424. DASYBATUS FROM THE JAPANESE MIOCENE*

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Introduction and Acknowledgements

Two small, gradually tapering shafts with minute and curved denticle on both lateral sides, and from different localities, were offered to the writers for study. One of the two specimens was obtained by Mr. Yoshiharu TAMURA, a graduate of the Institute of Geology and Paleontology, Tohoku University, during his field work in the classical area of Mizunami in Gifu Prefecture, and the other which is the smaller, by Dr. Koichiro MASUDA of the Department of Geology, College of Education, Tohoku University from the well known area of Ninohe in Iwate Prefecture. The former was dug out from a tuffaceous sandstone situated at about seven to eight meters above the base of the lower part of the marine Yamanouchi formation in the Karimabara valley at Togari in Mizunami City, Gifu Prefecture and the latter from the marine Shiratori member of the Kadonosawa formation in the valley at Nisatai, Fukuoka-machi, Ninohe-gun, Iwate Prefecture.

The larger specimen was compared with the Recent Dasybatus akajei (MÜLLER and HENLE) from the shallow sea off Miyagi Prefecture and found to be very similar in the preserved features of the shaft. The smaller one which was collected by Dr. MASUDA was compared with both the Gifu specimen and Recent ones and found to be somewhat different, thus its generic position is doubtful. However, since this may be the first record to fossil Dasybatus from the Cenozoic deposits of Japan, it is thought worthy to describe and illustrate them.

Here the writers thank Dr. Koichiro MASUDA and Mr. Yoshiharu TAMURA for kindly offering the specimens to the writer's study. Particular thanks are due to Professor Keiichi OMORI of the Institute of Economic Geology, Petrology and Mineralogy of the Tohoku University for kindly identifying the material from which the shafts are made.

Description of Dasybatus Specimens

Dasybatus nipponensis HATAI and KOTAKA, n. sp.

Plate 30, Figures 5, 8, 10.

Description:—Shaft slender, gradually tapering, measuring 92 mm in length.
plus 14 mm of impression, about 9 mm at preserved broadest anterior part and about 2 mm at preserved narrowest posterior part and about 5 mm in thickness. Shaft nearly straight, flattened anteriorly and posteriorly, more or less by subsequent pressure, with deep and narrow grooves and rounded narrow ridges longitudinally arranged on external surface, the number decreasing posteriorly. Sides of shaft with numerous anteriorly directed denticles numbering about five per five millimeters distance. Each dentine conical, polished, well rounded, sharply pointed at apex, broadening basally, broader than their interspaces, all directed anteriorly. Extending outwards from basal part almost perpendicularly although somewhat obtusely, then becoming more or less parallel with the lateral sides of shaft. All denticles pointed apically, their respective interspaces and thickness may vary somewhat and some appear to be equal to their interspaces in breadth although of the same shape. Dorsal and ventral sides of shaft apparently with sharply elevated central ridge developed posteriorly but not anteriorly where it grades into more or less uniformly rounded shaft but a little flattened so far as preserved parts show.

**Locality:**—From a tuffaceous sandstone situated at about seven to eight meters from base of lower part of Yamanouchi formation in the Karimabora valley at Togari, Mizunami City, Gifu Prefecture. Early Miocene.

**Remarks:**—Compared with the shaft of the Recent *Dasybatis akajei* (MÜLLER and HENLE) (Figs. 3, 4, 6, 7, 9) a living species of Japan, the fossil form is almost indistinguishable except for the more robust shaft, apparently stronger ridges on its anterior dorsal portion, sharper angled dorsal and ventral ridges at the posterior part. more number of denticles per ten millimeters distance, there being only about eight to nine in the living species at the posterior part and about 12 near the middle part, which is more than in the fossil specimen measured at the nearly same positions. However, both are similar to one another in the general shape, possession of grooves and ridges on the dorsal surface at the anterior half of the shaft, sharply pointed conical denticles all directed anteriorly and in their being closely arranged. The denticles of both fossil and living specimens are similar in extending outwards, first rather perpendicularly then abruptly or gradually becoming nearly parallel with the contour of the shaft itself.

