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Cretaceous Algal Stromatolites from Kokura, Kitakyushu City, Japan

By

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The Wakino Subgroup of the Kanmon Group is distributed in and around the hilly land in the southern part of Kokura, Kitakyushu City. The uppermost member of the subgroup consists of mudstone, tuff and sandstone. On the basis of *Estheria*, *Diplomystus* and other fossils contained therein, this member has been defined as a Cretaceous fresh-water deposit in some published reports (Kusumi, 1960; Ota, 1953). Fossil fish from this member was reported by Professor Yoshihisa Ohta (Fukuoka Gakugei University) in 1957. In order to confirm the fossil locality, the cliff exposed at 200 m west of the main gate of the former Yamada ammunition depot was excavated in 1976 by Mr. Takashi Sotsuka (Kokura High School), Dr. Masamichi Ohta (Akiyoshidai Science Museum) and others. In the excavation numerous fossils of fish, *Estheria*, etc., were obtained. Some fossils were apparently algal stromatolites, and part of them were offered to the writer from Mr. Sotsuka through Dr. Yoshikazu Hasegawa of the National Science Museum. Before proceeding with the present report the writer wishes to extend his sincere thanks to Mr. Takashi Sotsuka and Dr. Masamichi Ohta who kindly helped the writer in the field and provided the material for study, and to Dr. Yoshikazu Hasegawa for his valuable assistance in facilitating this study.

Finely stratified calcareous crusts or calcareous bodies of various shapes having a lamina structure have been called algal stromatolites or pisolites. By the difference in their general form or growth form and by the different geologic ages, they have been given a large variety of names as shown in the following list. Such forms are known from the remote Precambrian to the Recent. But each of the names is a so-called form genus lacking the data indicative of algal origin.

Actinophycus Korde, 1954	Up. Cambrian-Low. Ordovician
Anomalophycus Fenton and Fenton, 1906	Up. Cambrian-Low. Ordovician
Aphrostoma Gurich, 1906	Mississippian (Visean)
Archeozoon Matthew, 1890	Precambrian
Artophycus Johnson, 1937	Low. Pennsylvanian
Aulophycus Fenton and Fenton, 1937	Up. Cambrian
Calyptophycus Johnson, 1937	Low. Pennsylvanian
Chondrostoma Gurich, 1906	Mississippian
Codonophycus Fenton and Fenton, 1939	Mississippian

Collenia WALCOTT, 1914	Precambrian-Silurian
Collenella JOHNSON, 1937	Low. Pennsylvanian
Conophyton MASLOV, 1937	Cambrian
Coppelia WALCOTT–MASLOV	Cambrian
Cryptozoon MASLOV, 1937	Precambrian-Permian?
Dictophycus KORDE, 1954	Up. Cambrian
Dolatophycus FENTON and FENTON, 1937	Cambrian
Gouldina JOHNSON, 1940	Low. Pennsylvanian
Gymnosolen STEINMANN, 1911	Precambrian
Leptophycus JOHNSON, 1937	Low. Pennsylvanian
Malacostroma GURICH, 1906	Mississippian-Permian
Nematophycus KORDE, 1954	Up. Cambrian
Onchobyrsella JOHNSON, 1937	Oligocene
Osagia TWENHOFEL, 1919	Low. Permian
Ottonosia TWENHOFEL, 1919	Low. Permian
Poecilophycus KORDE, 1954	Up. Cambrian
Pycnostroma GURICH, 1906	Mississippian-Permian
Shermanophycus JOHNSON, 1940	Low. Pennsylvanian
Somphospongia BEEDE, 1899	Low. Permian
Spongiostroma GURICH, 1906	Devonian-Pennsylvanian
Spongophycus KORDE, 1954	Cambrian
Stereophycus KORDE, 1954	Up. Cambrian

