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SOUTH CAROLINA

(WITH TWO PLATES)

BY
REMINGTON KELLOGG
Bureau of Biological Survey, U. S. Department of Agriculture



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DESCRIPTION OF AN APPARENTLY NEW TOOTHED CETACEAN FROM SOUTH CAROLINA

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BUREAU OF BIOLOGICAL SURVEY, U. S. DEPARTMENT OF AGRICULTURE

(WITH TWO PLATES)

Mr. Earle Sloan of Charleston, South Carolina, has given me permission to study the skull of a fossil dolphin from that state. An account of a geological section¹ near where this specimen was obtained was published in 1908. The fossil may be described as follows:

XENOROPHUS, new genus

Type.—*Xenorophus sloanii*, new species.

Diagnosis.—Resembling *Agorophius* and *Archaeodelphis* in the presence of an intertemporal constriction. Differing from these genera (so far as their characters are known) in the following peculiarities: premaxilla widened posteriorly so that it extends conspicuously outward under the maxillary in the interorbital region; lachrymal very large, sheathing most of the upper margin of the orbit; maxillary abruptly sloping in region immediately in front of orbits, its anterior and posterior portions horizontal; palatine extending forward as far as the anterior margin of the alveolus for the last molar. Teeth with finely serrated cutting edges and rugose enamel. Seven are double-rooted. In front of these the remaining portion of the rostrum bears the alveoli of two single-rooted teeth.

XENOROPHUS SLOANII, new species

Type.—Cat. No. S. 402 W., Sloan Collection (now on deposit in Section of Vertebrate Paleontology, United States National Museum). Incomplete skull, including the interorbital region and the major portion of the rostrum. Six molars are in place and an additional one was found imbedded in the matrix above palate.

¹ Sloan, E., Catalogue of the mineral localities of South Carolina. Bull. No. 2, ser. 4, South Carolina Geol. Surv., Columbia, p. 286, No. 402, 1908.

Type locality.—Marl at Woodstock Station on the Ingleside Mining Company property, Berkeley County, South Carolina. Near $80^{\circ} 5'$ Lat., and $32^{\circ} 58'$ Long.; shown on Ravenels Quadrangle, United States Geological Survey. The following statement has been furnished by Mr. Sloan:

At a depth of fifteen feet below the upper surface of the marl the specimen was exhumed and given by the Superintendent to the writer, who examined the pit on numerous occasions, and who considers the upper part of the Ashley-Cooper marl as probably Oligocene, and the lower part, which is separated by a layer of rounded pebbles in some localities, and by a layer of oyster shells in others, as Upper Jackson. The upper marl is of homogeneous texture, and drab green color; and contains 74 per cent calcium carbonate; it encloses occasional fossil shells of which the following have been identified: *Cassis* (*Morio*) *petersoni* Con., *Ostrea trigonalis* Con., *Volutilithes petrosa* Con., and *Pecten calvatus* Morton.

Dorsal view.—The tapering rostrum (pl. 1) exhibits many modifications present in *Squalodon calvertensis*.¹ Although constricted at the level of the maxillary notches, the rostrum swells out in front of the last molar, and then as far as preserved, gradually tapers toward the extremity. The mesorostral gutter apparently was open the full length of the rostrum, though the premaxillae may have approximated each other very closely near the level of the first two-rooted teeth. Distally, this gutter is formed by the premaxillae, which meet mesially and ventrally in a linear suture in front of the alveoli for the first two-rooted teeth; proximally the vomer and the premaxillae contribute to its formation. This gutter is partially roofed by the arched premaxillae. The distal extremity of the vomer appears at the level of the anterior margins of the alveoli for the first two-rooted teeth. It takes part in the formation of the lateral walls of the mesorostral gutter, sheathing the premaxillary bones, but the contact between the vomer and the premaxilla has its posterior limit at the level of the maxillary foramina. Slender remnants of the thin ascending plates of the vomer are present on each side of the frontal fontanelle, but they have been damaged in the region of the nasal passages. Ventrally, the external wall of the nasal passage was no doubt formed by the pterygoid bone, but since both pterygoids are missing, no further comments are necessary. Inferiorly the palatine bounds the nasal passage, and superiorly the premaxilla contributes a portion of the wall. No ascending process of the palatine appears to have been

