

10.—*Investigations in South African Fossil Reptiles and Amphibia*
(Parts 1-4). — By S. H. HAUGHTON, B.A., F.G.S., *Assistant*
Director.

1. *On a New Species of Trematosaurus (T. sobeyi).*

(Plates VIII., IX.)

THE remarkably fine skull upon which the following observations are based was recently presented to the South African Museum by Messrs. Sobey Bros. through the medium of the Queenstown Municipal Authorities. It was found in the building-stone quarries belonging to these gentlemen, and when received at the Museum the top had been wholly freed from matrix. The palate was embedded in a slab of hard, homogeneous calcified sandstone, and the occipital condyle had been broken off, and has not been recovered. I have cleaned one side of the palate to show the sutures between the bones. In doing so the skull fractured across in three places, and thereby enabled some knowledge of the relations of the median bones to be obtained. The skull obviously belongs to a hitherto undescribed species, and I have pleasure in naming it after the donors.

The skull is large, triangular in outline, the snout gradually tapering. The nostrils are oval in shape, approximate, some distance behind point of snout. Orbits are small, placed midway between front and back of skull. The snout is rugose. The sculpturing of the cranial bones is of the usual Labyrinthodont type, pitted at the centre with radiating grooves at the periphery. The supra-squamosal, postfrontal, and postorbital are relatively less grooved and more pitted than the other bones.

The chief measurements of the skull are as follows:—

Greatest length along border	517 mm.
Greatest breadth	305 „
Tip of snout to occipital plate	411 „
Snout to plane of front of nostril.....	65 „

Length of nostril	27 mm.
Internasal breadth	31 „
Preorbital length	217 „
Length of orbit	24.5 „
Interorbital width	90 „
Length of frontal	160 „
Length of nasal	149 „
Length of parietal	114 „

The premaxillae are divided from one another by a median suture, and posteriorly they are separated for half their length by the nasals. They form most of the snout, and the whole of the anterior borders of the nostrils. Midway between the front of the nasals and the snout the premaxillary suture is pierced by a small fenestra, which apparently contains no bone corresponding to the internasal described by Watson in *Micropholis stowi*. A fracture obliquely across the nostrils shows the premaxilla lying outside the septomaxilla and below and within the maxilla, articulating with the latter by a complex suture.

The maxilla extends for a length of 308 mm. from the premaxilla back to the quadrato-jugal. It is a narrow bone, tapering out posteriorly from a maximum height of 27 mm. just behind the septomaxilla.

The septomaxilla appears on the surface of the face for a distance of 11 mm. behind the nostril, and forms almost the whole of the posterior border of the nostril, the nasal just entering into the border on the superior edge. The septomaxilla meets the maxilla and the nasal, but not the lachrymal. Its cheek portion has a triangular form. It forms the floor of the nostril, and extends downwards inside the maxilla and premaxilla.

The nasal is a large bone articulating with the premaxilla, septomaxilla, maxilla, lachrymal, prefrontal, frontal, and interfrontal. Anteriorly and between the nostrils it is comparatively narrow; in the middle it widens out to form the whole of the upper surface, while posteriorly it tapers, being separated from its neighbour by the interfrontal and frontals.

The interfrontal is a median rhombic bone, 50 mm. long and 9 mm. broad, articulating for half its length with the nasals and for half with the frontals. Broom has recently described this bone in *Eryops*, and it is known to occur in a number of small Stegocephalians. Unfortunately the type of *Trematosaurus kannemeyeri* does not show this region. If an interfrontal did occur in that

species, however, it must have been considerably further in advance of the orbits than in the species under consideration.

The lachrymal is a long bone forming the inferior anterior quadrant of the orbital border, and passing forward to within 33 mm. of the nostril. Anteriorly it lies between the nasal and the maxilla, and posteriorly meets the jugal below the orbit. Superiorly it has a long articulation with the prefrontal.

The prefrontal is a broader and stouter bone forming the superior anterior quadrant of the orbital border. It meets the lachrymal, nasal, frontal, and postfrontal.

The frontal is a comparatively narrow, elongate bone, 160 mm. in its greatest length, completely shut out from the orbit by the junction of the prefrontal and postfrontal. Together the frontals form one-half of the interorbital width. Posteriorly they meet the parietal, being separated from each other for the last 35 mm. by that bone.

The postfrontal is larger than the prefrontal. It forms at the most but 12 mm. of the orbital border. It articulates with the prefrontal, frontal, parietal, suprasquamosal, and postorbital.

The postorbital is considerably larger than the postfrontal, forming 15 mm. of the orbital border, and extending back for 130 mm., being 40 mm. broad in its widest part. It articulates with the jugal for most of its length, with the squamosal, suprasquamosal, and postfrontal. It differs from the corresponding bone in *T. kannemeyeri* in that there is no constriction behind the orbit. Indeed, from the orbital border the bone rapidly widens.

The jugal is a large bone, forming part of the posterior border of the orbit and extending from the lachrymal backwards for a length of about 200 mm. It has a short vertical articulation with the lachrymal, a long junction with the maxilla, and posteriorly lies between the quadrato-jugal and the squamosal. On its upper border it meets the postfrontal.

The parietal is smaller than the frontal, and lies in a marked depression of the cranial surface. Its greatest length is 115 mm., and the circular pineal foramen lies between the bones 82 mm. behind the anterior point of the elements.

The suprasquamosal is a large bone 100 mm. long and 55 mm. broad, practically rectangular in shape. It articulates with the parietal, postfrontal, postorbital, squamosal, tabulare, and postparietal.

The postparietal is placed behind the parietal, forming part of the upper cranial surface and being bent at right angles to form the

central half of the upper part of the occipital plate. Its lower occipital border articulates apparently wholly with the exoccipital.

The tabulare forms the outer upper angle of the occiput. It appears on the upper cranial surface, articulating with the squamosal, suprasquamosal, and postparietal. It forms most of the upper border of the lateral occipital foramen, and part of the outer and lower border; but owing to fracturing and splintering of the bones its articulation with the paroccipital is difficult to ascertain exactly.

The squamosal is larger than the suprasquamosal. Above it articulates with the postorbital, suprasquamosal, and tabulare, and below with the jugal and quadrato-jugal.

The quadrato-jugal is a large bone forming the posterior angle of the skull. Anteriorly it passes forward to the maxilla, articulating with the jugal and squamosal. It is bent to form part of the back

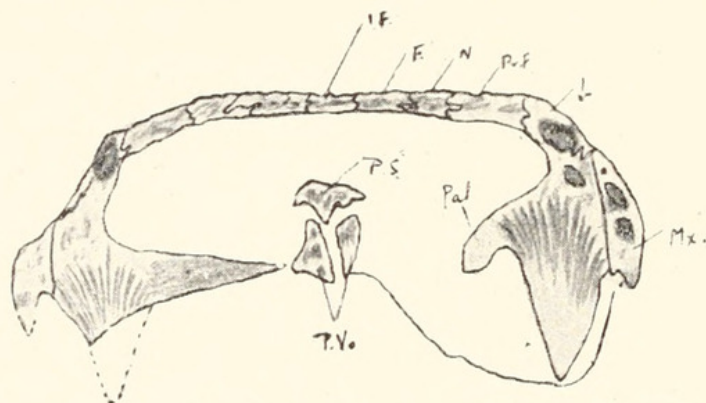


FIG. 6.—*Trematosaurus sobeyi*, Haughton. Diagram of section of skull just anterior to the orbits. $\times \frac{1}{2}$.

surface of the angle, and overlaps the quadrate, which is also overlapped on its inner border by the squamosal and pterygoid.

Both the premaxilla and maxilla bear teeth of more or less uniform size. Near the front of the snout the premaxilla carries two slightly larger teeth, of which the first is 15 mm. long and recurved. There are 10 other smaller teeth on the premaxilla. The maxillary teeth are about 50 in number, borne in a row along the whole length of the bone, the final teeth being slightly the smallest. The average length of the larger teeth is about 10 mm., and they are arranged fairly evenly along the bone, 10 teeth below the orbit occupying a space of 26 mm.

The palatal view of the skull shows some interesting features. The premaxilla extends back for a distance of about 50 mm. from the front of the palate, and articulates behind with the prevomer.

The prevomer is a large bone, forming the inner and anterior walls of the posterior nares, and most of the front of the palate. It articu-

lates with the premaxilla in front, and with the palatine and parasphenoid behind. Arising from a depression in front of the posterior nares is a large tusk, with a basal diameter of 20 mm. and a height of about 33 mm.—the largest tooth in the skull. Lying along the wall of the posterior opening is a series of 8 smaller teeth, elliptical in section, with the long axis of the ellipse lying at right angles to the mid-plane of the palate. These teeth are separated from each other by elliptical pits, now filled with calcite crystals. There is no evidence of minute prevomerine teeth.

The palatine forms the hinder border of the posterior nares, and articulates with the prevomer, the maxilla, and the transpalatine. It carries three large tusks in an antero-posterior line, of which the first is the largest.

The transpalatine lies along the inside of the maxilla, articulating with the pterygoid behind and the palatine in front. It carries a row of teeth of varying size.

The pterygoid is a large bone, diverging in three directions from a central plate at the back. Interiorly it is loosely articulated with the flat portion of the median bone which is presumably the parasphenoid; posteriorly it passes upwards and backwards partially to wrap round the quadrate, and meets the squamosal; anteriorly and externally it meets the transpalatine in a long articulation. Behind this last articulation it is covered with a number of minute pointed teeth almost to the plane of the back of the large vacuity. It also has a short articulation externally with the maxilla.

The parasphenoid has the form of a large median thin plate at the back of the palate, which passes forward to the prevomers. These pass backwards on both sides of the lower part of the bone for some distance as thin bones with long articulating inner surfaces. A section across the skull between the orbits and the nostrils shows the parasphenoid lying above the prevomers and sending down a small process between them. A section across the parasphenoid at the front of the parietals shows a vertically elongated oval with two wing-like projections superiorly—not passing to the bones of the cranium. Between these projections and the mass of the bone I can detect no sutures. Posteriorly the parasphenoid plate sends up a short process to meet the downward projection of the exoccipital.

The occiput is broken away in part, and neither the basisphenoid nor basioccipital can be detected. The exoccipital seems to have played the most prominent part in the formation of the occipital condyle.

2. *On a New Dinocephalian from the Gouph.*

(Plate X.)

The specimen on which the following description of a new genus and species is based is No. 2678 in the South African Museum collection, and was collected by the Rev. J. H. Whaits near Vivier Siding, 30 miles south-west of Beaufort West, from beds in the *Pareiasaurus* zone. It consists of the almost perfect skull which has undergone considerable weathering. The general shape and features of the skull differ sufficiently from the other Dinocephalian genera to warrant its inclusion in a new genus and species, and for it I propose the name *Struthiocephalus whaitsi*, g. et sp. nov.

The chief generic characters are as follows: Skull large; snout relatively long and slender; frontal and temporal regions not so much elevated above snout as in *Tapinocephalus*; eyes look forward and outward; heavy overhanging supraorbital crests; temporal fossae larger than orbits, elliptical in shape with shorter axis parallel to axis of skull; teeth weak, undifferentiated, and few in number.

The following table gives some of the chief measurements:—

Greatest length	580 mm.
Greatest breadth	355 „
Greatest height	230 „
Length of snout to back of internal nares	200 „
Breadth of snout at back of internal nares	230 „
Length of orbit	95 „
Height of orbit	60 „
Length of temporal fossa	80 „
Height of temporal fossa	148 „
Interorbital width at front of orbit	180 „
Interorbital width at back of orbit	295 „
Intertemporal width	130 „
Basal length	515 „

The snout is slightly distorted from its true position, the angle of distortion being about 15° to the right. The premaxilla bears three

teeth, which are small and of the usual type. On the maxilla two teeth can be discerned.

The nostrils are large, and placed well forward. The nasals are long bones, and along their junction below the well-marked frontal boss is a fairly deep median groove 56 mm. long.

It is difficult to be absolutely certain of the sutures of the top of the skull on account of the peculiar weathering of the surface, but their probable positions can be assigned.

The prefrontal and lachrymal are both large bones, coming well forward from the orbital border on to the cheek. The prefrontal forms most of the anterior border of the orbit.

The frontals form the upper border of the orbit, giving rise to the very pronounced supraorbital crest. Near their anterior margin, and just above the groove in the nasals, is a large median boss, the presence or absence of which may probably be taken as a specific character in this genus. The postfrontals, if present, are indistinguishable.

The pineal foramen is large and situated just behind the postorbital bar. It is entirely surrounded by the parietals.

The eye is large, looking forwards and outwards. The temporal fossa is larger than the eye, higher than long, and looks outwards, upwards, and slightly backwards. It is almost wholly bounded by the postorbital and the squamosal, only a portion of its superior border being formed by the parietal.

The postorbital bar is very massive, being strongest at the junction with the jugal. The squamosal has a broad descending portion which passes forward, articulating with the jugal and pushing the quadrate forward to the level of the middle of the orbit.

The quadrate has a large articular surface for the lower jaw. Posteriorly it forms a flat, plate-like bone which articulates with the squamosal and the paroccipital. The quadrato-jugal is well defined, but small. Its upper border is clasped by the jugal, its lower border rests on the squamosal, while internally it articulates with the quadrate. Apparently it forms no part of the articular surface for the lower jaw.

The interparietal is 70 mm. high, and narrows rapidly below. It articulates laterally with the tabulare, and inferiorly with the bone which may be the supraoccipital, although—on account of the imperfection of the specimen—no suture can be seen between that bone and the basioccipital. The element in the lateral part of the occiput, which was mentioned in the description of *Scymnognathus tigriceps* as occurring in Dinocephalians, is here well seen, and

is the tabulare. It is a large membrane bone lying behind the squamosal almost for the whole length of the posterior border of the temporal fossa, being thickest at its lowest end. It forms the larger part of the occipital plate lying above the condyle.

The squamosal forms but little of the occipital plate, the paroccipital extending almost to the border. In other Dinocephalians the squamosal enters largely into the composition of the occipital aspect.

The condyle is large, single and rounded.

The palatal view is similar to that of *Tapinocephalus*. The basioccipital is a large bone. The pterygoids are separated by a long median groove. The stapes articulates with the basioccipital and the pterygoid.

3. *On Two New Therocephalians from the Gouph.*

TROCHOSAURUS INTERMEDIUS, g. et sp. nov.

This new genus and species is founded upon a weathered and crushed skull and lower jaw found on the farm Abraham's Kraal, in the Prince Albert Division, in beds belonging to the *Pareiasaurus* zone. The parietal region is incomplete and the occipital plate is missing, while the zygomatic arches are very weathered. Fracturing of the skull has displayed the structure of the palate.

The right premaxilla bears five incisors, of which only the fifth retains the crown. They are subequal in size, and together occupy a space of 48 mm. at the margin of the bone. The 5th, which is slightly smaller than the others, has a diameter of 6.5 mm. at the gums and is 15 mm. long, curving slightly backwards. The incisors were simple, pointed teeth, apparently without serrations or longitudinal grooves. There is a diastema of 7 mm. between the fifth incisor and the first canine. There are two canines, both of which were large and functional, the second being slightly larger than the first. In section the teeth were apparently oval. A section across the snout shows a smaller replacing tooth lying internal to the first canine and parallel to it. Close behind the second canine came the small molars, of which there do not seem to have been more than four.

