DESCRIPTION OF A NEW GENUS AND SPECIES OF WHALEBONE WHALE FROM THE CALVERT CLIFFS, MARYLAND.

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In the course of studying the collection of fossil cetaceans in the United States National Museum, a cranium of an apparently undescribed whale was found. A cursory examination revealed so many features of unusual interest that it led to further comparisons and a review of previously described forms. This cranium lacks the rostrum, as well as the jugals, the lachrymals, the palatines, and the nasals. What remains, however, is fairly well preserved and clearly pertains to a small mystacocetacean of a primitive type, related to the Miocene cetotheres, but differing in certain important details from the previously known crania referred to this group.

The cranium belonged to a small cetacean, probably some 15 or 20 feet long. Obvious peculiarities are its relatively narrow and compressed braincase, wide basicranium, parietals forming part of the vertex, relatively small and flattened occipital condyles, and subhemispherical protuberances on the lateral margins of the basioccipital. These characters, together with features exhibited by the periotic and tympanic, are sufficient to indicate its relationship to the Mystacoceti. Though possessing many features in common with *Idiocetus* and *Cetotherium*, this cranium shows so many points of difference that it seems worthy of rank as a distinct genus.

PARIETOBALAENA, new genus.

Diagnosis.—A new and interesting cetothere with large parietals which meet mesially and form a short sagittal crest between the apex of the supraoccipital and the frontals; maxillary, premaxillary, and nasal sutures barely extending backward beyond level of anterior margin of supraorbital plate of frontal at constriction; orbit large; temporal fossae wide; zygomatic process of squamosal relatively small and slender, but apparently not extending forward to extrem-

ity of post orbital projection of supraorbital plate; condyles small and borne on short necks; exoccipitals directed obliquely downward and backward, with their lateral margins projecting beyond level of articular faces of condyles; jugular incisure deep and rather broad; angle formed by anterior margin of squamosal and its zygomatic process external in position.

The periotic exhibits a marked modification of the type present in skulls of *Rhachianectes glaucus*, *Megaptera nodosa*, and *Cetotherium rathkei*. The labyrinthic region is strongly compressed, so much so that the cerebral aperture of the facial canal, the internal acoustic meatus, and the aperture of the *aquaeductus cochleae* open on the dorsal face of this bone and not on the internal face as in living whalebone whales. The tympanic and periotic exhibit only minor modifications of the type found in *Idiocetus laxatus*.

PARIETOBALAENA PALMERI, new species.

Type.—Cat. No. 10668, Division of Vertebrate Palaeontology, United States National Museum. This specimen consists of a cranium in a fair state of preservation; the nasals, jugals, and lachrymals, as well as the rostrum and its component parts, the maxillæ, premaxillæ, and vomer are missing. Both periotics are preserved in place. One imperfect tympanic also belongs with this skull.

Type locality.—The occurrence is as follows: Near latitude 38° 35′ N., longitude 76° 31′ E., on the western shore of Chesapeake Bay, 1 mile above Dares Wharf, Calvert County, Maryland. Shown on Patuxent Quadrangle or Patuxent Folio No. 152, United States Geological Survey.

Horizon.—The specimen was discovered and excavated by William Palmer on August 14, 1913. It was dug from the cliff 3 feet above the beach and about 8 feet above the wide shell stratum (Shattuck's zone 10), which is at this point well under the beach level; thus, it was found at about the center of zone 11, both strata being here much thicker than further northward. It may thus be assigned to Shattuck's zone 11 of the Calvert Miocene formation of Maryland.

DESCRIPTION OF THE SKULL.

Dorsal view.—In general form the skull of *Parietobalaena* is directly intermediate between *Cetotherium* and *Idiocetus*. The most obvious features of this skull (pl. 1) are: The marked intertemporal constriction of the cranium and the triangular shape of the supraoccipital, which is broad at the base and whose sides curve obliquely upward, forming an apex on the vertex. The form and dimensions of the bones comprising the rostrum are unknown. The frontals and squamosals project strongly from the sides of the brain

case. As a result of these features, together with the exclusion of the frontals from the vertex of the skull and the position of the nasal, maxillary, and premaxillary sutures. it bears a general resemblance to the skull of *Idiocetus laxatus*,[1] and is thus somewhat different from that *Agorophius pygmaeus*. A more detailed comparison shows that the skull of *Agorophius* is considerably smaller. possesses projecting condyles and relatively shorter supraorbital processes of the frontals and lacks a sagittal crest; the nasal, premaxillary, and maxillary sutures lie posterior to the anterior margins of supraorbital processes, while the apex of the supraoccipital is rounded and not pointed on the vertex of the skull. An additional modification is shown in the great transverse breadth and proportionately short length of the temporal fossae of *Parietobalaena*.

The frontals in the skull of *Parietobalaena* are excluded from the vertex of the skull by the parietals, which meet mesially in the intertemporal region to form a short sagittal crest. The rostral wall of the cranium is formed largely by the frontals. They are relatively short antero-posteriorly and are suturally united along the median line. Either frontal, with its lateral extension—the supraorbital plate—is constricted mesially; the preorbital projection is rounded, while the postorbital is slender and produced backward. The supraorbital plate of each frontal has a strong sagittal arch, anterior to which the surface slopes forward in a moderate curve, while posteriorly it turns sharply downward. Compared with *Cetotherium rathkei*,[2] the supraorbital plates are narrower, shorter, and consequently less curved.

The parietals, which meet along the dorsal margin of the cranium behind the orbits to form a short sagittal crest, are suturally united with the triangular supraoccipital posteriorly and with the frontals anteriorly. Anteriorly the parietal sends forward a thin sheet of bone which, on the left side of the cranium, partially conceals the fronto-parietal suture. The imperfect preservation of this surface on the right side exposes the suture for its entire extent. From this it will be seen that it is similar in position to the same suture in the skull of *Agorophius pygmaeus*.[3]

The frontals, as remarked above, are overridden by the parietals posteriorly, and the maxillæ, premaxillæ. and nasals anteriorly. On either side of the median line there is a narrow grooved sinus, with its inner margin elevated above and its outer margin depressed

[1] Van Beneden, P. J., Description des ossements fossiles des environs d'Anvers. Part 5. Annales du Musée Royal d'historie Naturelle de Belgique, Bruxelles, vol. 13, pl. 54, fig. 1, 1886.

[2] Brandt, J. F., Untersuchungen ueber die fossilen und subfossilen Cetaceen Europa's, Mem. Acad. Imp. Sci. de St. Petersbourg, ser. 7, vol. 20, No. 1, pl. 1, figs. 1–2, 1873.

