tracts run to the tip of the papillum. A central canal is visible in the center of the papillae but there is no opening visible. There are large fusiform tylostyles, in a wide size-range, longest ones often with one or several subterminal rings (180–1750 × 8–22 µm), and a small category of tylostyles (65–110 × 3–6 µm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Patchily distributed at depths between 81 and 338 m in generally low-relief (i.e., flat-bottomed) habitats of small pebbles and coarse sand with moderate to high current. Found at maximum densities up to eight individuals per m^2 in coarse sand habitats at 82 m depth.

Photos. 1) Specimen collected at a depth of 82 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ during collection. 3) Specimen observed at a depth of 142 m in the central Aleutian Islands. A prowfish (*Zapora silenus*) lies in a den just below the specimen.

32. *Polymastia pacifica* Lambe, 1893

Description. This sponge is subglobular to cushion-shaped. Surface is smooth to the unaided eye but microhispid with several papillae. Consistency is firm. Diameter is to at least 15 cm. Externally it is brownish orange in color; internally it is bright orange with lighter polyspicular tracts visible to the unaided eye.

Skeletal structure. Ectosomal palisade of small tylostyles are supported by intermediate tylostyles. Large tylostyles radiate in polyspicular tracts to the surface. There are large tylostyles (up to 4400 × 20 μm), intermediate tylostyles (200–600 × 12–16 μm), and small tylostyles (120–160 × 5–7 μm).

Zoogeographic distribution. Uncommon. North Pacific Ocean. In Alaska – central Aleutian Islands. Elsewhere – previously reported from Vancouver Island to California.

Habitat. In Alaska – attached to pebbles at depths between 150 and 160 m. Elsewhere – 73 m depth (Vancouver Island). Lamb and Hanby (2005) report that this species occurs from Alaska to California at depths between the intertidal zone and 183 m.

Photo. 1) Fragment of a specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.

33. *Stylocordyla borealis eous* Koltun, 1966

Description. Thin stalk terminates in a globular or oval body with a smooth surface. Stalk is to 9 cm; body to approximately 2 cm^3. Color in life is golden brown.

Skeletal structure. Skeleton of the stalk is a tight mass of parallel spicules running into the body and radiating to the sides in tracts. Smaller oxeas form a palisade at the surface of the body. Microxeas form a tangential crust at the surface. Oxeas are exclusively centrotylote, sometimes with blunt ends. Oxeas occur in a wide size-range, possibly in three categories: 790–2460 × 10–37 µm, 400–700 × 10–12 µm, and microxeas 70–110 × 2–3 µm.

Zoogeographic distribution. Locally abundant in the North Pacific Ocean. In Alaska – central Aleutian Islands and Bering Sea (Pribilof Canyon). Elsewhere – Sea of Okhotsk.

Habitat. In Alaska – attached to pebbles and emergent epifauna at depths between 125 and 307 m and generally in low-relief (i.e., flat-bottomed) habitats (central Aleutian Islands). Sponges with very similar morphology have been observed in the Aleutian Islands at depths near 1100 m, but we would need to collect a specimen to confirm conspecificity. Elsewhere – reported at a depth of 200 m.

Remarks. *Stylocordyla borealis eous* can be distinguished from the similar *Rhizaxinella clavata* by its thinner stalk and smooth oval body. Also, *S. borealis eous* has exclusively centrolyte oxeas while *R. clavata* has tylostyles and subtylostyles.

Photos. 1) Specimen collected at a depth of 127 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (indicated by the white arrow) in situ. 3) Specimen collected at a depth of 208 m in Pribilof Canyon, Bering Sea. Specimen is attached to an unknown hexactinellid sponge.

34. *Aaptos kanuux* Lehnert, Hocevar, and Stone 2008

Description. Species is irregularly globular. Surface is almost smooth, microscopically slightly uneven. No oscula are visible. Consistency is firm, only slightly elastic. Diameter ranges from 9 to 19 mm. Color in life is mustard yellow.

Skeletal structure. SEM images of spicules are shown in Appendix IV. Spicules are strictly radially arranged in the choanosome; spicule density is very high. Special dermal oxeas are densely arranged perpendicular to the surface and form a palisade. There are fusiform strongyloxeas (1795–2132 × 15–22 μm), subtylostyles (500–770 × 8–10 μm), and ectosomal tylostyles (104–215 × 4–8 μm).

Zoogeographic distribution. Locally common. In Alaska – known only from the type locality in Pribilof Canyon, Bering Sea. Elsewhere – not reported.

Habitat. Attached to pebbles in low-relief (i.e., flat-bottomed) silt and sand habitat at depths between 203 and 240 m. Often found in association with several unknown species of hydroids, zoanthids, and the demosponge *Stylocordyla borealis eous*.

Photos. 1) Specimen collected at a depth of 219 m in Pribilof Canyon, Bering Sea. 2) Same specimen as in photo 1 showing close-up detail of the radial arrangement of the choanosome. 3) Same specimen as in photos 1 and 2 in situ. The separation between the red laser marks is 10 cm.

35. *Rhizaxinella clavata* (Thiele, 1898)

Description. Thin stalk terminates in a globular or oval body. Species is similar to *Stylocordyla borealis eous*. This species has a slightly thicker stalk which widens towards the body and a strongly hispid surface of the body compared to the smooth surface of *S. borealis eous*. Spicules are arranged radially in the interior of the sponge with dense spicule brushes at the surface. Length is up to 5.5 cm. Color in life is golden brown.

Skeletal structure. There are tylostyles to subtylostyles (1050–1780 × 15–32 μm) and smaller tylostyles (180–370 × 6–10 μm).

Zoogeographic distribution. Uncommon. In Alaska – Bering Sea (Zhemchug Canyon). Elsewhere – the holotype was recorded from the Sea of Japan.

Habitat. In Alaska – attached to hexactinellid sponge skeletons at a depth of 915 m. Elsewhere – reported on mud bottoms at a depth of 183 m.

Remarks. *Rhizaxinella clavata* can be distinguished from the similar *Stylocordyla borealis eous* by its thicker stalk and hispid oval body. Also, *R. clavata* has tylostyles and subtylostyles while *S. borealis eous* has exclusively centrolyte oxeas.

Photo. 1) Specimen collected at a depth of 915 m in Zhemchug Canyon, Bering Sea. Specimen is attached to an unidentified hexactinellid sponge skeleton.

36. *Suberites excellens* (Thiele, 1898)

Description. This massively lobate sponge has irregularly cylindrical lobes. Surface is smooth to the unaided eye but microscopically hispid. Circular oscula are near tips of lobes and slightly elevated above the surface. Consistency is firm but elastic. Height is to 14 cm. Color in life is yellowish brown.

Skeletal structure. Skeletal architecture is more or less confused in the interior but becomes radial towards the surface. The surface consists of a palisade of smaller tylostyles. There are thick tylostrongyles with round tyles at one end and only slightly tapering at the other (640–1890 × 17–46 µm), somewhat thinner and flexuous tylostrongyles (1140–2100 × 17–26 µm), and small tylostyles forming the palisade at the surface (175–520 × 8–12 µm).

Zoogeographic distribution. Rare. In Alaska – Bering Sea (Zhemchug Canyon) and eastern Gulf of Alaska. Elsewhere – Holotype described from Sagami Bay, Japan; also recorded along Korean Coast (Sim and Kim, 1988).

Habitat. In Alaska – attached to boulders and cobbles at depths between 390 and 601 m. Elsewhere – no information available.

Remarks. This was previously known as *Rhizaxinella excellens* Thiele, 1898. It typically harbors an abundant and diverse complement of ophiuroid associates.

Photos. 1) Fragments of specimen with ophiuroid associates collected at a depth of 390 m in Zhemchug Canyon, Bering Sea. 2) Close-up view of oscula atop the lobes.

37. *Suberites simplex* Lambe, 1893

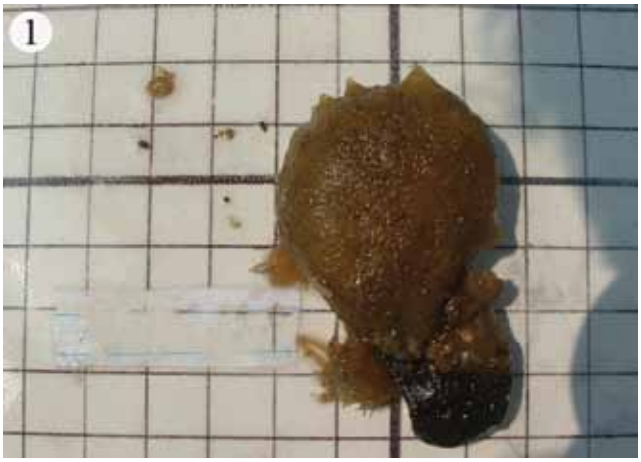
Description. This small sponge has a subglobular to globular growth form. Surface is smooth to the unaided eye but microscopically hispid. Consistency is firm but elastic. Diameter is at least 5 cm. Color in life is golden brown to brown.

Skeletal structure. Ectosomal skeleton consists of bouquets of small tylostyles at the surface. Densely packed larger tylostyles in the interior are arranged without orientation. Tylostyles are large (620–1170 × 10–20 µm) and small (120–230 × 3–5 µm).

Zoogeographic distribution. Uncommon in the North Pacific Ocean. In Alaska – central Aleutian Islands. Elsewhere – Vancouver Island.

Habitat. In Alaska – attached to pebbles at depths between 150 and 160 m. Elsewhere – reported at a depth of 73 m.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.



38. *Suberites* sp.

Description. This "mobile" sponge lives as an irregularly globular encrustation on empty gastropod shells. Frequently lives in symbiosis with hermit crabs including *Pagurus dalli*. Surface is smooth to the unaided eye but microscopically hispid due to dense spicule brushes that leave open numerous small pores (50–100 µm diameter). Irregular short tracts in the choanosome form a vague reticulation. Diameter is at least 10 cm. Color in life is red, orange, or tan; pale yellow in ethanol.

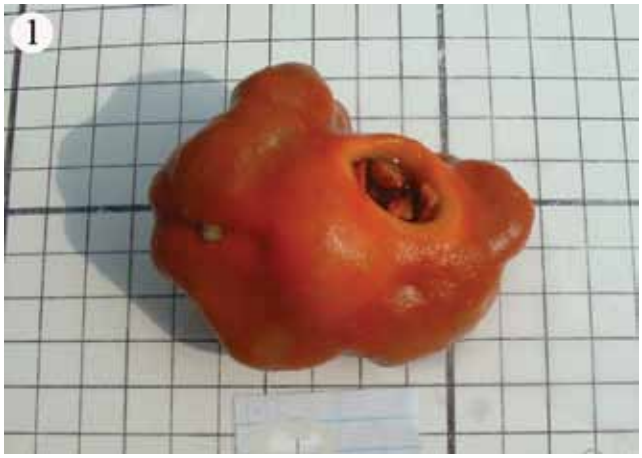
Skeletal structure. Viewed under high magnification, the spicules are relatively dense without particular orientation. There are tylostyles to tylostrongyles (123–350 × 7–12 µm).

Zoogeographic distribution. Locally abundant. In Alaska – Bering Sea to Southeast Alaska.

Habitat. In Alaska – typically encrusts gastropod shells at depths between 20 and 165 m.

Remarks. This species is indistinguishable from *Suberites domuncula* that is common to the Mediterranean Sea and Atlantic Ocean along the west coast of North Africa. However, we doubt conspecificity based on the disjunct zoogeography and leave the species assignment for this specimen as undecided. The species complex is in desperate need of taxonomic revision. There are probably several sibling species that live in symbiosis with hermit crabs (more than a dozen species reported worldwide). *S. domuncula* contains suberitine, a neurotoxin that can cause fatal hemolytic hemorrhaging in some animals including some reef fish. However, the hawksbill turtle (*Eretmochelys imbricata*) does prey upon it in tropical waters (Meylan, 1988). No studies have been conducted on Alaskan specimens.

Photo. 1) Specimen collected at a depth of 84 m in the central Aleutian Islands. This is the ventral side of the sponge showing the cavity in which a hermit crab *Pagurus dalli* (completely retracted) is living. Grid marks are 1 cm^2.



39. *Hemigellius porosus* (Fristedt, 1887)

Description. This sponge is massively encrusting and very fragile. Surface is smooth to the unaided eye but microscopically hispid. No oscula are visible. Fristedt (1887) described this species as forming irregular knolls, 9 cm in longest dimension. Color in life is whitish yellow to creamy white.

Skeletal structure. It has an irregular unispicular or paucispicular mesh of oxeas (250–340 × 9–11 µm) and stigmata (40–60 µm).

Zoogeographic distribution. Widespread but uncommon. In Alaska – Bering Sea (Zhemchug Canyon). Elsewhere – North Pacific Ocean (Sea of Okhotsk and Sea of Japan), Arctic Ocean (Barents Sea, Kara Sea, Laptev Sea), North Atlantic Ocean (West of Spitzbergen, East of Greenland, Denmark Strait, Davis Strait, Gulf of St. Lawrence, between Iceland and the Faroe Islands).

Habitat. In Alaska – attached to cobbles at a depth of 909 m. Elsewhere – reported at depths between 68 and 256 m.

Photo. 1) Fragments of specimen collected at a depth of 909 m in Zhemchug Canyon, Bering Sea.

40. *Cornulum clathriata* (Koltun, 1955)

Description. This stalked fan-shaped sponge consists of a meshwork or net; not flat but slightly concave. Consistency is wiry due to the mesh of spicule tracts. It is relatively small; height to 11 cm. Color in life is light yellow.

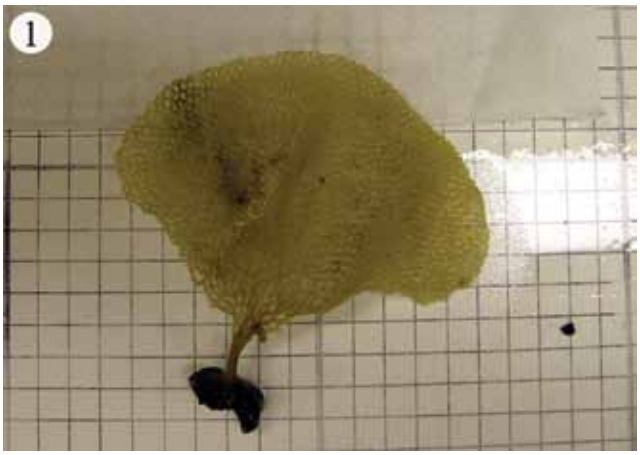
Skeletal structure. Structure includes ectosomal tylotes with acanthaceous ends (280–420 × 6–8 μm); choanosomal styles with slightly acanthaceous blunt ends in a wide size range (215–2000 × 18–33 μm); and spherical isochelae (17–25 μm) and toxa in two size categories – large (55–220 μm) and small (10–18 μm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – previously known from only two records near the Commander Islands (Russia) in the western Bering Sea.

Habitat. In Alaska – attached to bedrock or mudstone at depths between 843 and 1720 m. Elsewhere – reported at a depth of 2440 m.

Remarks. Previously known as *Melonchela clathriata* Koltun, 1955.

Photos. 1) Specimen collected at a depth of 1720 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.



41. *Iophon piceum* (Vosmaer, 1882)

Description. This sponge is massively encrusting. According to Koltun (1959), growth form may also be massive-lobate, tabular, dactylate, ramified, or irregularly lobate. Oscula are on short elevations or flush with the surface. Dermal membrane is thin and pellicular. Consistency is soft and easily torn. It may reach a height of 15 cm. Color in life is golden brown to brown.

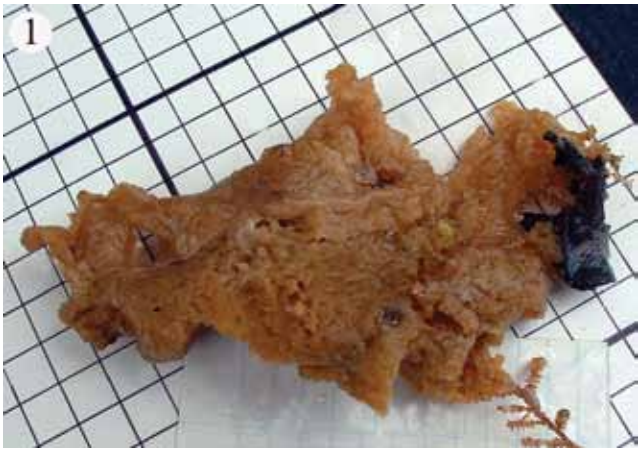
Skeletal structure. Ectosomal tornotes (150–270 × 6–10 μm) with micro-spined heads, are arranged in bundles tangential to the surface. Choanosomal skeleton is reticulate with smooth styles or acanthostyles (195–435 × 9–18 μm), anisochelae (18–37 μm), and bipocillae (8–14 μm).

Zoogeographic distribution. Widespread and locally common. In Alaska – central Aleutian Islands. Elsewhere – North Pacific Ocean (Sea of Okhotsk and Sea of Japan), Arctic Ocean (Barents Sea including White Sea, Kara Sea – Vilkitsky Strait, and Greenland Sea), and North Atlantic Ocean (Norwegian Sea, Davis Strait, and Denmark Strait).

Habitat. In Alaska – attached to pebbles and small cobbles at depths between 94 and 155 m. Elsewhere – eurybathic; reported at depths between 9 and 1785 m.

Remarks. This species often grows in association with, and encrusts, hydroids and bryozoans.

Photos. 1) Specimen collected at a depth of 94 m in the central Aleutian Islands. Specimen is encrusting the hydroid *Abietinaria* sp. (lower right). Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (indicated by the white arrows) in situ with the plumose hydroids (*Abietinaria* sp.). 3) Specimen collected at a depth of 155 m in the central Aleutian Islands. Specimen is encrusting the bryozoan (*Microporina* cf. *articulata*). Grid marks are 1 cm^2.



42. *Iophon piceum abipocillus* Koltun, 1959

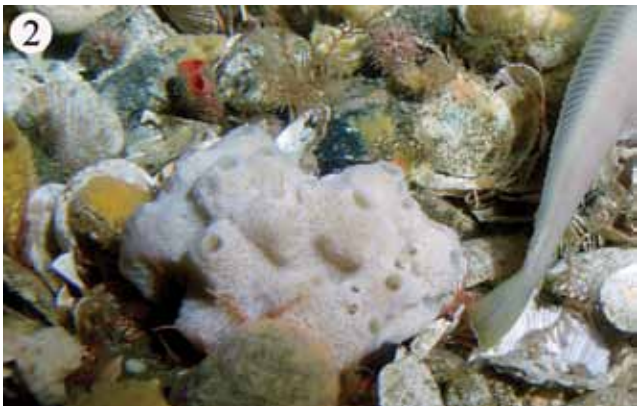
Description. This sponge is massively encrusting. It is very similar to *Iophon piceum* except the ectosome is white rather than golden-brown and the oscula are distinctly conical. Diameter is to 25 cm. Color in life is white; turns completely brown with darker brown oscula in ethanol.

Skeletal structure. It is very similar to *Iophon piceum* except that bipocillae are absent.

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – Sea of Okhotsk.

Habitat. In Alaska – attached to boulders, cobbles, and pebbles at depths between 82 and 192 m. Elsewhere – reported at a depth of 1240 m.

Photos. 1) Specimen collected at a depth of 100 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.



43. *Megaciella anisochela* Lehnert, Stone and Heimler, 2006

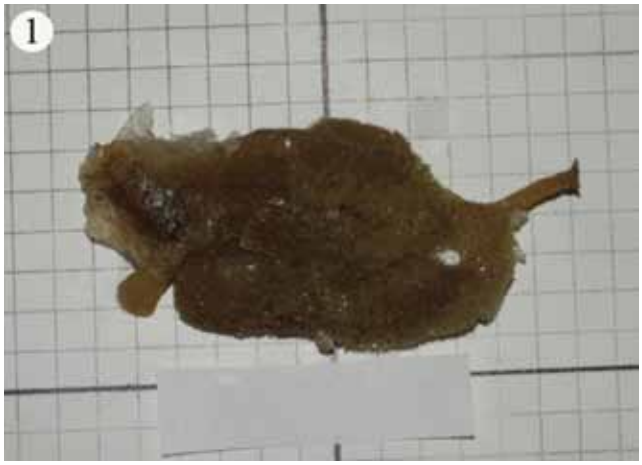
Description. This sponge has clusters of 4–8 tubes with a common stalk. The surface is finely hispid with no recognizable oscula. The consistency is soft and elastic. The dimensions of the short stalk are 2.0 × 0.5 cm and the tubes are approximately 11 × 5 cm. Color in life is light yellow; golden brown after freezing; beige in ethanol.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome is a thin translucent membrane with tangentially arranged tylotes, singly or in small bundles, facing in all directions within the tangential plane. The ectosome contains many isochelae and is supported by underlying styles. The choanosome is a combination of a unispicular reticulation of single spicules and ascending paucispicular tracts connected by single spicules. Ascending tracts of styles penetrate the ectosomal membrane and cause the hispidation. Ectosomal tylotes (245–380 × 4–9 μm) have acanthose heads. Smooth choanosomal styles measure 490–615 × 18–22 μm. Microscleres are palmate isochelae (13–17 μm) with narrow extensions, a small category of palmate isochelae (6–8 μm), and a small category of distorted anisochelae (4–6 μm).

Zoogeographic distribution. In Alaska – locally abundant in central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to bedrock, boulders, and cobbles at depths between 702 and 750 m.

Photos. 1) Specimen collected at a depth of 702 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.



44. *Megaciella spirinae* (Koltun, 1958)

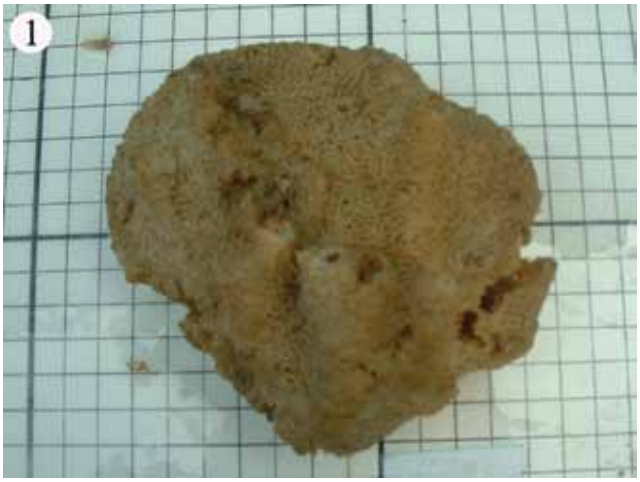
Description. This irregularly massive-lobate sponge has an uneven, corrugated surface. Oscula are present on top of cylindrical elevations. Consistency is elastic, soft, and easily torn. Diameter is to 13 cm. Color in life is golden brown.

Skeletal structure. Ectosomal tornotes (160–210 × 4-6 μm) have acanthose ends. There are choanosomal acanthostyles (175–212 × 12–16 μm), arcuate isochelae (28–32 μm), and toxa (90–150 μm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – eastern Tartar Strait, near the Pacific Coast of the southern Kuril Islands.

Habitat. In Alaska – attached to small cobbles and pebbles in generally low-relief (i.e., flat-bottomed) habitat at depths between 150 and 160 m. Elsewhere – attached to pebbles in sandy habitat at depths between 71 and 414 m and at temperatures between 2.3 and 6.6°C.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.



45. *Clathria* (*Clathria*) *barleei* (Bowerbank, 1866)

Description. This sponge is elongated and massive. It is irregularly ramified with a corrugated surface; oscula are flush with the surface. Diameter is to 15 cm. Color in life is orange-brown.

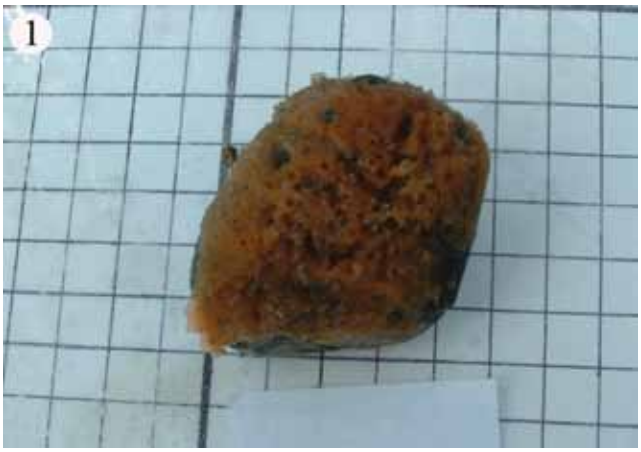
Skeletal structure. Dermal styles (270–360 × 3–6 μm) have acanthose heads. There are choanosomal smooth styles (420–540 × 18–35 μm), isochelae (16–20 μm), and toxa (130–720 μm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – Arctic Ocean (Barents Sea near Murmansk, Russia) and Northeast Atlantic Ocean (from Ireland to France and Norway).

Habitat. In Alaska – attached to small cobbles and pebbles in generally low-relief (i.e., flat-bottomed) habitat at depths between 150 and 160 m. Elsewhere – reported at depths between 72 and 440 m and temperatures between 1 and 4.2° C.

Remarks. Specimens from the Northeast Atlantic are described as flabellate with a characteristic honeycombed surface of a different color (Van Soest and Stone, 1986). The spicule complement (types and size ranges) of this specimen conforms perfectly to *Clathria barleei* so we assume it to be another growth form of the same species in the Pacific Ocean. Van Soest and Stone (1986) report this species from the Arctic to the west coasts of Ireland and France so a circumpolar distribution seems possible.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm².



46. *Clathria* (*Clathria*) *laevigata* Lambe, 1893

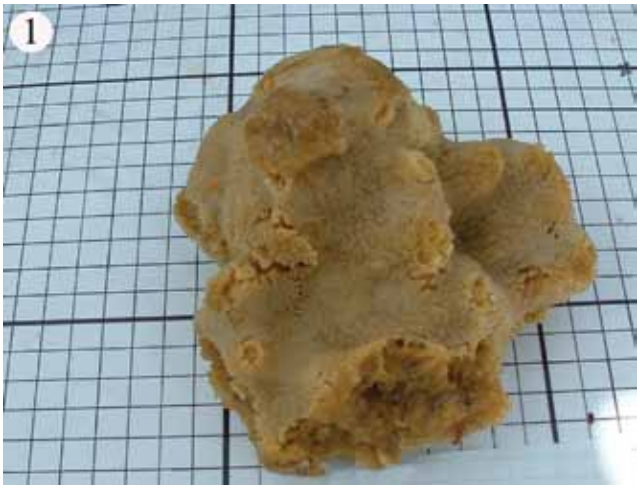
Description. This sponge is massive, laterally compressed, and irregularly lobate. Consistency is soft and fragile with round, slightly elevated oscula. Diameter is to 30 cm. Color in life is golden brown. The ectosomal membrane may have a greyish tinge.

Skeletal structure. Structure includes ectosomal smooth small styles (230–290 × 6–10 µm); choanosomal smooth styles (440–560 × 20–30 µm) occasionally with acanthose heads; and small acanthostyles (90–240 × 8–12 µm). Microscleres are palmate isochelae (20–25 µm) and toxas (200–530 µm).

Zoogeographic distribution. Locally common in North Pacific Ocean. In Alaska – central Aleutian Islands. Elsewhere – known from Kuril Strait (Russia) and near Vancouver Island (Canada).

Habitat. In Alaska – attached to cobbles and pebbles at a depth of 167 m. Elsewhere – reported at depths between 72 and 138 m.

Photos. 1) Fragment of a specimen collected at a depth of 167 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (indicated by the white arrow) in situ.



47. *Clathria* (*Axosuberites*) *lambei* (Koltun, 1955)

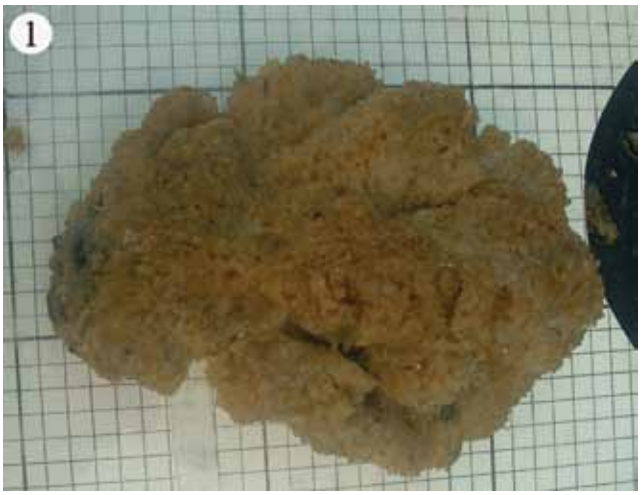
Description. This sponge grows from an encrusting base to a mass of branches or lobes with an uneven surface. Consistency is soft and elastic. Diameter is to 30 cm. Color in life is golden brown.

Skeletal structure. Ectosome consists of brushes of smaller subtylostyles and tylostyles with large protruding choanosomal styles. Choanosomal smooth styles, often with acanthaceous heads, are arranged in plumose tracts and echinated by small acanthostyles. There are eectosomal tylostyles and subtylostyles (520–1370 × 8–18 µm); choanosomal large styles (540–1960 × 28–40 µm) with acanthose heads, acanthostyles (120–430 × 10–20 µm), and palmate isochelae (18–25 µm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – southern Sea of Okhotsk and Sea of Japan (southern Kuril Islands).

Habitat. In Alaska – attached to small cobbles and pebbles in generally low-relief (i.e., flat-bottomed) habitat at depths between 150 and 160 m. Elsewhere – reported at depths between 91 and 550 m on oozy sand and pebbles and at temperatures between 1 and 1.3°C and a salinity of 34.18 psu.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.



48. *Echinoclathria vasa* Lehnert, Stone and Heimler, 2006

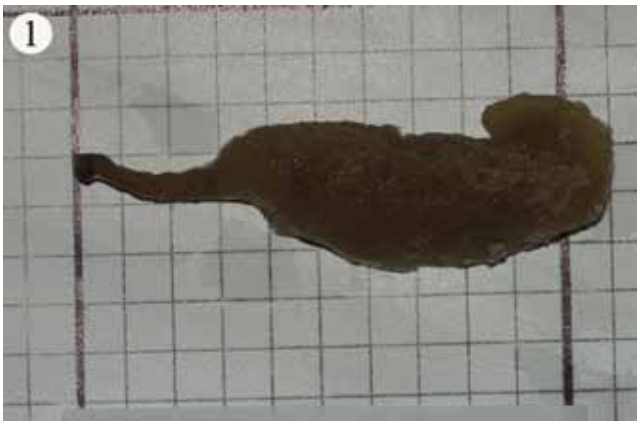
Description. This sponge has a stalked vase with a flared lip and a markedly concave surface; walls are 5–10 mm in thickness. Consistency, except for the stalk, is very soft and elastic. In areas of water current this species typically bends over near the base and sometimes lies in contact with the seafloor. Height is to 13 cm and width to 3 cm. Color in life is light yellow to creamy white; golden brown after freezing.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome is a thin membrane packed with anchorate isochelas (21–27 µm). The choanosome consists of paucispicular tracts of thick styles (760–920 × 16–21 µm) and brushes of thin styles that fan out towards the surface with many isochelas in between. Thin styles (740–1230 × 4–6 µm) are slightly curved to sinuous and have finely acanthose heads.

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Occurring individually on exposed bedrock, cobbles, and pebbles at depths between 622 and 876 m and generally in low-relief (i.e., flat-bottomed) habitats.

Photos. 1) Preserved (frozen) specimen collected at a depth of 744 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ during collection. 3) Same specimen as in photos 1 and 2 in situ showing detail of the flared lip.



49. *Artemisina amlia* Lehnert, Stone and Heimler, 2006

Description. This sponge is stalked with a subhemispherical or conical body. The stalk widens gradually from 4 to 25 mm over a distance of approximately 9 cm and is not sharply separated from the body. The consistency is soft, elastic, and easily torn. There are wart-like, slightly elevated oscula on the dorsal surface of the sponge only that are circular and 2 mm in diameter. Diameter of conical body is to 20 cm; total height to 15 cm or more. Color in life is light orange to golden brown. In ethanol the body has a whitish, translucent ectosome on top with a yellowish, fibrous choanosome underneath.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome of the conical body is composed of a mesh-work of polyspicular tracts (55–175 µm in diameter) of small styles with a mesh-size of 350–750 µm. This large mesh is subdivided by a finer net of strands of spongin-embedded isochelae. This finer net has a mesh-size of 45–90 µm; single, translucent strands are 15–25 µm in diameter. The ectosome of the stalk is thinner and consists of a dense, unispicular layer of tangentially arranged, parallel-oriented thick styles. In the choanosome of the stalk, ascending polyspicular tracts of thick styles are connected by paucispicular tracts and single spicules, comparable to the choanosome of the conical body. There are large, smooth styles (400–520 × 20–25 µm), small styles (330–550 × 10 µm) with acanthose heads and often with one prominent dent, isochelae (10–13 µm), and toxa (110–170 µm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to bedrock, boulders, cobbles, and pebbles at depths between 97 and 253 m. Associated with the demosponge *Mycale carlilei*.

Photos. 1) Specimen collected at a depth of 119 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ showing dorsal surface with elevated oscula.

50. *Artemisina arcigera* (Schmidt, 1870)

Description. This sponge is stalked and tube-shaped in the Aleutian Islands, but Koltun (1959) described this species as cushion-shaped, spherical, or somewhat elongated, and up to 5.5 cm in height. The surface of the sponge is smooth at the stalk and gradually changes from hispid to rugose in the lower half and is smooth again in the apical region. No oscula are visible. The consistency of the stalk is wiry and gets softer along its length. In areas of water current this species typically bends over near the base and sometimes lies in contact with the seafloor. Stalked forms are to 31 cm in height and 7 cm in width. Color in life is brown to golden brown.

Skeletal structure. There are ectosomal brushes of smaller subtylostyles (280–428 × 9–18 µm); choanosomal large subtylostyles (430–676 × 6–9 µm), occasionally with acanthaceous heads; palmate isochelae (6–15 µm); and toxas with acanthaceous ends (60–360 µm).

Zoogeographic distribution. Widespread and locally common. In Alaska – central Aleutian Islands. Elsewhere – widely distributed in the Arctic Ocean (Barents Sea – White Sea, Kara Sea – Vilkitsky Strait, Greenland Sea – Island of Spitsbergen) and Northeast Atlantic Ocean (Norwegian Sea, Denmark Strait, Davis Strait).

Habitat. In Alaska – attached to cobbles and pebbles at depths between 170 and 436 m. Elsewhere – reported at depths between 14 and 1000 m and temperatures between 1.4 and 5.0°C.

Remarks. Specimens from the Aleutian Islands differ in form from previous records but the spicule complement (types and size ranges) of the specimens conform perfectly to *A. arcigera* so we assume they are a previously unreported growth form of the same species. The shrimp *Eualus barbatus* is often associated with this sponge.

Photos. 1) Specimen collected at a depth of 192 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ (center). 3) Same specimen as in photos 1 and 2 showing details of the rugose surface and apical region.

51. *Artemisina stipitata* Koltun, 1958

Description. This sponge is flabellate in the Aleutian Islands but spherical and lobate forms have been reported elsewhere. It is basally stalked and gradually tapers to a holdfast. Conspicuous oscula are present on dorsal surfaces. The stalk is cylindrical and rigid. The body is soft and elastic. Height and width are at least 50 cm. The ectosome is yellow or light brown. The choanosome is orange-brown.

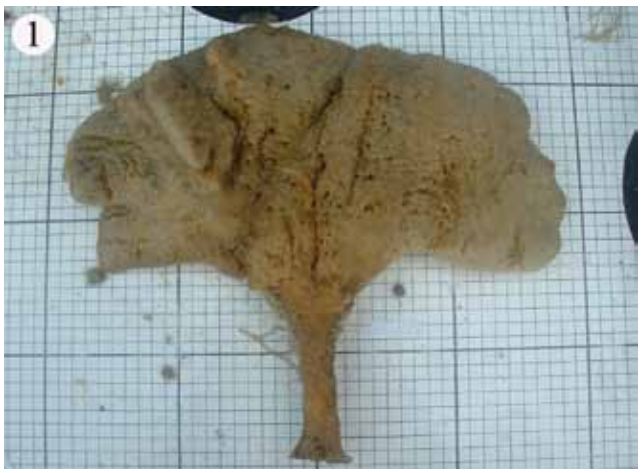
Skeletal structure. Ectosomal skeleton has tangentially arranged small styles with acanthose heads (220–340 × 6–10 μm). The reticulate choanosomal skeleton has fusiform styles with acanthose heads (460–510 × 18–25 μm). Microscleres are palmate isochelae (10–19 μm).

Zoogeographic distribution. Locally abundant. In Alaska – central Aleutian Islands. Elsewhere – previously known from only two specimens collected in southern Kuril Strait until discovered in the central Aleutian Islands in 2004.

Habitat. In the Aleutian Islands – attached to bedrock outcrops, boulders, and cobbles at depths between 80 and 239 m on shelf and upper slope habitats. Elsewhere – no information available.

Remarks. It is similar in appearance to *Tedania kagalaskai,* with which it co-occurs. The dorsal surface of *A. stipitata* is typically more rounded than *T. kagalaskai* and the body form of the latter species is much smoother and more distinctly triangular. *A. stipitata* is often associated with the gorgonian *Fanellia compressa.*

Photos. 1) Specimen collected at a depth of 150 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ showing the detail of the oscula on the dorsal surface. 3) Specimen observed in situ at a depth of 87 m in the central Aleutian Islands. 4) Specimen observed in situ at a depth of 105 m in the central Aleutian Islands. A juvenile king crab uses the sponge as a perch.



52. *Artemisina* sp.

Description. Aleutian Island specimens consist of many large rounded lobes growing from a narrow base. Large lobes often develop side-branches. Koltun (1959) described this same species as funnel-shaped, thickly tabular or massive. The surface is strongly rugose with a thin ectosomal membrane. Circular oscula are flush with the surface. It is soft and elastic but fragile. Size is large with height to 40 cm and width to 60 cm. Color in life varies from yellowish grey, light brown to orange; typically golden yellow color in situ.

Skeletal structure. Ectosomal thin styles form a unispicular reticulation with microscleres scattered in between. Choanosomal multispicular tracts have large styles and single spicules. Styles are often acanthaceous at the base. There are large styles (490–840 × 15–30 μm), small styles (210–480 × 7–10 μm), palmate isochelae (12–22 μm), small toxa (30–120 μm), and large toxa (280–340 μm).

Zoogeographic distribution. Locally abundant. In Alaska – central Aleutian Islands. Elsewhere – Arctic Ocean (Barents, Greenland, Kara, and Laptev seas).

Habitat. In Alaska – attached to bedrock, boulders, and cobbles at depths between 80 and 195 m. Elsewhere – reported at depths between 18 and 380 m.

Remarks. This is *Artemisina apollinis* sensu Koltun (1959). However, *A. apollinis* was originally described from near the Kerguelen Islands in the southern Indian Ocean so conspecificity is unlikely. It is similar in appearance to *Mycale loveni* with which it co-occurs, but this species is much more heavily lobed than *M. loveni* and narrows to a stout and narrow base. *M. loveni* is more massive with a less defineable base. It may be preyed upon by the sea star *Henricia* sp.

Photos. 1) Specimen collected at a depth of 195 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2. 3) Specimen observed at a depth of 122 m in the central Aleutian Islands.

53. *Coelosphaera oglalai* Lehnert, Stone and Heimler, 2006

Description. This sponge is subglobular or massively encrusting. The smooth surface is covered irregularly with conical papillae of very different sizes, ranging from 2–20 mm in height and 1–18 mm in diameter. Individuals are to about 8 cm in diameter. Color in life is light orange; beige in ethanol.

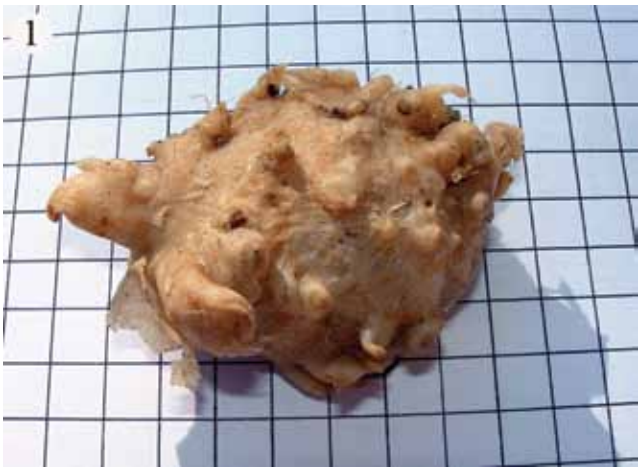
Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome is a tangential arrangement of tylote bundles in some areas and a tangential arrangement of all spicule types in other areas. In the choanosome, strongyles are arranged halichondroid, relatively dense; polyspicular tracts are vaguely recognizable in some areas. The choanosomal megascleres vary from blunt ended (anis-) oxeas to strongyles (570–634 × 27–32 μm), always with finely acanthose ends. Ectosomal tylotes (325–364 × 7–10 μm) have slightly acanthose ends. Microscleres are arcuate isochelae (47–52 μm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to cobbles and pebbles at depths between 100 and 155 m.

Remarks. They may be overgrown with bryozoans and found in association with the demosponge *Iophon piceum abipocillus*.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.



54. *Inflatella globosa* Koltun, 1955

Description. This sponge is subglobular with a conulose surface. Tiny conules are distributed uniformly over the surface of the sponge, but oscula are atop small papillae that are restricted to the dorsal surface. The oscula contract upon fixation. Consistency is rather firm but elastic. Diameter is to approximately 50 cm. Color in life is orange, yellow, to creamy white; pale yellow in ethanol.

Skeletal structure. There is a thick dermal membrane, densely packed with tylotes (300–400 µm in thickness) without apparent organization. Tylotes (about 240–350 × 5–10 µm) have distinctive swollen heads that form polyspicular tracts arranged in an irregular meshwork. There are no microscleres.

Zoogeographic distribution. Locally common in the North Pacific Ocean. In Alaska – central Aleutian Islands. Elsewhere – Bering Sea near Mednyi Island (Commander Islands), western Sea of Okhotsk, and Sea of Japan.

Habitat. In Alaska – attached to bedrock and cobbles at depths between 56 and 138 m. Elsewhere – on rock, gravel, and sand at depths between 6 and 299 m and a temperature of 2°C.

Remarks. The genus *Inflatella* typically has strongyles but Koltun (1959, fig. 59) described *Inflatella globosa* as having tylotes. So this species as described by Koltun might be transferred to another genus in the future. *I. globosa* is similar to *Kirkpatrickia borealis* but is more globular with oscules on top of small papillae, while the latter species is irregularly massive with relatively inconspicuous oscules. Also, *I. globosa* has tylotes only, while *K. borealis* has tylotes, styles, and a few strongyles.

Photos. 1) Specimen collected at a depth of 138 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.

55. *Lissodendoryx* (*Lissodendoryx*) *behringi* Koltun, 1958

Description. This sponge is globular. Surface is very uneven, covered with numerous wart-like papillae. Oscula atop the papillae contract upon collection. The contracted surface of the specimen on deck (see photo) suggests that it looks quite different in situ. Consistency is only slightly elastic, easy to tear. Ectosome is relatively thick and easily detachable. Size is to 30 cm (diameter) × 20 cm (height). Color in life ranges from yellow to light orange.

Skeletal structure. This species has ectosomal tornotes (380–750 × 10–18 μm) resembling strongyles and styles, choanosomal acanthostyles (290–680 × 20–40 μm), and arcuate isochelae (42–47 μm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – known from the Bering Sea (Russia) and the Sea of Okhotsk.

Habitat. In Alaska – attached to cobbles and boulders at depths between 87 to 220 m. Elsewhere – reported at depths between 32 and 198 m.

Remarks. Koltun (1958) mentions strongylote ectosomal megascleres only in his description of this species, but we note some individual differences between specimens that we have examined. In some specimens strongylote forms dominate, while others have mainly stylote ectosomal tornotes. As all other characters and the dimensions of the spicules are within the range for *L. behringi*, we attribute these differences to intraspecific variations. Gross morphology and spicule complement are similar to *Phorbas paucistyliferus*, but the spicule architecture is quite different.

Photo. 1) Specimen collected at a depth of 124 m in the central Aleutian Islands. Grid marks are 1 cm^2.

56. *Lissodendoryx* (*Ectyodoryx*) *olgae* (Hentschel, 1929)

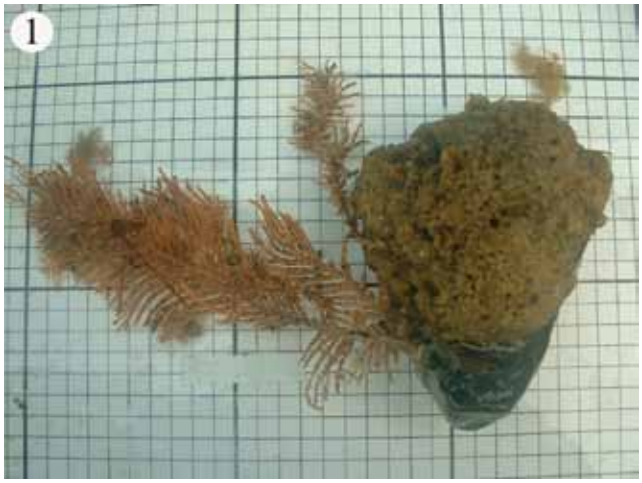
Description. This sponge is massively encrusting. Oscula are in small depressions; surface is corrugated. Consistency is soft and very fragile. Diameter is to 15 cm. Color in life is brown to golden brown.

Skeletal structure. There are tangentially arranged ectosomal tylotes (240–290 × 4–8 µm), often strongylote. Choanosomal acanthostyles are in two size categories – large (235–310 × 12–18 µm), and smaller echinating acanthostyles (120–160 × 6–8 µm). There are large arcuate chelae (48–52 µm), small isochelae (15–20 µm), and sigmas (48–62 µm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – Arctic Ocean (western Barents Sea) and North Atlantic Ocean (near Norway).

Habitat. In Alaska – attached to small cobbles and pebbles in generally low-relief (i.e., flat-bottomed) habitat and at depths between 150 and 160 m. Elsewhere – reported at depths between 130 and 210 m.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands growing with the gorgonian *Plumarella* sp. Grid marks are 1 cm^2.



57. *Lissodendoryx* (*Lissodendoryx*) *oxeota* Koltun, 1958

Description. This sponge is massive-lobate and encrusting. Surface has small papillae. A thick ectosomal membrane covers an underlying honeycombed structure of the ectosome. Consistency is elastic and compressible. Diameter is to 15 cm. Color in life is golden brown.

Skeletal structure. There are ectosomal oxeas and tylotes (239–322 × 9–12 μm), choanosomal acanthostyles (231–426 × 12–18 μm), and arcuate isochelae (16–21 μm).

Zoogeographic distribution. Rare. In Alaska – central Aleutian Islands. Elsewhere – previously known from only two records in the Sea of Okhotsk (east of Sakhalin Island and in Kuril Strait).