The nostrils are large and are placed almost terminally. Almost the whole of the lower border is formed by the large septomaxillary, which sends off a turbinal process partially dividing the nares into two portions. Between the septomaxilla and maxilla is the usual outer foramen.

The nasal is fairly broad and comparatively short.

The interorbital width is almost twice that of the intertemporal region. The frontals are large, forming 9 mm. of the upper border of the orbit.

The limits of the prefrontal and lachrymal are not wholly determinable, but the prefrontal was certainly large.

There is a distinct though small postfrontal, which forms no part

of the border of the temporal opening. The pineal foramen is large, 18 mm. behind the postorbital bar, and entirely surrounded by the parietals.

The postorbital is rather weak, and forms the whole of the anterior and more than half the upper border of the temporal fossa.

The palate is typically Therocephalian in structure. The pre-vomers are narrow bones passing some distance backward behind the internal nares, and forming the inner border of those openings. Their sutures with the pterygoid are indeterminable.

The palatine is a plate-like bone forming a small part of the posterior border of the internal nares, and having a long articulation with the maxilla.

The pterygoid is large. The transpalatine is large, and articulates with the pterygoid, maxilla, and palatine. Between it and the pterygoid there is a very well-defined foramen.

The symphysis of the lower jaw is weak. The dentary is a strong bone, forming about two-thirds of the jaw. It possesses a pronounced mentum. The splenial extends back as far as the plane of the front of the orbit, lying along the inside of the dentary. It is a thin bone. The coronoid is small. The angular lies posterior to the dentary, wedged in between that bone and the splenial. Between it and the dentary is a small foramen. The surangular is large, but is more than half-hidden from view by the angular.

The chief measurements of the skull are :—

Greatest length	230 mm.
Distance from snout to front of orbit	115 „
Diameter of orbit	42 „
Interorbital width	46 „
Intertemporal width	28 „

In the possession of two large canines and five incisors this form resembles *Lycosuchus* and *Trochosuchus*. It lies nearest to the former genus, being distinguished from it by the shallow incisor region of the upper jaw, by the much deeper dentary—characters in which it agrees with *Trochosuchus*—and by the greater width of the intertemporal region. From *Trochosuchus* it is distinguished by the fact that the two canines are approximately equal in size, whereas in the older genus the first canine is of the size of the incisors, and the second canine is considerably larger. This form, therefore, seems to stand in an intermediate position between *Lycosuchus* and *Trochosuchus*.

The type is in the South African Museum (Cat. No. 2756).

TITANOSUCHUS DUBIUS, sp. nov.

The portion of mandible on which this species is founded was obtained from the farm Abraham's Kraal in the Prince Albert Division. It is the right ramus, showing four incisors, one canine, and eleven small molars. It differs from *T. cloetei* in having a more massive symphysis, in being even squarer in the front of the jaw, in the much larger canine and smaller molars—differences which appear to warrant the erection of a new species.

A table showing the teeth measurements in the three known species of *Titanosuchus* will emphasize their differences:—

	<i>T. ferox.</i>	<i>T. cloetei.</i>	<i>T. dubius.</i>
First incisor	Imperfect	21 × 14	Imperfect
Interval between <i>i.1</i> and <i>i.2</i>	10	10	9
Second incisor	21 × 15	18 × 13·5	19 × 14·5
Interval between <i>i.2</i> and <i>i.3</i>	10	11	4
Third incisor.....	20 × 12	20 × 14	20 × 15
Interval between <i>i.3</i> and <i>i.4</i>	18	8	6
Fourth incisor	23 × 17	18 × 14	16·5 × 13
Interval between <i>i.4</i> and <i>c</i>	?	9	5
Canine	50 × 35	30 × 26	47 × 20
Four molars occupy.....		40	30
Eleven molars occupy.....			107

[All these measurements are in millimetres.]

It will be seen that the incisors are set much closer together in this new form, although on the whole their size does not differ appreciably from those of *T. cloetei*. The canine is narrower and longer. In fact, whereas in *T. cloetei* it approximates in section to a circle, in the new species it is almost oblong, with one side more than twice the length of the other.

The molars are small and circular in section. A line drawn along the inner side of the molars just touches the canine, and is also tangential to the inner surface of the 4th incisor.

If a line be drawn across the front of the jaw at right angles to the symphysis, the back of the canine lies 76 mm. from it, and the back of the 4th molar 111 mm.; whereas in *T. cloetei* the figures for the same measurements are 67 mm. and 116 mm. respectively.

4. *On Some New Anomodonts.*

(Plate XI.)

DICYNODON MUSTONIS, sp. n.

This species is founded on an almost perfect small skull and lower jaw collected by me in 1913 at Dunedin, Beaufort West. The only parts lacking are the posterior extension of the right squamosal, the right postorbital arch, and the left articular end of the lower jaw. Most of the matrix has been cleared away, and the sutures between the bones are for the most part beautifully displayed.

In general shape the specimen approximates most nearly to *Diictodon Kolbei*, although it is but half the size; but it is generically distinct in that the small preparietal does not entirely surround the pineal foramen, but forms only its anterior border. The anterior half is roughly of the shape of an equilateral triangle, the posterior half almost square. The skull is flat and of graceful proportions. The antorbital portion is short, the orbits large and directed mostly upwards, lying wholly in the anterior half of the skull.

The premaxillary is large, the internasal process passing back almost to the frontals. The maxilla is comparatively small, although the caniniform process descends considerably below the level of the beak and zygomatic arch. The nostril is large, and is overhung by a prominent rugose nasal boss. There appears to be a small septomaxillary at the back of the nostril, which does not, however, form any part of the cheek.

The anterior frontal region is flat, but posteriorly the region between the postorbital arches and extending between the postorbitals is markedly concave. The frontals are long, passing back almost to the pineal foramen, each separating the two anterior processes of the parietal. There is a marked supraorbital ridge which passes forward into the prefrontal, the ridge becoming less pronounced towards the lachrymal.

The postfrontals are large, elongate, triangular bones extending back between the parietals and postorbitals to the level of the pineal foramen. The postorbital arch is comparatively slender, and in its

outer half the postorbital is supported by the jugal, which also extends along two-thirds of the inner side of the zygoma.

The pineal foramen is situated some distance behind the postorbital arch. It is 6 mm. long, and its anterior border is formed by the narrow, elongate preparietal. The parietal sends a process forward between the frontal and preparietal to the level of the postorbital arch, and extends back for about half the length of the temporal fossa. The postorbital forms almost the whole of the upper border of the fossa.

The squamosal is large, and has a large boss on its expanded portion. It extends back for some considerable distance behind the occipital plate, which slopes well forward in its upper half.

The interparietal comes well on the top of the skull and is greatly developed laterally. The quadrato-jugal is large, and the quadrate well displayed.

The lower jaw has a very deep mentum, the lowest point coming a little behind the plane of the caniniform process, *i.e.* just below the front of the orbit.

The following are the chief measurements of the skull :—

Greatest length	150 mm.
Maximum width	112 „
Maximum width of parietal region.....	24 „
Maximum width of frontal region	19 „
Maximum width of nasal overhang.....	29 „
Minimum width across pterygoids	15 „
Length of pineal foramen.....	6 „
Width of pineal foramen	3 „
Distance of pineal foramen behind postorbital bar	10 „
Basal length	126 „
Width between inside of caniniform processes...	24 „
Maximum depth of lower jaw	33 „

I have much pleasure in naming this species after Mr. J. A. Musto, the former owner of Dunedin, from which place so many interesting and varied types have been obtained.

Type. Female skull. (S.A.M. Cat. No. 2674.)

DICYNODON BREVICEPS, sp. n.

This new species is founded upon a somewhat imperfect and weathered skull and lower jaw (S.A.M. Cat. No. 2366) from the

farm Voetpad in the Division of Murraysburg, Cape. The chief features lie in the shortness of the skull compared with the width, the great height, the size and shape of the orbit and of the temporal fossa. Although all the features are not visible, enough is seen to show that the skull differs considerably from any hitherto-described species.

The greatest length is 170 mm., while the maximum width across the squamosals was probably 180 mm. The front of the snout is weathered away, but was nearly vertical and very high, the nasal region being very convex and the nostrils almost at the front of the skull. The preorbital portion is short.

The premaxilla is small. The nasals are narrowed anteriorly—the nostrils being close together. There is a well-marked septo-maxillary forming the posterior wall of the nostril and a small portion of the cheek-surface.

The eyes are large, rhomboidal in shape, looking mainly outwards. The frontal region widens considerably posteriorly, the minimum width—25 mm.—being well towards the front of the orbit. The frontal region is flat and there is a slight supraorbital ridge.

The postorbital portion is not complete. The bar was apparently comparatively slender, while the postorbital extended back to form the whole of the upper border and part of the posterior border of the temporal fossa. The parietal region has a maximum width of 32 mm., and is very short.

There is a long and slender preparietal, supported along the posterior part by the parietals, and in its anterior half by the frontals. It extends only so far back as just to touch the anterior border of the pineal foramen, which lies 10 mm. behind the postorbital bar, and is 11 mm. long and 6 mm. wide.

The postfrontal is well seen on the right side. It is well developed, very narrow in its posterior half and articulates with the frontal, parietal, and postorbital.

The squamosal has a very long downward process supporting a large, plate-like quadrato-jugal. Anteriorly it is overlapped by the jugal, which is a very stout bone and extends half-way along the lower border of the temporal opening.

The palate is short and wide, the width between the bases of the caniniform processes being about 40 mm. There is no trace of tusks.

The lower jaw is displaced from its true position. Its total length is probably 110 mm., and the depth at the symphysis 40 mm. The front of the jaw is bluntly rounded and strong, and there is no

upwardly projecting beak and no pronounced mentum descending below the level of the bottom of the jaw.

LYSTROSAURUS OVICEPS, sp. n.

There is in the collection of the South African Museum the skull and lower jaw (No. 641) of a small specimen of *Lystrosaurus* which can be correlated with no hitherto-described species, and which is therefore described here as a new species. It is said to have come from the "Tarka River, Cradock District," and is in a fine-grained grey sandstone.

The greatest length of the skull when viewed from above is 163 mm. The greatest breadth is 129 mm. The minimum interorbital width is 46 mm. and the minimum intertemporal width 25 mm. The orbit is elliptical with the long axis parallel to the nasal plane; its length is 36 mm., its height 33 mm.

The snout is slightly convex with a median ridge, which is very prominent in the middle of the premaxilla, but dies away at the extremities of that bone. The premaxilla passes up as a narrow prolongation between the nasals. Its greatest length is 76 mm., and its width at the mouth—measured round the bone—is 56 mm.

The maxilla is a rectangular bone, with a suborbital prolongation supporting the jugal. The tusks are circular in section, and directed slightly inwards. Their diameter at the base is 9 mm.; length probably 25 mm. The distance between the inner sides of their bases is 46 mm.

The septomaxillary forms a distinct part of the cheek, besides being the posterior wall of the nostril.

The fronto-parietal plane makes an angle of about 120° with the general plane of the snout, but the change of slope is not very abrupt owing to the convexity of the snout. The transverse ridge across the nasals is not nearly so pronounced as in the other species. The prefrontal forms the superior anterior quadrant of the orbital border, but the supraorbital boss is very slight.

The frontal forms the remainder of the upper border of the orbit, and at the frontal junction is a slight median ridge. In each bone is a slight but well-marked central boss from which lines of sculpture radiate. These bosses are further from the median ridge than the corresponding protuberances in *L. declivis*.

The parietal is large, circular, excavated, concave, and has a maximum length of 19 mm. It forms the border of the anterior third of the pineal foramen, which is of the keyhole shape common

to species of *Lystrosaurus* and 8 mm. in length. The boundaries of the postfrontal are not seen, but it must have been a small bone.

The parietal region is wide and flat. The parietals are small, the postorbitals forming the whole of the upper borders of the temporal fossae. These are transversely oblong in shape, 39 mm. broad and 25 mm. long.

The squamosal has a pronounced ear-shaped expanded portion at the outer border of the temporal opening, the projection being more prominent than in *L. latirostris*. The zygomatic portion of the squamosal is thin and flat. There is a large quadrato-jugal which apparently forms part of the articular surface for the lower jaw.

The development of the posterior part of the palatal surface shows one or two interesting features. The pterygoid is of the usual *Lystrosaurus* type, having a long articulation with the basisphenoid, and an outward and backward process which extends to the stapes. The basisphenoid is bent at right angles to the plane of the palate, and is pierced by the two carotid foramina.

Hitherto in *Lystrosaurus* the whole of the lateral bone extending from the condyle to the squamosal has been called exoccipital; but this specimen shows that the so-called "exoccipital" is in reality made up of two bones, the true exoccipital and the paroccipital (opisthotic). The exoccipital is a small bone closely united to the paroccipital, forming part of the condyle and of the wall of the foramen magnum. The paroccipital is a large bone stretching from the squamosal to the small exoccipital and having an inner downward projection articulating with the basioccipital. It is pierced near the exoccipital suture by the opening for the IXth-XIIth nerves.

The depth of the lower jaw at the symphysis is 34 mm. The lowest point of the mentum is directly below the point of the tusk.

This new species comes nearest to *Lystrosaurus latirostris*, from which it differs, however, in the convexity of the snout, in the angle between the fronto-parietal and premaxillary planes, in the ratio between the interorbital and intertemporal widths, in the shape of the orbit, and in other minor features. When viewed posteriorly the skull is seen to differ from both *L. declivis* and *L. latirostris*. The parietal region is not grooved so deeply as in the type species, and the zygomatic portion of the squamosal is much wider in *L. latirostris*.

EXPLANATION OF PLATES.

PLATE VIII.

1. TREMATOSAURUS SOBEYI, sp. n.

FIG.

1. Top view of skull. $\times \frac{1}{3}$ nearly.
2. Diagram showing arrangement of bones of top of skull. $\times \frac{1}{3}$ nearly.

PLATE IX.

2. TREMATOSAURUS SOBEYI, sp. n.

1. Palatal view of skull. $\times \frac{1}{3}$ nearly.
2. Diagram showing arrangement of bones and teeth of palate. $\times \frac{1}{3}$ nearly.

PLATE X.

STRUTHIOCEPHALUS WHAITSI, g. et sp. n.

