

PLATE X.

Dissorhophus articulatus Cope, *American Naturalist*, 1895, p. 998; portion of skeleton, five-sixths natural size.

Fig. 1. Carapace from above.

Fig. 2. Vertebral column ribs and carapace from below; same specimen as Fig. 1.

Fig. 3. Anterior extremity of same specimen.

Lettering.

Q., Quadrate bone; *Md.*, Mandible; *Pg.*, Pterygoid; *MA.*, Meatus auditorius externus; *Cl.*, Clavicle; *Es.*, Episternum; *Sc.*, Scapula; *Co.*, Coracoid; *Gl.*, Glenoid cavity; *H.*, Humerus; *Cu.*, Cubitus; *Ce.*, Centrum; *Ic.*, Intercentrum; *Pc.*, Pleurocentrum; *Ns.*, Neural spine; *R.*, Rib; *Ca.*, Carapace; *Fe.*, Femur; *T.*, Tibia; *Fi.*, Fibula.

Sixth Contribution to the Knowledge of the Marine Miocene Fauna of North America.

By E. D. Cope.

(*Read before the American Philosophical Society, May 15, 1896.*)

The fifth contribution was published in the PROCEEDINGS of the Society for 1895, p. 135, and the fourth in the same for 1870, p. 270.

SYLLOMUS CRISPATUS Cope, gen. et sp. nov.

Char. gen.—Order Testudinata; family probably Cheloniidæ. Costal bones developed beyond rib extremities, and uniting with marginals by suture. Surface sculptured with grooves and ridges. Humerus with entepicondylar foramen enclosed, and flattened shaft. Radial process remote from head.

This is the only definable form of Testudinata yet discovered in the Yorktown bed of the Chesapeake region. It is quite rare, as I have met with it at one time and place only. The carapace is more fully developed than in *Chelone* and *Argillochelys*, and it differs from these and from *Lytoloma* in the sculpture of the surface. From all of these genera and from *Peritresius* it differs in the union of the marginal bones with the costoids by suture.

A few fragments of a species of *Lytoloma* have been found in the same formation.

Char. specif.—This tortoise is known to me from two incomplete costal bones and a humerus. One costal fragment is distal, and the other is proximal. The humerus has the deltoid crest broken off at the base.

The carapacial bones are very thin and consist of a thicker superior

dense layer, a light spongy layer, and a very thin inferior dense layer. There were no horny scuta, and it is doubtful whether there were any dermal sutures. The surface is marked with numerous tubercles which are of elongate form, and run in various directions, frequently inosculating and separating generally narrow fossæ. They are finer and more nearly parallel on the distal part of the costal than on the proximal, and they turn at right-angles to the intercostal sutures. The proximal part of the costal is crossed by an angular keel which runs parallel to the middle line of the carapace. It is smooth, interrupting the sculpture. There are therefore two low parallel keels on the superior part of the plastron. Whether there is a median keel cannot be determined, as no vertebral bone is preserved. At one side of this keel (?proximad) is a smooth shallow groove, which may represent the border of a vertebral scutum. Not enough of it is preserved to demonstrate its nature.

The shaft of the humerus is flat in the plane of the distal extremity and is nearly straight, except that it bends a little downwards proximad of the distal extremity of the deltoid crest. The latter descends low on the shaft marking one-third the length. Its inferior portion is recurved inwards towards the head. The long axis of the head is at right angles to that of the shaft. The radial process is prominent, and marks two-fifths the length of the shaft from the head on the internal edge. The straight line of the axis of the humerus reaches the distal extremity between the condyles and the entepicondylar foramen. Thus the condyles are turned slightly ectad. The internal portion of the condyle has a greater anteroposterior diameter than the external, and though the articular surface is convex anteroposteriorly, transversely there are three shallow concavities, one external and two internal. The internal epicondyle is wide and flat, and equals the condyles in transverse diameter. The external epicondyle is little prominent. The entepicondylar canal is oblique, entering nearer the inner margin below, and issuing at about the middle above.

<i>Measurements.</i>	MM.
Proximal width of costal 1.....	47
Thickness of do. at margin	7
Width of costal 2, at distal end	60
Thickness of do. at distal margin.....	3
Length of humerus.....	100
Diameters of head { anteroposterior	32
{ transverse.....	17
Width of humerus distally.....	41
Transverse extent of condyles	22
Length from radial process to distal end.....	53

I obtained the specimens above described from a Neocene bed on the Pamunky river, Virginia. It was associated with the *Mesocetus siphunculus* Cope, and various species of Platanistidæ, and a Squalodon.

METOPOCETUS DURINASUS, gen. et sp. nov.

Char. gen.—Lateral occipital crests continuous with anterior temporal crests which diverge forwards. Frontal bone elongate, not covered posteriorly by the maxillary, coössified with the nasals. Nasals short, coössified with each other, not projecting anterior to frontals.