[3] True, F. W., Remarks on the type of the fossil cetacean *Agorophius pygmaeus* (Müller). Special Publ. 1694, Smithsonian Institution, pl. 6, fig. 3, 1907.

below the frontal surface, for the reception of a nasal. The shape of this area suggests that the nasals must have been very narrow, closely approximated, and slightly widening anteriorly. The sinuses on the superior face of the frontal for the reception of the nasals, as discussed above, occupy a sloping surface 34 mm. long, 17 mm. wide proximally, and 23 mm. wide distally. The sutures are shallow posteriorly and become deeper anteriorly. At either side of the nasal sinuses appears a similar depression for the ascending process of the premaxilla, whose maximum width is about equal to that of the base of the nasal. External to these sinuses for the premaxillæ there are eight or more grooves for lodging the posterior ends of the maxillæ. Each of these grooved areas is approximately 33 mm. wide and beyond these the surface of the frontal is relatively smooth.

The supraoccipital is very broad at the base and its sides curve obliquely upward; in consequence the apical portion is pointed and not rounded as in *Agorophius pygmæus*. There is a well defined carina on the apical portion of this bone, on either side of which the surface is slightly depressed. These depressed areas on the apical half of the supraoccipital probably afforded an extensive area for the attachment of the muscles which assist in raising the snout. The condyles do not project beyond the plane of the exoccipitals. The squamosals and their slender zygomatic projections form the posterior and outer margins of the temporal fossæ. Both zygomatic processes are incomplete anteriorly, but it is doubtful whether they were originally in contact with the postorbital projection of the supraorbital plate of the frontal.

Posterior view.—As a whole this view narrows toward the vertex from the postglenoid processes of the squamosals. As seen from this aspect the supraoccipital curves upward and forward. The lambdoidal crest, formed by the lateral margins of this bone and the abutting edges of the parietals and squamosals, is well marked and becomes more prominent toward the apex. The supraoccipital is broadly sutured to the parietal as is shown by the exposed edge of the parietal (pl. 2) which at this point is 26 mm. wide.

The exoccipitals are relatively small, coalesced with the supraoccipital above, and projecting outward and backward. Anteriorly they are suturally united with the squamosals while inferiorly they are fused with the basioccipital. A somewhat similar arrangement of the bones comprising the basicranium is shown by *Cetotherium megalophysum*, but in this form the exoccipitals do not extend backward beyond the condyles, although they are produced downward below them.

The opening for the foramen magnum is almost circular. The occipital condyles are semielliptical in outline, considerably broader near the base than near the apex, and slightly convex from side to

side. They are borne on very short condylar processes and are set off from the exoccipitals by shallow concavities. The peculiarities of the occipital condyles correspond more closely with those of *Cetotherium megalophysum* than with any other cetothere described by Cope. In *Agorophius* and *Archaeodelphis*[4] the condyles are much more protuberant and are set off from the exoccipitals by distinct necks. The articulating surfaces of the condyles are relatively larger; their flattened appearance and short neck indicate that the skull rests firmly upon the corresponding articular surfaces of the atlas. This modification, in turn, leads one to conclude that the anterior cervicals, at least, were fused together. The small mastoid region for muscle attachments, taken in connection with a broad, flattened, and shallow condylar surface, indicates a limited degree of mobility for the head. In all probability its habits in feeding and the correlated movements of the head were similar to those of living whalebone whales.

Lateral view.—The marked convexity of the cranium, the arched base line, together with flattened occipital condyles, closely appressed exoccipitals, and the marked ventral projection of the postglenoid processes, combine to lend this aspect of the skull (pl. 3) a very different appearance from that of *Agorophius pygmaeus.* In this specimen the highest point of the dorsal profile is formed by the apex of the supraoccipital, in front of which the sagittal crest formed by the parietals slopes forward to the rostrum. In *Agorophius*, on the contrary, there is an obvious elevation of the skull at the base of the maxillaries, back of which the dorsal profile is seen to extend on a nearly horizontal plane to the apex of the supraoccipital.

The zygomatic process of the squamosal is slender, tapering anteriorly; the dorsal surface slopes gradually forward. This is in strong contrast to *Cetotherium rathkei*, in which it is large and thickened and underlaps the postorbital projection of the supraorbital plate. Correlated with this difference is the form of the glenoid cavity and the length of the postglenoid process. In form this portion of the squamosal apparently bears a closer resemblance to *Cetotherium* than to *Agorophius*, *Archaeodelphis*, or *Patriocetus*[5]. The postglenoid process is a thick plate of bone projected more backward than downward and whose posterior face is grooved by the external auditory meatus. This process is rather broad and terminates in a blunt, rounded tip. The squamosal as a whole is relatively large, firmly fixed to the side of the skull, and internally takes part in the formation of the lateral wall for the cranium.

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[4] Allen, G. M., A new fossil cetacean. Bull. Mus. Comp. Zool. at Harvard College, vol. 65, No. 1, pl., figs. 1–2, 1921.

[5] Abel, O., Die Vorfahren der Bartenwale. Denkschr. d. Kais. Akad. Wissensch. math.-naturw. Kl., Wien, vol. 90, pls. 2, 6, 12, 1913.

In the temporal fossa the external pterygoid lies below the alisphenoid and is in contact with the squamosal. In either temporal fossa the parietal is suturally united with the squamosal posteriorly, with the small alisphenoid inferiorly, and with the frontals anteriorly. The parietals, which instead of being excluded from the vertex of the skull as in some of the living whalebone whales, meet behind the frontals and form the narrow isthmus connecting the occipital portion of the skull with the pretemporal. As a whole the exposed surface of the parietal widens toward the vertex from the sphenoidal fissure.

In most cetaceans at least two foramina are visible in each temporal fossa. *Parietobalaena*, apparently, does not possess all of these foramina and may possibly have retained a more primitive method of affording exit to the cranial nerves. Slightly in advance of the zygomatic process is the foramen ovale whose aperture is seen at the anterior bifurcation of the squamosal. Above and in front of this foramen is the very large sphenoidal fissure, an excavation in the wall of the cranium. Through this fissure the optic and the second division of the fifth nerves probably emerged. The ala temporalis or alisphenoid is preserved on either side, and its extremity appears in the wall of the temporal fossa above the external pterygoid.

A complete osseous roof for the orbit is afforded by the supraorbital plate of the frontal. The postorbital projection of this plate is longer than the preorbital and, originally, may possibly have been in contact with the zygomatic process of the squamosal. This, however, is doubtful for the postorbital projection of the frontal bears no articular surface which would suggest such a contact. The supraorbital plate is convex above and concave below. It is thus evident that the supraorbital plate of the frontal has a more arched form, and in particular is relatively longer transversely than in *Patriocetus*.

