

On Delphinognathus conocephalus (Seeley) from the Middle Karoo beds, Cape Colony, preserved in the South African Museum, Capetown / by H.G. Seeley.

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Seeley, H. G. 1839-1909.
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Publication/Creation

[London] : [publisher not identified], 1892.

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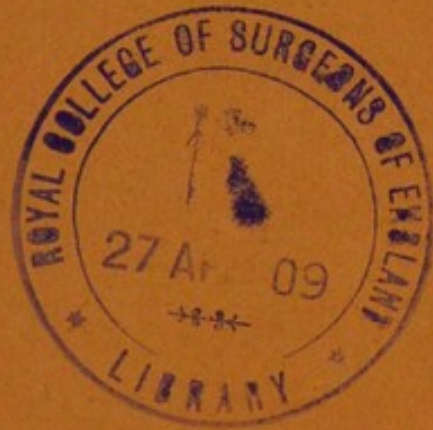
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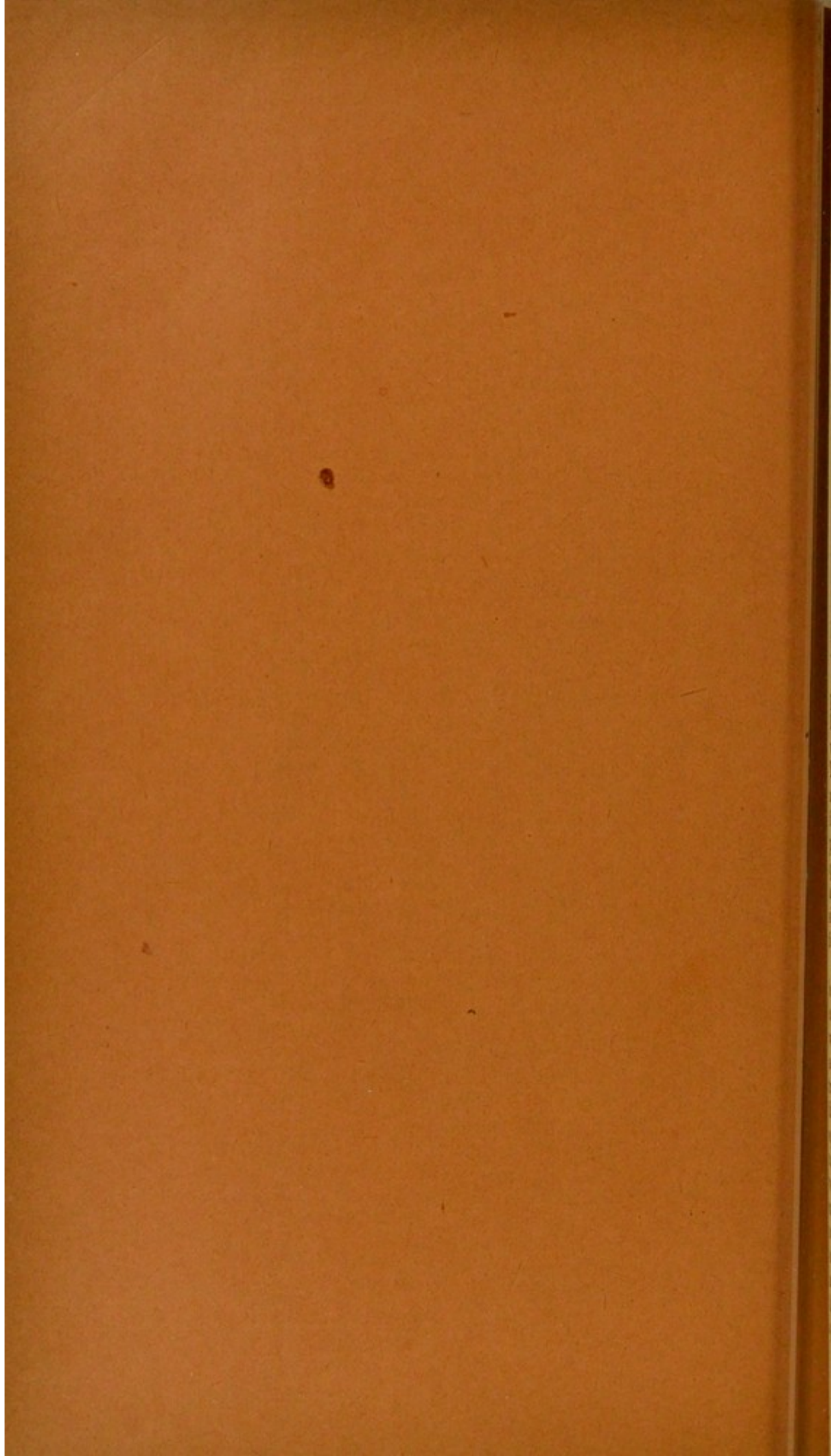
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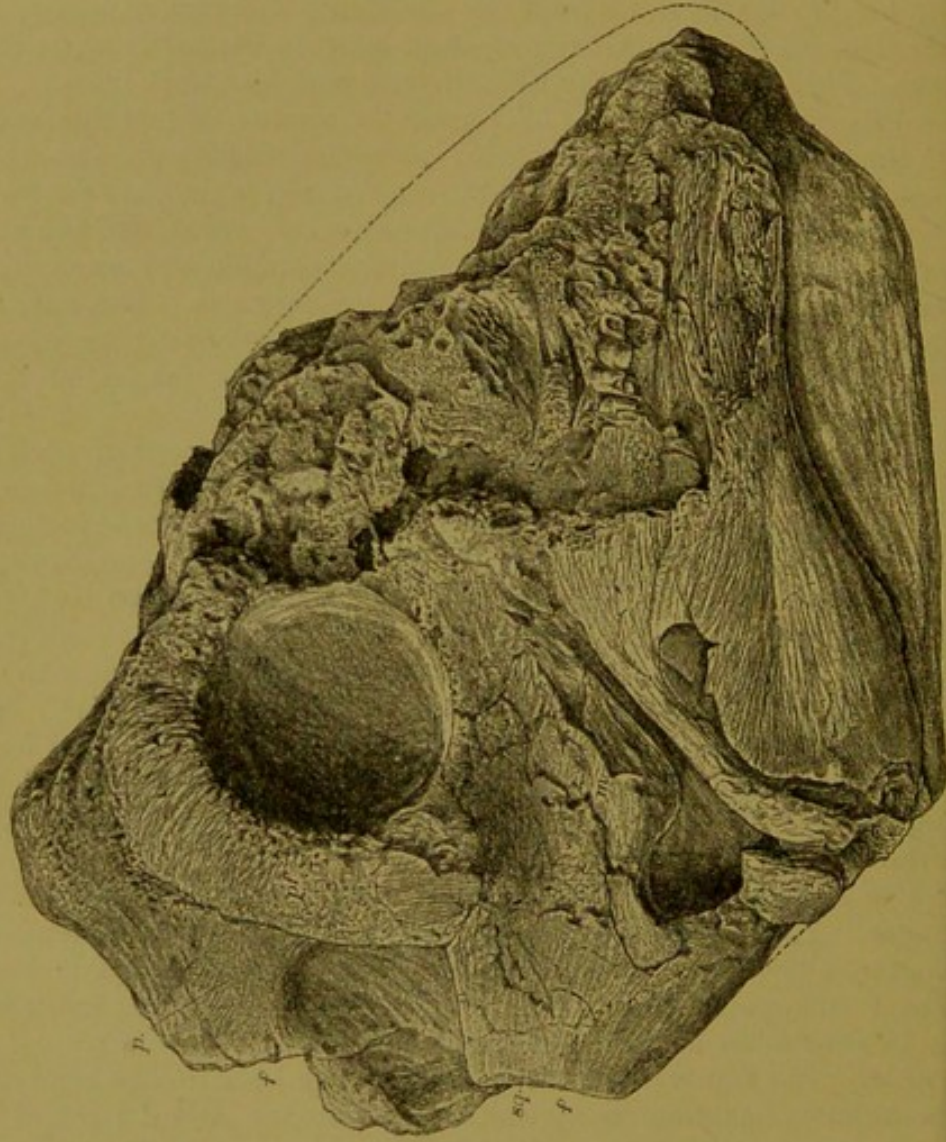
On DELPHINOGNATHUS CONOCEPHALUS (SEELEY) from the MIDDLE KAROO BEDS, CAPE COLONY, preserved in the South African Museum, Capetown. By H. G. SEELEY, Esq., F.R.S., F.G.S., Professor of Geography and Lecturer on Geology in King's College, London.

