

## Mesozoic fish scales from the Tetori Group (Middle Jurassic to Early Cretaceous) in Izumi Village, Fukui Prefecture, central Japan

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### Introduction

Recently abundant freshwater fish fossils consisting of seven orders were found from the Early Cretaceous Kwanmmon Group in Kitakyushu City, northern part of Kyushu (UYENO, 1979; YABUMOTO, 1994). Teleostean fish fossils of Japan, however, are certainly rare from the Mesozoic deposits, and are not found from the Tetori Group exposed in the Hokuriku district, central Japan. The Tetori Group consisting of the Middle Jurassic to Early Cretaceous deposits is subdivided into following three subgroups in ascending order (MAEDA, 1961); Kuzuryu subgroup (marine), Itoshiro subgroup (brackish to freshwater) and Akaiwa subgroup (freshwater). The author owes to his division of this Group (1961) here, because of that his detailed division is more useful than that of recent lithostratigraphical study (YAMADA *et al.*, 1989) in Izumi Village, Fukui Prefecture.

Isolated ganoid scales, mainly of freshwater fishes, had been obtained from some locations and geologic horizons during recent several years; Kitadani alternation Formation of the Akaiwa subgroup, Katsuyama City, Fukui Prefecture (YASUNO, 1989); Kuwajima alternation Formation of the Itoshiro subgroup, Shiramine Village, Ishikawa Prefecture (AZUMA and HASEGAWA, 1989); Kaizara shale Formation of the Kuzuryu subgroup, Izumi Village, Fukui Prefecture (YASUNO, 1994). Since thus finding of scales the author had searched fish fossil from this Group. When the author had a short geologic excursion in Izumi Village in this summer together with his daughter, a elementary school student, he found firstly a cycloid fish scale FPKH-9501 from the Itsuki shale Formation at Itsuki. A week later he could found secondly a cycloid scale FPKH-9502 at the same location. Then he reexamined carefully some rocks with mesozoic molluscan fossils under the binocular, and could found fortunately a fragment of fish scale FPKH-9503. Their rocks are sampled from the Kaizara shale Formation about twenty yaers ago by the author. And they are examined carefully, but they could

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not classified paleontologically in order level. The characteristic outlines of them are described here. Because of that they are the first record of the cycloid fish scales from the Tetori Group, and especially the scale FPKH-9503 is rather large and evidently rare in the Jurassic deposits of Japan. Terms of ornamentations of the scale used here study of KOBAYASHI (1958).

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### Geological setting

The scale fossils described here from the Tetori Group are found from two different stratigraphical horizons and also locations in Izumi Village, Fukui Prefecture (Fig.1). At Itsuki (Loc. 1) two scales FPKH-9501 and FPKH-9502 are found in the piced rocks on the foot of big roadside outcrop composed of the Itsuki shale Formation which is considered to be in Early Cretaceous (Berriasian) in age (MAEDA, 1961). The beds yielding rich fossils are mainly composed of shale, sandstone and their alternation, and the stratigraphical section of them is shown in Fig.2. The molluscan fossils are namely yielded in the fine grained sediments. They are occasionally in the thin fossil beds and of following species; *Viviparus*, *Melanoides*, *Ostrea*, *Corbicula* (*Mesocorbicula*), *Polymesoda* (*Paracorbicula*) and *Plycatounio* (one specimen). Plant fossils are almost of fragments and

