2. *A Report on a collection of Fossil Reptilian Bones from Tanganyika Territory.* By Lieuwe D. Boonstra, D.Sc.

(With 7 text-figures)

Introduction

Recently I received from Mr. G. M. Stockley eight cases of fossil reptilian bones collected from the Ruhuhu Coalfield region. This collection was obtained from three distinct localities. Those labelled S346 come from the Matomondo area, S559 from the Ngaka-Kingori Hill area, and S340 from the Njalila-Mkongeleko area. The geological horizon of the first two localities is given as the Lower 'Bone Bed' of the Songea Series, and the third as the Upper 'Bone Bed' of the same series.

Stockley states that the bones 'were picked up from the surface and thus are much weathered'. It is clear that all the fragments collected from a locality were given the same number, and each number undoubtedly includes fragments derived from a number of different skeletons. I have no means, other than the state of preservation, of determining the degree of association of the various fragments. For the greater part the fragments thus have to be considered individually. No evidence is given by the collector that the fragments bearing the same number were obtained or derived from the same horizon within the bed. On the contrary, it is evident on morphological grounds that from the Upper 'Bone Bed' there are at least four groups of specimens and that these were derived from four different levels within the bed. It should be stressed that in future collecting attention should be paid to the relative levels within the bed from which each specimen is collected.

A. Material from the Lower 'Bone Bed'

1. *Anomodont Skull Fragments*

Under the label S346 there are a small number of weathered pieces which include fragments identifiable as parts of a fairly large anomodont skull with a narrow parietal crest. This feature apparently excludes reference to the *Aulacephalodon* group of genera, and these fragments must thus represent a large species of the genus *Dicynodon*.

Under the label S559 there are a large number of weathered pieces—cranial as well as post-cranial. Of the recognizable skull fragments the following identifications have been possible, mainly on pieces of the intertemporal region bearing the pineal foramen and the structures immediately surrounding it.

(*a*) In one piece of the intertemporal region of a fairly large dicynodont there is a medium-sized oval foramen situated at the posterior end of a depression formed by the preparietal. The parietal crest is of medium width and height. The distinguishing feature in this fragment is the nature of the preparietal.

From the anterior border of the foramen the sides of the prepariétal diverge in anterior direction. The prepariétal thus meets the frontal in a long transverse suture. The whole of the bone lies in a depression. Direct comparison proved the identity of this specimen with a form from the Luangwa Valley of Northern Rhodesia which I described under the name *Dicynodon roberti*. This specimen now bears the South African Museum Cat. No. 11706.

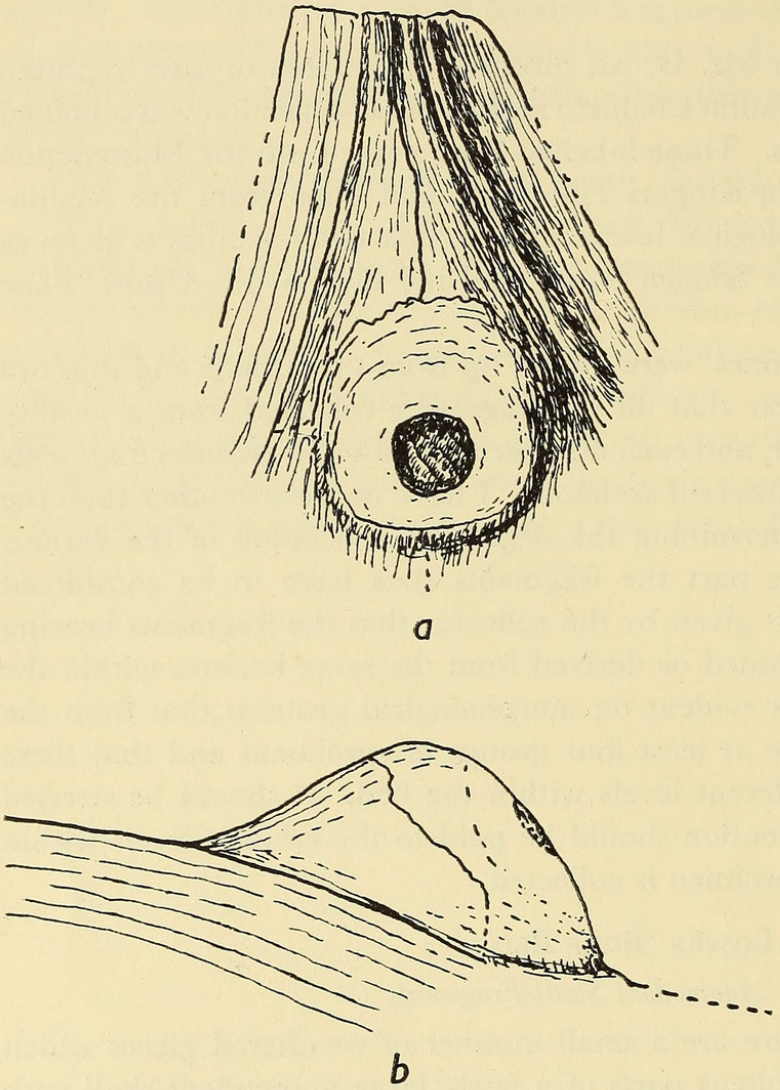

FIG. 1.—*Neomegacyclops cyclops* n. sp. S.A.M. Cat. No. 11707. *a*, dorsal view of pineal region (×½). *b*, lateral view (left) of pineal boss (×½).