THE skull herein described is the only portion of the animal collected. No locality for it is recorded in the South African Museum, but Mr. Thomas Bain, the Government geologist in Cape Colony, believes it to have been collected by himself from near Beaufort West. It is slightly distorted with the folding of the strata. The preservation of the specimen leaves something to be desired, for the pre-orbital region is more or less obscured by weathering, which has destroyed the superior contour of the snout, the alveolar border, and the anterior extremity of the jaws. The occipital condyle and much of the occipital plate from the back of the skull are also lost. But, notwithstanding these defects, the skull is the most interesting Anomodont preserved in Cape Colony, and indicates a new family of fossil Reptilia.

The head is characterized by its broad, high, vertical occipital plate. The broad subpentagonal roof to the brain-case (fig. 2) ascends laterally from the inclined temporal region, and is elevated in a cone, which terminates in a large, circular, crater-like parietal foramen. The skull has large sub-circular vertical orbits, placed far backward above the hinder extremity of the lower jaw, so as to converge forward. The temporal fossæ are short and small, owing to the position of the orbits and the width of the cerebral region. The quadrato-squamosal region is directed obliquely forward, and forms a vertical articular surface to articulate with the lower jaw, which is singularly deep posteriorly, and suggests the jaw of a porpoise in its form.

The skull is now 31 centim. long, but was probably somewhat longer. The occipital plate was higher than wide. It extends 24 centim. above the inferior margin of the mandible. The bones which compose the plate lie in a vertical plane, and are conditioned as in *Dicynodon* and its allies, but their several limits cannot be traced. The transverse measurement of the back of the head over the foramen magnum is 20 centim., and at the lateral borders the squamosal bones are prominent. Those bones make the external narrow, vertical borders of the small temporal vacuities. The vertical measurement from the base of the occipital condyle to the summit of the occipital plate is 16 centim.; the superior lateral contours of the plate converge upward in half an ellipse. Inferiorly, there is only a slight narrowing caused by a slight approximation of the squamosal bones in the region of the condyles for the lower jaw. The foramen magnum is not clearly evidenced, but appears to have been small, narrow, and vertical, not more than 2·7

Fig. 1.—SKULL OF DELPHINOGNATHUS CONOCEPHALUS (Seeley).



Explanation.

$\frac{1}{3}$ nat. size.

pf = post-frontal bone.

p = parietal bone.

sq = squamosal bone.

m = malar bone.

ff = fractured surfaces.

centim. high by 1.3 centim. wide. The occipital condyle is inferred from the fracture to have been fully 4 centim. wide. The exoccipital bones as preserved are large and extend outward and slightly upward. On their infero-lateral borders they receive the quadrate bones, which lie internal to and behind the squamosal bones. The quadrate bones extend below the occipital condyle; their posterior surfaces are flattened, inclined somewhat forward, and vertical when seen from behind. Each quadrate bone terminates in a pedicle, with a vertical condyle which looks forward (fig. 1), is saddle-shaped, 4 centim. wide, and relatively shallow, concave transversely and convex from front to back. The transverse width of the interspace between the condyles of the quadrate bones is 6 centimetres. The supra-occipital bone is a sub-quadrate ossification above the foramen magnum, which lies between the exoccipital bones. The details of these elements of the occipital plate are lost, and its lateral margin is injured by fracture.

The interparietal bone appears to form the summit of the occipital plate as in Dicynodonts. It is of transversely oblong form, has a squamous union with the supra-occipital, and lies in front of that bone so that it is partly overlapped by it. It shows a slight median vertical ridge.

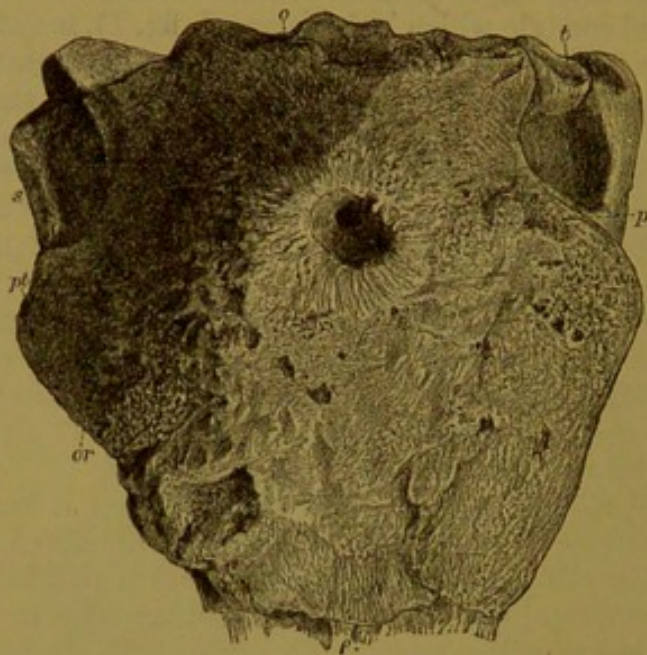
The superior surface of the skull comprises a long, narrow, triangular pre-orbital portion which is badly preserved; and a remarkably wide sub-pentagonal supra-cerebral region behind, which is defined by the occipital plate behind, and laterally by the borders of the temporal vacuities, and by the orbits. The transverse width of the post-orbital mass is about 11.5 centim. It rises in the form of a cone to a height of several centimetres above the level of the frontal margin of the orbit, and terminates superiorly in a large circular parietal foramen which is nearly 2 centim. in diameter. The middle of this foramen is situate vertically above the posterior border of the orbit. The external surface of the cone is smooth, and furrowed with vascular impressions which radiate in every direction. If the foramen were fancifully compared to the crater of the cone, these markings would simulate the irregularities of lava-streams.

