

# Deep Water Demospongiae from New Zealand

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## INTRODUCTION

Recent dredgings in deep water off the coast of New Zealand have yielded several species of Demospongiae which have not been recorded previously from the New Zealand region. Notable among these are *Chondrocladia clavata* Ridley and Dendy and three species of *Stylocordyla* Thompson which represent new records of two families characteristic of deep water sponge faunas in all seas, the Cladorhizidae and the Stylocordylidae, respectively.

## DESCRIPTION OF SPECIES

All color notations are after Munsell (1942). Means of spicule dimensions are based on fifty measurements and are quoted in brackets.

### ORDER POECILOSCLERIDA TOPSENT

#### FAMILY CLADORHIZIDAE de LAUBENFELS

Deep water Demospongiae with distinctive external shape having symmetrical projections arising from a round or oval body. Often stalked. Megascleres oxeas, styles or tylostyles, microscleres isochelae of elaborate form accompanied by sigmas.

#### Genus *Chondrocladia* Thompson

Sponges of symmetrical form with a strong spicule axis and with projections arising from a rounded head. Spicules styles, unguiferate isochelae and sigmas.

#### *Chondrocladia clavata* Ridley and Dendy

*Chondrocladia clavata* Ridley and Dendy, 1886, p. 345.

*Chondrocladia clavata* Ridley and Dendy, 1887, p. 100, pl. XX, Fig. 1, 1a; pl. XXI, Fig. 11.

*Chondrocladia clavata* Burton, 1929, p. 431.

*Chondrocladia clavata* Koltun, 1966, p. 39.

*Chondrocladia clavata* Levi, 1964, p. 76, fig. 26, pl. IV(d).

OCCURRENCE:: Cook St., 990 m.

DESCRIPTION: A single damaged specimen has been collected. The sponge is stalked with round head 1.5 cm in diameter from which protrude at least six stiff branches

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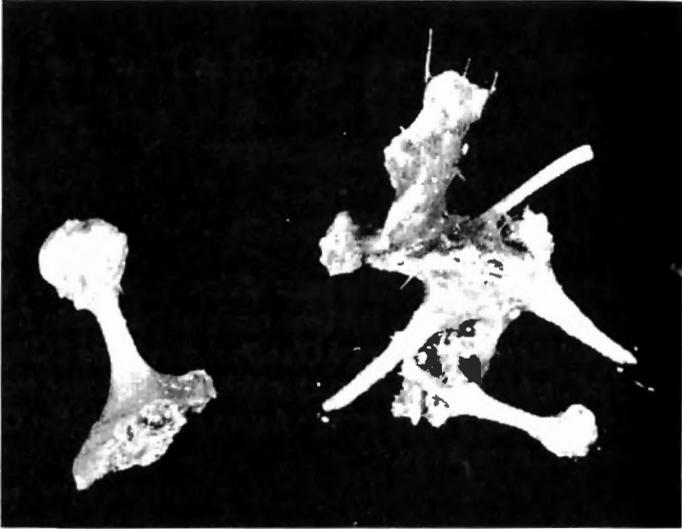


Fig. 1. *Chondrocladia clavata*, fragmentary specimen with some branches truncated, others retaining terminal expansions.

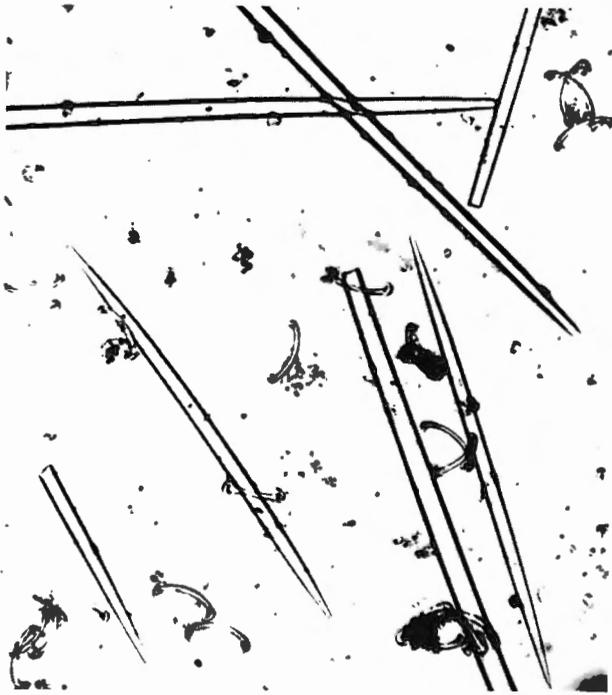


Fig. 2. Spicules of *Chondrocladia clavata*, oxeas and isochelae ( $\times 150$ ).