(*b*) In another fragment (fig. 1) the pineal foramen pierces a large oval boss which is almost entirely formed by the prepariétal. The posterior third of the boss is formed by the parietal, but this bone only stretches two-thirds up the posterior surface of the boss and is thus excluded from the border of the pineal foramen. The prepariétal completely surrounds the foramen, which is of medium size and nearly circular. The foramen is directed anteriorly, and the plane in which it lies makes an angle of 45° with the plane of the dorsal surface of the skull. Posteriorly, the surface of the boss, here formed mainly by the parietal, slopes gently backwards. The parietal, which has only a small exposure, is then covered by the two post-orbitals which meet on the median line. Anteriorly, the boss is abruptly marked off from the surface of the frontals by a semicircular groove. A near approach to this condition of the pineal region, in the more fully known Karoo species, is shown by some of the species of the genus *Platycyclops*, where the foramen is also completely surrounded by the prepariétal raised in the form of a boss. A nearer approach still is shown in the species of the genus *Megacyclops*, where the parietal participates in and forms the posterior part of the boss. In the present specimen the shape of the boss differs remarkably

from that of *M. whaitsi* of the South African Karoo and of *M. rugosus* described by Haughton from Tanganyika, but agrees in other features, particularly in being so definitely anteriorly directed and in the manner in which the parietal participates in its formation. It differs from *M. usiliensis* of Von Huene in the slope of the boss and in the fact that the parietal is excluded from the border of the foramen. It is thus evident that we have here a new species of *Megacyclops** and this fragment can be designated as the type specimen of *Neomegacyclops cyclops* n. sp. This specimen now bears the South African Museum Cat. No. 11707.

(*c*) In a third fragment where the intertemporal region is preserved, the nature of the pineal region is strongly reminiscent of that known in the genus *Rachiocephalus* of the *Endothiodon* zone of the South African Karoo and may be provisionally referred to that genus. This specimen now bears the South African Museum Cat. No. 11708.

(*d*) Another identifiable fragment is of the central part of a massive occiput. The basisphenoidal tubera are exceptionally massive and are, furthermore, peculiar in that they lie practically horizontally instead of approaching the vertical, so that the *foramen ovale* is directed nearly completely posteriorly, whereas the more usual direction is nearly completely ventrally. This condition is not known to exist in the genera *Megacyclops* and *Rachiocephalus*. This fragment is thus not derived from either of the large skulls that yielded the pineal regions mentioned above. In none of the larger Anomodonts examined by me nor in the published descriptions have I seen basisphenoidal tubera of a similar nature. This fragment thus indicates the existence in Tanganyika of a new type of the larger Anomodonts, of which one hopes that a more complete skull may soon be found and be designated as the type of this new species. This specimen now bears the South African Museum Cat. No. 11709.

2. *Anomodont Limb-bones*

Included in the collection are a number of weathered distal and proximal ends of some large humeri, femora and ulnae. The former two are of about the same size and nature as the humerus and femur described by Haughton and referred to as *Eocyclops*? and *Megacyclops* respectively. In addition to these there are some proximal and distal ends of humeri and femora of Anomodonts of smaller size which could be associated with a skull of the size of a form like *Dicynodon huenei*—a species peculiar to Tanganyika. These specimens now bear the South African Museum Cat. Nos. 11710 and 11742.

3. *Pareiasaurian Vertebrae*

Two medium-sized vertebrae are preserved in a weathered condition. These are typically Pareiasaurian, and are smaller than those of the larger genera which predominate in the *Tapinocephalus* zone of the Union. They are also

* I find that the name *Megacyclops* which Broom (1931) proposed for this anomodont genus is preoccupied for a crustacean (Kiefer, 1927). I propose that this anomodont genus be known under the new name *Neomegacyclops* nom. nov.

smaller than, and do not show the peculiarly narrow elongated dorsal spine so characteristic of, the vertebrae described by Haughton from locality B19, west of Kingori. These vertebrae prove the presence in Tanganyika of Pareiasaurs probably closely related to the medium-sized types of the South African Karoo. These now bear the South African Museum Cat. No. 11743.

4. *Therapsid Cranial Material*

Among the mass of weathered fragments from the Ngaka-Kingori Hill area there are two incomplete snouts much weathered, and one fairly complete but

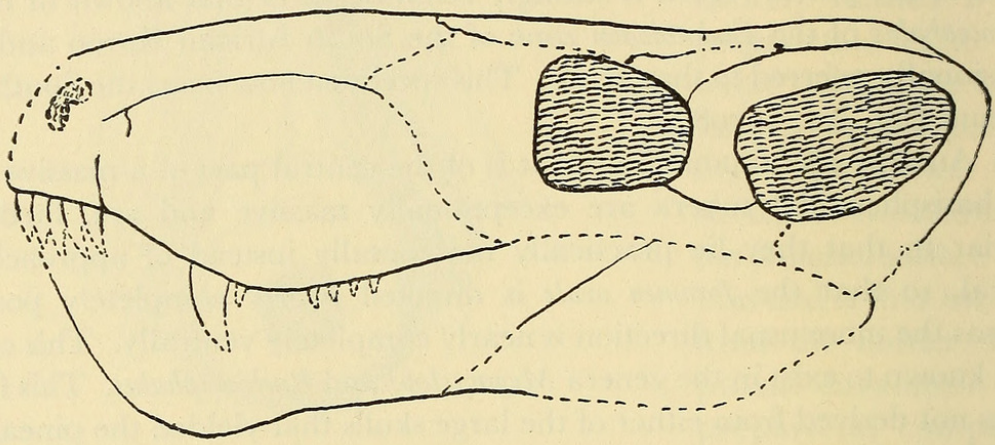

FIG. 2.—*Tangagorgon tenuirostris* n. g. et n. sp. S.A.M. Cat. No. 11744. Lateral view of skull ($\times \frac{1}{2}$).