The exoccipitals are flattened up against the squamosals and from a side view are concealed by the squamosals.

Ventral view.—The basioccipital is a relatively narrow bone with ventral surface concave from side to side. On each side and near the condyles is a prominent subhemispherical protuberance whose posterior face slopes obliquely forward and is conspicuously concave. On account of these knoblike lateral processes the basioccipital bears a close resemblance to the same element in the basicranium of *Cetotherium*.

Anterior to the lateral protuberance on the left side is the posterior end of the imperfectly preserved internal pterygoid. The basicranium was broken during removal from the cliff and some of the bones and sutures were thus damaged or destroyed. The suture be-

tween the basioccipital and the basisphenoid does not show on plate 4, but close scrutiny of the exposed surfaces shows that this transverse suture lies between the base of the V-shaped fracture and the anterior margins of the subhemispherical protuberances. The occipital condyles do not project backward as far as the plane of the exoccipitals. A groove, which originates within the cranial cavity, follows down the external face of the basioccipital, makes a broad, deep channel on the basioccipital and exoccipital, and terminates on the posterior margin of the last mentioned bone. This is interpreted to represent the posterior lacerated foramen.

The basisphenoid is a flat bone and may have been largely concealed by the vomer. No pieces of the vomer were preserved with this skull. The vaginal plates of the internal pterygoids are not preserved in their entirety, but the one on the right side overspreads a portion of the basisphenoid. It is suturally united above with the external pterygoid. The internal pterygoid as originally preserved was in contact with the supraorbital process of the frontal, touching the descending anterior wall of the optic canal near the base of that structure. An examination of the interior of the cranium shows that two processes arise from the anterior end of the basisphenoid, one of which, the ala temporalis, projects upward and outward and its extremity appears in the temporal fossa as a small element (quadrangular in outline) wedged in between the squamosal, parietal, and pterygoid; the other process, the external pterygoid,[6] appears in the internal wall of the temporal fossa, and apparently forms the floor for the scaphoid fossa. The roof of the scaphoid fossa is formed in part by the basisphenoid and the overspreading external pterygoid.

The internal pterygoid terminates posteriorly in front of the lateral protuberance of the basioccipital. The curvature of the descending portion of the internal pterygoid and the position of the suture which marks its contact with the external pterygoid supports the view that the hamular processes would be reduced or even absent.

The zygomatic process of the squamosal is slender in *Parietobalaena*, but not strongly arched, and hence the jaw articulation would be limited in extent. In skulls of the living species of *Balaenoptera*, especially *Balaenoptera borealis*, there is within the temporal fossa a deep crease in the anterior margin of the squamosal. This

[6] In an article which appeared after this description was accepted for publication, Ridewood (Philos. Trans. Roy. Soc. London (B), vol. 211, pp. 260–266, 268, text figs. 14, 15. May, 1922) points out that Schulte (Mem. Amer. Mus. Nat. Hist., New York, new ser., vol. 1, pt. 6, pp. 476–477, pl. 54, fig. 2, pl. 55, fig. 2, March, 1916) has incorrectly interpreted the so-called external pterygoid bone and scaphoid fossa. Schulte distinguishes two pterygoid bones separated from each other by a suture. Ridewood maintains that Van Kampen (Morphol. Jahrb., Leipzig, vol. 34, Heft 3–4, p. 649, December, 1905) has correctly interpreted the parts under discussion. According to the latter, the pterygoid bone has pushed its way in between the alisphenoid and squamosal and thus forms part of the internal wall of the temporal fossa. In consequence, the pterygoid bone by itself bounds the pterygoid fossa [=scaphoid fossa of Schulte] anteriorly.

crease or angle is most conspicuous when viewed from the ventral side and is situated in front of or internal to the glenoid fossa. The absence of this crease or angle is one of the generic distinctions for *Megaptera*, for in this genus the anterior margin of the squamosal extends in an even curve from the zygomatic to the falciform process of that bone. The curvature of the anterior margin of the squamosal in the skull of *Parietobalaena* corresponds with that of *Cetotherium megalophysum* and *Metopocetus durinasus*, and thus differs from all living balaenopterine whales. In *Parietobalaena* the anterior margin of the squamosal, as seen from the ventral view, slopes obliquely outward and backward to a point on a line with the anterior margin of the periotic and then because of the zygomatic projection is directed rather abruptly forward. The angle is situated externally and not internally, as in *Balaenoptera*. The foramen ovale is situated in a V-shaped aperture formed between the diverging glenoid and falciform processes of the squamosal and their union with the external pterygoid.

In ventral view the lateral projection of the squamosal forms the anteriorly projecting zygomatic process and the downward projecting postplenoid process; the antero-internal portion of the squamosal is bifurcated, forming the falciform and glenoid processes of that bone and thus contributing to the formation of the foramen ovale; the postero-internal portion is deeply indented and serves to lodge the periotic. The left zygomatic process as seen from the ventral view is slender and tapers anteriorly. The glenoid surface of the squamosal lies in approximately the same plane as the basioccipital; the anticular surface is rather wide and concave antero-posteriorly. A broad and deep channel for the external auditory meatus, which commences at the postero-internal margin of the squamosal, continues its course outward by winding around the postplenoid process of that bone. The apophysis of the periotic fills in the space between the exoccipital and the posterior margin of the groove on the squamosal for the external auditory meatus.

Ventrally, the frontals are produced outward, as mentioned previously, to form the expanded supraorbital plates. The right supraorbital plate is so incomplete that description will necessarily be limited to the opposite plate. It should be noted that the preorbital surface—that is, the surface in front of the obliquely directed crest which forms the anterior wall of the optic canal—presents no features which would prevent or indicate an overspreading of this surface by the horizontal ventral plates of the maxillæ.

MEASUREMENTS OF THE SKULL.

	mm.
Greatest breadth of skull across supraorbital processes (as preserved)	349
Greatest transverse diameter of left frontal (measured in a straight line from inner margin of frontal to tip of postorbital projection)	213.5
Least antero-posterior diameter of supraorbital process of frontal	66.5

	mm.
Greatest antero-posterior diameter of supraorbital process of frontal (tip of preorbital projection to tip of postorbital projection)	115
Distance from apex of supraoccipital to level of anterior margins of frontals	138.5
Greatest breadth of skull across zygomatic processes of squamosal	332
Vertical height of skull (basisphenoid to apex of supraoccipital)	133
Least breadth of cranium between temporal fossae	99
Distance from vertex to upper margin of foramen magnum (estimated)	147
Height of foramen magnum (estimated)	37
Breadth of foramen magnum	40.5
Greatest distance between outer margins of occipital condyles	86.5
Greatest diameter of left condyle	65
Distance across skull between outer margins of exoccipitals	225.5
Distance between tip of postglenoid and tip of zygomatic process of left squamosal	115
Distance between tip of left zygoma (as preserved) and postorbital projection of frontal	36.5
Distance between tip of preorbital projection of supraorbital process of frontal and tip of postglenoid process of squamosal	242
Greatest breadth of basioccipital across lateral protuberances	75.5
Distance between anterior margin of foramen magnum and anterior margin of basisphenoid	126

PERIOTIC.