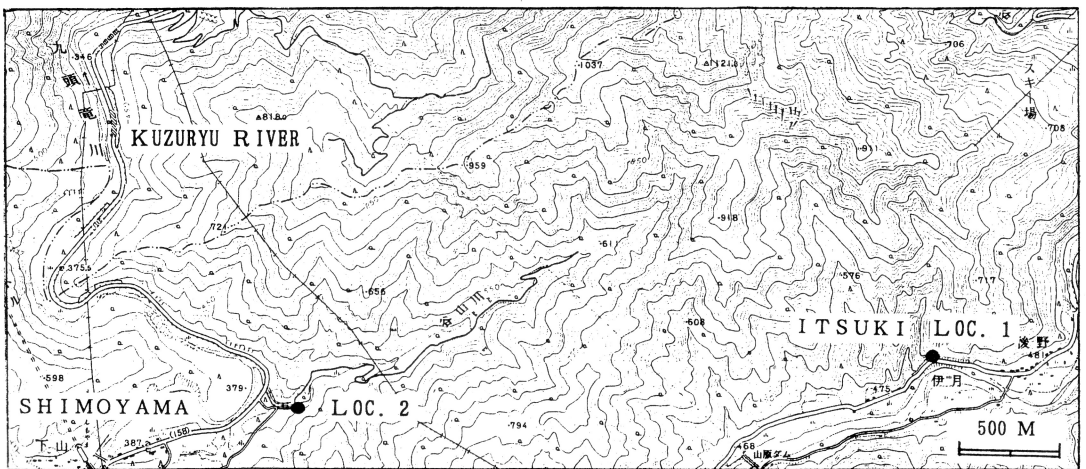


Fig.1 Map showing the fossil locations.  
Cited from the topograph map of Shimoyama (1/25,000).

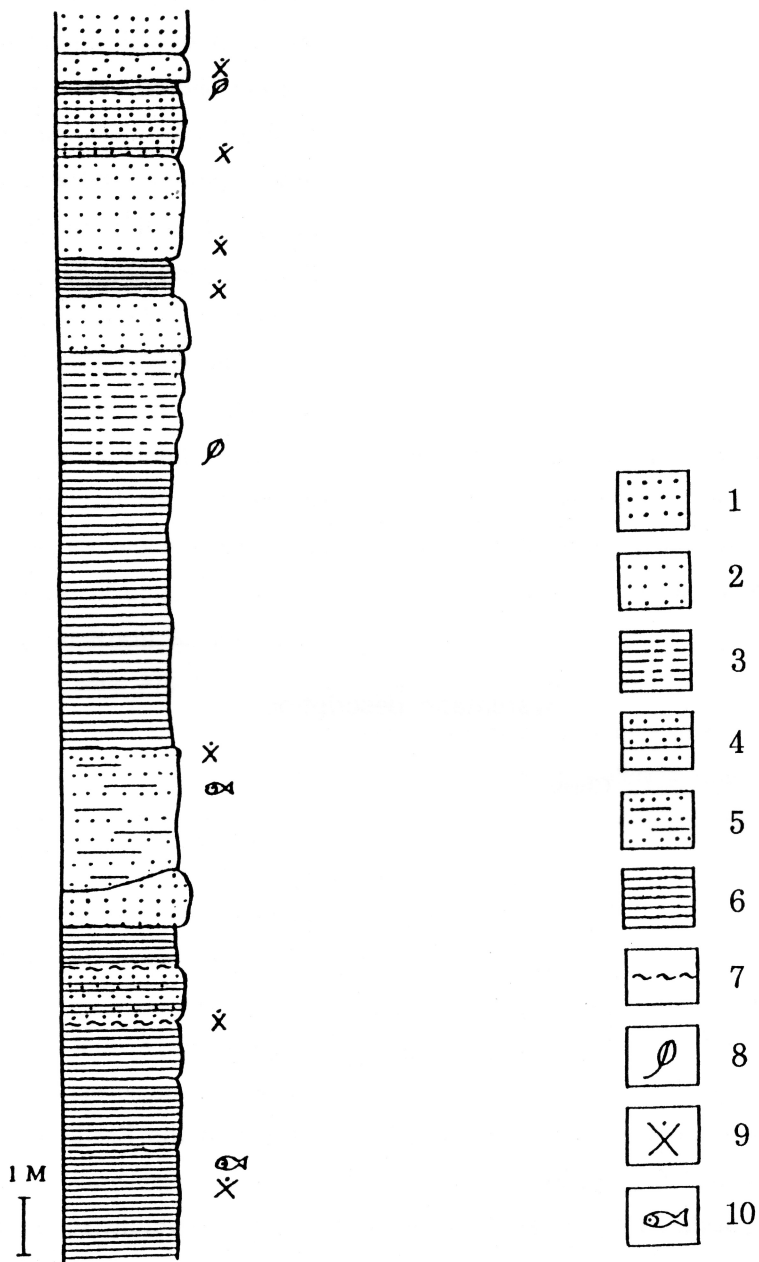


Fig.2 Columnar section of the Itsuki shale Formation at fossil location in Izumi Village.