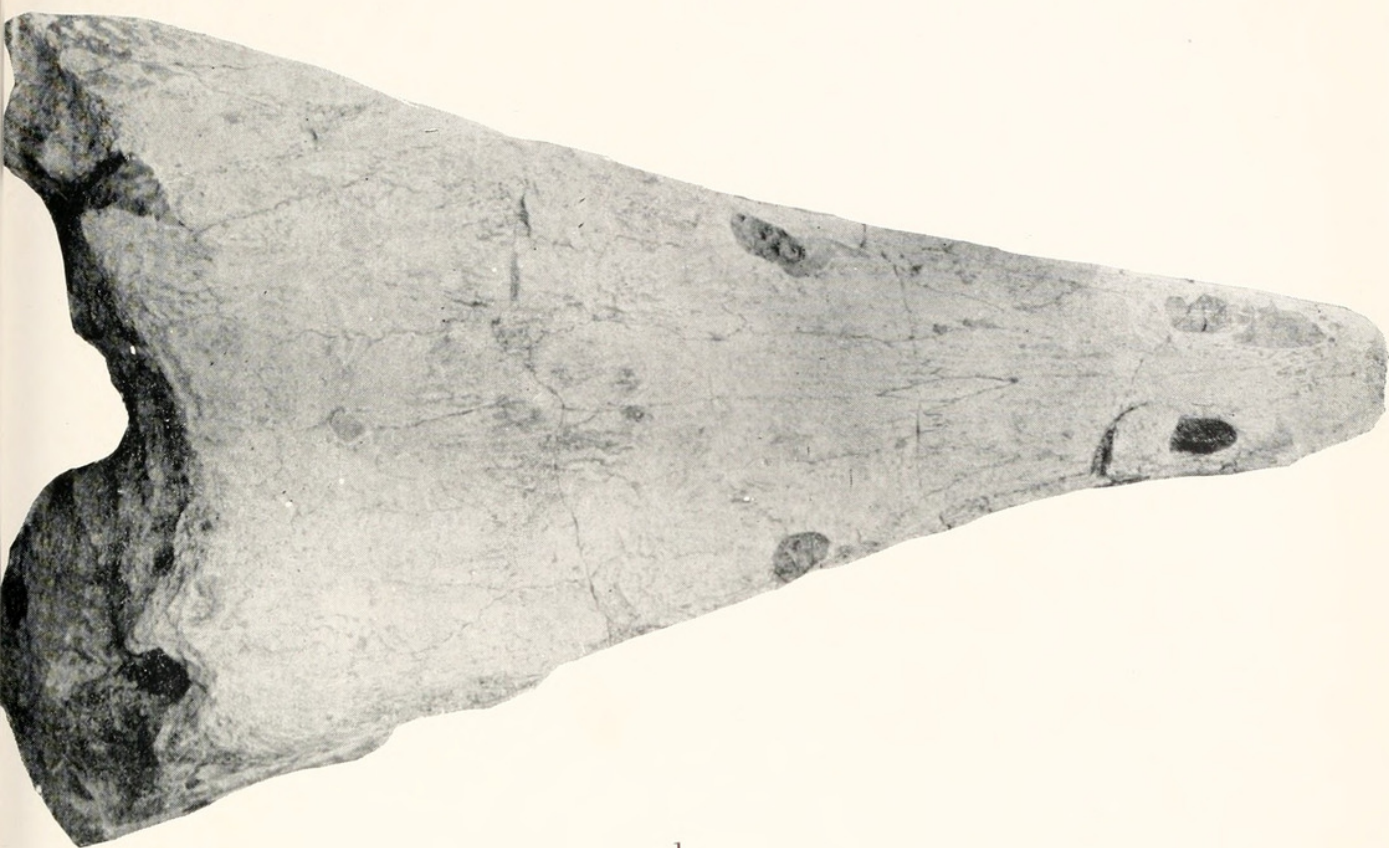
1. Side view of skull. $\times \frac{1}{5}$.
2. Palatal view of skull. $\times \frac{1}{5}$.
3. Top view of skull. $\times \frac{1}{5}$.

PLATE XI.

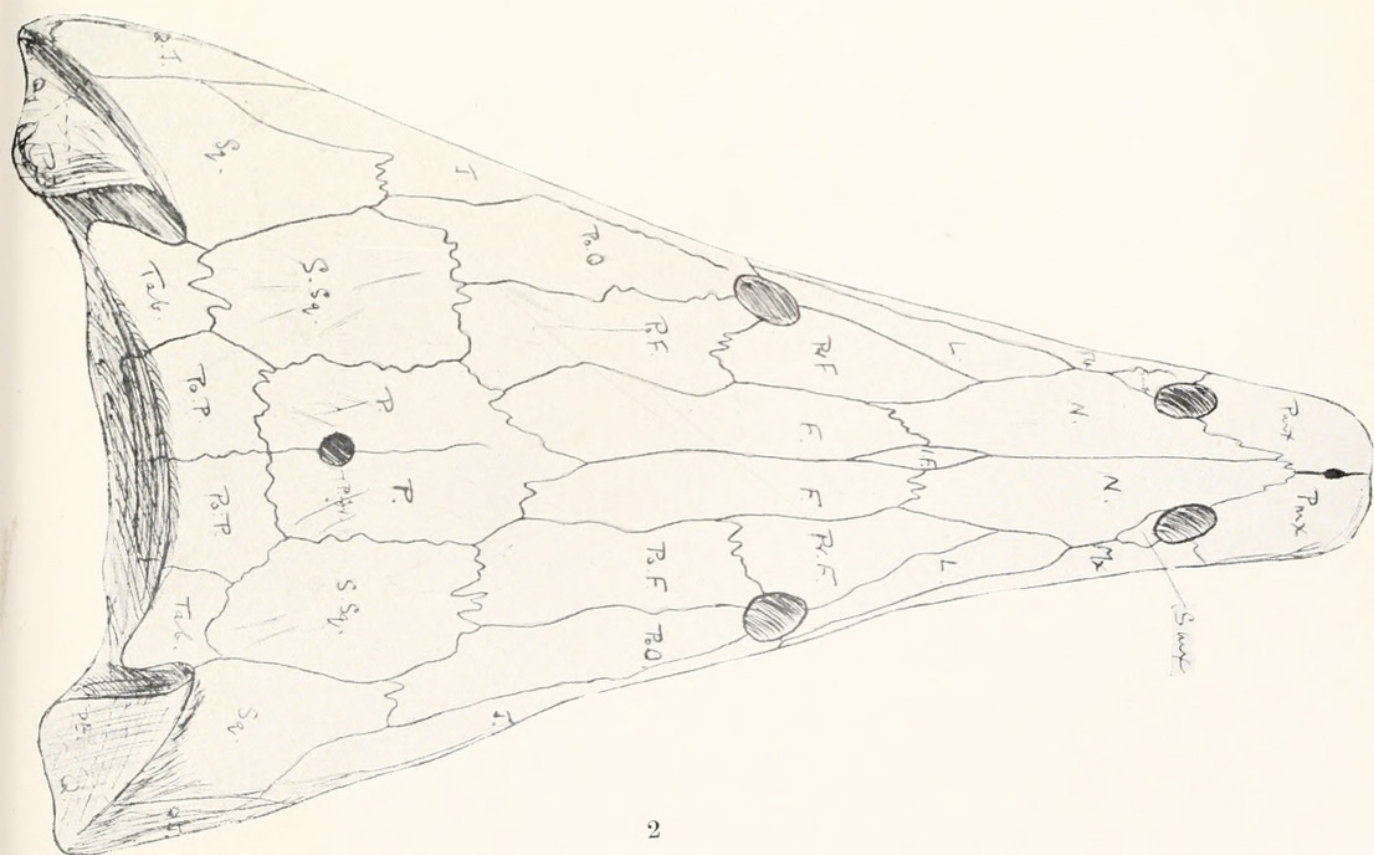
1. Top view of skull of *Dicynodon mustonis*, sp. n. $\times \frac{1}{2}$.
2. Diagram showing arrangement of bones round pineal foramen in *Dicynodon breviceps*, sp. n. $\times 1$.
3. Top view of skull of *Lystrosaurus oviceps*, sp. n. $\times \frac{7}{16}$.
4. Side view of skull of *Lystrosaurus oviceps*, sp. n. $\times \frac{1}{2}$.

EXPLANATION OF LETTERING.

F., Frontal; I.F., Interfrontal; J., Jugal; L., Lachrymal; Mx., Maxilla; N., Nasal; P., Parietal; Pal., Palatine; Pa.S., Parasphenoid; P.for., Pineal foramen; Pmx., Premaxilla; Po.F., Postfrontal; Po.O., Postorbital; Po.P., Postparietal; Pp., Preparietal; Pr.F., Prefrontal; Pt., Pterygoid; P.Vo., Prevomer; Q., Quadrate; Q.J., Quadratojugal; Smx., Septomaxilla; Sq., Squamosal; S.Sq., Suprasquamosal; Tab., Tabulare; T.P., Transpalatine.

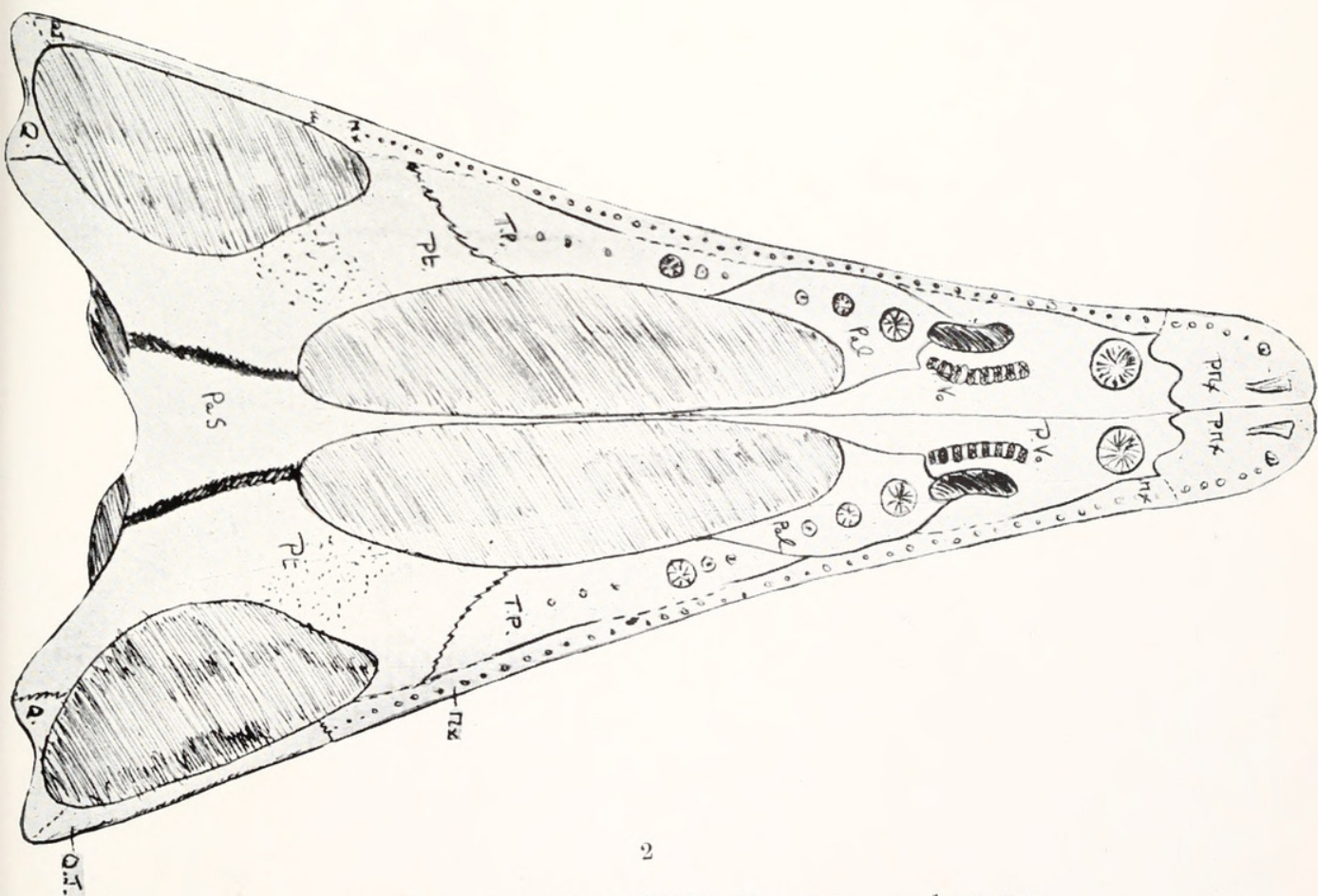
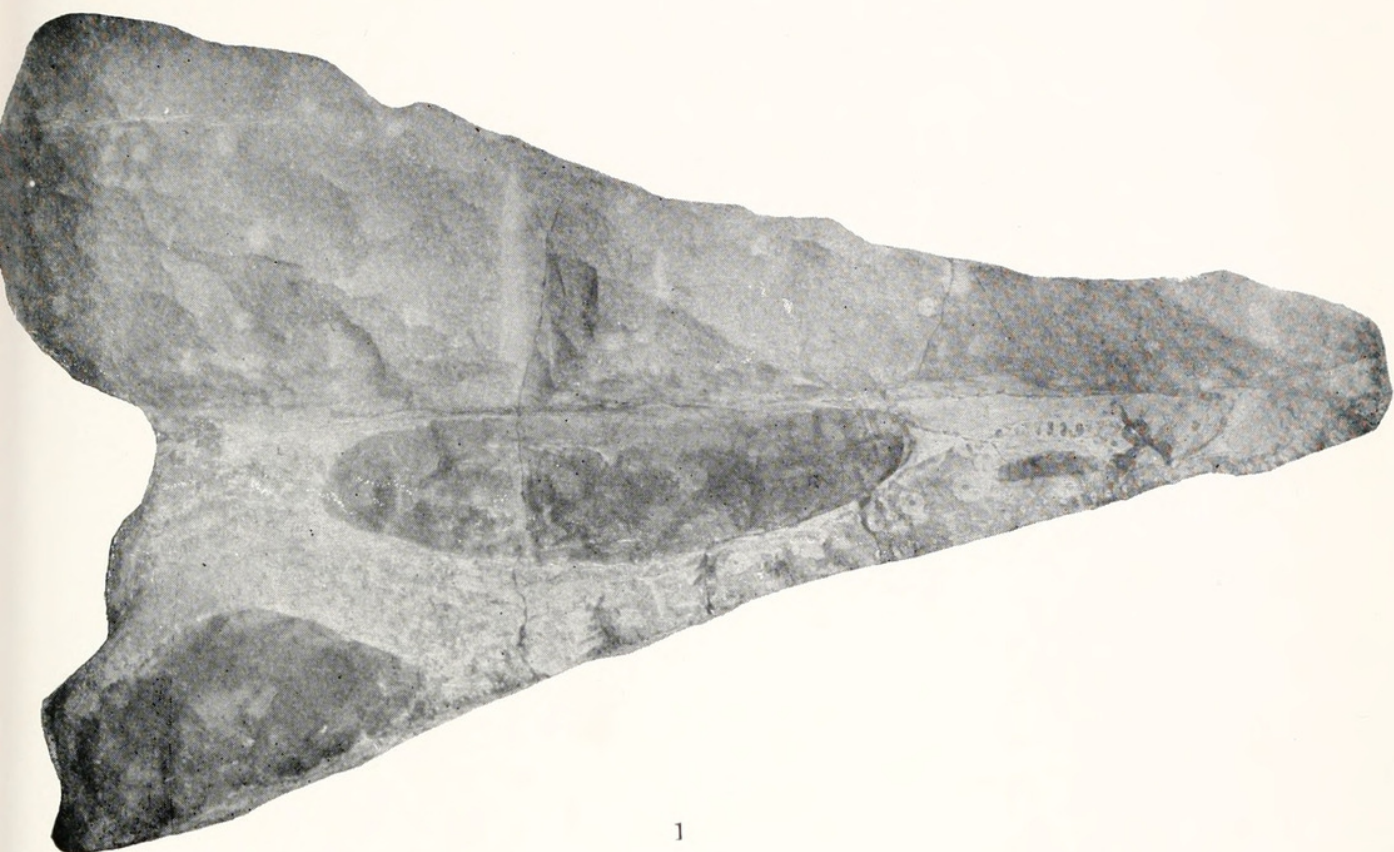