This conical crown to the head descends posteriorly and laterally into the temporal vacuities, which are convex from above downward, concave from back to front, and marked with longitudinal ridges. The antero-posterior measurement of the vacuity is 5 centim.; and the measurement is 11 centim. from the summit of the parietal cone to the superior margin of the squamosal bone, which defines the temporal fossa. That vacuity is limited in front by the post-frontal bone, which forms the posterior border of the orbit. The malar bone may be excluded from the zygoma, which descends as a nearly vertical curved bar extending from the frontal to the squamosal.

The orbit of the eye is 7 centim. in diameter, nearly circular, vertical, and looks outward and forward. The frontal bone which presumably forms its upper border is thickened, rounded, and marked with small vascular impressions. This inflated superior margin is

prolonged downward by the post-frontal bone which forms the hinder border to the orbit. The bone twists as it descends, so that its lower extremity, which has lost the inflation of its upper part, is nearly in the same plane with the squamosal bone. It is from 2 to 2.5 centim. wide. There is an excavation behind its posterior angle,

Fig. 2.—View of upper portion of Skull of Delphinognathus.



$\frac{1}{3}$ nat. size.

<i>o</i> = occipital margin.	<i>f</i> = frontal bone.
<i>s</i> = squamosal bone.	<i>t</i> = temporal vacuity.
<i>pt</i> = post-frontal bone.	<i>p</i> = parietal foramen.
<i>or</i> = margin of orbit.	

where it meets the squamosal bone, and this gives a sharp posterior margin to the post-frontal bone. The squamosal bone contributes to the hinder part of the inferior border of the orbit; while the malar bone forms a narrow bar on the antero-inferior border of the orbit. It meets the squamosal behind, and is prolonged downward and backward below the squamosal, terminating above the supracondyloid notch; anteriorly it presumably meets the maxillary bone, but the suture is not evident. The squamosal bone, which is imperfect posteriorly, is of a sub-rhomboid form as preserved, with a talon extending downward and forward to cover the condyle formed by the quadrate bone. It is flattened on the vertical external surface. The infero-posterior outline is nearly straight, becoming concave towards the quadrate condyle, and, as preserved, is about 11 centim. long. The oblique transverse measurement from that border, which is rounded from within outward, to the orbital margin is about 7.5 centimetres.

The condyle is about 4 centim. deep, but behind the vertical articular surface the bone is a little constricted from above down-

ward. This is partly due to a remarkable sub-ovate notch, between 2 and 3 centim. wide and deep, which excavates the bone above it in front. The upper border of the excavation is made by the malar bone. I am not aware of a similar excavation in any other animal, though the quadrate bone is similarly inclined forward in some Ornithosaurs and some Lacertilians.

As the malar bone extends forward its contour ascends, so that the hinder margin of the jaw forms a concave arch, the summit of which, as preserved, is elevated above the inferior border of the orbit. The state of preservation does not demonstrate the characters of the anterior maxillary alveolar border, but the jaw was probably straight and not concave in the dentary region as in the present state of the specimen.

The frontal bones appear to be paired at their anterior extremities. The nasal region is compressed, and prolonged the elevated frontal area forward for some distance, before the jaw descended towards its anterior extremity.

The exact position of the anterior nares is not quite manifest, though they appear to be some distance in front of the orbits and close together. The bones in the median line of the snout only show that the jaw becomes much depressed in front. No teeth are seen at its anterior extremity; on the right side the alveolar border is not preserved, and on the left side it is covered by the displaced lower jaw. The maxillary teeth have mostly disappeared, and the few which remain, imperfectly preserved, show a cylindrical type not altogether unlike that of *Procolophon*, only the crowns are more inflated.