1 : Coarse grained sandstone, 2 : Medium grained sandstone with laminated siltstone, 3 : Fine grained sandstone with thin shale, 4 : Alternation of sandstone and shale, 5 : Alternation of sandstone with thin shale, 6 : Black shale 7 : Ripple mark, 8 : Plant fossil, 9 : Molluscan fossil, 10 : Fish scale fossil

could rarely be obtained such as *Podocarpus*, *Chladophlebis*, *Onycyopsis* and *Neocalamites*. Footprints of dinosaur (AZUMA *et al.*, 1991) were traced under the sandstone at about ten m upper horizon of the top of the above down section (Fig.2).

The scale FPKH-9501 associates with *Corbicula* and *Melanoidea* was obtained from the black shale including loose concretion of pyrite grains, of which stratigraphical horizon is presumed at near shale beds of the lower part of the cliff (Fig.2). The scale FPKH-9502 was obtained from the siltstone possessing some very thin sand pipes and ill parallel lamination. Its horizon is presumed stratigraphically at about six m upper one of the scale FPKH-9501. At Shimoyama (Loc. 2) the scale FPKH-9503 of marine fish was found from a arkosic and coarse grained sandstone of the Kaizara shale Formation of the Kuzuryu subgroup correlated with the upper most of Middle Jurassic (Callovian) in age (MAEDA, 1961). This sandstone with patched black shale is poorly sorted and associates following marine fossils; Crinoidea, Ammonoidea, Belemnoidea, Pelecypoda (*Trigonia*), Brachiopoda etc.

### Systematic description

Class	Osteichthyes
Subclass	Achtnopterygii
Infraclass	Neopterygii
Division	Halecostomi
Subdivision	Teleostei
Or. Fam. Gen. <i>et sp.</i>	indet.

(Plate 1, Fig.1)

*Material*: A scale of collection number FPKH-9501 stored in the Earth Science Room, Fukui Prefectural Koshi Senior High School.

*Description of the scale FPKH-9501*: This is a rather large cycloid scale. It makes a pentagonal form, and is 13 mm in length and also 14 mm in width. It is almost completely preserved and is a trace of the outer surface. The focus is nearly situated at the apical part. On its surface the following features could not be recognized; radial groove, radial ridge, spine, granule and tubercle. The carbonized scale material remained scarcely as piced growth lines. Under the binocular and naked eyes five or six rough ridges are recognized. They arrange parallelly to the lateral and basal margins, and become more delicate ones in the apical part. Between them some very

thin concentric ridges are traced.

*Remarks:* This is a rather large cycloid scale in having above features, and is possibly of about six years old. So far as the surface ornamentation of scale, this scale is little similar to that of sarmoniformes or cypriniformes fishes (CHU, 1935; KOBAYASHI, 1958), and distinguished clearly from that of culpeid fish from the marine or nonmarine deposits of the Cretaceous time in Japan (YABE and OBATA, 1930; UYENO, 1979; YABUMOTO, 1991) and in Brazil (examined a elopsoid fish), and also from that of Leptolpiformes and Lycopteriformes fishes in China (CHANG and CHOW, 1977) which provide radial ridges or characteristic transversed ridges.

Subdivision      Teleostei  
Or. Fam. Gen. *et sp. indet.*  
(Plate 1, Fig.2)

*Material:* A scale of collection number FPKH-9502 stored in the Earth Science Room, Fukui Prefectural Koshi Senior High School.

*Description of the scale FPKH-9502:* This is a small cycloid scale. It makes more or less a pentagonal form, and is rather longer form, 3.4 mm in length and 2.5 mm in width. The scale which has a obscurely apical part is almost completely preserved. The focus is nearly situated at the apical part. One prominent and straight radial groove on the apical part reaches near the focal part and subdivided clearly there into two lobes. The concentric ridges arranges clearly along the both lateral margins. Their ridges are laterally countable, about forty in number, and increase rapidly three times in number in the apical part. The marginal part of the scale is rather thin, namely in the apical part, and it becomes more thick in the central part.

