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A Fossil of the Righteye Flounder, *Clidoderma asperrimum*, from Pliocene Tatsunokuchi Formation, Soma City, Fukushima Prefecture, Japan

By

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Abstract A part of trunk and caudal region of a righteye flounder was found in the Pliocene Tatsunokuchi Formation, Soma City, Fukushima Prefecture, Japan. It was identified as the extant species *Clidoderma asperrimum* in the family Pleuronectidae.

Introduction

A part of trunk and caudal region of a righteye flounder was found in Soma City, Fukushima Prefecture, Japan.

The fossil was discovered from the sandstone bed belonging to the Tatsunokuchi Formation, Sendai Group, in the Pliocene. It was identified as the extant species *Clidoderma asperrimum* (TEMMINCK et SCHLEGEL) in the family Pleuronectidae, Pleuronectiformes, by the following characters: rough bony tubercles are densely scattered on the body of the ocular side, and larger tubercles are arranged in more or less definite longitudinal rows; caudal vertebrae are 30 in number. This fossil represents the first fossil record of *Clidoderma asperrimum* in the world.

In the present paper, the fossil was described and compared with Recent specimens of *Clidoderma asperrimum* in detail.

Locality and Horizon

The specimen was collected by Mr. Yoshimi ARA at the bank of the Uda River (about 1.6 km from its mouth) in Inada, Soma City, Fukushima Prefecture, Japan (Fig. 1). The specimen was discovered in the sandstone matrix belonging to the Tatsunokuchi Formation, Sendai Group, in the Pliocene.

In the analysis of the sandstone which yielded the present fossil, 30 species of diatoms were identified by TANIMURA (pers. comm.) and following species are found to be common or abundant: *Denticulopsis seminae* var. *fossilis* SCHRADER, *Denticulopsis* spp., *Paralia* sp., *Thalassionema nitzschioides* GRUNOW, *Thalassiosira antiqua* (GRUN.) CLEVE-EULER and *T. oestrupii* PROSKINA-LAVRENKO. The association mainly consists of the Recent cold water elements. This combination of the diatom species

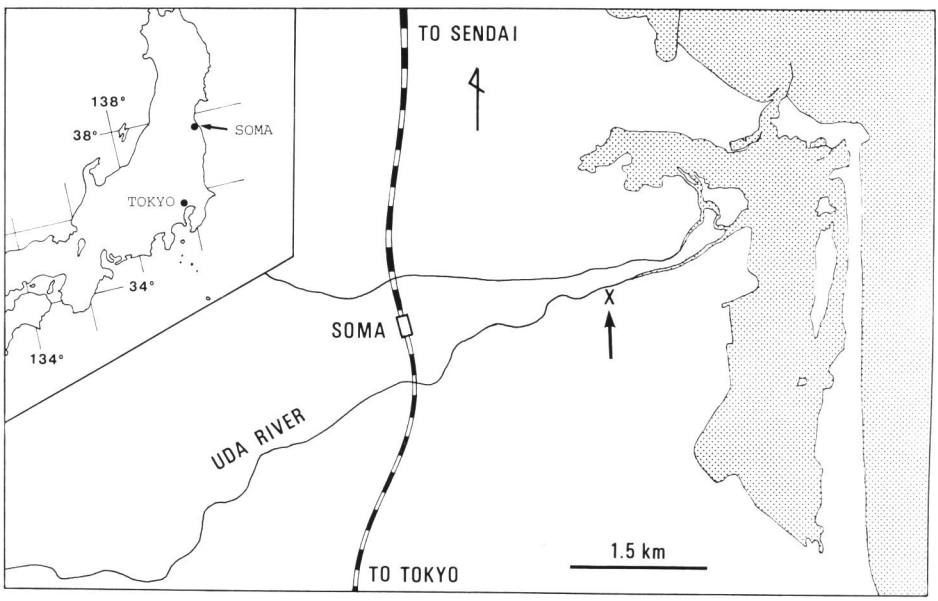

Fig. 1. A map of the locality yielded the Pliocene fossil of *Clidoderma asperrimum*.

indicates that the present sandstone bed is the uppermost Pliocene to the lower Pleistocene in age.