Accompanying the cranial fragment on which this genus is founded is a piece of a premaxillary bone of appropriate size, which presents the character of that of a whalebone whale. The true position of this genus is probably between *Cetotherium* and *Agorophius*. It is probably a mysticete which approximates the ancestral zeuglodont type which is represented in our present knowledge by the genus *Agorophius*. It is connected with *Cetotherium* by the new genus *Cephalotropis*, which is described below. The three genera form a group, which may be properly referred to the *Balænidæ*, which is characterized by the elongation of the frontal and parietal bones on the superior walls of the skull. They differ as follows:

A temporal ridge; maxillaries little produced posteriorly; nasals not produced beyond frontal, coössified with the frontal and with each other.....*Metopocetus* Cope.

A temporal ridge; maxillaries much produced posteriorly; nasals free from frontals and from each other, produced well anteriorly.....
Cephalotropis Cope

No temporal ridge; maxillaries much produced posteriorly; nasals free from frontals and from each other, well produced forwards.....
Cetotherium Brandt.

The specimen on which the genus *Metopocetus* is founded is quite mature so that the sutures are coössified. The frontomaxillary and frontopremaxillary sutures are however distinct, as they appear to me, and they are remarkable for their position. They extend but little posterior to the external nareal openings. The latter are, in relation to the supraoccipital crest, anterior, but in relation to the position of the nasals, posterior. The nasals are short for a *Balænid*, although they enter wedge-like into the frontals for a considerable distance.

The position of the genera *Metopocetus* and *Cephalotropis* may be similar to that of the genera *Ulias* and *Tretulias*, which are known from mandibular rami only. One or both of the former may be identical with one or both of the latter; but of this there is as yet no evidence.

Char. specif.—The specimen which represents the *Metopocetus durinasus* is a cranium posterior to the nares, lacking the left exoccipital and squamosal regions, and the right zygomatic process. Both occipital condyles are preserved, and the basicranial region as far as the anterior nares.

The supraoccipital extends well forwards and its lateral crests present a moderate concavity outwards and forwards. Its apex is represented by a semicircular mass, posterior to which it is deeply concave, and the concavity is divided by a longitudinal median crest. The temporal

fossæ approach near together on the median line, forming a short sagittal crest, which is about as wide as it is long. From this the temporal ridges diverge abruptly, and these extend in a nearly straight line forwards, diverging from the line of the axis of the skull at an angle of about twenty-five degrees. Between it and the lateral occipital crest the temporal fossa is concave to the line of the anterior border of the squamosal bone. At the latter point the line of the suture presents an angle, which extends downwards, outwards and forwards. Between it and the posterior temporal crest the surface is concave above.

The exoccipital is flat vertically, and extends a little posterior to the transverse line of the occipital condyles. The postglenoid face of the squamosal is vertical, and it projects laterally beyond the exoccipital. The postglenoid crest is not conspicuous, and the glenoid cavity presents downwards, and very little forwards. The posterior temporal crest bounds a groove of the superior face of the part of the squamosal that lies posterior to it. The latter face is quite wide, and its external bounding angle is a right angle. It is continued as the superior face of the zygomatic process.

The petrous bone has a peculiar form. Its mastoid portion presents externally a nearly discoid outline between the exoccipital and squamosal. Its inferior portion descends as a process which forms the short stem of a half-tubular horizontal portion, which opens downwards and posteriorly, forming a partial meatus auditorius.

The lateral descending borders of the basioccipital are so prominent as to enclose a deep groove between them. The posterior nares are about opposite to the anterior border of the foramen lacerum.

The frontal region at its posterior apex is convex from side to side. As it widens it presents three subequal faces, two lateral and one median. The median plane is separated from the laterals by a shallow groove on each side, which become deeper anteriorly, and turn abruptly outwards at the nareal border. They appear to be the outlines of the nasal bones. Anteriorly the lateral planes become thickened longitudinally just external to these grooves. The entire anterior portion of the external planes is a sutural surface, with longitudinal grooves for a length averaging 40 mm. This surface can relate to nothing but the premaxillary and maxillary elements. This point of attachment is, however, anterior to that of any known genus of Mysticete; and is anterior to that in the *Agorophius pygmaeus* Müll. In not extending so far posteriorly as the nasal bones, it leaves the frontals to embrace the latter anteriorly to an unusual extent. This is on the supposition that the indistinct grooves on each side of the middle line really represent the lateral borders of the nasal bones, which is not certain, except as to their anterior portions.

Measurements.

MM.