*Remarks:* This scale belongs obviously to the cycloid one in having the above mentioned ornamentations of the outer surface. This scale seemes to be a lateral line scale of two years old. It is considered that a fish with this scale is more closer to the brackish water fishes than that of the scale FPKH-9501 in composition of the associated molluscan fossils. This scale is distinguished from the scale FPKH-9501 in having the radial ridges. However, this scale can not be distinguisd easily from the culpeiformes fishes lived widely in the Cretaceous time like as the scale FPKH-9501.

Subdivision      Teleostei  
Or. Fam. Gen. *et sp. indet.*  
(Plate 1, Fig.3)

*Material:* A scale of collection number FPKH-9503 stored in the Earth Science Room, Fukui Prefectural Koshi Senior High School.

*Description of the scale FPKH-9503:* This is a small fragment of large cycloid scale. The preserved part is 8 mm respectively in length and width. The outer surface was traced under a plate of the scale material which is of fine and massive calcareous material of about 0.3 mm in thickness, and it appeared by dissolving its plate by the thin hydrochloric acid. The thick and strong concentric ridges which seems to be of the annual rings are observed and are countable, about 10 ones in number. The clear thin concentric ridges are arranged among them, and of about 10 ones in number. The rather thick radial ridges are arranged and countable, 11 ones in number.

*Remarks:* This scale can be identified as that of the teleostean fishes from its features. The features of concentric and radial ridges suggest that it is surely of the apical part of scale. Reconstruction of this scale as that having its focus in the central part seems to be comparatively large one, longer than 20 mm in length. This scale differs evidently from the Cretaceous clupeiformes fishes. For the present condition, it may be difficult to classify this scale under the order level in detail. Because the scales of the teleostean fishes in marine are really little from the Jurassic deposits of Japan and China.

## Conclusions

Most of all fish fossils from the Tetori Group has been only of freshwater fishes belonging to the Holostean fishes excluding one marine specimen from the Kuzuryu subgroup (YASUNO, 1994). They are composed of following materials; a lower jaw, isolated scales and pieces of fin rays. In addition to them three cycloid scales of the teleostean fishes are firstly described in this study.

Two cycloid scales (FPKH-9501, -9502) of them from the Itsuki shale Formation in the Early Cretaceous belong to those of the brackish water or the freshwater fishes from the association of molluscan fossils. According to UYENO (1979) and YABUMOTO (1994), very rich freshwater fishes, nearly twenty species of the seven orders, are found from the Early Cretaceous deposits in Kitakyusyu of Japan. However their cycloid scales had lacked and were not described. The present two scales (FPKH-9501, -9502), therefore, can not compare with that of their Cretaceous fishes here. From their features the two scales (FPKH-9501, -9502) differ possibly from the Cretaceous culpeiformes fishes having characteristic transversed ridges in the central part and the radial ridges in the apical part, which had widely existed in marine and freshwater.

The scale FPKH-9501 seems to be somewhat similar to that of the cypriniformes or of the sarmoniformes fishes. But they had evidently appeared from Late Cretaceous in age (UYENO, 1976; ROMER, 1966). In addition to the appearance of the marine teleostean fishes, fish fossils of the Jurassic deposits are quite few in Japan as a head part of *Lpitolepis* sp. which was found from the Early Jurassic Kuruma Group, Toyama Prefecture, (OHE and CHIBA, 1988). However fishes of the genus *Lpitolepis* (order Lepitolepidiformes) are generally of small in size, several cm in body length. then the present scale FPKH-9503 may possibly differs from *Lpitolepis* species. There are some cycloid scales from the Upper Cretaceous marine deposits from Hokkaido (OHE, 1972) which are of rather small size and unidentified, and could not be made detailed comparison with this scale FPKH-9503. From thus paleontological facts the scale FPKH-9503 can not be classified in detail, but recognizes as that of teleostean fishes.