somewhat distorted and weathered skull. The more complete skull is of a Gorgonopsian and the two snouts appear to be Therocephalian.

(*a*) The more complete specimen (figs. 2 and 3) has the outer surface considerably eroded, so that it is difficult to determine the sutures. The skull is of medium size. The chief measurements are:

Maximum length	190	mm.
Basioccipital—Premaxilla	184	,,
Premaxilla—Pineal foramen	145	,,
Premaxilla—Orbit	104	,,
Width across squamosals	95	,,
Interorbital width	49	,,
Intertemporal width	53	,,
Width across canines	40	,,
Height from Mx. edge—median suture	50	,,
Height of mentum	?40	,,
Length of molar series: Left (4 teeth)	17	,,
Right (3 teeth)	17	,,
Length of incisor series	25	,,

Dental formula: Right, i5, co+1, m3.
Left, i5, c1+1, m4.

The snout is long, high and narrow. Anterior to the orbits the cross-section is squarish. The orbits are situated in the posterior half of the skull and are laterally directed. The temporal openings are of medium size, oval, and directed as much dorsally as laterally. The pineal foramen is small and posteriorly situated. The frontals apparently form only a small part of the orbital border. The snout is higher than wide. The maxilla is deep. The interparietal is only slightly inclined downwards from the general dorsal surface and is more a bone of the dorsal surface than of the occiput. From the posterior edge of the interparietal the occiput descends practically vertically. The nature of the rest of the occiput is obscured by the presence of the proatlantal arches, atlas and axis. The teeth are poorly preserved. On the left there are preserved five medium-sized incisors, a fairly weak canine with the tip of a replacing? canine just emerging, and the roots of four small molars. On the right side the last of the five incisors is small (a replacing tooth?), the canine has been lost and a replacing? one is emerging; the crowns of three small molars are preserved, number 3 having fallen out.

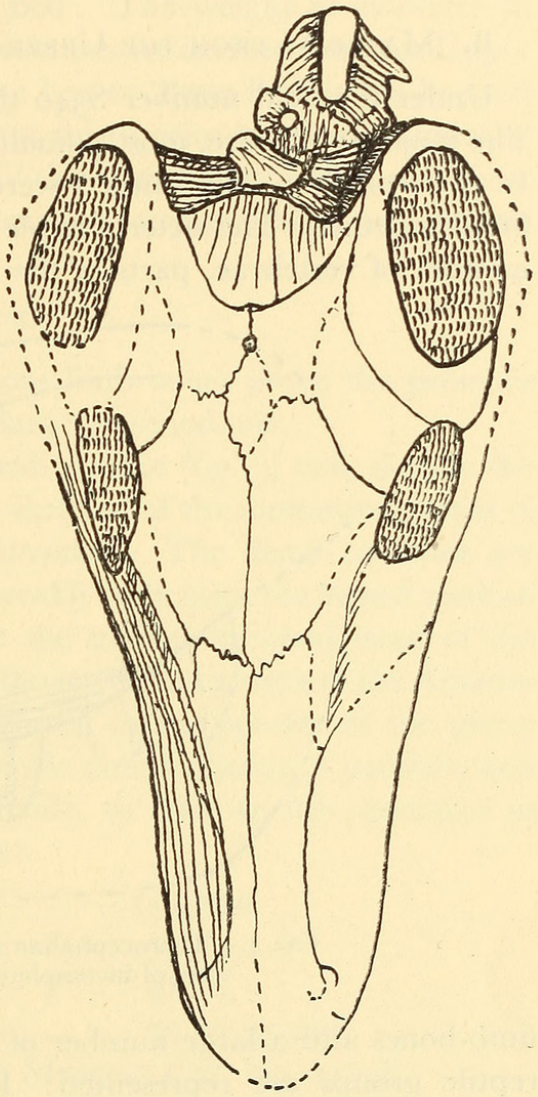

FIG. 3.—*Tangagorgon tenuirostris* n. g. et n. sp. S.A.M. Cat. No. 11744. Dorsal view of skull with proatlas, atlas and axis. ($\times\frac{1}{2}$)

The characters enumerated above do not occur together in any known Gorgonopsian, and I therefore designate this specimen as the type of a new genus and species—*Tangagorgon tenuirostris*. This type specimen now bears the South African Museum Cat. No. 11744.

(*b*) The smaller snout fragment is nearly completely stripped of bone but shows the roots of five strong and large incisors. This specimen, which is probably Therocephalian, now bears the South African Museum Cat. No. 11745.

