Deep-Sea Newsletter 20, 15-18, 1993

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SPONGE SPICULES IN ABYSSAL AND BATHYAL SEDIMENTS OF THE NE ATLANTIC

Siliceous sponge spicules are concurrently mentioned in deep-sea expedition reports as constituents of abyssal and bathyal sediments, although generally comprising only a few percent of the single samples.

Abyssal and lower bathyal depths

In the North Atlantic, a very comprehensive documentation has been given by Murray & Chumley (1924). In 1426 samples, mostly from north of the Equator, they found sponge spicules in 1365 (96%). All the localities were at depths greater than about 200 m, and by far the largest number came from more than 1000 m depth.

Murray & Chumley (1924) mention only few localities north of 50°N, but the results from the Danish Ingolf Expedition 1895-96 support their main views as far as to 70°N. Boeggild (1900) found in the *Ingolf* material that out of the 143 stations taken, samples from 90 (63%) contained sponge spicules; of the 80 stations taken deeper than 1000 m, 64 (80%) contained spicules.

Dahl et al. (1976) mentioned "fairly large quantities of sponges, especially in the trawl samples from the Greenland basin", taken by the NORBI Expedition; most of these are spicule masses and dead skeletons (Tendal, unpubl.). In the report from the Norwegian North-Atlantic Expedition 1876-78 Schmelck (1882) stated that at depths greater than about 1800 m "most of the samples were found to contain delicate spicules of sponges"; the expedition worked in the whole area east of the island of Jan Mayen, from West Spitzbergen to the Norwegian coast. Barthel et al. (1991) found spicules in all sediment samples from bathyal and abyssal depths off West Spitzbergen. During the YMER-80 Expedition spicule masses and dead skeletons were taken at 1000-3900 m in the Nansen Basin of the Polar Sea (Tendal, unpubl.). Our general observations during several cruises with the "Håkon Mosby" (University of Bergen) indicate that siliceous sponge spicules are common in abyssal samples from the Iceland Sea and parts of the Norwegian Sea.

The taxonomic identity of the spicules is stated for only few of the samples mentioned in the literature. In broad terms spicules from abyssal depths south of the Scotland-Faroes-Iceland-Greenland Ridge complex seem to come from hexactinellids, as do most of those found in the Iceland, Greenland and Polar Seas, while those from the Norwegian Sea and the area off West Spitzbergen appear to be mostly from choristids and other demosponges.

Upper bathyal and lower shelf depths

Here, sponge spicules have been found in the sediments of many places in the NE Atlantic, the amount varying from loose single spicules to mass occurrences, sometimes forming felt-like layers. Reports on mass occurrences so far are very scattered, and the taxonomic identity is not always stated: Off Mauretania, 800-900 m, hexactinellids (Lutze & Thiel 1989); Porcupine Seabight, 1000-1300 m, hexactinellids (Bett et al. 1992; Bett & Rice 1992; Rice et al. 1990); off Scotland, 800 m, hexactinellids (Thomson 1870); between Scotland and the Faroes, 700-1000 m, hexactinellids (Schulze 1882); several places around the Faroes, 300-900 m, choristids (our observations); north of the Faroes, 890-1300 m (Boeggild 1900); north of Iceland, 500 m, demosponges (our observations); southwest of Iceland, 1000-1200 m, hexactinellids (our observations); south of Iceland, 1200 m, demosponges (our observations); between Iceland and Greenland, 220-365 m (Boeggild 1900); all the way from Spitzbergen to western Norway, roughly between 900 and 2000 m, Schmelck (1882) found what he called "transition clay".... "which is absolutely interwoven with these minute silicious needles, so that, on touching the dried bottom sample, the hand gets covered with them."; several places along the edge of the Norwegian Trough, 500-700 m (T. Brattegard, pers. comm.); Tromsøflaket off northern Norway, 280 m, demosponges (Könnecker 1989); off Finmark up to 70°N, about 200-400 m (Schmelck 1882, Rezvoj 1928, Zenkevitch 1963); off West Spitzbergen, 400 m downwards (Schmelck 1882; demosponges, Barthel et al. 1991); north of Spitzbergen, 650-1000 m, hexactinellids (Schulze 1900, Hentschel 1929).