The body of the right periotic (pl. 5, fig. 1) is irregularly quadrangular, although the internal margin is indented by a deep V-shaped depression. It differs greatly from the periotics of such whalebone whales as *Rhachianectes glaucus*, *Megaptera miocaena*,[7] and *Cetotherium rathkei*,[8] or from *Metopocetus durinasus*, and exhibits a close resemblance to that of *Idiocetus laxatus*.[9] The structural peculiarities of the periotic of *Idiocetus laxatus* are of the same general type as this fossil periotic. The differential features of the *Parietobalaena* periotic consists of a shorter and more robust posterior process and a larger internal acoustic meatus. The periotic of *Heterocetus brevifrons*[10] might be confused with this form, but in the latter the apex of the labyrinthic region is more pointed and the groove above external aperture of the *aquaeductus vestibuli* is much narrower. The labyrinthic region is strongly compressed, so much so that from a dorsal view (pl. 5, fig. 2) it appears to be crushed against the prootic. The margins of the labyrinthic region are well defined on the dorsal face. The dorsal surface of the prootic is closely applied to the petrous portion of the squamosal, and the anterior margin is in contact with the pterygoid process of the alisphenoid.

[7] Kellogg, R., Proc. U. S. Nat. Mus., vol. 60, No. 2435, text figs. 1, 3, 6, 7, 1922.

[8] Brandt, J. F., Mem. Acad. Imp. Sci. de St.-Petersbourg, ser. 7, vol. 20, No. 1, pl. 3, fig. 2, 1873.

[9] Van Beneden, P. J., Description des ossements fossiles des environs d'Anvers. Part 5. Annales du Musée Royal d'histoire Naturelle de Belgique, Bruxelles, vol. 13, pl. 54, figs. 3–4, 1886.

[10] Van Beneden, P. J., Idem, vol. 13, pl. 26, figs. 2–5.

The posterior end, or apophysis, is elongate and expanded, and is produced externally as in most whalebone whales. The apophysis fills the cavity between the exoccipital and the posterior margin of the groove for the external auditory meatus. The posterior pedicle of the tympanic is fused to the apophysis. The pedicle on the anterior end of the tympanic is fused with the pro-otic and the point of contact (pl. 5, fig. 4) is situated in advance of the labyrinthic portion of the periotic. The anterior process, or pro-otic, is very large in proportion to the labyrinthic portion. The antero-external corner of the anterior process is rounded and the antero-internal is produced inward, forming a wedge-shaped plate or lamina. On the ventral face of the pro-otic (pl. 5, fig. 3) and opposite the fenestra ovalis is a circular depression in which the head of the malleus is lodged.

The internal wall of the opisthotic descends obliquely inward while the external wall of the labyrinthic portion of the periotic is more nearly vertical. Between these two closely approximated faces and at the top of the sinus which they form lies the semi-inclosed groove for the facial nerve. The groove which marks the course of the nerve is 10 mm. above the inferior face of the opisthotic and 8.5 mm. above the corresponding surface of the labyrinthic. The groove for the facial nerve begins at the posterior margin of the periotic and, curving inward, leads to the epitympanic orifice of the facial canal. The fenestra ovalis is situated on the ventral face of the labyrinthic portion of the periotic and on a level with the internal margin of the above-mentioned groove. The foot plate of the stapes is firmly imbedded in the fenestra ovalis; the remainder is missing. The incus was lost, possibly during preparation, though the malleus (pl. 5, fig. 4) was in place when the skull was placed in the writer's hands for description.

The postero-external face of the labyrinthic portion projects backward as a thin sheet or lamina of bone; internal to this process and on the posterior face there is a circular opening, the fenestra rotundum.

The most noticeable feature of this periotic is the circular concavity on the dorsal face, which, coupled with the location of the internal foramina, impart an unusual appearance to this bone. As seen from the dorsal view (pl. 5, fig. 1), the labyrinthic region is roughly triangular. Below the apex of this structure is a large elliptical opening, which is divided mesially by a thin, bony partition. The posterior fossa represents the internal acoustic meatus, at the bottom of which are three small circular depressions. The more internal one of these leads to a small opening, presumably the foramen centrale. The spiral tract is represented by the two remaining depressions. The fossa is approximately 7 mm. deep. The passage anterior to the internal acoustic meatus represent the internal

opening of the facial canal, which pierces the pro-otic as mentioned above and then turns obliquely backward at the point where it enters the labyrinthic. Thus the pro-otic and labyrinthic portions of the facial canal form an acute angle with each other at their junction.

External to the internal acoustic meatus and anterior to the slit-like depression is a minute opening, which may possibly be the *aqueductus vestibuli*. Near the posterior margin of the labyrinthic and adjacent to the internal acoustic meatus is the opening of a small canal, which connects with the fenestra rotundum below it. The latter is the external aperture of the *aquaeductus cochleae*. There is a small concavity on the posterior face of the labyrinthic above the aperture of the *aquaeductus cochleae* and the internal acoustic meatus.

MEASUREMENTS OF THE PERIOTIC BONE.

	mm.
Greatest length of periotic (tip of anterior process to tip of posterior process)	82
Greatest depth of labyrinthic region of periotic	15.7
Greatest breadth of labyrinthic region of periotic	29.5
Length of posterior process or apophysis (external wall of groove for facial canal to tip of apophysis)	47
Greatest antero-posterior diameter of apophysis	26
Distance from apex of labyrinthic to tip of the process below foramen rotundum that projects backward and inward	30.7

TYMPANIC.

Perfect conjoined tympanic and periotic bones have not as yet been found in the Calvert Cliffs. Since the periotic and the tympanic bones of the Cetacea are joined together by two small processes they would hardly escape being broken apart while the skull was being rolled about by the water. In most of the Mystacoceti the periotic is firmly lodged and is held in place by the apophysis and the projecting edges of the squamosal bone. Hence the periotic is usually in place when the skull is excavated. In exceptional cases the tympanic bone is not dislodged by the action of the water, but in such cases the weight or pressure of the overlying beds breaks the connections and crushes the fragile processes which project from the tympanic. As a result of these destructive forces practically all of the tympanics found are fractured or broken.