Width of skull at exoccipitals	406
“ “ “ postglenoid angles.....	570

<i>Measurements.</i>	MM.
Width of occipital condyles.....	150
“ foramen magnum.....	65
“ sagittal crest.....	17
“ anterior border of nasal bones.....	90
“ skull at sagittal crest.....	170
“ sphenoid at middle of for. lacerum.....	135
Anteroposterior diameter of glenoid surface.....	115
Length of nasal canal.....	250
“ from occipital condyles to anterior nares	450
“ “ foramen magnum to posterior end of sagittal crest (oblique)	210
Length of sagittal crest	15
“ from “ to anterior nares.....	195

This specimen was obtained by Prof. Arthur Bibbins from a Miocene marl from near the mouth of the Potomac river, in Maryland. I am under much obligation to the Rev. John T. Goucher, President of the Woman's College, of Baltimore, for the opportunity of studying the specimen, which belongs to that institution.

CEPHALOTROPIS CORONATUS, gen. et sp. nov.

Char. gen.—Parietal bone separating supraoccipital and frontal by a considerable space and presenting a sagittal crest. Frontal extensively overlapped by the maxillaries, premaxillaries and nasals. Nasals elongate, distinct from the adjacent elements. Frontal presenting divergent temporal angles.

This genus differs from *Cetotherium* in the presence of temporal ridges or angles. It differs from *Metopocetus* in the free elongate nasal bones.

Char. specif.—The specimen which represents this species is a portion of the cranium which includes the elements which surround the brain except the occipital, the superior part of the latter remaining; together with the posterior parts of the maxillaries, premaxillaries and the greater part of the nasals, and the basisphenoid and presphenoid in part, and a considerable portion of the left temporal. The sutures distinguishing the several elements are distinct, so that the boundaries of the latter can be readily distinguished. In describing this fragment I will compare it especially with the *Metopocetus durinasus* and *Cetotherium megalophysum*, where the corresponding parts are preserved.

The supraoccipital angle is produced further anteriorly than in either of the species named, and the sagittal crest is longer than in either. The summit of the smooth occipital surface forms a transverse border, which cuts off the apex of the occiput, thus bounding posteriorly a triangular area, of which the sides are a little longer than the base. This triangle has a low, median keel, on each side of which the surface is

concave, and is marked with numerous irregular fossæ. The surface has been evidently the seat of the insertion of something; but whether it was entirely of a ligamentous character or whether some tegumentary structure had its basis there I do not know. The superior border of the temporal fossa is regularly concave towards the middle line, and regarding the sagittal crest as restricted to the parietal bone, its truncate edge is wider at the extremities than at the middle. The narrowest portion of the crest is nearer the frontoparietal than the parietooccipital suture. The temporal ridge is in regular continuation of the edge of the sagittal crest, and becomes transverse in direction towards the orbital border of the frontal bone. This border is broken off.

The vertical temporoparietal suture does not run along a ridge as in the *M. durinasus*, but its superior portion is on a low, obtuse angle. The frontoparietal suture extends posteriorly from the sagittal crest downwards, much posterior to the direction it presents in the *C. megalophysum*, where its direction on each side is a trifle anterior to transverse. Across the front the suture is coarsely serrate, differing from the sutures of the anterior border of the frontal bone, which are closely and deeply interdigitate, as in the *C. megalophysum*. The superficial median part of the frontal is about one-third as long as the corresponding part of the parietal. The nasomaxillary suture with the frontal is short in the transverse direction, not reaching the temporal ridge on each side. The frontomaxillary suture then becomes nearly longitudinal for a distance of 50 mm. and then turns outwards for 25 mm. On the opposite side the posterior border of the maxillary is more oblique, and extends from the transverse median portion divergent from the line of the temporal ridge, forwards and outwards. The latter is probably the normal direction of the suture. The nasal bones are very narrow, but expand gradually anteriorly. They do not terminate posteriorly in an acute angle as they do in the *C. megalophysum* and *M. durinasus* (apparently), but are truncate. The premaxillaries are also narrow at this point. Their posterior extremities are broken off. The glenoid cavity presents downwards. The presphenoid is plane below anteroposteriorly and transversely posteriorly, but is slightly convex below anteriorly. It is hollow.

<i>Measurements.</i>		MM.
Length of supraoccipital triangle to occipitoparietal suture.		80
Length of parietal on middle line.		60
“ frontal “ “ “		25
Width of supraoccipital at base of supraoccipital triangle.		124
Width of base of cranium opposite supraoccipital triangle.		115
“ sagittal crest.		18
“ nasals at base.		28
“ “ 140 mm. anterior to base		50

In the interstices of the specimen portions of matrix remain which have the color and character of the material of the Yorktown formation. Embedded in this at certain points are fragments of Mollusca of the genera *Pecten*, *Lucina* and *Turritella*. It was probably derived from the Chesapeake region. The fragment belongs to the museum of Johns Hopkins University, of Baltimore, and I am under many obligations to Prof. William B. Clark, State Geologist of Maryland, for the opportunity of studying it.