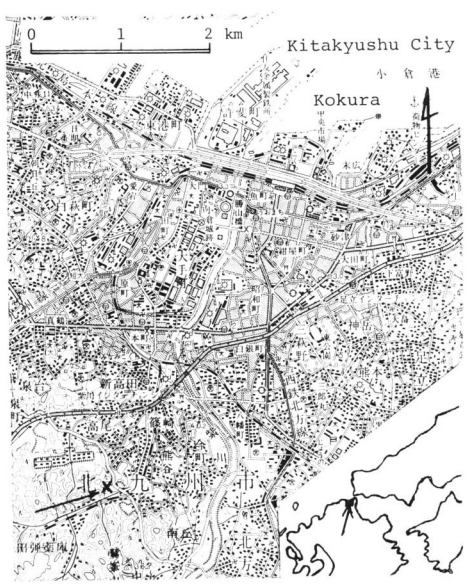

Fig. 1. Map showing the fossil locality at Kokura, Kitakyushu City.

Stylophycus JOHNSON, 1940	Low. Pennsylvanian
Tetonophycus FENTON and FENTON, 1939	Up. Cambrian
Thaumatophycus KORDE, 1950	Up. Cambrian
Weedia WALCOTT, 1914	Up. Cambrian

Opinions were diverse on their origin also, because their microstructure remains unknown. Some scholars have assigned them to an organic origin, while others insist on an inorganic origin. In the past they have repeated various opinions and doubt has been expressed as to whether they were really of organic origin (CLOUD, 1942, p. 363.) However, the recent work of LOGAN, REZAK and GINSBURG (1964) advocated a new classification of algal stromatolites founded on the arrangement of lamina and from the observation on the modern algal stromatolites. According to their studies, such forms are being developed to day by many of lower type of algae. In the course of the study of the specimens from Kokura, the writer was inclined to believe that some of them, aside from the Precambrian ones, are organic. It is

Fig. 2. Detailed sketch of the same specimens shown in Plate 3, figs. 2 and 3.

possible that certain species of low order algae—blue-green algae, for example—came to form the organo-sedimentary structure characteristic of organic origin, according to the condition of their habitat. Mucous secretion from the cells of some Cyanophyceae might have captured calcareous silt or mud and fixed it to make a calcareous film or thin layer, and on this layer the algae grew again, resulting in the next layer. The lamina structure is probably a product of the repetition of this process. In other words, formation of the lamina structure is related to the growth stage or to seasonal or annual variation of the algae.

On the Specimens from Kokura

The algal stromatolites were found adnate to pale-green siltstone. The lamina is not macroscopic so as to be easily recognized in the field. The weathered surface reveals aggregation of globular, subglobular or oval colonies which are generally smooth (Plates 1 and 2) but some are slightly erumpent. Each colony is 4 to 6 mm across and 3 to 5.3 cm high. The colonies are 3 to 4 mm apart from each other, and the interspaces are filled with silt.

In the polished longitudinal section the stromatolites are deep-black and are clearly distinguished from the pale-green substratum. The stromatolites are sticking together at the base but they get apart upward like fingers and then stick to each other again, expanding on the whole in a radial manner or a fan shape. Very gently curving minute arched layers constituting the lamina structure are observed well with the naked eye. The space between laminae is 0.3 to 0.5 mm, never exceeding this range. The lamination is thus very regular and fine. It was formed most likely in a calm environment of a very shallow water. (See PERYT, in FLUGEL's Fossil Algae, 1977, F. 13)

Depository: Illustrated specimen NSM-PP 15632

Algal stromatolite is one of the major organo-sedimentary structures that are found in all geologic times. Most of the specimens hitherto reported as algal stromatolites are Precambrian to Paleozoic in age.

In Japan there are the reports by KONISHI (1959, 1967) of Kanazawa University and by KOBAYASHI (1936) of the University of Tokyo. The specimens examined by the writer are entirely different in many points from those recorded in the past, and are probably assigned to a new genus, but the writer will reserve the assignment until some future time when more materials become available. The characteristics of the specimens are as follows:

1. The relation of the stromatolite to the substratum is distinct. 2. The laminae are fine and regular, and are very gently arched. 3. Most of stromatolites reported in the past are marine, but the present specimens are of fresh-water origin. 4. Their age is Neocomian of Early Cretaceous. This is the first record of stromatolites of this age. Younger ones were reported by JOHNSON (1937), as exemplified by Onchobyrsella from the Oligocene which bears close resemblance to the present specimens but

the lamina is steeper and the colonies differ in size.