The single tympanic bone (pl. 6, fig. 1*b*) which was found associated with the skull is imperfect; part of the thin outer lip, as well as the anterior process and the accessory ossicle borne by it, are missing. It was found that the fractured end of the posterior process of the tympanic fits into the corresponding surface of the fragment of this process that is ankylosed to the apophysis of the left periotic. The contact between the proximal and distal fragments of the posterior process is sufficiently close to justify the association of this tympanic with the left periotic.

The thick convex involuted portion of the tympanic (pl. 6, fig. 1*a*). or involucrum, is slightly and unequally depressed below the level of the overarching outer lip, and rather abruptly decreases in thickness anterior to the furrow on the outer lip, while in *Cetotherium* and *Megaptera* it gradually decreases in thickness to the anterior or eustachian angle. The dorsal surface of the involucrum shows the flattened or gently convex undulation which characterizes the tympanic bone of the baleen whales.

MEASUREMENTS OF THE TYMPANIC BONE.

	mm.
Greatest length of bulla	56
Greatest width of bulla	32
Greatest depth of bulla on internal side	31.7
Distance from antero-internal end of tympanic to anterior end of involucrum	23

DESCRIPTION OF TWO TYMPANICS.

Cat. No. 10722, Division of Vertebrate Palaeontology, U. S. National Museum.

As remarked above, practically all of the tympanic bones which are discovered are imperfect; the thin brittle outer lip which bends over the thick rounded involucrum or inner lip is usually damaged even in the best preserved specimens. However, a pair of tympanics in an exceptionally fine state of preservation were collected by William Palmer. Their size and proportions suggested comparison with *Parietobalaena*. The best preserved tympanic bone (pl. 6, figs. 2*a*, 2*b*) measures 52 mm. in length. This tympanic resembles *Parietobalaena* (pl. 6, fig. 1*a*) in the relative thicknesses of the convex and the concave portions of the involucrum, in the contour of the eustachian end of the cavity, in the proportions of the posterior conical apophysis (pl. 6, fig. 1*b*), and in the general outlines of the tympanic as a whole. This left tympanic is sufficiently entire to show the form of the tympanic cavity which is bounded by the overarching outer lip, and the size and direction of its anterior outlet or tympanic aperture of the eustachian canal.

The anterior process of the right tympanic (pl. 6, fig. 3*b*), which unites with the periotic, is broken off at the level of the outer lip. There is a deep groove on the tympanic between the *processus sigmoideus* and the so-called posterior conical apophysis of Beauregard. This apophysis is rounded and projects but slightly above the superior face of the involucrum.

The posterior process projects mainly from the involucrum, although the outer lip posterior to the conical apophysis contributes the thin edged outer margin. The tympanic cavity is continued forward without interruption to the anterior end of that bone and the outlet is relatively narrower than in *Idiocetus laxatus*.[11]

[11] Van Beneden, P. J., Description des ossements fossiles des environs d'Anvers. Part 5. Annales du Musée Royal d'histoire Naturelle de Belgique, Bruxelles, vol. 13, pl. 56, figs. 3, 10, 1886.

The thinner portion of the involucrum is distinctly continued forward to the anterior limit of the tympanic cavity; the convexity of the postero-internal portion of the involucrum abruptly subsides, while the anterior portion becomes decidedly concave. The inner surface of the outer lip of the left tympanic is very rugged opposite the convex portion of the involucrum, but this may be due to a pathological condition for the same surface on the right tympanic is perfectly smooth.

The ventral surface of the tympanic bone (pl. 6, fig. 2*a*) maintains a more equable breadth from the posterior to the anterior end, the antero-external and the postero-interal angles of which are rounded. The anterior and posterior faces of the tympanic slope obliquely backward from the internal to the external margins.

The characters derivable from the tympanic bones are sufficiently diagnostic to be used as a guide in the determination of species. In regard to the differences which are observable in the tympanic bones of *Parietobalaena*, *Cetotherium*, *Idiocetus*, and the form under discussion, it may be said that, though seemingly of slight importance, they afford a means of distinguishing the various species. The peculiar features of the two tympanics described above are sufficiently marked to justify their being regarded as belonging to a distinct species, but nearest allied to *Parietobalaena palmeri*. There is a strong possibility that these tympanics belong to one of the previously described fossil cetaceans of the Calvert formation, but no definite allocation will be made until more material is available for study.

MEASUREMENTS OF THE TYMPANIC BONES.

	mm.
Greatest length of right bulla	52.5
Greatest length of left bulla	52
Greatest width of right bulla	30
Greatest width of left bulla	30.7
Greatest depth of right bulla on internal side	29
Greatest depth of left bulla on internal side	29
Greatest depth of right bulla on external side (ventral face to tip of *processus sigmoideus*)	40
Distance from antero-internal end of right tympanic to anterior end of involucrum	18.5
Distance from antero-internal end of left tympanic to anterior end of involucrum	19.5

EXPLANATION OF PLATES.

Parietobalaena palmeri, new genus and species. Cat. No. 10,668, Division of Vertebrate Palaeontology, United States National Museum. Calvert formation, western shore of Chesapeake Bay, 1 mile above Dare's Wharf, Calvert County, Maryland. Collected by William Palmer, August 14, 1913.

PLATE 1.

Dorsal view of skull of *Parietobalaena palmeri*. About one-third natural size. Abbreviations: *C.* condyle; *Ex. o.* exoccipital; *Fr.* frontal; *Max. s.* maxillary sutures; *Na. s.* nasal sutures; *Pa.* parietal; *Pmx. s.* premaxillary sutures; *Po. p.* postorbital projection of frontal; *Pr. p.* preorbital projection of frontal; *So.* supraoccipital; *Sq.* squamosal.

PLATE 2.

Posterior view of skull of *Parietobalaena palmeri*. About seven-sixteenths natural size. Abbreviations: *Bo.* basioccipital; *C.* condyle; *Ex, o.* exoccipital; *Fo. m.* foramen magnum; *Meat. aud. ext.* meatus auditorius externus; *Pa.* parietal; *Po. gl. p.* postglenoid process; *Po. p.* postorbital projection of frontal; *So.* supraoccipital; *Sq.* squamosal.

PLATE 3.

Lateral view of skull of *Parietobalaena palmeri*. About one-half natural size. Abbreviations: *Ex. o.* exoccipital; *Ex. pt.* external pterygoid; *Fo. ov.* foramen ovale; *Fr.* frontal; *Meat. aud. ext.* meatus auditorius externus; *Pa.* parietal; *Po. gl. p.* postglenoid process; *Po. p.* postorbital projection; *Pr. p.* preorbital projection; *Sph. f.* sphenoidal fissure; *Sq.* squamosal.