0.5–1.0 cm long. Three branches retain rounded terminal expansions. Color in life pale gray (gY7/2), texture hard and brittle, surface granular, striated by tangential spicules. No pores or oscules visible. Ectosomal skeleton constituted by tangential styles, endosomal skeleton of irregular spicule fibres. Megascleres styles 508–1560  $\times$  17–28  $\mu$  (1170  $\times$  23  $\mu$ ) and 300–340  $\times$  4.5  $\mu$  (327  $\mu$ ), microscleres unguiferate isochelae 39–80  $\times$  5  $\mu$  (69  $\mu$ ) with stout shaft expanded at each end, and sigmas, 60–89  $\mu$  (78  $\mu$ ) of normal contort form.



Fig. 3. *Chondrocladia clavata*, whole specimen, (after Ridley and Dendy).

REMARKS: This specimen was similar in external form to those described previously except in having expanded tips to some of the branches. In those branches where the terminal knobs have been lost the appearance is identical to that of specimens illustrated by Ridley and Dendy (1887) (Fig. 3) and Levi (1964). Spicule dimensions are comparable in all specimens described except for the fact that Antarctic specimens have occasional megascleres in excess of 2000  $\mu$ . A trend toward production of large megascleres in high latitude populations of wide ranging species has been noted previously by Hentschel (1914a).

*C. clavata* is obviously related closely to *C. antarctica* Hentschel (1914b); the distinction between the species rests on the presence of extremely large sigmas (160  $\mu$ ) and isochelae (112  $\mu$ ) in the latter. Unfortunately Koltun (1966), the only author

to have collected both species, makes no attempt to evaluate the relationship between them.

PREVIOUS DISTRIBUTION: Fiji, 252 m (R and D); Antarctica, McMurdo Sound 342–434 m (Burton); Antarctica, Victoria Land 252–434 m (Koltun); Madagascar 4820 m (Levi).

## ORDER HADROMERIDA TOPSENT

### FAMILY STYLOCORDYLIDAE TOPSENT

Sponges of symmetrical form and stipitate habit invariably found in deep water on soft substrates. The organization of the skeleton is on a weak radial pattern with some axial condensation. Megascleres are styles or oxeas, the latter frequently centrotylote, microscleres if present are oxeote or strongylote.

#### Genus *Stylocordyla* Thompson

*Stylocordyla* Wyville Thomson, 1874, p. 114.

*Oxycordyla* Topsent, 1904, p. 135.

Definition as for the family, *Stylocordyla* being the only valid genus.

#### *Stylocordyla australis* n. sp.

Fig. 4

HOLOTYPE: Dominion Museum Wellington. Dom. Mus. Por. 33.

OCCURRENCE: North of Three Kings Is. 33°58'S, 172°07'E. 252 m. Four specimens.

DESCRIPTION: External form typical for the genus, 4.0 to 8.0 cm high; head 0.8–1.1 cm high, 0.6 to 0.9 cm wide; stalk 0.5 to 1.2 mm diameter. Upper surface of the head flattened, fringed with projecting spicules and bearing a single, central, oscular papilla. Color in life gray (Y 8/2), in spirit white. Texture firm. Skeleton of the stalk composed of compacted, vertically disposed oxeas or strongyles 1500–2400 × 20–35  $\mu$  (1950 × 26  $\mu$ ), skeleton of the head made up of divergent fascicles of oxeas often centrotylote, 620–1200 × 8–13  $\mu$  (780 × 12.0  $\mu$ ) originating at the center of the head and fanning out toward the periphery. Surface skeleton, both vertical and tangential, made up of flexed styles 135–150 × 4.5  $\mu$  (140 × 4.5  $\mu$ ). No heteroxeas, no interstitial microxeas or microstrongyles.

REMARKS: All specimens of the genus *Stylocordyla* are remarkably uniform in external appearance and this has in no small measure contributed to the present difficulties in defining species within the genus. Specimens of *Stylocordyla* from any given collection taken from one location are uniform in spiculation. However, specimens from different collections, even within the same region (e.g. Antarctic North Atlantic), frequently show striking differences in spiculation, differences in size of spicules and variability in the categories of spicules present. However many authors have not described the spicule complement of their specimens, and have merely recorded the occurrence as *S. borealis* (Lovén).