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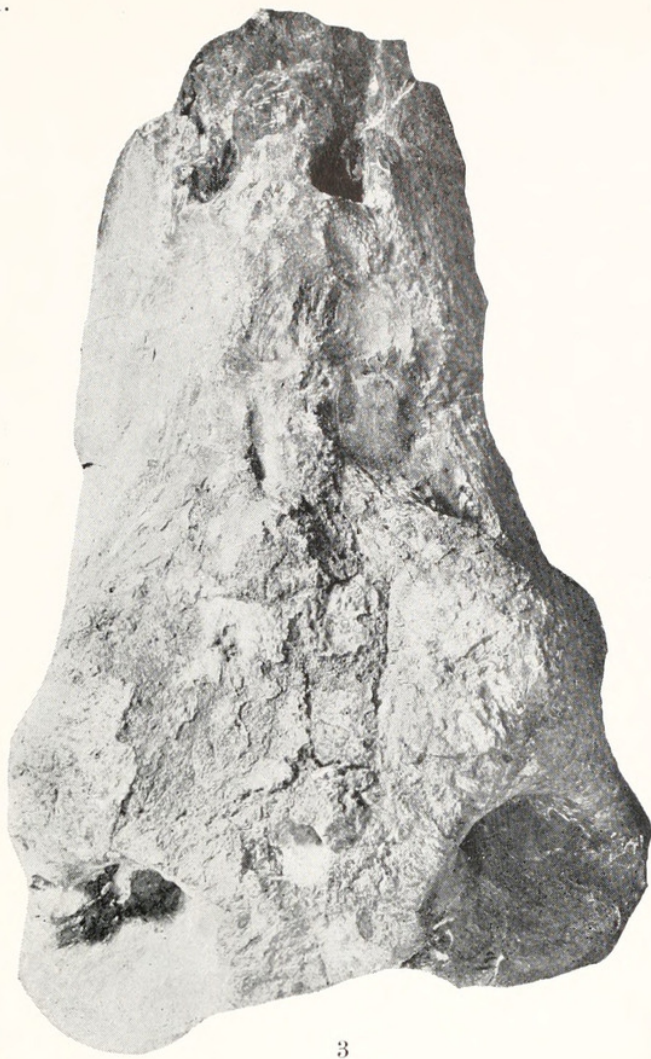


2

TREMATOSAURUS SOBEYI, HAUGHTON. $\times \frac{1}{3}$ NEARLY.



TREMATOSAURUS SOBEYI, HAUGHTON. $\times \frac{1}{3}$ NEARLY.



3



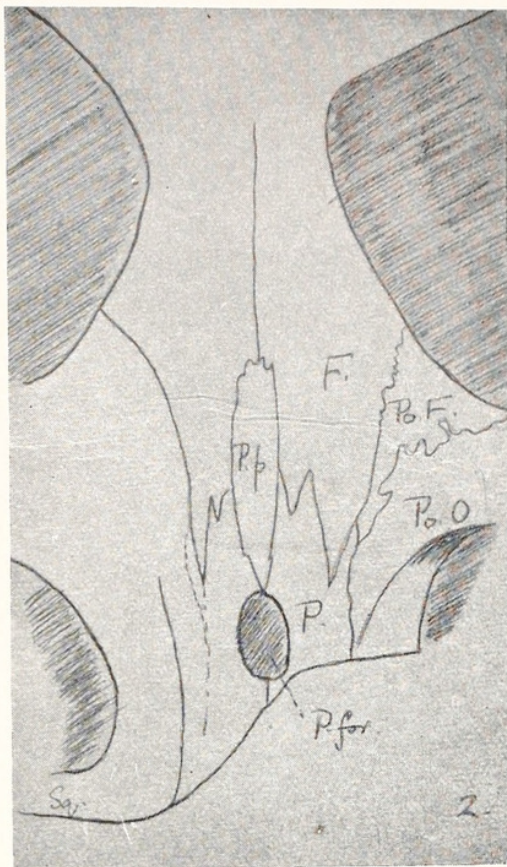
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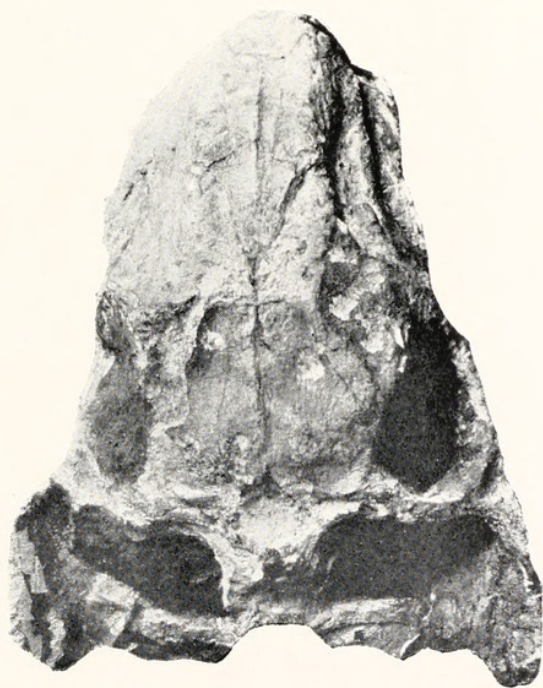
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1



2



3



4

1. *DICYNODON MUSTONIS*, HAUGHTON. $\times \frac{1}{2}$.
2. *DICYNODON BREVICEPS*, HAUGHTON. $\times 1$.
- 3, 4. *LYSTROSAURUS OVICEPS*, HAUGHTON. $\times \frac{1}{2}$.

11.—*Investigations in South African Fossil Reptilia and Amphibia* (Parts 5-9).—By S. H. HAUGHTON, B.A., F.G.S., *Assistant Director*.

5. *On the Genus Rhinesuchus, Broom, with Notes on the described Species.*

THE genus *Rhinesuchus* was first described by Broom in the *Annals of the South African Museum* (vol. iv., p. 376, 1908) from some fragmentary remains of the skull of a presumably temnospondylous Labyrinthodont found near Prince Albert, Cape Colony, to which the specific name *R. whaitsi* was given. The genus was said then to include also the species named by Lydekker *Eryops africanus* and the European species called *Macromerion Gumbeli* by von Ammon. At first the genus was thought to have no affinities with *Eryops*, but later (1910, *Bull. Amer. Mus. Nat. Hist.*, xxviii.) Broom modified this view, concluding that the two genera were apparently closely allied. In 1911 van Hoepen (*Ann. Transvaal Museum*, iii., 2) described part of a skull of a large Labyrinthodont from Senekal, O.F.S., as *Myriodon senekalensis*, while in 1912 Broom described part of another skull from the same place as *Rhinesuchus major*. Recently, thanks to the courtesy of the authorities of the Bloemfontein Museum, I was enabled to examine the beautiful Labyrinthodont skeleton which they obtained from Senekal. In addition to that specimen I have also examined a skull from Beaufort West, a crushed skull from the Nieuweveld (both collected by the Rev. J. H. Whaits), and a portion of lower jaw from Senekal. These three latter specimens are in the collection of the South African Museum.

The original description of the genus *Rhinesuchus* as given by Broom is as follows:—

“Skull probably like that of *Capitosaurus* in general shape; maxillaries and dentaries each bearing a row of uniform teeth; inside of maxillary teeth are large numbers of very small teeth, probably borne by palatines, and covering much of the pterygoids and continued across the back part of the parasphenoid: similar small teeth are found inside of the teeth borne by the dentary; they

are probably on the splenial bone ; the median anterior part of the parasphenoid is narrow."

The following is a translation (the original paper is in Dutch) of van Hoepen's description of the genus *Myriodon* :—

"Skull triangular, rounded in front, almost as long as broad. Maxilla and dentary bear each a row of large, conical, pointed, pleurodont, flattened teeth, becoming smaller posteriorly, probably labyrinthodont in section. Within the row of maxillary teeth, probably on the palatine, is a row of large teeth, similar to the maxillary and dentary teeth. On the remaining bones of the palate are large numbers of small teeth, of which the biggest is far smaller than the large teeth already mentioned. Similar small teeth are found on a ridge which runs along the row of teeth on the dentary." Van Hoepen further says that his genus differs from *Rhinesuchus* in that it has but one row of teeth on the palatine, and lacks the small teeth on this bone.

The fragment of skull upon which Broom based his description of the palatine bone is in a crushed condition, and it is probable that these supposed palatine teeth are on the prevomer. In the complete skull of *R. whaitsi* which I describe in this paper there is a row of medium-sized teeth lying on the inner border of the internal nares which are almost certainly carried by the prevomer. I am unable to find in the type fragments any justification for the statement, "Inside of maxillary teeth are large numbers of very small teeth, probably borne by palatines." The only fragments which show small teeth are portions of the lower jaw, which bear the usual coronoidal teeth lying internal to the larger teeth of the dentary.

For these reasons the two genera must be grouped together under the one generic name—*Rhinesuchus*, Broom—for which the following short diagnosis may stand :—

"Medium-sized to large temnospondylous Labyrinthodonts. Skull triangular, rounded in front, median length slightly greater than breadth. Eyes wholly in posterior half of skull. Otic notch present. Bones of skull-roof complete. Maxillary and dentary each carrying row of uniform teeth, slightly decreasing in size posteriorly. Prevomer carrying one or more large tusks, a few medium-sized teeth, and covered—together with the major parts of the parasphenoid and the pterygoid—with minute denticles. Palatine with row of teeth similar to those on maxilla. Small transpalatine with teeth present. Coronoid carries number of denticles on upper surface."

Besides having the eyes larger and set more nearly together, and

in being more pointed, the skull of *Rhinesuchus* differs from that of the American genus *Eryops* in lacking the interfrontal bone. I have searched carefully for evidence of this bone in all the species, but can find none. Moreover, although the lower jaws I have examined are not in the best condition for showing sutures, I am not able to find any tripartite division in the coronoid bone.

RHINESUCHUS WHAITSI, Broom.

(Plate XII., figs. 3, 4. Text-fig. 7.)

1908. Broom, Ann. S. African Mus., iv., 8, p. 373; pl. xlv., fig. 3.

An almost complete skull and lower jaw (S.A.M. Cat. No. 3009) collected by the Rev. J. H. Whaits at Beaufort West (*Endothiodon* zone of Beaufort Beds) enables me to give more details concerning this species.

In its general outline the skull has a shape like that of *Eryops megacephalus* and *Rhinesuchus senekalensis*. The upper surface of the skull and the outer surface of the lower jaw are covered with a pitted sculpturing. In the snout and mid-regions of the skull the pits are roughly circular; in the jugal, quadratojugal, and squamosal regions the pits are more elongated. The orbits are wholly in the posterior half of the skull and are comparatively more nearly set together than in *Eryops*. The articular region extends well behind the occiput. The following are some of the principal measurements of the skull:—

Maximum length	312 mm.
Length on median line	265 „
Maximum width	258 „
Interorbital width	40 „
Internasal width	41 „
Length from back of nostril to front of orbit.....	125 „
Length from plane of snout to front of orbit.....	158 „
Length of orbit	33 „
Width of orbit	34 „

Comparison with the type specimen of *R. whaitsi* shows that the skull is flattened, but the width and general size of the parasphenoid and the pterygoids, as far as they can be compared, leave no doubt that this skull belongs to the species already described. Unfortunately the sutures on the top of the skull are not visible, but the structure of the palate can be made out fairly well.

The parasphenoid has a flat posterior portion similar to that

figured by Broom in his description of this species, and passes forward between the large vacuities to meet the prevomer. As in the type the anterior part of the plate bears a number of tiny denticles. Posteriorly the bone covers a large part of the basi-occipital. The lateral articulations with the pterygoids are of the type seen in *Eryops*.

The pterygoid forms most of the posterior and outer walls of the large vacuity. Behind the parasphenoid the pterygoid passes backwards and downwards, articulating with the squamosal and overlying the inner half of the quadrate. Laterally it passes forward outside the large vacuity to meet the prevomer, articulating on its outer border with the palatine. From the posterior corner of this bone, just behind the level of the parasphenoid, the surface is covered with small denticles save for a narrow band on the inner side along the wall of the vacuity. This non-dentigerous band is about 50 mm. long, and at its widest—at the posterior end—has a breadth of 13 mm. In the type specimen there is also an outer non-dentigerous band. As the bone narrows anteriorly the denticles tend to become arranged in well-defined rows.

The palatine lies between the maxilla on the outside and the pterygoid and prevomer internally. It bears one row of large teeth, of which the first two are larger and more tusk-like and the remainder small and flattened, so that the breadth is greater than the length. There is a slight decrease in size of the teeth posteriorly. The few that are preserved entire show that the teeth were simple, pointed, and conical, with very slight longitudinal grooves. Just behind the internal nares, internal to the row already described, and possibly on the palatine, is a secondary row of three or four similar teeth.

I am unable to say definitely that a transpalatine is present; but behind and outside the palatine is a small mass of bone slightly below the level of the palatine bearing three or four medium-sized teeth. This may be the transpalatine.

The prevomer is large. The pair of bones lie between the posterior nares forming most of the front of the palate. On the outside of the large vacuity they pass back to meet the pterygoids, and between the openings they send back a long process to meet the parasphenoid. In front of the posterior nares are two large tusks. Between the hinder pair of these is a transverse row of smaller teeth, each prevomer bearing three. Between this row and the posterior vacuities is a very well-defined dentigerous area covered with denticles, which area passes backwards almost, if not quite, to the pterygoids.

The premaxilla carries teeth along its border, as does the maxilla.

The quadrate is a triangular bone lying between the pterygoid and the quadrato-jugal and squamosal. It appears mostly on the back of the skull, the apex of the bone lying 32 mm. above and some distance internal to the articular surface. This latter is weakly concave, the concavity being directed backwards and outwards from the anterior inner angle of the bone.

Passing outwards and backwards from the posterior lateral curved border of the parasphenoid is a small, thin, apparently plate-like bone. This may be the stapes.