(*c*) The larger snout fragment (fig. 4) represents the anterior half of a medium-sized skull. The tip of the snout is weathered away and no upper incisors are preserved. The lower edge of the dentary is also weathered away. A moderately sized canine is represented by a root, and four irregularly spaced and directed molars are present. The molars are implanted on a flange of bone lying in a plane medial to the general lateral maxillary surface. The lacrymal is of small antero-posterior extent and its intra-orbital surface is pierced by two

foramina. The accompanying sketch gives the general shape and proportions. The affinities of this Therocephalian are uncertain, but the nature of the lacrymal indicates that it is not a very primitive form, and that its affinities would lie with the Therocephalian forms younger than those from the *Tapinocephalus* zone. This specimen now bears the South African Museum Cat. No. 11746.

B. Material from the Upper 'Bone Bed'

Under the field number S340 there were six cases of weathered fragments. The majority of these, mostly small pieces, are so worn as to be indeterminable. In the workshop few contacts were found and only a small number could be fitted together. The determinable pieces consist of cranial fragments, a large number of vertebrae, parts of the pelvic and shoulder girdles, three complete

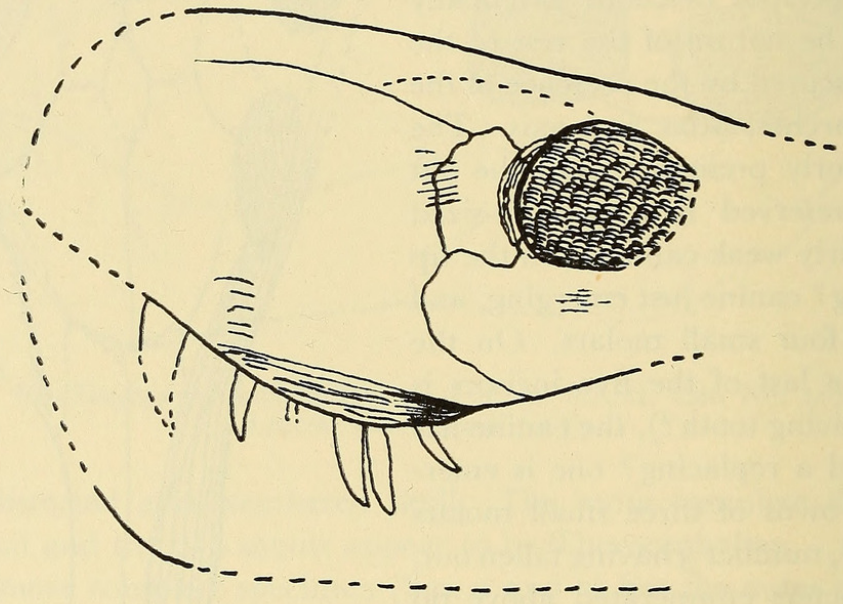

Fig. 4.—Therocephalian sp. S.A.M. Cat. No. 11746. Lateral view of incomplete and weathered snout. ($\times \frac{1}{2}$)

limb-bones and a large number of ends of various limb-bones. The following reptile groups are represented: Pareiasaurians, Anomodonts, Rhynchosaurians, Pseudosuchians, Cynodonts, and a Theropodous Dinosaur.

1. *Pareiasaurians*

Of this group there is preserved a single weathered distal end of a small right humerus. It is much smaller than the specimen from Tanganyika figured by Haughton and described under the new specific name *Anthodon minusculus*. In Haughton's specimen the greatest width across the condyles is 87 mm., whereas in this specimen it is only 63 mm. In all other determinable features the two specimens agree very closely. It would thus appear that we have here a humeral end of a smaller species or more probably of a juvenile specimen of *Anthodon minusculus*.

In the material from Tanganyika described by Haughton some errors of labelling are mentioned by him. The type specimen bears the number S342

and a second specimen the number S350; the former number being given to specimens from a locality (Njalila) in the Upper 'Bone Bed' and the latter number to specimens from a locality (below and west of Kingori) in the Lower 'Bone Bed'. Haughton assumed the number S342 to be an error in the labelling. Now, the present specimen bears the number S340, which refers to a locality (Njalila-Mkongeleko) in the Upper 'Bone Bed'. The weight of evidence in regard to the labelling is thus that all these specimens are derived from the Upper 'Bone Bed'. Palaeontologically, however, the Lower 'Bone Bed' is the horizon indicated, unless we consider it probable that this species survived practically unchanged into the Upper 'Bone Bed'. Until this uncertainty is removed these specimens must be cited with caution in drawing stratigraphical or faunistic conclusions.

2. *Anomodonts*

Fragments of skulls, lower jaws and various limb-bones prove the presence in these beds of species of medium sized to large Anomodonts.

(*a*) A well-preserved right humerus of medium size (fig. 5) can, despite the paucity of our knowledge of the post-cranial skeleton of the numerous species of Anomodonts, be referred to the genus *Lystrosaurus*. The distal condyles are undeveloped, the antero-ventral line is only weakly indicated, the lateral median line undeveloped, and no definite scar for the medial humeral head of the triceps is present. These characters exclude the terrestrial genera of the Anomodonts, and agree with the condition manifested in the species of the genus *Lystrosaurus*. In the absence of a skull no specific determination is possible, and it is advisable, until further data are available, to refer to this specimen as *Lystrosaurus* sp. The chief measurements are:

Greatest length	140 mm.
Greatest proximal width	77 „
Greatest distal width	91 „
Shaft	33 by 35 mm.