Habitat. In Alaska – encrusts other demosponges at depths between 758 and 955 m. Elsewhere – reported at depths between 100 and 110 m.

Remarks. Aleutian Island specimens encrust near the base of the demosponges *Esperiopsis flagrum* and *Abestopluma ramosa*.

Photos. 1) Specimen collected at a depth of 954 m in the central Aleutian Islands. Specimen is encrusting the demosponge *Esperiopsis flagrum* near the base. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (indicated by the white arrow) in situ. The separation between the red laser marks is 10 cm.

58. *Lissodendoryx* (*Lissodendoryx*) *papillosa* Koltun, 1958

Description. This species appears as described by Koltun (1958) as a globular or massive-lobate sponge, only slightly elastic and up to 6 cm in height. It bears closely spaced cone-shaped papillae and has an easily detachable dermal membrane. Color in life is gold to golden brown.

Skeletal structure. Spicules form an irregular mesh. Styles (495–1050 × 15–24 μm) are smooth, generally slightly acanthose at the blunt end. Ectosomal tylotes (275–415 × 8–10 μm) have acanthose ends. Microscleres are arcuate isochelae (25–38 μm).

Zoogeographic distribution. Rare. In Alaska – Bering Sea (Zhemchug Canyon). Elsewhere – previously known only from the Sea of Okhotsk.

Habitat. In Alaska – attached to hexactinellid sponge skeletons at a depth of 911 m. Elsewhere – no information available.

Photo. 1) Specimen collected at a depth of 911 m in Zhemchug Canyon, Bering Sea, with associated ophiuroids.

59. *Monanchora alaskensis* (Lambe, 1895)

Description. This stalked sponge widens from a relatively narrow peduncle to the appearance of many agglutinated tubes (up to eight tubes). Growth form may also be flabellate, dactylate, or irregularly lobate (Koltun, 1959). Surface is smooth; large oscula are arranged in rows on the apical surface. The consistency is elastic and compressible but difficult to tear due to the polyspicular tracts of the choanosome. Height is to at least 17 cm. Color in life is golden brown to brown.

Skeletal structure. There are ectosomal thin styles (120–200 × 7–9 μm), choanosomal styles (180–360 × 13–20 μm) that form an irregular meshwork of polyspicular tracts, anchorate isochelae (70–90 μm), and small isochelae (30–40 μm).

Zoogeographic distribution. Widespread but uncommon in the North Pacific Ocean. In Alaska – central Aleutian Islands and Bering Sea. Elsewhere – Bering Sea (Russia) and Sea of Okhotsk.

Habitat. In Alaska – attached to bedrock and cobbles at depths between 146 and 364 m. Elsewhere – on pebbles, rocks, and sand at depths between 32 and 148 m and temperatures of 1.4 to 6.5°C.

Photo. 1) Specimen collected at a depth of 146 m in the central Aleutian Islands. Grid marks are 1 cm^2.

60. *Monanchora laminachela* Lehnert, Stone and Heimler, 2006

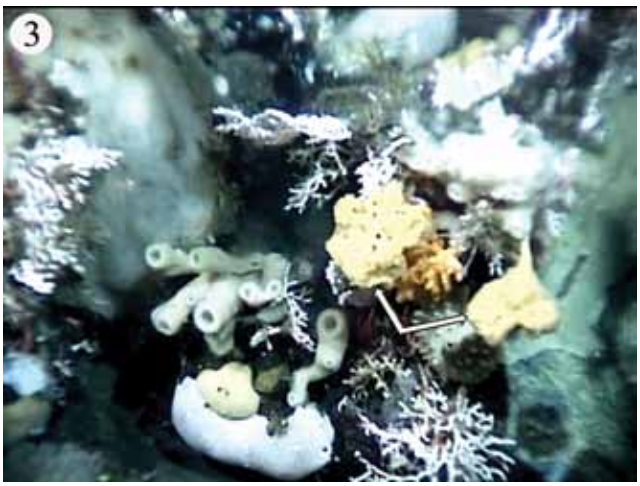
Description. This sponge is stalked with a subglobular body and a corrugated surface in life which becomes conulose after freezing. Small circular oscula in depressions on the surface are only visible in live specimens. Consistency is elastic but firm. Total height is to 10 cm; smooth stalk with a height of 4 cm. Color in life is golden yellow.

Skeletal structure. SEM images of spicules are shown in Appendix IV. Ectosomal skeleton consists of a thick membrane of tangential brushes of smaller styles, fairly dense, and isochelae in between. Choanosome consists of thick, ascending polyspicular tracts of large, thick styles connected by shorter tracts of large styles. Ascending tracts (114–387 μm in diameter) support the surface tubercles and are visible to the unaided eye when dissecting the sponge. Spicules consist of megascleres – thin, small, ectosomal (sub)tylostyles (350–395 × 9–11 μm), and choanosomal thick styles (840–1170 × 34–42 μm). Two categories of microscleres are present – anchorate isochelae with a peculiar plate in the middle (22–25 μm) and thin sigmas (19–23 μm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to boulders and cobbles at depths between 203 and 485 m.

Photos. 1) Preserved specimens (frozen) collected at a depth of 485 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimens as in photo 1 with other biota. 3) Same specimens as in photos 1 and 2 (indicated by the white arrows) in situ.



61. *Monanchora pulchra* (Lambe, 1894)

Description. This sponge is flabellate with flattened, often coalesced branches. It is typically uniplanar in high current areas and multi-planed, even bushy, in areas of lower current. The surface is smooth and the consistency is elastic. Height and width are to at least 50 cm. Color in life is orange, yellow, or brownish orange.

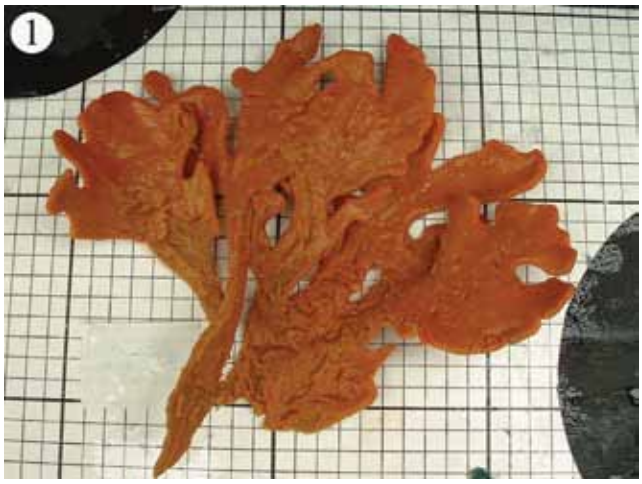
Skeletal structure. Ectosomal subtylostyles are scattered without obvious orientation. There are ectosomal styles to subtylostyles (225–680 × 8–12 µm). Choanosomal styles to subtylostyles are longer and thicker (670–990 × 28–40 µm). Isochelae are anchorate (18–22 µm). Sigmas (16–20 µm) are typically present.

Zoogeographic distribution. Locally abundant. In Alaska – Aleutian Islands. Elsewhere – Pacific Coast of the Kuril Islands and Pacific Coast of Canada (British Columbia).

Habitat. In Alaska – attached to bedrock, boulders, cobbles, and pebbles at depths between 79 and 330 m. Elsewhere – attached to pebbles and rocks at depths between 87 and 232 m and at temperatures between 1.8 and 5.3°C.

Remarks. May be preyed upon by the sea star *Henricia* sp.

Photos. 1) Fragment of a specimen collected at a depth of 80 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ (center) with a lighter-colored specimen (right). 3) Specimen collected at a depth of 150 m in the central Aleutian Islands.



62. *Crella brunnea* (Hansen, 1885)

Description. This sponge is polymorphic; may be tabular, irregularly compressed, occasionally massive-lobate or markedly lobate with an uneven, corrugated surface. The dermal membrane is thinly pellicular. Oscula are not visible on the surface. Dimensions are to 7 cm. Color in life is light to dark brown.

Skeletal structure. Ectosomal tornotes have 2–4 pointed "teeth" at the ends (150–290 × 4–7 µm). There are choanosomal acanthostyles to acanthostrongyles (210–380 × 10–21 µm) and small anchorate isochelae (23–37 µm). Koltun (1959) additionally reports large anchorate isochelae (44–84 µm); these were lacking in specimens we examined from the Aleutian Islands.

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – Arctic Ocean (Barents Sea – White Sea, and Kara Sea) and North Atlantic Ocean (Norwegian Sea, Denmark Strait, Davis Strait).

Habitat. In Alaska – attached to pebbles at a depth of 190 m. Elsewhere – reported at depths between 20 and 300 m, temperatures of 1.5 to 4.95°C, and salinities of 27.68 to 35.01 psu.

Photo. 1) Fragmented specimen collected at a depth of 190 m in the central Aleutian Islands. Grid marks are 1 cm^2.

63. *Hymedesmia* (*Stylopus*) *dermata* Lundbeck, 1910

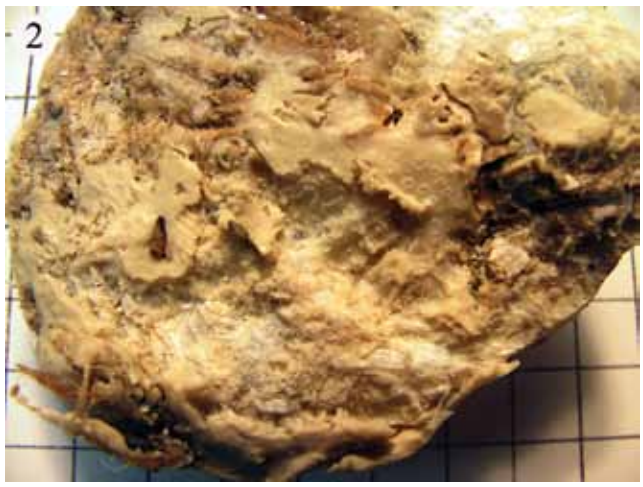
Description. This sponge is small, thin, and encrusting. Oscula are not visible on the surface. Consistency is soft. Color in life is light orange; beige after preservation in ethanol.

Skeletal structure. There are polytylote subtylostyles to subtylostrongyles (380–450 × 5–6 μm), erect on the substrate with the points facing out, and acanthostyles (430–470 × 10–12 μm).

Zoogeographic distribution. Widespread but uncommon. In Alaska – Aleutian Islands. Elsewhere – Arctic Ocean (Barents Sea, Laptev Sea, Kara Sea – Vilkitsky Strait, and Greenland Sea) and North Atlantic Ocean (between Faroe Islands and Iceland).

Habitat. In Alaska – attached to mollusk shells at a depth of 146 m. Elsewhere – attached to rocks and pebbles on sandy ooze at depths between 91 and 410 m, water temperatures of 1.47 to 1.17°C, and salinities of 34.42 to 34.65 psu.

Photos. 1) Preserved specimen (in ethanol) attached to a green false jingle (*Pododesmus macrochisma*) shell collected at a depth of 146 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Close-up view of same specimen as in photo 1.



64. *Hymedesmia* (*Hymedesmia*) *irregularis* Lundbeck, 1910

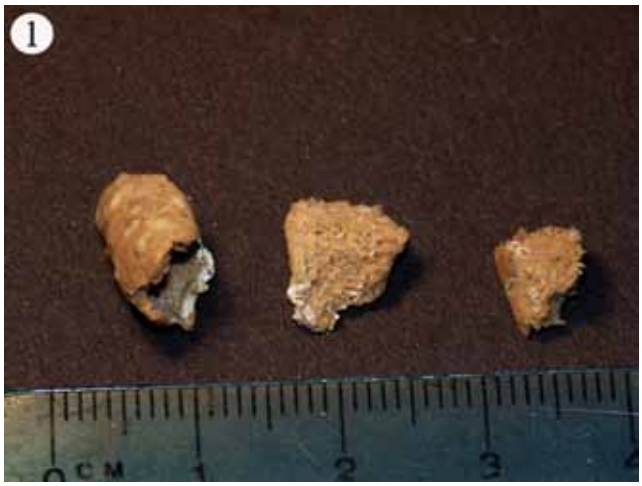
Description. This sponge is thinly encrusting with a smooth or partially hispid surface. According to Koltun (1959) there are oscula atop broad papillae. Color in life is greyish yellow or bluish white.

Skeletal structure. There are acanthostyles (125–540 × 16–32 μm). Ectosomal spicules are polytylote strongyles (280–410 × 6–10 μm) tangentially arranged in bundles. Microscleres are arcuate isochelae (32–48 μm).

Zoogeographic distribution. Widespread but uncommon. In Alaska – Bering Sea (Pribilof Canyon). Elsewhere – Arctic Ocean (White Sea) and North Atlantic Ocean (Davis Strait, Denmark Strait, southwest of Iceland near the Faroe Islands).

Habitat. In Alaska – grows on boulders and cobbles at depths around 300 m. Elsewhere – reported at depths between 293 and 1441 m.

Photo. 1) Fragments of a preserved (frozen and then stored in ethanol) specimen collected at a depth of 300 m in Pribilof Canyon, Bering Sea.



65. *Kirkpatrickia borealis* Koltun, 1970

Description. In situ this species has a globular body covered with numerous papillae and possesses large circular oscula. On deck specimens typically collapse completely and appear to be irregularly massive-lobate without papillae and oscula. Surface is smooth and covered by a thin ectosomal membrane. Circular oscula on the surface are slightly elevated and close upon collection. The consistency is elastic and compressible. Diameter is to 10 cm. Color in life is yellow, orange, or golden brown.

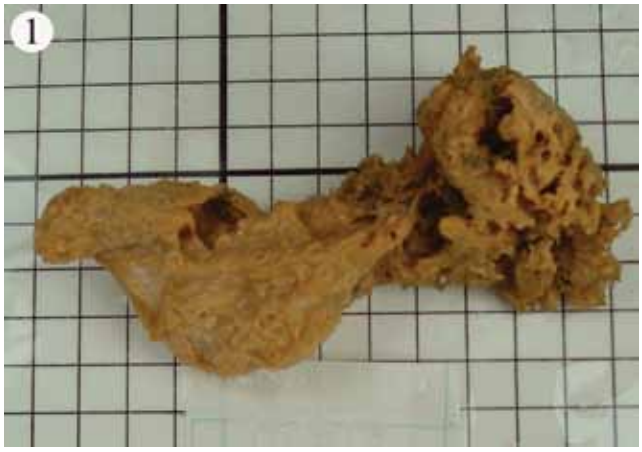
Skeletal structure. There are ectosomal tylotes (350–440 × 4–7 μm); choanosomal styles include a few strongyles (470–680 × 15–22 μm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – Northwest Pacific Ocean (previously known only from off Shikotan Island, Kuril Islands).

Habitat. In Alaska – attached to boulders and cobbles at depths between 82 and 426 m. Elsewhere – reported at depths between 472 and 479 m.

Remarks. *K. borealis* is similar to *Inflatella globosa* but is irregularly massive with relatively inconspicuous oscules, while the latter species is more globular with oscules on top of small papillae. Also, *K. borealis* has tylotes, styles, and a few strongyles while *I. globosa* has tylotes only.

Photos. 1) Collapsed specimen collected at a depth of 146 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.



66. *Phorbas paucistylifer* Koltun, 1958

Description. This sponge is globular with two distinct surface morphologies; some specimens are covered with round, crater-like depressions and round oscula that are flush with the surface, others have a surface covered with short papillae. Dermal membrane is thick. Consistency is soft and elastic. Diameter is to 20 cm. Color in life is bright orange (dominant phase) or yellow.

Skeletal structure. Anisotornotes (420–490 × 8–12 µm) with long thin points form a dense ectosomal crust together with numerous isochelae. Choanosomal ascending plumose spicule tracts are of the same tornotes, cored and echinated by acanthostyles (280–540 × 10–30 µm). Anchorate isochelae are strongly bent, the outline of a half circle and tridentate (32–40 µm). Koltun (1959) described somewhat smaller tornotes and acanthostyles.

Zoogeographic distribution. North Pacific Ocean. Locally common. In Alaska – central Aleutian Islands. Elsewhere – Sea of Okhotsk and Sea of Japan.

Habitat. In Alaska – patchily distributed on bedrock and cobbles at depths between 56 and 120 m. Elsewhere – reported on rocks and ooze at depths between 3 and 414 m and a temperature of 2.3°C.

Remarks. Gross morphology and spicule complement are similar to *Lissodendoryx behringi*, but the spicule architecture is quite different.

Photos. 1) Specimen collected at a depth of 124 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ with the gorgonian *Fanellia compressa*. 3) Specimen collected at a depth of 110 m in the central Aleutian Islands. Grid marks are 1 cm^2. 4) Same specimen as in photo 3 in situ.

67. *Melonanchora globogilva* Lehnert, Stone and Heimler, 2006

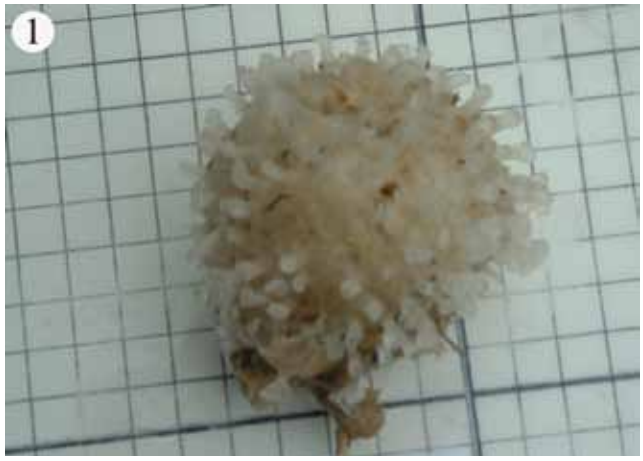
Description. This sponge is globular. The surface is covered with numerous thin-walled, bulbous fistules, 4–8 mm high and up to 4 mm in width; widest at the distal end. The ectosome is a translucent white layer, easily detachable, 400–650 µm thick. Diameter is to about 10 cm. Color in life is light yellow with whitish, almost translucent fistules.

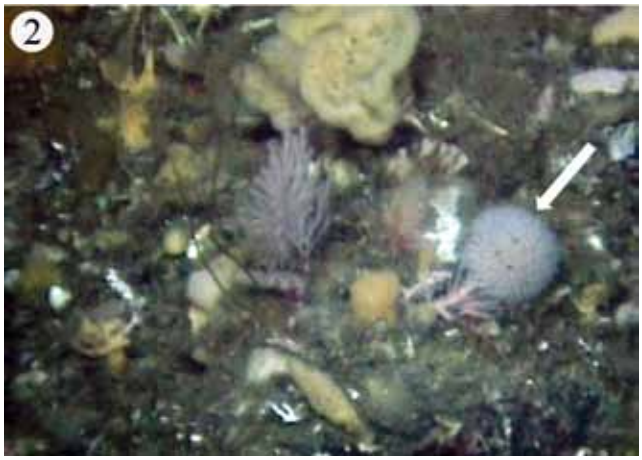
Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome has smooth tylotes partially arranged perpendicular to the surface but oriented in all directions to some degree. From the choanosome there are tracts of tylotes fanning out towards the ectosome. Tylotes with acanthostyles are also found in the choanosome. Tylotes are 640–680 × 10–12 µm. Choanosomal acanthostyles (660–670 × 20–30 µm) are singly distributed without recognizable orientation. Microscleres are three categories of isochelae: large isochelae with fimbriae (65–93 µm), large isochelae of the same size but with dented outer margins, and small anchorate isochelae (23–25 µm).

Zoogeographic distribution. Rare. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to pebbles and shell hash at a depth of 173 to 190 m.

Photos. 1) Specimen collected at a depth of 190 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen (indicated by the white arrow) observed at a depth of 179 m in the central Aleutian Islands.





68. *Myxilla* (*Myxilla*) *behringensis* Lambe, 1895

Description. This sponge is massive and irregularly globular. Surface is smooth. Consistency is slightly elastic and rather firm due to the polyspicular tracts of the choansosome. Diameter is to at least 4–5 cm. Color in life is whitish to golden brown.

Skeletal structure. Tylotes (220–270 × 6–10 µm) are ectosomal. Choanosomal acanthostyles (250–380 × 10–15 µm) occur in a meshwork of polyspicular tracts. There are anchorate large isochelae (70–80 µm), small isochelae (15–18 µm), large sigmas (65–78 µm), and small sigmas (27–32 µm).

Zoogeographic distribution. Widespread but rare in the North Pacific Ocean. In Alaska – central Aleutian Islands and Bering Sea. Elsewhere – Sea of Okhotsk, Sea of Japan, and British Columbia (Vancouver Island).

Habitat. In Alaska – encrusts other demosponges at depths between 190 and 195 m. Elsewhere – reported at depths between 32 and 104 m and a salinity of 33.95 psu.

Remarks. In Alaska, the species is epizoic on the demosponge *Halichondria oblonga*. It was considered by Koltun (1958) as a subspecies of *Myxilla incrustans*.

Photo. 1) Specimen (center) collected at a depth of 195 m in the central Aleutian Islands. Grid marks are 1 cm^2. Specimen is encrusting the demosponge *Halichondria oblonga*.

69. *Myxilla* (*Ectyomyxilla*) *parasitica* Lambe, 1893

Description. This sponge is encrusting, typically on the shells of scallops (*Chlamys* sp.). Surface is finely structured with radiating canals leading to small oscula that are flush with the surface. Thin encrustation is less than 1 cm in height and typically covers the entire available shell surface. Color in life is light brown to golden brown.

Skeletal structure. Ectosomal tornotes have unequal ends and mammillate projections at these ends (160–186 × 7–9 μm). Choanosomal acanthostyles are in an irregular meshwork (208–310 × 10–15 μm); microscleres are large isochelae (52–65 μm), small isochelae (15–20 μm), and thin sigmata (17–25 μm).

Zoogeographic distribution. Locally abundant in the North Pacific Ocean. In Alaska – central Aleutian Islands. Elsewhere – Bering Sea (Russia), Sea of Okhotsk (near the Kuril Islands) and British Columbia (near Vancouver Island).

Habitat. In Alaska – encrusts scallop shells at depths between 98 and 250 m. Elsewhere – on rocks, pebbles, and sand at depths between 15 and 126 m.

Remarks. They are often very abundant in scallop beds.

Photos. 1) Specimen collected at a depth of 138 m in the central Aleutian Islands. Specimen completely encrusts a scallop (*Chlamys* sp.). Grid marks are 1 cm^2. 2) Specimen (center) collected at a depth of 98 m in the central Aleutian Islands. 3) A bed of scallops (*Chlamys* sp.), almost all of which are completed encrusted with *Myxilla parasitica*. The gorgonian *Fanellia fraseri* is at center.

70. *Myxilla* (*Burtonanchora*) *pedunculata* Lundbeck, 1905

Description. This sponge is globular or lobate, usually with a stalk. The surface is slightly hispid. Irregularly scattered circular oscula are flush with the surface. Consistency is soft and elastic. Height and width are to 12 cm. Color in life is yellow to bright yellow.

Skeletal structure. Spicules are arranged in long ascending fibers, connected by shorter spicule tracts and single spicules. There are smooth or slightly acanthose styles (270–551 × 10–20 µm), ectosomal tornotes (220–380 × 6–10 µm), and microscleres that are anchorate isochelae (42–75 µm).

Zoogeographic distribution. Widespread but uncommon. In Alaska – Bering Sea (Pribilof Canyon). Elsewhere – Arctic Ocean (Kara Sea – Vilkitsky Strait, Laptev Sea) and North Atlantic Ocean (Iceland and Faroe Islands).

Habitat. In Alaska – attached to pebbles and cobbles at depths between 204 and 236 m. Elsewhere – reported at depths between 28 and 325 m.

Photos. 1) Specimen collected at a depth of 204 m in Pribilof Canyon, Bering Sea. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 showing the detail of the oscula. 3) Specimen in situ collected at a depth of 236 m in Pribilof Canyon, Bering Sea. The demosponge *Craniella spinosa* is attached to the specimen. The separation between the red laser marks is 10 cm.

71. *Stelodoryx oxeata* Lehnert, Stone and Heimler, 2006

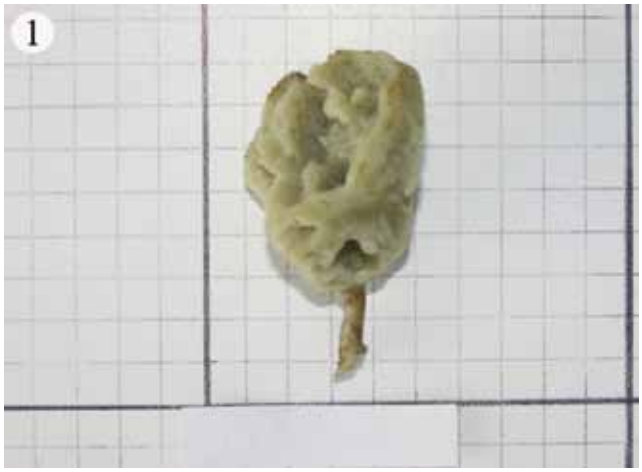
Description. This species exhibits two growth forms. One is a stalked, conical form with a ridged surface. The other is a massively encrusting, lobate sponge with a smooth surface. Consistency is rather hard and only slightly elastic, due to the densely packed spicules in the ectosome. The stalked specimen has a stalk of 2 × 0.7 cm, and the body is 5 × 4 cm in greatest dimensions. Color in life for both growth forms is greenish yellow to light green.

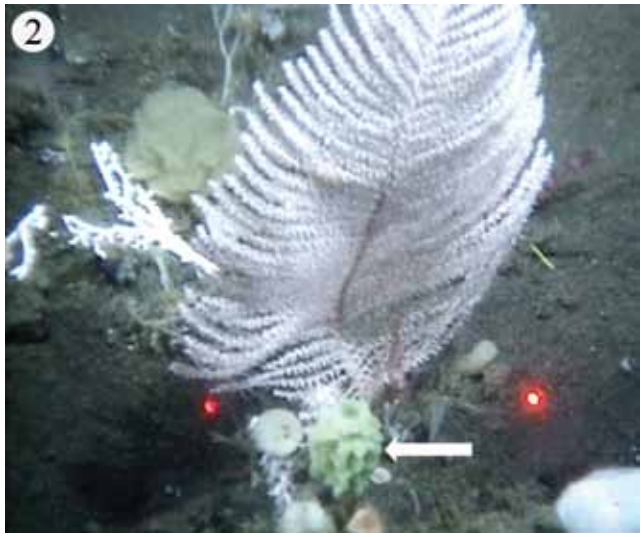
Skeletal structure. SEM images of spicules are shown in Appendix IV. Ectosome is densely packed with a tangential arrangement of tornotes, peculiar shaped oxeas, and microscleres. The choanosome consists in places of an irregular reticulation of single spicules or short spicule tracts. Megascleres are oxeas (517–558 × 20–30 μm); the points of oxeas have a ragged, dented outline. Tornotes have acanthose ends (230–270 × 9–11 μm). Microscleres are large isochelae (54–110 μm), medium-sized isochelae (23–32 μm), small anchorate isochelae (9–13 μm), and thin centrotylote sigmas (8–12 μm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to cobbles and pebbles at depths between 175 and 712 m.

Photos. 1) Specimen collected at a depth of 395 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen (indicated by the white arrow) collected at a depth of 711 m in the central Aleutian Islands. The separation between the red laser marks is 10 cm. 3) Specimen (top, center) collected at a depth of 175 m in the central Aleutian Islands. The separation between the red laser marks is 10 cm.





72. *Stelodoryx toporoki* Koltun, 1958

Description. This sponge is stalked, flabellate, or a somewhat flattened funnel. Consistency is elastic with a thin ectosomal membrane. It is soft and floppy in situ. Height is to 17 cm and width to 12 cm. Color in life is light yellow; dark brown after freezing.

Skeletal structure. Ectosomal tylotes have acanthaceous ends (218–300 × 8–10 µm). Choanosomal styles (500–1140 × 21–30 µm) occasionally have acanthaceous heads, and anchorate isochelae are in two size categories – large (115–150 µm) and small (30–40 µm).

Zoogeographic distribution. Locally common in the North Pacific Ocean. In Alaska – central Aleutian Islands. Elsewhere – Sea of Okhotsk (near the Kuril Islands).

Habitat. In Alaska – occurring in small patches (up to 5 individuals per m^2) on bedrock, mudstone, boulders, and cobbles at depths between 1714 and 2314 m. Elsewhere – found on sand, pebbles, and "reefs" at depths between 113 and 303 m and at temperatures between 1.8 and 3.1°C.

Remarks. A sponge with similar appearance except larger (up to 50 cm diameter) and more robust (forming distinct bowls) occurs at depths between 1185 and 1540 m. Collection of a specimen within this depth range and examination of the spicules is necessary to confirm conspecificity, however.

Photos. 1) Preserved (frozen) specimen collected at a depth of 2176 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (lower center) in situ. 3) Close-up view of specimen in situ at a depth of 1505 m in the central Aleutian Islands.

73. *Stelodoryx vitiazi* (Koltun, 1959)

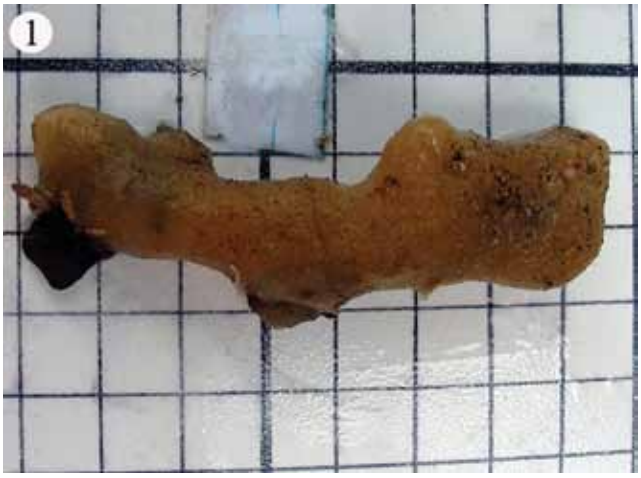
Description. This sponge is tube-shaped, sometimes irregularly cylindrical, with a hollow center. It occurs in clusters of up to five individuals and is fragile and inelastic. Height is to 15 cm and width to 4 cm. Color in life is light yellow to golden brown.

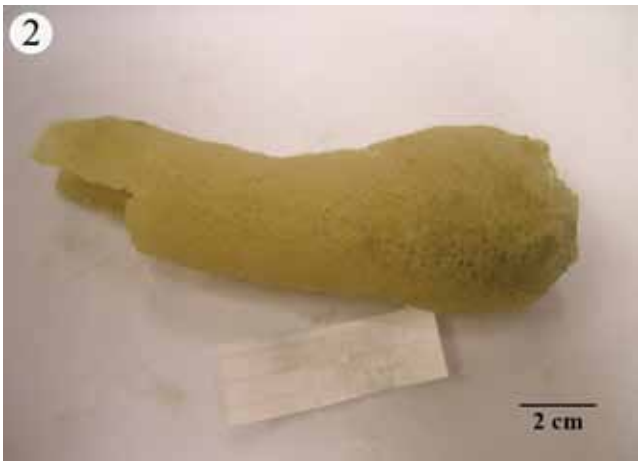
Skeletal structure. Tangentially arranged tornotes have acanthaceous ends in the ectosome. There is an irregular meshwork of paucispicular tracts and individual acanthostyles in the choanosome. There are tornotes with acanthose ends (180–291 × 4–7 μm), acanthostyles (370–520 × 20–29 μm), and anchorate isochelae (25–46 μm).

Zoogeographic distribution. Locally common in the North Pacific Ocean. In Alaska – central Aleutian Islands. Elsewhere – Bering Sea (near the Commander Islands) and the Sea of Okhotsk.

Habitat. In Alaska – attached to cobbles and pebbles at depths between 155 m and 1009 m. Elsewhere – found on sand, pebbles, and "reefs" at depths between 115 and 820 m.

Photos. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen collected at a depth of 1009 m in the central Aleutian Islands. 3) Same specimen as in photo 2 in situ.





74. *Echinostylinos hirsutus* Koltun, 1970

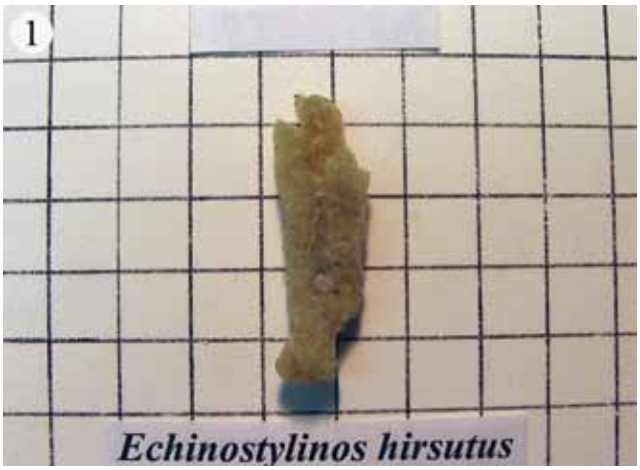
Description. This sponge is short with a cylindrical body and hollow central cavity. Koltun (1970) reported that this species was stalked, but our observations indicate that it narrows near the base and does not necessarily have a true stalk. Surface is corrugated. Height is to 5 cm. Color in life is light brown to light yellow.

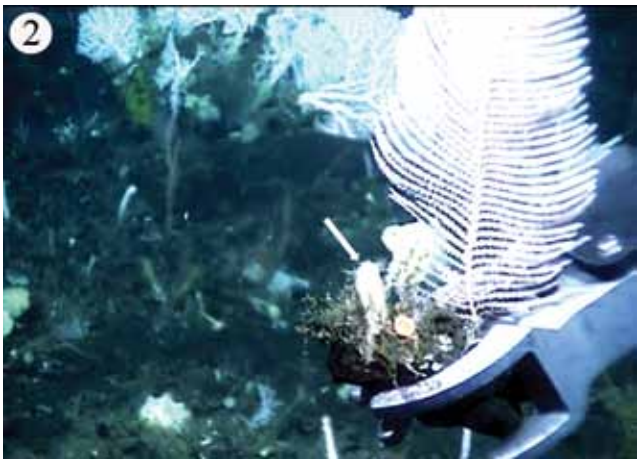
Skeletal structure. There are two categories of styles: long, 1320 × 25 µm (Koltun: 660–1650 × 45–54 µm), and shorter, 350 × 9 µm (Koltun: 400–540 × 5–10 µm). It has isochelae (sigmancistras) 27–30 µm (Koltun: sigmoid arcuate chelae 18–27 µm) and sigmas 40 µm (Koltun: filiform sigmas 16–22 µm). We regard the differences in spicule sizes as intraspecific variation.

Zoogeographic distribution. Apparently a very rare species; known from only two locations. In Alaska – central Aleutian Islands. Elsewhere – Sea of Okhotsk.

Habitat. In Alaska – occurring singly on cobbles and pebbles at depths between 665 and 711 m. Elsewhere – reported at depths between 1440 and 1540 m.

Photos. 1) Preserved (frozen) specimen collected at a depth of 711 m in the central Aleutian Islands. 2) Same specimen as in photo 1 (indicated by the white arrow) in situ on cobble.





75. *Tedania* (*Tedania*) *dirhaphis* Hentschel, 1912

Description. This sponge is irregularly massive-lobate, often with dactylate processes bearing circular oscula on top. The surface is smooth. The consistency is soft and elastic. Height and width are to 20 cm. Color in life is yellow to golden yellow; brown after freezing.

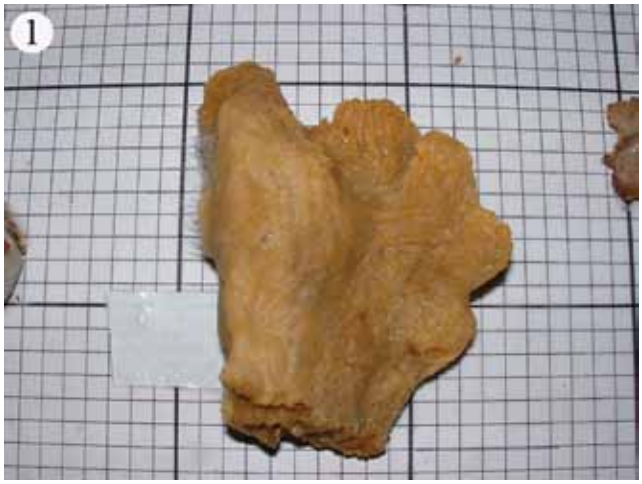
Skeletal structure. Styles are smooth (238–565 × 9–18 μm). Ectosomal tylotes have slightly acanthose ends (215–487 × 5–8 μm). Microscleres are rhaphides in two size categories – large rhaphides (200–400 μm) and small rhaphides (45–180 μm).

Zoogeographic distribution. North and West Pacific Ocean. Uncommon. In Alaska – central Aleutian Islands and Bering Sea (Pribilof Canyon). Elsewhere – Sea of Okhotsk, Pacific Coast of Kuril Islands, and South China Sea.

Habitat. In Alaska – attached to cobbles at depths between 100 m and 341 m. Elsewhere – reported at depths between 4 and 550 m.

Remarks. *Tedania dirhaphis* was originally described by Hentschel (1912) from shallow Indonesian waters. Koltun (1959) reported the same species from the Sea of Okhotsk and the Kuril Islands in the North Pacific Ocean and the Alaskan specimens conform perfectly to Koltun's decription. The Alaskan specimens also conform to the original description (p. 45 and pl. XIX, fig. 20) in spicule complement, growth form, and color (Hentschel, 1912) and differ from the Indonesian specimens in size only (somewhat larger). Accordingly, we report this species as *T. dirhapsis* sensu Koltun, 1959, but caution that given the extremes in zoogeography, additional taxonomic work on this species is warranted.

Photos. 1) Specimen collected at a depth of 100 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Preserved (frozen) specimen collected at a depth of 341 m in Pribilof Canyon, Bering Sea. Grid marks are 1 cm^2. 3) Same specimen as in photo 1 in situ with a shortspine thornyhead (*Sebastolobus alascanus*) at left. The separation between the red laser marks is 10 cm.



76. *Tedania kagalaskai* Lehnert, Stone and Heimler, 2006

Description. This large flabellate sponge is attached to substrate with a firm stalk that widens about 10 cm above the holdfast. Surface is very smooth; oscula are in several rows on the flattened apical surface. Body is soft; stalk is wiry. Maximum dimensions of the roughly triangular body are approximately 30 × 30 × 5 cm. Color in life is light brown to orange-brown.

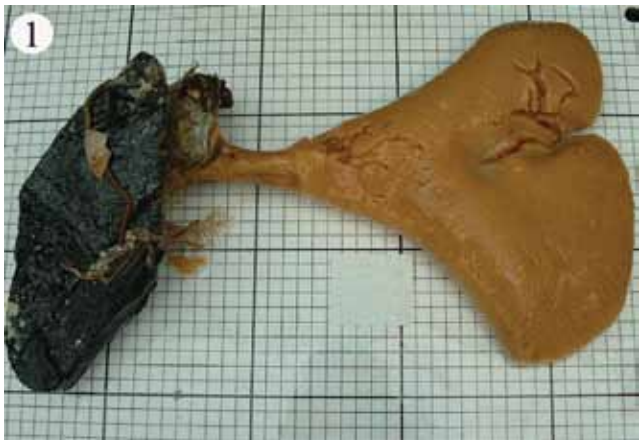
Skeletal structure. SEM images of spicules are shown in Appendix IV. Ectosomal tylotes (300–330 × 4–6 μm) have acanthose ends. There are choanosomal smooth styles (360–390 × 15–20 μm), and onychaetes possibly in two size categories – large (170–210 μm) and small (30–40 μm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to bedrock, boulders, and cobbles at depths between 59 and 170 m. Specimens with a similar gross morphology have been observed at depths near 478 m, but collection of a specimen within this depth range and examination of the spicules is necessary to confirm conspecificity.

Remarks. Species is similar in appearance to *Artimisina stipitata* with which it co-occurs. The dorsal surface of *T. kagalaskai* is typically flatter and the body form more distinctly triangular and with a much smoother surface than *A. stipitata*. This is the only known species of *Tedania* that is stalked.

Photos. 1) Specimen collected at a depth of 146 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. 3) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2. 4) Specimen in situ collected at a depth of 105 m in the central Aleutian Islands.



77. *Asbestopluma ramosa* Koltun, 1958

Description. This sponge is flagelliform. This species appears as described by Koltun (1959) and often consists of numerous more or less cylindrical branches diverging from one point and arranged in one plane. We have observed up to five branches that diverge at multiple points, however. Branches may be bent or slightly curved. Occasionally the sponge is markedly elongated and has a ramified, stalk-like appearance with many closely spaced fine projections (according to Koltun). Height is to at least 72 cm with branches up to 1.5 cm thick. Color in life is light yellow, light orange, or creamy white; the lower portion is often devoid of the fine lateral projections and consequently a darker color, often brown.

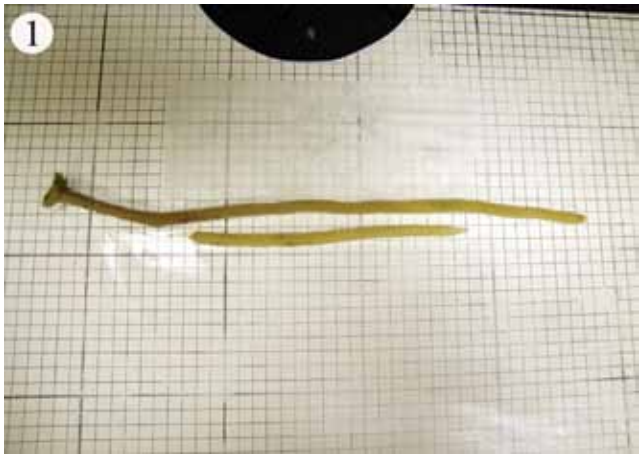
Skeletal structure. Styles are arranged in a central axis with side-tracts running into the lateral projections; styles are 238–1500 × 7–18 μm and anisochelae are 10–17 μm.

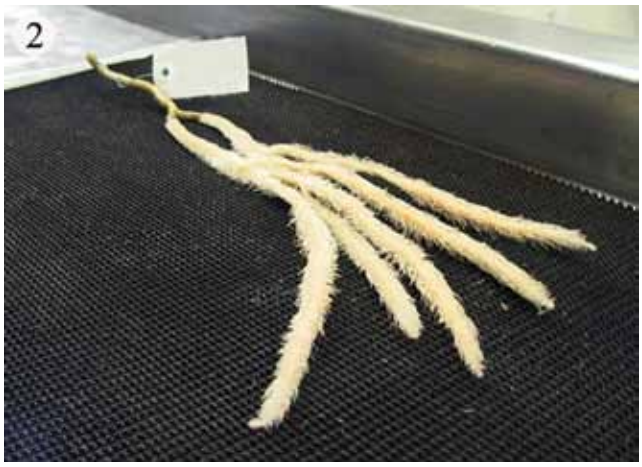
Zoogeographic distribution. Widespread and locally abundant. In Alaska – central Aleutian Islands, eastern Gulf of Alaska (near the Fairweather Ground). Elsewhere – North Pacific Ocean (Kuril Islands, Vancouver Island), Arctic Ocean (Southwest Barents Sea, Kara Sea – Vilkitsky Strait, Laptev Sea – Shokalsky Strait, East Siberian Sea, Greenland Sea, and Baffin Bay), and North Atlantic Ocean (Faroe Islands).

Habitat. In Alaska – attached with a holdfast to bedrock, mudstone, boulders, cobbles, and occasionally hexactinellid sponge skeletons at depths between 395 and 1812 m; more abundant at depths shallower than 1200 m. Elsewhere – reported on ooze and sandy-ooze bottoms at depths between 41 and 1134 m and temperatures of 1.64 to 4.8°C.

Remarks. This species occasionally has ophiuroid associates particularly at depths shallower than 500 m. It occurs within the same depth range as *Esperiopsis flagrum* but attaches to hard substrate rather than anchoring in soft sediment. *A. ramosa* may have a carnivorous feeding habit like other Cladorhizidae so collected specimens may have small crustaceans trapped in their outer tissues.

Photos. 1) Specimen collected at a depth of 1715 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen collected at a depth of 1501 m in the eastern Gulf of Alaska. 3) Specimen observed in situ at a depth of 843 m in the central Aleutian Islands. 4) Close-up view of same specimen as in photo 3 showing detail of the closely spaced fine projections.





77. *Asbestopluma ramosa* Koltun, 1958 (continued)

78. *Cladorhiza bathycrinoides* Koltun, 1955

Description. This stalked sponge terminates in a partially inverted conical head. Basal root-like processes consist of glassy, polyspicular tracts (2.5 cm long). Polyspicular tracts of the root-like processes become united at the base of the cylindrical stalk and are coated by a thin ectosomal veneer. The circular upper plane of the head has a diameter of 1.4 cm and thin appendages (up to 12) are inserted along its margin. The appendages measure 1.9 cm × 0.8 mm, but the diameter of the appendages regularly varies like a string of pearls. Typical of the genus, the polyspicular tracts of the system of root-like processes are united at the base of the stalk, run in bundles through the stalk, and then diverge again to support the appendages. The height from distal ends of the root-like processes to the upper end of the head is up to at least 12 cm. The stalk is up to 7 cm long and 1–2 mm in diameter. Color in life is white or creamy white.

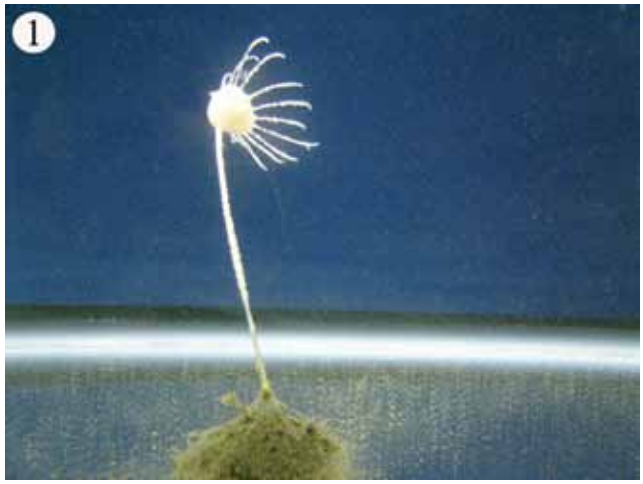
Skeletal structure. SEM images of spicules are shown in Appendix IV. Ectosomal veneer is packed with anisochelae. Fusiform styles (980–2100 × 12–40 μm) and tylostrongyles (350–900 × 2–10 μm) are most abundant at the distal parts of the root-like processes. There are large anisochelae (55–75 μm), rare small anisochelae (25–35 μm), large sigmas (95–110 μm), small sigmas (43–55 μm), and flattened sigmoids with claw-like appendages at the ends (42–45 μm). Large sigmas were typically damaged in our SEM preparations indicating that they are extremely thin-walled, hollow, and fragile.

