

Upper Cretaceous Elasmobranchs from Matsuyama, Ehime Prefecture, Japan

By

Teruya UYENO

Department of Paleontology, National Science Museum, Tokyo 160

and

Tetsuo MINAKAWA and Masaki MATSUKAWA

Department of Earth Sciences, Faculty of Science,
Ehime University, Matsuyama 790

Introduction

At Dogo-Himezuka in the northeastern part of Matsuyama City, Ehime Prefecture, the western end of the Upper Cretaceous Izumi Group crops out. In the period from 1968 to 1978, one of the authors, MINAKAWA, collected there some shark teeth and numerous fossils of ammonites, bivalves, and plants. These specimens were exposed on the cliff made in the process of constructing a residential ground.

Previously only a single tooth of *Hexanchus microdon* was reported from this locality (UYENO *et al.*, 1975).

Recently NISHIMOTO and MOROZUMI (1979) reported on 6 species of sharks from 4 localities in Izumi Mountains, Wakayama Prefecture, which are about 150 km east of Matsuyama City. Adding informations on shark teeth from these localities, now we have a fairly good image of the Upper Cretaceous shark fauna in the Izumi Group.

Stratigraphic notes

The stratigraphy of the deposit yielded shark teeth was described, and its position was shown in the geologic map and cross section by SHIGENAGA and NAKANO (1967) and NODA and TASHIRO (1973). The basal conglomerate bed of the Izumi Group unconformably rests upon the biotitegranite that includes white or pink feldspar. The basal conglomerate bed is composed of irregularly directing pebbles and cobbles, most of which show incomplete sorting and roundness.

The bed is estimated to be 20 meters thick. The alternating beds of sandstone and shale which are 20 or 50 meters and conformably overlie the conglomerate bed. The boundary between the conglomerate bed and alternating beds of sandstone and shale is fairly distinct in this place.



Fig. 1

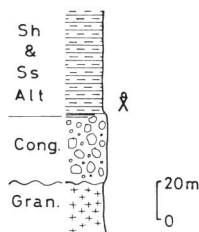


Fig. 2

Fig. 1 (left). The map indicating the locality yielded shark teeth.

Fig. 2 (above). A columnar section of Dogo-Himezuka.

The fossils of shark teeth are obtained from the alternating beds of sandstone and shale together with ammonoids and bivalves (Figs. 1 and 2). The feature described above suggests the unstable shallow sea formed by transgression or rapid subsidence. NODA and TASHIRO (1973) and MATSUMOTO (1973) listed genera and species of ammonoids and bivalves from these beds. This assemblage is similar to the faunas of Upper Sub-group of Himenoura in Amakusa-shimajima and Shimo-koshikejima and of Misho Formation in Shimanto Group.

MATSUMOTO (1973) distinguished "*Helcion*" *giganteus* (SCHUMIDT), and *Gaudryceras striatum* (JIMBO) and *Tetragonites* sp. cf. *T. popetensis* (YABE) with *Inoceramus schumidti* MICHAEL, and mentioned that this assemblage seems to be similar to the fauna from the locality near "Kitakarafuto akoh" (Alexisandrof in Sahaline), Ray 1 of lower Ryugase Group, Upper Cretaceous deposits at Naibuchi River and the lower part of K6 in Soya, Teshio-Saku and Tomiuchi (former name Hetonai) in Hokkaido. Thus the horizon of shark teeth fossils is assigned to the Upper Campanian in the international scale.

Description

Class Chondrichthyes

Order Hexanchiformes

Family Hexanchidae

Genus *Hexanchus* RAFINESQUE, 1810

Hexanchus microdon (AGASSIZ, 1843)

(pl. 1, A-E)

NSMT-PV 17109 (pl. 1, A and B): This specimen is probably a left lower jaw tooth of which the crown is complete. It has 6 cusps and 9 serrations at the anterior

edge of the first cusp. The cusps become shorter toward the posterior end. The length of the crown base is 15.0 mm; the distance between the apex of the first cusp and the anterior end of the crown base is 9.1 mm.

NSMT-PV 17110 (pl. 1, C and D): This specimen is a right lower jaw tooth. The general appearance and the size is similar to the one described above with 6 cusps and 9 serrations at the anterior edge.

NSMT-PV 17111 (pl. 1, E): This specimen is a cast of a tooth which is similar to the above with 6 cusps. These teeth are quite similar to the teeth described from Upper Cretaceous in Hokkaido (UYENO, 1972), and Izumi Mountains in Wakayama (NISHIMOTO and MOROZUMI, 1979). It is difficult to distinguish taxonomically these specimens from Japan and the specimens reported as *Hexanchus* (or *Notidanus*) *microdon* from Europe by AGASSIZ (1843) and WOODWARD (1912). Before making a taxonomic conclusion, it is necessary to study a number of specimens to understand tooth variations for positions on the upper and lower jaws, comparing with Recent specimens of the species. Since many Recent sharks in the family Hexanchidae are cosmopolitan (BASS *et al.*, 1975), it is probable that hexanchid sharks in the Upper Cretaceous were also cosmopolitan.

Order Lamniformes

Family Lamnidae

Genus *Squalicorax* WHITLEY, 1939

Squalicorax sp.