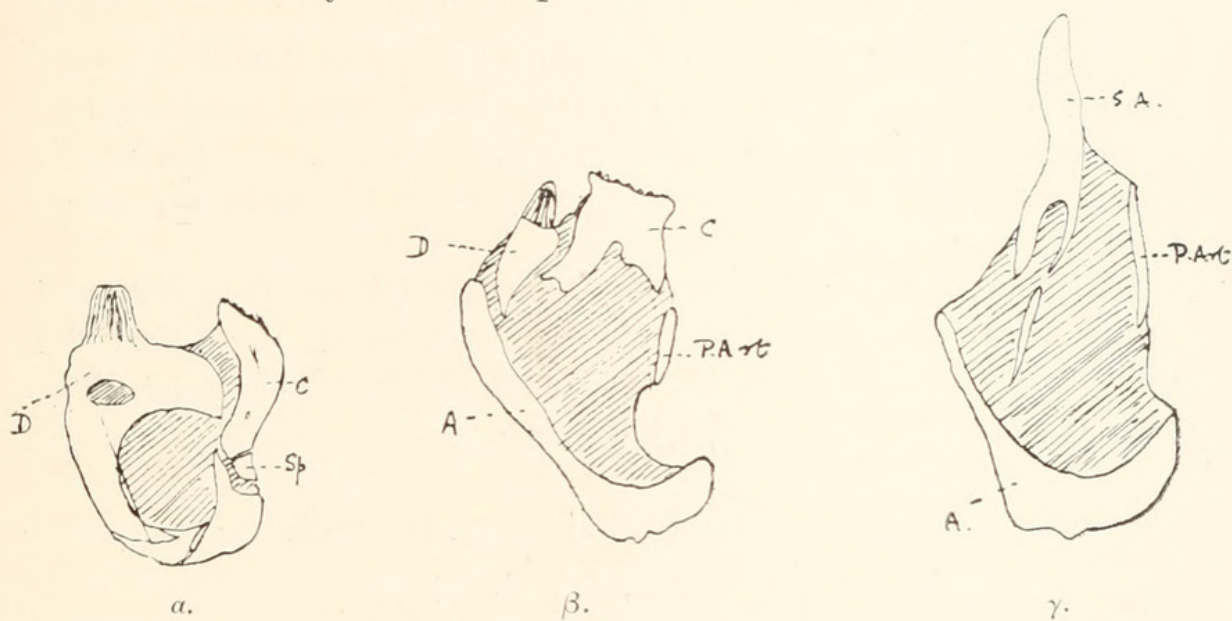


FIG. 7.

Sections across left ramus of lower jaw of *Rhinesuchus whaitsi*:

a. 85 mm., behind point of jaw.

β. 185 mm., behind point of jaw.

γ. 220 mm., behind point of jaw.

D, dentary; C, coronoid; Sp, splenial; A, angular; P.Art, Prearticular; S.A., surangular.

The whole of the left side of the lower jaw is preserved, together with the articular region of the right. The length of the jaw is about 322 mm.

The dentary carries a row of labyrinthodont teeth. It has a narrow posterior elongation extending towards the articular surface for some distance behind the last tooth.

Lying along the inside of the dentary and extending almost from the front of the jaw to the anterior border of the supra-Meckelian fossa is the "coronoid," which throughout nearly the whole of its length bears a large number of small teeth. In the jaws of *Trimerorachis* and *Eryops*, as described by Broom and by Williston, this "coronoid" consists of three elements—the coronoid proper,

the intercoronoid, and the precoronoid. Unfortunately the bones of the lower jaw in this specimen are somewhat crushed; but, except for a possible line of suture between a precoronoidal portion and the remainder of the bone, I am unable to distinguish the three elements each from the other. Moreover, the whole series of coronoidal teeth is evenly distributed; no portion of the upper surface of the bone bears an augmented share, and none is without teeth, whereas in the figure given by Williston of the jaw of *Trimerorachis alleni* the "coronoidal" teeth are grouped in three well-defined areas, the edges of the upper surface of each of the three elements being non-dentigerous.

The lower jaw is of much more slender build than that of *Eryops* or of *Trimerorachis*, and the supra-Meckelian fossa considerably smaller in proportion. Viewed from within, the posterior flattened expansion of the prearticular completely hides the fossa and surangular from view.

A fragment of the right jaw shows what is apparently a distinct suture between the splenial and the postsplenial, the latter of which is the preangular of Broom. This suture occurs below the front margin of the small anterior fossa.

RHINESUCHUS SENEKALENSIS (v. Hoepen).

(Plate XII., figs. 1, 2.)

1911. *Myriodon senekalensis*, van Hoepen. Ann. Transvaal Mus. iii., 2, p. 103; pls. 1, 2.

1912. *Rhinesuchus major*, Broom. Trans. Geol. Soc. S. Africa, xiv., p. 79; pl. xiii., 1-2.

The types of van Hoepen and Broom were obtained at Senekal. From the same place came the almost perfect specimen now in the Bloemfontein Museum, which I was able to examine by permission of the authorities of that Museum, and of which a cast was made for the South African Museum. In addition there is in the South African Museum a portion of the left mandible and the left maxilla of the same species, also from Senekal, presented by the late H. Kynaston, Esq.

The following description of the species is based mainly on the Bloemfontein specimen. This shows the whole of the upper side of the animal crushed flat on a slab of sandstone, together with some of the ventral armour. The front legs lie bent backwards along the sides of the body, while the hind legs are spread out at right angles to the trunk. Unfortunately the sutures of the skull can scarcely

be made out among the sculpturing of the surface, and in this connection I have made use of the facts given by Dr. Broom. The specimen described by him seems to be a smaller representative of the species than the Bloemfontein one; but from the general similarity and from the fact that all the known examples come from the same locality, I think there can be no doubt as to their specific identity. Comparison of the photograph of the Bloemfontein specimen with the restoration of the skull given by Broom shows that in the latter the snout is somewhat too long, the nostrils being nearer the front of the skull.

As preserved, the animal measures nearly 7 feet in length. There are only five caudal vertebrae showing, so that the length may have been nearly 8 feet in life, supposing that the tail was short as in *Eryops*.

The skull is moderately long with a rounded snout and practically straight sides, flat, and broadest at the back. It has the pitting characteristic of this genus and *Eryops*, the pits being roughly circular in the middle of the bones and lengthening out towards the edges. The otic notch is not large. The nasal-frontal region is furnished with a median groove, and on either side is a bow-shaped channel running from the plane of the back of the nostrils to that of the front of the orbits, concave towards the median line.

The greatest length of the skull is 580 mm., the greatest breadth 444 mm. The nostrils lie 33 mm. from the front of the snout, and the orbits 308 mm. There is a small pineal foramen 407 mm. behind the snout. The internasal width is 53 mm., the interorbital width 57 mm. (Broom's specimen has an interorbital width of 50 mm.). From the orbit to the nostril the distance is 235 mm. (Broom's specimen gives 203 mm.).

No sutures can be seen in the preorbital region save parts of the boundary of the prefrontal. This is a very large bone. Broom says: "The frontal bones are long and narrow, and separated from the orbits by the forward extension of the postfrontals, agreeing in this with *Archegosaurus*. The prefrontal is very large, stretching more than half-way to the nostril. The nasal bone is also very large. The lachrymal is narrow and placed well forward. The jugal is large and forms about a quarter of the side of the head. It only forms a small part of the orbital margin. Behind it is the large prosquamosal, or, as it is more often called, the supratemporal. The postorbital comes well down behind the orbit."

In the Bloemfontein specimen it is possible to delimit most of the posterior cranial bones, partly from the sutures and partly from

the sculpturing. The quadrato-jugal forms the outer posterior angle of the skull, articulating with the squamosal, jugal, and probably with the maxilla. The squamosal is a fairly large pentagonal bone forming the outer boundary of the auditory notch, having a well-defined junction with the suprasquamosal, and probably meeting the postorbital in front. The suprasquamosal forms a small part of the boundary of the auditory notch, the inner wall of which is formed by the tabulare. The pineal foramen lies wholly in the parietals, which are rectangular bones.

The postorbital apparently extends further out from the orbit than in *Eryops*. The postfrontal is small, and the frontal is completely excluded from the orbital border. The jugal forms about 30 mm. of the outer border of the orbit, and is the largest bone on the surface of the skull. The postparietal has an almost square cranial portion, and is larger than the corresponding bone in *Eryops*. The superficial cranial bones completely hide the exoccipital condyles in a view from above.

Nothing can be seen of the palate. Several teeth are seen along the edge of the maxilla, each about 15 mm. long. They are simple, pointed, unserrated.

Vertebral column.—There are 29 vertebrae between the occiput and the sacrum. Most of the dorsal spines are missing, and the ventral side of the column has not been exposed. The left-hand sides of most of the intercentra are displayed, and all the neural arches. As in *Eryops*, the neural arch of the first vertebra consists of two halves, the anterior portions of which articulate with the exoccipital condyles, and the upper portions of which pass backwards along the sides of the dorsal spine of the axis. Each half of the atlantal spine has an articular width of 32 mm. and is 54 mm. long.

From the axis to the sacrum the neural arches are approximately similar. There are well-marked transverse processes for the articulation of the ribs. From the 7th vertebra to the sacrum the width across the transverse processes gradually decreases. The following gives the measurements of two of the best-preserved vertebrae:—

	13th vertebra.	22nd vertebra.
Length of arch	45 mm.	52 mm.
Length of dorsal spine	36 „	27 „
Height of spine above transverse process	31 „	29 „
Width between extremities of processes...	88 „	61 „

All the vertebrae carry ribs. The ribs from the 2nd to the 8th have their distal thirds strongly expanded with a well-defined

superior process from the expanded portion. The ventral portion of the expanded end is bent inwards and lies below the next succeeding rib.

Shoulder girdle.—Only the upper end of the scapula on each side is seen. The bone is a thin flat blade with an antero-posterior length at its extremity of 75 mm., and with an average thickness of not more than 8 mm. The upper border is approximately straight and posteriorly it is produced, so that the posterior angle is acute while the anterior angle is obtuse.

The cleithrum differs in shape from that of *Eryops*. It has a length of at least 210 mm., and is closely applied to the anterior border of the scapular blade and to the outside of the anterior end of the upper border. For at least half of its length it is overlain by the clavicle. It is a strong bone, spatulate at its distal end when viewed from above, and not possessing the fan-shaped expansion seen in *Eryops*. It extends back beyond the scapula, not in contact with most of the upper border of that bone, and it almost covers the scapula when viewed from above.

The upper part of the clavicle lies in front of and upon the cleithrum. It is expanded and somewhat spoon-shaped when seen from above, with an inner pointed distal angle. Its maximum width is 46 mm. Proximally it is curved inwards to meet its neighbour beneath the interclavicle, which is not seen; the proximal portion of the bone is more rounded in cross-section than the distal expanded portion.

Fore-limb.—Of the humeri only the distal ends have been displayed, and they have been mutilated to a certain extent, so that it is not possible to give any details of their form.

The radius and ulna of both fore-limbs are lying in position. The radius is a single shaft with slightly expanded ends, 80 mm. long, with a minimum width of shaft of 16 mm. The proximal end has a width of 27 mm., and is hollowed for articulation with the humerus. The distal end has a width of 24 mm., and has two articulating faces. The inner one is comparatively short, while the ulnar surface is much longer and nearly flat.

The ulna has a form similar to that figured by Case for *Eryops*. The olecranon process is very blunt. The radial border of the bone is concave, the outer border straight from the head to the beginning of the distal expansion. The length of the ulna is 82 mm. The outer angle of the distal end is bluntly rounded for articulation with the pisiforme, while the main surface is truncate.

The carpus of *Eryops* has been discussed by Cope, Emery, Broom, and Case. In the specimen under description only two elements of the carpus remain—the “carpus” seen on the right limb being merely lumps of matrix that have been painted black and photographed before their true nature was noticed. There were undoubtedly four elements in the proximal row. The element remaining, the intermedium, articulated with the lower part of the ulnar surface of the radius. It is a lozenge-shaped bone 20 mm. by 12 mm. in extent. Internal to it was the radiale. Articulating with the intermedium, radius, and ulna was the ulnare—to follow Broom’s interpretation of the *Eryops* carpus; and articulating with the external surface of the ulna was the pisiforme, probably small. The other bone of the carpus remaining is imperfect, and is probably the 2nd carpale.

The metacarpals are more slender than those of *Eryops*. Only four metacarpals and four digits are preserved on each side, and the phalangeal formula as preserved is 2, 2, 3, 3 (?) or 4. The following table gives the chief measurements:—

	Length in mm.	Proximal width in mm.
1st metacarpal	23	15
1st phalanx	15	14
Claw	11	11
2nd metacarpal	29	14
1st phalanx	21	15
Claw	12	11
3rd metacarpal	28	17
1st phalanx	19	14
2nd phalanx	17	10
Claw	?	?
4th metacarpal	23	15
1st phalanx	16	12
2nd phalanx	12	9

Pelvis.—The pelvis is remarkable for the shape of the ilium. In the possession of a backwardly directed superior process and the absence of any superior anterior portion, the bone is more strongly reminiscent of such reptiles as *Varanosaurus* and *Ophiacodon* than of *Eryops* or the Cotylosaurs. The posterior process of the ilium slopes backwards and somewhat upwards, and has a rounded superior margin. The anterior margin is slightly convex, and there is no

preacetabular process. The inner border is concave behind the attachment of the sacral rib.

The pubes are large and plate-like, broadly expanded in front with a convex anterior margin.

Hind limb.—The hind limb of each side is preserved almost completely, the only missing bones being one or two from the tarsus.

The femur is approximately straight, with expanded extremities. The total length is 170 mm. The proximal end is swollen posteriorly, and apparently somewhat flattened anteriorly. The maximum width of the proximal end is 62 mm., and of the distal end 55 mm. The distal end has two prominent flattened articular surfaces. The shaft is moderately robust, with a minimum antero-posterior diameter of 25 mm.

The tibia and fibula are bones with widely expanded extremities, each bone being about half the length of the femur. The distal end of each bone has apparently two faces, the tibia articulating with the tibiale and intermedium, and the fibula with the intermedium and fibulare.

Most of the structure of the tarsus and pes is satisfactorily shown, although two of the tarsalia are missing. The intermedium is applied closely to the inner condyle of the fibula, lying between that bone and the tibia. It is irregularly rhomboidal in shape on the dorsal surface; the length of the fibular side is 25 mm., its width is 25 mm., and its height 28 mm. The tibiale and fibulare are both lozenge-shaped bones, each articulating with the intermedium. The tibiale is the larger bone, having a width of 36 mm. and a height of 19 mm., while the fibulare is 24 mm. wide and 19 mm. high.

Of the tarsalia but two are preserved—the first and what is probably the third. The first tarsale supported exclusively the first metatarsal. It is rectangular in shape, 16 mm. wide and 12 mm. high. The third lies in such a position that it probably assisted in the support of both the third and fourth metatarsals, a view which is borne out by its ovoid shape. It is smaller than the first tarsale, with a width of 15 mm. and a height of 10 mm. Lying between the tibiale and the first tarsale is a small rectangular bone measuring 12 mm. by 6 mm. This is the centrale.