¹ Kellogg, R., Description of two squalodonts recently discovered in the Calvert Cliffs, Maryland; and notes on the shark-toothed cetaceans. Proc. U. S. Nat. Mus., vol. 62, art. 16, Publ. 2462, pl. 1, 1923.

present: At the end of the vomerine gutter and some distance above it, there is a single large frontal fontanelle through which the nasal branches of the ophthalmic (V) nerve probably passed.

The premaxilla is narrowest near the third two-rooted tooth. Posterior to this tooth, the premaxilla commences to expand horizontally and attains its greatest width on the rostrum above the sixth two-rooted tooth. At the level of the maxillary foramen the exposed portion of the premaxilla is relatively narrow and from this point posteriorly it is hidden for the most part by the overlying frontal plate of the maxilla. Along the external boundary of the nasal aperture the premaxilla has been elevated to form a thin edged crest which commences in front of the maxillary foramen and follows the internal border of the maxilla backward beyond the posterior margin of the nasal. The anterior border of the nasal aperture is formed by the upturned inner margins of the premaxillae. At its posterior extremity, the left premaxilla has a maximum breadth of 50 mm., although it is largely hidden by the overlying maxilla.

Though the braincase is absent, it is fairly certain that this skull was characterized by a very narrow interorbital constriction. The maxillae and premaxillae terminate above the anterior margins of the temporal fossae. The premaxilla overspreads the frontal and a portion of its supraorbital process, and in turn is overlapped by the frontal plate of the maxilla though a wide triangular area is exposed behind and above the postero-internal margin of the maxilla. The maxilla increases in width from the extremity of the rostrum posteriorly and attains its greatest width at the level of the nasals, but because of the peculiar position of the lachrymal does not reach the outer edge of the orbit. The internal margin of the maxilla is in contact with the premaxilla for its entire length.

The rostrum is depressed below the level of the orbits and in correlation with this modification each maxilla is strongly excavated or hollowed out between the maxillary notch and the fifth two-rooted tooth. The broad base of the rostrum is formed mainly by the lateral expansion of the maxillae. On the left side of the rostrum, the roots of the fifth and sixth two-rooted teeth have pierced the dorsal face of the maxilla and have been clinched.

In contrast to all other known cetaceans, the lachrymal projects backward along the outer margin of the supraorbital process of the frontal as far as the postero-external angle of the maxilla and the posterior margin of the eye. It agrees with certain forms, such as *Kogia*, in that it curves downward in front of the supraorbital process

and on the ventral face of the skull extends inward beyond the infra-orbital foramen. From a dorsal view it is triangular in outline and is of approximately the same thickness as the frontal plate of the maxilla. There is no preorbital process or apophysis. The distal end of the jugal is present on both sides of this skull. This portion of the jugal is subtriangular in outline and occupies a median position in the maxillary notch. It is merely a small wedge which has forced its way in between the maxilla and the lachrymal from both of which it is separated by sutures.

The nasal bones are about equal in length to the maximum breadth between the premaxillae of the exposed portions of the frontals on the vertex of the skull. In position, the nasals are considerably posterior to those of *Archaeodelphis*¹ and probably are farther back than those of *Agorophius*, both nasals of which are missing. The anterior margins of the nasal bones in the *Xenorophus* skull do not extend beyond the middle of the supraorbital process. The nasals do not completely roof over the nasal passages, and hence the anterior nares open in almost the same direction as in *Squalodon calvertensis*. On each side the nasals are bounded by the broad premaxilla.