This specimen now bears the South African Museum Cat. No. 11748.

(*b*) Under the number S340 are included about a dozen ends of limb-bones. Among these are seven distal and three proximal ends of humeri, three distal and two proximal ends of femora which, with slight individual differences, agree well with the corresponding bones of *Kannemeyeria*. The widths across the distal ends of the humeri are: 180, 160, 158, 154, 148, 139 and 125? mm. These humeral ends are manifestly different from the humerus figured by Haughton under the name *Eocyclops*(?) sp. These specimens now bear the South African Museum Cat. No. 11749. Some fragments of the pelvic and pectoral girdle may also very well belong to this genus. In addition to these limb-bones there are also preserved the ends of much smaller Anomodont humeri and femora. So that, contrary to our experience in the South African Karoo, small Anomodonts survived comparatively late in Tanganyika. These bones now bear the South African Museum Cat. No. 11750.

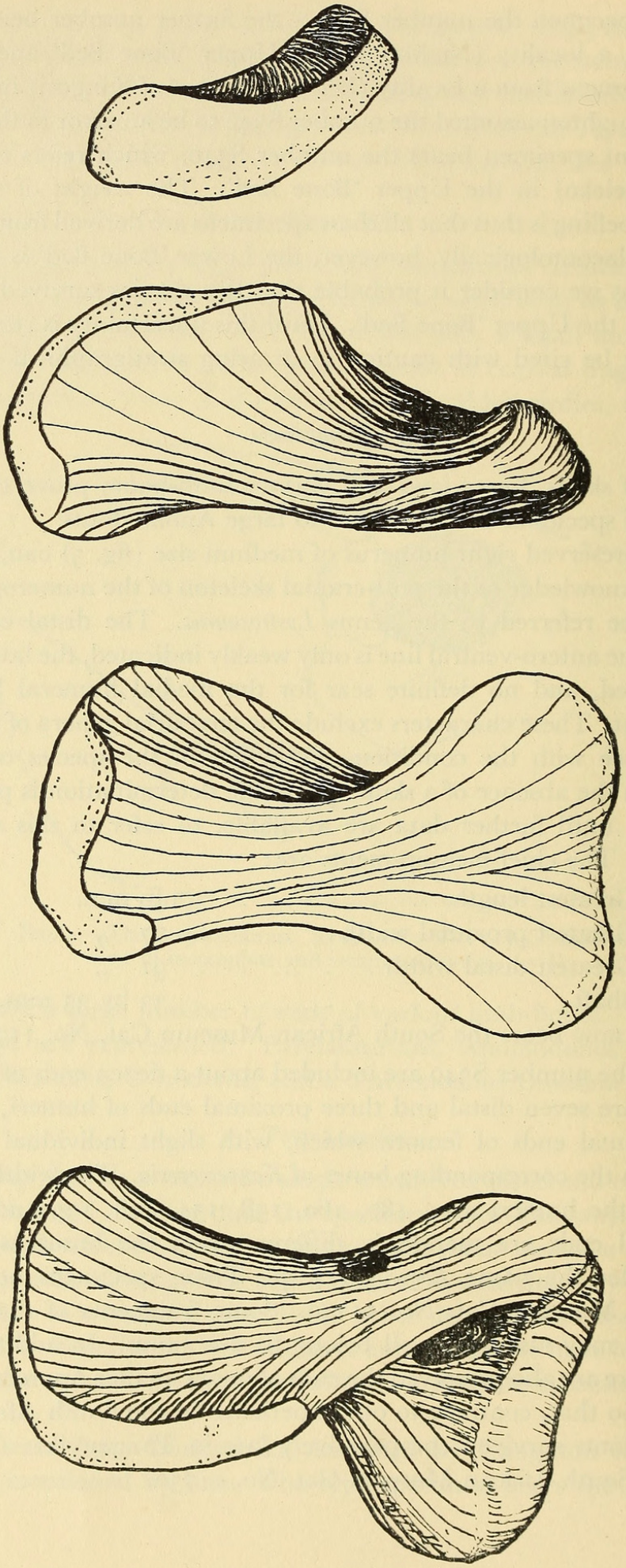

FIG. 5.—*Lystrosaurus* sp. S.A.M. Cat. No. 11748. Right Humerus in ventral, dorsal, anterior and proximal views ($\times \frac{1}{2}$).

(*c*) The Anomodont cranial material includes parts of the temporal arches, a quadrate, and some pieces of occiput. One occiput, with its tripartite condyle and its characteristically shaped and ventrally directed basisphenoidal tubera nearly surrounding the foramen ovale, is strongly reminiscent of the same structures in the skull of *Kannemeyeria* and may with confidence be referred to that genus. Some pieces of maxilla with the canine roots preserved may also be included in this determination. These fragments now bear the South African Museum Cat. No. 11751.

(*d*) Three other occipital fragments are more massive. Here the condyle is rounded with no grooves tripartitioning it. The basioccipital tubera, though massive, do not descend so far ventrally and are situated some distance apart. A very similar condition is shown by a number of the larger *Aulacephalodon*-like forms, but as in the large number of described forms this area is neither figured nor described, closer comparison is not possible, and for more specific determinations it is necessary that we have better descriptions of known forms or better-preserved skulls from this area. These specimens now bear the South African Museum Cat. No. 11752.