The foot is short and heavy, larger than that of the fore-limb. All the metatarsals are somewhat expanded at the extremities, the first and last being shorter than the others. The digital formula is 2, 2, 3, 4, 3. The ungual phalanges are short and very bluntly

pointed, as in the fore-foot. The following are the chief measurements of the bones of the digits in millimetres:—

	Length in mm.	Proximal width in mm.
1st metatarsal	24·5	18
1st phalanx	15	18
Claw	approx. 10	13
2nd metatarsal	36	21
1st phalanx	26	19·5
Claw	approx. 11	12
3rd metatarsal	38	19
1st phalanx	24·5	20
2nd phalanx	17	15
Claw	11	11
4th metatarsal	37	19
1st phalanx	24	19
2nd phalanx	15	15
3rd phalanx	12	10
Claw	missing	—
5th metatarsal	23	16
1st phalanx	21	15
2nd phalanx	16	12
Claw	11	8

Armour.—The whole of the under side of the body was covered with an armour consisting of elongated, overlapping scales arranged in diagonal rows. The length of each scale in the mid-ventral region is about four times the width. Each scale, viewed from above, has a median groove, with one or two interrupted and narrower lateral grooves. Broom, in his description of a specimen from Senekal, says: "The armour consists of elongated, imbricated scales. One set of scales, probably from near the middle line, are much flattened and almost identical in appearance from those of the middle region of the abdomen of *Eryops*. The other series are probably from the more lateral region, and are narrower and less flattened."

RHINESUCHUS AFRICANUS (Lydekker).

1890. *Eryops africanus*, Lydekker. Quart. Journ. Geol. Soc., xlv., p. 291; pl. xii., fig. 2.

This species was described by Lydekker from a somewhat incomplete mandibular ramus obtained from some unknown locality in the Karroo, and was placed in the genus *Rhinesuchus* by Broom.

The species is imperfectly known. A crushed and incomplete skull and lower jaw (S.A.M. Cat. No. 3010) collected by the Rev. J. H. Whaits at Dunedin, Nieuweveld, Beaufort West (*Cistecephalus* zone), probably belongs to the species. It shows a type somewhat smaller than *R. senekalensis*, with a basal length of about 400 mm. The lower jaw is more robust than that of *R. whaitsi*, and there is no subdivision of the coronoid bone. More material is necessary before the details of this species can be satisfactorily determined.

6. *On a New Type of Dinocephalian* (*Moschosaurus longiceps*).

(Text-figs. 8, 9.)

The skull on which this new genus is founded was collected in 1914 on the farm La-de-da in the Division of Beaufort West from beds belonging to probably the upper part of the *Pareiasaurus* zone. With it were preserved half a dozen vertebrae, almost without doubt anterior dorsals.

The skull is long, low, and narrow, and although there is a slight elevation in the parietal region, there is none of the tremendous thickening of the bones which is so prominent a feature of the larger Dinocephalians such as *Tapinocephalus* and *Struthiocephalus*. The nostrils are rather far back. The eyes are wholly in the posterior half of the skull and are larger than the temporal openings. The quadrate is carried forward to the plane of the middle of the orbit. The lower jaw is massive.

The front of the nostril is 60 mm. behind the tip of the snout. The nostrils are large, longitudinally oval, and the internasal width is 20 mm.

The premaxilla has a suture with its fellow, and together the bones form the rather pointed extremity of the snout. Superiorly they separate the nostrils, sending back a narrow process to separate the anterior portions of the nasals. The suture with the maxilla is doubtful, but each premaxilla bore three or four large teeth. Each tooth is carried in a separate socket. The roots are long, and the crowns are differentiated into a long anterior cusp and a smaller posterior one. The antero-posterior width of the crown is at least $1\frac{1}{2}$ times the width of the root, the posterior cusp of the crown being a sort of process some distance above the level of the anterior cusp. Similar teeth are known from other and larger Dinocephalians. In *Struthiocephalus* the outside of the crown is convex and the anterior cusp is bluntly pointed, while the interior surface is concave below the posterior cusp which is convex on both sides. In some of the teeth in that genus there are one or two longitudinal grooves on the inside of the crown.

The maxilla is a large bone forming the lower border of the nostril and apparently passing back to form part of the sub-orbital arcade. It carried probably 6 or 7 teeth, of which only one or two are preserved. The posterior teeth are smaller than the anterior. The first may have functioned as a canine, being apparently bluntly pointed, but it was certainly comparatively much smaller than the canine of *Titanosuchus*.

The facial part of the septomaxilla is small, forming part of the posterior wall of the nostril and separating the maxilla and nasal for a short distance.

The nasals form a well-marked upstanding ridge between the nostrils and orbits along the centre of the skull, a region well marked off from the cheeks, which slope at an angle of about 50° from the jaws and are concave directly in front of the orbits. This nasal ridge is wide in its posterior part, suddenly narrows, and then has a uniform width of about 30 mm. throughout the anterior two-thirds of its length.

The orbit lies wholly within the posterior half of the skull, is longer than high, and shows very little supraorbital thickening. The prefrontal forms the anterior upper quadrant of the orbital margin, but its front margin is not well delineated.

The lachrymal is smaller than the prefrontal and does not reach the septomaxillary.

The interorbital area has a width of nearly 80 mm. It is flat, formed mostly by the frontals, which form a small part of the superior borders of the orbits.

The postorbital bar is comparatively weak, but the postorbitals pass back to form a large part of the upper border of the temporal fossa. The parietals are not distinguishable, but they must have been small.

The pineal foramen is sub-circular in shape and very large, having a longer diameter of 26.5 mm. The parietal region surrounding it was raised slightly above the level of the frontals. The foramen is placed very far back, in the plane of the back of the temporal fossa.

The squamosal, quadrato-jugal, and jugal occupy apparently the same relations as in *Moschops* and *Delphinognathus*, but there is no foramen between the jugal and quadrato-jugal such as occurs in *Delphinognathus*. The quadrate is scarcely seen from the side of the skull. It is pushed forward by the large squamosal to the level of the middle of the orbit. From behind it is roughly boot-shaped with the "heel" internal and the "toe" pointing outwards and

slightly forwards. The articular of the lower jaw is closely applied to it.

The occipital plate is weathered and broken. There is a large foramen magnum placed high up. The squamosal only forms the edge of the plate and the outer boundary of the lateral post-temporal fossa. Most of the side of the occipital plate seems to be formed by the tabulare. Below the basioccipital condyle there is a vertical mass of bone as in the other *Dinocephalians*.

The lower jaw is deep and displayed only in outer view. Its total length is about 215 mm. The dentary covers almost the whole of the anterior half of the jaw, the lower border being formed by the

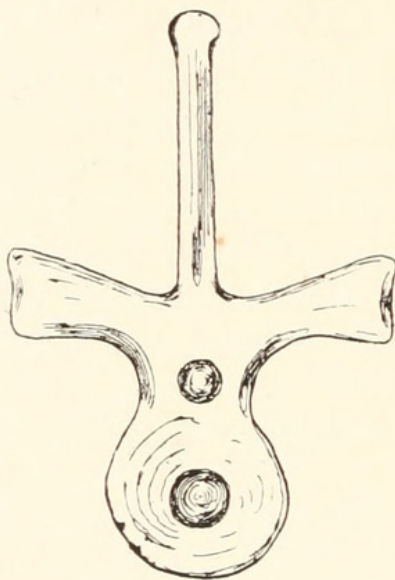


FIG. 8.—Anterior view of vertebra of *Moschosaurus longiceps*. $\times \frac{1}{2}$.

splenial; and the dentary extends backwards along the upper border of the jaw for about four-fifths of its length. This posterior process is much more slender than that seen in *Dimetrodon*. The dentary carries 5 or 6 teeth, forwardly directed and presumably diminishing in size posteriorly.

The splenial forms a small portion of the symphysis and is only visible along the lower border of the anterior half of the jaw.

The back of the angular is missing; but the notch in its lower border must have been a small one. The bone overlaps the articular which, from below, is seen to be swollen vertically and to pass forwards and upwards.

Six consecutive vertebrae are preserved, without doubt anterior dorsals. The centra are short with circular biconcave ends. The lower border is concave with a slight median ridge. The sides are

more concave than the ventral surface. The transverse processes are large, pointing slightly upwards, thicker distally than proximally. The neural spines are high and flattened laterally.

The following table gives the measurements of three of the vertebrae, the 1st, 3rd, and 5th of the series:—

	1st Vertebra.	3rd Vertebra.	5th Vertebra.
Length of centrum.....	30 mm.	33 mm.	32 mm.
Height of centrum.....	28 „	31 „	31 „
Total height	88 „	112 „	117 „
Width across transverse processes	70 „	68 „	? „
Height of spine	35 „	52 „	58 „
Length of spine	17 „	23 „	22 „

No intercentra are preserved.

This type, although undoubtedly a Dinocephalian, presents in its external shape so great a contrast to the other members of the group that I propose to erect for it a new genus, and to name it *Moschosaurus longiceps*, g. et sp. nov.

Type. Skull and lower jaw. (S.A. Mus. Cat. No. 3015.)

Locality. La-de-da, Beaufort West, Cape Colony.

Horizon. Lower Beaufort Beds. (Upper part of *Pareiasaurus* zone.)

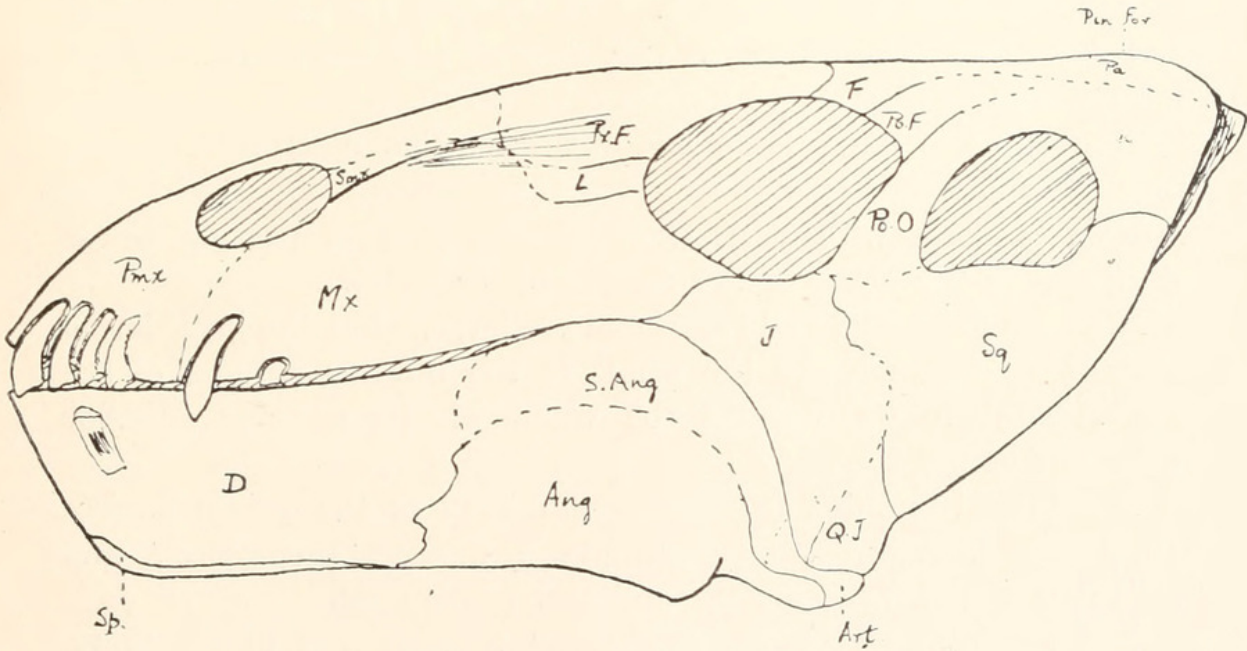


FIG. 9.—Skull of *Moschosaurus longiceps*. $\times \frac{1}{3}$.

7. *On Some New Gorgonopsians.*1. *GALESUCHUS GRACILIS*, g. et sp. nov.

(Text-figs. 10, 11.)

This new genus and species is founded on a specimen collected at Abraham's Kraal, Prince Albert Division, that is, from the lower half of the *Pareiasaurus* zone, where it occurred in conjunction with *Trochosaurus intermedius* and bones of *Pareiasaurus* and of large Dinocephalians. It is a weathered skull and lower jaw, lacking the anterior part in front of the canine.

The skull is small. As preserved its greatest length is 120 mm., while the maximum width across the squamosals was probably 75 mm. The orbits look outwards, and the antorbital portion seems not to have been quite so elongated as in the Gorgonopsians from the *Endothiodon* and *Cistecephalus* zones. The antero-posterior diameter of the orbit is 32 mm., and the interorbital width 30 mm., being equal to the intertemporal. The temporal fossa looks upwards and outwards. The occiput is very sloping, inclined at an angle of not much more than 30° to the top of the skull.

The canine is fairly large and vertical. The molars are small, four in number, simple, unserrated, and slightly recurved. The maxilla is deep, with a posterior slender process passing below the jugal to the plane of the middle of the orbit.

Both the prefrontal and lachrymal are large, while the jugal forms part of the anterior, and the whole of the inferior, borders of the orbit. The prefrontal forms the whole of the anterior superior quadrant of the border.

The frontal is large, forming 5 mm. only of the orbital border. It passes backwards, supporting the median preparietal, and articulating also with the parietal and postfrontal.

The postfrontal is large, and forms a large part of the upper border of the orbit, having the same general shape as in *Scylacops capensis*.

The preparietal is 15 mm. long, and lies 4 mm. in front of the pineal foramen, which is 5 mm. long and oval in shape.

The parietals are large, and wholly enclose the pineal foramen. Owing to weathering of the bone surface their relations with the squamosals cannot be determined.

The interparietal forms the upper half of the occipital plate and articulates below with the supraoccipital.

The foramen magnum is large, oval in shape. Its lateral borders are formed by the small exoccipitals. The basioccipital condyle

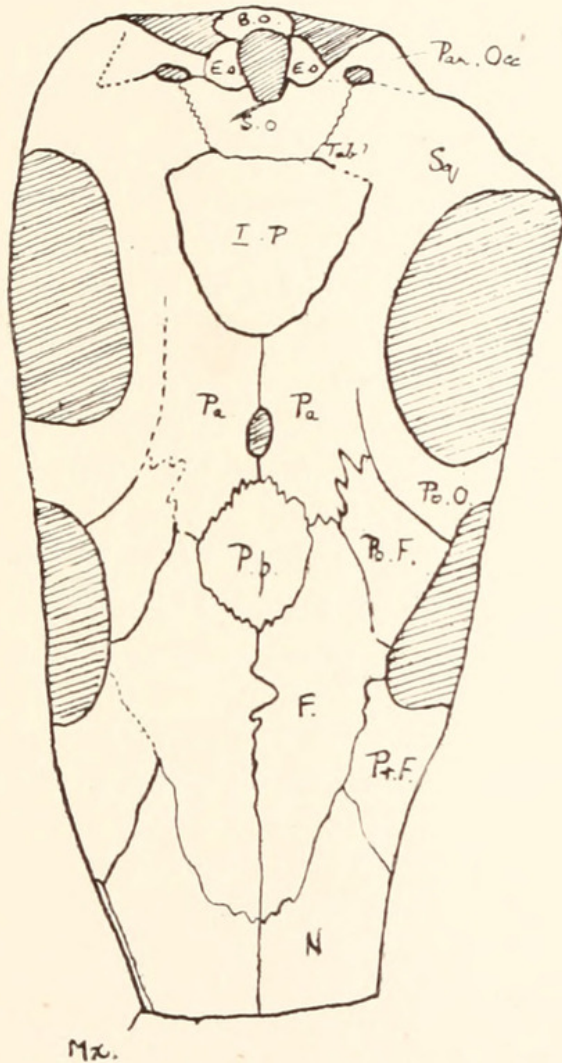


FIG. 10.—*Galesuchus gracilis*.