Systematic Paleontology

Class Osteichthyes
Order Pleuronectiformes
Family Pleuronectidae FLEMING, 1828
Genus *Clidoderma* BLEEKER, 1862
Clidoderma asperrimum (TEMMINCK et SCHLEGEL, 1846)

[Japanese name: same-garei]

Material: catalogue number NSM PV-18699.

Description: the specimen is incomplete and lacks head and most abdominal regions. Posterior 33 dorsal and 12 anal rays are observable. Forty-five proximal pterygiophores of the dorsal fin and 51 proximal pterygiophores of the anal fin are recognized. Two proximal pterygiophores of the dorsal and anal rays are located between two adjacent haemal or neural spines. The abdominal vertebrae are incomplete and only the last two abdominal vertebrae with haemapophyses are observable. The caudal vertebrae are complete and counted as 30. The anterior 25 caudal vertebrae are provided with anterior transverse apophyses gradually becoming smaller toward the

Fig. 2. A Pliocene fossil of *Clidoderma asperrimum*, NSM PV-18699, from the Pliocene Tatsunokuchi Formation, Soma City, Fukushima Prefecture, Japan. ×0.64.

posterior end of the fish, judging from the pores which are traces of those apophyses and gradually become smaller backward.

There are close-set, rough, bony tubercles on the body of the ocular side (Figs. 2 and 3). Large ones are observable at the dorsal region, which are arranged in two more or less definite longitudinal rows. At the ventral region, one definite longitudinal row consisting of larger tubercles is found just as in the dorsal region. Large tubercles are also observed on the posterior part of the body cavity (=the anteriormost part of the fossil specimen).

Most of neural and haemal spines have several striations. Parhypural, hypurals and epural have several ridges.

Nineteen caudal rays are recognizable (Fig. 3).

Consideration

Although the present fossil lacks head and most abdominal regions, it clearly shows characters to be a member of the order Pleuronectiformes by a great body depth, the consistent presence of two proximal radials of the dorsal and anal rays between two adjacent haemal and neural spines (UYENO, 1975). Judging from the body of the ocular side densely covered with rough bony tubercles (NORMAN, 1934; SAKAMOTO,