3. *Cynodonts*

One very badly eroded fragment consists of the anterior two-thirds of a fairly small Cynodont skull. The outer surface is so badly weathered that the structure is indeterminable, and on the palatal surface little more than the teeth sockets are preserved. These indicate that we have here a specimen of the genus *Trirachodon*. This specimen now bears the South African Museum Cat. No. 11755.

4. *Rhynchosaurians*

The collection includes the following bones, or parts of bones, determinable as Rhynchosaurian: a complete humerus, two proximal and seven distal ends of humeri, six proximal and four distal femoral ends, parts of the pelvic and pectoral girdles, a large number of disarticulated vertebrae, a jaw fragment and two incomplete occiputs.

(*a*) *The Humerus* (fig. 6).—Direct comparison of these humeral elements to the type humeral end of *Stenaulorhynchus stockleyi* proves them to be specifically identical. In size and in the proportions there are considerable differences in the hitherto described material and that at present under consideration, as will be apparent from the following table:

	Type	*Para-type*	*Huene's Spec.*	*Spec. a*	*Spec. b*	*Spec. c*	*Specs. d*	*e*	*f*
Max. length	?	?	145	166	?	?	?	?	?
Max. width across prox. end	101	77	92	110	120	?	?	?	?
Shaft.	41×30	21×17	25×20	32×24	?	?	?	?	?
Proc. lat.—prox. end . .	83	57	60?	81	94	?	?	?	?
Proc. med.—prox. end .	85	63	88?	101	110	?	?	?	?
Thickness at med. corner .	37	26	33	31	40	?	?	?	?
Max. width across dist. end	?	?	80	100	?	93	80	78	97

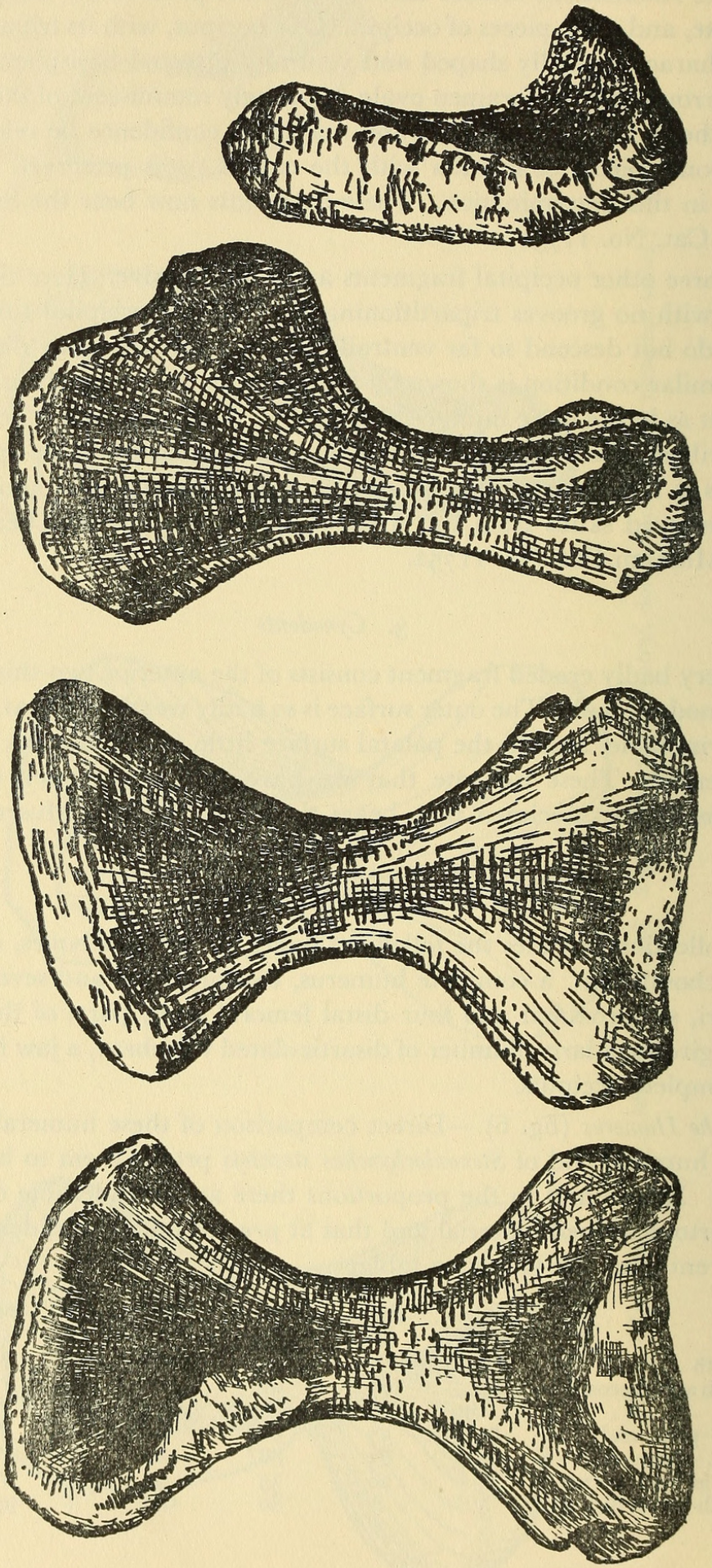

FIG. 6.—*Stenaulorynchus stockleyi*. S.A.M. Cat. No. 11753. Right Humerus in ventral, dorsal, anterior and proximal views ($\times \frac{1}{2}$). Drawing by Dr. A. J. Hesse.