Although the writer cannot confirm cell or tissue to prove the specimens to be algae, he considers that they are stromatolites of algal origin, not produced by mechanical or chemical causes, because some living algae of low order show the growth type very similar to this one. Necessity of a sufficient comparative study of fossil species with such living species is keenly felt. The writer at the present stage, therefore, restricts himself just to recording the fossil occurrence.

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Explanation of Plates

Plate 1

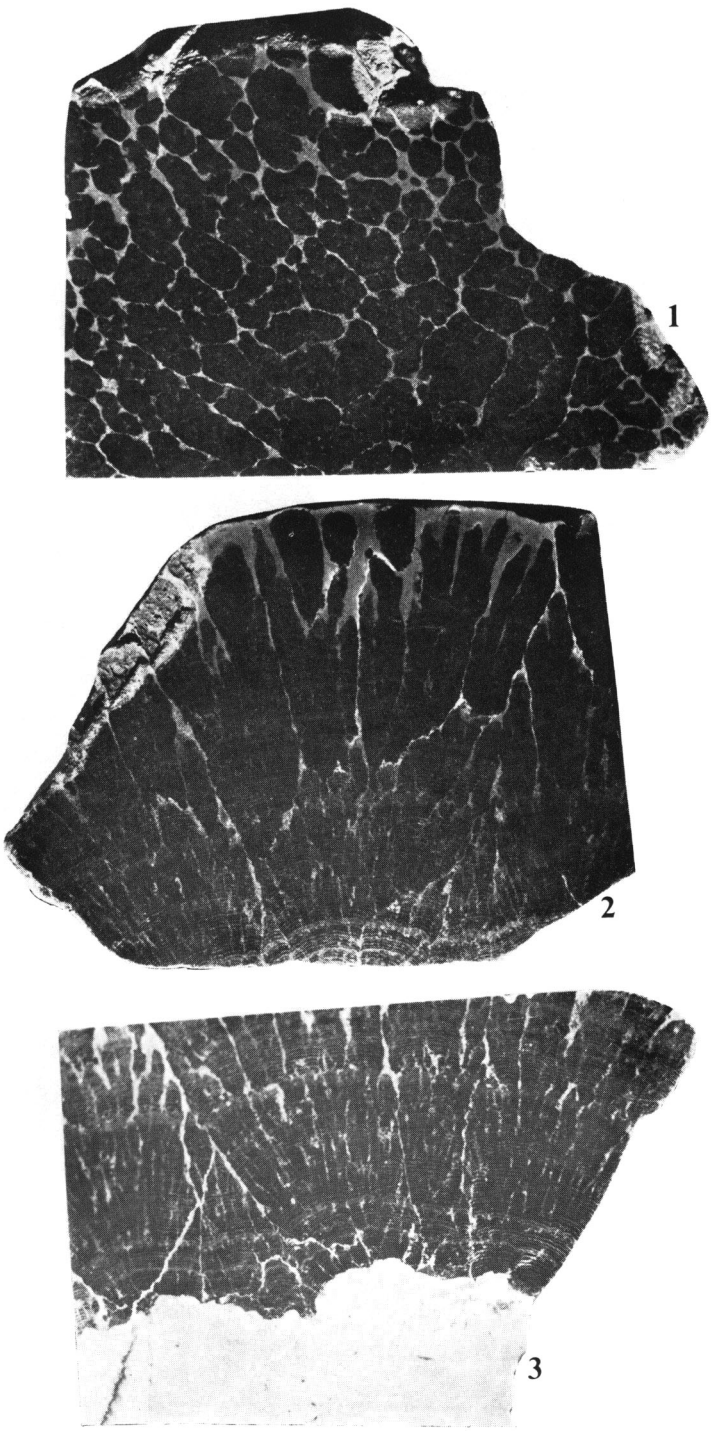
Top view of slab covered with algal stromatolite.

Plate 2

Polished section of a algal stromatolite: transverse (fig. 1) and vertical (figs. 2 and 3).

Plate 3

Microstructure in thin section: vertical.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