PLATE 4.

Ventral view of skull of *Parietobalaena palmeri*. About one-third natural size. Abbreviations: *Ap. per.* apophysis of periotic; *Bo.* basioccipital; *Bs.* basisphenoid; *C.* condyle; *Can opt.* canalis opticus; *Ex. o.* exoccipital; *Ex. pt.* external pterygoid; *Fo. opt.* foramen opticus; *Fo. ov.* foramen ovale; *Fr.* frontal; *Fo. lac. post.* foramen lacerum posterius; *Gl. f.* glenoid fossa; *In. pt.* internal pterygoid; *Meat. aud. ext.* meatus auditorius externus; *Per.* periotic; *Po. gl. p.* postglenoid process of squamosal; *Po. p.* postorbital projection of frontal; *Pr. falc.* processus falciformis; *Pr. p.* preorbital projection of frontal; *Prs.* presphenoid; *S. or. pr.* supraorbital process of frontal; *Sq.* squamosal; *Zyg.* zygomatic process of squamosal.

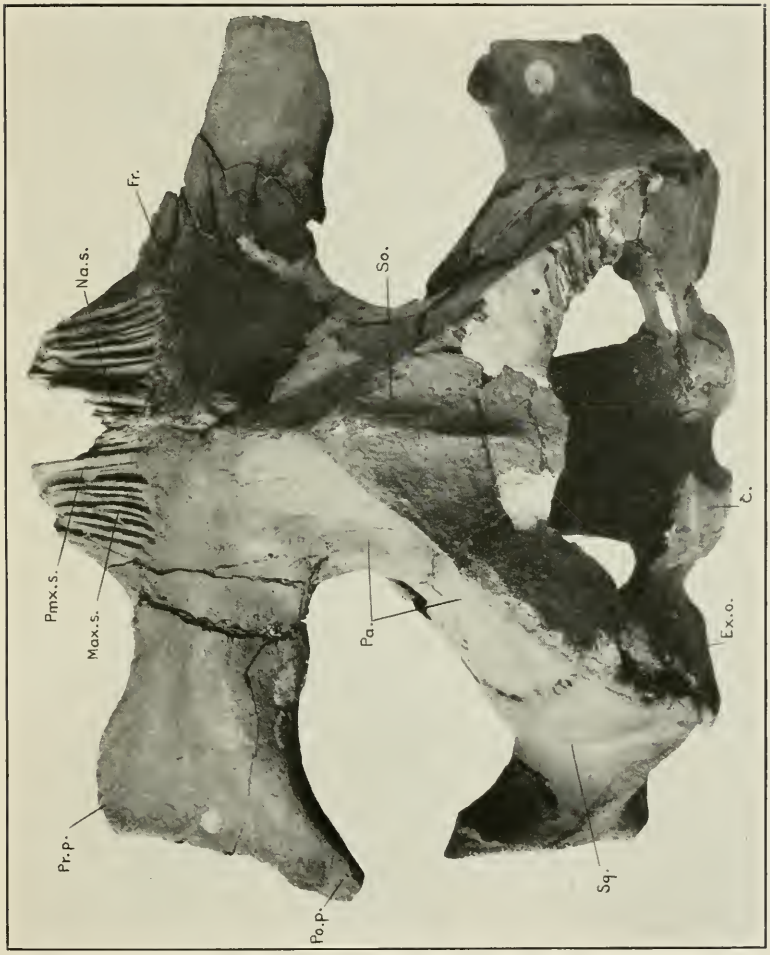
PLATE 5.

Right periotic of *Parietobalaena palmeri*. Fig. 1, Superior view about five-eighths natural size; Fig. 2, Superior view, posterior apophysis removed, about three-fourths natural size; Fig. 3, Inferior view, about five-eighths natural size; Fig. 4, Inferior view, posterior apophysis removed, malleus in place, about three-fourths natural size. Abbreviations: *A. M.* internal acoustic meatus: *A. ped.* anterior pedicle; *Aq. c.* aquaeductus cochleae; *Aq. v.* aquaeductus vestibuli: *F. C.* facial canal; *F. ov.* fenestra ovalis; *F.* and *F. r.* fenestra rotundum; *Incus* (this is not the *incus* as stated in text and should be labeled *malleus*); *Pr. a. pt.* processus anterior petrosi; *Pr. po. pt.* processus posterior petrosi.

PLATE 6.

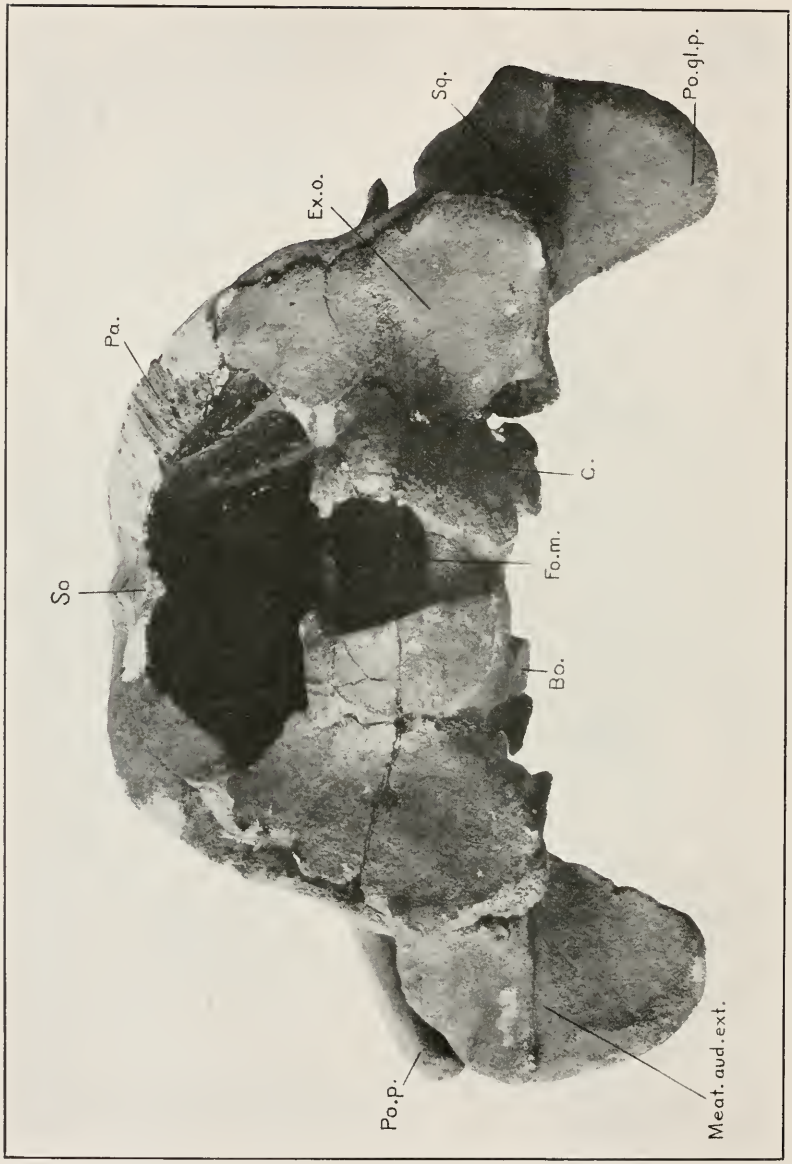
Left tympanic of *Parietobalaena palmeri*. Fig. 1*a*, Superior view; Fig. 1*b*, External view.