Sketch of top of skull showing arrangement of bones. $\times \frac{2}{3}$.

is rounded. The basisphenoidal tubera are far back and considerably below the level of the condyle, so that the foramen magnum appears to be high up on the back of the skull. The paroccipital process is deep and strong, and the post-temporal fossa is as high as the top of the foramen magnum, looking wholly backwards. The foramen jugulare is not seen, but it must have been high up as in *Arctops*.

The condition of the matrix renders it almost impossible to develop

the palate, but fracturing of the specimen has shown one or two of its features. The descending processes of the pterygoids are large. As in *Scylacops capensis* and other Gorgonopsians the pterygoid is closely united with the transpalatine, there being no evidence of any foramen between them. The ascending pterygoidal plates pass forward above the palatine. Superiorly the fused pterygoids thin out into a plate slightly displaced from its true position, which does not appear to meet the ethmoid, although the two bones may have met further back. The ethmoid is a median element lying vertically beneath the frontal suture, and separated from the upper cranial wall.

The palatine carries a few simple pointed teeth.

Only the posterior half of the vomerine bone is seen. It descends below the level of the front of the palatine, which ascends anteriorly towards the top of the skull as a thin plate. Between this plate and the vomerine bone is a distinct foramen. This bone is apparently single.

The lower jaw is incomplete, but agrees in external characters with that of *Scymnognathus*. The dentary is very large, and its posterior process rather more powerful than in the other Gorgonopsians. The angular is large.

Type. Incomplete weathered skull. (S.A.M. Cat. No. 2754.)

Locality. Abraham's Kraal, Prince Albert Division.

Horizon. Beaufort Beds. (*Pareiasaurus* zone.)

2. GORGONOGNATHUS LONGIFRONS, g. et sp. nov.

(Plate XIII., figs. 1, 3.)

The skull about to be described is No. 2671 of the South African Museum collection, and was collected at Dunedin, Beaufort West, from a bed of sandstone $1\frac{1}{2}$ miles east of the homestead. The top of the snout and back of the temporal region are denuded of bone by weathering, and the whole skull is somewhat distorted. The general features of the skull are those of *Gorgonops torvus*, which occurs, however, at a lower horizon: but the head is not quite so much depressed, and is much larger than Owen's type.

The maximum length of the skull was between 340 mm. and 350 mm. From the snout to the front of the orbit is 200 mm. The basal length from the snout to the back of the occiput is 305 mm. The interorbital width is 77 mm., while the intertemporal width was probably about 85 mm.

The premaxilla is divided by a median suture. The septomaxilla

and maxilla have the normal Gorgonopsian relationships. The septomaxilla is large, and has the inwardly directed turbinal process dividing the nares into upper and lower passages. It forms an appreciable portion of the cheek behind the nostril, and has the usual outer foramen between it and the maxilla. The nostrils are nearly terminal.

The maxilla is large, forming nearly three-quarters of the cheek, and having a sub-orbital portion supporting the jugal.

The dental formula is $i5\ c1\ m4$. Most of the teeth are missing, only the fourth incisor on either side being present, but the sockets are plainly visible. The incisors are large, nearly equal in size to one another, and closely set together, the five teeth occupying a space of 54 mm. at the edge of the bone. At that level the 4th incisor has an antero-posterior diameter of 11 mm. The roots of the teeth are long and simple. Each tooth is implanted in a separate socket. Behind the last incisor is a diastema of 14 mm., and then comes the socket of a massive canine 28 mm. in diameter. Directly behind the canine is a series of four molars—all lost—gradually decreasing in size, and occupying together a space of 33 mm.

The nasals are very large, forming the top of the snout, and having posterior projections which separate in part the frontals from the prefrontals.

The prefrontal is large, forming the upper anterior quadrant of the orbital border. The frontal is largely shut out from the orbital border, but it forms 13 mm. of it between the prefrontal and post-frontal. It passes forward, separating the posterior parts of the nasals.

The orbit is small, looking forwards and outwards and possibly slightly upwards, and lies wholly in the posterior half of the skull. The postfrontal is large, forming nearly one-fourth of the orbital margin, and articulating apparently with the parietal to behind the pineal foramen.

The temporal fossa is slightly larger than the orbit. The inter-temporal region is wide, and the pineal foramen is placed back almost as far as the occipital crest. The preparietal is small, and wholly in advance of the pineal foramen.

The squamosal forms the lower and most of the posterior borders of the temporal fossa and the outer sides of the occipital plate. The lower part of the bone and the quadrate region are missing.

The occipital plate is broader than high, and vertical. The interparietal is slightly broader than deep, and forms a large part

of the plate. It has a prominent median ridge in its lower half, which barely passes over to the bone below.

The most recent accounts of the basicranial region of the *Gorgonopsia* have been given by Watson, who describes skulls of *Arctops willistoni* and *Scymnognathus whaitsi*, discussing their relations with *Dimetrodon* on the one hand and *Diademodon* on the other. In *Gorgonognathus* the basioccipital condyle is rounded and swollen below, and hollowed above for the reception of the foramen magnum. The paroccipital process is short and powerful, forming the lower border of the post-temporal fossa. It is considerably in advance of the tabulare, and shallow when viewed from behind, so that the post-temporal fossa looks almost wholly downwards. The exoccipitals are like those figured by Watson, and form the lateral borders of the foramen magnum. The foramen jugulare is at the bottom of the skull in front of the exoccipital, bounded by that bone, the paroccipital, and the basioccipital, and looks wholly downwards.

The whole occiput is concave and the squamosals fairly wide. The interparietal is narrow and the tabulare large as in *Scymnognathus*. The interparietal carries a well-marked median ridge, which dies out below on the supraoccipital. The tabulare forms the outer upper border of the post-temporal fossa, and covers part of the back of the inner ramus of the squamosal.

Thus this form, occurring as it does in the *Cistecephalus* zone, seems to occupy rather an anomalous position. In the width of the parietal region, the shortness of the temporal fossae, the shape of the basioccipital condyle, and the stoutness of the paroccipital it agrees with *Arctops*. But in the reduction in height of everything below the foramen magnum, the downward aspect of the post-temporal fossae, the position of the foramen jugulare, and the size of the squamosal, interparietal and tabulare it agrees with *Scymnognathus*, indicating possibly an advance on that form.

The palatal view of the premaxilla shows a somewhat pitted flat plate anteriorly, which forms part of the inner border of the large internal narial openings, and articulates behind with the "vomer."

This vomer is comparatively broad anteriorly and narrows behind. It has ventrally a median keel and two lateral keels, with slight intermediate grooves. Although the median suture separating the two premaxillae can be well seen, there is no suture running down the middle of this bone, and it is undoubtedly a single bone. For some time Dr. Broom has considered that this median bone is a

pair of fused prevomers, and Watson has recently mentioned that in the type skull of *Arctops* the bone seems to be actually double when seen in section on the anterior end of the specimen. As a contribution to our knowledge on this subject I have examined skulls of three Gorgonopsians from different zones, viz. *Galesuchus gracilis* from the *Pareiasaurus* zone, a snout of *Gorgonops* sp. (S.A.M. Cat. No. 3038) from the *Endothiodon* zone of Beaufort West, and *Scymnognathus serratidens* from the *Cistecephalus* zone of Dunedin, Beaufort West. All these skulls show a cross-section through the vomer. The bone is fairly similar in all three cases with regard to the ventral surface, but the dorsal surface shows some variation, best seen and understood by reference to the figures.

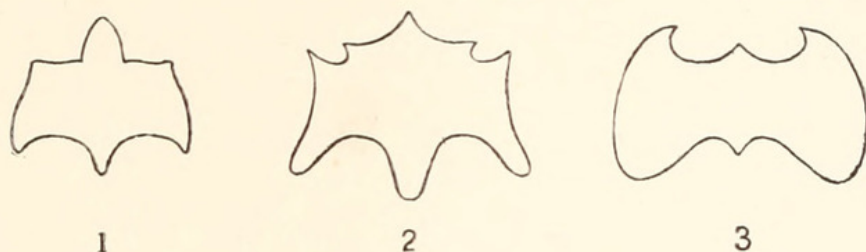


FIG. 11.

1. Cross-section through vomer of *Galesuchus gracilis* through canine.
 2. Cross-section through vomer of *Gorgonops* sp. immediately anterior to canine.
 3. Cross-section through vomer of *Scymnognathus serratidens* through canine.
- All the figures $\times 3$.

There is seen on the dorsal surface a progressive reduction of the median ridge, and a tendency for the two grooves to become one. None of the specimens show any signs of a median suture.

The front of the palate is considerably vaulted, the plane of the premaxilla and "vomer" being above that of the palatine and maxilla, whose inner portions rise vertically at right angles to the outer portions.

The palatines approximate to each other to form the beginning of a secondary palate considerably below the primary. The palatine is a large bone passing forward almost to the back of the canine. On its posterior and inner portion it carries a few strong, well-developed teeth.

The pterygoid has a very powerful descending process, deepest at the side of the mandible, and rising to the level of the palatine where it meets its neighbour. The maximum depth of this process is 60 mm. and the distance between the two extremities 110 mm. In

front the pterygoid meets the transpalatine and palatine. Behind the descending processes is a long narrow median bar. The anterior portion of this is formed by the pterygoids in contact, but for the greater part the pterygoids seem to be separated by a thin median forward process of the basisphenoid. This process may be the parasphenoid, but no suture can be traced between it and the main body of the bone. Superiorly the pterygoid forms a thin bony plate which is not ankylosed to its neighbour, but in places is completely separated from it by matrix.

At the back of the basisphenoid are two tubera which are strong and but slightly in advance of the basioccipital condyle.

Type. Crushed skull in sandstone. (S.A.M. Cat. No. 2671.)

Locality. $1\frac{1}{2}$ miles E. of Homestead, Dunedin, Nieuweveld, Beaufort West.

Horizon. Beaufort Beds. (*Cistecephalus* zone.)

3. SCYMNOGNATHUS SERRATIDENS, sp. nov.

(Plate XIII., figs. 2, 4. Text-fig. 11.)

The type of this new species is the anterior two-thirds of a skull and lower jaw found 3 miles WSW. of the homestead on the farm Dunedin, Beaufort West, in a calcareous nodule. It is smaller than either *S. whaitsi* or *S. tigriceps*, and slightly smaller than *S. angusticeps*, although agreeing in general shape with the two former. It differs from *S. tigriceps*, *S. angusticeps*, and *S. minor* in having all its teeth serrated behind in their lower halves. The incisors and canines of *S. tigriceps* are worn down to a certain extent, and it is just possible that the lower parts of these teeth might have been serrated; but the molars of the larger form certainly show no trace of serration.

The premaxilla, maxilla, and septomaxilla are as in *S. tigriceps*, the septomaxilla having an anteriorly directed turbinal which divides the nares almost completely into upper and lower portions.

The dental formula for the upper jaw is $i5\ c1\ m4$. The first two incisors are smaller than the others; the largest are the third and fourth. The five incisors occupy a space of 38 mm. They are serrated on the posterior border. On the 3rd, which is the most perfectly preserved, the serrations begin 7 mm. below the edge of the premaxilla and continue almost, if not quite, to the point of the tooth. On the same tooth in a distance of 14 mm. there are 36 serrations. The maximum width of the 3rd incisor is 7 mm., and

its length below the edge of the bone 25 mm. The following gives the length of the incisors: *i*1, 19 mm.; *i*2, 21 mm.; *i*3 25 mm.; *i*4, 24 mm.; *i*5, 20 mm. In section the teeth are oval. There is a diastema of 21 mm. between the last incisor and the canine. The canine is very long, reaching almost to the bottom of the mentum, 55 mm. below the edge of the maxilla, pointed and backwardly curved. It is serrated behind in its lower half. Behind is a diastema of 15 mm., and then come four molars occupying a space of 24 mm. These are simple, pointed teeth, serrated posteriorly in their lower halves. The first molar has 14 serrations in a distance of 4 mm., the whole length of the crown being 10 mm. All the teeth are implanted in very deep, distinct sockets.

The prefrontal forms the upper and anterior quadrant of the orbital border. The frontal is 85 mm. long, and just forms part of the orbital border, being almost shut out from it by the prefrontal and postfrontal. The relation of the frontal to the orbital margin in this genus is a variable one. In *S. angusticeps* the frontal forms a considerable part of the margin; in this species it is almost excluded from it; while in *S. tigriceps* and *S. whaitsi* it is very doubtful whether it plays any part in the border at all. In *Galesuchus* and *Gorgonognathus* the frontal forms but a small part of the border, while in *Scylacops* it is completely excluded by the junction of prefrontal and postfrontal.

The median preparietal is bounded by the frontals and parietals, with which it articulates by interdigitating sutures. It is oval in shape, 30 mm. long and 17 mm. broad, and is situated at the level of the postorbital bar. The pineal foramen is large and lies 5 mm. behind the preparietal.

The hinder part of the cheek below and in front of the orbit is very much hollowed out. The slope from the front of the orbit is very abrupt, while that from the maxilla is much more gentle. This concavity is much more pronounced than in *S. tigriceps*.

The nasals are long, but not convex, sloping upwards from the face to form a prominent sharp median ridge which extends back as far as the frontals.

The lower jaw has the mentum relatively less deep than that of *S. tigriceps*, and a backward slope so that the point of the jaw comes directly below the canine.

The chief features of the species are its comparatively small size, the possession of serrated teeth, of a ridge on the top of the snout, and the pronounced backward slope of the front of the lower jaw.

The following are the chief measurements of the type:—

Tip of snout to front of orbit	132 mm.
Tip of snout to back of orbit	177 „
Interorbital width	66 „
Intertemporal width	64 „
Depth—snout to mentum	130 „

Type. Incomplete skull. (S.A.M. Cat. No. 2672.)

Locality. Dunedin, Nieuweveld, Beaufort West.

Horizon. Beaufort Beds. (*Cistecephalus* zone.)

8. *On a Skull of the Genus Kannemeyeria.*

(Text-figs. 12-14.)

The genus *Kannemeyeria* was founded by Seeley in 1908 (Rep. Brit. Ass., 1908, p. 713) on a skull of a large Anomodont found by Dr. Kannemeyer near Burghersdorp, which is—according to Watson (Ann. Mag. Nat. Hist., 1912, x., p. 575)—an imperfect skull of *Dicynodon simocephalus*, Weithofer. Weithofer described his species in 1888 (Ann. K.K. Natur. Hof Mus., Wien, Bd. iii.) and figured the type, an imperfect skull. Broom (Bull. Amer. Mus., 1913) refers to this species as *Kannemeyeria simocephalus*.

The genus is characterized by having a broad frontal region, a narrow and high parietal crest, a parietal region inclined at an oblique angle to the frontal plane, the pineal foramen at the front of the parietal crest situated in a well-marked depression, an absence of the postfrontal and probably of the preparietal bones.