Zoogeographic distribution. North Pacific Ocean. Locally common. In Alaska – central Aleutian Islands; patchy distribution at low densities. Elsewhere – Sea of Okhotsk.

Habitat. In Alaska – on soft sediments (silt and sand) at depths between 1108 and 2854 m. Elsewhere – eurybathic; reported at depths between 150 and 3800 m.

Remarks. *C. bathycrinoides* probably has a carnivorous feeding habit like other Cladorhizidae. We observed one specimen in situ capture a small shrimp with one of its appendages (actually the shrimp swam into the appendage and appeared to adhere to it). Collected specimens may have small crustaceans trapped in their outer tissues.

Photos. 1) Specimen collected at a depth of 1371 m in the central Aleutian Islands and held live in a shipboard aquarium. Note the basal root-like processes. 2) Same specimen as in photo 1 in situ. The separation between the red laser marks is 10 cm.



79. *Cladorhiza corona* Lehnert, Watling and Stone 2005

Description. Body consists of a long cylindrical stalk with a basal plate and two sets of distal appendages: the basal set radiating in a full circle more or less in one plane, and the distal set forming a quarter circle of triangular-shaped structures oriented in a plane almost perpendicular to the basal appendages. Distal appendages are shorter than the basal and terminate in a spherical tyle. Root-like processes (common within the genus) are absent and the sponge attaches directly to hard substrate via the broadened basal plate. Consistency is wiry and elastic, with an easily detachable ectosomal membrane. Total length is to at least 33 cm. Color in life is light yellow or creamy white.

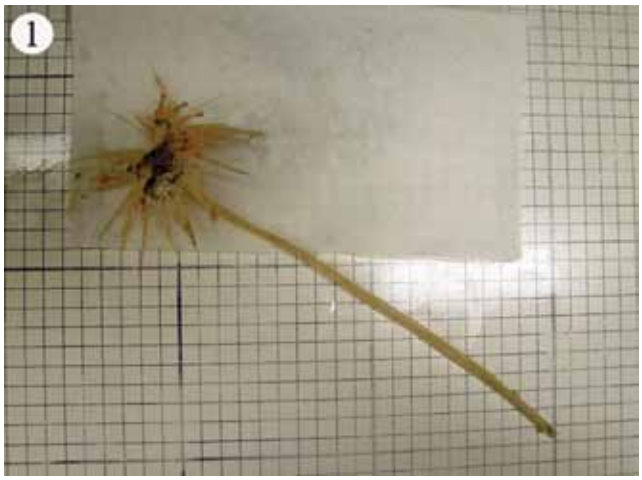
Skeletal structure. SEM images of spicules are shown in Appendix IV. The three distinct parts of the sponge (basal plate, stalk with the basal appendages, and the crown) differ considerably in spicule types and their arrangement. The basal plate consists of fusiform styles and shorter anisoxeas with slightly unequal ends, packed in one plane parallel to the surface of the substrate. The basal plate has no ectosomal membrane and is devoid of microscleres. From the basal plate polyspicular tracts of long fusiform styles run in thick bundles through the center of the long cylindrical stalk, which is covered by an ectosomal membrane, densely packed with ancorate anisochelae. The basal appendages are constructed in a similar manner as the stalk. The polyspicular tracts of long fusiform styles reaching the crown fan out in one plane, leaving little space between the tracts. Single, thin (sub-) tylostyles are arranged more or less perpendicular to the thick fusiform styles. The ectosomal membrane of the crown is devoid of anisochelae but rather contains flattened sigmancistras with thin claw-like extensions at each end. These latter two spicule types occur exclusively in the crown. Megascleres include fusiform styles, almost anisoxeas (600–4260 × 10–65 µm), present in all parts except the ectosomal membrane; (sub-) tylostyles (510–1650 × 8–20 µm) present in the ectosomal membrane of the crown; and thick, short anisoxeas with slightly unequal blunt ends (140–660 × 38–43 µm) present in the basal plate. Microscleres include anchorate anisochelae (30–42 µm), present in the ectosomal membrane of the stalk and the basal appendages; and flattened sigmancistras, each end with a thin pointed "claw" (35–42 µm), present in the ectosomal membrane of the crown.

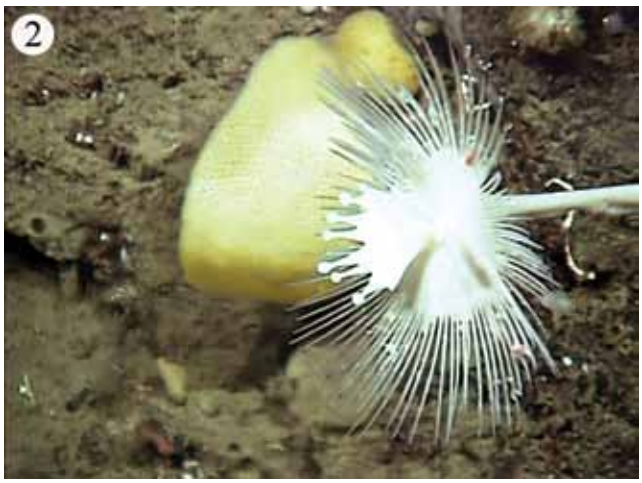
Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Occurs in small patches at depths between 726 and 2077 m on bedrock, fragmented bedrock, mudstone, and cobbles, and at temperatures between 1.8 and 3.1°C.

Remarks. *C. corona* is carnivorous and feeds mainly on calanoid copepods (Watling, 2007). Collected specimens may have small crustaceans trapped in their outer tissues.

Photos. 1) Specimen collected at a depth of 1720 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.





80. *Chondrocladia* (*Chondrocladia*) *concrescens* (Schmidt, 1880)

Description. This stalked sponge has numerous lateral processes with terminal swellings (as many as 80). Size and growth form of this species is variable. There are root-like tufts of polyspicular tracts fixing the sponge in the substrate. The consistency of the stalks is firm and wiry while the rest of the sponge is soft and fragile. Thick polyspicular tracts support the stalk; thinner polyspicular tracts support the branches. Height is to 30 cm. Color in life is golden brown to light brown and reddish brown in shallower water (<1000 m depth).

Skeletal structure. There are styles (950–4300 × 23–65 µm), accessory styles (550–880 × 10–27 µm), ectosomal styles to tylostyles (220–270 × 1–4 µm), occasionally acanthose isochelae in two size categories – large (55–130 µm) and small (18–45 µm), and sigmas in two size categories – large (70–165 µm) and small (16–50 µm).

Zoogeographic distribution. Widespread and locally common. In Alaska – central Aleutian Islands. Elsewhere – North Pacific Ocean (Sea of Okhotsk, Kuril Islands), Arctic Ocean (Greenland Sea), and North Atlantic Ocean (Norwegian Sea).

Habitat. In Alaska – occurs in generally flat, soft-sediment habitats but occasionally on silt-covered bedrock slopes at depths between 563 and 1984 m. In shallower water (<1000 m depth) this sponge appears to attach directly to hard substrate. Elsewhere – eurybathic; depths between 200 and 8660 m.

Remarks. *Chondrocladia* are carnivorous, but unlike other Cladorhizidae they possess a modified aquiferous system used to inflate the terminal swellings where they capture prey (Vacelet, 2008). Collected specimens may have small crustaceans trapped in their outer tissues.

Photos. 1) Specimen collected at a depth of 1341 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. 3) Specimen observed at 1206 m in the central Aleutian Islands.

81. *Biemna variantia* (Bowerbank, 1858)

Description. This sponge is subglobular. Surface is covered with numerous papillae. Oscula are at the top of the sponge in clusters. It is very soft, fragile, and easily torn. Diameter is to 10 cm. Color in life is greenish yellow to light brown; brown or dark brown after freezing.

Skeletal structure. A thin ectosomal membrane contains only microscleres. There are styles (420–1450 × 18–35 µm), sigmas possibly in two size categories (40–310 µm), rhaphides (60–125 µm), and spherules (10 µm). Long ascending and branching polyspicular tracts of styles in the choanosome have many spicules scattered between the tracts.

Zoogeographic distribution. Widespread but uncommon. In Alaska – central Aleutian Islands. Elsewhere – North Pacific Ocean (Bering Sea – Russia), Arctic Ocean (Barents Sea and Greenland Sea), and North Atlantic Ocean (eastern Scotian Shelf east to Iceland and south to the Canary Islands; western Mediterranean Sea).

Habitat. In Alaska – attached to cobbles and pebbles at depths between 155 and 489 m. Elsewhere – reported at depths between 62 and 1800 m depth.

Photos. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Preserved specimen (frozen) collected at a depth of 489 m in the central Aleutian Islands. Grid marks are 1 cm^2. 3) Same specimen as in photo 2 (indicated by the white arrow) in situ.

82. *Eucheliplума elongata* Lehnert, Stone and Heimler, 2006

Description. This sponge is flagelliform or whip-like and occasionally bifurcated. The species is similar to *Asbestopluma ramosa* and *Esperiopsis flagrum* (differentiation requires careful examination). Rigid long, thin stalk is covered with thin, relatively short processes. It is basally attached in soft substrates with a rigid root-like system. Length is to at least 35 cm, but few specimens attain this size. Color in life is light yellow to creamy white.

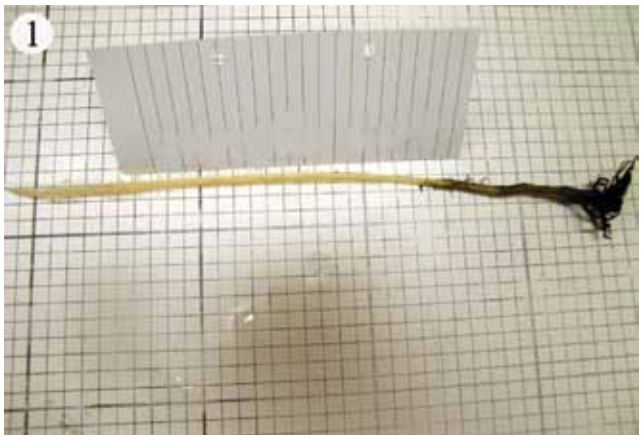
Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome consists of densely arranged isochelas, underlain by parallel oriented fusiform styles with blunt ends and smaller tylostyles. Single tylostyles are placed perpendicular to the orientation of the styles and tylostyles. The choanosome is dominated by ascending polyspicular tracts of styles, tylostyles, and isochelae. Megascleres are blunt-ended fusiform styles (1310–1510 × 40–55 μm). Tylostyles (620–660 × 9–13 μm) often have the tyle subterminal and occasionally polytylote. Microscleres are isochelae (80–95 μm), placochelae (70–88 μm), and sigmas (9–25 μm).

Zoogeographic distribution. Locally abundant. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached with a root-like system in unconsolidated sediments at depths between 1525 and about 2200 m. Fairly abundant in some areas, reaching densities near 15 individuals per m^2.

Remarks. There are only four known species of *Eucheliplума* worldwide. *E. elongata* is by far the largest species in the genus. This species does not appear to harbor the ophiuroid associates that are so common with the whip-like pennatulacean corals present in the same depth range. It may occasionally be preyed upon by the sea star *Hippasteria*. It does not co-occur with *Esperiopsis flagrum* but does overlap in depth range with *Asbestopluma ramosa*. Unlike *A. ramosa*, however, it anchors in soft-sediment rather than attaching to hard substrate.

Photos. 1) Specimen collected at a depth of 2161 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ (foreground).



83. *Guitarra abbotti* Lee, 1987

Description. This sponge is subglobular and massive. Consistency is elastic, soft, and easy to tear. Oscula are small, circular, and slightly elevated on short conical projections. The surface is smooth to the unaided eye but microscopically hispid or brain-like with narrow convolutions. Diameter is to 15 cm. Color in life is yellow, orange, or dark brown.

Skeletal structure. SEM images of spicules are shown in Appendix IV. There is no specialized ectosomal skeleton; the dermal membrane consists of spicule brushes at the ends of short polyspicular tracts, ascending only a short distance from the choanosome. Sections parallel to the surface show the regularly spaced spicule brushes up to 300 µm in diameter. Short polyspicular tracts of styles make up a relatively dense but irregular meshwork in the choanosome, mesh-size 100–200 µm, with single spicules scattered in between. The short length of the tracts gives a halichondroid appearance throughout much of the choanosome. Megascleres are fusiform styles (330–400 × 7–10 µm). There are seven types of microscleres: large placochelae (105–115 µm); small placochelae (30–50 µm); large biplacochelae (35–52 µm); small and relatively rare biplacochelae (13–16 µm in diameter); a rare, large category of isochelae (58-65 µm); small sigmoid isochelae (10–13 µm) almost closed; and small sigmoids (5–9 µm). All spicule-types are distributed without an obvious pattern throughout the sponge.

Zoogeographic distribution. North Pacific Ocean. Locally common. In Alaska – central Aleutian Islands. Elsewhere – previously known only from Cordell Bank, California.

Habitat. In Alaska – attached to cobbles at depths between 100 and 146 m. Elsewhere – reported at depths between 35 and 46 m.

Photos. 1) Specimen collected at a depth of 138 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ (center). 3) Specimen (center) collected at a depth of 146 m in the central Aleutian Islands.

84. *Guitarra fimbriata* Carter, 1874

Description. This sponge is cushion-shaped with a tuberculate surface; no oscula visible. Consistency is only slightly compressible and not very elastic. Diameter is to 20 cm. Color in life is yellow to orange-brown.

Skeletal structure. Spicules are anisotylotes (230–700 × 5–15 μm) often one end conspicuously more inflated than the other, large placochelae (70–90 μm), small placochelae (35–55 μm), and bipocilli (6–15 μm).

Zoogeographic distribution. Cosmopolitan and locally common. In Alaska – central Aleutian Islands. Elsewhere – Pacific coast of southern Kuril Islands, North Atlantic Ocean, Indian Ocean, and Antarctica.

Habitat. In Alaska – attached to small boulders and cobbles at a depth of 146 m. Elsewhere – reported on rocky bottoms at depths between 28 and 188 m and at temperatures between 1.5 and 16.2°C.

Photos. 1) Partial specimen collected at a depth of 146 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ (center).

85. *Amphilectus digitatus* (Miklucho-Maclay, 1870)

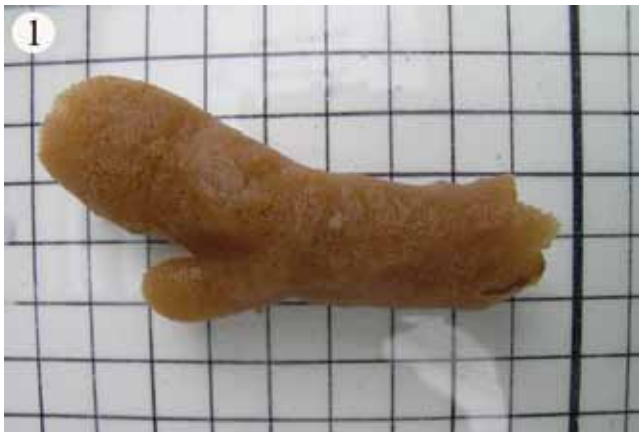
Description. This species appears as described by Koltun (1959) and may be massive-lobate, laminate, dactylate, funnel-shaped, or vase-like, and usually has a stalk. The surface is smooth. The consistency is elastic, easily compressible, but difficult to tear. Vase-like forms to 10 cm in height; funnel-shaped forms to more than 60 cm in diameter and 30 cm in height. Color in life is light grey, creamy white, yellow or brown.

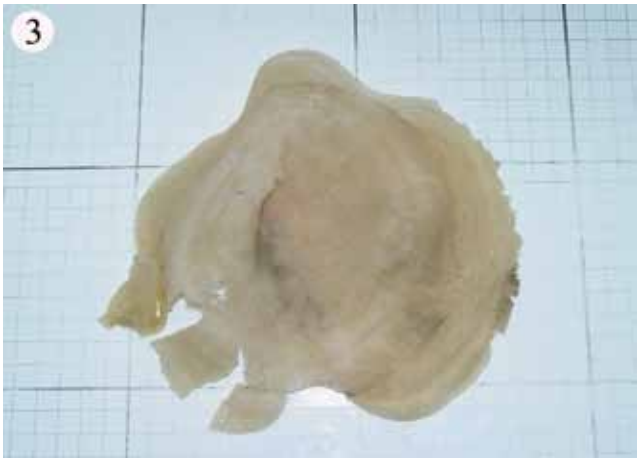
Skeletal structure. Spicules are styles (130–280 × 8–19 µm) and palmate isochelae (12–28 µm).

Zoogeographic distribution. Widespread and locally common. In Alaska – central Aleutian Islands and eastern Gulf of Alaska. Elsewhere – North Pacific Ocean (Kamchatka Coast, Bering Sea, British Columbia), and Arctic Ocean (Chukchi Sea and East Siberian Sea).

Habitat. In Alaska – central Aleutian Islands (attached to pebbles at a depth of 100 m), eastern Gulf of Alaska (attached to bedrock, boulders, and cobbles at depths between 152 and 218 m). Elsewhere – reported at depths between 9 and 291 m.

Photos. 1) Specimen collected at a depth of 100 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ (center). 3) Specimen collected at a depth of 165 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 4) Same specimen as in photo 3 in situ.





86. *Esperiopsis flagrum* Lehnert, Stone and Heimler, 2006

Description. This sponge has a flagelliform or cylindrical growth form; similar to *Asbestopluma ramosa* and *Eucheliplumа elongata* (differentiation requires careful examination). Occasionally it is bifurcated. A central long thin axis tapers near the tip and is covered with many thin processes. Processes are 3–5 mm in length, elastic but somewhat stiff. The central axis is up to 54 cm in length with a diameter of 4 mm at the base and 2.5 mm at the tip. This cylindrical axis is compressible, elastic but resilient. Color in life is beige to creamy white.

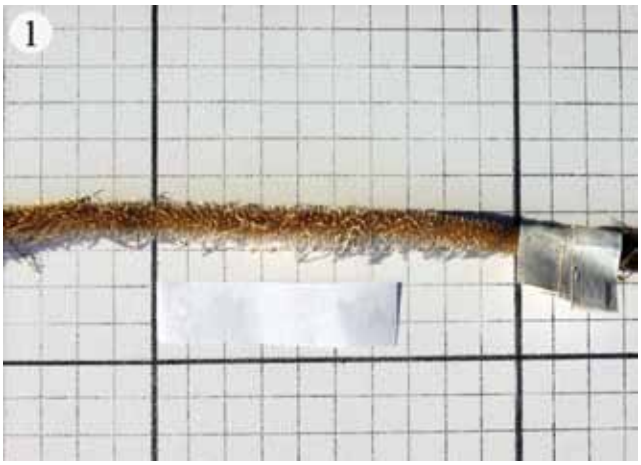
Skeletal structure. SEM images of spicules are shown in Appendix IV. No special ectosome is developed. The central axis consists of interwoven polyspicular tracts of styles with many microscleres in between. The lateral processes are supported by single polyspicular tracts running into them. The outermost layer of the processes and the longitudinal axis consists of densely arranged microscleres. Megascleres are fusiform styles (980–1320 × 20–28 μm). Microscleres are large palmate isochelae (98–112 μm), small palmate isochelae (28–43 μm), large sigmas (37–48 μm), and small sigmas (17–20 μm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Occurs at depths between about 700 and 1389 m. Appears to bury with root-like processes in soft unconsolidated sediments.

Remarks. The lower portion of the stalk is often fouled with hydroids. The species occurs within the same depth range as *Asbestopluma ramosa*, but occurs in soft-sediment habitats rather than attaching to hard rock. It does not co-occur with *Eucheliplumа elongata*.

Photos. 1) Mid-section of a specimen collected at a depth of 954 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ.



87. *Semisuberites cribrosa* (Miklucho-Maclay, 1870)

Description. This stalked sponge has two distinct forms: 1) several small funnels or cups (up to at least 20 cups per individual) that branch initially from a central stalk, and 2) a long, thin stalk (30 cm or more in length) that terminates in a single cup-shaped body, rarely two, with a maximum diameter of approximately 25 cm. The stalk is wiry, firm but elastic; the body(s) of softer consistency. Surface is smooth to the unaided eye but microscopically hispid. Total height and width are to 70 cm (multi-cupped form). Color in life is golden brown to light brown.

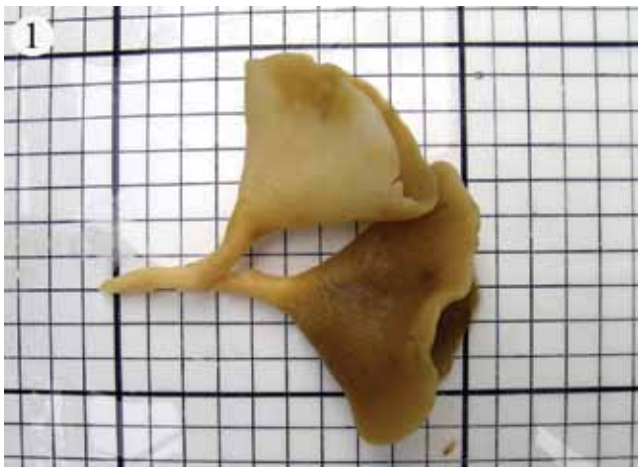
Skeletal structure. There is no specialized ectosomal skeleton; dermal membrane consists of the ends of ascending polyspicular tracts. Choanosomal polyspicular ascending tracts are quite conspicuous and cm-long fibers are easy drawn from the sponge. Tracts are connected by single spicules, styles in a very wide size range (75–650 × 6–15 µm).

Zoogeographic distribution. Widespread but uncommon. In Alaska – central Aleutian Islands, Bering Sea (Zhemchug Canyon), and Gulf of Alaska. Elsewhere – widely distributed along the north and east coasts of Russia (Bering and Chukchi Seas), Arctic Ocean (Greenland Sea), and North Atlantic Ocean (Norwegian Sea).

Habitat. In Alaska – the two forms appear to be ecomorphs. The multi-cupped form is attached primarily to bedrock (occasionally cobbles) at depths between 80 and 270 m in low to moderate current areas. The single-cupped form is found in high current areas. Aleutian Islands – patchy distribution on moderately sloped sandy habitats; attached to pebbles with root-like processes at depths between 99 and 306 m. Bering Sea – rare; pebble and sand slopes at depths around 170 m. Elsewhere – reported at depths between 14 and 325 m, temperatures between 1.9 and 7.0°C, and salinities between 29.81 and 35.23 psu.

Remarks. This species may be preyed upon by the blood star (*Henricia* sp.) and appears to be particularly fragile.

Photos. 1) Fragment of a specimen collected at a depth of 100 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ (center). 3) Specimen collected at a depth of 97 m in the central Aleutian Islands. 4) Specimen collected at a depth of 170 m in Zhemchug Canyon, Bering Sea. Note that the specimen has a single large cup that was apparently two smaller cups now fused together. 5) Specimen collected at a depth of 139 m in the central Aleutian Islands. Note that the cup has been sliced open for examination. Grid marks are 1 cm^2. 6) Same specimen as in photo 5 in situ (top half). 7) Same specimen as in photo 5 in situ (bottom half).



87. *Semisuberites cribrosa* (Miklucho-Maclay, 1870) (continued)

88. *Mycale* (*Aegogropila*) *adhaerens* (Lambe, 1893)

Description. This massive or thickly encrusting sponge has a bulbous or even fistulose surface. Oscula are not visible. Consistency is soft and elastic. Size is to 20 cm in all dimensions. Color in life is yellow to golden brown.

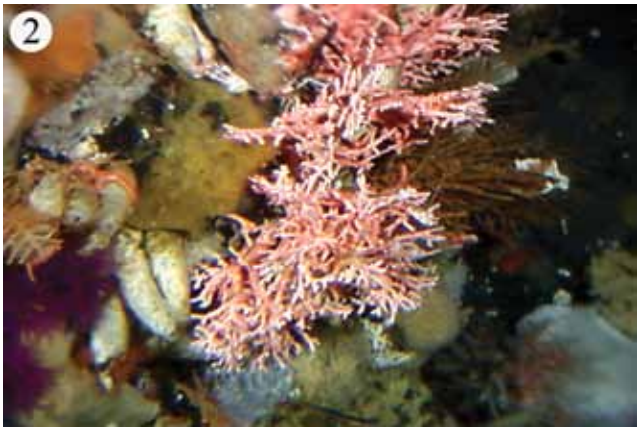
Skeletal structure. It has ectosomal reticulation of polyspicular tracts with microscleres in-between tracts. There is a choanosomal mesh of polyspicular tracts, often branching. There are tylostyles (350–440 × 5–12 µm), anisochelae arranged differently in two size classes – large anisochelae in rosettes (75–100 µm) and small anisochelae (18–50 µm); sigmata (45–58 µm), and rhaphides single and in trichodragmata (45–90 µm).

Zoogeographic distribution. Widespread and common. In Alaska – central Aleutian Islands and Bering Sea. Elsewhere – North Pacific Ocean (Sea of Okhotsk, Sea of Japan, Vancouver Island) and Arctic Ocean (Greenland Sea).

Habitat. In Alaska – encrusts all hard substrates including hydrocoral skeletons at depths between 104 and 442 m. Generally found in rough, steep-sloped habitats. Elsewhere – on rocks, pebbles, and sand bottoms from the intertidal zone to a depth of 270 m.

Remarks. This species encrusts hydrocorals (*Stylaster* sp. and *Cyclohelia lamellata*) and other sedentary biota in Aleutian Island coral gardens; inaccurately reported in Stone (2006) as *Myxilla incrustans*.

Photos. 1) Fragment of a specimen collected at a depth of 190 m in the central Aleutian Islands. Specimen is encrusting the hydrocoral *Cyclohelia lamellata*. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (center) in situ. 3) Specimen collected at a depth of 109 m in the central Aleutian Islands.



89. *Mycale* (*Carmia*) *carlilei* Lehnert, Stone and Heimler, 2006

Description. This clavate sponge typically has a single cylinder, occasionally several (up to four) smaller branches, atop a thinner well-defined stalk. One or more large oscula are atop each cylinder; several smaller oscula along sides are obvious in situ. Surface is smooth. Consistency is very soft, except for the wiry stalk. Height is to 50 cm or more. Color in life is golden brown.

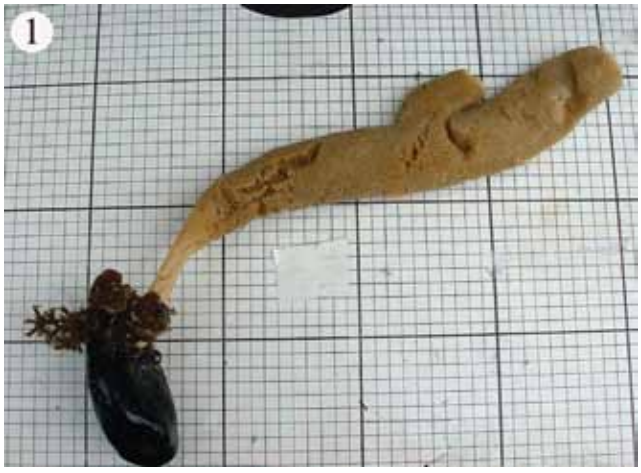
Skeletal structure. SEM images of spicules are shown in Appendix IV. The stalk consists of longitudinally arranged masses of tylostyles; individual tracts are not recognizable. A special ectosome is not developed. The choanosome consists of irregularly arranged pauci- and polyspicular tracts of tylostyles with masses of sigmas and very abundant anisochelae, both single and in rosettes. Spicules consist of tylostyles (470–520 × 10–14 µm), anisochelae (55–75 µm), and sigmas (65–80 µm).

Zoogeographic distribution. Locally abundant (up to 8 individuals per m^2). In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to bedrock, boulders, cobbles, and pebbles at depths between 82 and 360 m.

Remarks. *Mycale loveni* and *M. bellabellensis* are the only other species in the genus that exhibit a stalked growth form.

Photos. 1) Specimen collected at a depth of 150 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. 3) Specimen with several *M. loveni* at a depth of 112 m. 4) Specimen with several *Halichondria oblonga* (upper right) at a depth of 119 m.



90. *Mycale* (*Mycale*) *jasoniae* Lehnert, Stone and Heimler, 2006

Description. This massive sponge has several large tubes basally connected. In situ, several exhalent canals flow into large circular oscula surrounded by thin walls. These oscula collapse and are not readily visible on collected specimens. The surface is bulbous with many irregularly distributed conical processes. The consistency is rather soft, easily torn, and fibrous. Diameter is to 25 cm. Color in life is yellow to light yellow.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome is a tangential arrangement of short spicule tracts and single spicules with many microscleres in between the tracts. The choanosome consists of rather short spicule tracts (60–95 µm in diameter) that frequently branch off side tracts in all directions. This pattern is obscured by the presence of many single mega- and microscleres in between the tracts and without obvious orientation. Megascleres are tylostyles (405–460 × 10–12 µm). Microscleres include large anisochelae (80–100 µm), small anisochelae (40–60 µm), and rhaphides (42–65 µm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to cobbles at depths between 178 and 340 m.

Remarks. *M. jasoniae* is quite similar to *M. loveni* but possesses rhaphides that the latter species lacks.

Photos. 1) Preserved (frozen) specimen collected at a depth of 208 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ with a sculpin (*Malacocottus* sp.). 3) Close-up of same specimen as in photos 1 and 2.

91. *Mycale* (*Mycale*) *loveni* (Fristedt, 1887)

Synonym: *Mycale* (*Carmia*) *bellabellensis* (Lambe, 1905)

Description. This sponge is polymorphic; massively encrusting or stalked. The consistency is fragile, inelastic but difficult to tear against the direction of the long polyspicular tracts (laterally); easier to tear parallel to the tracts (top to bottom). Aleutian specimens may be stalked vases to 20 cm in height or massive forms to 1 m high and wide. Color in life varies from yellow to greenish yellow to brown. Gulf of Alaska specimens have a cone-shaped body with a slender stalk and are club-shaped until approximately 8 cm high or wide and then develop the characteristic cone shape. Cones may reach 1 m or more in height and diameter. Color in life varies from yellow to light yellow.

Skeletal structure. Very long ascending polyspicular tracts (visible to the unaided eye) lie below a reticulate dermal skeleton. Tracts are branching with thick tracts connected by shorter tracts. Tylostyles (370–495 × 10–15 µm) often have the largest diameter just before the point. Anisochelae are large (80–110 µm) and small (30–42 µm).

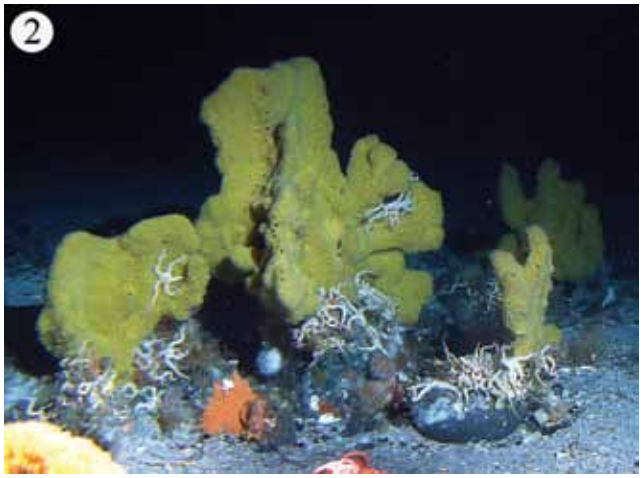
Zoogeographic distribution. Widespread and locally abundant. In Alaska – Chukchi Sea, Bering Sea, Aleutian Islands, and Gulf of Alaska. Elsewhere – Sea of Okhotsk, Pacific Coast of the Kuril Islands, Chukchi Sea (Russia), Arctic Ocean (East Siberian Sea), and British Columbia.

Habitat. Central Aleutian Islands – typically attached to boulders, cobbles, and pebbles at depths between 56 and 744 m (massive form) and 171 to 191 m (stalked form). Bering Sea (Pribilof Canyon) – uncommon; attached to cobbles and pebbles at depths between 260 and 309 m. Eastern Gulf of Alaska – most specimens are attached to bedrock, boulders, and cobbles at depths between 143 and 289 m in the eastern Gulf of Alaska (and presumably much deeper based on unconfirmed catches with longline gear). Elsewhere – no information is available.

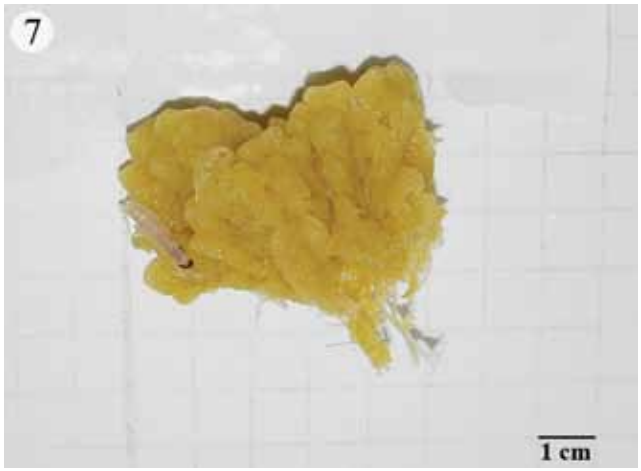
Remarks. We consider *M. loveni* and *M. bellabellensis* to be the same species, the latter being a cone-shaped ecomorph adapted for low-current habitats in the Gulf of Alaska. The two species have the same spicule complement and arrangement and internal skeletal structure. In the eastern Gulf of Alaska the species is club-shaped until approximately 8 cm wide and then it develops the characteristic cone shape. The sharpchin rockfish (*Sebastes zacentrus*) and other rockfish species often use this sponge as perching habitat. This species is preyed upon by the sea star *Ceramaster patagonicus*.

Photos. 1) Fragment of a specimen (massive form) collected at a depth of 309 m in Pribilof Canyon, Bering Sea. Grid marks are 1 cm^2. 2) Several specimens (massive form) at a depth of 96 m in the central Aleutian Islands. 3) Several specimens (massive form) with a sharpchin rockfish (*Sebastes zacentrus*) at a depth of 119 m in the central Aleutian Islands. 4) Preserved (frozen) specimen (stalked form) collected at a depth of 192 m in the central Aleutian Islands. Grid marks are 1 cm^2. 5) Same specimen as in photo 4 in situ. The separation between the red laser marks is 10 cm. 6) Specimen collected at a depth of 167 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 7) Juvenile specimen (with associated euphasid) collected at a depth of 165 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 8) Same specimen as in photo 7 in situ. 9) Specimen with a gravid sharpchin rockfish (*S. zacentrus*) at a depth of 170 m in the eastern Gulf of Alaska. Photo by J. Lincoln Freese (AFSC). 10) A more robust cone-shaped form with a sharpchin rockfish (*S. zacentrus*) in a higher current area at a depth of 179 m in the eastern Gulf of Alaska. Note the juvenile specimen at the upper left. Photo by J. Lincoln Freese (AFSC).

91. *Mycale* (*Mycale*) *loveni* (Fristedt, 1887) (continued)



91. *Mycale* (*Mycale*) *loveni* (Fristedt, 1887) (continued)



92. *Mycale* (*Mycale*) *tylota* Koltun, 1958

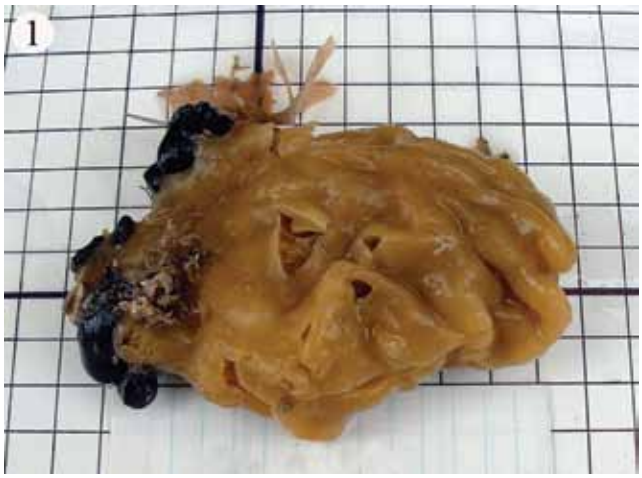
Description. This sponge is massive with a smooth but convoluted surface. Circular oscula are on conical elevations. Consistency is inelastic and very easily torn. Diameter is to 10 cm. Color in life is yellow to golden brown.

Skeletal structure. There is a thick ectosomal crust of styles to tylotes that are scattered without obvious orientation and tangentially arranged with many microscleres in between. Choanosomal pauci- to polyspicular tracts are in triangular meshes with masses of sigmas in between. Rosettes of large anisochelae are less abundant. There are ectosomal styles to tylotes (415–570 × 10–16 µm), choanosomal styles (670–890 × 15–25 µm), large anisochelae (95–112 µm), small anisochelae (15–35 µm), large sigmas (82–105 µm), small sigmas (25–35 µm), and rhaphides (70–110 µm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – southern Kuril Strait.

Habitat. In Alaska – attached to cobbles and pebbles at depths between 135 and 175 m. Elsewhere – reported at depths between 73 and 181 m.

Photos. 1) Specimen collected at a depth of 172 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (indicated by the white arrow) in situ.



93. *Latrunculia (Biannulata) oparinae* Samaii and Krasokhin, 2002

Description. Globular sponge has numerous small oscula on short, wart-like elevations. Water jets are emitted through the oscula when the sponge is squeezed. Areolate pore-fields collapse upon collection and are only visible in situ. Consistency is rather firm, only slightly elastic and difficult to tear. Diameter is to at least 16 cm. Two distinct colors have been observed in situ – dark brown (dominant) and olive-green.

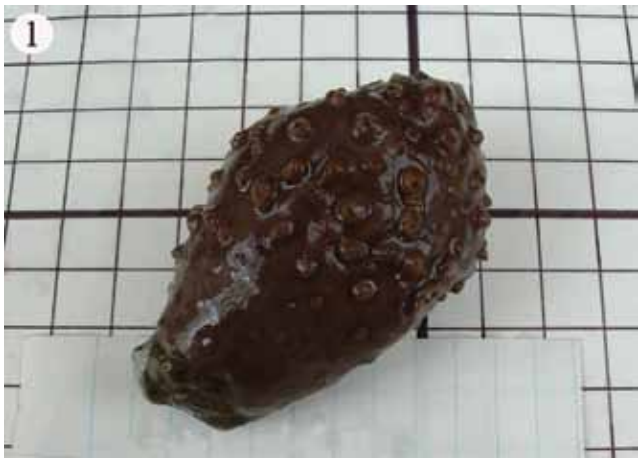
Skeletal structure. Ectosome is thick and leathery, consisting of a cortex of tightly packed anisodiscorhabds. Fusiform, slightly sinuous styles have acanthose heads (320–525 × 9–15 μm) and anisodiscorhabds (42–50 μm).

Zoogeographic distribution. Locally common and abundant (densities up to 14 individuals per m^2 in Alaska). In Alaska – central Aleutian Islands. Elsewhere – previously known only from the Kuril Islands in the Sea of Okhotsk.

Habitat. Attached to bedrock, boulders, cobbles, and pebbles at depths between 79 and 288 m (possibly to 438 m). Elsewhere – reported at depths between 176 and 202 m.

Remarks. Sponges in the genus *Latrunculia* contain the cytotoxic discorhabdin class of pyrroloiminoquinone alkaloids that exhibit significant antiviral activity against hepatitis virus C (HCV), antimalarial activity against *Plasmodium falciparum*, and antimicrobial effects against the AIDS opportunistic pathogens methicillin-resistant *Staphylococcus aureus* (MRSA), *Mycobacterium intracellulare*, and *M. tuberculosis* (Na et al., 2010). This species is associated with several gorgonians, including *Thouarella* spp. and *Plumarella* spp.

Photos. 1) Specimen collected at a depth of 150 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (right) in situ with the olive-green morph (left). 3) Specimen collected at a depth of 146 m in the central Aleutian Islands. Grid marks are 1 cm^2. 4) Same specimen as in photo 3 (center) in situ.



94. *Latrunculia velera* Lehnert, Stone and Heimler, 2006

Description. This cone-shaped sponge has a flattened smooth top that is typically circular but occasionally kidney-shaped. On deck, specimens appear subglobular because they have been laterally compressed. This species has a smooth uneven surface, thick and leathery, only slightly elastic, and easily torn. The interior is markedly fibrous, somewhat similar to *L. oparinae* but differing slightly in shape and clearly in the absence of areolate pore-fields and the form of the anisodiscorhabds. Diameter is to about 12 cm. Color in life is dull brown; dark brown on deck.

Skeletal structure. SEM images of spicules are shown in Appendix IV. The ectosome is a unispicular layer of discorhabds, all arranged with their longitudinal axis perpendicular to the surface. The choanosome is a reticulation of polyspicular tracts of styles with some discorhabds in between. Megascleres are styles with slightly acanthose heads (500–540 × 9–11 µm). Microscleres are relatively smooth anisodiscorhabds (37–43 µm).

Zoogeographic distribution. Locally common. In Alaska – central Aleutian Islands. Elsewhere – not reported.

Habitat. Attached to bedrock, boulders, and cobbles at depths between 412 and 1009 m, but relatively rare at depths shallower than 600 m.

Remarks. There appears to be another species of *Latrunculia* in the central Aleutian Islands at intermediate depths (i.e., slightly overlapping the depth ranges of both *L. oparinae* and *L. velera*). *Latrunculia* specimens in the depth range of 200 to 500 m should be a priority for collection.

Photos. 1) Preserved (frozen) specimen collected at a depth of 1009 m in the central Aleutian Islands. Note that the specimen has been laterally compressed. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (far left) in situ. 3) Specimen observed in situ at a depth of 929 m. The separation between the red laser marks is 10 cm.

95. *Latrunculia* sp. (undescribed)

Description. This globular sponge has broad crater-shaped pore fields; these are prominent structures on the sponge surface. Surface is uneven and slimy. Diameter is to about 8 cm. Color in life is khaki-green to olive-green.

Skeletal structure. The majority of megascleres are anisostyles, fusiform, not terminally spined, rarely polytylote, with only slight differentiation between the two ends (325–397 × 7–10 μm). Microscleres are anisodiscorhabds (49–66 × 4–7 μm). The manubrium, a base of six short, downward pointing smooth spines, is closely followed by the basal whorl, which consists of a ring of horizontally aligned, smooth spines. The median whorl (21–31 μm in diameter) is located midway along the shaft and composed of undulate petals with denticulate margins, and some sculpted regions. The subsidiary whorl is composed of similar undulating petals with denticulate margins and sculpted sections, but the petals slant upwards and are located just underneath the apical whorl. The apical whorl is formed of fused undulating petals with denticulate margins forming a beautiful corona.

Zoogeographic distribution. Locally abundant. In Alaska – continental shelf off Cape Ommaney, Baranof Island, eastern Gulf of Alaska. Elsewhere – a sponge, believed to be this species, has also been reported from British Columbia and northern Washington State.

Habitat. In Alaska – attached to bedrock at depths between 69 and 210 m, temperatures between 5.5 and 7.6°C, and salinities between 32.2 and 33.7 psu. Elsewhere – no information available.

Photos. 1) Specimen collected at a depth of 102 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ with the hydrocoral *Distichopora borealis* (right).

96. *Axinella blanca* Koltun, 1959

Description. This sponge has irregular branching and is extremely arborescent. Consistency is moderately firm and elastic. Surface of the side branches is smooth but microscopically hispid. Size is to at least 50 cm × 50 cm. Color in life is highly variable ranging from light brown, light grey, light yellow, golden-yellow to light orange. Light brown is the dominant color in waters deeper than 120 m in the central Aleutian Islands; golden yellow and light orange are dominant in shallower water.

Skeletal structure. Skeletal architecture consists of ascending spicule tracts; spicules protruding from these tracts cause the hispid surface of the ectosome. Spicules are long oxeas (850–1350 × 18–35 μm) and short styles (320–530 × 8–15 μm).

Zoogeographic distribution. Locally abundant. In Alaska – central Aleutian Islands and Bering Sea. Elsewhere – Bering Sea near Mednyi Island (Commander Islands, Russia).

Habitat. In Alaska – forms dense fields almost completely covering the seafloor in areas of bedrock, boulders, and cobbles on steep slope habitat and at depths between 80 and 269 m. Elsewhere – reported at depths to 160 m.

Photos. 1) Specimen collected at a depth of 140 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ with the gorgonian *Plumarella* sp. (right). 3) Specimen observed in situ at a depth of 92 m in the central Aleutian Islands.

97. *Axinella rugosa* (Bowerbank, 1866)

Description. This sponge is clavate. Branching, fan-shaped, or single tubes (occasionally two tubes) are to 17 cm in height. Consistency is firm but elastic, with a hispid surface. Color in life is grey, light yellow, golden brown to brownish red.

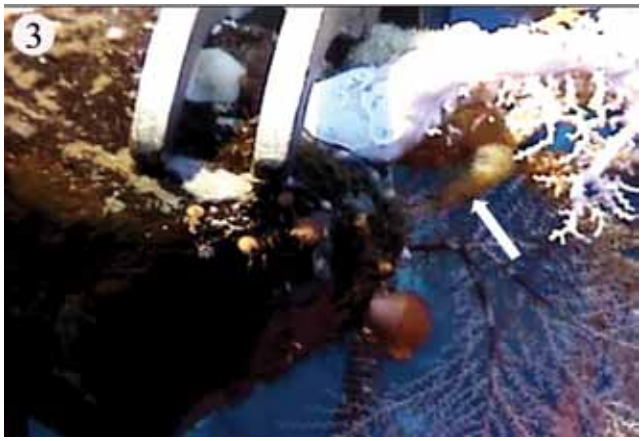
Skeletal structure. Axinellid spicule tracts consist of styles, strongyles, and oxeas. All spicules have a large variation in length up to 1750 μm.

Zoogeographic distribution. Widespread and locally abundant. In Alaska – central Aleutian Islands, Bering Sea, and eastern Gulf of Alaska. Elsewhere – North Pacific Ocean (Sea of Japan), Arctic Ocean (Barents Sea and Greenland Sea), and North Atlantic Ocean (Norwegian Sea).

Habitat. In Alaska – attached to hard substrate at depths between 87 and 712 m. Densities to 63 individuals per m^2 in the eastern Gulf of Alaska. Elsewhere – reported at depths between 90 and 320 m, temperatures between 2 and 5°C, and salinities between 34.20 and 35.01 psu.

Remarks. Though superficially similar to *Mycale carlilei*, *A. rugosa* is a hollow tube whereas *M. carlilei* is a solid tube with a flat top and one or more prominent oscula. The Alaskan specimens are the first tube forms reported for the species.

Photos. 1) Specimen collected at a depth of 172 m in the eastern Gulf of Alaska. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. 3) Specimen (indicated by the white arrow) collected in situ at a depth of 712 m in the central Aleutian Islands.



98. *Bubaris vermiculata* (Bowerbank, 1866)

Description. This sponge is encrusting, elongated, foliate or lobate. Consistency is soft with a hispid surface. Dimensions are to 15 cm^2. Color in life is bright red to golden brown.