Tympanic bones of undetermined fossil cetacean, Cat. No. 10, 722, United States National Museum. Fig. 2*a*, Left tympanic, Inferior view; Fig. 2*b*, Left tympanic, External view; Fig. 3*a*, Right tympanic, Superior view; Fig. 3*b*, Right tympanic. External view. Figures about five-sevenths natural size.



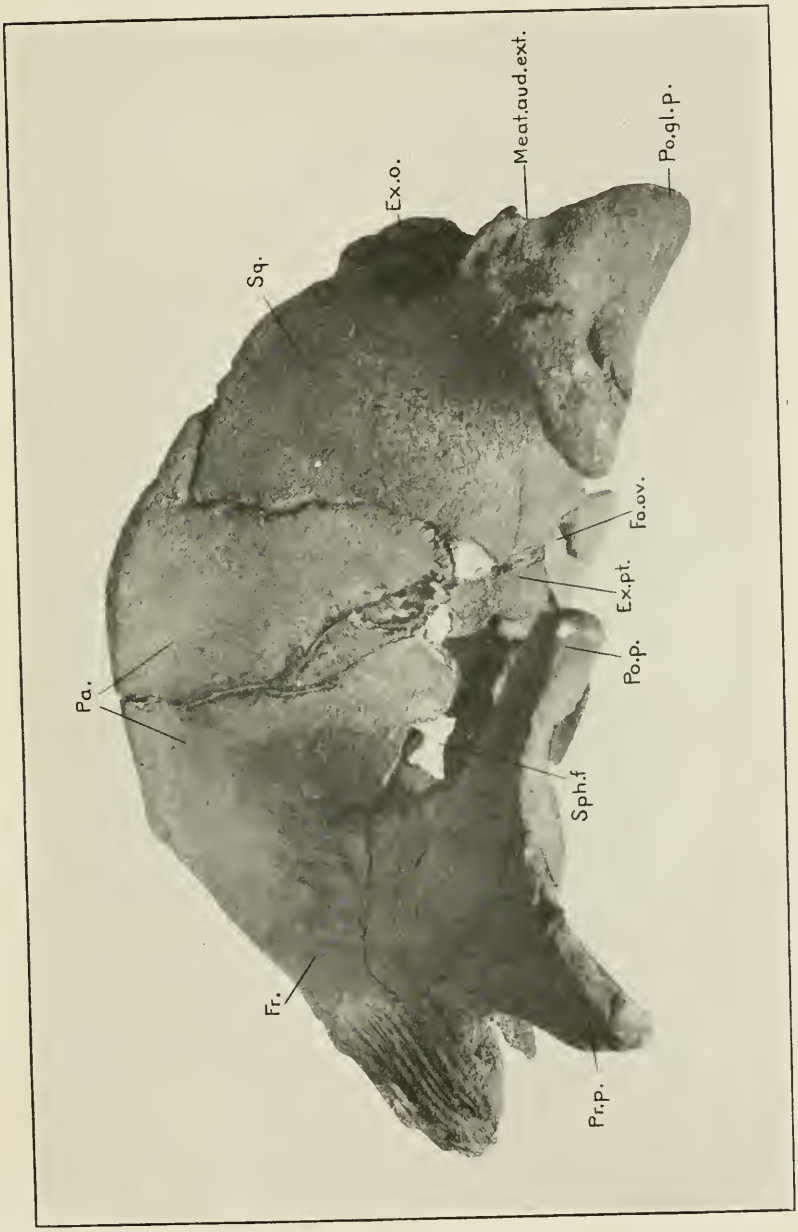
DORSAL VIEW OF SKULL OF PARIETOBALAENA PALMERI.

FOR EXPLANATION OF PLATE SEE PAGE 14.



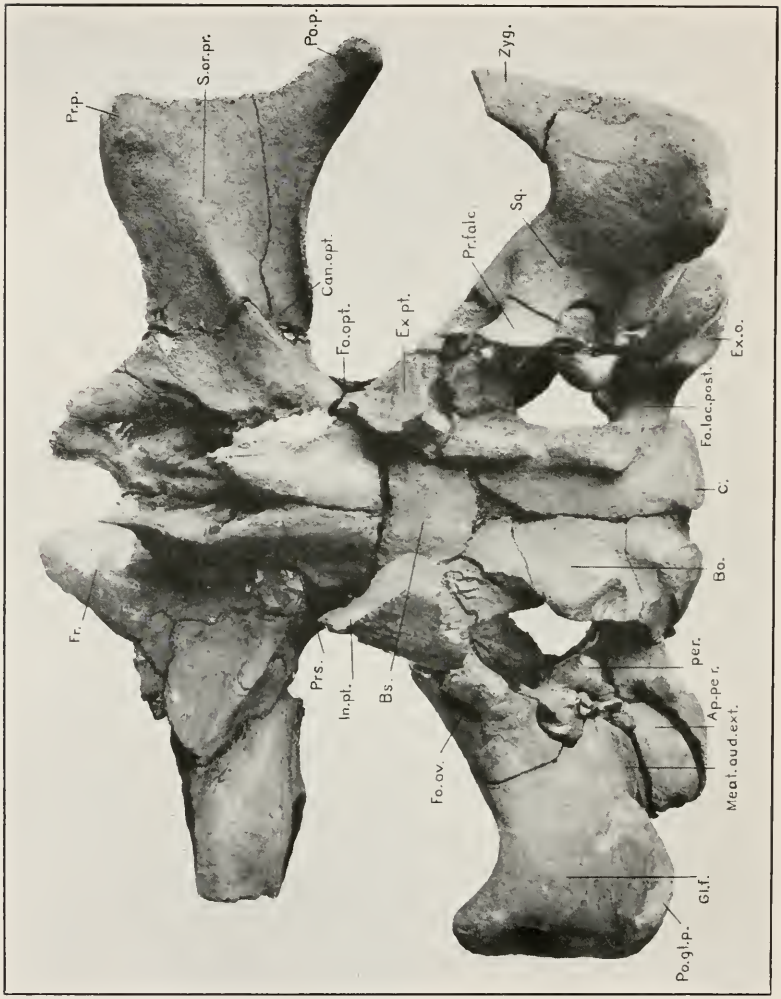
POSTERIOR VIEW OF SKULL OF PARIETOBALAENA PALMERI.