The frontals are much reduced in extent on the vertex, being over-spread by the premaxillae laterally and by the nasals anteriorly. The supraorbital process slopes forward; its postero-external extremity appears to be imperfect and probably curved downward. A close examination of the posterior ends of the frontals does not reveal any evidence for sutural union with the parietals at this level and the surfaces correspond to similar fractures elsewhere on this skull. The curvature of the sides of the skull in the temporal fossae, and the narrowness of the frontals on the vertex is evidence that this skull was characterized by a better marked intertemporal constriction than in either *Archaeodelphis* or *Agorophius*. In both of these forms, each parietal sends forward a median process which fits into a corresponding depression in the combined frontals.

Lateral view.—The dorsal outline of the rostrum is almost straight in front of the maxillary notches, but slopes downward toward the extremity. As a whole the skull appears to have been rather slender, and the height at the vertex is proportionately low in comparison with that of the base of the rostrum. The crest-like ridge of the premaxilla is the highest point of the dorsal profile anterior to the intertemporal constriction. The alveolus for the last two-rooted tooth terminates

¹ Allen, G. M., A new fossil cetacean. Bull. Mus. Comp. Zool. at Harvard College, vol. 45. No. 1, pl. 1, fig. 1, 1921.

23.2 mm. in advance of the maxillary notch. The greatest vertical depth of the supraorbital process of the left frontal is 12.5 mm., and the greatest length is 61 mm.

All of the braincase posterior to the presphenoid is missing. The side of the presphenoid is visible from this view. Of the parietals practically nothing remains except in the temporal fossa. Here a portion of the lateral wing which overspreads the frontal and extends forward to the posterior rim of the supraorbital process can be traced. Below the supraorbital process and between the vomer and the arched palatine is the exposed nasal passage.

Ventral view.—The most striking feature of the ventral aspect (pl. 2) is the relatively large size of the palatine bones. Anteriorly they extend forward beyond the maxillary notches, but in *Archaeodelphis* they terminate slightly posterior to them. The palatine region of the *Agorophius* skull was not figured. In contrast to *Archaeodelphis*, the alveolus of the last molar in *Xenorophus* is not situated in advance of the anterior margin of the palatine. Externally the palatine contributes the lower and outer margins for the infraorbital foramen. Each palatine attains its maximum horizontal expansion in a line with the inferior margin of the jugal. The emargination of the anterior end of each palatine is quite noticeable and rather irregular. Together they are almost as broad as the space between the tooth rows, but they were not in contact mesially.

The vomer first appears as a splint-like bone inserted between the maxillae, commencing near the anterior margin of the alveoli for the first two-rooted teeth, and disappearing at the level of the last tooth. It appears again between the palatines at the level of the infraorbital foramina and extends backward beyond their posterior margins. The vomer is very thin and crest-like between the posterior margins of the palatines but from there on abruptly diminishes in height and increases in width, and finally sheathes the entire ventral face of the presphenoid. It is deepest at the nasal passages.

Between the anterior margins of the palatines and the first two-rooted teeth, the maxillae are separated from each other by the vomer. In front of this bone the premaxillae form a wedge which increases in width anteriorly. The ventral surfaces of the maxillae are rather flat between the rows of two-rooted teeth, and are marked by shallow longitudinal grooves. The base of the rostrum is characterized by a well-marked constriction which commences at the postero-external angles of the alveoli for the next to the last molars. Posteriorly, the maxillae are overspread by the palatines.

An enlarged and thickened wedge like lachrymal is inserted between the supraorbital process of the frontal on the rear, and the horizontal plate of the maxilla and the jugal on the front. It extends inward beyond the internal wall of the infraorbital foramen, and apparently was in contact with the pterygoid. The position of the lachrymal on the ventral face of the skull is more in agreement with that of *Kogia* than any other cetacean known to the writer. In *Squalodon bariensis*¹ a splint-like process of the jugal extends backward from the maxillary notch to the antero-inferior margin of the zygomatic process of the squamosal. Anteriorly, the jugal in this fossil skull occupies the same relative position, but its posterior extension is missing on both sides.