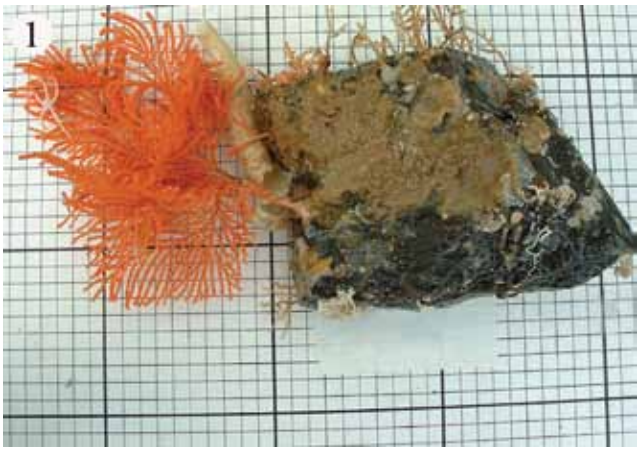
Skeletal structure. It has characteristic axinellid spicule tracts. Styles are 426–4550 × 10–38 µm; strongyles and oxeas are irregularly curved or distorted (208–588 × 6–15 µm).

Zoogeographic distribution. Widespread and locally common. In Alaska – central Aleutian Islands. Elsewhere – Arctic Ocean (Barents and Greenland Seas), North Atlantic Ocean (Norwegian Sea to the Azores), and Mediterranean Sea.

Habitat. In Alaska – encrusts mudstone, cobbles, and pebbles at depths between 165 and 888 m. Elsewhere – reported at depths between 9 and 1360 m.

Remarks. This is the same species as *Axinella vermiculata* sensu Koltun, 1959.

Photos. 1) Specimen (center) collected with the gorgonian *Plumarella aleutiana* at a depth of 165 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen (right) collected on mudstone at a depth of 888 m in the central Aleutian Islands.



99. *Halichondria* (*Halichondria*) *colossea* Lundbeck, 1902

Description. This species appears as originally described and is irregularly cup-shaped and somewhat compressed. Large osculum is on the inside of the cup. The surface is smooth on the outside and hispid on the inside of the cup. The consistency is firm. Width is to 50 cm and height to 30 cm. Color in life is greyish brown to creamy white.

Skeletal structure. Smaller oxeas have tangential arrangement in the ectosome and larger oxeas are in characteristic confused "halichondroid" arrangement in the choanosome. Oxeas in two size categories range in length from 140–2000 μm.

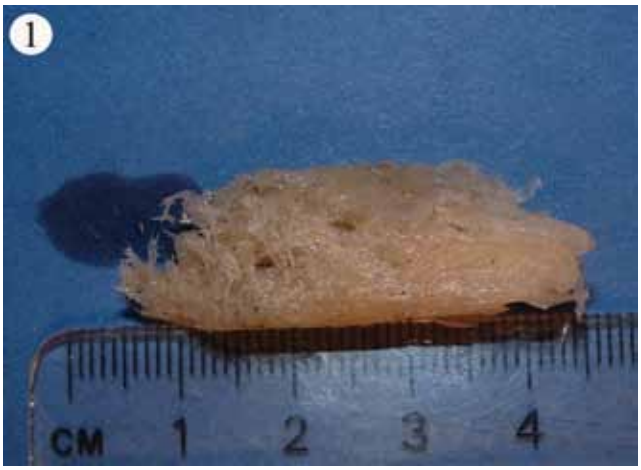
Zoogeographic distribution. Rare. In Alaska – Bering Sea (Pribilof Canyon). Elsewhere – North Atlantic Ocean (Denmark Strait).

Habitat. In Alaska – attached to cobbles at a depth of 300 m. Elsewhere – reported at a depth of 1039 m.

Remarks. The specimen collected in Pribilof Canyon is only the second record for the species worldwide and the first from the Pacific Ocean. Several specimens collected from the Atlantic Coast of the U.S. (Massachusetts) have been tentatively identified as *H. colossea* (Van Soest[6]).

Photo. 1) Fragment of a specimen collected at a depth of 300 m in Pribilof Canyon, Bering Sea.

[6] Van Soest, Rob. 2008. Personal commun. Zoological Museum, University of Amsterdam, Amsterdam, The Netherlands 1090 GT.



100. *Halichondria* (*Halichondria*) *oblonga* (Hansen, 1885)

Description. This cylindrical, tube-shaped sponge has a narrow stalk. It may branch near the base of the stalk so that several tubes (up to 12) may be connected basally. Consistency is only slightly elastic and stiff. Near the base the tubes are 3–4 mm in diameter and widen to a maximum diameter of 2 cm. Maximum height is to 18 cm. Color in life is golden brown with a light, almost whitish tip.

Skeletal structure. The brown part of the sponge is more stiff and covered with an ectosomal layer of densely packed, parallel arranged tangential oxeas. The whitish tip of the sponge is covered by a thin dermal membrane without spicules. Choanosomal ascending paucispicular tracts are connected by single spicules. Oxeas are 320–480 × 14–20 µm.

Zoogeographic distribution. Widespread and locally abundant. In Alaska – central Aleutian Islands. Elsewhere – Arctic Ocean (Barents Sea and Kara Sea) and North Atlantic Ocean (Greenland and the Faroe Islands).

Habitat. In Alaska – patchy distribution; attached to hard substrate (generally cobbles and pebbles) at depths between 115 and 305 m. Elsewhere – reported at depths between 18 and 823 m.

Photos. 1) Specimens collected with the demosponge *Myxilla behringensis* (left center) at a depth of 195 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimens as in photo 1 in situ. 3) Cluster of specimens (lower center) below the golden king crab (*Lithodes aequispina*) at a depth of 272 m in the central Aleutian Islands.

101. *Halichondria* (*Eumastia*) *sitiens* (Schmidt, 1870)

Description. This sponge has a short stalk that typically branches into several agglutinated tubes. Consistency is inelastic and stiff due to a combination of high spicule density and lack of spongin, but easy to tear. Oscula are not obvious. Height is to at least 15 cm. Color in life is light brown, golden brown, or creamy white.

Skeletal structure. Spicules are arranged tangentially in the ectosome as is typical for the genus. The choanosome is constructed by polyspicular tracts and many spicules without orientation in between. Oxeas are of a wide size range (145–1200 × 5–20 μm).

Zoogeographic distribution. Cosmopolitan and locally common. In Alaska – central Aleutian Islands, Bering Sea (Pribilof Canyon), and Arctic Ocean. Elsewhere – North Pacific Ocean, Arctic Ocean, and North Atlantic Ocean.

Habitat. In Alaska – attached to boulders and cobbles at depths between 97 and 167 m (central Aleutian Islands). In the Bering Sea it attaches to cobbles and pebbles at depths between 208 and 300 m. Elsewhere – reported at depths between 6 and 220 m.

Remarks. Koltun (1959) described a cushion-shaped sponge with a surface of numerous elongated papillae with oscula on top. The agglutinated small tubes of the Aleutian Island specimens are the equivalent of these papillae in a fully grown sponge. The very long oxeas in halichondroid confused arrangement occur in both specimens and are regarded as diagnostic.

Photos. 1) Specimen collected at a depth of 167 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (center) in situ growing in a cluster of the same species. 3) Fragmented specimen collected at a depth of 300 m in Pribilof Canyon, Bering Sea.

102. *Halichondria* sp.

Description. This sponge is extremely polymorphic; reported growth forms include encrusting, massive-lobate, tubular, lobate, and vase-shaped. Oscula may be flush with the surface, slightly elevated, or on larger cone-shaped elevations. Consistency is only slightly elastic but easily fragmented. Size is to at least 30 cm × 30 cm. Color in life ranges from brown, grey, orange, green, yellow, to creamy white.

Skeletal structure. Ectosomal spicules are tangentially arranged. Choanosomal arrangement of spicules is mostly confused but in places may be a unispicular reticulation or meshes of polyspicular tracts. Spicules are oxeas (220–335 × 15–24 µm).

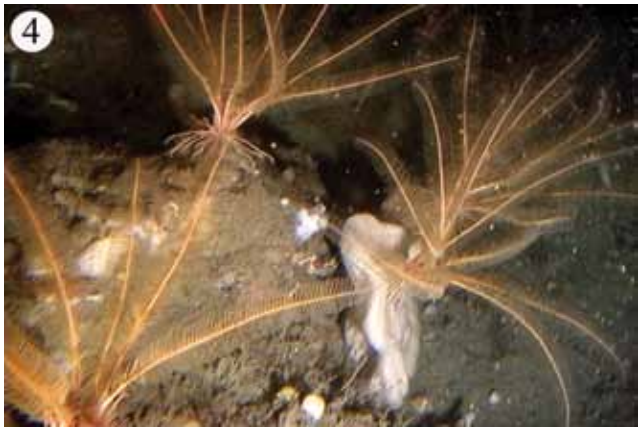
Zoogeographic distribution. Locally abundant. In Alaska – Aleutian Islands, Bering Sea (Pribilof Canyon), and eastern Gulf of Alaska. Elsewhere – North Pacific Ocean.

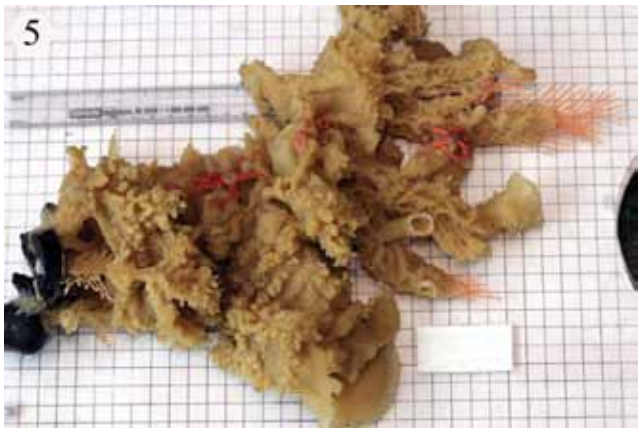
Habitat. In Alaska – attached to hard substrate. Depths between 155 and 208 m (Aleutian Islands); depths between 71 and 255 m (eastern Gulf of Alaska); Bering Sea (Pribilof Canyon) – locally abundant; attached to bedrock, cobbles, pebbles, and encrusting the gorgonian coral *Plumarella echinata* at depths between 208 and 309 m. Elsewhere – no information available.

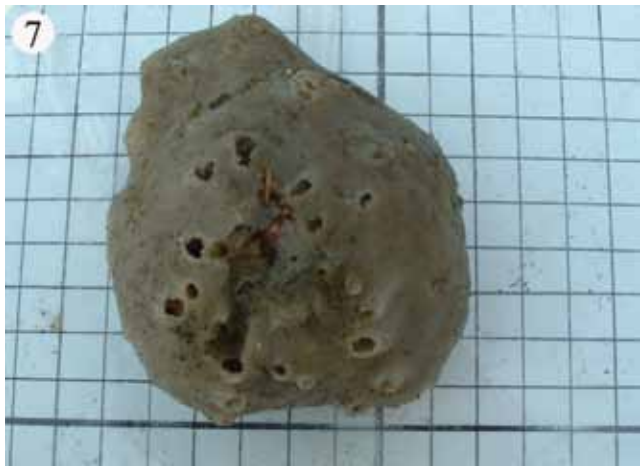
Remarks. This species might represent an undescribed species. The Alaskan specimens are similar to *Halichondria panicea* (Pallas, 1766) that is common to the North Atlantic Ocean and was recently introduced to San Francisco Bay. Alaskan specimens have a slightly different external appearance and the spicules are shorter and more robust than those of *H. panicea*. There are ongoing discussions about whether there are several sibling species or whether the Atlantic and Pacific Ocean populations are conspecific (Erpenbeck and Van Soest, 2002). Eggs and hatching larvae similar to those of the snailfish (*Careproctus* sp.) were found in flabellate forms of this species in Pribilof Canyon, Bering Sea (Busby[4]). This species is preyed upon by the sea stars *Hippasteria* spp., *Pteraster tesselatus*, *Ceramaster patagonicus*, and possibly *Henricia longispina*.

Photos. 1) Specimen collected at a depth of 175 m in the central Aleutian Islands. Grid marks are 1 cm². 2) Same specimen as in photo 1 in situ. The specimen was detached and lying on the seafloor in an area that had been trawled. 3) A fragment of a specimen collected at 152 m in the eastern Gulf of Alaska. Grid marks are 1 cm². 4) Same specimen as in photo 3 (lower right) in situ. Crinoids (*Florometra serratissima*) use the sponge as an elevated perch. 5) Specimen collected at a depth of 310 m in Pribilof Canyon, Bering Sea. This specimen has completely encrusted the gorgonian *Plumarella echinata* (tips exposed at right). Grid marks are 1 cm². 6) Same specimen as in photo 5 (indicated by the white arrow) in situ. 7) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm².

102. *Halichondria* sp. (continued)







103. *Hymeniacidon assimilis* Levinsen, 1887

Description. This sponge is polymorphic; massive-lobate, massively cylindrical, ramified, semiglobular, or even encrusting. Some Aleutian specimens are highly ramified with some branches coalesced together. Rows of small oscula are visible in situ. The consistency is only slightly elastic, stiff, and easily torn. It appears to be particularly fragile. Height of highly ramified form is to 1 m or more. Color in life is yellow, light brown, golden-brown or creamy-white.

Skeletal structure. Ectosomal spicules are tangentially arranged without further orientation. There is choanosomal reticulation of polyspicular tracts and in other parts short tracts and single spicules without orientation. Styles (135–560 × 6–23 µm) probably occur in two size categories.

Zoogeographic distribution. Cosmopolitan and locally common. In Alaska – central Aleutian Islands, Bering Sea, and Chukchi Sea. Elsewhere – North Pacific Ocean (Sea of Okhotsk and Sea of Japan), Arctic Ocean (Barents Sea, East Siberian Sea, and Kara Sea), and North Atlantic Ocean.

Habitat. In Alaska – attached to cobbles at depths between 119 and 253 m; also encrusts the gorgonian *Muriceides nigra*. Elsewhere – reported at depths between 15 and 110 m.

Photos. 1) Partial specimen (ramified form) collected at a depth of 119 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (center) in situ. 3) Close-up view of same specimen as in photos 1 and 2 showing rows of small oscula. 4) Fragment of specimen (encrusting form) collected at a depth of 160 m in the central Aleutian Islands. Specimen encrusts the gorgonian *Muriceides nigra*.

104. *Topsentia disparilis* (Lambe, 1893)

Description. On deck this species appears a massive sponge, but in situ it forms stout hollow tubes with spicule tracts protruding far above the surface. The consistency is fragile, inelastic, and easily torn. Height is to 7 cm and width to 5 cm. Color in life is light brown to creamy white.

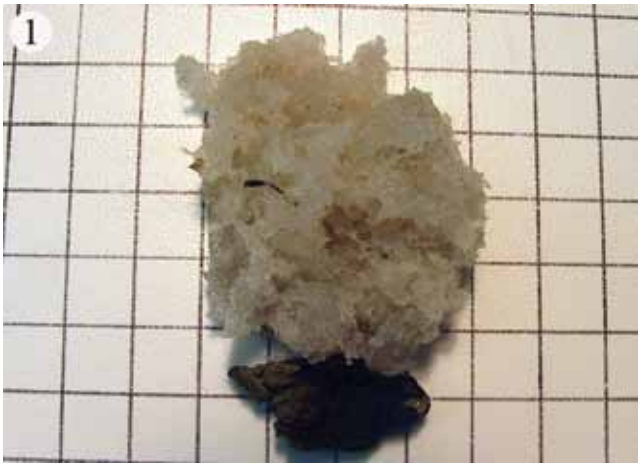
Skeletal structure. Skeleton is confused and halichondroid. Large oxeas are 438–1400 × 13–21 μm; small oxeas (50–150 × 4–6 μm) are concentrated in the ectosome.

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands, Bering Sea, and Arctic Ocean (Beaufort Sea – Point Barrow). Elsewhere – Vancouver Island, British Columbia.

Habitat. In Alaska – attached to mudstone on steep canyon habitat at a depth of 2828 m. Grows in small clusters of up to eight individuals. Elsewhere – reported at depths between 80 and 110 m.

Remarks. This species was previously known as *Halichondria disparilis* Lambe, 1893. It appears to be extremely eurybathic.

Photos. 1) Preserved (frozen then stored in ethanol) specimen collected at a depth of 2828 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (lower left) in situ with a cluster of the same species.



105. *Cladocroce ventilabrum* (Fristedt, 1887)

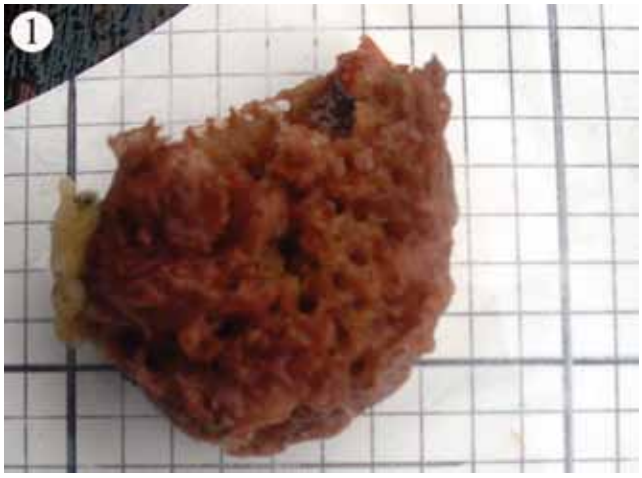
Description. Two growth forms exist: 1) massive to hemispherical, and 2) fan-shaped and stalked. The fan may be thin-bladed or form an ovoid tube with a large osculum on top. The surface is irregularly corrugated with crater-like oscula. Both growth forms narrow somewhat to a basal attachment or short stalk. Consistency is soft, elastic, and easily torn. Size is to 10 cm × 10 cm. Color in life is reddish brown or golden brown.

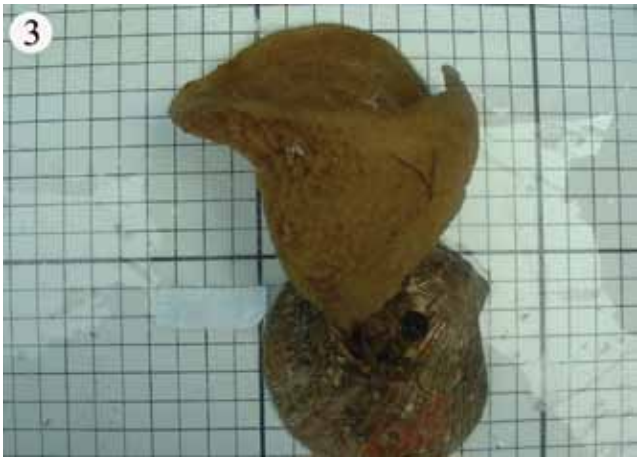
Skeletal structure. There is an ectosomal unispicular reticulation of tangentially arranged oxeas (160–180 × 5–12 µm). Where oxeas are connected, one to four are arranged perpendicular to the surface. There is a choanosomal unispicular reticulation; in places paucispicular tracts are connected by single spicules.

Zoogeographic distribution. Widespread but uncommon. In Alaska – central Aleutian Islands. Elsewhere – North Pacific Ocean (Sea of Japan), Arctic Ocean (Barents Sea and Greenland Sea), and North Atlantic Ocean (Davis Strait).

Habitat. In Alaska – attached to cobbles, pebbles, and bivalve shells at depths between 155 and 235 m. Elsewhere – reported at depths between 40 and 718 m.

Photos. 1) Specimen collected at a depth of 190 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (center) in situ. 3) Specimen attached to a scallop shell (*Chlamys* sp.) collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2. 4) Specimen attached to a pebble collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.





106. *Haliclona bucina* Tanita and Hoshino, 1989

Description. This small vase-shaped sponge has a thin fistular stalk or basal fistular stolons. Due to the reticulation of single spicules these sponges are only slightly elastic and consequently very fragile. Height is to 3 cm and width to 1 cm. Color in life is light brown to golden brown.

Skeletal structure. There is a unispicular reticulation of oxeas (165–195 × 7–9 μm), slightly longer than those originally described.

Zoogeographic distribution. Rare. In Alaska – central Aleutian Islands. Elsewhere – known only from Sagami Bay, Japan.

Habitat. In Alaska – attached to the calcareous sponge *Leucandra tuba* at a depth of 145 m. Elsewhere – depths between 80 and 95 m.

Photo. 1) Specimen (center) attached to the calcareous sponge *Leucandra tuba* collected at a depth of 145 m in the central Aleutian Islands. Grid marks are 1 cm^2.

107. *Haliclona* (*Gellius*) *digitata* (Koltun, 1958)

Description. Koltun (1959) described this species as "elongated, thinly tabular (foliate), or rolled up and intergrown in such a manner that it acquires an irregular shape … hollow dactylate projections…." Aleutian Island specimens are typically stalked and flabellate. The surface is smooth. The oscula are circular, chimney-like, on top of oblique tubes. The consistency is only slightly elastic and easy to tear. Size is to at least 15 cm in height and width. Color in life is light brown to golden brown; appears characteristically yellow in situ.

Skeletal structure. The choanosomal skeleton consists of long polyspicular tracts connected by single spicules, oxeas (320–370 × 12–18 μm), and thin sigmas (18–25 μm).

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands. Elsewhere – North Pacific Ocean (Sea of Okhotsk near the Pacific coast of the southern Kuril Islands).

Habitat. In Alaska – attached to bedrock, boulders, cobbles, and pebbles at depths between 96 and 258 m. Elsewhere – found on sand and gravel at depths between 285 and 287 m and at a temperature of 1.7°C.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.

108. *Haliclona* (*Gellius*) *primitiva* (Lundbeck, 1902)

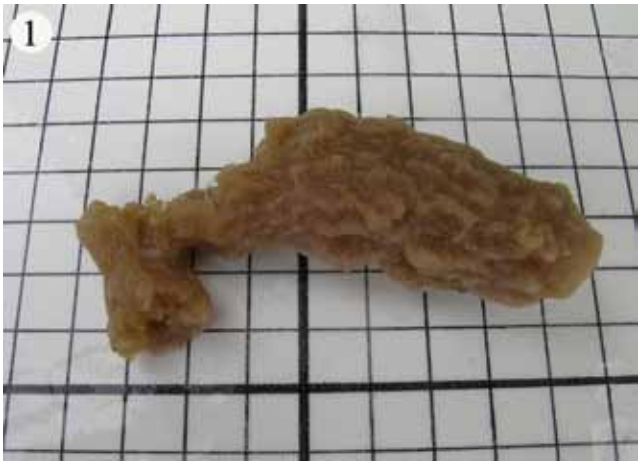
Description. According to Koltun (1959) this species is massive-lobate, or cushion-shaped, up to 10.5 cm in height, and often forms dactylate, lobate or other types of projections. Aleutian Island specimens are dactylate with hollow centers; up to three fingers are basally attached. Surface is corrugated. Color in life is light yellow, brown, or golden brown.

Skeletal structure. The ectosomal skeleton is a tangential, unispicular reticulation of single spicules. Conspicuous polyspicular tracts, several mm in length, are connected by a reticulation of single spicules in the choansosome. Oxeas are 140–175 × 8–13 µm and toxa are 45–135 µm.

Zoogeographic distribution. Widespread but uncommon. In Alaska – central Aleutian Islands and Bering Sea. Elsewhere – North Pacific Ocean (Sea of Okhotsk, Sea of Japan, Pacific coast of the Kuril Islands), Arctic Ocean (White Sea), and North Atlantic Ocean (west of Greenland).

Habitat. In Alaska – attached to pebbles at a depth of 138 m. Elsewhere – found on sand, rock, and ooze at depths between 27 and 200 m, at temperatures between 0.1 and 3.4°C, and at salinities between 27.0 and 33.9 psu.

Photos. 1) Partial specimen collected at a depth of 138 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (indicated by the white arrows) in situ covered with ophiuroids.



109. *Haliclona tenuiderma* (Lundbeck, 1902)

Description. This sponge is cushion-shaped with a finely hispid surface. Consistency is very delicate; only slightly elastic and easily torn. Circular oscula are slightly elevated from the surface and not visible on collected specimens. Height is to 15 cm and width to 8 cm. Color in life is light grey to creamy white.

Skeletal structure. Choanosomal paucispicular tracts are connected by single spicules and short tracts; oxeas (330–430 × 13–15 μm).

Zoogeographic range. Widespread but rare. In Alaska – central Aleutian Islands. Elsewhere – North Pacific Ocean (Sea of Okhotsk and Sea of Japan), Arctic Ocean (Barents Sea and Greenland Sea), and North Atlantic Ocean.

Habitat. In Alaska – attached to bedrock, boulders, and mudstone at depths between 974 and 1706 m. Elsewhere – reported at depths between 0 and 15 m (Barents Sea) and at a depth of 887 m (North Atlantic Ocean).

Photos. 1) Fragments of preserved (frozen then ethanol) specimen collected at a depth of 1352 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 in situ. 3) Close-up view of same specimen as in photo 2 and 3.

110. *Haliclona* (*Haliclona*) *urceolus* (Rathke and Vahl, 1806)

Description. This sponge is stalked and oviform or stalked tubes (de Weerdt, 1986a). Aleutian Island specimens are stalked tubes; stalk approximately 1 cm long, overall length to about 10 cm. Color in life is light yellow with a darker stalk.

Skeletal structure. There is a unispicular reticulation of oxeas (178–280 µm).

Zoogeographic range: Uncommon. In Alaska – central Aleutian Islands (first record in the North Pacific Ocean). Elsewhere – Arctic Ocean (Kara Sea) and North Atlantic Ocean (North Sea).

Habitat. In Alaska – attached to cobbles at depths near 490 m. Elsewhere – found on sediment covered stones in sheltered habitats at depths between 5 and l000 m.

Photos. 1) Preserved (frozen) specimen collected at a depth of 490 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Same specimen as in photo 1 (right) in situ.

111. *Haliclona* sp. 1

Description. This sponge is massively encrusting or cushion-shaped. Oscula are deep and crater-shaped. Surface is slightly rough; consistency is soft and fragile. Diameter is to about 10 cm. Color in life is light brown or golden brown.

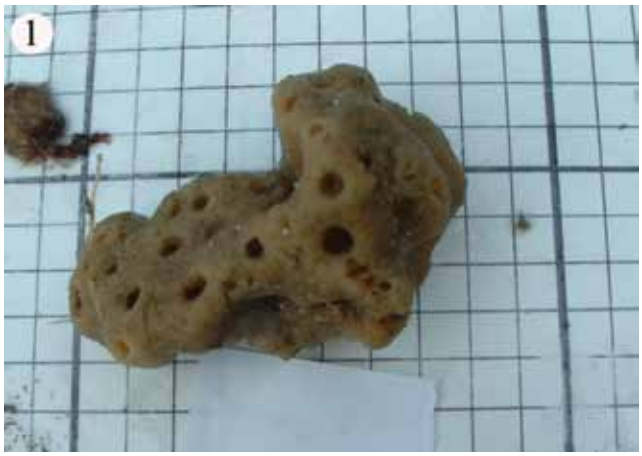
Skeletal structure. There is a choanosomal arrangement of oxeas (160–220 × 10–15 µm) in paucispicular tracts connected by single spicules.

Zoogeographic distribution. Uncommon. In Alaska – central Aleutian Islands and Bering Sea.

Habitat. Attached to cobbles and pebbles at depths between 150 and 160 m.

Remarks. This species might represent an undescribed species.

Photo. 1) Specimen collected at a depth of 155 m in the central Aleutian Islands. Grid marks are 1 cm^2.



112. *Haliclona* sp. 2

Description. This sponge is flabellate; single- or multiplaned. Oscula are conspicuous, slightly elevated and scattered over the entire surface. It is extremely slimy, even in preservative. Consistency is very soft and elastic. Height and width are to 20 cm. Color in life is yellowish brown to light brown, but appears characteristically white in situ.

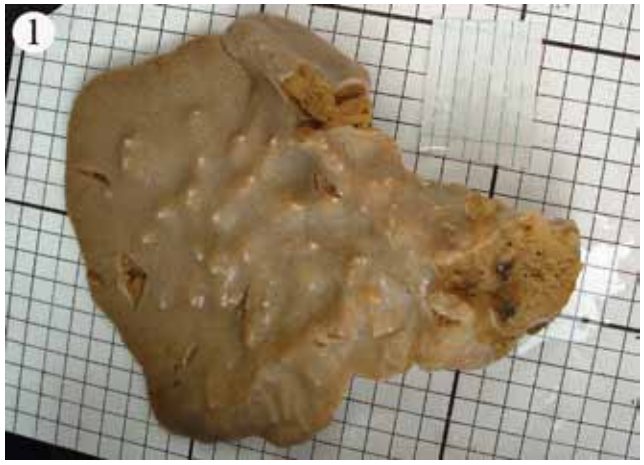
Skeletal structure. Ectosomal tangential unispicular reticulation is strengthened by large quantities of spongin which covers the sponge like a perforated plate. Choanosomal paucispicular tracts are connected by single spicules to unispicular reticulation of oxeas (180–230 × 5–12 μm).

Zoogeographic distribution. In Alaska – locally abundant in central Aleutian Islands.

Habitat. Attached principally to bedrock, but occasionally to boulders and cobbles at depths between 74 and 195 m; more common at depths shallower than 120 m.

Remarks. This species might represent an undescribed species. It is similar in growth form to *Haliclona cinerea* and displays the slime strands previously regarded as diagnostic for the species. However, *H. cinerea* has smaller oxeas than this species and is known only from shallow waters of the Celtic Seas Region of the North Atlantic Ocean. This species may be preyed upon by the blood star (*Henricia* sp.).

Photos. 1) Specimen collected at a depth of 80 m in the central Aleutian Islands. Grid marks are 1 cm^2. 2) Specimen (right) observed at 92 m in the central Aleutian Islands.



Acknowledgments

We thank E. Brown, D. Carlile, S. France, L. Watling, S. Rooney, P. Malecha, T. Marshall, K. Lowyck, J. Hocevar, M. Ridgway, A. Andrews, and J. Mondragon for assistance with the collection of specimens. We thank John Hocevar of Greenpeace International for allowing us to include in this guide specimens collected during their 2007 Bering Sea Canyons Expedition. T. Warshaw provided the topside photographs of the Bering Sea specimens; B. Masuda helped with much of the photo editing. M. Kelly (NIWA) provided the skeletal structure description for the undescribed species of *Latrunculia*. The field collections were supported by the Alaska Fisheries Science Center of the National Marine Fisheries Service, West Coast and Polar Regions Undersea Research Center of NOAA's National Undersea Research Program, and the North Pacific Research Board. We thank three anonymous reviewers for helpful comments on an earlier version of this manuscript. Funding for the completion of this guide was provided by the National Marine Fisheries Service, Office of Habitat Conservation, as part of the Deep Sea Coral Research and Technology Program.

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Appendix I. Sponge species reported from Alaskan waters

This list includes the sponges currently known to occur in the deep waters (>80 m) of Alaska. The list has been drawn from the published literature (mostly species descriptions) and from recent collections of specimens that have been definitively identified by us through examination of microscopic characters. We provide a complete list of all species reported from the area, but only provide detailed species descriptions in this guide for those species that we collected and examined ourselves. For all other species we provide the zoogeographic ranges, but refer the reader to the primary literature for those species descriptions. The taxonomic names are all modern, systematically arranged to family, and alphabetically arranged by genus and species within family. (*) indicates that the species was reported without precise coordinates but we believe that the collection was made in Alaskan waters.

PHYLUM PORIFERA

CLASS CALCAREA

Order Baerida
- Family Baeriidae
  - *Leuconia alaskensis* de Laubenfels, 1953; (Arctic Ocean – Point Barrow, Beaufort Sea)
  - *Leucopsila* cf. *stylifera* (Borojevic, Boury-Esnault and Vacelet, 2000); (Aleutian Islands)

Order Clathrinida
- Family Clathrinidae
  - *Clathrina* sp. . . . . Page 12

Order Leucosolenida
- Family Amphoriscidae
  - *Leucilla nuttingi* (Urban, 1902); (Aleutian Islands)
- Family Grantiidae
  - *Leucandra ananas* (Montagu, 1818); (Arctic Ocean – Point Barrow, Beaufort Sea)
  - *Leucandra heathi* Urban, 1906; (Aleutian Islands)
  - *Leucandra poculiformis* Hozawa, 1918 . . . . . Page 13
  - *Leucandra pyriformis* (Lambe, 1893); (Aleutian Islands)
  - *Leucandra taylori* Lambe, 1900; (Aleutian Islands)
  - *Leucandra tuba* Hozawa, 1918. . . . . Page 14
- Family Leucosoleniidae
  - *Leucosolenia eleanor* Urban, 1905; (Aleutian Islands, Gulf of Alaska)
- Family Sycettidae
  - *Sycon compactum* Lambe, 1893; (Aleutian Islands)

CLASS HEXACTINELLIDA

Subclass AMPHIDISCOPHORA

Order Amphidiscosida
- Family Hyalonematidae
  - *Hyalonema* (*Cyliconema*) *apertum apertum* Schulze, 1886; (western Aleutian Islands)
  - *Hyalonema* (*Cyliconema*) *apertum simplex* Koltun, 1967; (Bering Sea)
  - *Hyalonema* (*Cyliconema*) *hozawai vicarium* Koltun, 1967; (Bering Sea)*
  - *Hyalonema* (*Leptonema*) *ovuliferum* Schulze, 1899; (southern Gulf of Alaska)
  - *Hyalonema* (*Cyliconema*) *tenerum vitiazi* Koltun, 1967; (Bering Sea)*

Subclass HEXASTEROPHORA

Order Hexactinosida
- Family Farreidae
  - *Farrea kurilensis* ssp. nov. Reiswig and Stone, in preparation . . . . . Page 16
  - *Farrea occa occa* Bowerbank, 1862. . . . . Page 17
  - *Farrea watasei* Okada, 1932; (Bering Sea)*
  - *Farrea* sp. Okada, 1932; (Bering Sea)
  - *Farrea* sp. nov. Reiswig and Stone, in preparation . . . . . Page 18

Appendix II. Priorities for bycatch monitoring

This list includes the deep-water (>80 m) sponges presented in this guide. Each species is ranked from low (1) to high (3) for its importance as fish habitat and its vulnerability to disturbance from fishing activities. Ranks for these two measures are averaged to provide a score. Species with scores greater than 2.0 should rank as a high priority for monitoring as bycatch in commercial fisheries and stock assessment surveys. The scores for high priority species are presented in **bold** lettering.

Species	Importance as fish habitat	Vulnerability to disturbance	Score
CLASS CALCAREA			
Clathrina sp.	1	2	1.5
Leucandra poculiformis	1	1	1.0
Leucandra tuba	2	2	**2.0**
CLASS HEXACTINELLIDA			
Farrea kurilensis ssp. nov.	3	2	**2.5**
Farrea occa occa	3	3	**3.0**
Farrea sp. nov.	1	1	1.0
Genus nov., sp. nov.	2	1	1.5
Tretodictyum sp. nov.	1	2	**1.5**
Aphrocallistes vastus	3	3	**3.0**
Heterochone calyx calyx	3	3	**3.0**
Regadrella okinoseana	1	1	1.0
Acanthascus (Acanthascus) profundum ssp. nov.	1	1	1.0
Acanthascus (Rhabdocalyptus) dawsoni dawsoni	3	2	**2.5**
Acanthascus (Rhabdocalyptus) mirabilis	1	1	**1.0**
Acanthascus (Staurocalyptus) solidus	2	2	**2.0**
Acanthascus (Staurocalyptus) sp. nov. 1	2	3	**2.0**
Acanthascus (Staurocalyptus) sp. nov. 2	2	2	**2.0**
Aulosaccus pinularis	1	1	1.0
Aulosaccus schulzei	1	2	1.5
Bathydorus sp.	1	1	1.0
Caulophacus (Caulophacus) sp. nov.	2	1	1.5
CLASS DEMOSPONGIAE			
Plakina atka	1	1	1.0
Plakina tanaga	1	1	1.0
Craniella arb	1	2	1.5
Craniella sigmoancoratum	1	1	1.0
Craniella spinosa	1	1	1.0
Craniella sputnika	1	1	1.0
Erylus aleuticus	1	1	1.0
Geodia lendenfeldi	1	1	1.0
Poecillastra tenuilaminaris	3	3	**3.0**
Polymastia fluegeli	1	1	1.0
Polymastia pacifica	1	1	1.0
Stylocordyla borealis eous	1	2	1.5
Aaptos kanuux	1	2	1.5
Rhizaxinella clavata	1	2	1.5
Suberites excellens	2	1	1.5
Suberites simplex	1	1	1.0

Species	Importance as fish habitat	Vulnerability to disturbance	Score
CLASS DEMOSPONGIAE (continued)			
Suberites sp.	1	1	1.0
Hemigellius porosus	1	2	1.5
Cornulum clathriata	1	1	1.0
Iophon piceum	1	2	1.5
Iophon piceum abipocillus	1	2	1.5
Megaciella anisochela	1	1	1.0
Megaciella spirinae	1	2	1.5
Clathria (*Clathria*) *barleei*	1	2	1.5
Clathria (*Clathria*) *laevigata*	1	2	1.5
Clathria (*Axosuberites*) *lambei*	1	2	1.5
Echinoclathria vasa	1	1	1.0
Artemisina amlia	1	2	1.5
Artemisina arcigera	1	2	1.5
Artemisina stipitata	2	3	**2.5**
Artemisina sp.	2	3	**2.5**
Coelosphaera oglalai	1	2	1.5
Inflatella globosa	1	2	1.5
Lissodendoryx (*Lissodendoryx*) *behringi*	1	2	1.5
Lissodendoryx (*Ectyodoryx*) *olgae*	1	1	1.0
Lissodendoryx (*Lissodendoryx*) *oxeota*	1	1	1.0
Lissodendoryx (*Lissodendoryx*) *papillosa*	1	1	1.0
Monanchora alaskensis	2	2	**2.0**
Monanchora laminachela	1	2	1.5
Monanchora pulchra	3	2	**2.5**
Crella brunnea	1	1	1.0
Hymedesmia (*Stylopus*) *dermata*	1	1	1.0
Hymedesmia (*Hymedesmia*) *irregularis*	1	1	1.0
Kirkpatrickia borealis	1	2	1.5
Phorbas paucistylifer	1	2	1.5
Melonanchora globogilva	1	1	1.0
Myxilla (M*yxilla*) *behringensis*	1	1	1.0
Myxilla (*Ectyomyxilla*) *parasitica*	1	1	1.0
Myxilla (*Burtonanchora*) *pedunculata*	1	2	1.5
Stelodoryx oxeata	1	2	1.5
Stelodoryx toporoki	2	1	1.5
Stelodoryx vitiazi	1	1	1.0
Echinostylinos hirsutus	1	1	1.0
Tedania (*Tedania*) *dirhaphis*	1	2	1.5
Tedania kagalaskai	2	2	**2.0**
Asbestopluma ramosa	2	2	**2.0**
Cladorhiza bathycrinoides	1	1	1.0
Cladorhiza corona	1	2	1.5
Chondrocladia (*Chondrocladia*) *concrescens*	1	2	1.5
Biemna variantia	1	2	1.5
Eucheliplumа elongata	1	1	1.0
Guitarra abbotti	2	1	1.5
Guitarra fimbriata	2	1	1.5
Amphilectus digitatus	2	2	**2.0**
Esperiopsis flagrum	2	1	1.5
Semisuberites cribrosa	2	2	**2.0**

Species	Importance as fish habitat	Vulnerability to disturbance	Score
CLASS DEMOSPONGIAE (continued)			
Mycale (*Aegogropila*) *adhaerens*	2	3	**2.5**
Mycale (*Carmia*) *carlilei*	2	2	**2.0**
Mycale (*Mycale*) *jasoniae*	2	2	**2.0**
Mycale (*Mycale*) *loveni*	3	3	**3.0**
Mycale (*Mycale*) *tylota*	1	2	1.5
Latrunculia (Biannulata) oparinae	2	2	**2.0**
Latrunculia velera	2	1	1.5
Latrunculia sp. (undescribed)	1	1	1.0
Axinella blanca	3	3	**3.0**
Axinella rugosa	2	2	**2.0**
Bubaris vermiculata	1	1	1.0
Halichondria (*Halichondria*) *colossea*	2	1	1.5
Halichondria (*Halichondria*) *oblonga*	1	2	1.5
Halichondria (*Eumastia*) *sitiens*	2	2	**2.0**
Halichondria sp.	2	3	**2.5**
Hymeniacidon assimilis	2	2	**2.0**
Topsentia disparilis	1	1	1.0
Cladocroce ventilabrum	1	2	1.5
Haliclona bucina	1	1	1.0
Haliclona (*Gellius*) *digitata*	1	2	1.5
Haliclona (*Gellius*) *primitiva*	1	2	1.5
Haliclona tenuiderma	1	1	1.0
Haliclona (*Haliclona*) *urceolus*	1	2	1.5
Haliclona sp. 1	1	2	1.5
Haliclona sp. 2	2	1	1.5

Appendix III. Glossary of terms

Acanthose: spined

Anchorate: anchored or anchor-like

Apical: located at the apex; distal

Arborescent: highly branched

Areolate: surface covered with numerous circular areas

Choanosome: interior tissue

Clavate: club-shaped

Conspecificity: belonging to the same species

Conules: cone-shaped projections

Conulose: surface with numerous conules raised by the underlying skeleton

Crenulate: surface with minutely notched or scalloped projections

Dactylate: finger-like projections

Digitate: deeply divided finger-like projections

Ecomorph: growth form adapted for different ecological regime

Ectosome: exterior surface

Emergent epifauna: fauna having most of its parts elevated above the level of the surrounding seafloor

Endopsammic: main part of the body buried in sand

Epizoic: living attached to the body of an animal; a non-parasitic animal that lives attached to the outer surface of another animal

Eurybathic: broadly distributed with depth

Filiform: shaped like a thread

Fistules: cone-shaped elevations or tube-like protuberances

Flabellate: fan-shaped

Flagelliform: shaped as a single, very long, erect branch

Foliate: shaped like a leaf

Globular: ball-shaped or spherical

Gonochoristic: having male and female individuals in the same population

Hispid: covered with bristly hairs

Holotype: the single specimen used as the basis for the first published description of a species and designated as the type specimen

Labyrinthic: an intricate structure of interconnecting passages

Lobate: having lobes or rounded projections

Mammillate: shaped like a nipple

Massive: large and compact but amorphous or without a definable shape (note that the term "lumpy" is used in some of the sponge literature)

Megascleres: large structural spicules

Microscleres: small to minute reinforcing or packing spicules

Osculum (a): the opening through which water is expelled from the sponge

Ostium (a): the opening through which water enters the sponge

Oviparous: producing eggs that are laid and hatch externally

Papillae: Nipple-like protuberances projecting from the sponge surface that bear either ostia, oscula, or both

Pellicular: covered with a liquid film or organic membrane

Polymorphic: occurring in different shapes

Polyspicular: composed of multiple spicule types

Saccate: shaped like a sac or pouch

Sibling species: a species that closely resembles another in appearance and other characteristics but cannot interbreed with it

Spicules: small needle-like structures made of silica or calcium carbonate that support the soft tissues of sponges

Spongin: the fibrous framework of collagen that forms the sponge's organic skeleton

Spongocoel (= atrium): the central exhalant cavity of the sponge

Stolon: a creeping or prostrate rope-like structure

Subglobular: deviating slightly from globular

Subspecies: a morphologically and genetically distinct population within a species that inhabits a separate geographic area or depth range

Tabular: having a plane surface or flat

Tuberculate: warty or verrucose

Uncinate: large straight diactin spicules covered with barbs and brackets all inclined at one end

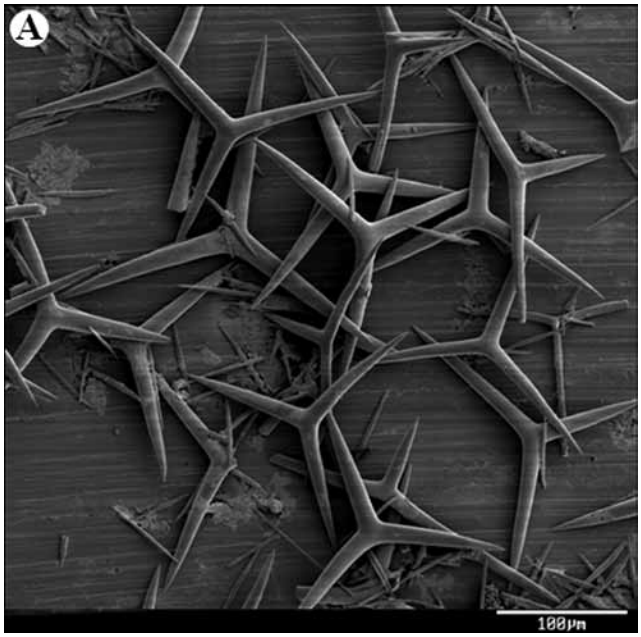
Viviparous: producing live offspring from within the body of the parent

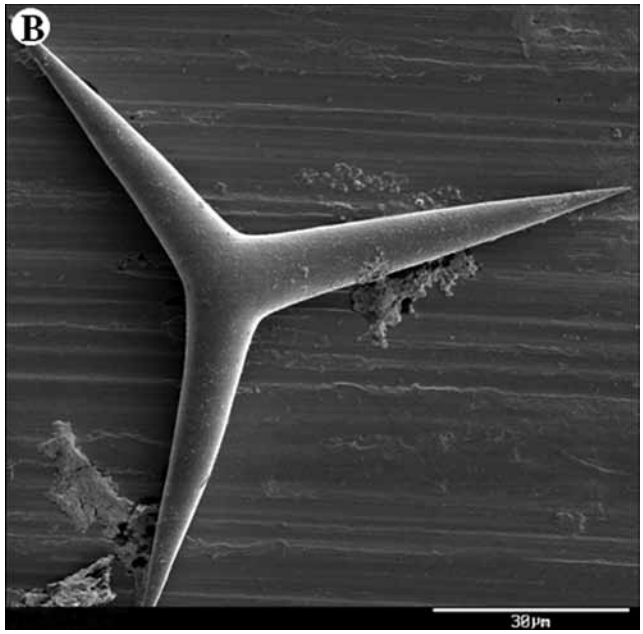
Appendix IV. Spicule types

This appendix includes scanning electron microscopy (SEM) images of spicules from select calcareous sponges and demosponges collected during the 2004 Aleutian Island expeditions. It also includes several SEM images of spicules from a few hexactinellid sponge species that are common in Alaskan waters. The purpose of the appendix is to provide the reader with a representative collection of spicule images so that they may gain an understanding of the terms used in the guide and an appreciation for the variation between species and among spicule types. This collection also serves as a source of reference material for those who wish to microscopically examine sponges. We refer the reader to the Thesaurus of Sponge Morphology (Boury-Esnault and Rützler, 1997) for a comprehensive glossary of terminology and a pictorial guide to spicule types and skeletal structures. The species in this appendix have been arranged systematically to family and alphabetically arranged within family.