Autochthonous and allochthonous spicule deposition

It is our impression that at abyssal depths the spicules set free after the death of the sponges are mainly deposited locally. One example is extensive beds of *Caulophacus* (Hexactinellida) stalks and loose spicules in the deepest parts of the Greenland Sea, where the sponge is abundant. Another is stalks of *Hyalonema* (Hexactinellida) commonly dredged in some areas of the abyssal plains of the North Atlantic.

Along the continental slope, downward transport of spicules can be caused by currents, resuspension and sediment gliding. Local topography and hydrographic events define the spreading pattern. An example is from the Faroes, where in some places choristid sponges are found at about 250 m depth on gravel, and spicules of choristid types occur as thin mats on the soft sediment only few km away at 350-400 m depth (own observations). A second example is from between Spitzbergen and Björnøya, where large amounts of sediment are transported away from land into the deep Norwegian Sea, probably by cascading of very cold water from the Barents Sea shelf. Choristid and other demosponge spicule types are here found very far at sea, at depths where the sponges in question do not live (Barthel et al. 1991) (Fig. 1). If in such cases recognizable spicules are abundant and the distribution of sponges living in the area is known, the occurrence of the spicules can be taken as an indication of the direction and distance of the sediment transport.

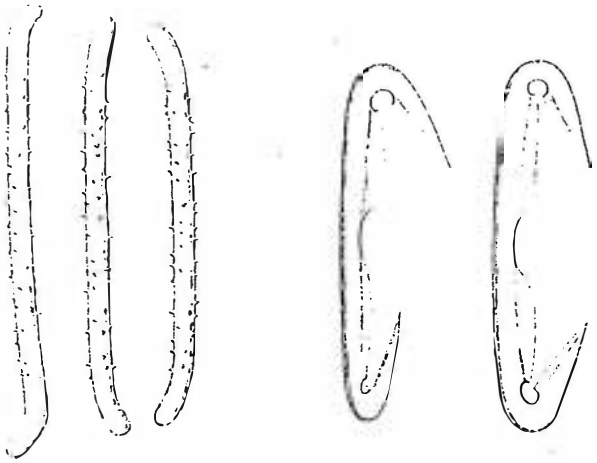

Figure 1. Examples of spicules found at 2500 m depth off Björnøya.

Left: macroscleres (skeleton spicules), 200-240 µm long, from Metschnikowia spinispiculum *Carter, 1876. The species is known from the western Barents Sea at about 200 m depth.*

Right: microscleres (free spicules), 140-200 µm long, from Hamacantha *sp.* Hamacantha *has not been taken in the area, but in the southwestern Barents Sea down to about 360 m.*

Ecological importance

Where sponge spicules occur in large masses, and particularly where they form thick coherent mats, they have a profound effect on the physical properties of the bottom and on the composition of the local fauna (Barthel 1992, Barthel & Gutt 1992).

In localities where spicules are abundant, but do not form coherent mats, their biological impact is more difficult to assess. They seem to give the bottom a loose structure, making it easier for small organisms to find space. One might also expect the activities of larger mud eaters and burrowers to be influenced. A certain vertical sorting and concentration of spicules in distinct layers is sometimes seen in box cores, and may be caused by bioturbation (J. Rumohr, pers.comm.).

For some foraminifers sponge spicules are a suitable substrate (Jumars & Eckman 1983, Lutze & Thiel 1989), while others use spicules from the sediment as material for their agglutinated tests (examples are found in: Christiansen 1958, 1964 and Heron-Allen & Earland 1912). There are also cases of use of sponge spicules for more special purposes, such as expanders for the pseudopodial network (Lutze & Altenbach 1988). Certain sponges use foreign spicules instead of own spicules in their skeleton fibers, and in such cases spicules of many different origins can be found together (Barthel et al. 1991).

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