This species, as at present recorded, ranges from Antarctic to Arctic with oc-

currences in the tropics near Brazil and Granada and in temperate regions near Japan, and East Coast of United States (Burton, 1934). *Stylocordyla* normally occurs in depths of over 200 m. Koltun (1966) records specimens from 13 m and one specimen has been taken off the New Zealand coast in 110 m; the great majority of specimens come from depths 600–800 m. Coupled with this deep water habitat the reproductive habits of *Stylocordyla* are such that long range dispersal is not achieved.

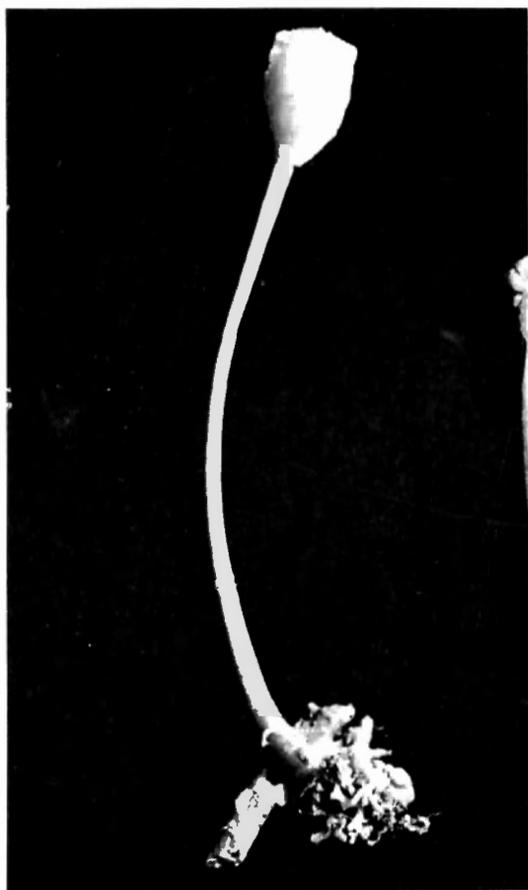


Fig. 4. *Stylocordyla australis* n. sp. Holotype.

*Stylocordyla* incubates young sponges; no free larvae have been observed. These young sponges can probably develop sexually or asexually. Thus, it is unlikely that the variability suggested to occur within *S. borealis* is variability within one species; differences are better recognized as specific differences in a genus where populations are usually confined in deep canyons. In such locations external form is stabilized in response to environment but internal structures can be variable.

In line with this reasoning *S. australis* is described as a distinct species. By

comparison with *S. borealis* (best described by Topsent, 1896), *S. australis* has a simple spiculation, lacking heteroxeas and microxeas, with all spicules substantially shorter and more slender. *S. australis* is closest to *S. irregularis* Henschel from which it differs in lacking microxeas and in having smaller, more slender spicules.

***Stylocordyla borealis* (Lovén)**

Fig. 5

*Hyalonema boreale* Lovén, 1868, p. 105, pl. II, figs. 1–38 (for a detailed synonymy see Burton, 1934, p. 13).

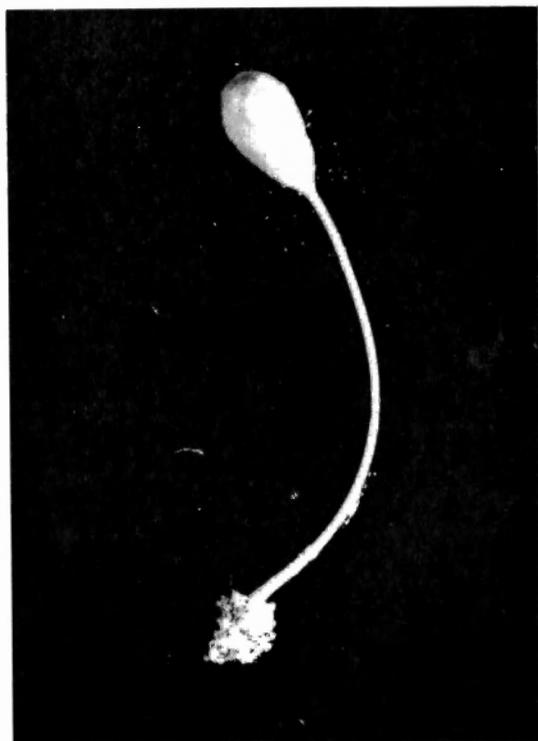


Fig. 5. *Stylocordyla borealis* (Lovén).