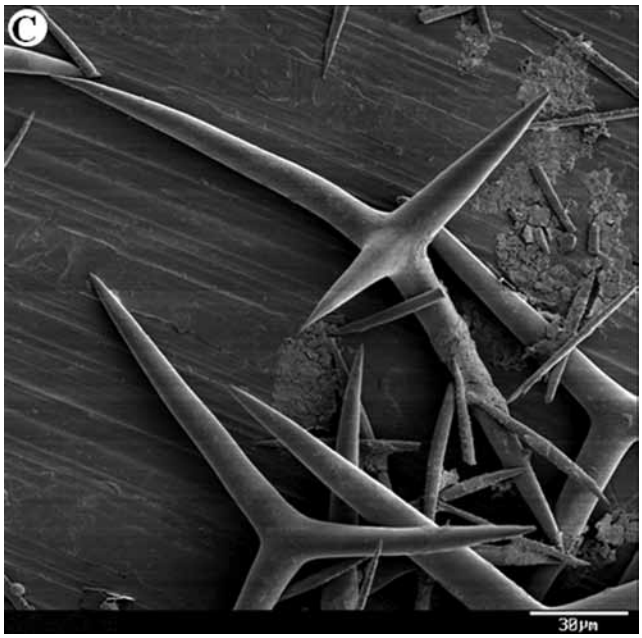
Class Calcarea, Family Grantiidae, *Leucandra poculiformis* Hozawa, 1918.

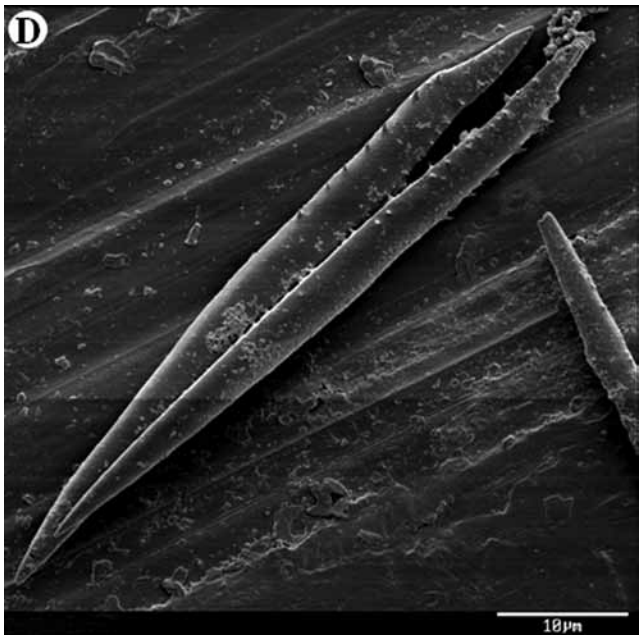
(A) Overview of occurring spicules: large tri- and tetractines and small oxeas; (B) large triactine; (C) a rare large tetractine; and (D) acanthose microxeas with characteristic bend called a "lance-head" by Hozawa.





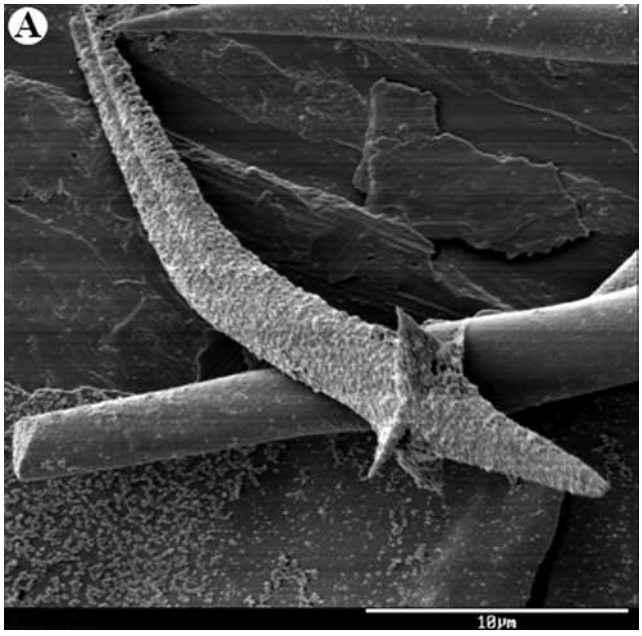
***Leucandra poculiformis* Hozawa, 1918 (continued)**

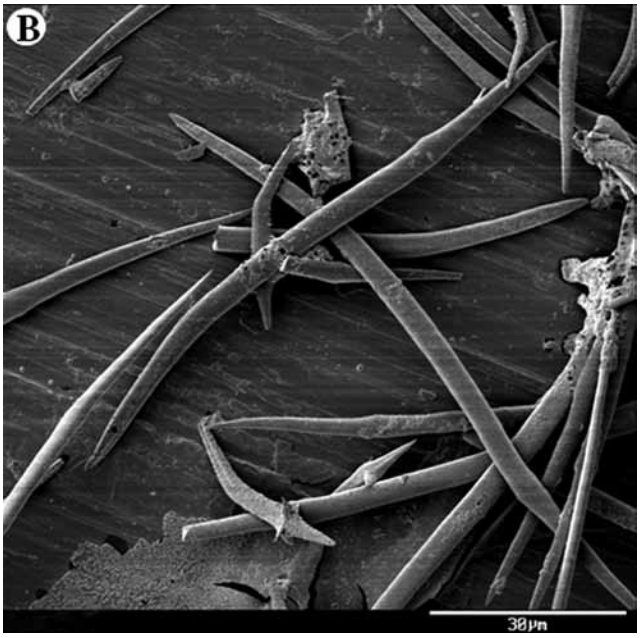




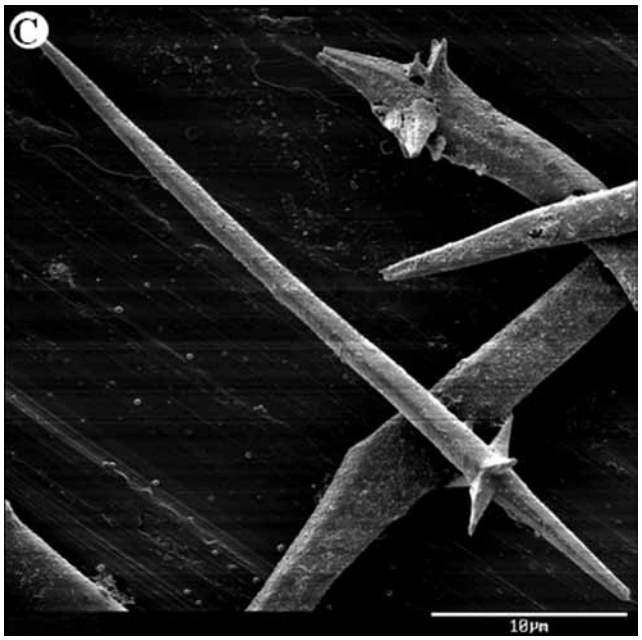
Class Calcarea, Family Grantiidae, *Leucandra tuba* Hozawa, 1918.

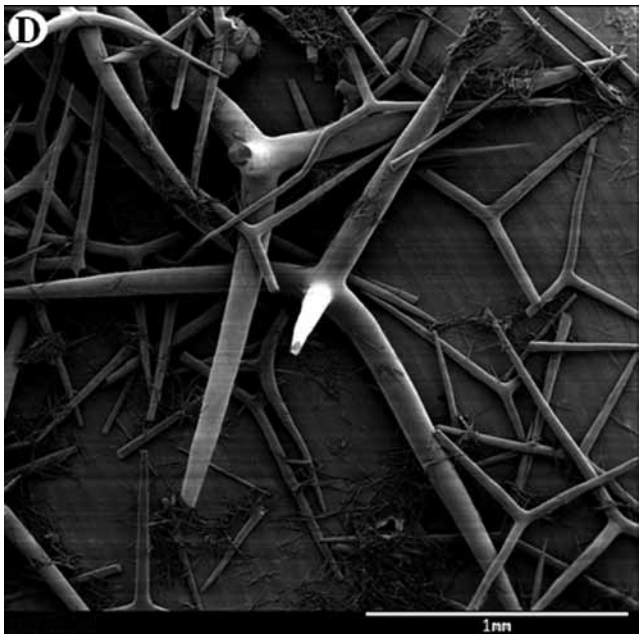
(A) Pugiole with unusual biforked end; (B) pugioles, small and large oxeas; (C) typical pugiole with normal points; (D) giant tetractines among small category of triactines; and (E) triactines among minute oxeote spicule types.

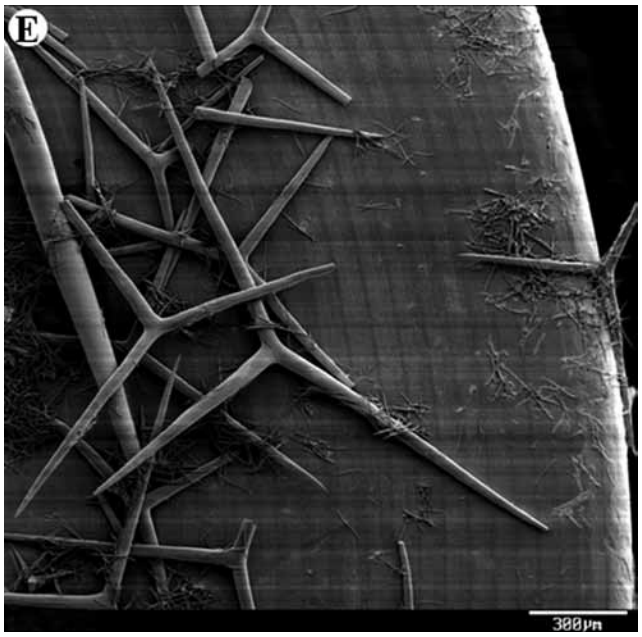




***Leucandra poculiformis* Hozawa, 1918 (continued)**

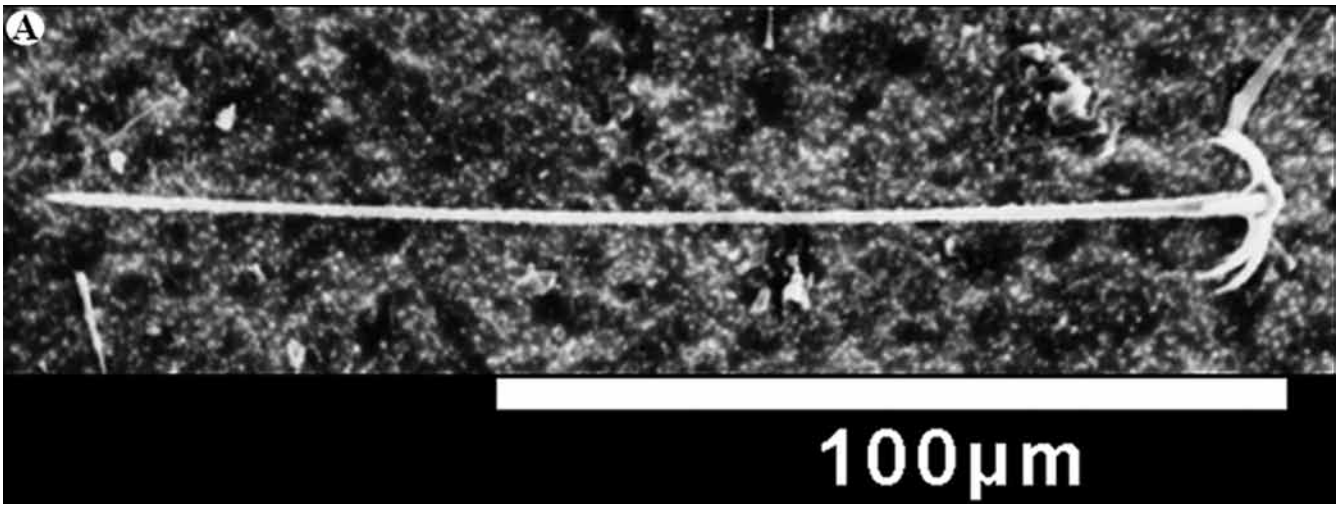


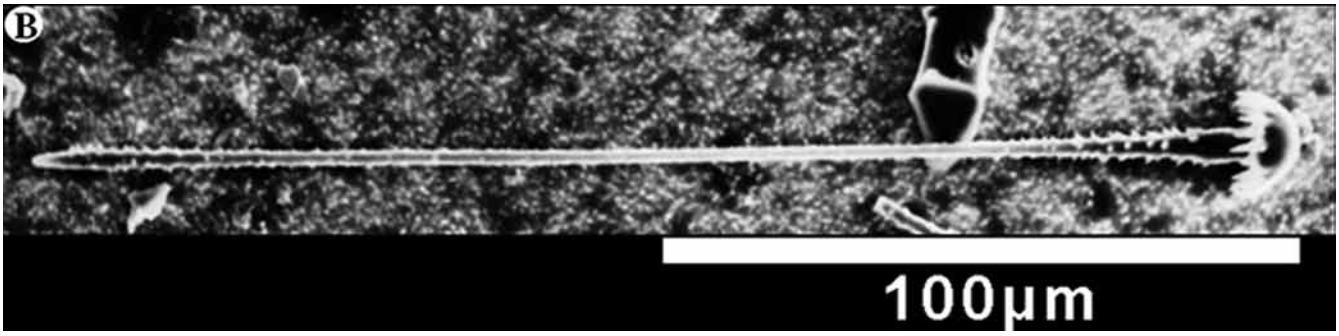


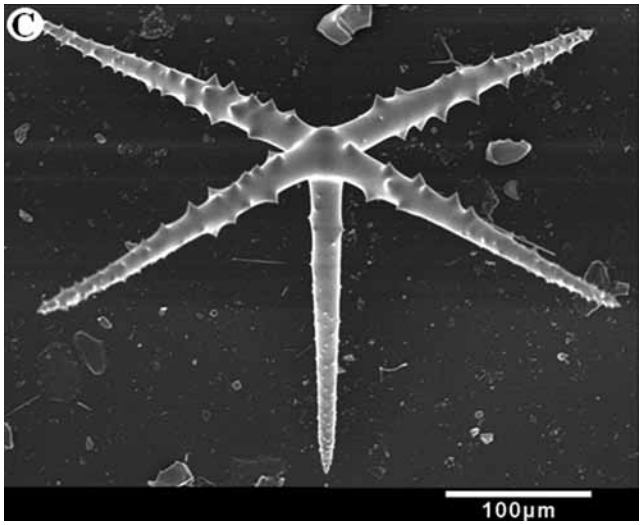


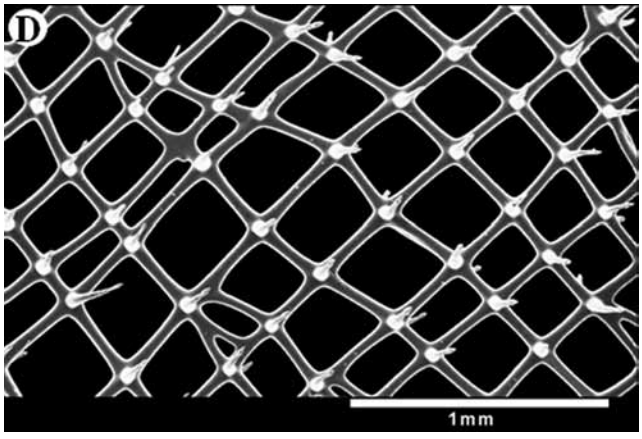
Class Hexactinellida, Family Farreidae, *Farrea occa occa* Bowerbank, 1862.

(A) An anchorate clavule; (B) a pileate clavule; (C) a dermal pentactin; (D) dictyonal framework; and (E) an oxyhexaster.

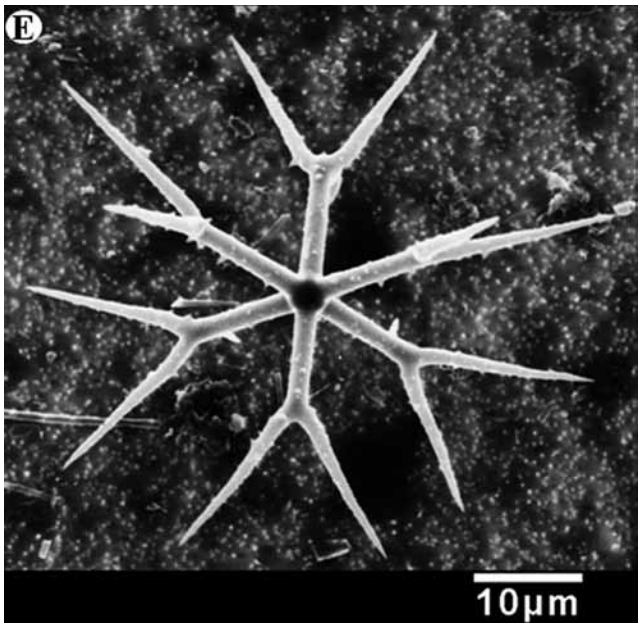






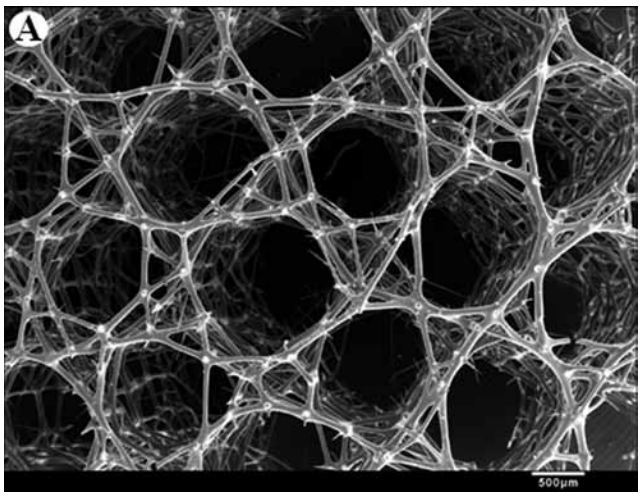


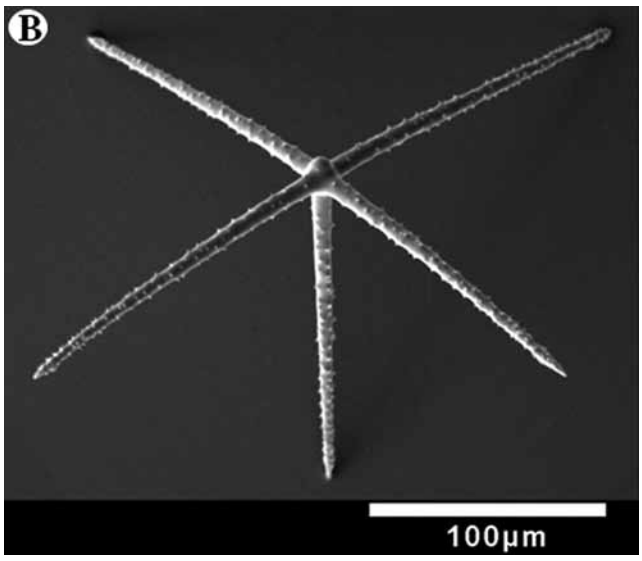
***Farrea occa occa* Bowerbank, 1862 (continued)**



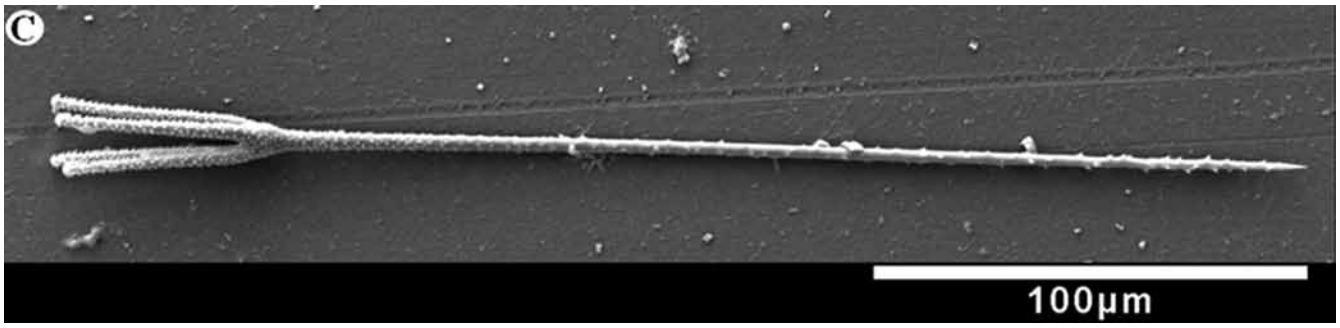
Class Hexactinellida, Family Aphrocallistidae, *Aphrocallistes vastus* Schulze, 1886.

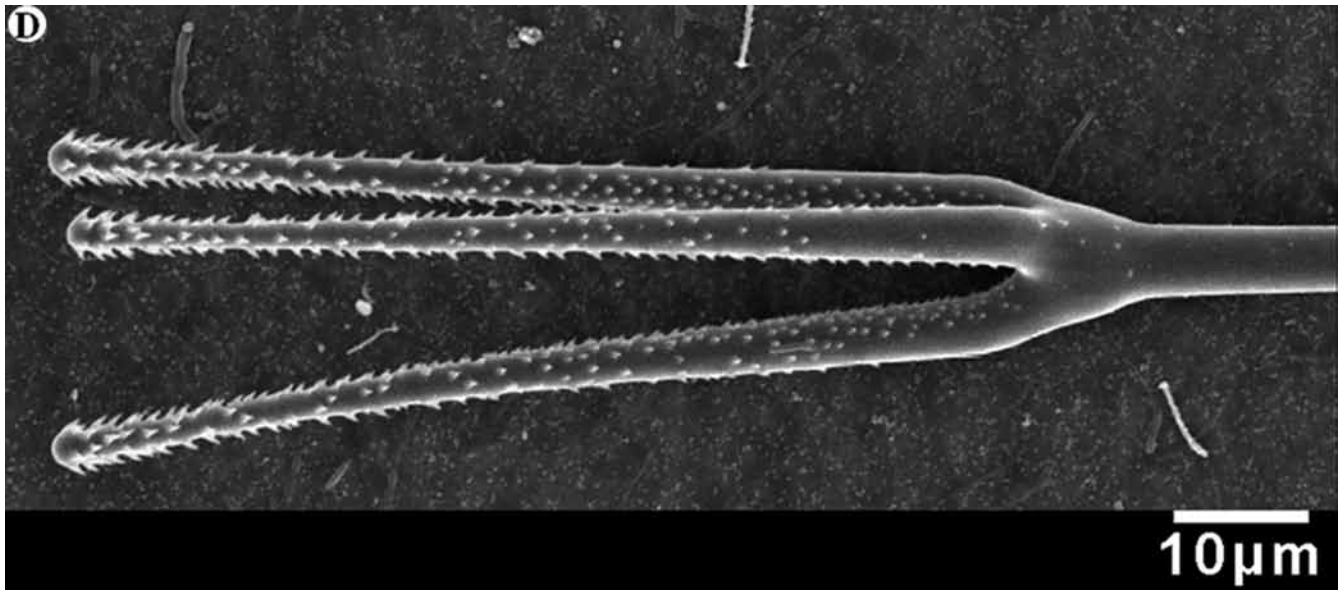
(A) Dictyonal framework (scale bar equals 500 µm); (B) a pentactin from a juvenile specimen; (C) a scopule from a juvenile specimen; (D) a scopule head; (E) a spiny oxyhexaster; and (F) a stout oxyhexaster.

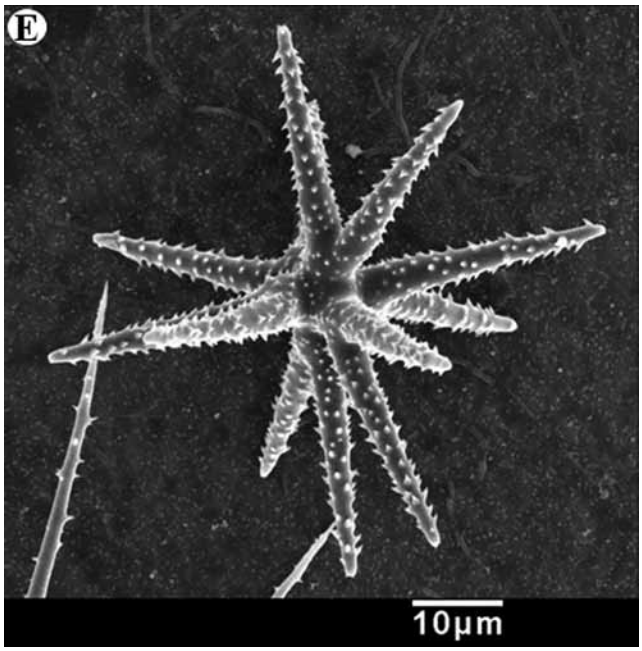


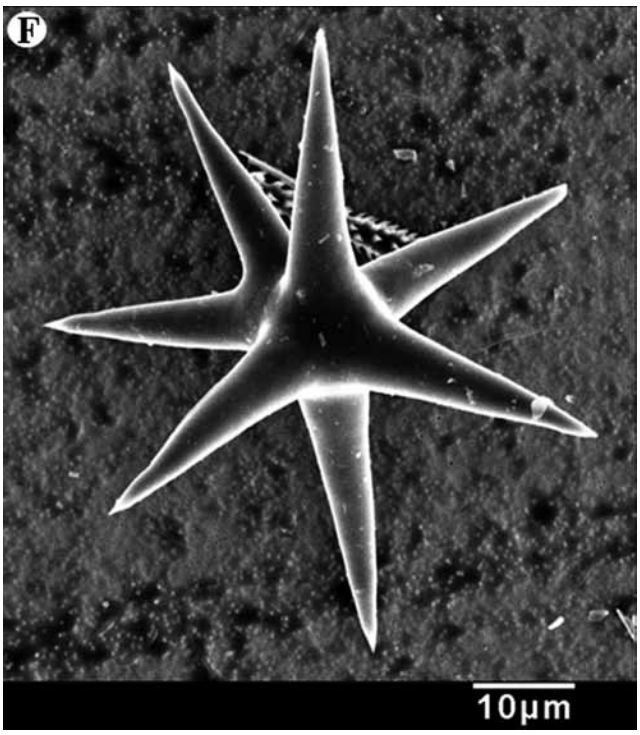


***Aphrocallistes vastus* Schulze, 1886 (continued)**



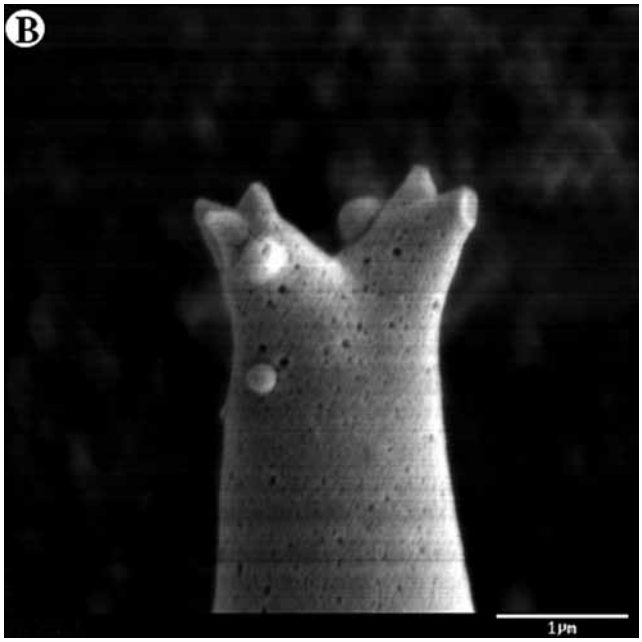


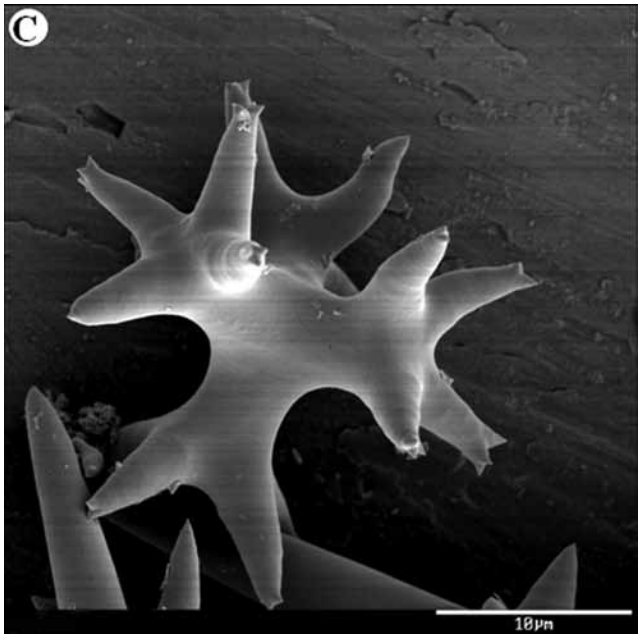


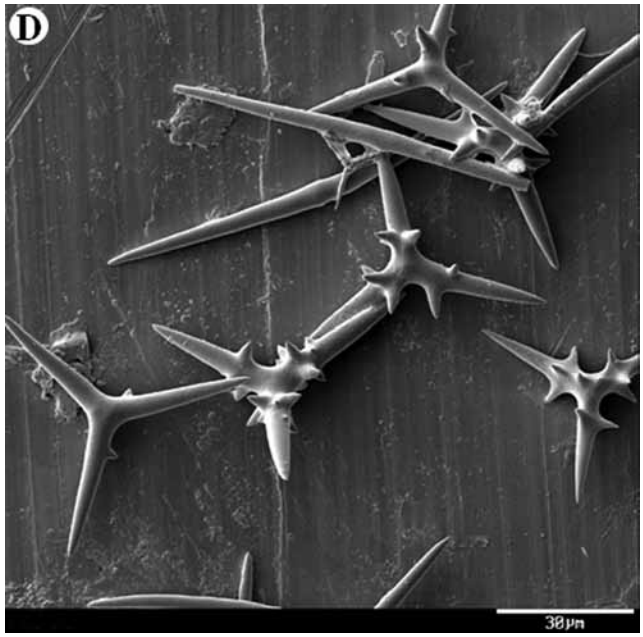


Class Demospongiae, Family Plakinidae, *Plakina atka* Lehnert, Stone and Heimler, 2005.

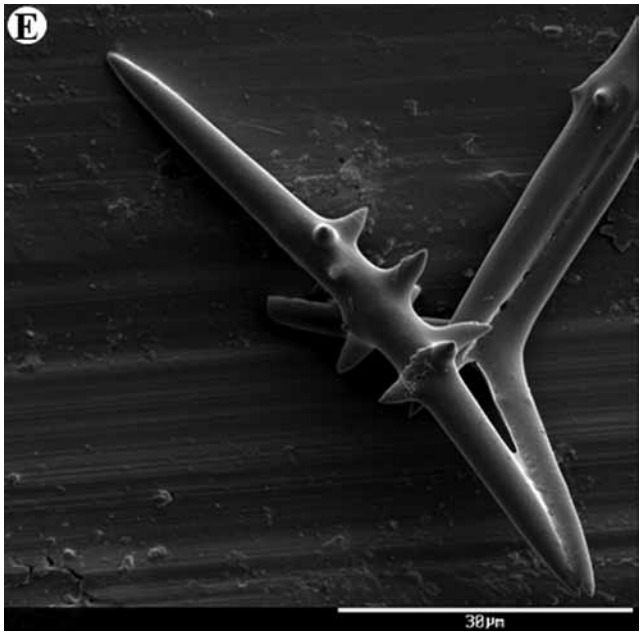
(A) Spined calthrops with reduced 4th ray, all rays with basal spines; (B) microfurcate end of ray from a tetraloph, tetrafurcate lophocalthrops; (C) tetralophose calthrops, all rays tetrafurcate, points of rays microfurcate; (D) smooth diods, smooth triods, and thicker triods with strongly spined bases of rays; and (E) thick category of diods with central spines. Probably derived from spined triods through reduction of one ray. (Figures A–E reproduced with permission from Zootaxa, Magnolia Press.)





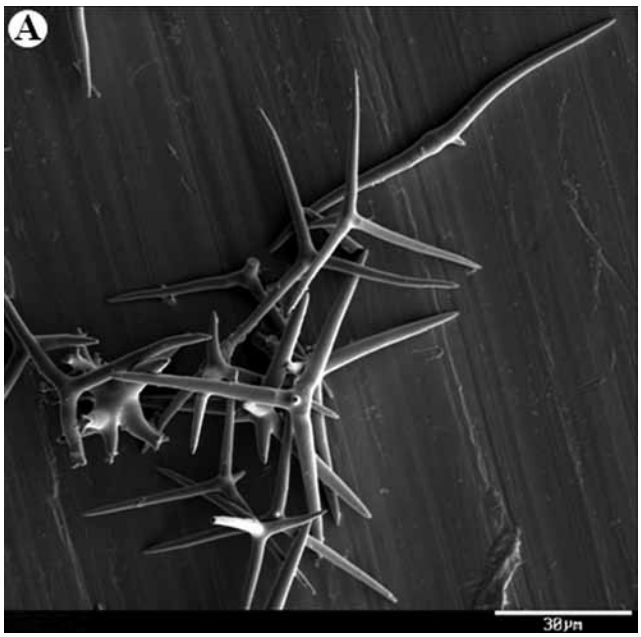


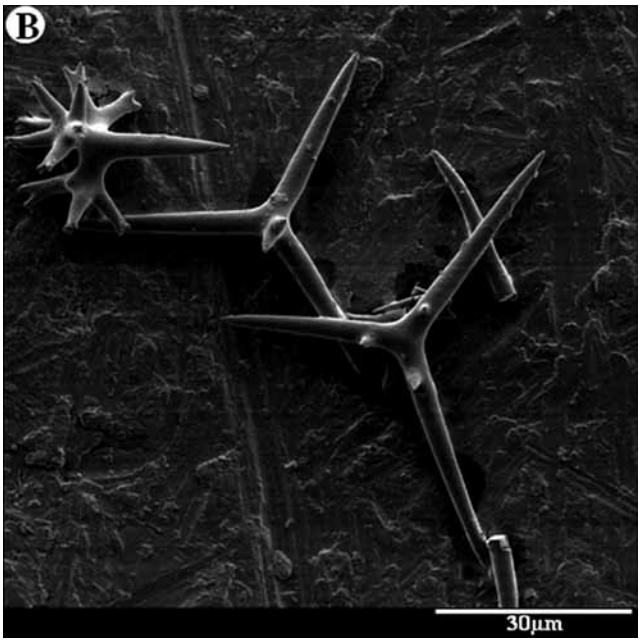
***Plakina atka* Lehnert, Stone and Heimler, 2005 (continued)**

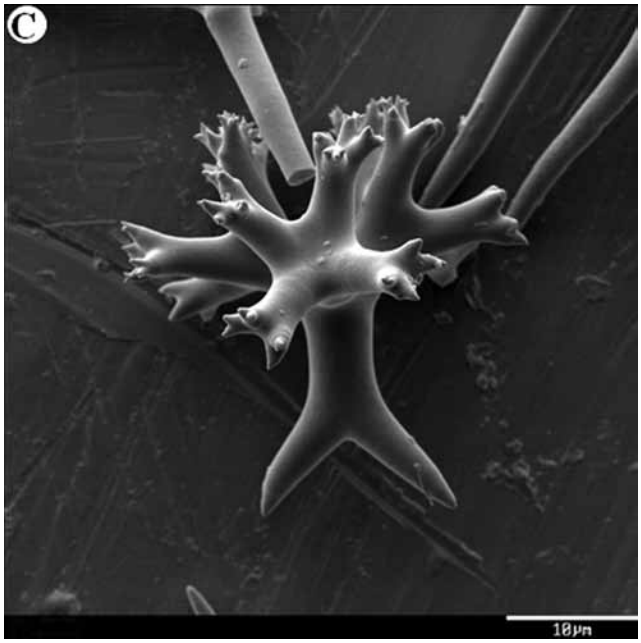


Class Demospongiae, Family Plakinidae, *Plakina tanaga* Lehnert, Stone and Heimler, 2005.

(A) Smooth oxeas, triods, and trilophose calthrops; (B) weakly spined triods and trilophose calthrops; and (C) trilophose calthrops with tetrafurcate lophose rays and biforked non-lophose ray. (Figures A–C reproduced with permission from Zootaxa, Magnolia Press.)

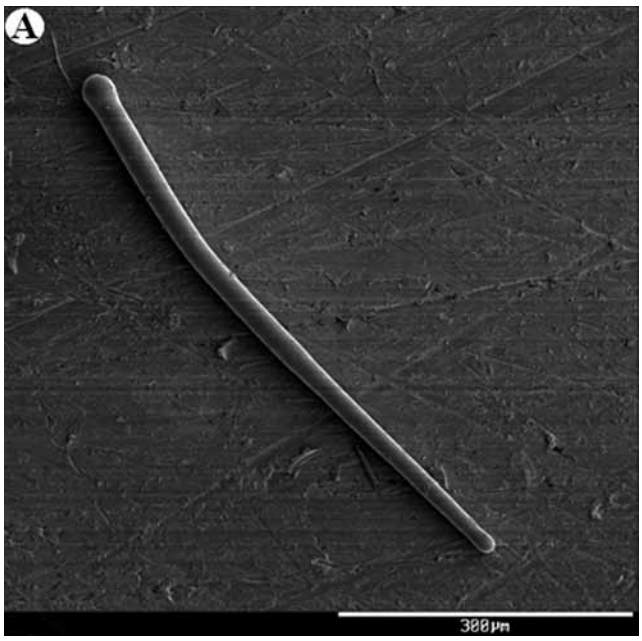


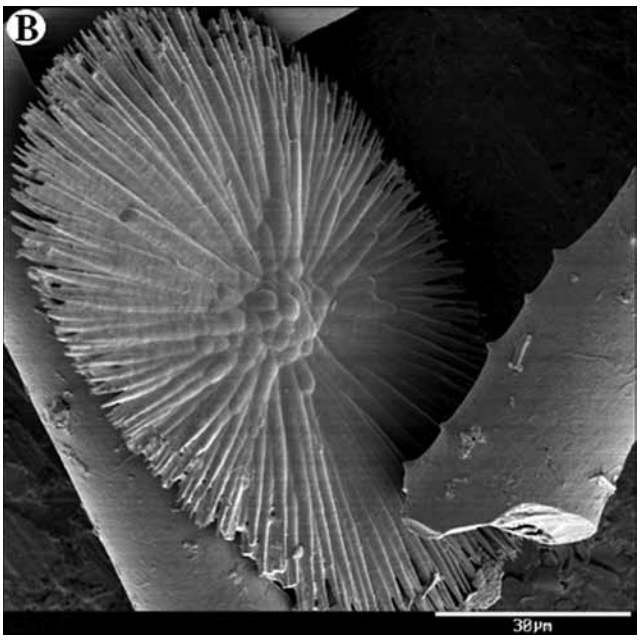


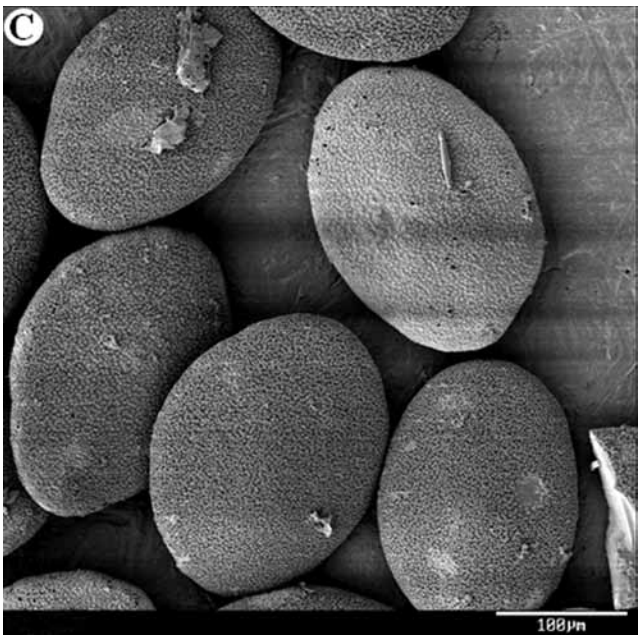


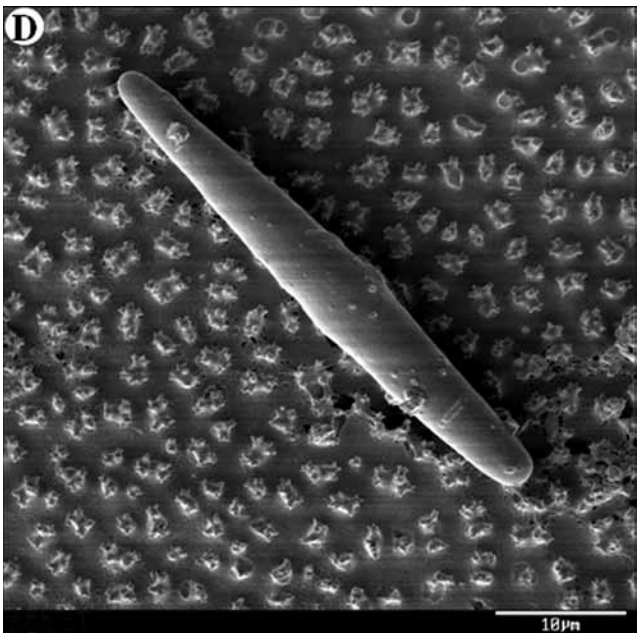
Class Demospongiae, Family Geodiidae, *Erylus aleuticus* Lehnert, Stone and Heimler, 2006.

(A) An anisotylote (one of several unusual spicule types occurring in this species); (B) a juvenile apidaster with different surface structure; (C) adult apidasters; (D) a centrolyte microstrongyle on the surface of an apidaster; (E) cladome of triaene with bent rays; (F) star-shaped surface structure on adult aspidaster; (G) oxyaster; and (H) surface structures on aspidasters may vary in geometry. (Figures B, C, D, E, and F reproduced with permission from the Journal of the Marine Biological Association of the United Kingdom.)

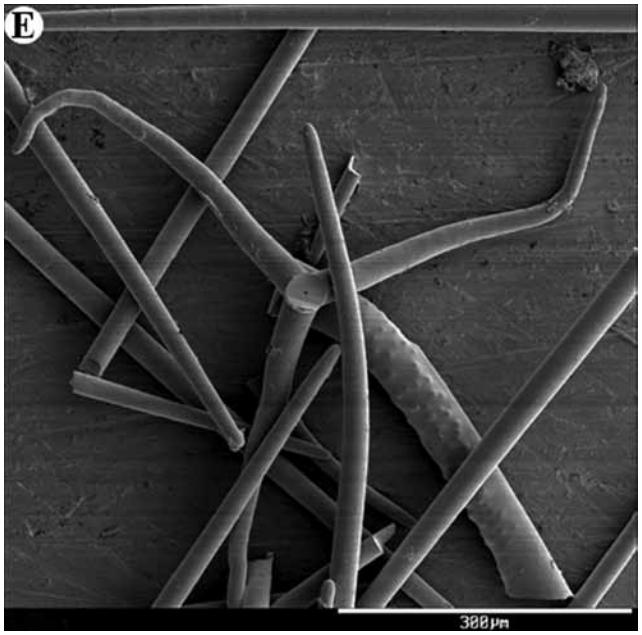


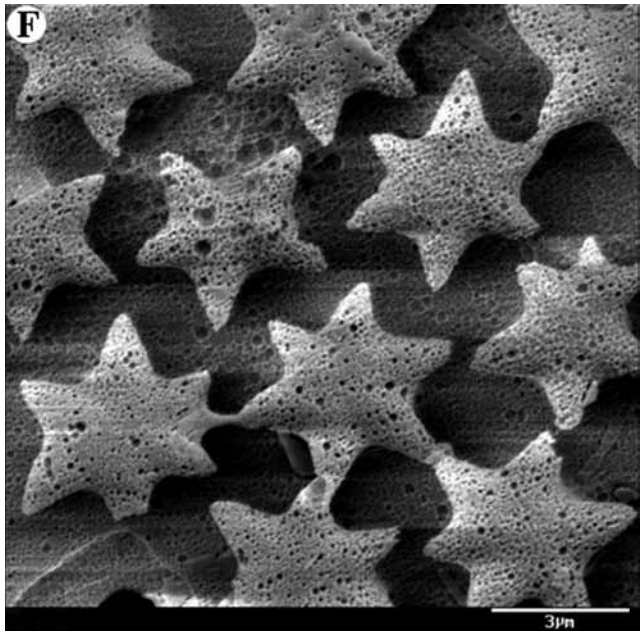


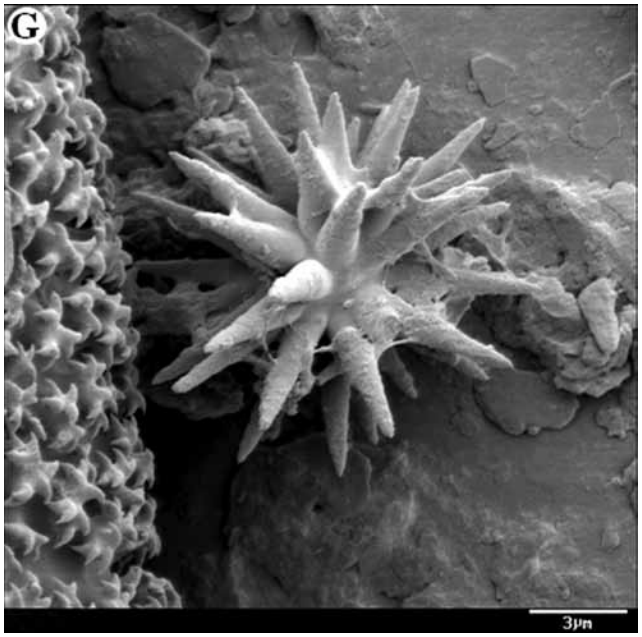


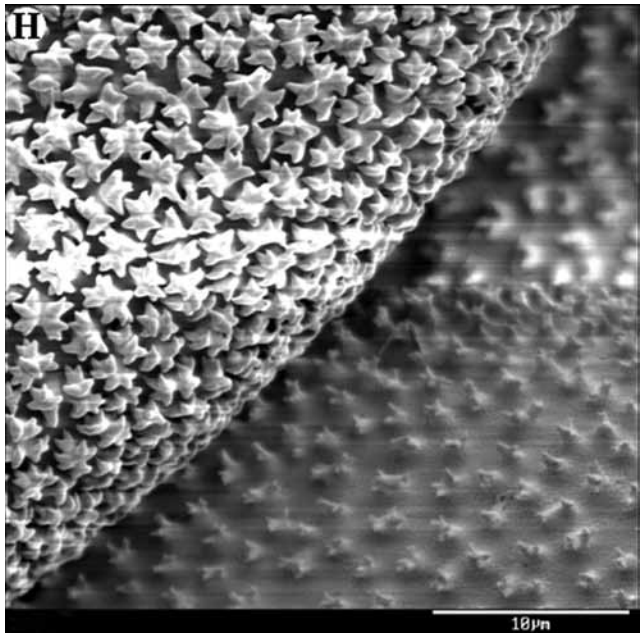


Erylus aleuticus **Lehnert, Stone and Heimler, 2006 (continued)**



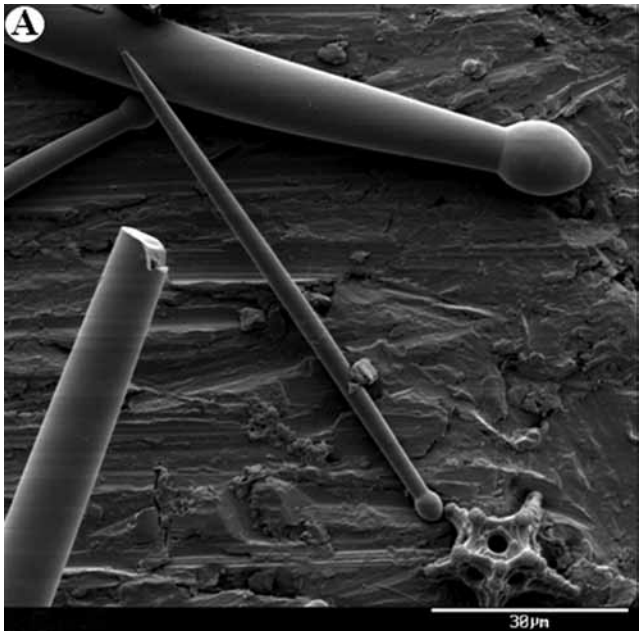


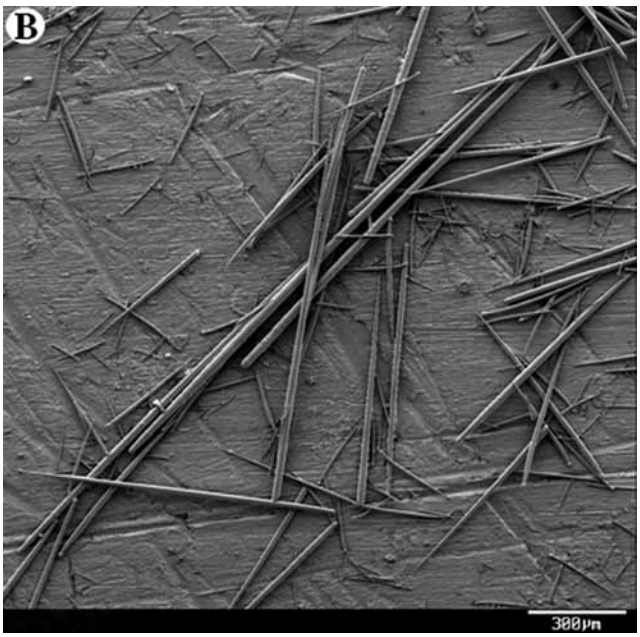


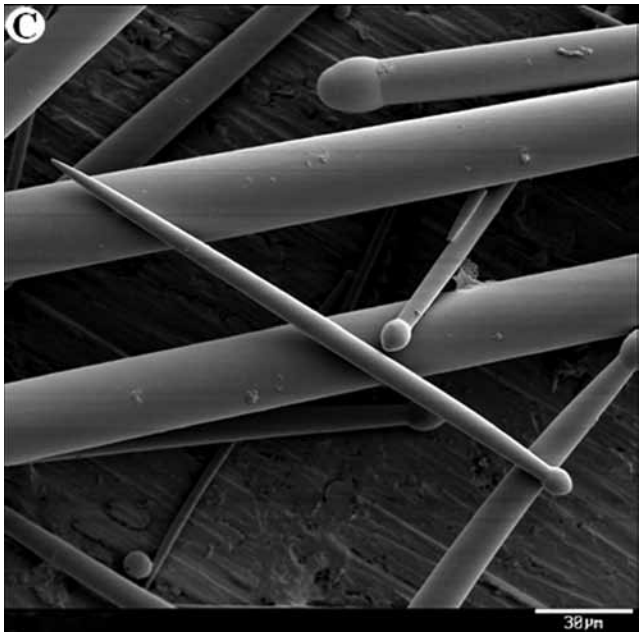


Class Demospongiae, Family Polymastiidae, *Polymastia fluegeli* Lehnert, Stone and Heimler, 2005.