Because of the differences above stated of the fossil specimen and the Recent one, the former is considered to represent a new species, for which the name of *nipponensis* is here proposed.

Shafts are developed in *Myliobatus tobi- jei* BLEEKER, *Pteroplatea japonica TEM- MINCK and SCHLEGER, Dasybatis Zugei* (MÜLLER and HENLE). *Urolophius fuscus* GARMAAN, besides *Dasybatis akajei* (MÜLLER and HENLE), among which only the last mentioned is in the present collection. The shafts of the other mentioned species were examined from illustrations. All of the mentioned species are known from the seas of the Japanese Islands being more common in the southern part but individually abundant in northern Japan (*Dasybatis akajei*). *Raja Kenojei* MÜLLER and *Naske japonica* (TEMMINCK and SCHLEGER) belong to the same group, but are not known to have double-saw-teeth-like shafts.

It is very difficult to obtain Recent specimens particularly because the tails are nearly always removed immediately after their capture by chopping or cutting since they may cause severe injury. For this reason it is thought worth while
to describe the Recent specimens at hand and also because very little is known of the characteristic feature. The descriptions will be given of the tails of *Dasybatis akajei* (MÜLLER and HENLE) which were collected from the shallow sea off Miyagi Prefecture and submitted to the writer for study by Dr. Senji TANITA of the Tohoku Regional Fisheries Research Laboratory at Shiogama, Miyagi Prefecture, to whom the writer’s deep appreciation is due.

The shafts (Figs. 3, 4, 7, 9) appear to be outgrowths from the cartilage tail and thus only the shafts would be preserved as fossil whereas the cartilage skeleton and tail would decompose. These shafts are situated generally on the dorsal central surface (Figs. 7, 9) of the tail occupying only the anterior half. The posteriormost shaft is the largest and best developed whereas those situated more anteriorly are smaller, taper more rapidly, thinner, with only weak development of grooves and ridges at their basal parts, usually extending outwards at a higher angle, and have along their lateral sides small denticles. Underneath the shafts are found conical swellings (Figs. 6, 7, 9) apparently in contact with the shafts, and these apparently disappear with the growth of the shafts. The largest shaft has no such swelling below it whereas the smaller the shaft the more developed is the swelling. This suggests that the shaft-bone develops by excretion of apatite from the mentioned conical swelling referred to above. The process in excretion of the apatite crystalized from collophane of a cartilage tail and the true nature of the mentioned swellings underneath the shafts and in contact with them is unknown to writers.

A *Dasybatis akajei* tail measuring about 51 cm in length has one very large and three small shafts, two pre-mature ones between the first and second, and one minute one anterior to the first small shaft. The distance from the tip of the first small shaft to that of the second is about 10 mm, from the second to third about 35 mm, and from the tip of the third to the tip of the largest and fourth about 125 mm. The largest shaft measuring 102 mm in length from base to tip attains about nine mm in its broadest part which is near the basal part. The apical part is smooth for about seven mm whereas anteriorly or basally the denticles gradually become well developed but are not developed at the 32 mm distance from base apically. Grooves and ridges extend apically for only about 70 mm length from basal part apically, thereon apically the shaft is smooth. The denticles are closely spaced, all directed anteriorly and show very slight variation in their spacing, strength and development. The three smaller shafts show similar features as the largest one, but the development of the denticles is premature. The largest shaft is flatly rounded transversally oval in its anterior part (which is also basal) but apically the shaft develops sharply elevated mesial portion both dorsally and ventrally. Although the basal part of the largest shaft narrows, those of the smaller three broaden and under the obliquely projecting shafts are found the conical extensions of the tail-skin.

Another tail of the same species (living) of about similar length has four small shafts and one large one, all of which are smaller than those described. All other features are the same as described above.

This may show that the lengths of the shafts and number of secondary shafts are not related with the length of the tail, although the actual size of the ray-body may have some relationship
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therewith, but this could not be determined.