**OCCURRENCE:** 45°38'–46°00'S, and 170°58'–171°4'E, 414–900 m. 15 stations, numbers ranging from 3 to 800. Bottom sediment silty sand to gravel sand. Bottom temperature at 420 m 5–6°C.

**DESCRIPTION:** External form typical for the genus. Dimensions 3.0 to 8.0 cm high, stalk 2.5 to 7.0 cm long 0.2 to 1.2 mm thick, head 0.4 to 1.1 cm high, 1.5 to 5 mm wide. Upper surface of the head flattened with a single, central, oscular papilla, no spicule fringe around the head. Color in life and in spirit grayish white (Y-GY 8/2), texture firm. Skeleton of the stalk made up of close packed, vertically disposed centrotylote strongyloxeas or oxeas  $900\text{--}1150 \times 15\text{--}20 \mu$  ( $1057 \times 18 \mu$ ). Skeleton of the head made up of radially disposed bundles of centrotylote oxeas

410–500×7–11 (470×9  $\mu$ ) which fan out below the surface to interdigitate with a continuous layer of small oxeas 130–290×4–5  $\mu$  (240×4.8  $\mu$ ) and heteroxeas 130–250×1.5–2.0  $\mu$  (184×1.6  $\mu$ ). The surface is reinforced by a layer of centrotylote microxeas 50–70×2.0  $\mu$  (62×2  $\mu$ ) disposed tangentially. The same spicules also occur interstitially in no fixed orientation.

REMARKS: *S. borealis* is distinguished from other species of the genus by its full complement of spicule types and by the occurrence of microxeas interstitially as well as superficially.

DISTRIBUTION: It is difficult to be certain of the distribution of *S. borealis* as many authors have recorded the species without comment on the skeleton and thus the records cannot be verified. The species certainly has a bipolar distribution and extends into subarctic and subantarctic regions, and cool temperate seas of both hemispheres.

### *Stylocordyla fragilis* n. sp.

Fig. 6, 7

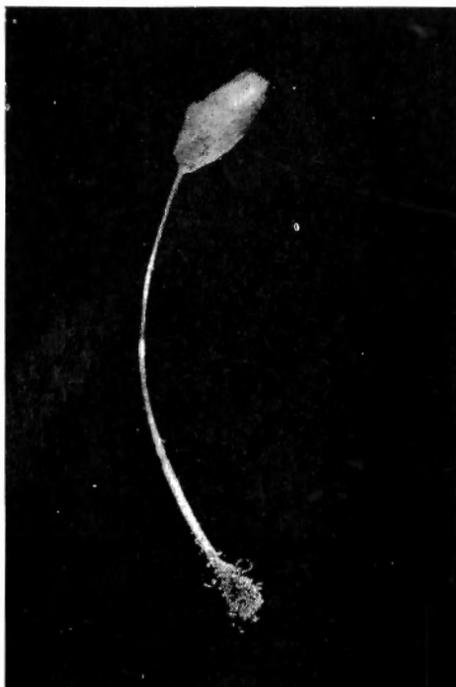


Fig. 6. *Stylocordyla fragilis* n. sp. Holotype.

HOLOTYPE: Dominion Museum Wellington. Dom. Mus. Por. 34.

OCCURRENCE: 2 miles Nth of Alderman Is. 110 m. Fine silt, one specimen.

DESCRIPTION: External appearance typical for the genus. Height 2.9 cm, stalk 2.4 cm high and 0.4 mm wide, head 0.5 cm high and 3.0 mm wide. Upper surface

of the head is a cone surmounted by a single oscular papilla. Color in life and in spirit (Y-GY 8/4) yellowish white. Texture firm. Skeleton of the stalk composed of a solid tract of vertical, often centrotylote oxeas  $580-900 \times 7-9 \mu$  ( $720 \times 8.0 \mu$ ). Skeleton of the head made up of radially disposed tracts of oxeas of two types centrotylote, straight oxeas  $180-270 \times 4 \mu$  ( $240 \times 4 \mu$ ) or heteroxeas  $210-420 \times 3-5 \mu$