The lower jaw is short and remarkably deep behind the teeth. Owing to the quadrato-squamosal articulation of the skull being below the middle of the orbit, and the circumstance that the lower jaw is not prolonged backward behind the condyle, it is much shorter than the skull. Its coronoid region forms a sort of coronoid process which exactly corresponds with and fits into the concavity in the palatal contour in front of the orbit, formed by the malar and squamosal bones. The hinder portion of this outline is long, straight, oblique, and connects the rounded coronoid eminence with the vertical articulation of the lower jaw. The inferior outline of the lower jaw, convex behind, concave in the middle, is necessarily developed downward as it extends backward; so that, though the total length of the mandible as preserved is only 20 centim., the depth below and behind the coronoid is about 13 centimetres. Hence the posterior half of the jaw has the aspect of being bent downward at an angle of 45° with the dentary part, while its form is obliquely oblong, and nearly twice as deep as is the dentary region. The articular condylar surface is vertical, and so situate on the infero-posterior extremity of the bone as to give the impression that the larger part of the jaw is superior in position to the articulation. The inferior border of the dentigerous region would about pass through the middle of the condyle. It is therefore manifest that, as the jaw extends forward, its vertical depth contracts, chiefly

owing to the concavity of the inferior border; by this contraction it is diminished to about 6 centim. behind the last tooth, and not more than 5 centim. at the anterior extremity of the jaw, which is manifestly imperfect. The external layer of bone is lost in the alveolar region, but about half-a-dozen closely-set cylindrical teeth with conical crowns are preserved. The interspaces between the teeth are narrow. A slight cinguloid constriction defines the crown of the tooth, which is convex, and inflated as far as it is exposed, but the summit of the crown is not seen. The cylindrical roots are about 5 or 6 millim. in diameter. Successional teeth rise within the sockets on the inner side. On the left side the traces of the teeth are less satisfactory.

The lower jaw is composite and appears to show on the external surface the dentary, coronoid, angular, surangular, and articular elements, though their limits are indefinite. The jaw is flat externally, like that of a porpoise, and the rami similarly converge forward, but no trace of a symphysis is to be seen. There is a vascular foramen above the condyle, about midway between its upper margin and the summit of the coronoid process.

In the general form of the skull there is some resemblance to an Artiodactylate mammal in the large size and backward position of the vertical orbit, with its posterior boundary, and in the elongated form of the pre-orbital region, though the arch which supports the lower jaw is unlike that in any mammal. The lower jaw can only be compared to that of the Dolphin tribe in form and in dentition, as preserved. These superficial resemblances are the more interesting because the characters of the occiput, in so far as they are preserved, so closely conform to the Anomodont type of the Dicyodontia as to leave no ground for reasonable doubt that the genus must be included in the Anomodont order. The characters of the post-orbital region, however, are all different from those of every type hitherto comprised in that order. The differences appear to be more than those of a family; they are especially the forward direction of the quadrate bone, the excavation above the condyle which it forms, the short post-orbital region, and the depth of the zygomatic bar, relatively to its short length. The teeth are quite consistent with reference to the Theriodontia, though there is no evidence preserved of incisors or canines; for I conceive that Theriodonts may develop dental modifications as varied as those of Mammals. *Ælurosaurus* has the orbit large, sub-circular, placed far backward, with a short post-orbital region, and the quadrate bone directed downward beneath the orbit so as to form an articulation which faces forward.¹ The lower jaw in *Ælurosaurus* similarly increases in depth as it extends backward. Consideration of these facts, which are so dissimilar to the corresponding conditions in the type of the Theriodontia, *Galesaurus planiceps*, led me to regard *Ælurosaurus felinus*, *Lycosaurus curvimola*, and their allies as referable to a sub-order Gennetotheria, which is nearly related apparently to the Pelycosauria, and lies midway between the typical

¹ Owen, Quart. Journ. Geol. Soc. vol. xxxvii. (1881) pl. ix. fig. 1.

Theriodontia and the Dicynodontia. It is to this sub-order that *Delphinognathus* may be referred, though it forms a family type distinct from the *Ælurosauridæ*, distinguished by the conical parietal with a large foramen, the supra-condylar notch, and other modifications of the skull and the teeth.

I would in conclusion express my grateful thanks to the trustees of the South African Museum, Capetown, for the opportunity of describing this remarkable type.

