

SILICEOUS SPONGE SPICULES OF PENNSYLVANIAN AGE FROM ILLINOIS AND INDIANA*

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Those sponges which are subject to fossilization under any but the most exceptional circumstances possess a true skeleton composed of spicular elements secreted by the animal itself. These spicules are composed of either a hydrated form of amorphous silica allied to opal, or calcite, in each case with a slight admixture of organic matter. Most of the fossil sponges which have been described from American strata of Paleozoic age are forms in which the spicules are joined to form a rigid framework or cemented together into a series of anastomosing fibers. The skeletons of such types have commonly not become disintegrated after the death and decomposition of the animals that formed them and consequently have been preserved as fossils in a more or less complete condition.

Other sponges which occur equally, if not even more abundantly, possess numerous unconnected siliceous spicules bound together into a flexible skeleton by an organic substance known as spongin. This material readily decomposes after the death of the sponge and the spicules are loosened and scattered upon the sea bottom. Fossil remains of such sponges other than the isolated spicules are of very rare occurrence.

It has long been known that a large part of the silica composing cherts in the Paleozoic limestones was derived from the remains of sponges. Apparently, however, the skeletons of these organisms are unusually subject to attack and alteration by ground water so that few localities are known when they are well preserved. The minute structure of those sponges which possessed ridged skeletons is very rarely preserved. In most cases it is necessary to classify them on the basis of external form only and in many cases it is not known with certainty whether their skeletons were originally calcareous or siliceous. The minuteness of the skeletal elements of those sponges which possessed unconnected siliceous spicules has rendered them inconspicuous and their presence has doubtlessly been commonly overlooked. The classification of these forms also is attended with great uncertainty as peculiar-

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ities in form and shape of isolated spicules are the only features upon which it can be based.

The only notice of siliceous sponge spicules of Pennsylvanian age in America was published by Ulrich who proposed names for one new genus and two new species on the basis of material collected from the limestone cap-rock of the Rock Island (No. 1) coal at Seville, Fulton County, Illinois.

The spicules listed below were obtained from the limestone cap-rock of the Rock Island (No. 1) coal exposed in the southwest corner of sec. 25, T. 17 N., R. 1 W., Rock Island County, Illinois, and from a limestone occurring low in the Pennsylvanian section near the center of the N. $\frac{1}{2}$ sec. 35, T. 21 N., R. 9 W., Warren County, Indiana. The limestones at both of these localities are dense, dark colored and impure. The occurrence of silicified fossils such as bryozoa and small gastropods at these places attracted particular attention and the sponge spicules were discovered in the insoluble residues obtained by treating fragments of the rock with hydrochloric acid. It is probable that the silica which has replaced the calcium carbonate of the other fossils was derived from sponge spicules but silicification is very unequally developed.

These sponge spicules are of interest on account of their comparatively large size and robust form which is exceeded by few Carboniferous spicules known from other parts of the world. None of the smaller types of spicules which are present in the bodies of most modern sponges have been found. It is probable that these were destroyed by those processes which have been responsible for the alteration of the larger spicules to crystalline silica. The assemblage of forms obtained from the two localities is also interesting because of the abundant presence of hexactinellid remains. In the modern seas these forms are confined almost exclusively to the deeper waters. The nature of the deposits in which the fossil spicules occur and the associated fauna, however, indicate clearly that representatives of this order formerly inhabited very shallow seas.

Following is a list of species of Porifera recognized:

Class SILICISPONGIA

Order MONACTINELLIDA

Genus RENIERA Schmidt

Reniera arca n. sp. Smooth cylindrical spicules, considerably curved. Length 1.8 mm. Thickness .13 to .22 mm. Warren County, Indiana.

Reniera siliqua n. sp. Similar to *R. arca* but less curved. Rock Island County, Illinois.

Reniera phaseola n. sp. Curved cylindrical spicules .45 mm. in length and .08 mm. in thickness. Ends sometimes slightly inflated. Rock Island County, Illinois.

Order TETRACTINELLIDA

Genus GEODITES Carter

Geodites pateus n. sp. Spicules composed of tapering shaft ray 4 mm. in length and .16 to .22 mm. in greatest thickness and three diverging head rays .3 to .4 mm. long. Associated with cigar-shaped monaxons up to 5 mm. in length. Warren County, Indiana.

Geodites carbonaria (Ulrich). Similar to *G. pateus* but more delicate and shaft rays do not taper. Associated with similar monaxons. Rock Island County, Illinois.

Geodites sp. A single broken spicule resembling *G. carbonarius* except that the one remaining head ray is angularly deflected at mid-length nearly parallel to the shaft. Rock Island County, Illinois.

Geodites? deflecterus n. sp. Anchor-like spicules composed of slender shaft ray and three small recurved head rays. Warren County, Indiana.

Geodites? bifurcatus n. sp. Spicule composed of shaft ray and three head rays which are symmetrically bifurcated. Warren County, Indiana.

Order HEXACTINELLIDA

Group Lyssakina

Genus HYALOSTELIA Zittel

Hyalostelia diabolus n. sp. Very variable spicules one or more of whose rays are inflated to produce irregular or bulbous ends. Rock Island County, Illinois.

Genus RHAKISTELLA n. gen.

Rhakistella alba n. sp. Symmetrical spicules characterized by small equally sized and spaced spines. One or more of the rays may bifurcate. Rock Island County, Illinois and Warren County, Indiana.

Hexactinellida delicatula (Ulrich). Spicules variable and commonly somewhat distorted. Rays long and slender to short and acute. Associated with coarse broken monaxial fragments which are believed to have been derived from the root-tuft of this species. Rock Island County, Illinois.

Order HETERACTINELLIDA

Genus ASTERACTINELLA Hinde

Asteractinella audax n. sp. Variable spicules composed of numerous unequal rays, irregularly arranged, attaining a size of 4 mm. The spicules of the surface zone are more or less intergrown. Warren County, Indiana.

Genus THOLIASTERELLA Hinde

Tholiasterella? trunca n. sp. Spicule composed of a slender shaft ray and six short head rays lying nearly in a plane at right angles to the shaft. Warren County, Indiana.

Class CALCISPONGIA

Family Pharetrones

Genus PERONELLA Zittel

Peronella? dubia n. sp. Three slightly curved rays extend nearly in a plane and a fourth at right angles. Preserved in silica possibly due to alteration of original material. Warren County, Indiana.

INCERTAE SEDIS

Monaxial spicules attaining maximum length of 6.5 mm. and thickness of .2 mm. They are slightly sinuous and acutely pointed at both ends. Such spicules are not characteristic of any particular type of sponge. Rock Island County, Illinois and Warren County, Indiana.