FOR EXPLANATION OF PLATE SEE PAGE 14.



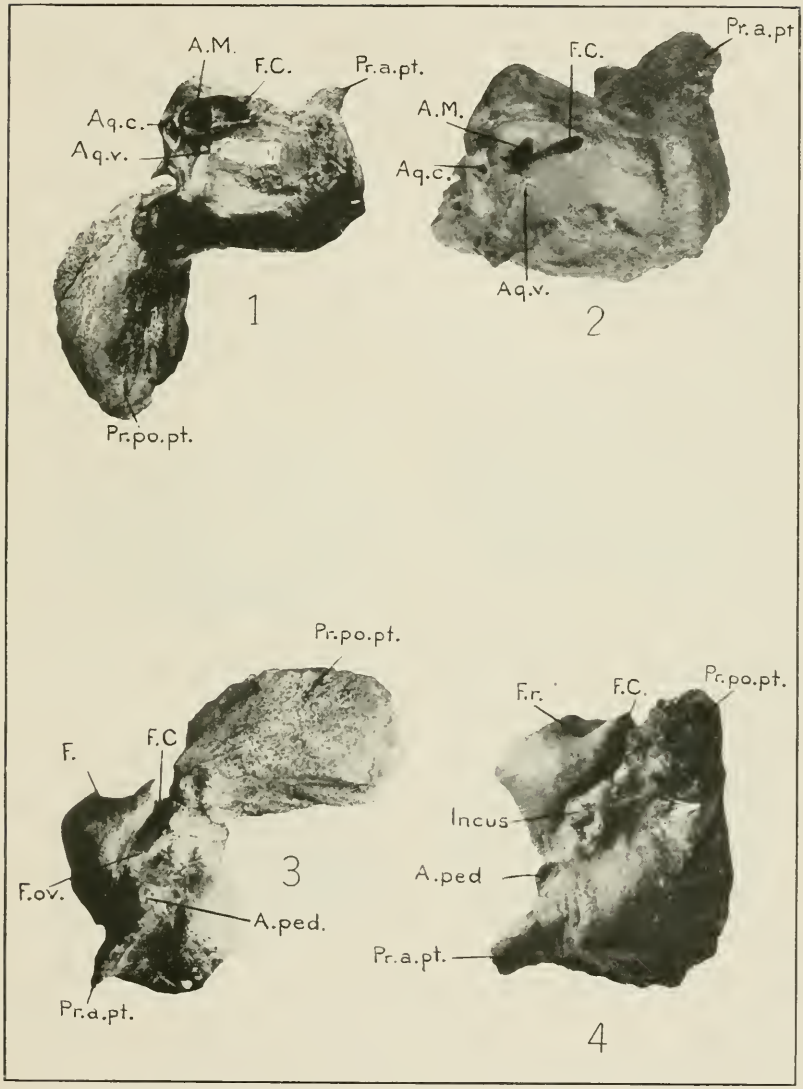
LATERAL VIEW OF SKULL OF PARIETOBALAENA PALMERI.

FOR EXPLANATION OF PLATE SEE PAGE 14.



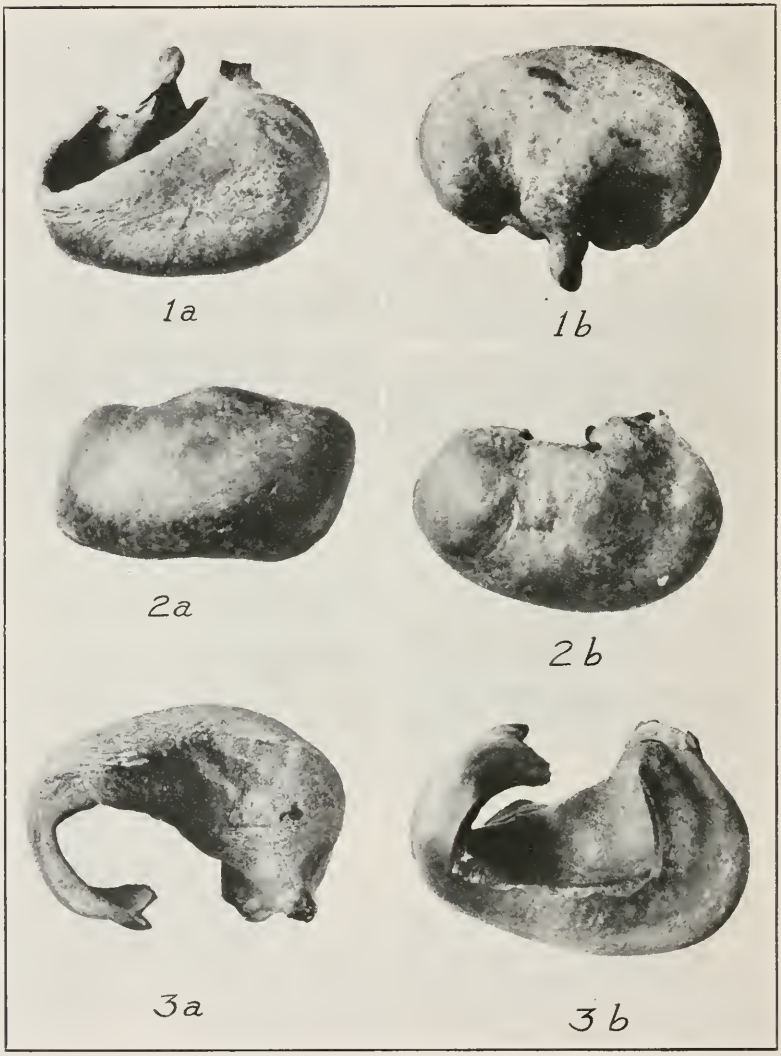
VENTRAL VIEW OF SKULL OF PARIETOBALAENA PALMERI.

FOR EXPLANATION OF PLATE SEE PAGE 14.



VIEWS OF RIGHT PERIOTIC OF PARIETOBALAENA PALMERI.

FOR EXPLANATION OF PLATE SEE PAGE 14.



VIEWS OF TYMPANIC BONES.

FOR EXPLANATION OF PLATE SEE PAGE 14.