In the light of our present limited knowledge it is advisable to consider these differences of size and proportions as age and/or sex variations and not as denoting any specific distinctness.

(*b*) *The Femur.*—In the collection there are six proximal and four distal ends of femora. Direct comparison with the type material proves these bones to be specifically identical to Haughton's *Stenaulorhynchus stockleyi*. As in the type material there is considerable variation in the various dimensions:

	a	*b*	*c*	*d*	*e*	*f*
Max. width over trochanter .	93	73	72	71	65	64
Max. thickness of prox. end .	58	?	44	53	48	52
Trochanter—prox. end . . .	37	?	33	15	22	31

There is, moreover, considerable variation in point of size, shape and position of the trochanter:

In *a* the slightly bulbous trochanter is connected with the proximal surface by a somewhat constricted neck.

In *b* the trochanter is less bulbous and the neck less constricted.

In *c* the trochanter is hardly thickened, and instead of a neck a sharp ridge connects it to the proximal surface.

In *d* the trochanter lies nearly in the same plane as the proximal surface, and in proximal view appears as a tongue-like extension of the proximal surface, without any neck.

In *e* the bulbous trochanter connects with a short neck to the side of the proximal end to form a distinct step.

In *f* a thickened ridge attaches the trochanter to the proximal end.

In the specimen recently described by me under the name *Scaphonyx africanus* the bulbous trochanter is separated from the proximal surface by a much greater step than in *e*. The amount of variation shown by the above specimens impels one to reconsider the position of *Scaphonyx africanus*. This must now be considered as an extreme variant of a femur of *Stenaulorhynchus stockleyi*, and the name given by me becomes a synonym of *Stenaulorhynchus stockleyi* Haughton.

The distal femoral ends of our material agree very well with that of the type material and the shaft of one specimen with that figured by Von Huene.

(*c*) *The Girdles and Vertebrae.*—The material here preserved agrees in all essentials with the corresponding bones figured by Von Huene in his paper on *Stenaulorhynchus*.

(*d*) *The Occiput.*—Included in the material there are two imperfect and weathered occipital fragments that appear to be identical to the occiput described by Von Huene and figured in fig. 4 in his paper on *Stenaulorhynchus* and in fig. 6 in his 'Die Verwantschaftsgeschichte der Rhynchosauriden des Südamerikanischen Gondwanalandes'. A very eroded fragment in a different type of matrix shows a part of the maxilla and dentary which also appears to be Rhynchosaurian. All these Rhynchosaurian bones now bear the South African Museum Cat. No. 11753.