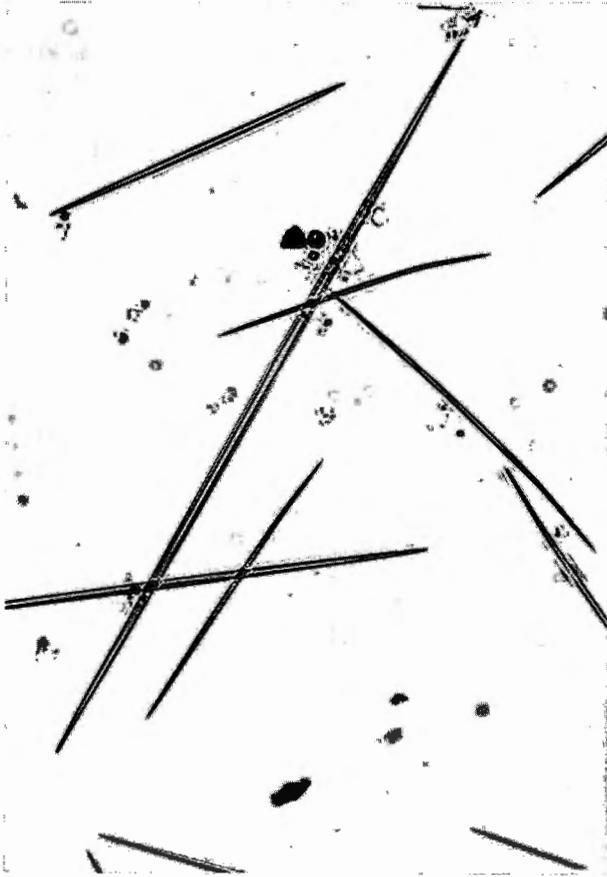


Fig. 7. *Stylocordyla fragilis*. Spicules, oxeas, and heteroxeas ( $\times 150$ ).

( $330 \times 4.5 \mu$ ). Smaller heteroxeas are more abundant at the sponge surface. No special surface spicules, no microxeas, no interstitial spicules, no strongyles, strongyloxeas or styles.

REMARKS: *S. fragilis* is distinguished from other species of *Stylocordyla* by having a skeleton composed entirely of oxeote megascleres. No surface or interstitial microscleres occur. It can be compared with *S. (Oxycordyla) pellita* Topsent from which it differs in having several categories of oxeas.

REPRODUCTION IN *STYLOCORDYLA*

Burton (1928) published a description of reproduction in three "subspecies" of *S. borealis*. While his descriptions are incomplete and some of his assertions are not supported by recorded observations there is no doubt that *Stylocordyla* incubates its developmental stages until they are highly structured young adults. The closest parallel to this behavior is found in *Tetilla* (Sollas, 1888; Bergquist, 1969) and *Tethya* (Hallmann, 1914; Bergquist *et al.*, 1969).

Burton concentrates on the later developmental stages where the embryo takes on a pyriform shape and where spicules, identifiable with adult spicule types, are zoned between future stalk, body and surface regions. At no stage did Burton recognize sex cells in *Stylocordyla* and he assumes from this that these bodies are asexual, originating from aggregations of archaeocytes. It is possible that this is the case.

