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GEMMULAE OF *EUNAPIUS FRAGILIS* (LEIDY, 1851) (PORIFERA: SPONGILLIDAE) FROM A HOLOCENE FRESHWATER DEPOSIT AT BEVEREN-WAAS NEAR KALLO (BELGIUM)

by

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Texel

Cadée, G. C. Gemmulae of *Eunapius fragilis* (Leidy, 1851) (Porifera: Spongillidae) from a Holocene freshwater deposit at Beveren-Waas near Kallo (Belgium), - Meded. Werkgr. Tert. Kwart. Geol., 16 (3): 123 - 127, 1 pl., Rotterdam, September 1979.

Fossil gemmulae are described which could be identified with the Recent *Eunapius fragilis* (Leidy, 1851) on base of the crustlike development and form of the gemmulae and the form of gemmoscleres and megascleres.

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Contents:

INTRODUCTION

Several months ago I received a tube with fossils from Mr. A. W. Janssen (RGM, Leiden) collected by him from a Holocene freshwater deposit at Beveren-Waas near Kallo, Belgium. These fossils have puzzled me for a long time, but at last I found some figures of gemmulae of a freshwater sponge, which were identical with these fossils. The presence of sponge spicules was a further proof.

The great majority of the ca 5.000 species of living sponges is marine. Only about 150 species occur in freshwater, most of these belong to the Spongillidae. A revision of the Spongillidae was given by Penney & Racek (1968). Data on their biology can be found i.a. in Wesenberg-Lund (1939), Redeke (1948), Pennak (1953) and Fry (1970).

The formation of gemmulae (highly resistent resting stages) is a characteristic feature of the Spongillidae, although not restricted to these freshwater sponges as de Laubenfels (1955, p. 23) states: gemmulae were reported also for some marine sponges (Ott & Volkheimer, 1972, p. 61; Fell, 1974).

Gemmulae are roughly spherical and range in size from 0.15 to 1 mm. They are frequently formed at the end of the growing season: autumn in our latitude, at the end of the rainy season in the tropics. Gemmulae consist of an outer wall of several layers of dead chitinous material in which spiculae (gemmoscleres) are imbedded which differ in size and form from the normal spiculae. Inside the gemmulae dormant living cells occur which germinate under favourable conditions and give rise to a new sponge colony. Gemmulae can resist dryness and high as well as low temperatures. Mergner (1970) cites examples from the literature. Gemmulae were kept dry for 30 years and were still able to germinate. Some were kept for 4 days at -20°C others for up to 8 years at +2°C and still a number of these germinated. They are comparable to the statoblasts formed by freshwater Bryozoa.

Gemmulae may be formed as a basal layer in the colony or scattered throughout the colony, they may remain attached to the substrate or become free in which case they may rise to the surface or sink to the bottom.

Form and size of spiculae and gemmoscleres vary with variations in environmental factors as proved experimentally by Poirrier (1974) for *Ephydatia fluviatilis* L.; this demonstrates the difficulty in using spiculae and gemmoscleres for the recognition of species.

SYSTEMATIC PART

Phylum PORIFERA
Classis DEMOSPONGIA
Ordo HAPLOSCLERIDA
Familia SPONGILLIDAE
Genus *Eunapius* Gray, 1876

Eunapius fragilis (Leidy, 1851)
Plate 1, fig. 1 - 4

1851 *Spongilla fragilis* Leidy p. 278
1909 *Spongilla fragilis* - Weltner p. 183, figs.
1928 *Spongilla fragilis* - Arndt p. 60, figs. 66 - 69
1968 *Eunapius fragilis* - Penney & Racek p. 25, pl. 3, fig. 1
1974 *Eunapius fragilis* - Racek p. 140, fig. 1 d-e

Material: several fragments of gemmula groups, only some encrusting wood or shell fragments, RGM 222 427 - 222 430.

Locality: Beveren-Waas, province of E. Flanders, Belgium. North side of excavation for tunnel under first 'Kanaaldok'. Basal layer of gully-filling. Coordinates: x = 143,3 ; y = 217,5. Map sheet 15/1-2.

Age: Holocene, 5,750 ± 40 yr B.P. (^{14}C det. Groningen; GrN-7898).

Remarks: The gemmulae compare very well with description and figures given by Weltner and Arndt. The gemmulae form one layer thick crusts. Most gemmulae do not show the typical tubular extension of the gemmula opening, but in one fragment they are well preserved, apparently due to the fact that they are protected in an invagination of the crust. In the other fragments they are most probably eroded. In regular parts of the crust each gemmula is surrounded by 6 others, in irregular parts this number varies. Irregularity also effects a large variation in the distance between the pores (average 378 μm, standard deviation 63 μm, n = 25). The size of the gemmulae is 345 μm on average, standard deviation 39 μm (n = 25). The diameter of the aperture is c. 25 μm.