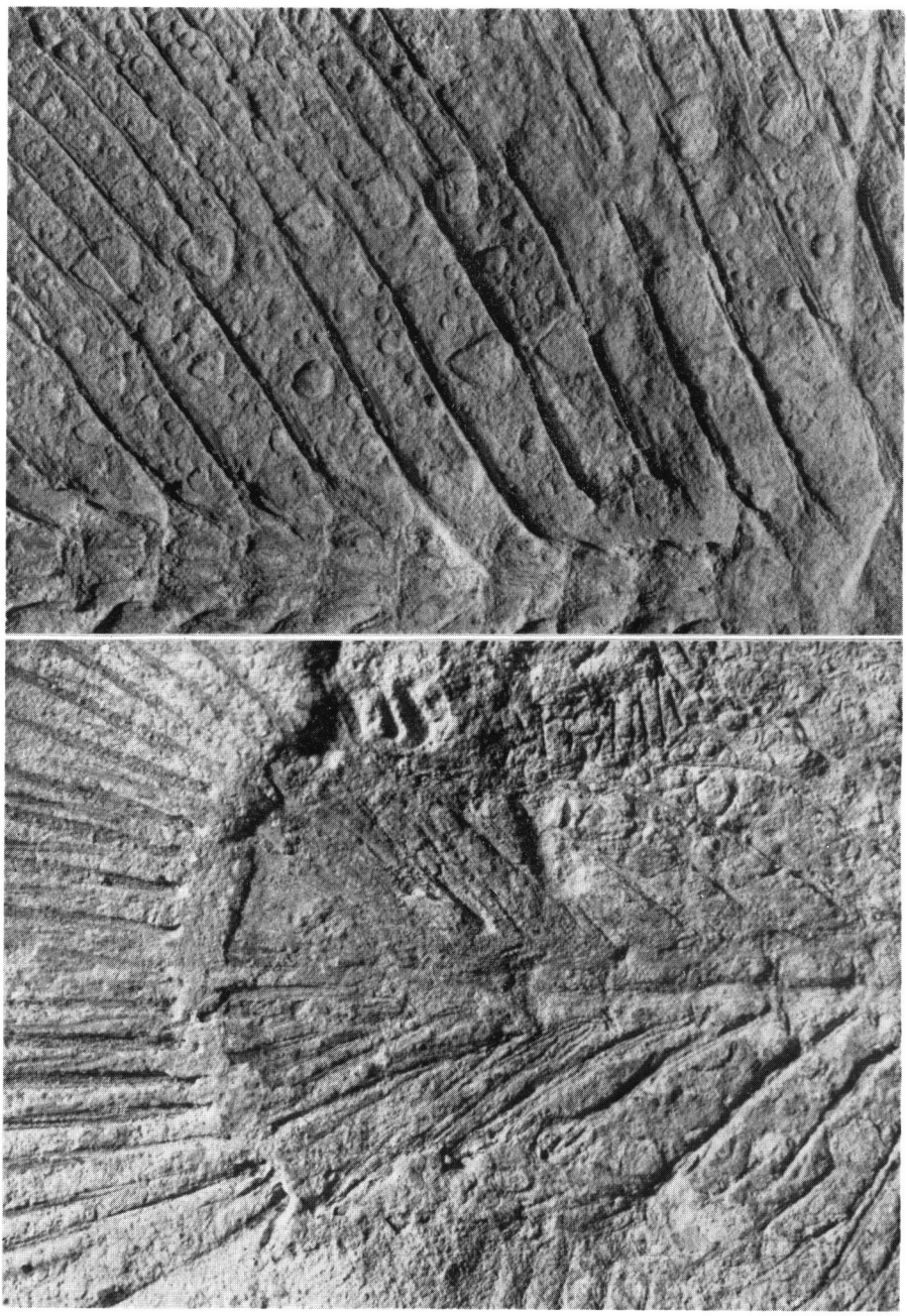

Fig. 3. Photographs showing tubercles of the dorsal region (above) and the caudal region (below) of the Pliocene fossil of *Clidoderma asperrimum*.