(A) Small category of tylostyle and tyle of large tylostyle (note the radiolarian skeleton at lower right); (B) large and small tylostyles; and (C) small category of tylostyles on large tylostyles. (Figures A and B reproduced with permission from Facies, Springer Verlag.)

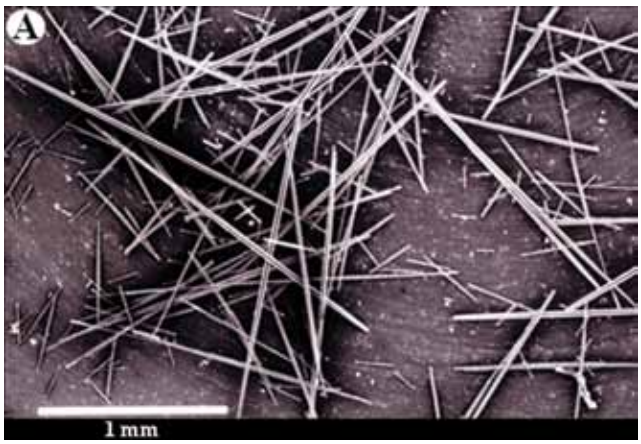


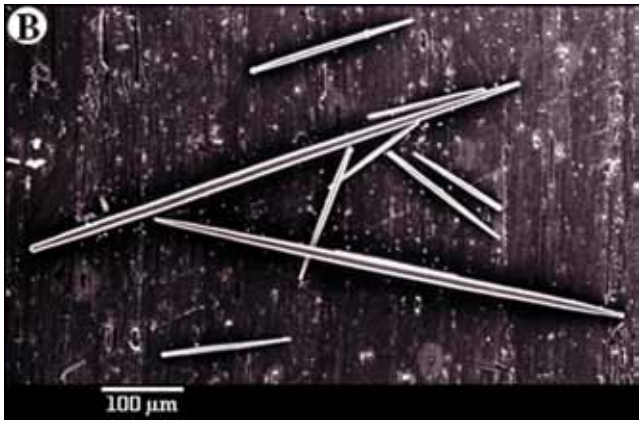


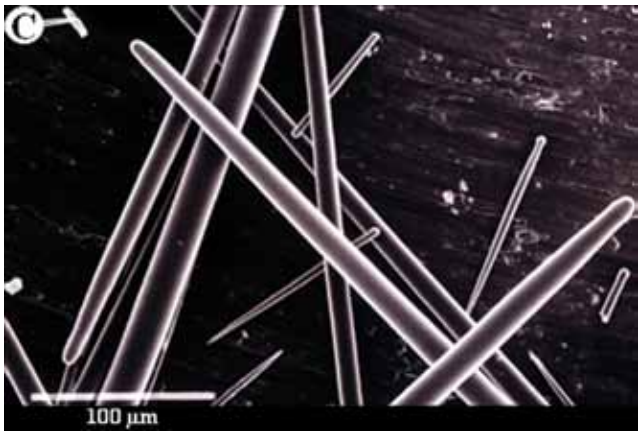


Class Demospongiae, Family Suberitidae, *Aaptos kanuux* Lehnert, Hocevar and Stone, 2008.

(A) Overview of spicules; large strongyloxeas, medium-size subtylostyles, and short ectosomal tylostyles; (B) medium-sized subtylostyles and ectosomal tylostyles; (C) ectosomal tylostyles and ends of medium-sized spicules. (Figures A–C reproduced with permission from Zootaxa, Magnolia Press.)

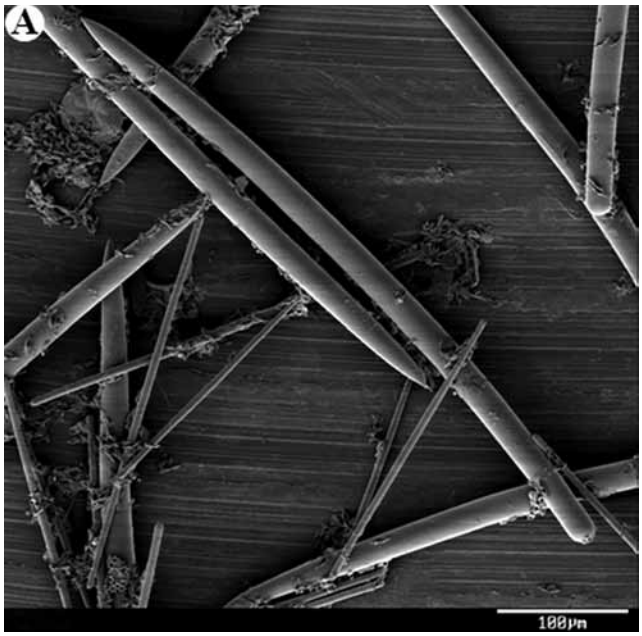


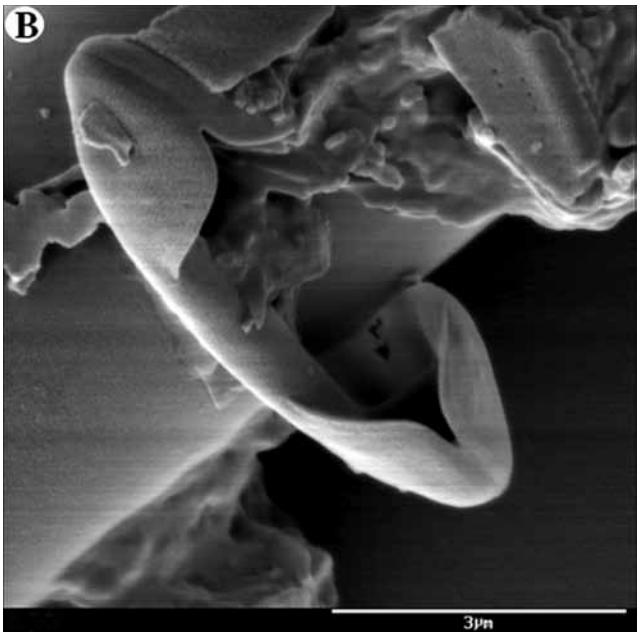


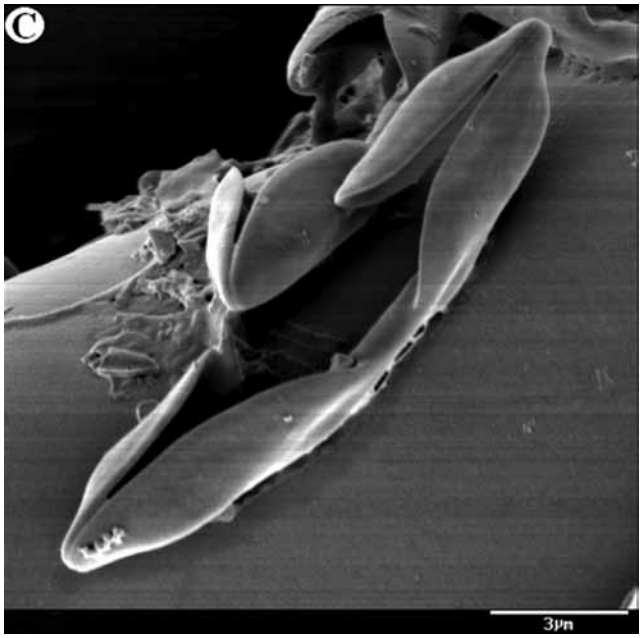


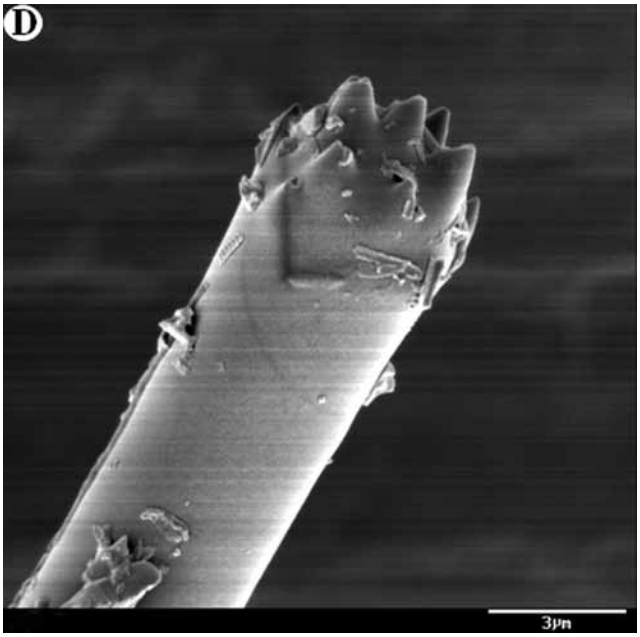
Class Demospongiae, Family Acarnidae, *Megaciella anisochela* Lehnert, Stone and Heimler, 2006.

(A) Category of thick styles among smaller tylotes and microscleres; (B) small category of palmate isochela; (C) large category of palmate isochela; (D) acanthose end of tylote (close-up view); (E) a distorted, tiny anisochela (this is the only species of *Megaciella* with anisochelae); and (F) an anisochela. (Figures A–D reproduced with permission from Zootaxa, Magnolia Press.)

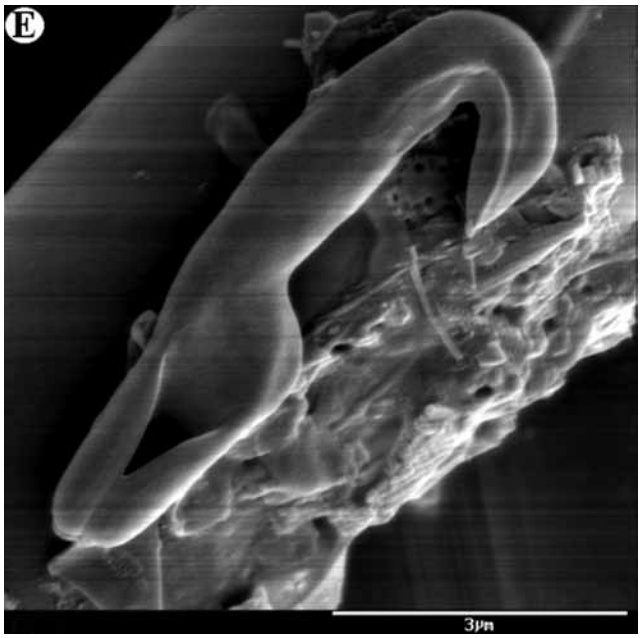


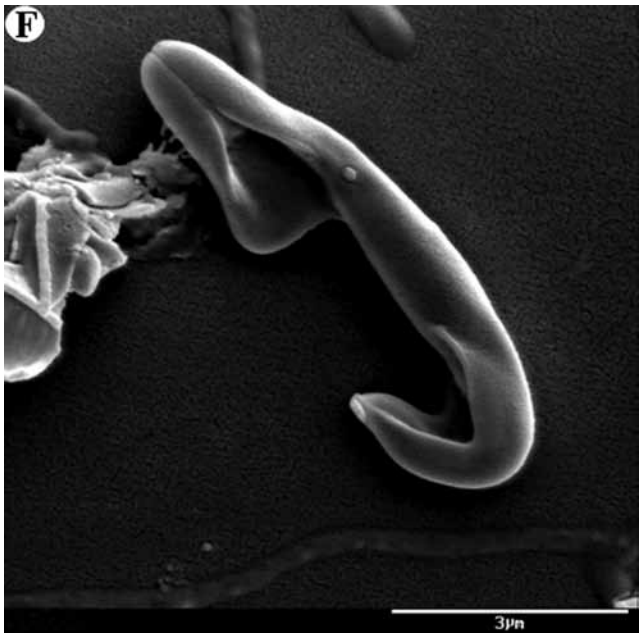






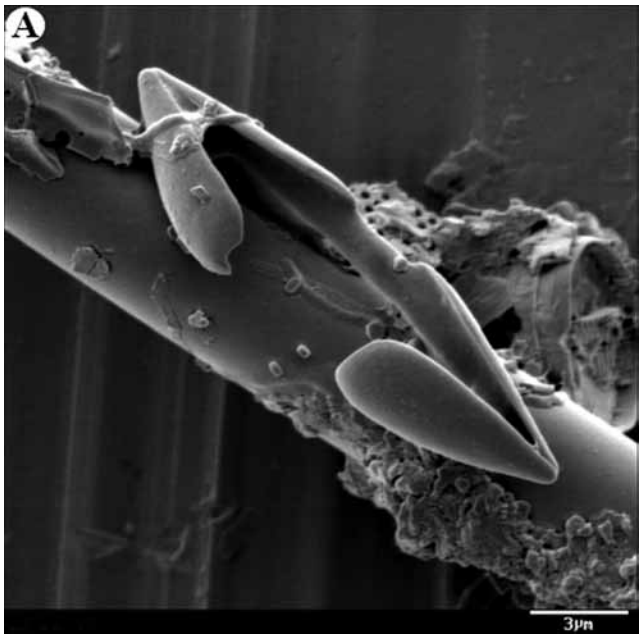
***Megaciella anisochela* Lehnert, Stone and Heimler, 2006 (continued)**

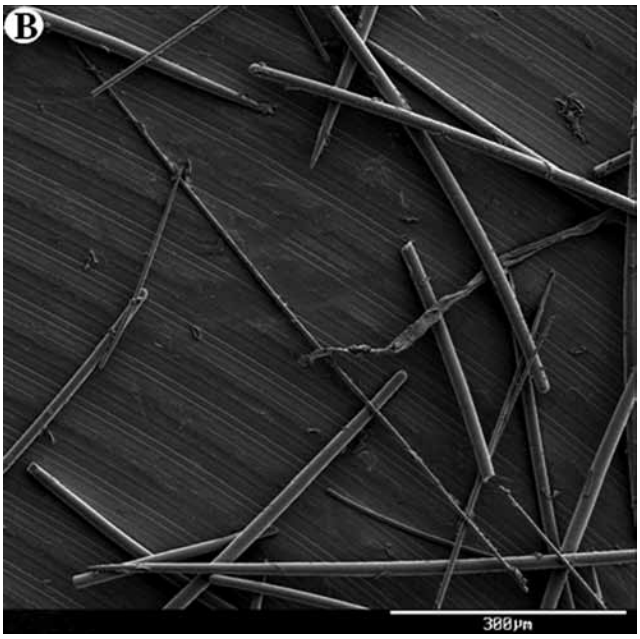


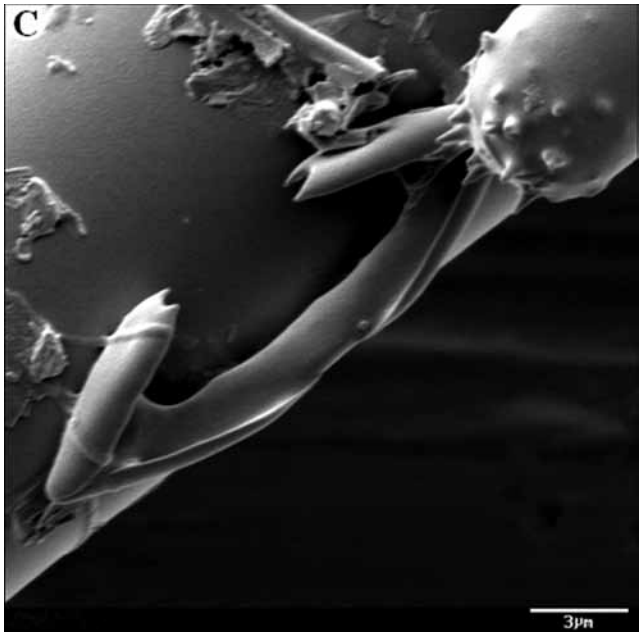


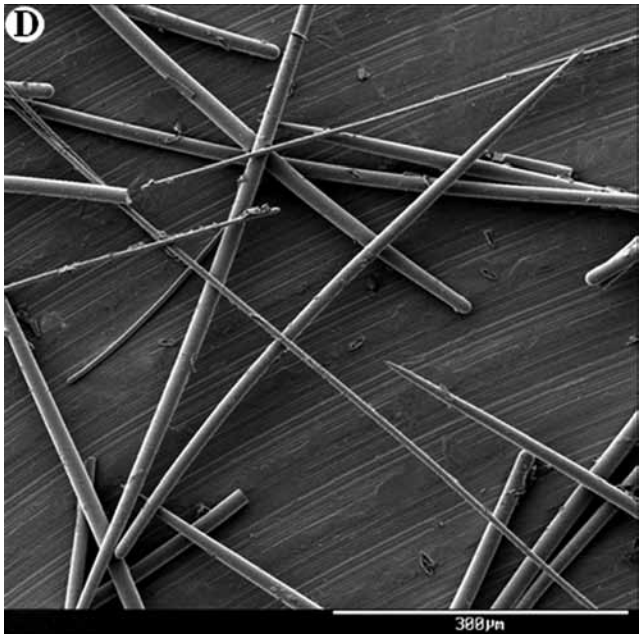
Class Demospongiae, Family Microcionidae, *Echinoclathria vasa* Lehnert, Stone and Heimler, 2006.

(A) A palmate isochela with narrow alae (note the rounded ends of alae); (B) long ectosomal thin styles among thick styles; (C) a palmate isochela, both alae with two points (acanthose end of thin style at upper right); (D) thick styles; (E) reduced palmate isochela (note different points on the alae); and (F) acanthose end of thin style. (Figures A–F reproduced with permission from Zootaxa, Magnolia Press.)

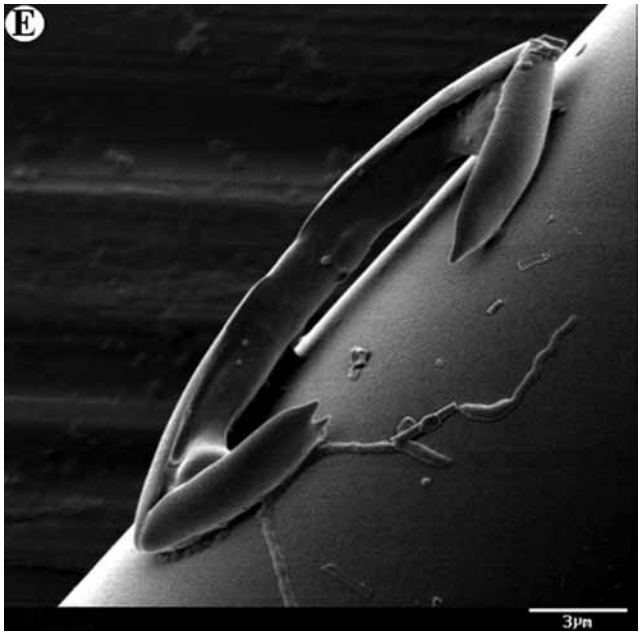


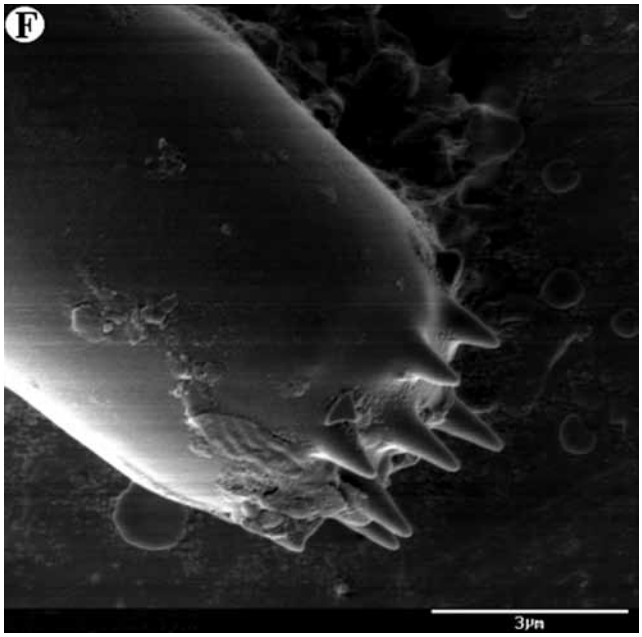






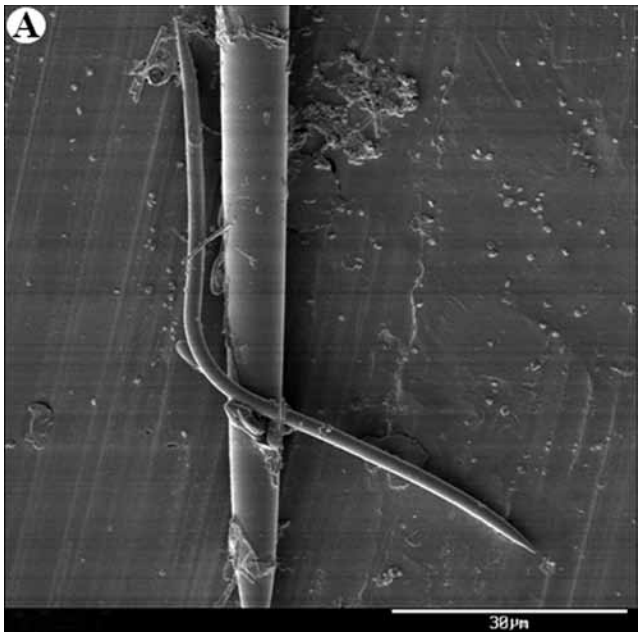
***Echinoclathria vasa* Lehnert, Stone and Heimler (continued)**

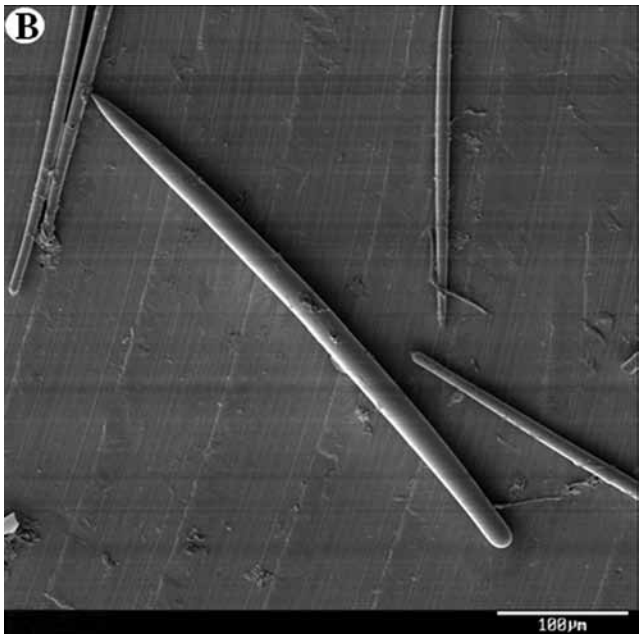




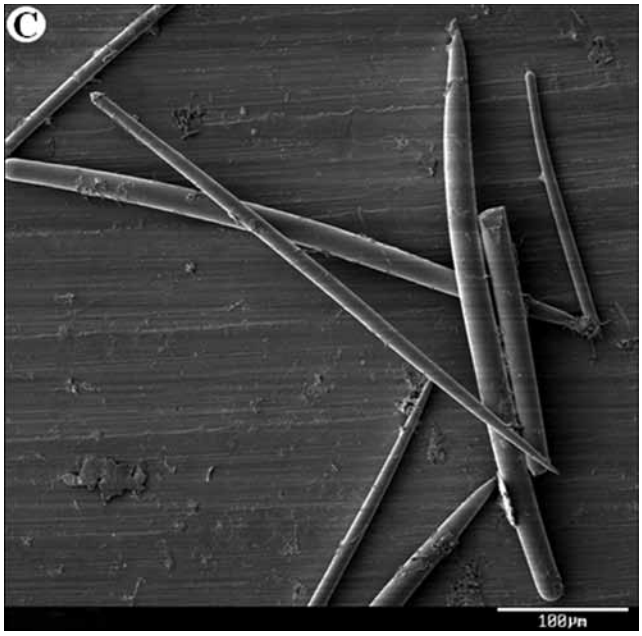
Class Demospongiae, Family Microcionidae, *Artemisina amlia* Lehnert, Stone and Heimler, 2006.

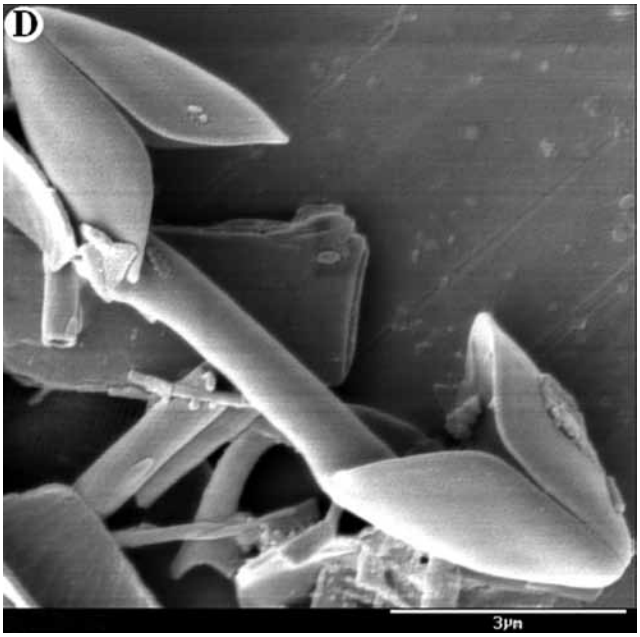
(A) A smooth toxon; (B) a large, smooth style; (C) a thin style with prominent tooth (upper left to lower right); (D) an isochela; and (E) a close-up view of prominent tooth on thin category of style. (Figures A–E reproduced with permission from Zootaxa, Magnolia Press.)

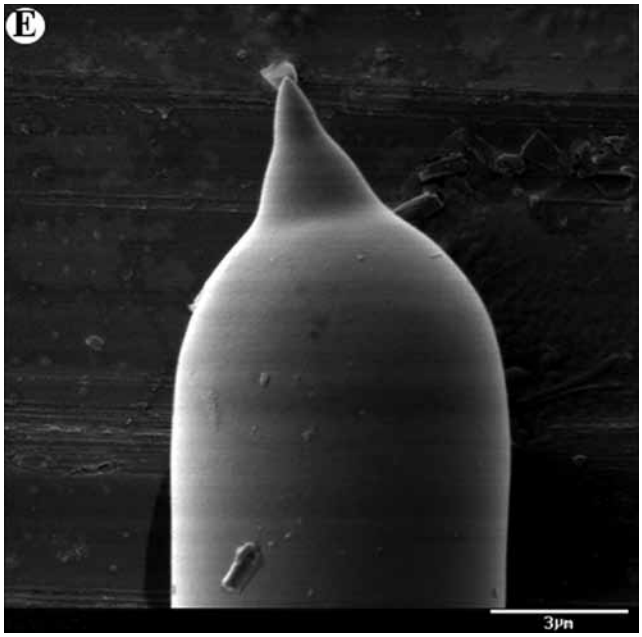




***Artemisina amlia* Lehnert, Stone and Heimler, 2006 (continued)**

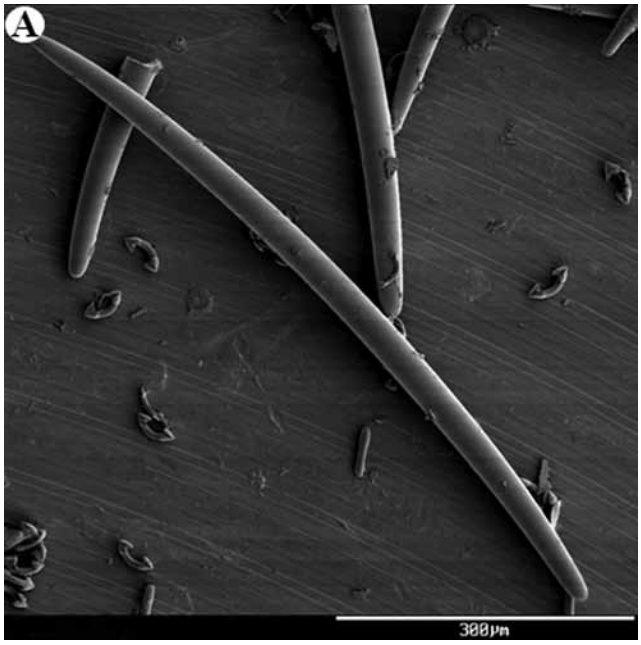


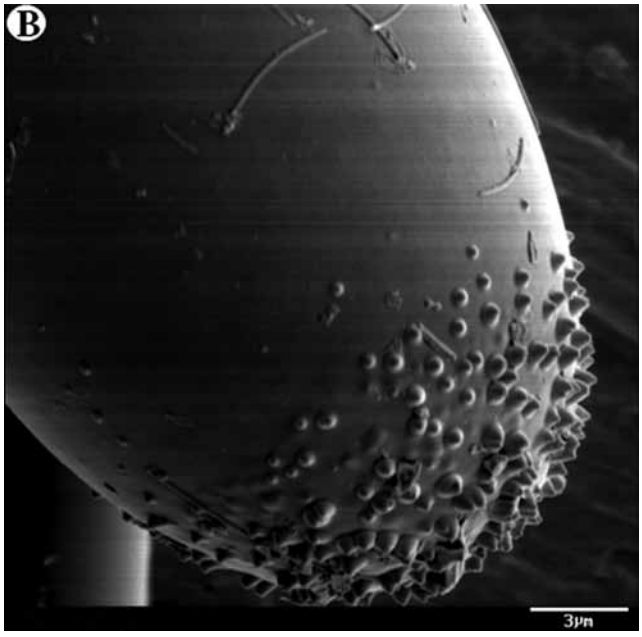


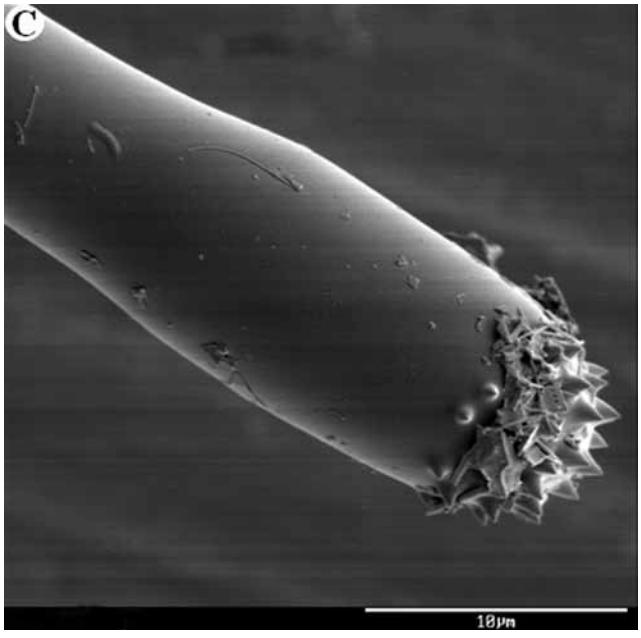


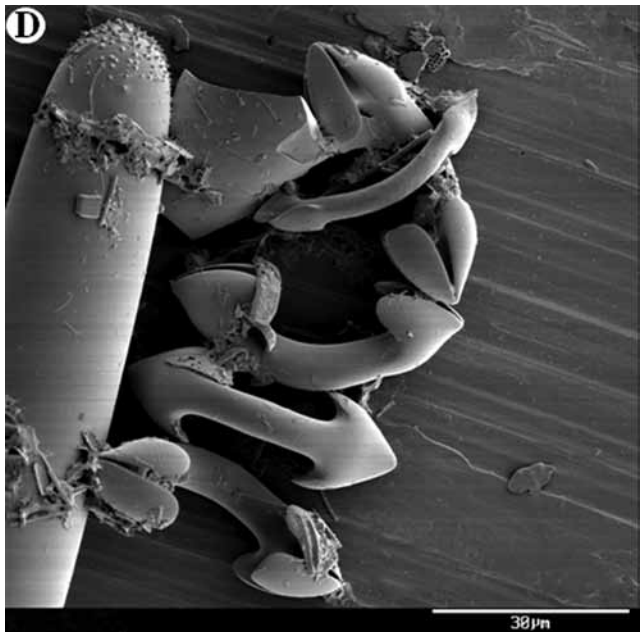
Class Demospongiae, Family Coelosphaeridae, *Coelosphaera oglalai* Lehnert, Stone and Heimler, 2006.

(A) A choanosomal strongyle among microscleres; (B) microacanthose end of a choanosomal strongyle (close-up view); (C) acanthose end of tylote (close-up view); (D) isochelae (right) and acanthose end of a strongyle (left); and (E) an ectosomal tylote (center). (Figures A–E reproduced with permission from Zootaxa, Magnolia Press.)

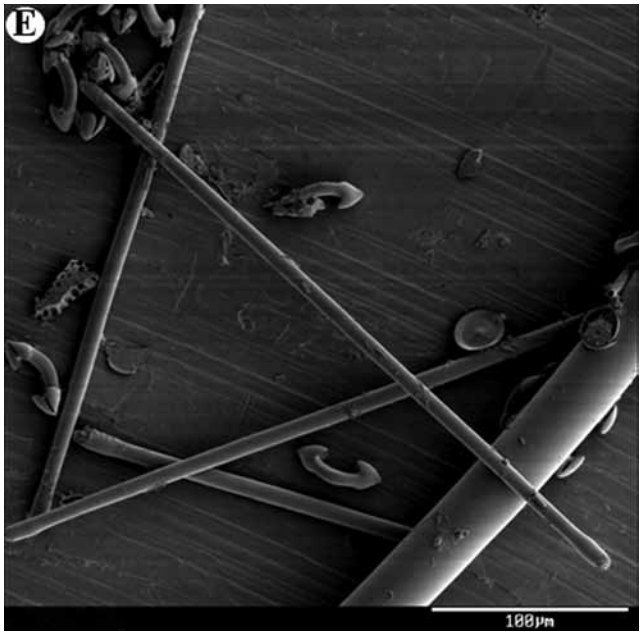






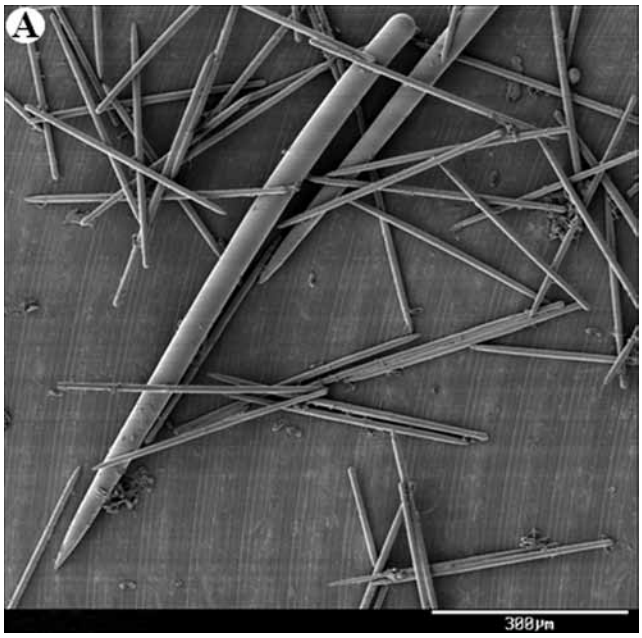


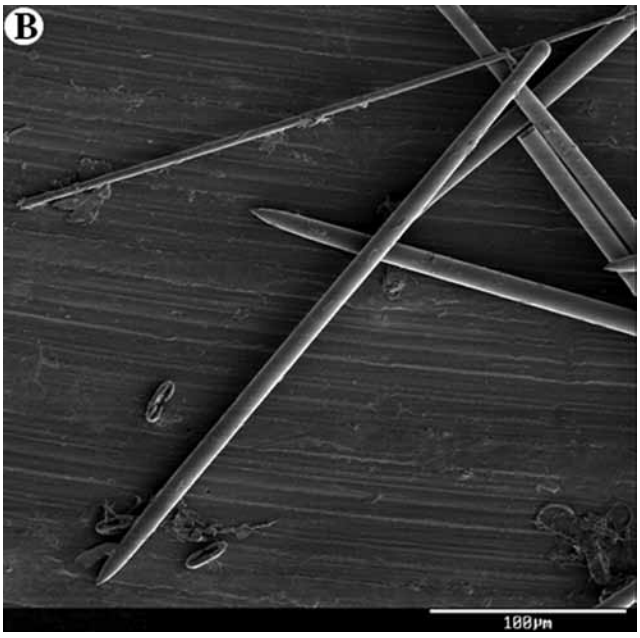
Coelosphaera oglalai Lehnert, Stone and Heimler, 2006 (continued)



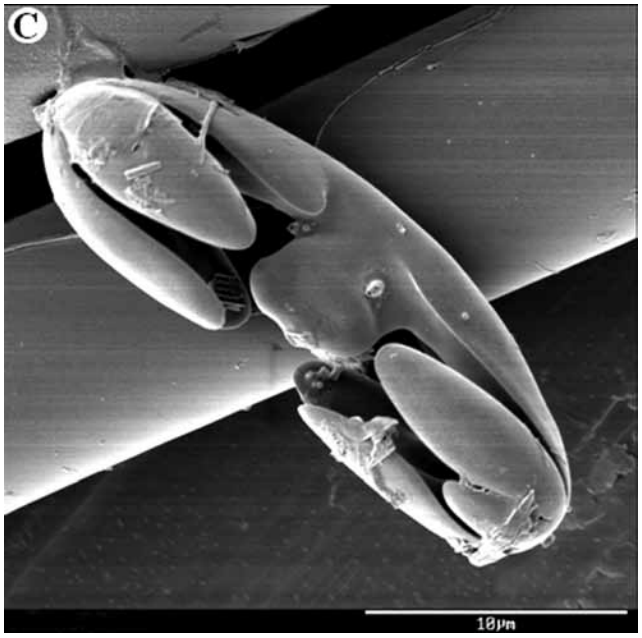
Class Demospongiae, Family Crambeidae, *Monanchora laminachela* Lehnert, Stone and Heimler, 2006.

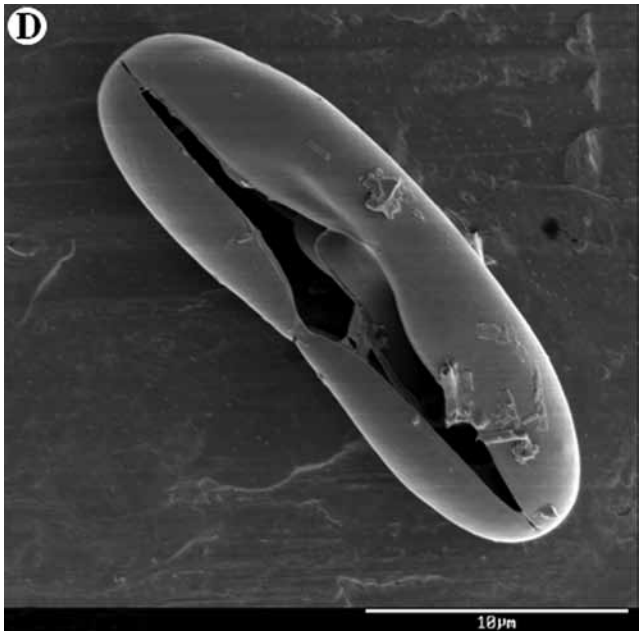
(A) Choanosomal thick style among thin styles; (B) an ectosomal thin style; (C) an anchorate isochela with characteristic central plate; (D) variation of isochela with fused alae; (E) an isochela (rear view); and (F) a sigma. (Figures A–D and F reproduced with permission from Zootaxa, Magnolia Press.)