The postorbital margins of the supraorbital processes of the frontal are rounded and their postero-external angles are not perfect. A narrow groove between the parietal and the presphenoid gives passage to the optic nerve from the interior of the braincase to the broad canal which traverses the middle of the supraorbital process. The lower portion of the narial passage is formed largely by the arching palatines. As the pterygoid is missing the side of the passage is not enclosed.

Teeth.—All six of the teeth which are in place in the maxillae have a well-marked cingulum. A distinctive feature is imparted to the cingulum by the closely approximated minute cusps which arise from it. Each of these teeth has two rather slender roots which are united at the base by a slender isthmus. The crown of the sixth two-rooted tooth is covered with rugose or striate enamel. The apex of the crown of the left tooth is missing, but there remain six well-defined cusps on the posterior, and four on the anterior cutting edge. The apex of the corresponding tooth on the right side is damaged to an even greater extent. Four cusps are present on the anterior cutting edge and an equal number on the posterior. The crown of the fifth two-rooted molar is higher than that of the sixth. There is a close agreement between the left and the right teeth in general features. Both have six well-defined cusps on the posterior cutting edge of which the two basal ones are rather minute, and four less prominent cusps on the anterior cutting edge. The fourth two-rooted teeth are so imperfect and fractured that description is impossible, but the sculpture of the enamel crown is the same as for the preceding.

¹ Lortet, L., Note sur le *Rhizoprion bariensis* Jourdan, Archives du Museum d'histoire naturelle de Lyon, vol. 4, pl. 25 bis, 1887.

MEASUREMENTS OF THE SKULL

	mm.
Total length as preserved.....	371
Length of rostrum as preserved (from maxillary notch).....	249
Greatest breadth of skull across supraorbital processes.....	183.3
Least breadth of cranium at intertemporal constriction..... (est.)	45
Greatest vertical height of skull (between frontals on vertex and crest of vomer)	105.7
Greatest vertical height of skull at base of rostrum (at level of maxillary notches)	86
Breadth of rostrum at maxillary notches.....	107
Breadth of rostrum at extremity.....	49
Total length of left maxilla as preserved.....	336.5
Greatest breadth of left maxilla (frontal plate).....	59
Greatest breadth of left premaxilla at distal end.....	18.3
Greatest breadth of left premaxilla at proximal end.....	50
Least distance between inner margins of maxillae across nasals.....	44
Greatest breadth of exposed portion of paired frontals between the premaxillae on the vertex of the skull.....	38
Greatest length of exposed portion of right frontal on vertex of skull....	44
Greatest antero-posterior length of left lachrymal.....	66.7
Greatest depth of lachrymal anteriorly.....	35
Greatest length of right nasal.....	34.7
Greatest length of left nasal.....	36.2
Greatest breadth of left nasal.....	15.4
Greatest breadth of presphenoid posterior to nares.....	35
Total length of vomer.....	301
Greatest length of left palatine.....	90.5
Greatest breadth of left palatine.....	53.7

MEASUREMENTS OF THE MOLARS

	Fourth upper molar Right	Fifth upper molar Right	Sixth upper molar Right	Fourth upper molar Left	Fifth upper molar Left	Sixth upper molar Left
Greatest length of crown..	—	19.2	19.	18.6	19.	19.
Greatest breadth of crown..	—	9.	8.7	—	8.4	8.5
Greatest height of crown (as preserved).	—	13.2	9+	—	13.3	11+



Xenorophus sloanii new genus and species. Type.

Dorsal view of skull. About $\frac{1}{2}$ natural size. Fo. Max., maxillary foramen; Fr. frontal; Ju., jugal; La., lacrimal; Max., maxilla; Na., nasal; Pmx., premaxilla; V., vomer.



Xenorophus sloanii, new genus and species. Type.

Ventral view of skull. About $\frac{1}{2}$ natural size. Ju., jugal; La., lacrimal; Max., maxilla; Pal., palatine; Pmx., premaxilla; S. or, pr. supraorbital process of frontal; V., vomer.