The shafts, both large and small, are a means for injuring the enemy by injecting them into the body. Since the tail is very flexible and easily moved in any direction, they are always removed immediately after catching.

A shaft called *Trygon* or *Myliobatis* was reported by LADD (1934, p. 244, pl. 42, fig. 9, pl. 43, fig. 5) from the Suva formation at an abandoned quarry on the south side of Walu Bay, near the entrance, a few feet above sea-level. This unnamed species resembles *Dasybatus nipponensis* HATAI and KOTAKA, n. sp. in general features, but is distinguishable by the number of denticles per one centimeter distance, shape of them and in the surface sculpture and dorso-ventral ridges.

*Dasybatus (?) masudae* HATAI and KOTAKA, n. sp.

Plate 30, Figures 1, 2.

Description:—Shaft short, measuring nearly 30 mm in preserved length, 4.5 mm in breadth anteriorly and 3.5 mm in breadth posteriorly and about 1 mm in thickness. Sides gradually tapering posteriorly, flatly oval in sectionan teriorly, more rounded posteriorly. Posteriorly shaft with sharply elevated central longitudinal ridge which dies out anteriorly. Anterior part of dorsal surface with three rough ridges and grooves, ventral surface concave, mesial grooves developed probably due to compression, posterior ventral surface with several rough grooves and ridges anteriorly merging into concave mesial groove. Posterior half of shaft with small denticles on lateral sides, all directed anteriorly. Denticles small, short, about 12 within a distance of 10 mm, low, rather widely spaced (from tip to tip), their basal parts very broad, the whole a low broad triangle inclined anteriorly. Denticles stronger posteriorly than anteriorly where they gradually decrease in size to nearly vanish near middle of preserved length of shaft.

Locality:—From the Shiratori member of the Kadonosawa formation in the val-

Explanation of Plate 30

Figs. 1, 2. *Dasybatus (?) masudae* HATAI and KOTAKA, n. sp.

Fig. 1-ventral surface showing median ridge, surface ornamentation and denticles. Fig. 2-dorsal surface of same specimen showing longitudinal ridges and grooves and the denticles. x5. Locality-Nisatai, Fukuoka-machi, Ninoh-gun, Iwate Prefecture.

Figs. 3, 4, 6, 7, 9. *Dasybatus akajei* (MÜLLER and HENLE).

Figs. 3, 4-ventral and dorsal surfaces of shaft showing median ridge, surface ornamentation and development of denticles. Fig. 6-cross-section of tubercle developed on back (nat. size). Figs. 7, 9. Showing positions of shaft on median portion of tail, the sculpture and denticles. Figs. 3, 4-x4. Fig. 6-nat. size. Figs. 7, 9-slightly less than nat. size. Recent. Locality-off Miyagi Prefecture in shallow water.

Figs. 5, 8, 10. *Dasybatus nipponensis* HATAI and KOTAKA, n. sp.

Fig. 5-enlarged view (x2) showing the development of denticles, rounded dorsal surface and longitudinal sculpture. Fig. 8-same specimen in natural size. Fig. 10-enlarged portion showing development of denticles and their detail shapes and spacing. (x2). Locality-Karimabora valley, Togari Mizunami City, Gifu Prefecture.
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Remarks:—This species is easily distinguishable from Dasybatus nipponensis by the narrower shaft, smaller denticles of different shape, and in the shaft having a concave mesial groove anteriorly on the ventral surface and by the sharply elevated portion at the posterior part being developed better on the dorsal surface. The specific name is named after the collector, Dr. Koichiro Masuda in recognition of his works on the paleontology of the Tertiary Pectinidae.

References

LADD, H. S., (1934). Geology of Vitilevu, Fiji. Bernice P. Bishop Mus., Bull. 119. p. 3-263, pls. 1-44, text-figs. 1-10, tables 1-7 (refer to p. 244, pl. 42, fig. 9, pl. 43, fig. 5).