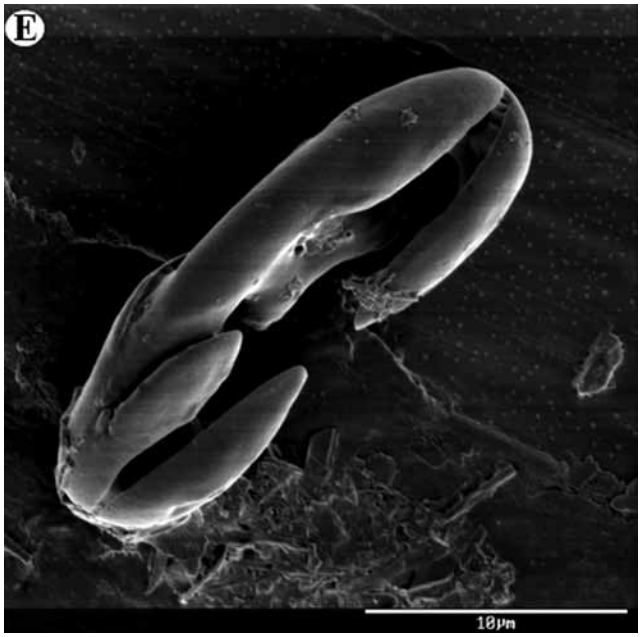


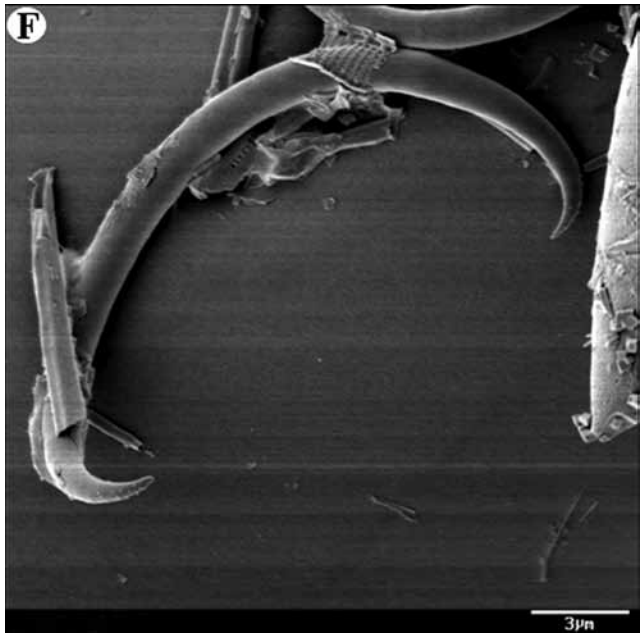


Monanchora laminachela **Lehnert, Stone and Heimler, 2006 (continued)**



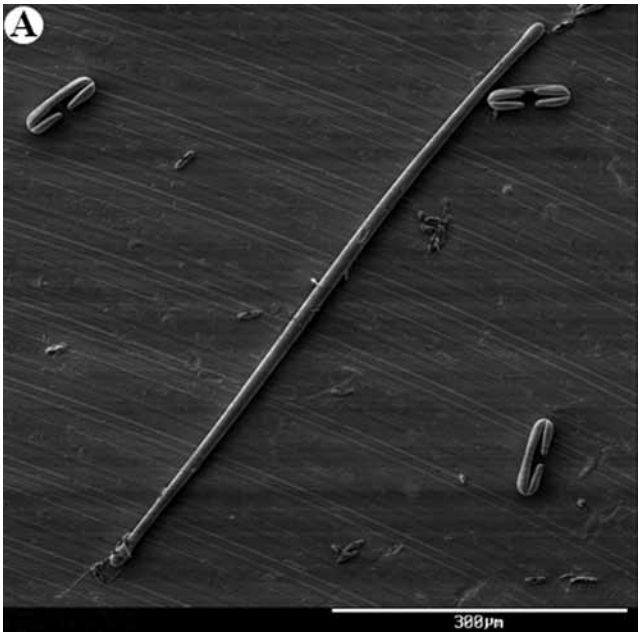


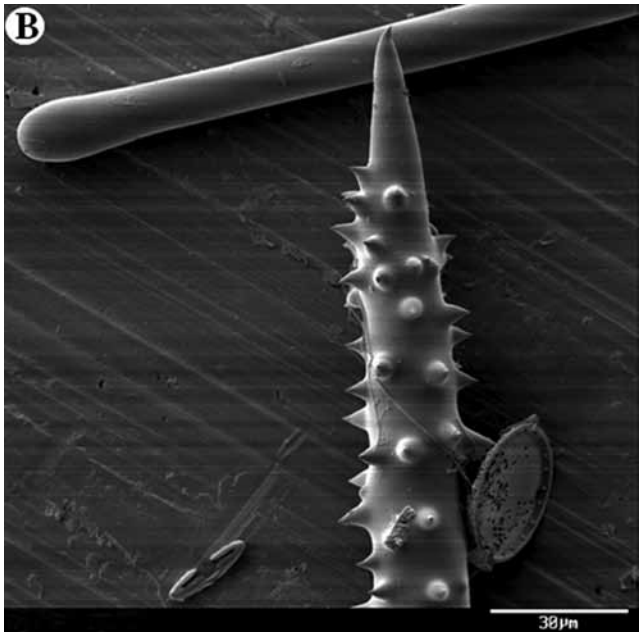


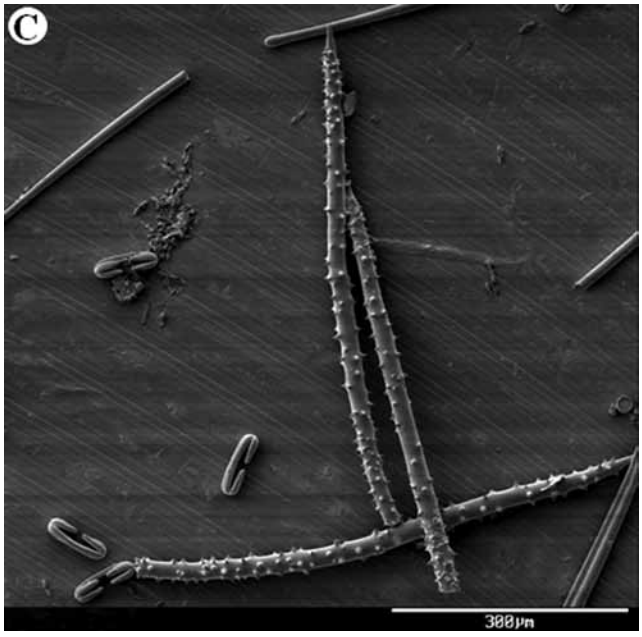


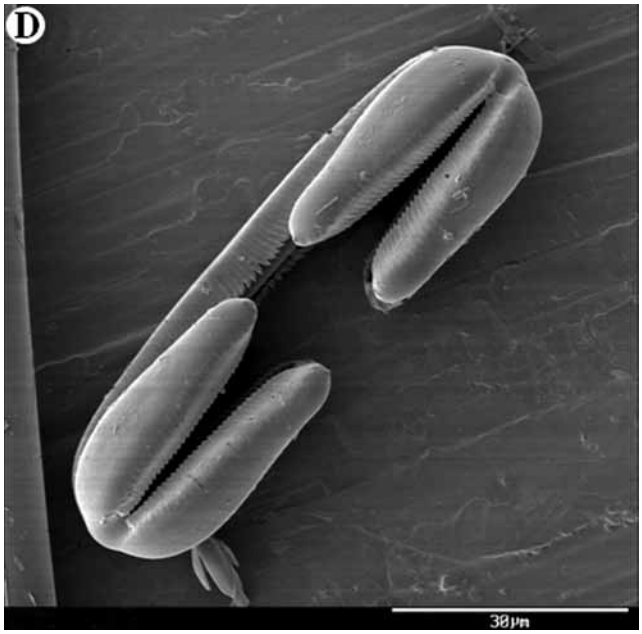
Class Demospongiae, Family Myxillidae, *Melonanchora globogilva* Lehnert, Stone and Heimler, 2006.

(A) An ectosomal tylote among microscleres; (B) smooth end of tylote and pointed end of acanthostyle (close-up view); (C) acanthostyles; (D) a large isochelae (shaft of inner margins of alae with fimbriae); (E) fimbriate inner margins of alae of isochelae (close-up view); (F) second type of large isochela with different shape and dented outer margins; (G) small category of isochelae; and (H) dented margins of second type of isochela (close-up view). (Figures A–H reproduced with permission from Zootaxa, Magnolia Press.)

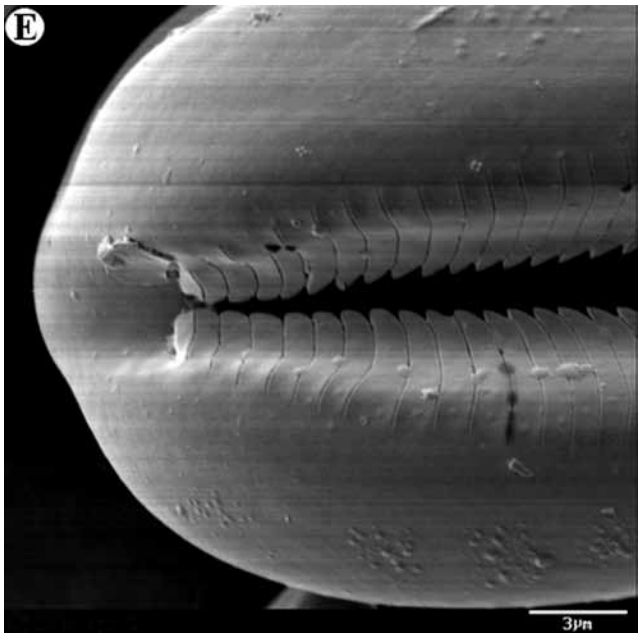


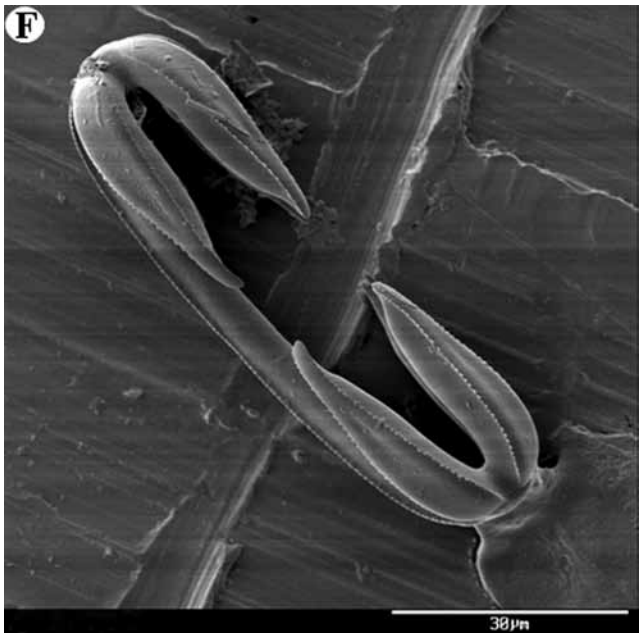


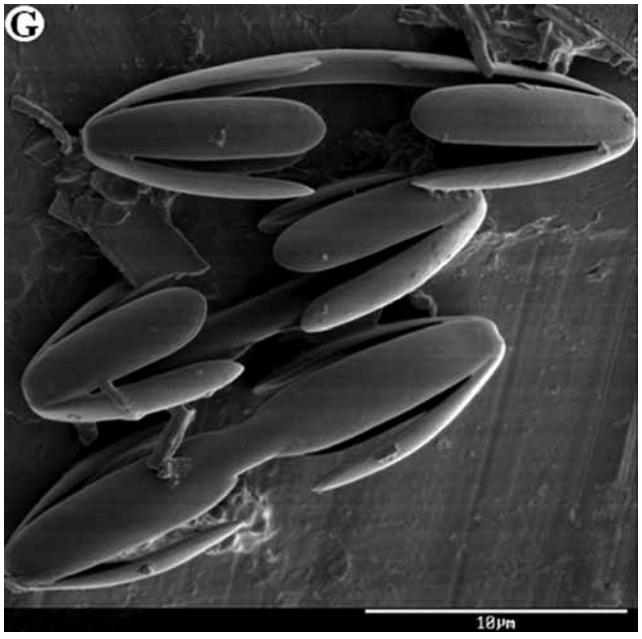


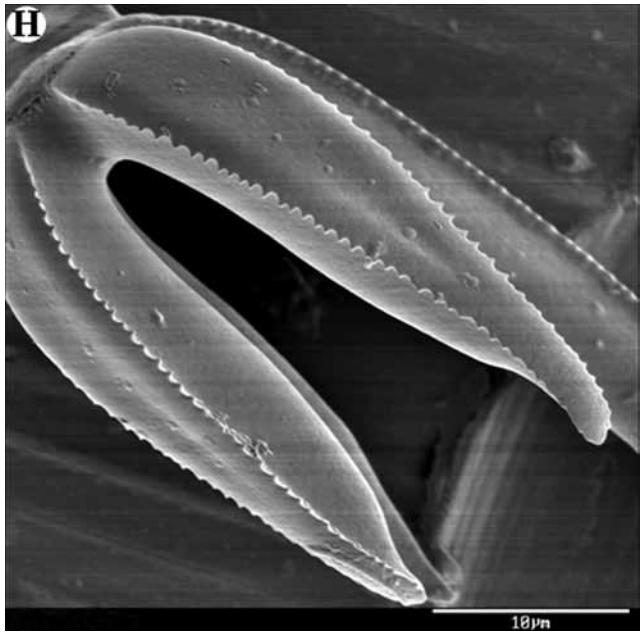


Melonanchora globogilva **Lehnert, Stone and Heimler, 2006 (continued)**



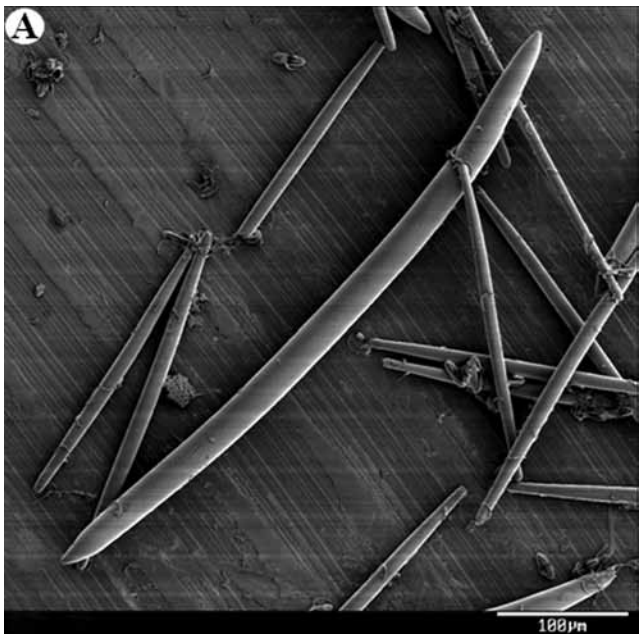


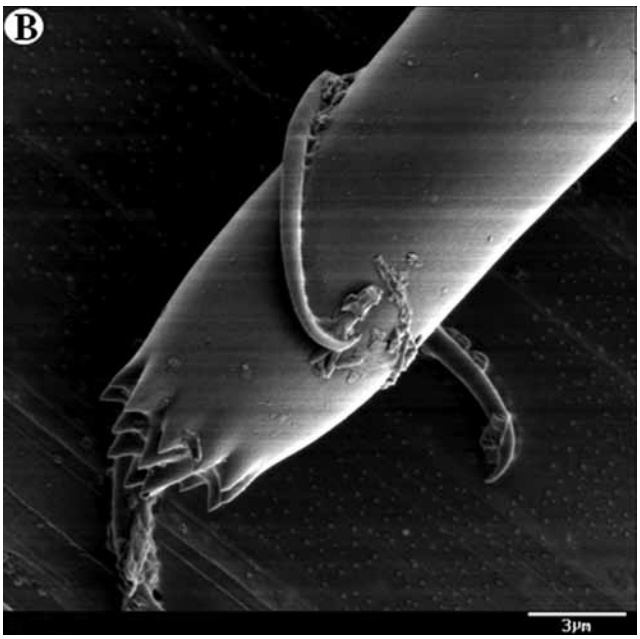


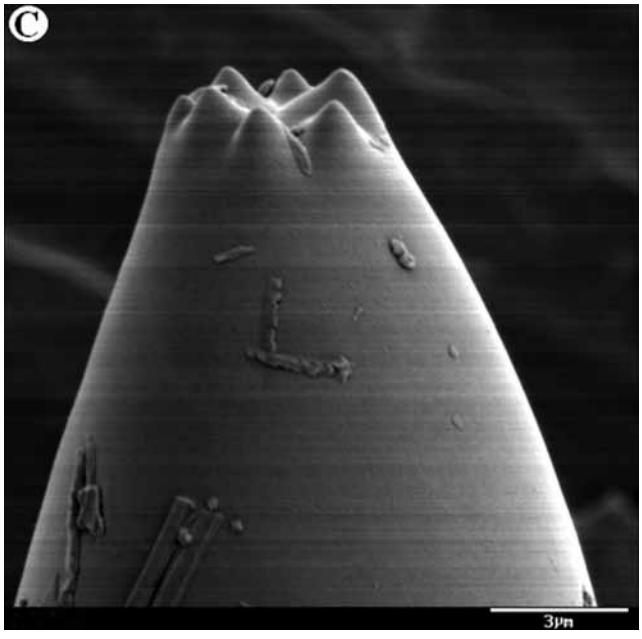


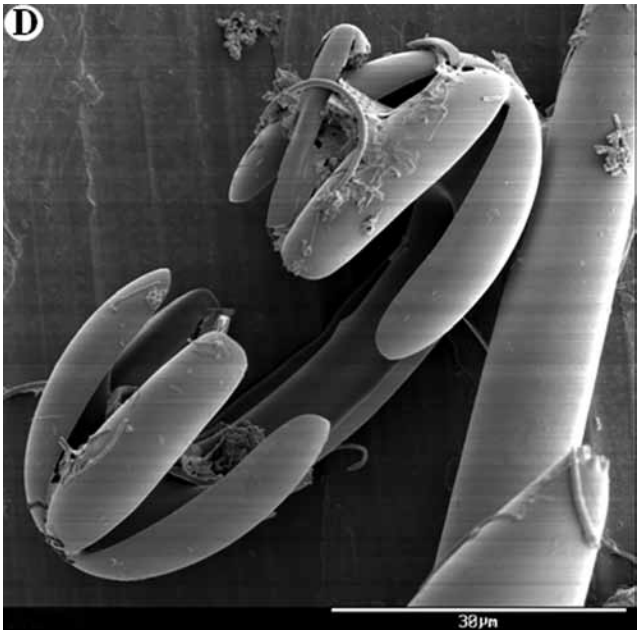
Class Demospongiae, Family Myxillidae, *Stelodoryx oxeata* Lehnert, Stone and Heimler, 2006.

(A) A large oxea with acanthose ends among tornotes with acanthose ends; (B) acanthose end of tornote and a sigma; (C) acanthose end of oxea (close-up view); (D) large category of anchorate isochela; (E) medium-sized category of anchorate, polydentate isochela; (F) small category of anchorate isochelae and centrolyte sigmas; (G) acanthose end of ectosomal tornote, centrotylote sigma (above) and medium-sized isochela (below); and (H) large category of isochela (side view). (Figures A–F reproduced with permission from Zootaxa, Magnolia Press.)

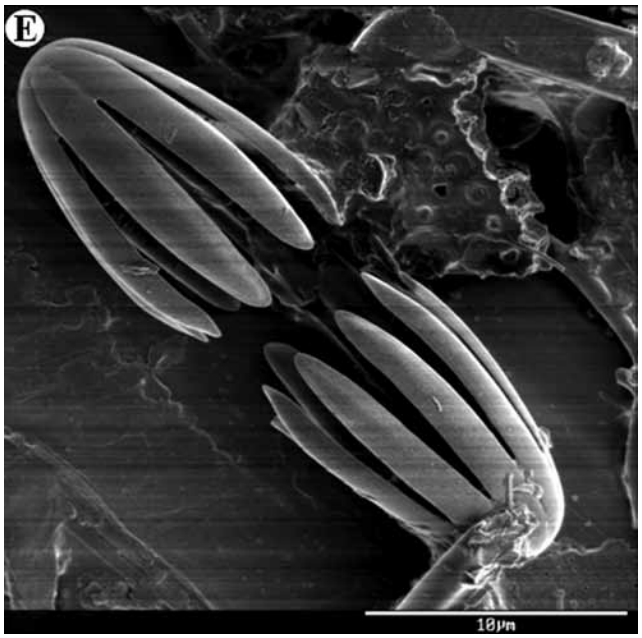


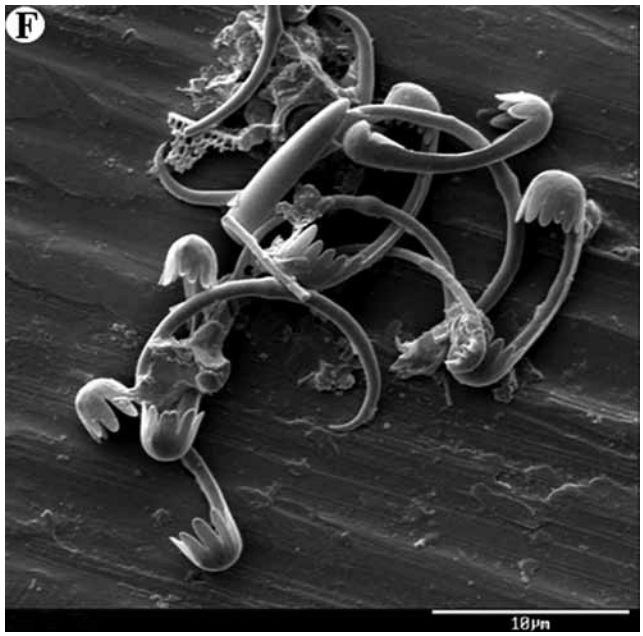


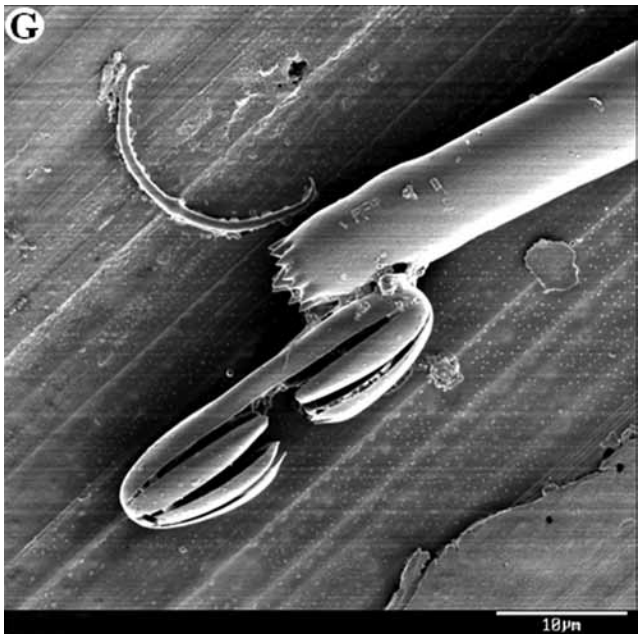


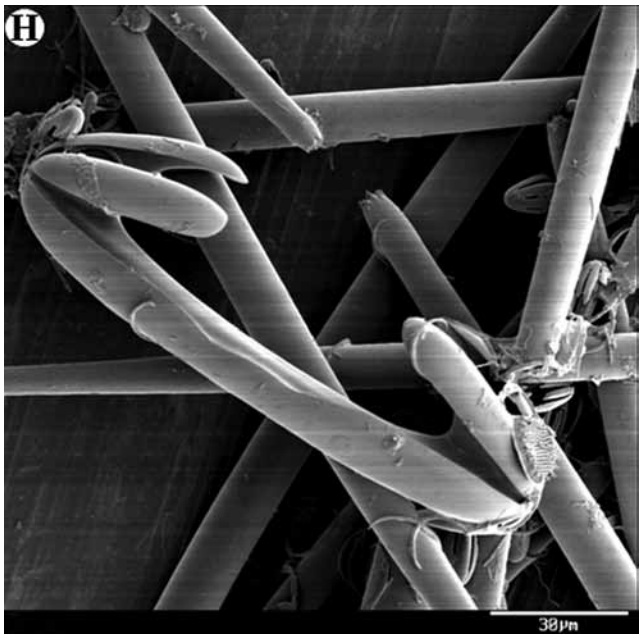


***Stelodoryx oxeata* Lehnert, Stone and Heimler (continued)**



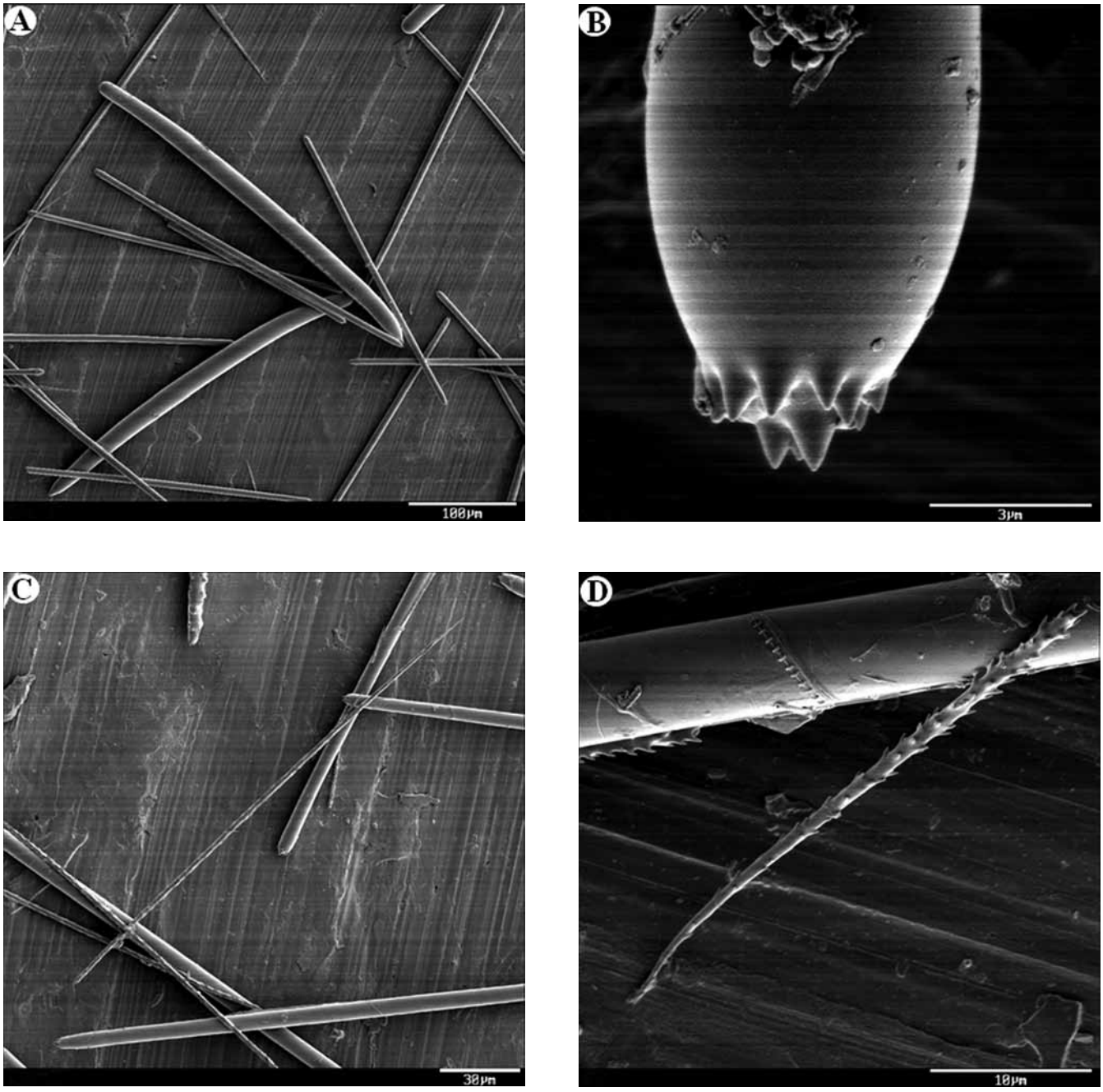






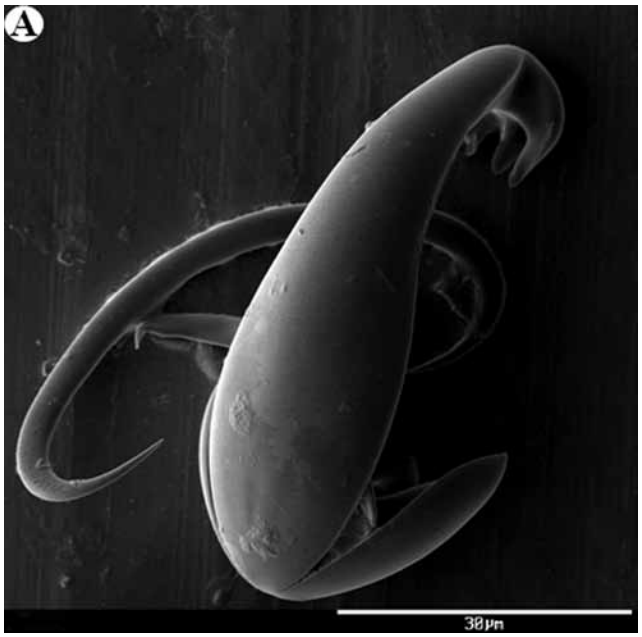
Class Demospongiae, Family Tedaniidae, *Tedania kagalaskai* Lehnert, Stone and Heimler, 2006.

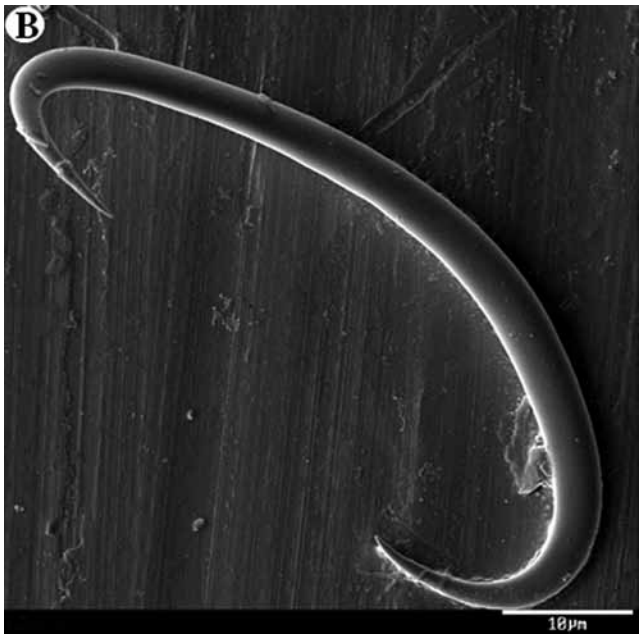
(A) Thick choanosomal styles and ectosomal tylotes; (B) acanthose end of tylote (close-up view); (C) large category of onychaete (lower left to upper right) among tylotes; and (D) small category of onychaete (note the unequal ends). (Figures A–D reproduced with permission from Zootaxa, Magnolia Press.)

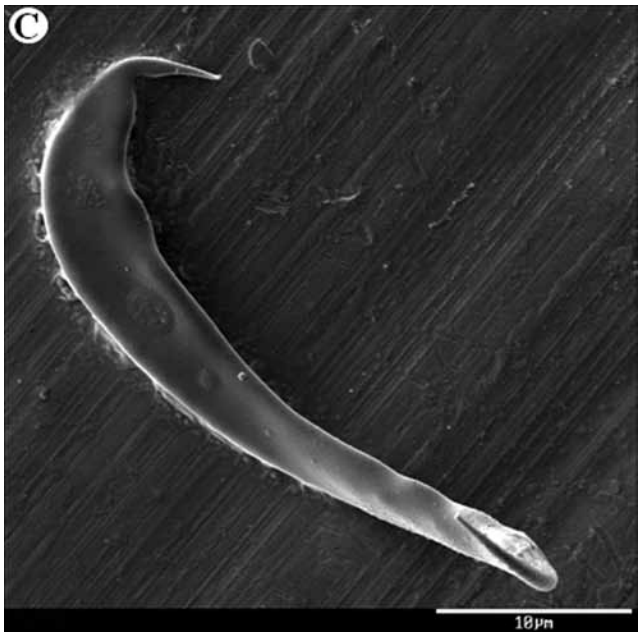


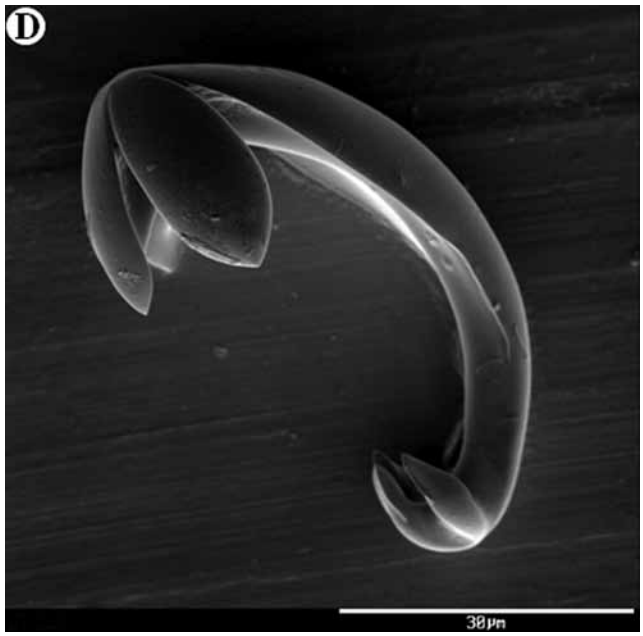
Class Demospongiae, Family Cladorhizidae, *Cladorhiza bathycrinoides* Koltun, 1955.

(A) An anisochela (rear view) with sigma (below); (B) a sigma; (C) a sigmancistra; (D) an anisochela; (E) an anisochela (rear view); (F) small end of anisochela with sharp claws (possibly adapted to capture prey) and pointed end of sigmancistra (above); (G) tylostrongyles and anisochelae; and (H) tylostrongyle and anisochelae.

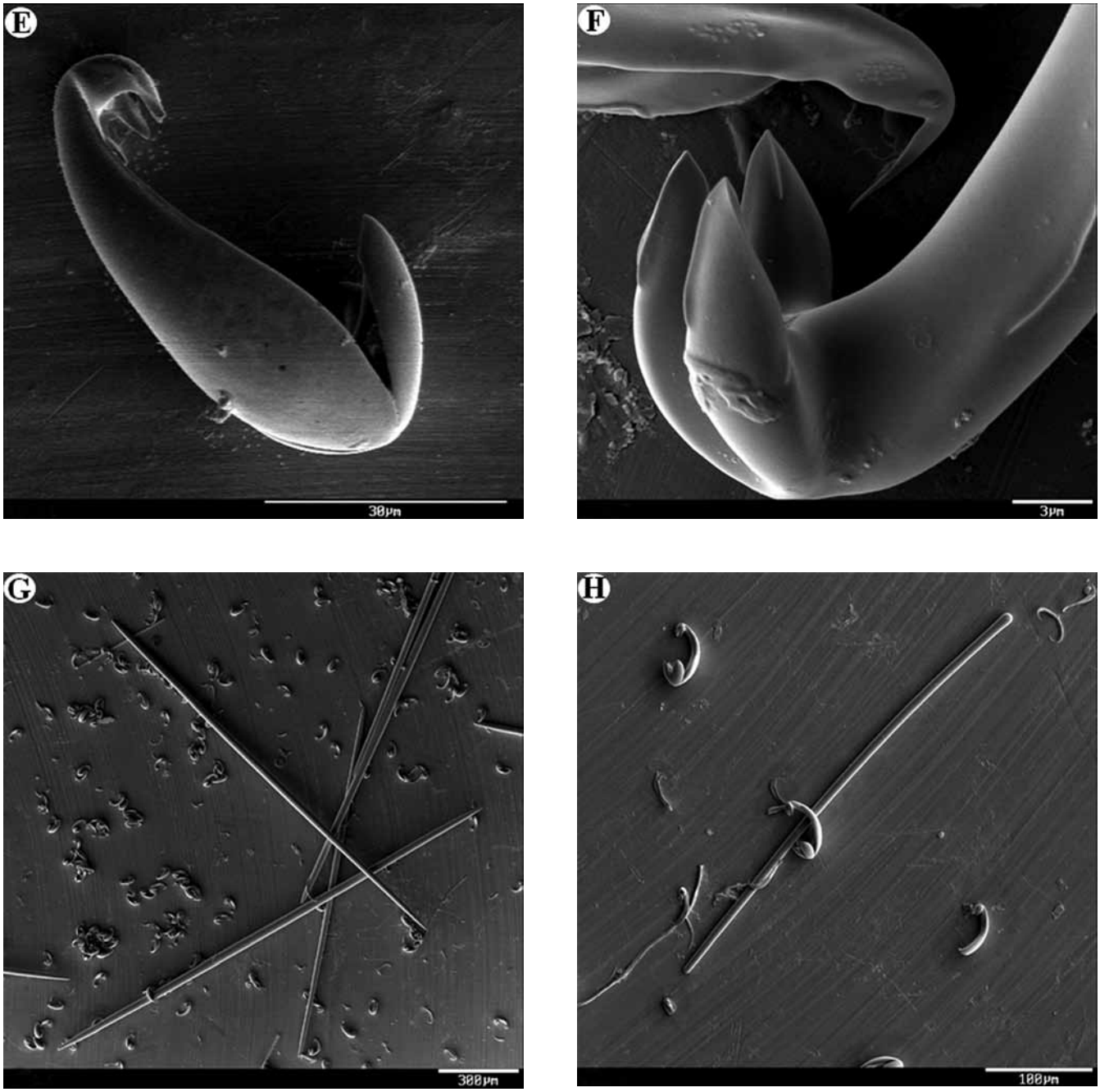






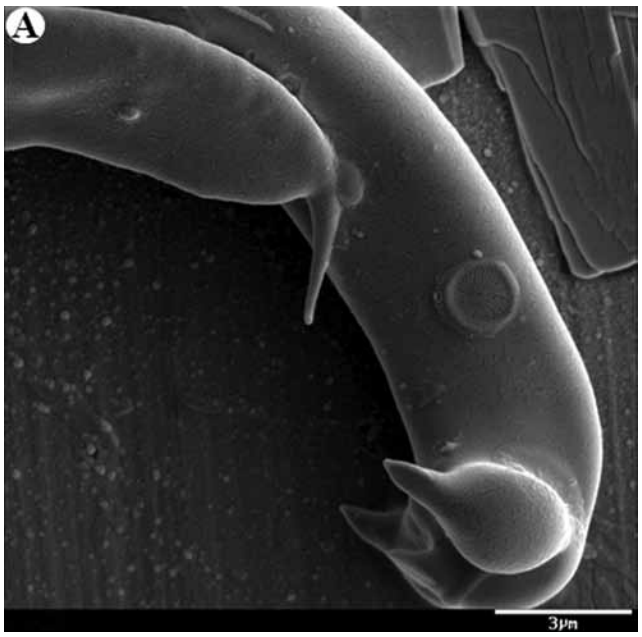


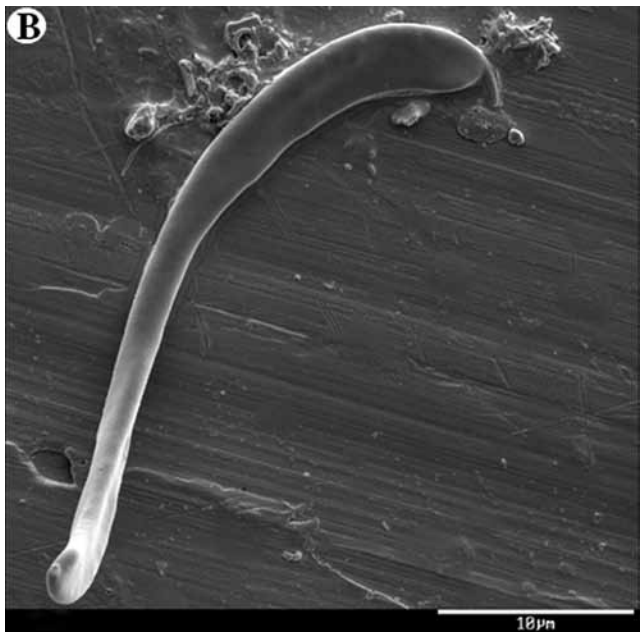
***Cladorhiza bathycrinoides* Koltun, 1955 (continued)**

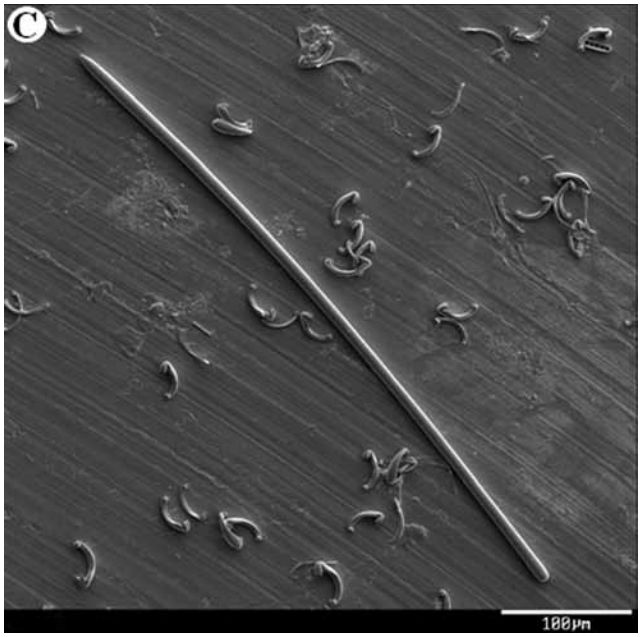


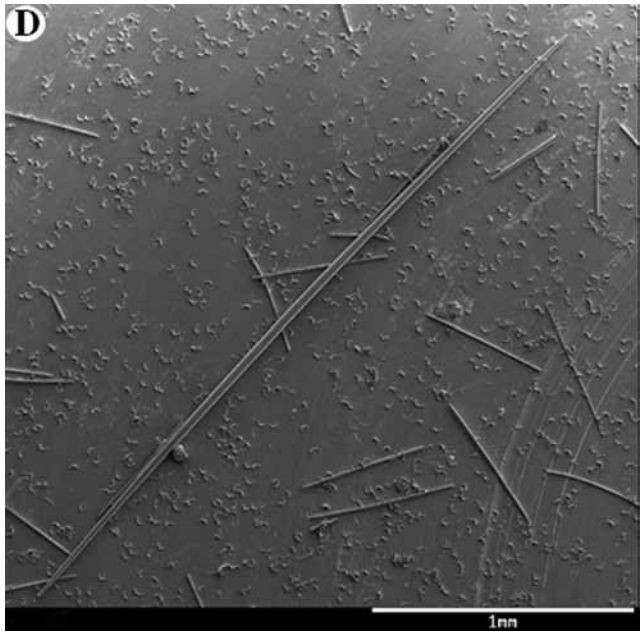
Class Demospongiae, Family Cladorhizidae, *Cladorhiza corona* Lehnert, Watling and Stone, 2005.

(A) Claw-like appendages at the small end of anisochelae; (B) a sigmancistra; (C) a tylostyle among microscleres; (D) a large fusiform style and short oxeas; (E) an anisochela with claw-like appendages; (F) a small (anis-)oxea (a spicule type present in the basal plate); and (G) large fusiform styles and small (anis-)oxea. (Figure A reproduced with permission from the Journal of the Marine Biological Association of the United Kingdom.)

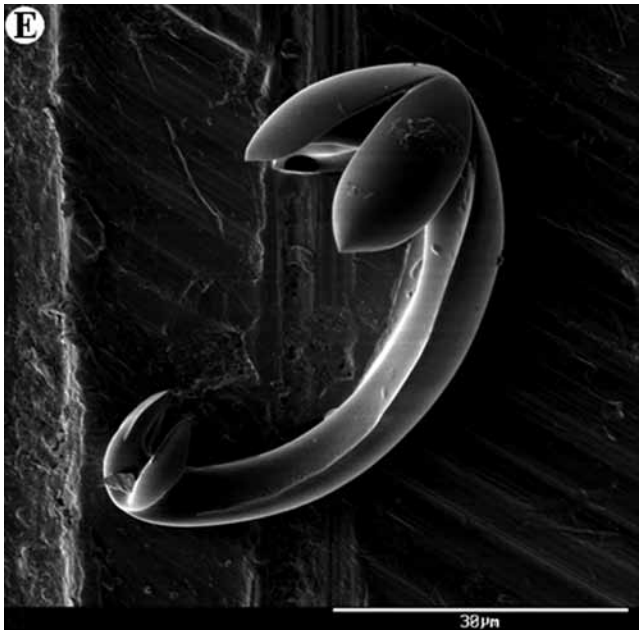


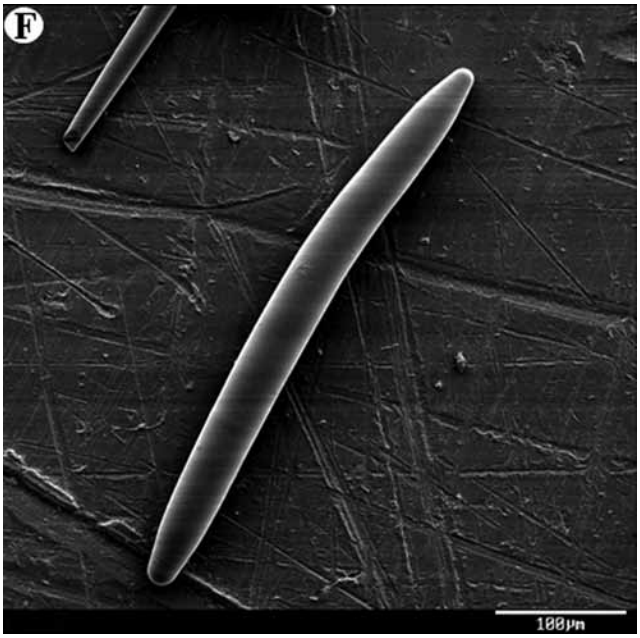


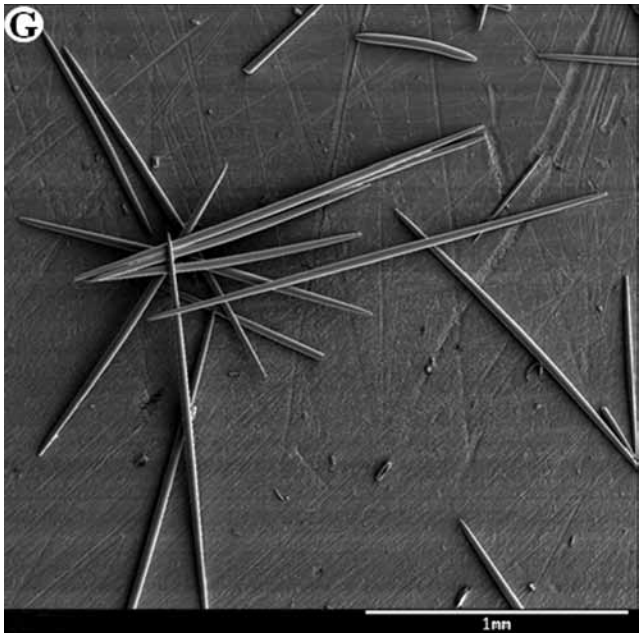




Cladorhiza corona **Lehnert, Watling and Stone, 2005 (continued)**

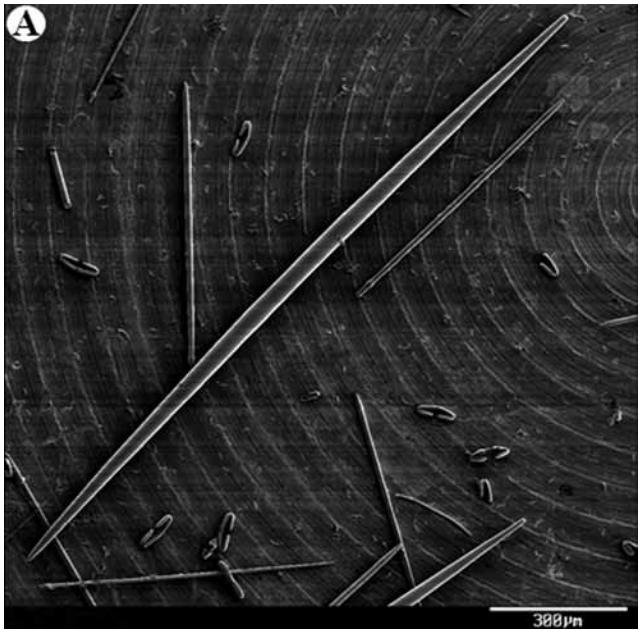


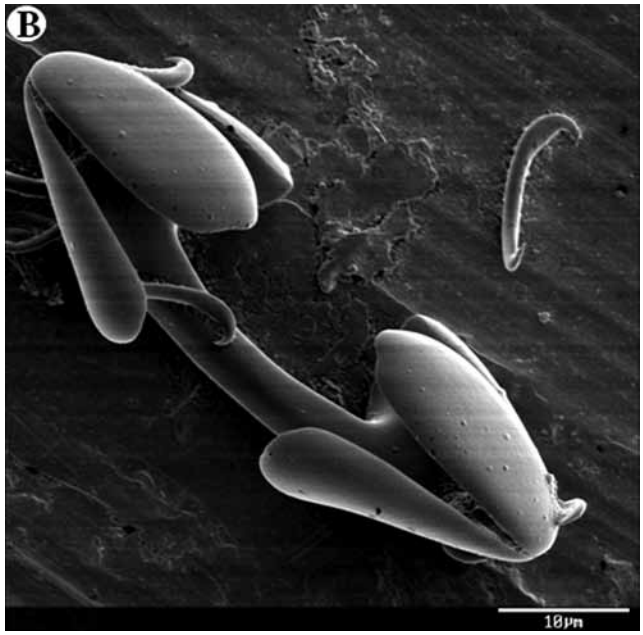


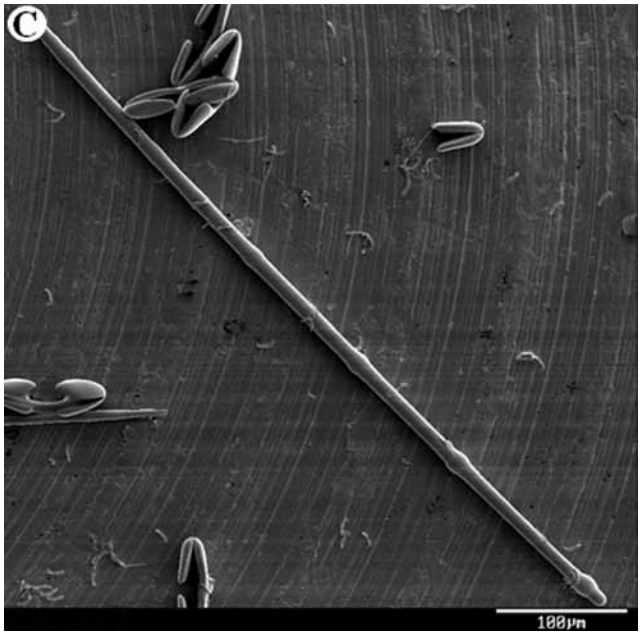


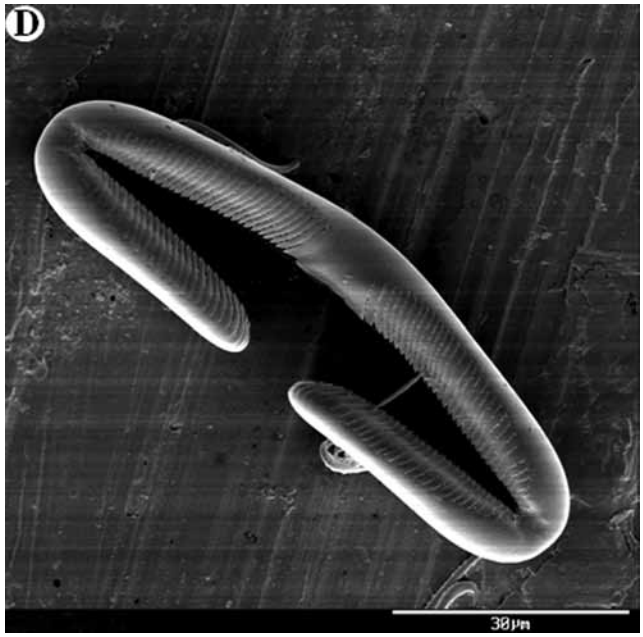
Class Demospongiae, Family Guitarridae, *Eucheliplumaelongata* Lehnert, Stone and Heimler, 2006.