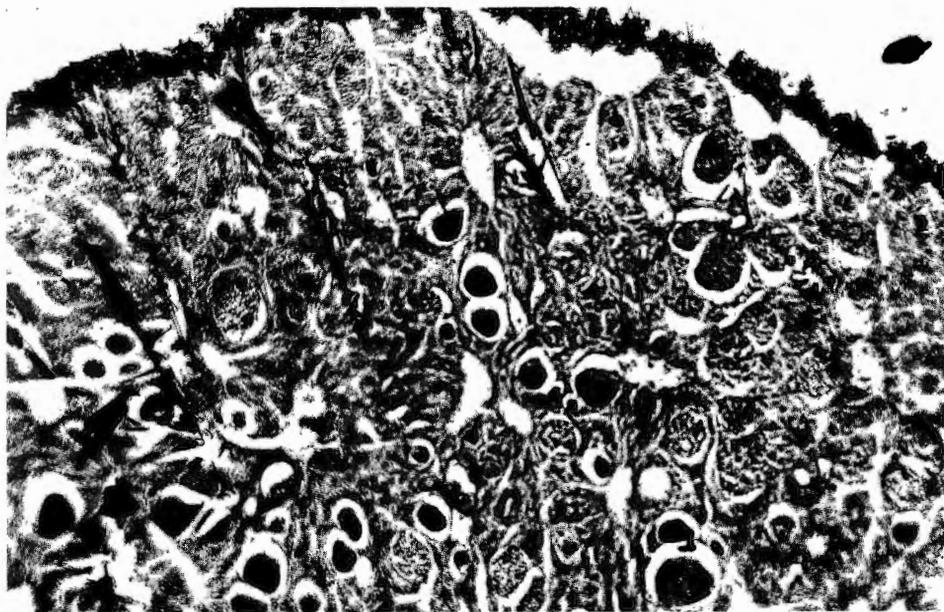


Fig. 8. Developing embryos in *Stylocordyla borealis*. Low power view to show location, abundance, and variation in size. ( $\times 80$ ).

In my material of *S. borealis* two samples taken in August and October and including 30 to 150 individuals, respectively, yielded 80 and 82 percent of specimens with developmental stages. In all specimens which were carefully sectioned, eggs, 12–20  $\mu$  in diameter, are identifiable in small numbers but no sperm is present. Later stages, where nurse cells have aggregated around the egg and been incorporated into the egg cytoplasm, are abundant and appear in most sections as spherical masses of anucleate nurse cells (Fig. 8, 9). Careful observation in most cases reveals egg nuclei (Fig. 10). These stages range from 40–200  $\mu$  in maximum dimensions; the

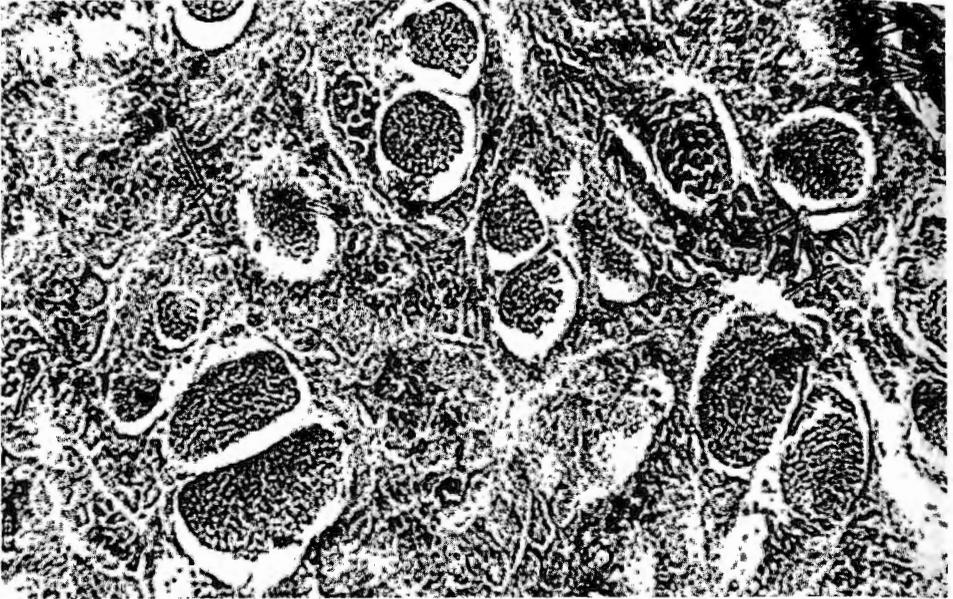


Fig. 9. Development in *Stylocordyla borealis*. Aggregations of nurse cells form around and largely obscure egg nuclei. ( $\times 120$ ).