The hitherto described species are two :—

Kannemeyeria simocephalus (Weithofer), (*loc. cit.*),

Kannemeyeria latifrons (Broom),

and to these I now add a third, founded upon a well-preserved and complete skull together with most of the lower jaw and the first 20 vertebrae found by Mr. E. W. Pocock at Winnaarsbaaken, Burghersdorp, in 1914 (S.A.M. Cat. No. 3017), to which I propose to give the name *Kannemeyeria erithrea*, sp. nov.

Skull.—The general shape of the skull can best be understood from the figures. The orbits look almost entirely outwards. The temporal fossae are large. The nostrils are near the front of the skull. The snout is rugose—as are the supraorbital borders and the nasal overhang—and is provided with a pronounced median ridge which extends back to the plane of the front of the orbit. From the posterior point to the plane of the back of the nostril this ridge has a median groove, so that it has the appearance of being double.

The nostril is large, reniform in shape, and near the front of the snout. It has a large, overhanging bony roof. The anterior border

is formed by the premaxilla, which has a median septum separating the two nostrils. From above only the front part of the nostril can be seen. The posterior half is overhung by the nasal, which is nearly twice as wide as the premaxilla. The premaxilla has a long posterior process separating the two nasals, which, although large



FIG 12.—Top view of skull of *Kannemeyeria erithrea*. $\times \frac{1}{5}$ nearly.

bones, only meet one another for a distance of about 40 mm. posteriorly.

The floor of the nostril is formed by the maxilla. This carries a large tusk, which is directed strongly forwards. Posteriorly the maxilla sends back a long process outside and below the jugal reaching to the postorbital bar. The bones in the nostril are slightly crushed, and I am unable to distinguish a separate septomaxilla. If present, it is small and certainly does not occur on the face.

The limits of the lachrymal and prefrontal are not well displayed in either of the two skulls we possess; the lachrymal is certainly small, but the prefrontal forms a large part of the inner orbital wall. The lachrymal foramen lies wholly within the orbit.

The frontal is broad and flat, forming the posterior half of the supraorbital border. It has a short process passing back along the side of the parietal, between that bone and the postorbital. There is no postfrontal.

The postorbital at its lower end rests on the jugal; it forms the whole of the postorbital bar and meets the parietal, forming part of the inner border of the temporal fossa.

The pineal foramen is placed in a distinct depression. I am inclined to believe that it is wholly surrounded by the parietals, the preparietal being absent.

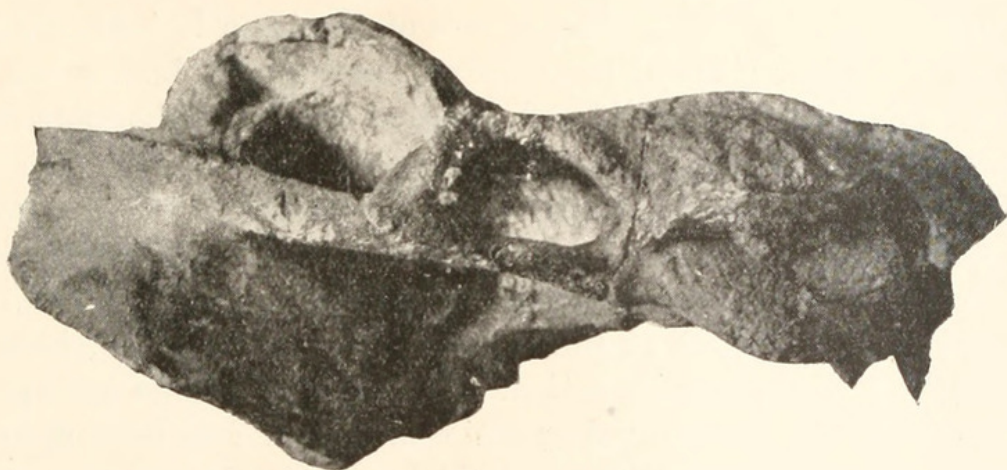


FIG. 13.—Side view of skull of *Kannemeyeria erithrea*. $\times \frac{1}{6}$ nearly.

The parietal crest is high and narrow. Posteriorly the parietals are separated by a deep groove which has a shallow prolongation on to the upper half of the occipital plate.

The occipital plate is peculiar. The lower two-thirds is vertical; but the interparietal and the upper halves of the squamosal parts are bent at an angle of between 110° and 120° , so that the plate is completely hidden from view both from above and from the sides. The bones of the occiput occupy the same relative positions as in other members of the Anomodontia. The foramen magnum is large. The exoccipital has, on the inner border midway between the condyle and the supraoccipital, a prominent protuberance, and external to that another smaller rugose knob; the posterior corner of the paroccipital is prolonged to form a bluntly pointed process. The lateral occipital foramen is large, lying mostly in the exoccipital,

the supraoccipital forming only a minute portion of its upper border, and the squamosal its outer border only. The condyle is tripartite.

The squamosal is a very large bone. The skull is peculiar in that the width between the outer edges of the descending processes of the squamosal is its greatest width.

Lying in the hollowed portion of the exoccipital just outside the condyle is a small rounded foramen for the exit of the 9th, 10th, 11th, and 12th nerves.

No sutures are distinguishable between the basisphenoid, exoccipital, and quadrate, and no separate quadrato-jugal can be seen.

The basioccipital forms the lower part of the tripartite condyle, narrows somewhat in front and then widens, forming on either side a large process with an outer concave articular surface, each pierced by the fenestra ovalis. The stapes is absent. The basisphenoid lies in front of the basioccipital and forms part of the anterior surface of the basioccipital process. The centre of the bone is hollowed out, and on the inner sides of the ridges bounding this hollow are the carotid foramina. Laterally and anteriorly the basisphenoid articulates with the pterygoid.

The pterygoid is a long narrow bone passing from the maxilla to the quadrate. It lies on the outer side of the palatine. For a short distance in front of the basisphenoid the two pterygoids unite in the median line. In front of this median pterygoidal plate, between it and the forked posterior end of the vomer is a large pterygoidal foramen. There is the usual posterior lateral process passing to the front of the quadrate. The sphenoidal portion of the pterygoid is very small.

The lower part of the columella cranii is seen, closely affixed to the outer side of the pterygoid and basisphenoid.

The posterior nares are large. The outer border is formed almost wholly by the palatine, which passes along the inside of the pterygoid and meets the "vomer" posteriorly. Anteriorly the palatine lies above the pterygoid and has a rugose surface which meets the premaxilla. The "vomer" is a thin median bone forming the median septum between the posterior nares. Posteriorly it forks, and curves on each side outwards to meet the palatine, passing behind that bone and forming most of the hinder wall of the posterior nares. According to Broom, this bone in the Anomodonts is formed of fused prevomers and is not homologous with the mammalian vomer.

In front of this median bone there is a pronounced median ridge on the premaxilla which extends forward half the length of the bone.

At the front of the palate this ridge is replaced by a groove, on either side of which is a less well-marked ridge.

The following are the chief measurements of the skull :—

Greatest length	450 mm.
Greatest breadth	330 „
Minimum width of nasal overhang	65 „
Maximum width of nasal overhang.....	119 „
Interorbital width	141 „
Intertemporal width	15 „
Snout to front of orbit	167 „
Length of orbit	82 „
Basal length	332 „
Minimum width across pterygoids	64 „

Lower jaw.—The most recent descriptions of the Anomodont lower jaw have been given by Watson and van Hoepen. The former gives a general account, basing his description of the bones of the back of the jaw on a “fragmentary jaw of *Kannemeyeria* collected by the author at Winnaarsbaaken, Burghersdorp District” —from which farm this type also comes. In general the jaw agrees with that figured by Watson except that, owing to the difficulty of development, it is impossible to be sure of the presence of the coronoid. Van Hoepen states expressly that a coronoid does not exist either in *Lystrosaurus* or in *Dicynodon*; but he seems certainly to have misunderstood the position of the coronoid as defined by Watson.

The front of the jaw projects slightly upwards, forming a beak which fits into the concave upper jaw. The front of the mandible has a median ridge running from the point to the mentum bounded by two lateral grooves, one on either side, on the outer side of each of which is a less well-defined ridge.

The dentary forms almost the whole of the front of the outer surface. Its edentulous border is provided with a longitudinal groove which narrows and deepens posteriorly. The posterior part of the bone is produced into two processes, the upper of which seems to lie outside the surangular and angular. Between it and the lower process is a deep notch. The lower process lies outside the angular.

In the side view the splenial is only just seen. It forms part of the median symphysis and passes inside the angular, whose thin anterior end lies between the dentary and the splenial.

On the right-hand side of the jaw lying in the groove in the dentary is a small piece of a bone which may be the displaced coronoid.

The suture between the surangular and articular is not seen; but those between the angular and surangular and angular and pre-articular are well displayed. The surangular forms most of the upper border of the fossa, and lies within the dentary and angular. Its upper edge forms a thickened ridge. The inner flange of the articular is very pronounced.

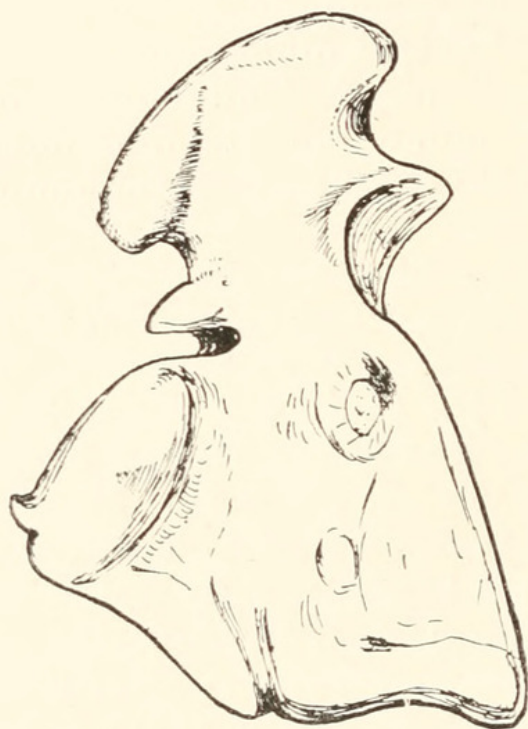


FIG. 14.—Sketch of odontoid and axis of *Kannemeyeria erithrea*. $\times \frac{1}{2}$.

Vertebrae.—Associated with the skull and lower jaw were a number of vertebrae, which seem to form a continuous series of 20 vertebrae from the odontoid backwards.

The odontoid is the only portion of the atlas preserved. It is of the usual trefoil shape with a height of 65 mm. and a maximum width of 62 mm. Its anterior face is strongly convex. In the centre of the front face is a small aperture which coincided with the small pit at the end of the occipital condyle. The upper surface is strongly concave for the floor of the neural canal. There is no intercentrum between the odontoid and the axis. The atlantal arch is not preserved. It rested, apparently, almost wholly on the odontoid, and articulated behind with the axial prezygapophyses and in front, probably, with the processes of the exoccipitals seen on either side the foramen magnum.

The axis and odontoid seem to be fused together; possibly the fusion may not be a true ankylosis, but due to the pressure of one against the other.

The axis has an elongated neural spine, compressed in the middle and swollen at either end, with a convex upper edge. The transverse processes are fairly short, and a short distance behind the front of the centrum and below the median line is a vertically elongated facet for the articulation of the capitulum of the double-headed axial rib.

The 3rd to 7th vertebrae—probably all caudals—are cemented together by matrix. The centra gradually enlarge, the flattened neural spines rapidly increase in size, as do the transverse processes, the facets for the articulation of the tubercula of the ribs becoming markedly oblong in shape. The central facets remain on the anterior edges of the centra.

The remaining vertebrae were mostly isolated in the matrix, but they seem to form a series. The neural spines from the 9th bend backwards and gradually decrease in size. The neurocentral suture becomes well marked, and the transverse and central facets are connected by an oblique groove.

The following are the chief measurements:—

	Vertebrae No.								
	Axis	3	4	5	6	7	8	13?	17?
Length of centrum	42	37	38	39	39	39	36	35	35
Width of centrum	56	55	51	62	60	59	61	50	55
Total height	128	142	161	?	195	189	170	132	143
Height of spine above transverse process	66	71	80	?	109	101	78	53	58
Width across transverse process	90	97	100	100	96	97	98	83	75
Width across prezygapophyses...	55	37	42	38	43	41	42	32	39
Width across postzygapophyses	32	35	30	48	38	35	27	32	32

[All the measurements are in mm.]

Type. Skull and lower jaw. (S.A. Mus. Cat. No. 3017.)

Locality. Winnaarsbaaken, Albert, Cape Colony.

Horizon. Burghersdorp Beds. (*Cynognathus* zone.)

9. *A New Thecodont from the Stormberg Beds.*

SPHENOSUCHUS ACUTUS, g. et sp. nov.

(Text-figs. 15-17.)

This exceedingly interesting new form is described from a specimen collected by Dr. A. L. du Toit from the Red Beds of Paballon, Mount Fletcher. It consists of an incomplete and somewhat crushed skull, with the cervical vertebrae attached, the two

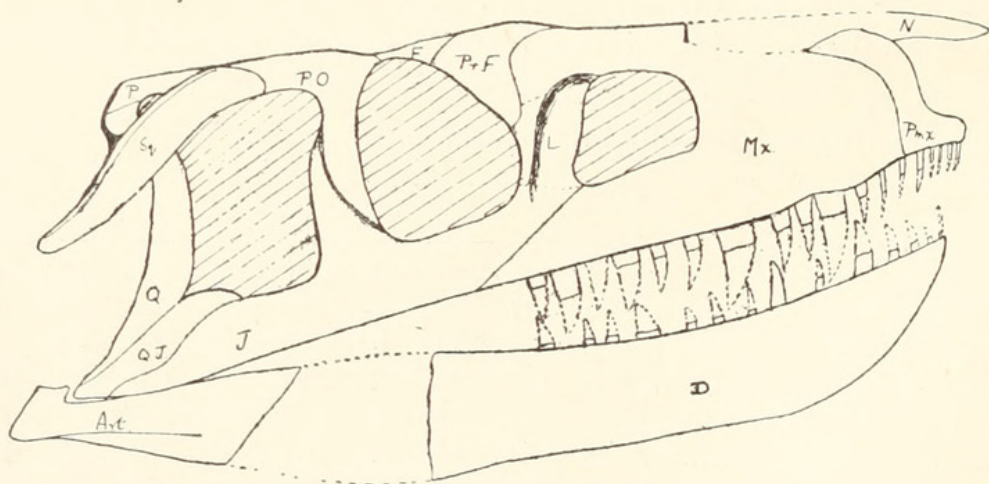


FIG. 15.—Side view of skull of *Sphenosuchus acutus*. $\times \frac{1}{2}$.
(Slightly restored.)

scapulae, two clavicles, an interclavicle, two humeri, and some other fragmentary bones—all in one slab of rock; and a complete tibia and the distal third of a fibula which in all probability belong to the same animal.

The skull is somewhat crushed but nearly whole, and shows all the external details. It is larger than that of *Euparkeria*, and is comparatively more pointed, longer, and narrower. The orbits are rounded, and wholly in the posterior half of the skull. The supratemporal fossa is elongate, oval in shape, and larger than that of *Euparkeria* or *Ornithosuchus*. The shape of the infratemporal fossa is characteristic in that its anterior border, formed by the



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