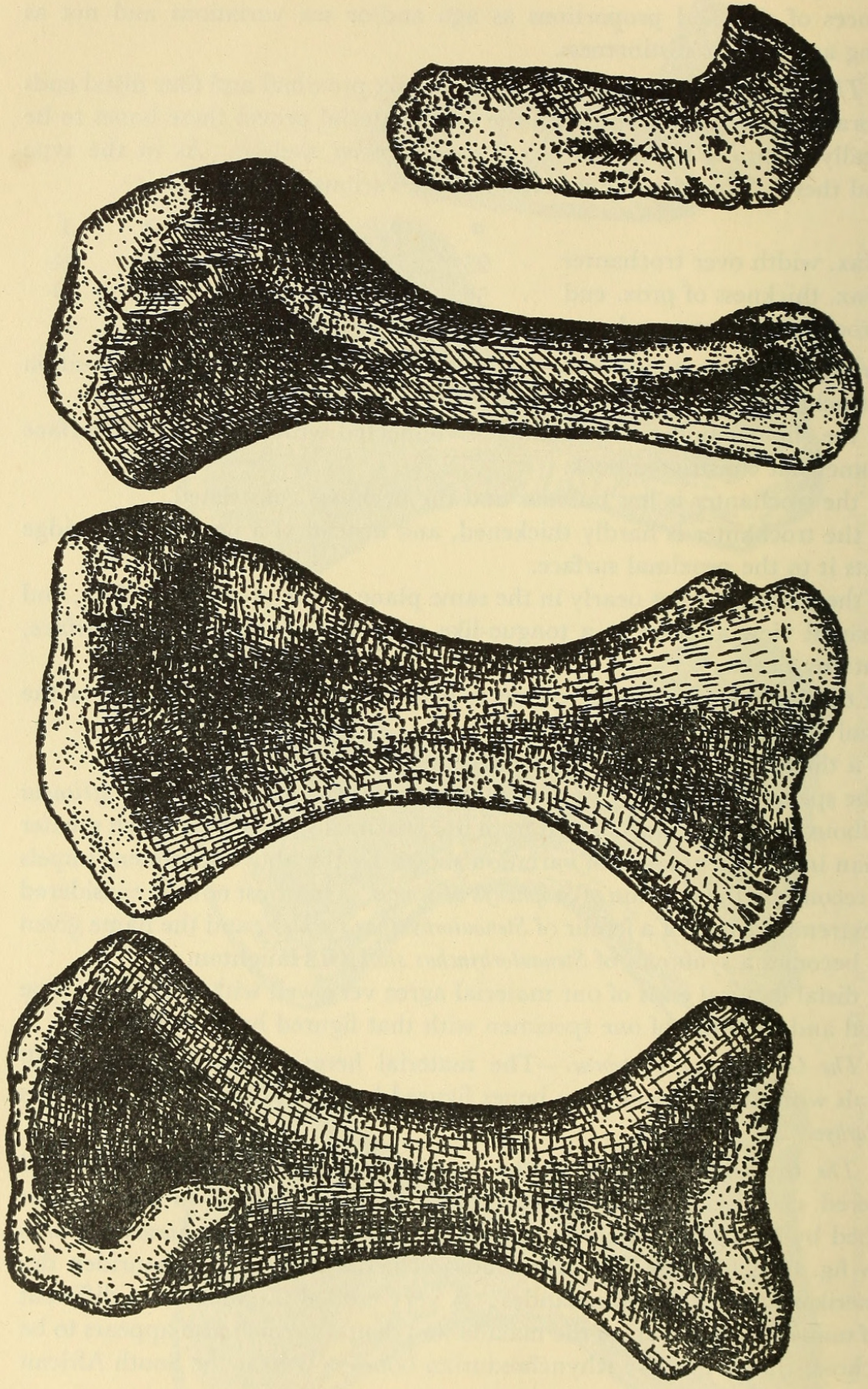

FIG. 7.—*Stagonosuchus tanganyikaensis* n. sp. S.A.M. Cat. No. 11754. Right Humerus in ventral, dorsal, anterior and proximal views ($\times \frac{1}{2}$). Drawing by Dr. A. J. Hesse.

5. *Pseudosuchians* (fig. 7)

Also bearing the field number S340 is a well-preserved right humerus. This bone shows undoubted and close relationship to the corresponding bone in the material collected by Dr. Nowack in the Njalila area, and included in the type material described by Von Huene under the name *Stagonosuchus nyassicus*, and representing a new genus and species of Stagonolepid Pseudosuchians. Although closely resembling Von Huene's form, the following comparative table of measurements in mm. will show that some noteworthy differences in size and proportions exist:

	St. nyassicus	*St. tanganyikaensis*
Maximum length	320	200
Max. width across prox. end . .	180	112
Max. width across dist. end . . .	130	93
Max. width of shaft	50	38
Proc. lat.—prox. end	70	52
Ectepicondylar flange—dist. end .	30	23

These differences appear to be of a specific nature, and I propose that this new species be known under the name *Stagonosuchus tanganyikaensis*. The main points of difference between *nyassicus* and *tanganyikaensis* may be enumerated: in *nyassicus* the processus lateralis lies in the same plane as the median corner of the proximal surface, whereas in *tanganyikaensis* the medial corner is not deflected and thus not situated so far distally; in *tanganyikaensis* the bicipital fossa is deeper and circumscribed much more definitely; the angle between the planes in which the proximal and distal ends lie is less in *tanganyikaensis* than in *nyassicus*; proportionally the distal end is wider, the shaft has a greater maximum width and is relatively shorter, the processus lateralis extends further distally in *tanganyikaensis* than in *nyassicus*. This humerus now bears the South African Museum Cat. No. 11754.

6. *Dinosaurs*

Among the large number of Rhynchosaurian vertebral elements in this collection I found a fairly small caudal vertebra lacking the upper part of the neural spine, of a Theropodous Dinosaur. The chief measurements are:

Greatest length of centrum	40 mm.
Greatest height of centrum	34 ,,
Greatest width of centrum	28 ,,

I have compared this vertebra with the *Thecodontosaurus* caudal vertebrae in our Museum and find a fairly close agreement, especially with the anterior caudals of a specimen from the Red Beds of the Stormberg Series of the Union. This specimen now bears the South African Museum Cat. No. 11793.

Conclusions

From the above account it is thus evident that in this collection there are from the Lower 'Bone Bed' no forms showing any close relationship to the fauna of the *Tapinocephalus* zone. The Anomodonts, Pareiasaurs and Therapsids it

contains are all manifestly akin to species from the *Endothiodon* and *Cistecephalus* zones of the Karoo of the Union. The beds represented in the Matomondo and Ngaka-Kingori Hill areas are thus homotaxial to the upper two zones of the Lower Beaufort of the Union.

The assemblage from the Upper 'Bone Bed' of the Njalila-Mkongeleko area, containing as it does small to medium-sized Anomodonts, Anomodonts of the Aulacephalodon group, a Lystrosaur, a *Kannemeyeria*, a Cynodont, a Rhynchosaurian, a Pseudosuchian and a Theropodous Dinosaur, is related to the fauna known from the beds of the Karoo ranging from the top of the *Cistecephalus* zone of the Lower Beaufort right up to the Red Beds of the Stormberg. A more detailed recording of the relative levels in which the various fossils occur will enable the stratigrapher to subdivide the Upper 'Bone Bed' of this area into beds respectively homotaxial to the Middle and the Upper Beaufort, the Molteno and the Red Beds. It is probable that in this area some of the Anomodonts were actually derived from the top of the Lower Beaufort.

ACKNOWLEDGMENTS

My thanks are due to Mr. G. M. Stockley and his collectors for the opportunity of examining this interesting collection, and to Dr. A. J. Hesse for two of the illustrations.

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