RHEGNOPSIS PALÆATLANTICUS Leidy. *Balæna palæatlantica*, *Proceeds. Academy Phila.*, 1851, p. 308. *Balænoptera palæatlantica* Cope, *Proceeds. Academy Phila.*, 1868, p. 193. *Protobalæna palæatlantica* Leidy, *Extinct Mamm. Dakota, Nebraska*, 1869, p. 440.

The typical and only specimen of this species is a fragment of a lower jaw from the Yorktown bed of S. E. Virginia. Its specific characters differ from those of other *Balænidæ* referred to in this and preceding papers by me, and it displays in addition a character which Leidy has described, and which is very conspicuous. That is, the presence of a Meckelian fissure, which extends deeply into the mandibular ramus. I agree with Leidy that this feature should be regarded as generic, and so define the genus as follows, under the name *Rhegnopsis*. Roof of dental canal perforated by gingival tubes; a Meckelian fissure. Dr. Leidy's name *Protobalæna* is preoccupied by Van Beneden (1867).

CETOTHERIUM LEPTOCENTRUM. *Eschrichtius leptocentrus* Cope, *Proceeds. Academy Phila.*, 1867, p. 147. *Cetotherium leptocentrum* Cope, *American Naturalist*, 1890, p. 616. *Cetotherium crassangulum* Cope, *Proceeds. American Philosophical Society* 1895, p. 148.

After the latest description of this species was published I visited the locality at which it was discovered, in company with Prof. Arthur Bibbins, of Baltimore. I found a part of a mandibular ramus which coincides in all respects so closely with the portions which are still adherent to the skull that I have no doubt that they pertain to the same species, and probably to the same individual. One character in which this fragment agrees with the other portions of the rami is the presence of coarse cancellous bony tissue throughout the gingival dental canal. This reduces the diameter of the latter to that of the large external gingival canals. The form of the middle part of the ramus as indicated by the fragment is very different from that of any other whalebone whale known to me. The internal face is nearly flat and vertical, while the external face is convex only at the superior portion. For a short distance exterior to the superior angle it is subhorizontal; it then gradually decurves, and is then entirely flat to the inferior subacute edge. The section is then subtriangular, with the base superior and the apex inferior. The interior gingival foramina continue very small, and they are not connected by a groove. Distance between two of them,

45 mm. The external foramina are quite large ; distance between two of them, 165 mm.

A third cervical vertebra was picked up on the James River, Virginia, by Prof. Bibbins, a few miles below the locality from which the type specimen of the *C. crassangulum* was derived, and kindly presented by him to me. It belongs to an adult animal, and considerable parts of one of the parapophyses and neurapophyses are preserved. The former are directed downwards at an angle of about 25° , and therefore much less steeply than in the *C. cephalus*. The form of the centrum is a transverse parallelogram and therefore similar to that of the two individuals previously described. The diameters are : transverse below middle 140 mm.; vertical 97 mm.; anteroposterior at base 34 mm. The dimensions, while less than those of the type *C. crassangulum*, are appropriate to a smaller individual of that species.

EXPLANATION OF PLATES.

PLATE XI.

Fragmentary crania of Balænidæ of the Yorktown epoch, one-sixth natural size.

- Fig. 1. *Cetotherium megalophysum* Cope, from above. Coll. Johns Hopkins University.
 Fig. 2. *Cephalotropis coronatus* Cope, from above. Coll. Johns Hopkins University.
 Fig. 3. *Metopocetus durinasus* Cope, from above. Coll. Woman's College, Baltimore.

PLATE XII.

Diagrams of sections from near the middle of the mandibular rami of extinct Balænidæ, one-half natural size.

- Fig. 1. *Cetotherium leptocentrum* Cope ; Virginia.
 Fig. 2. *Cetotherium cephalus* Cope ; Maryland ; section proximad of the middle.
 Fig. 3. *Cetotherium cephalus* Cope, same jaw as Fig. 2, distad of the middle.
 Fig. 4. *Cetotherium davidsonii* Cope ; California.
 Fig. 5. *Rhegnopsis palæatlanticus* Leidy ; Virginia.
 Fig. 6. *Mesocetus siphunculus* Cope ; Virginia.

No. 1, Coll. Woman's College, Baltimore ; 2, 3, 4, 5, Coll. Academy Natural Sciences, Philadelphia ; 6, Coll. E. D. Cope.

Lettering.

So., Supraoccipital bone ; *Sq.*, Squamosal ; *Z.*, Zygomatic ; *P.*, Parietal ; *F.*, Frontal ; *N.*, Nasal ; *Na.*, External Nares ; *Mx.*, Maxillary ; *Pmx.*, Premaxillary ; *T. R.*, Temporal Ridge.



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