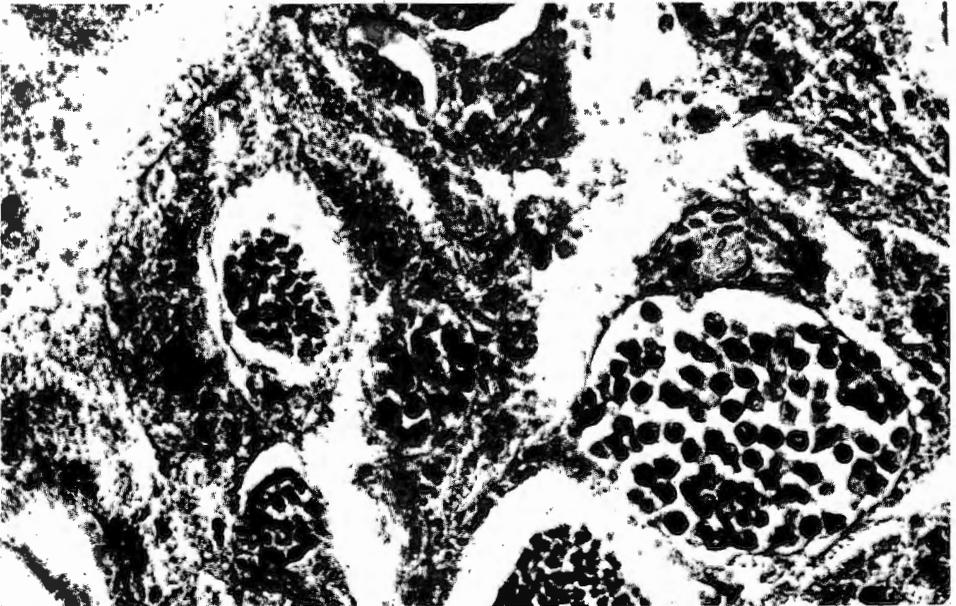


Fig. 10. Development in *Stylocordyla borealis*. Embryo at right shows part of the egg nucleus, below the plane of the nurse cells and more translucent ( $\times 300$ ).

larger aggregations, 150–200  $\mu$ , are beginning to assume a pyriform shape but no spicules are present. (Fig. 11).

It is possible that the developmental stages in my material are of asexual origin with parthenogenetic development proceeding if fertilization fails to occur. It is more likely however that these sponges are hermaphrodite, slightly protandric and self fertilizing and that the development and dispersal of sperm is a very rapid process.

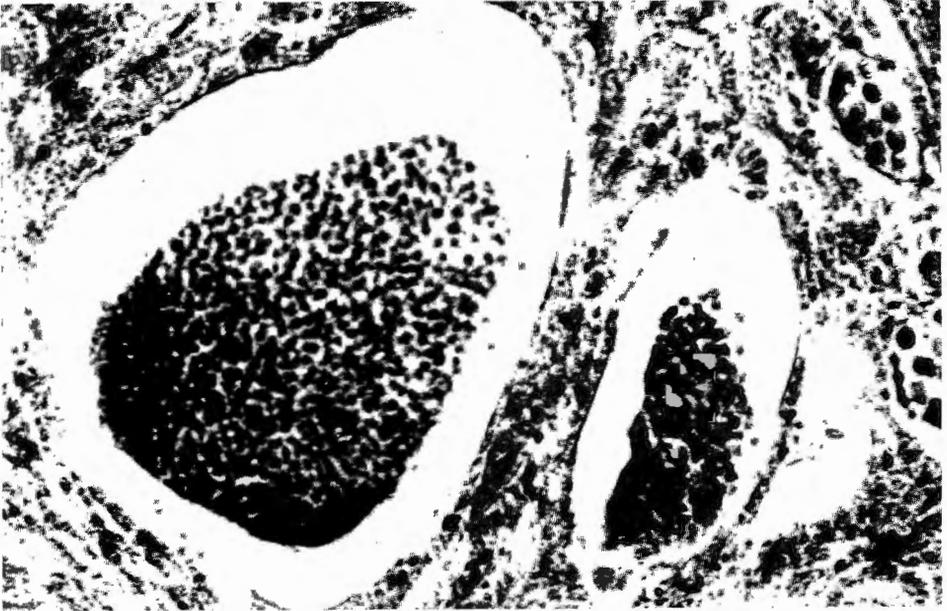


Fig. 11. Development in *Stylocordyla borealis*. Late embryo, showing the pyriform shape. ( $\times 300$ ).

Fertilization has only been observed twice in Demospongiae (Tuzet, 1930) in sponges which could readily be maintained in aquaria. It is of no significance that fertilization has not been observed to occur in the deep water *Stylocordyla*. The fact that the early developmental sequence in my material is comparable to that seen during normal larval production in *Haliclona* (Fell, 1969), *Adocia* (Meewis, 1941), and *Hymeniacidon* (Bergquist *et al.*, 1969) suggests that *Stylocordyla* is reproducing sexually.

Burton (1928) assumes that the developmental stages he observed would develop cilia and, after liberation become free swimming. This is most unlikely. Such highly structured larvae with a full and heavy spicule complement would fall to the bottom, attach, and grow immediately in similar manner to *Tetilla* larvae.

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