A mount of gemmoscleres was prepared by boiling some gemmulae in nitric acid on a slide over a flame (Pennak, 1953). Organic matter is destroyed by only this method; the silicious spicules remain. The gemmoscleres were embedded in Clearax (refr. index 1.67). The gemmoscleres compare well with figures given by the above mentioned authors, their size falls within the range given by Penney & Racek (1968) of 75 to 140 μm. The mount also contained a few megascleres which are larger than the gemmoscleres, smooth and sharply pointed at both ends.

THE FOSSIL RECORD OF THE SPONGILLIDAE

Fossil gemmulae are seldom reported in the literature. Wesenberg-Lund (1939, p. 382) mentions gemmulae together with other chitinous organic remains (statoblasts of freshwater Bryozoa, cocons of Planaria, Oligochaeta and Hirudinea; Daphnia-ephippia) from Danish Post-Glacial peat deposits. Ott & Volkheimer (1972) discovered well preserved freshwater spongillids with gemmulae in a lacustrine Cretaceous deposit in Patagonia. This was the first paleontological evidence of the Mesozoic occurrence of gemmulae-producing freshwater Porifera (see also Racek & Harrison, 1975). The preservation of this Cretaceous *Palaeospongilla* was due to the fact that the colonies were, apparently rapidly, overgrown by calcareous blue-green algae. No other fossil gemmulae are reported in the literature.

Spicular remains of freshwater Porifera have been recorded from a number of freshwater deposits of Tertiary age (see Racek & Harrison, 1975 for references). According to de Laubenfels (1955) the fossil record of the Spongillidae dates even back to the Jurassic.

The poor fossil record of gemmulae led me to publish this discovery of gemmulae in Beveren-Waas by Mr. A. W. Janssen. If gemmulae are better known they might be encountered more. Other spongillids do not produce basal crusts of gemmulae, but the individual gemmulae are scattered through the colony. They will therefore occur not as crusts but solitary in the sediment. Peat and peat-like deposits probably give the best possibilities for preservation of gemmulae and other chitinous organic remains as reported by Wesenberg-Lund (l.c.).

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REFERENCES

Arndt, W., 1928. Porifera, Schwämme, Spongien. - Die Tierwelt Deutschlands und der angrenzenden Meeresteile, 4: 1 - 94.

Fell, P. E., 1974. Diapause in the gemmules of the marine sponge Haliclona loosanoffi, with a note on the gemmules of Haliclona oculata. - Biol. Bull., 147: 333 - 351.

Fry, W. G., 1970. The biology of the Porifera. - Symposia zool. Soc. London, 25. London (Acad. Press), 512 pp.

Laubenfels, M. W. de, 1955. Porifera. In: R. C. Moore (edit.) Treatise of invertebrate paleontology, part E. Kansas (Kansas Univ. Press) 122 pp.

Leidy, J., 1851. Spongilla fragilis. - Proc. Acad. Nat. Sci. Philad., 5: 278.

Mergner, H., 1970. Ergebnisse der Entwicklungsphysiologie bei Spongilliden. In: W. G. Fry (edit.) The biology of the Porifera. - Symposia zool. Soc. London, 25: 365 - 397.

Ott, E. & W. Volkheimer, 1972. Palaeospongilla chubutensis n.g. et n.sp. - ein Süsswasserschwamm aus der Kreide Patagoniens. - N. Jb. Geol. Paläont. Abh., 140 (1): 49 - 63.

Pennak, R. W., 1953. Freshwater invertebrates of the United States. New York (Ronald Press Co.), 769 pp.

Penney, J. T. & A. A. Racek, 1968. Comprehensive revision of a worldwide collection of freshwater sponges (Porifera; Spongillidae). - Bull. U. S. Nat. Mus., 272: 1 - 184.

Poirrier, M. A., 1974. Ecomorphic variation in gemmoscleres of Ephydatia fluviatilis Linnaeus (Porifera: Spongillidae) with comments upon its systematics and ecology. - Hydrobiologia, 44 (4): 337 - 347.

Racek, A. A., 1974. The waters of Merom: a study of Lake Huleh IV. Spicular remains of freshwater sponges (Porifera). - Arch. Hydrobiol., 74 (2): 137 - 158.

Racek, A. A. & F. W. Harrison, 1975. The systematic and phylogenetic position of Palaeospongilla chubutensis (Porifera: Spongillidae). - Proc. Linn. Soc. N. S. Wales, 99 (3): 157 - 165.

Redeke, H. C., 1948. Hydrobiologie van Nederland. De zoete wateren. Amsterdam (De Boer), 580 pp.

Weltner, W., 1909. Spongillidae, Süsswasserschwämme. - Die Süsswasserfauna Deutschlands, 19: 177 - 190.

Wesenberg-Lund, C., 1939. Biologie der Süsswassertiere. Wien (Springer), 817 pp.

Explanation of plate I.

Eunapius fragilis (Leidy, 1851) from a Holocene freshwater deposit at Beveren-Waas near Kallo (Belgium).

Fig. 1. Gemmulae on a woodfragment, 16x. Coll. RGM 222 428.

Fig. 2. Gemmulae on a shell, *Radix (Radix) peregra* (O. F. Müller, 1774), 16 x. Coll. RGM 222 429.