(pl. 1, F-I)

NSMT-PV 17112: The specimen is an incomplete crown without the tip of the apex and portion near the root. About one fourth of the crown is left and three fourth is represented by the impression. The cutting edge is finely serrated.

NSMT-PV 17113: The specimen is an incomplete tooth without the root and basal part of the crown. The outer surface of the tooth is almost flat, and serrations along the cutting edges are well preserved. There are 26 serrations along 7.6 mm of the anterior cutting edge which is slightly convex, and 30 serrations along 30.0 mm of the posterior cutting edge which is slightly concave.

NSMT-PV 17114: This specimen is an incomplete crown which is similar to the one described above, excepting the more convex anterior cutting edge which has 33 serrations in 10.3 mm. The outer surface is exposed.

NSMT-PV 17115: This specimen is an incomplete crown with the convex inner surface exposed, and probably belongs to the genus *Squalicorax* which has been reported from the Upper Cretaceous to Paleocene. The specimens here assigned to the genus *Squalicorax* are incomplete and difficult to identify. The fine serrations along the cutting edge and the forms of the apex of the crown resemble those of the genus *Carcharhinus* which has been reported from the Miocene (or Oligocene ?) to Recent. Since these specimens resemble well specimens reported as *Squalicorax*

by HERMAN (1975, pl. 6), we tentatively assign them to this genus. The genus *Squalicorax* has not been previously reported from Japan.

Family Orthacodontidae
Genus *Orthacodus* WOODWARD, 1889
Orthacodus longidens (AGASSIZ, 1843)
(Pl. 1, J, N–O)

NSMT–PV 17116 (pl. 1, J): This specimen is an almost complete crown with its outer surface exposed. The crown is slightly curved, and its cutting edges are very thin and sharp. There are no lateral cusps. The distance from the apex to the center of the base of the crown is 18.8 mm. The outer surface is slightly convex.

NSMT–PV 17120 (pl. 1, N and O): This specimen is an almost complete crown lacking the basal part. The crown is somewhat oblique toward posterior direction.

NSMT–PV 17121 (pl. 1, P): This is a crown with inner surface exposed, and similar to the specimen PV 17116.

Genus *Lamna* CUVIER, 1817
Lamna appendiculata (AGASSIZ, 1843)
(pl. 1, K, Q and R)

NSMT–PV 17122 (pl. 1, K): This specimen is a crown which lacks posterior portion and the tip of anterior lateral cusp. The cutting edges are sharp without serration. The length of the anterior cutting edge is 16.0 mm.

NSMT–PV 17122 (pl. 1, Q and R): This specimen is a posterior half of a tooth lacking the apex and the posterior half. The outer surface is flat and the inner surface is convex. The lateral cusp is low and wide. The cutting edges have no serration.

NSMT–PV 17125 (pl. 1, U): This specimen is an almost complete crown showing the outer surface. Its anterior lateral cusp is missing. The apex is sharply pointed. The distance between the apex to the center of the crown base is 6.5 mm.

NSMT–PV 17123 (pl. 1, S) and 17124 (pl. 1, T) are probably impressions of this species.

Concluding Remarks

Four genera and species of Upper Cretaceous (Campanian) elasmobranchs are reported here from Dogo-Himezuka in Ehime Prefecture. *Squalicorax* is for the first time reported from Japan. On the basis of these findings and the specimens reported by NISHIMOTO and MOROZUMI (1979), the known elasmobranch fauna from Izumi Group becomes as follows including 8 or 9 genera: *Hexanchus microdon*, *Odontaspis* ?, *Scapanorhynchus texanus*, *Scapanorhynchus* sp., *Lamna appendiculata*, *Lamna* sp., *Orthacodus longidens*, *Squalicorax* sp., and *Pristiophorus* sp. The nomenclature of shark teeth from the Cretaceous Period is still at an unstable stage. It appears that

European workers tend to split genera. We believe that "genus" has a function to indicate relationships among species, and if it is splitted too much, the function becomes weak. Considering this aspect and the nature of diagnosis given for splitted genera, we think that it is probably more convenient to have larger genera and subgenera for the classification of Cretaceous sharks. Since many Recent sharks are cosmopolitan, it is necessary to compare and discuss Cretaceous shark teeth on the world wide basis.

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Explanation of Plate

Plate 1

Photographs of Upper Cretaceous shark teeth from Dogo-himezuka, Matsuyama, Japan. A–E, *Hexanchus microdon*, A and B (NSMT–PV 17109): outer surface (A) and inner surface (B); C and D (NSMT–PV 17110): actual specimen (C) and its impression (D); E (NSMT–PV 17111) impression only. F–I, *Squalicorax* sp., F (NSMT–PV 17112), G (NSMT–PV 17113), H (NSMT–PV 17114), I (NSMT–PV 17115). J, *Orthacodus longidens* (NSMT–PV 17116). K, *Lamna* sp., (NSMT–PV 17117). L, gen. et sp. indet. (NSMT–PV 17118). M, gen. et sp. indet. (NSMT–PV 17119). N–P, *Orthacodus longidens* (NSMT–PV 17120): outer surface (N) and inner surface (O), (NSMT–PV 17121): inner surface (P), Q–U, *Lamna appendiculata* (NSMT–PV 17122): outer surface (Q) and inner surface (R), S (NSMT–PV 17123), T (NSMT–PV 17124), U (NSMT–PV 17125).