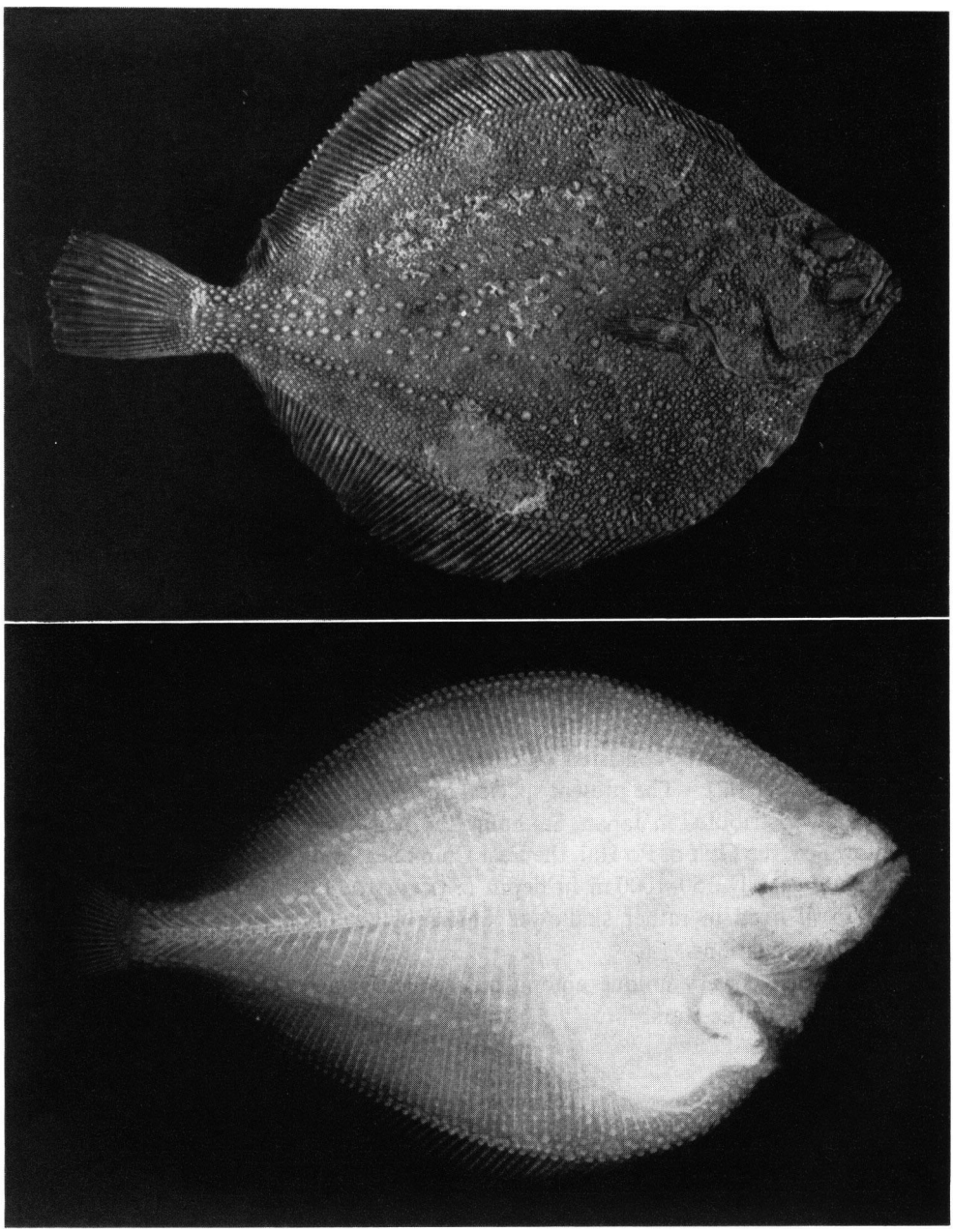

Fig. 4. Photograph (above) and radiograph (below) of a Recent specimen of *Clidoderma asperrimum* from the southern Okhotsk Sea, HUMZ 78629 (Laboratory of Marine Zoology, Hokkaido University), 272.2 mm in standard length, showing the arrangements of tubercles on the body of the ocular side.

1984a, b), it is identified to belong to the genus *Clidoderma* of the righteye flounder family Pleuronectidae.

Clidoderma is a monotypic genus which includes the Recent species *C. asperrimum*. We compared the present fossil with *C. asperrimum* in several characters which are observable in the fossil. They are the arrangement of bony tubercles on the body of the ocular side, the number of the caudal vertebrae and the number of the caudal rays. *C. asperrimum* have six longitudinal rows of bony tubercles on the body of the ocular side; three at the dorsal, the other three at the ventral, and the upper two ventral rows join to form one row at the middle of the body (Fig. 4). In the present fossil, the two rows corresponding to the first and second dorsal rows in *C. asperrimum* are observable at the dorsal; one row corresponding to the third ventral row can be found on the posterior part of the ventral. The other rows are not observable because of the poor condition of the fossil. The number of the caudal vertebrae of *C. asperrimum* is from 30 to 32 with a mode of 31 (SAKAMOTO, 1984a). That of the present specimen, 30, falls into the range of *C. asperrimum*. It has been reported that the number of the caudal rays of *C. asperrimum* was from 19 to 20 (usually 19) (NORMAN, 1934; SAKAMOTO, 1984a, b). The caudal ray count of the present fossil, 19, well agrees with that of *C. asperrimum*. From these comparison, the present fossil is reasonably identified as *Clidoderma asperrimum*.

The sedimentary environment of the Tatsunokuchi Formation is shallow marine (ISHIZAKI and TAKAYANAGI, 1981). According to HAYASAKA (1956) and KAMADA and HAYASAKA (1959), the molluscan fauna is characterized by cold Oyashio elements only. Also, the present study revealed that the association of the diatoms in the fossil locality mainly consisted of cold water elements. This result agrees with that of KOIZUMI (1972). The present species, one of the Recent cold water pleuronectid fishes, is now distributed in Japan, Sakhalin, the Kuril Islands, the Korean Peninsula, the Yellow Sea, the Gulf of Po Hai, the East China Sea, and southern British Columbia, and inhabits usually 150–1000 m in depth (SAKAMOTO, 1984b). These facts indicate that the fossil lived in rather shallower waters in the uppermost Pliocene than the present day populations.

This species is very unique among pleuronectiform fishes in feeding intensively on echinoderm, brittle-stars.

Acknowledgements

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