(A) Fusiform choanosomal style; (B) an isochela and sigmas; (C) ectosomal tylostyle, slightly polytylote among microscleres; (D) characteristically thin placochela; (E) developmental stage of polytylote tylostyle and two placochelae; (F) a sigma; (G) an isochela, placochela and sigmas; and (H) long fusiform styles, shorter ectosomal tylostyles and microscleres. (Figures A–F reproduced with permission from Zootaxa, Magnolia Press.)

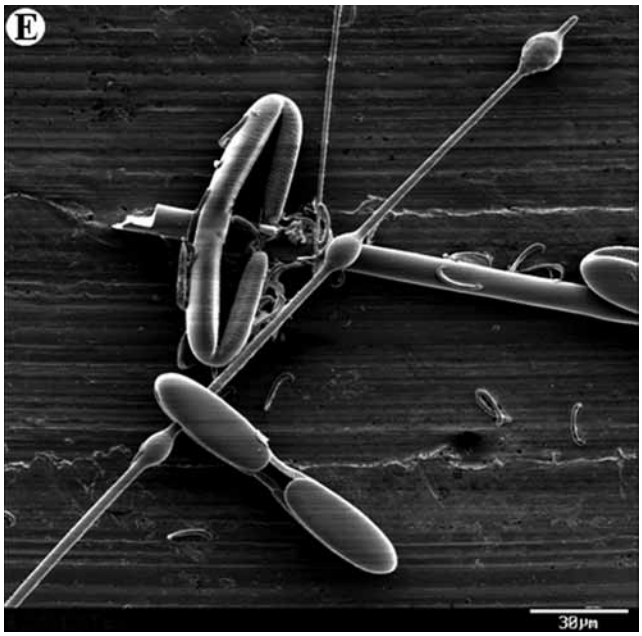


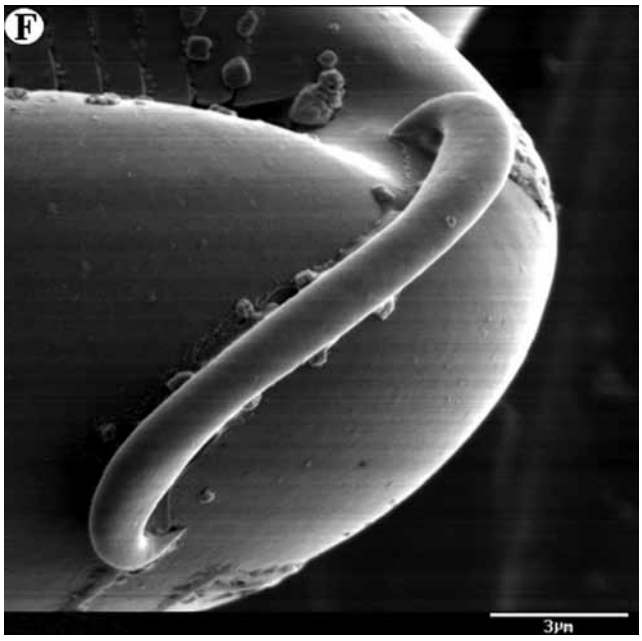


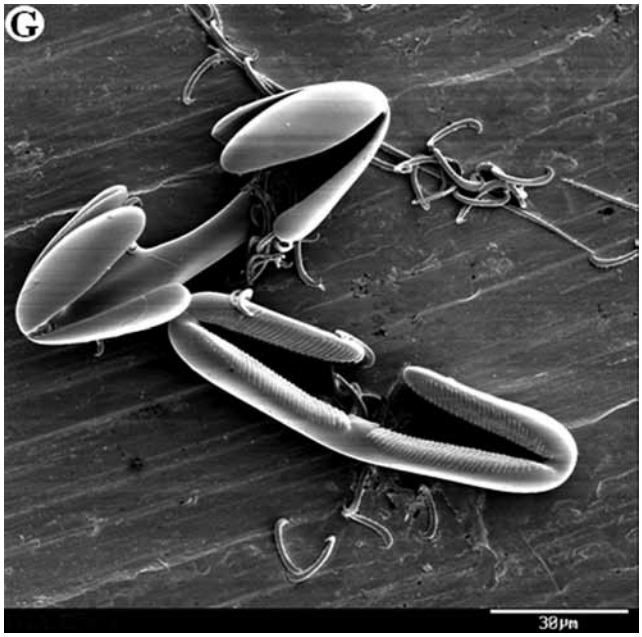


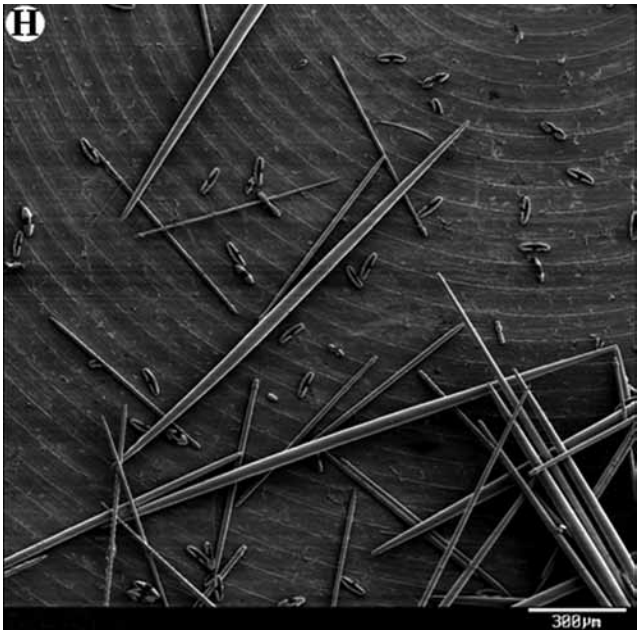


***Eucheliplume elongata* Lehnert, Stone and Heimler, 2006 (continued)**



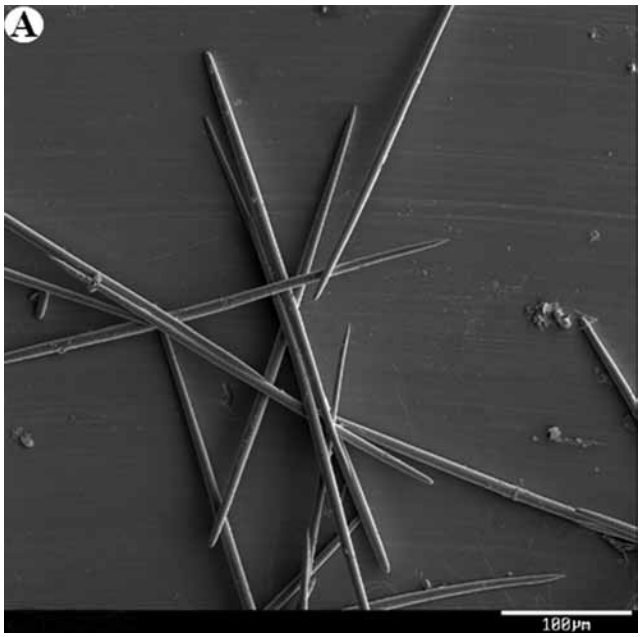


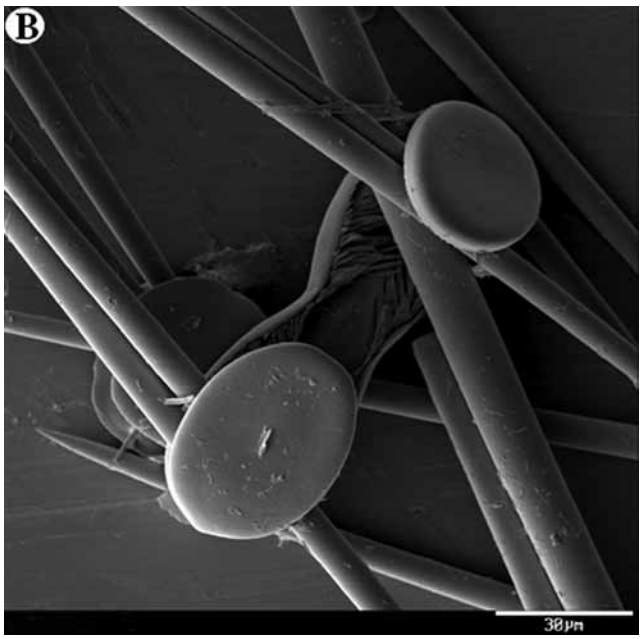


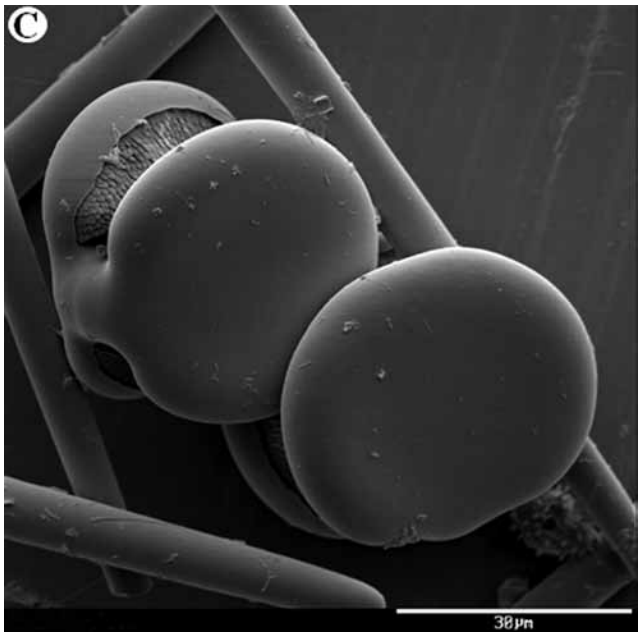


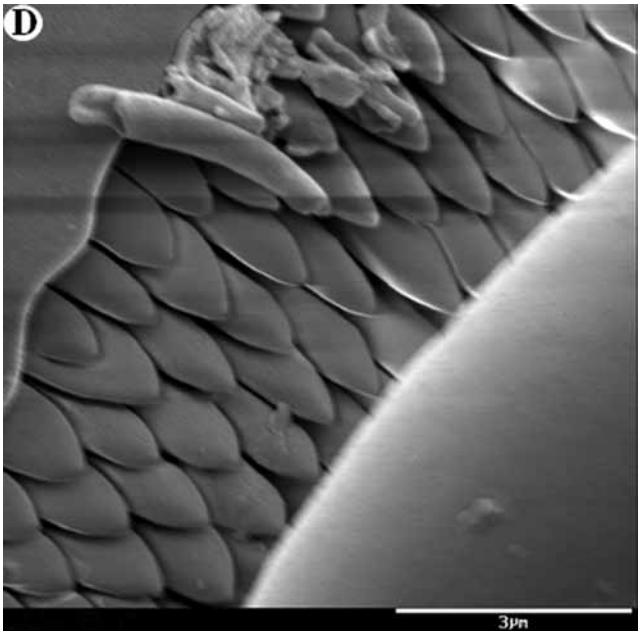
Class Demospongiae, Family Guitarridae, *Guitarra abbotti* Lee, 1987.

(A) Fusiform styles; (B) a large placochela among styles; (C) biplacochelae; (D) fimbriae of biplacochela (close-up view); (E) tiny, spined isochela; (F) a biplacochela showing frontal process; and (G) fimbriae of a biplacochela (close-up view).

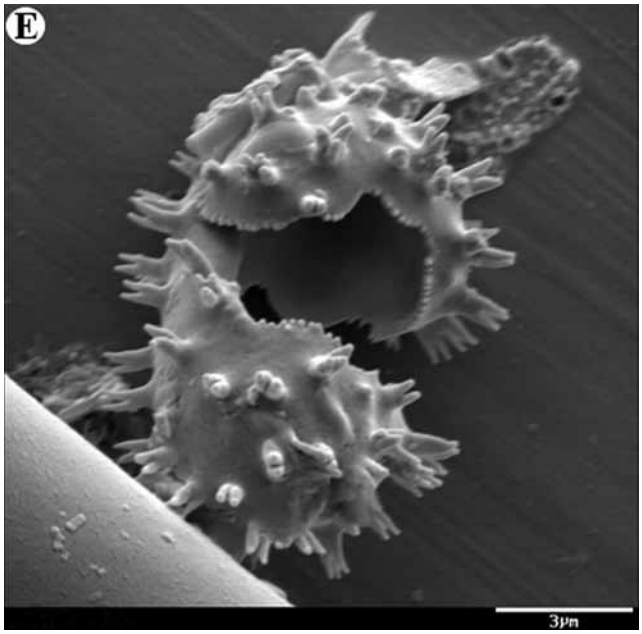


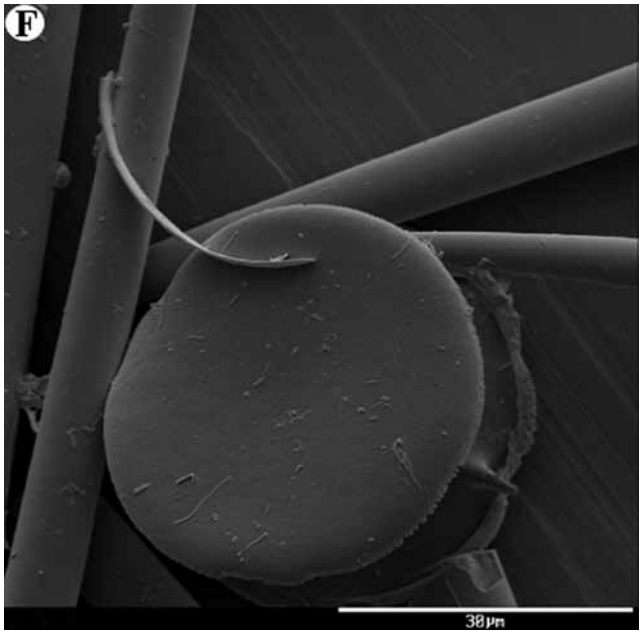


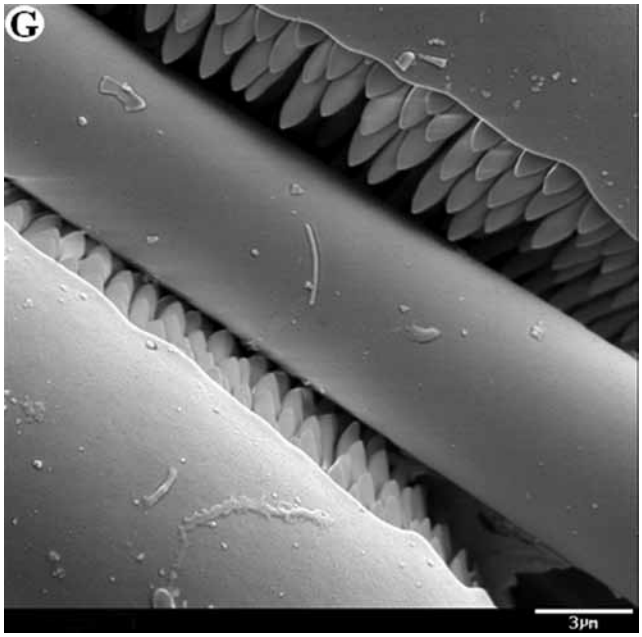




***Guitarra abbotti* Lee, 1987 (continued)**

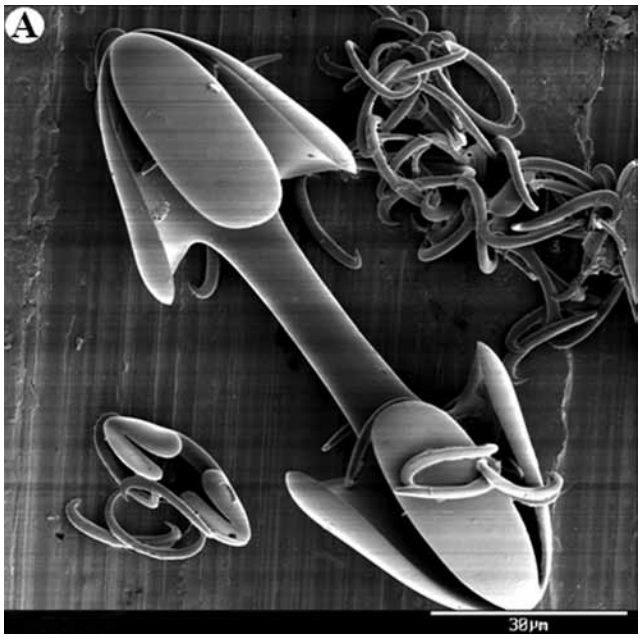


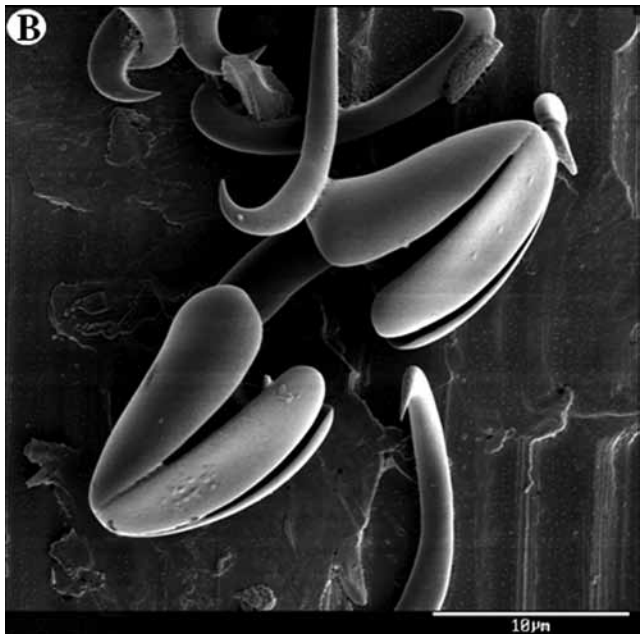


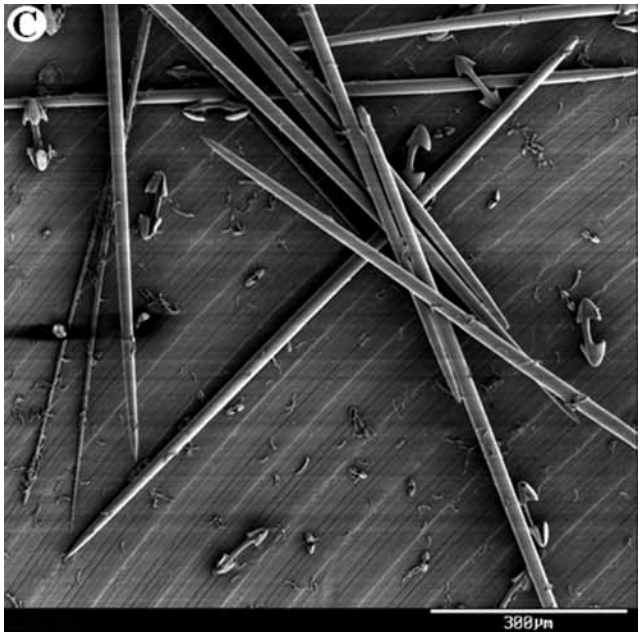


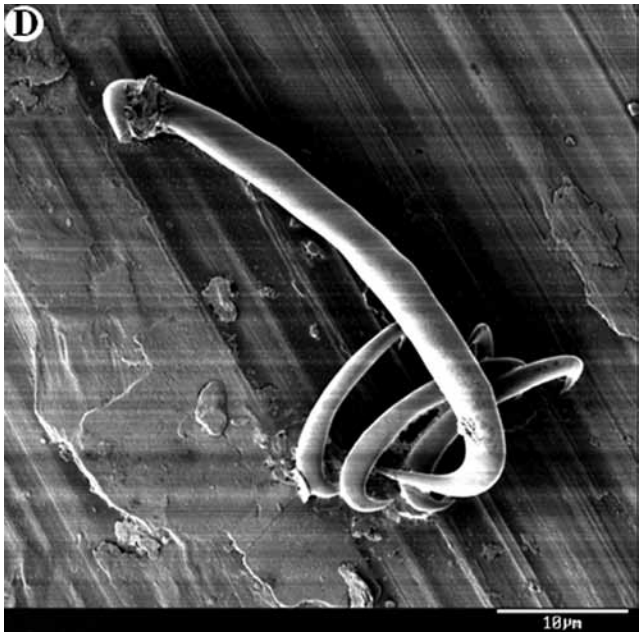
Class Demospongiae, Family Esperiopsidae, *Esperiopsis flagrum* Lehnert, Stone and Heimler, 2006.

(A) Microscleres (large and small categories of isochelae and sigmas); (B) a small isochela; (C) long fusiform styles and microscleres; (D) large and small sigmas; (E) a small isochela (side view); (F) a large isochela (rear view); and (G) large isochelae (front and rear views). (Figures A–F reproduced with permission from Zootaxa, Magnolia Press.)

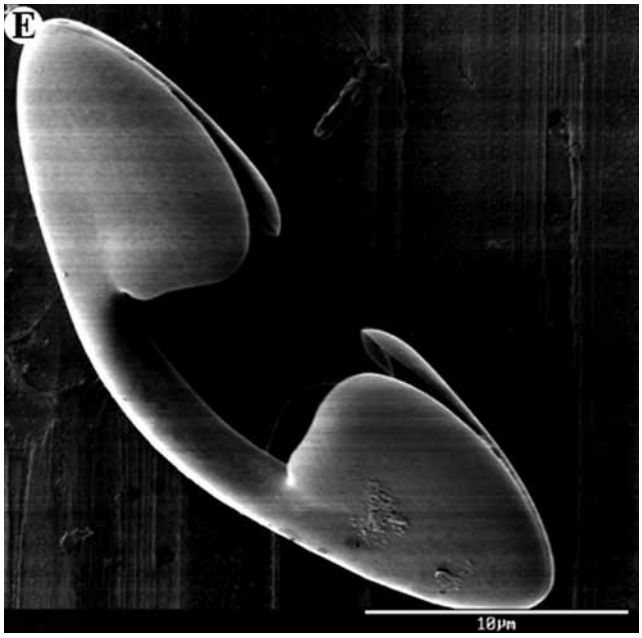


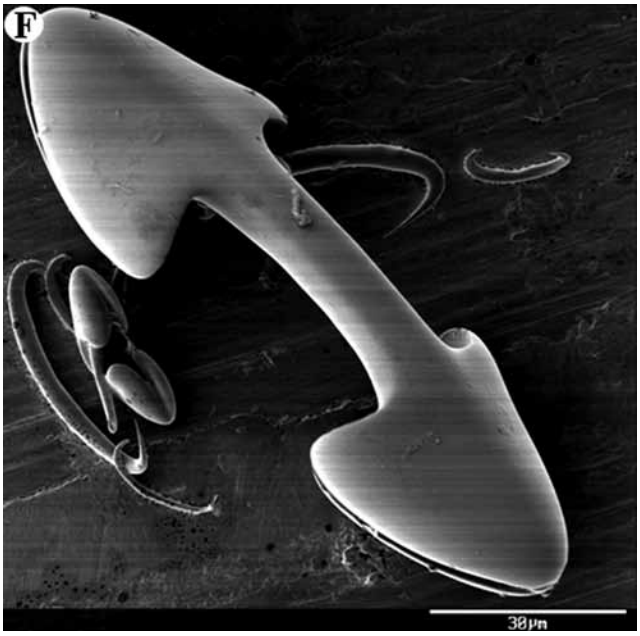


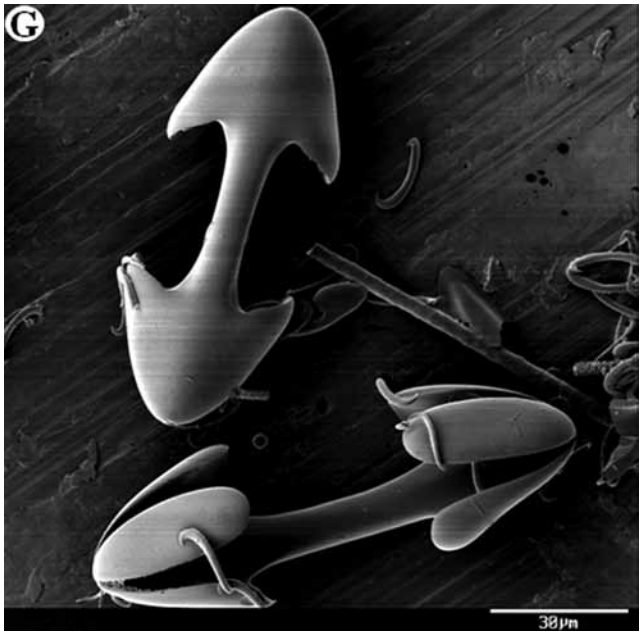




***Esperiopsis flagrum* Lehnert, Stone and Heimler, 2006 (continued)**

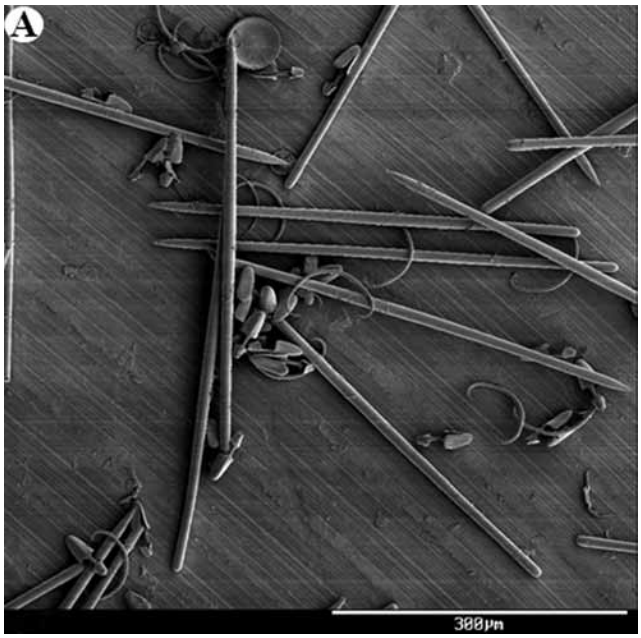


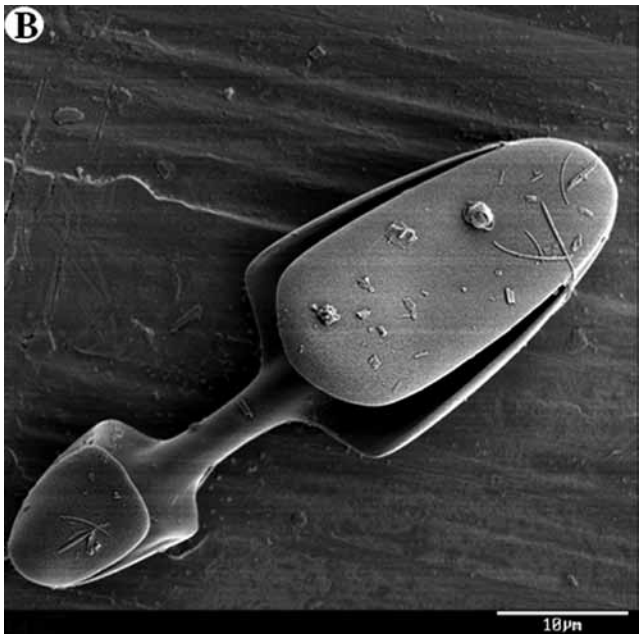


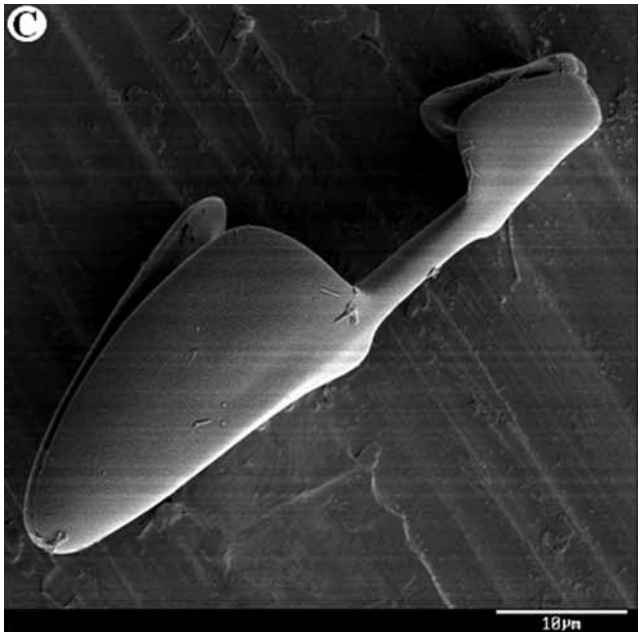


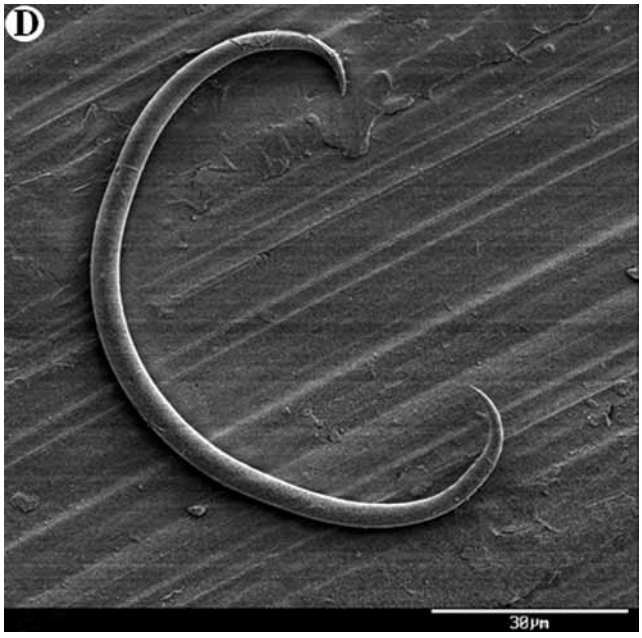
Class Demospongiae, Family Mycalidae, *Mycale* (*Carmia*) *carlilei* Lehnert, Stone and Heimler, 2006.

(A) Spicule overview (styles, anisochelae and sigmas); (B) an anisoschela (top view); (C) an anisochela (side view); and (D) a sigma. (Figures A–D reproduced with permission from Zootaxa, Magnolia Press.)



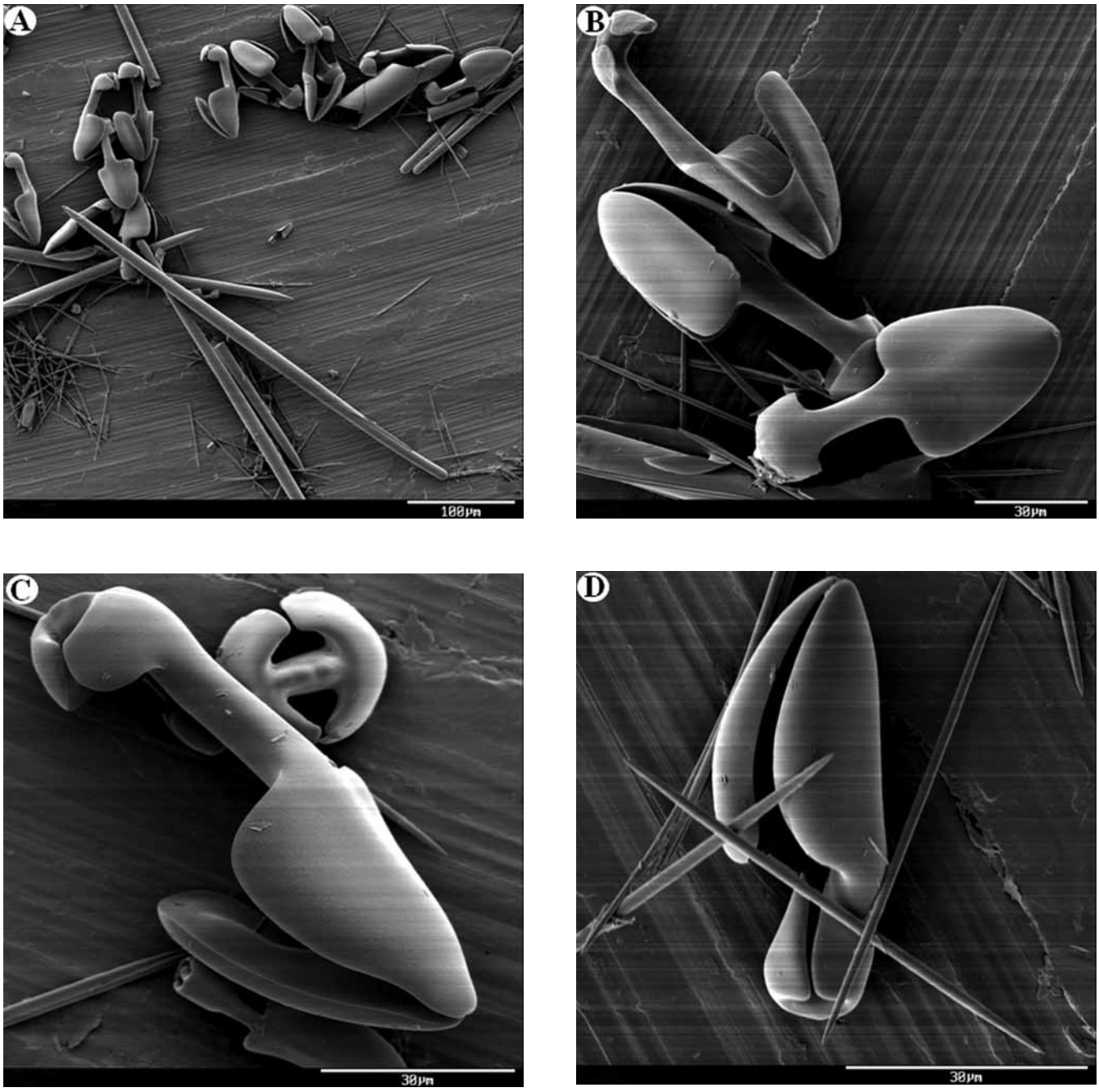




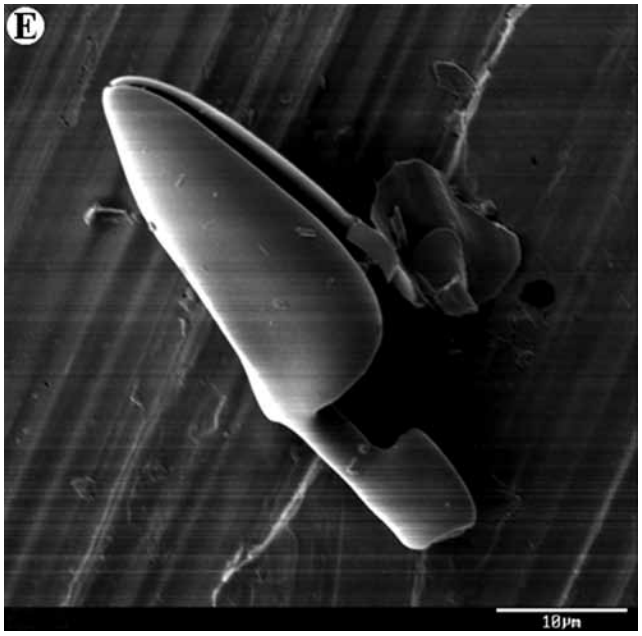


Class Demospongiae, Family Mycalidae, *Mycale* (*Mycale*) *jasoniae* Lehnert, Stone and Heimler, 2006.

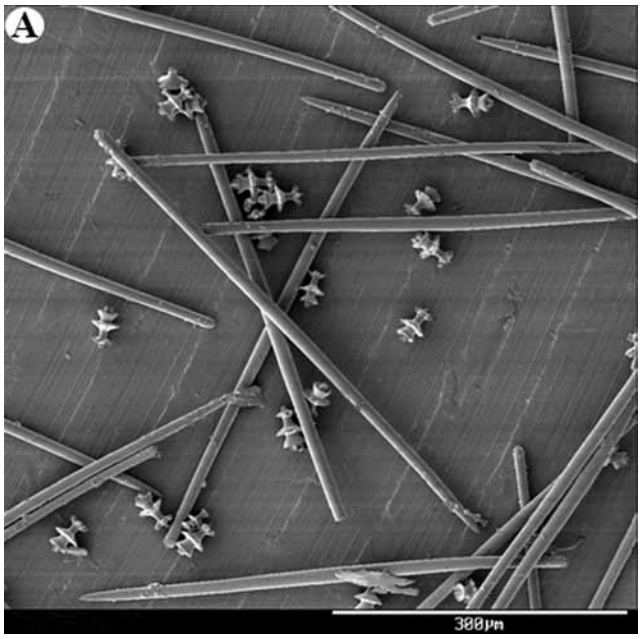
(A) Spicule overview (subtylostyles, large and small anisochelae, and rhaphids); (B) large anisochelae (front, side and rear views); (C) side view of a large anisochela (note top view of broken end of small anisochela); (D) small category of anisochela and rhaphids; and (E) a small anisochela. (Figures A–D reproduced with permission from Zootaxa, Magnolia Press.)

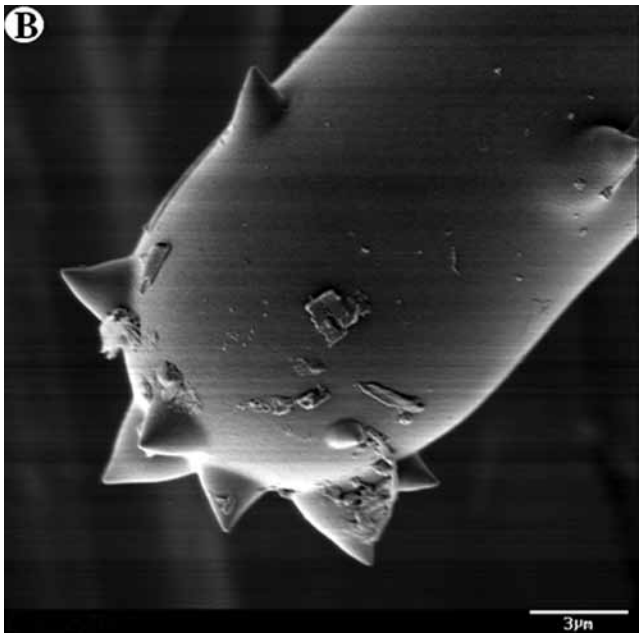


***Mycale* (*Mycale*) *jasoniae* Lehnert, Stone and Heimler, 2006 (*continued*)**

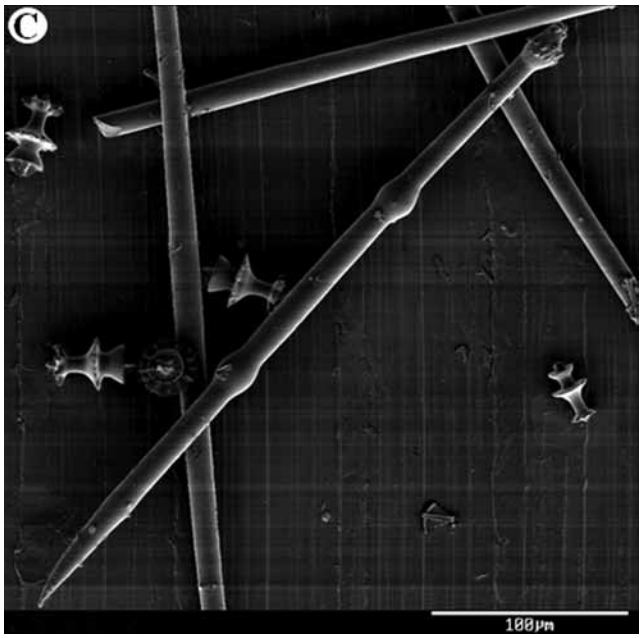


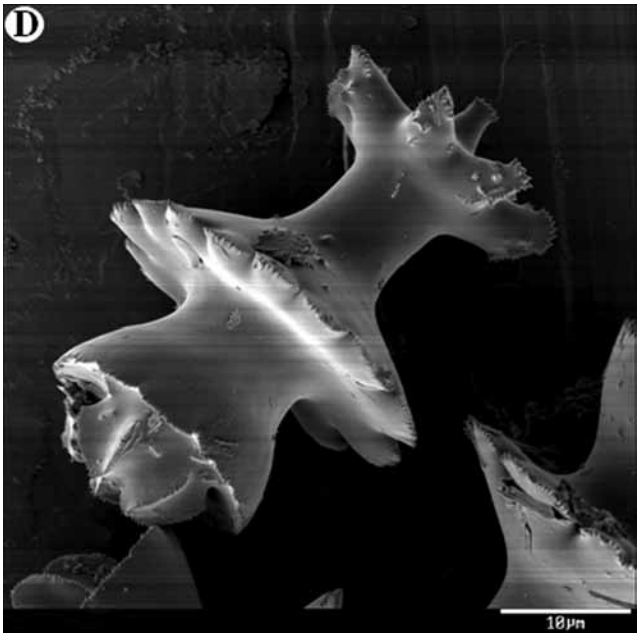
Class Demospongiae, Family Latrunculiidae, *Latrunculia velera* Lehnert, Stone and Heimler, 2006.
(A) Spicule overview (styles and anisodiscorhabds); (B) acanthose end of style; (C) a rare polytylote tylostyle; (D) an anisodiscorhabd; (E) an anisodiscorhabd (apex view); (F) apex of anisodiscorhabd (side view); (G) early developmental stage of anisodiscorhabd on pointed end of style (acanthose pointed ends, as shown here, are rare); (H) developmental stage of anisdiscorhabd between two fully developed ones; (I) smoother variation of an anisodiscorhabd; and (J) anisodiscorhabds. (Figures A–I reproduced with permission from Zootaxa, Magnolia Press.)

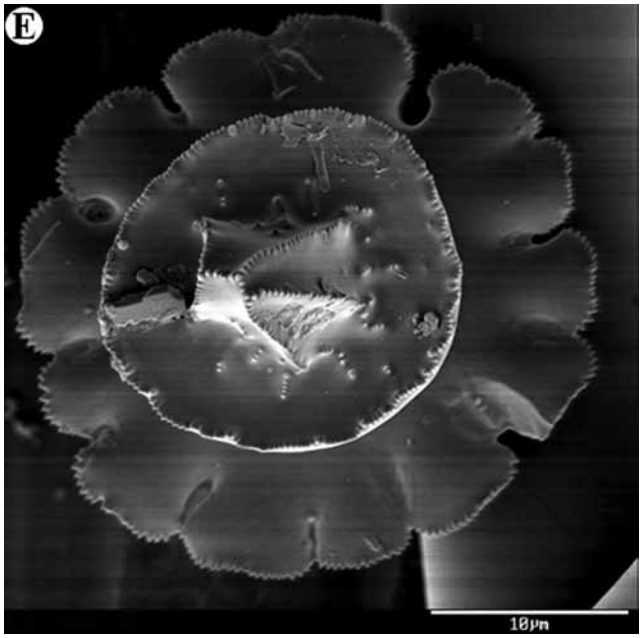


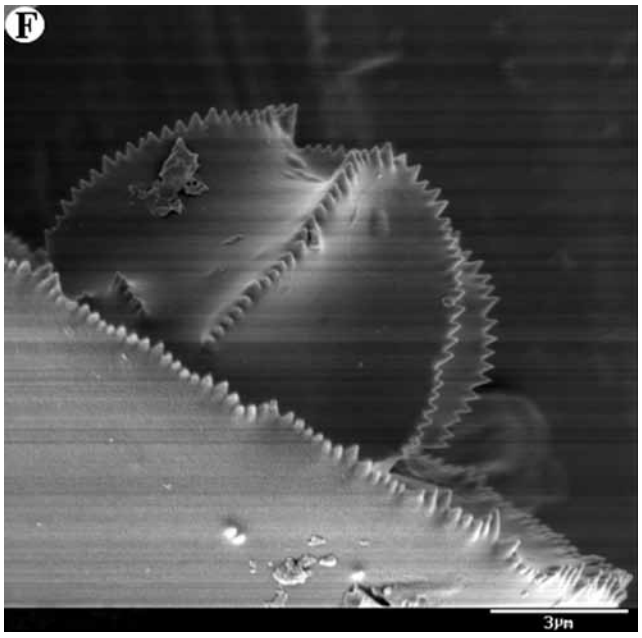


Latrunculia velera **Lehnert, Stone and Heimler, 2006 (continued)**









Latrunculia velera **Lehnert, Stone and Heimler, 2006 (continued)**