### References

- AZUMA, Y. and HASEGAWA, Y., 1989: b. Vertebrate fossils. In The Board of Education of Shiramine Village. (ed.) *Report of the countermeasure for preservation of the silicified wood sites in the basin of the Tetori River*. 26-29. The Board of Edu. of Shiramine Village (in Japanese).
- AZUMA, Y. and TAKEYAMA, K., 1991: Footprints from the Tetori Group, central Japan—Research of Dinosaur from the Tetori Group (4). *Bull. Fukui Pref. Mus.*, 4, 33-51.
- CHANG, M. -M. and C. -C. CHOW, 1977: On Late Mesozoic fossil fishes from Zhejiang Provinc, China. *Mem. Inst. Vert. Paleont. and Paleoanthropol., Academia Sinica*, 12, 1-59 (in Chinese with English abstract).
- CHU, Y. T., 1935: Comparative studies on the scales and their teeth in Chinese cyprinid, with particular references to taxonomy and evolution. *Bull. St. John's Univ.* 21-79.
- KOBAYASHI, H., 1958: Comparative morphology and hierarchy of the fish scales. *Bull. Aich Gakugei Univ. Special. Vol. 7*, pp.104 (in Japanese with English abstract).
- MAEDA, S., 1961: On the geological history of the Mesozoic Tetori Group in Japan. *Jour. Coll. Arts and Sci. Chiba Univ.* 3, (3), 371-409 (in Japanese with English abstract).
- OHE, F., 1972: Additional descriptions on the fossil fishes and localities of Hokkaido, northern Japan. (1). *Kaseki no Tomo 7*, 21-23 (in Japanese with English abstract).

- OHE, F., and CHIBA, M., 1972: A teleostean fish, *Lepitolepis* sp., from the Jurassic Kuruma Group, Daira-Gawa, Toyama Prefecture, Japan. *Abstract 1988 Annual Meet. Paleont. Soc. Japan*, 86 (in Japanese).
- ROMER, A. S., 1966: Vertebrate paleontology. Univ. of Chicago Press, Chicago. pp.1-458.
- UYENO, T., 1979: Early Cretaceous freshwater fishes from northern Kyushu, Japan. I. Description of two new species of the clupeid genus *Diplomystus*. *Bull. Kitakyushu Mus. Nat. Hist.* 1, 11-24.
- UYENO, T., 1975: Pisces. In SHIKAMA T. (ed.) *Paleontology III* (revised edition). Asakura Shoten, Tokyo. pp.181-242 (in Japanese).
- YABE, H. and OBATA, T., 1935: On some fossil fishes from the Cretaceous of Japan. *Jap. Jour. Geol. Geogr.* 8, (1-2), 1-7.
- YABUMOTO, Y., 1994: Early Cretaceous freshwater fish fauna in Kyushu, Japan. *Bull. Kitakyushu Mus. Nat. Hist.* 13, 107-254.
- YAMADA, K., NIWA, S. and KAMATA, M., 1989: Lithostratigraphy of the Mesozoic Tetori Group in the upper reaches of the Kuzuryu River, central Japan. *Jour. Geol. Japan.* 95, (5), 391-403 (in Japanese with English abstract).
- YASUNO, T., 1989: Fish fossils and their localities in Fukui Prefecture, central Japan. *Bull. Assoc. Edu. Fukui Pref.* 31, 34-45 (in Japanese with English abstract).
- YASUNO, T., 1994: Occurrence of a scale from the Middle Jurassic Tetori Group of Fukui Prefecture, central Japan. *Bull. Fukui City Mus. Nat. Hist.*, 41, 1-4 (in Japanese with English abstract).

### Explanation of plate 1

Cycloid scales of the teleostean fishes from the Teteri Group, Japan.

Left sides of all figures indicate the basal part of scale. All scale bars = 2 mm.

- Fig.1 Scale FPKH-9501. A print of outer surface. A fragment laying on the left top of this figure and showing the outer surface is a counter part from the basal margin.
- Fig.2 Scale FPKH-9502. A outer surface.
- Fig.3 Scale FPKH-9503. A print of outer surface.



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Plate 1



1



2



3