Fig. 3. Gemmoscleres, 560 x. Coll. RGM 222 430.

Fig. 4. Megasclere amongst gemmosclere fragments, 230 x. Coll. RGM 222 430.

Verklaring van plaat I.

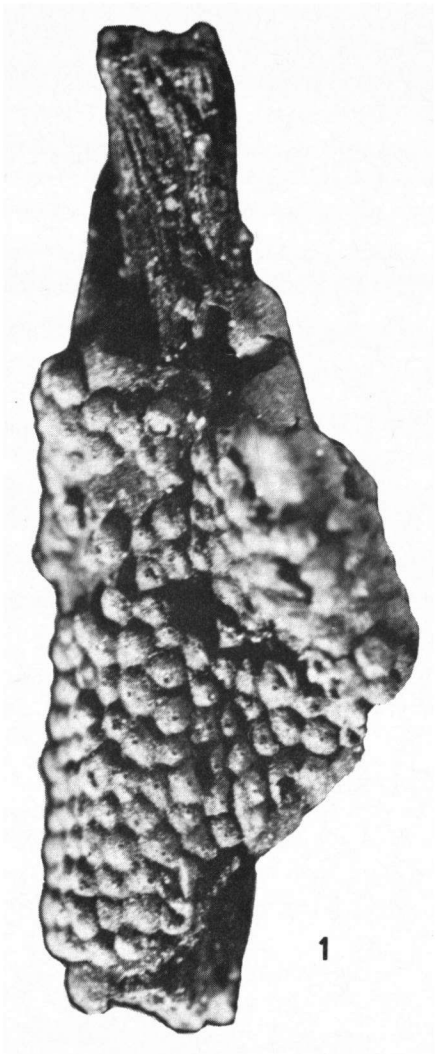
Eunapius fragilis (Leidy, 1851) uit een Holocene zoetwaterafzetting te Beveren-Waas bij Kallo (België).

Fig. 1. Gemmulae op een houtfragment, 16 x. Coll. RGM 222 428.

Fig. 2. Gemmulae op een schelp van *Radix (Radix) peregra* (O. F. Müller, 1774), 16 x. Coll. RGM 222 429.

Fig. 3. Gemmoscleren, 560 x. Coll. RGM 222 430.

Fig. 4. Megasclera te midden van fragmentaire gemmoscleren, 230 x. Coll. RGM 222 430.



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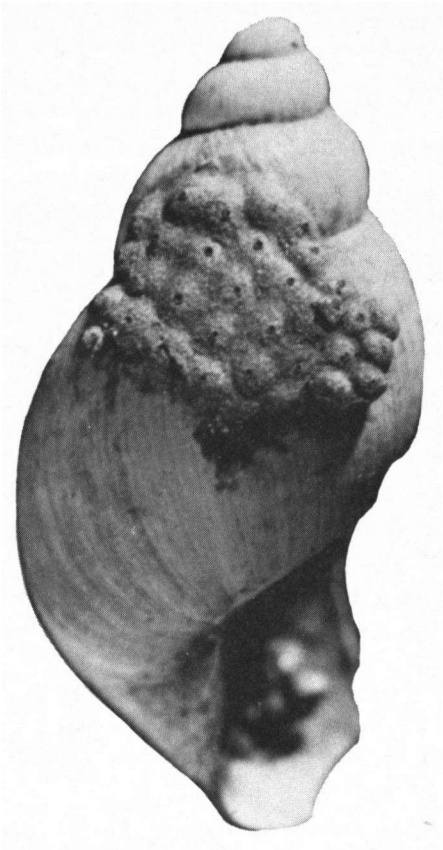

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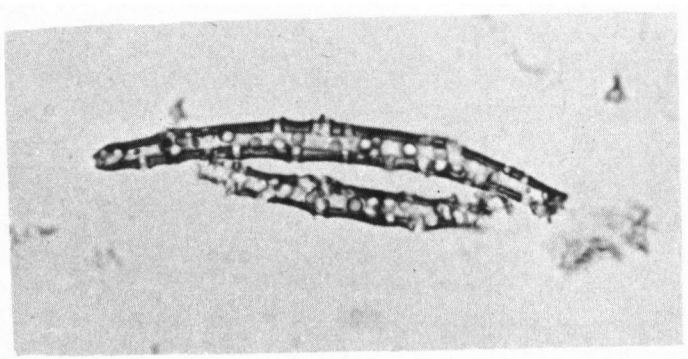

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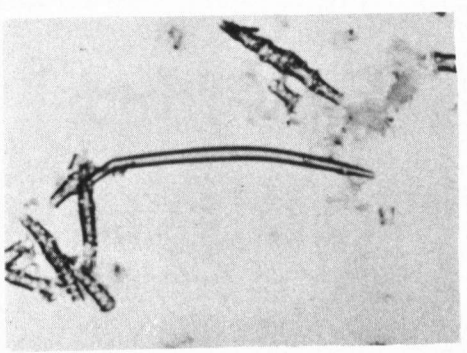

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