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Note: I have tried to retain the peculiarities of Hennig's use of vocabulary and style, so some sentences are decidedly odd by today's standards.

Hennig loves double and triple qualifications, which I have faithfully translated ("could perhaps be potentially indicative of"). Also, Hennig (and the other members of the expedition) usually used "Tendaguru" not as the name for a geographic location, but as the name for a landscape feature, Tendaguru hill. Thus, they were not "in Tendaguru (at Tendaguru)", but "am Tendaguru (at the Tendaguru [hill])". I have occasionally added "[hill]" to note this usage, except in the title.

***Kentrosaurus aethiopicus* the stegosaur of the Tendaguru**

By EDW. HENNIG

The richness in bones of the Dinosaur Beds at Tendaguru in German East Africa was quickly determined. Surety regarding the richness in differing forms was won only by and by. The sometimes large distances did not allow a direct comparison of bone. Finds were mostly wrapped at the digs and

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thus could not be seen next to each other in the storerooms. Memory did not recall the shapes not with sufficient certainty, given the plethora of remains found every day, to contrast certain bones after often weeks of intermission. Not to mention the matrix cover that for practical reasons was often not removed, or only in places, which was hiding things of importance from the eye. Drawings and photographs could capture only a very small part of the yield, and at least in the beginning it was not possible to predict which parts would become important for comparisons later on. Because the Tendaguru-Expedition had actually set out to recover if possible complete skeletal remains of the sauropod *Gigantosaurus* made known by FRAAS. Even the keenest expectations weren't set on a fauna of roughly a dozen dinosaur types plus additional forms aside.

In the first year of excavation, 1909, already repeated isolated finds of smaller dimensions were made, which in some cases could be recognized as being significantly different, but in part were believed to be juvenile individuals, as in the case of the femur. Additionally, they were too rare and dispersed to be brought into context with each other just because of their small size. On 24 July 1910, a Sunday, Professor JANENSCH managed the surprising confirmation of the presence of a close relative of the American plate- and spike-carrying *Stegosaurus*. Ten days before a dig had begun near the settlement Kindope, a few kilometers north of Tendaguru [hill]. In a low hillside along the path, along which here and there rather small vertebral centra had weathered out, quarrying was driven forward from the side. After initially barely encouraging success the yield soon increased. Until the end of the first expedition in fall 1911 (excepting the rainy season) work here continued with continuously favorable harvest. 18 bones a day were not a rare occurrence. And even Dr. Reck was able, in 1912, to bag a large number of in part excellent bones in a very short time, until the complete exhaustion of the quarry. Overall, this ditch called "St" yielded over 900 finds, ignoring numerous separate parts (rib fragments, neural arches, etc.) With relatively very few exceptions they belong to the mentioned stegosaur.

On the basis of this usually splendidly preserved material dispersed bone finds from other excavation locations could now be recognized without difficulty. Thus there are listed stegosaur remains from 28 ditches in the quarry diary, which could obviously be only a preliminary guide and required later inspection during the work on the material. Really large amounts of material stems only from seven of these ditches, and of these the majority and the best again belonged to the middle Dinosaur Beds, thus to the upper Kimmeridgian. The total yield of stegosaur remains is estimated at 1200 specimens.

After preparation has now reached a stage at which an overview is nearly possible the number of individuals that died together as a herd at the excavation locality seems no longer as high as I estimated based on the impression at the locality before. For example, of important paired bones from there I have currently (June 1915) on hand completely prepared:

	right	left	
femur	12	15	sa. 27
tibia	12	9	" 21
fibula	8	3	" 11
humerus	16	6	" 22
ulna	9	7	" 16
radius	5	6	" 11
scapula	12	5	" 17
coracoid	3	4	" 7
ilia ¹⁾	24	27	" 51

Because rich unprepared parts of the yield will come along, and because the right and left elements do not all make pairs of matching size we may reckon with roughly 30 individuals that died together.

Adding finds from other pits this is a stately collection. For comparison I confront this with what was available to Gilmore according to his statement at the United States National Museum in Washington as the basis for his monographic Osteology of

¹⁾ Including such fragments that definitely cannot be united with others and thus certainly represent an individual

Stegosaurus, e.g. 10 femora, 6 tibiae, 7 scapulae, 5 coracoid, 8 humeri, etc.

Preservation is excellent in the majority [of specimens]. As is generally the case at Tendaguru [hill] deformations of the bones or other troublesome changes on shape barely occur. Given the plethora of material it is thus not difficult to gain certainty on all details of the easily preservable skeletal parts. Sadly, important ones still are missing, even if only in very small parts. For instance, of the entire herd in ditch St only one tiny tooth and the occiput of only two specimens were preserved, otherwise absolutely nothing of the skull, and from all the other locations only a third occiput is added! Equally conspicuous is the low number of elements of the foot skeleton delivered by ditch St (roughly a dozen pieces), and deplorable, but easier to understand, that the neural arches and ribs of the cervical vertebrae seem to be completely missing thus far. Regarding the pes and manus bones another locality in the upper Dinosaur Beds (ditch X) luckily helps out, where large amounts of such remains (ca. 100 pieces) rested at close quarters and were accompanied by strikingly few other skeletal remains. Elsewhere²⁾ JANENSCH has already drawn the plausible conclusion, based on these conditions of discovery, that the animals got stuck in mud, that the cadavers later drifted to a somewhat removed location and were embedded without the easily detaching parts such as feet and skulls. The lower jaw, for example, is such a compact structure, and numerous very delicate and much easier to destroy bone parts are often so well preserved that the lack of the former pieces cannot well be ascribed to the construction and low preservation potential.

Therefore it is sadly not possible to combine a really flawless skeleton. At least the basis for an assembly of one or also several skeletons is present. But the jumble in which the remains were found creates the difficult task to combine correctly without distorting the proportions. In this regard ditch St gives far fewer clues than some of the smaller localities. While there are, with one exception, also always more than one individual present, because of the changing body size segregation is more likely possible there. Trials on different examples have shown that the proportions can be determined and by combination can be united to a reliable general appearance. For example,

²⁾ Archiv für Biontologie, Bd. 111, H. I.

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three cases give the well-corresponding values for the ratio of femur to humerus length of 1.60 : 1; 1.65 : 1; 1.68 : 1. In *Stegosaurus ungulatus* and *stenops* this ratio, in contrast, is 2 : 1. For the ratio between femur and tibia I find: 1.37 : 1; 1.44 : 1; 1.48 : 1. In *Stegosaurus stenops* this fracture is 1.68 : 1, in *Stegosaurus ungulatus* 1.85 : 1 and so on. More details will have to come to light during the detailed study, which will be presented to the Archiv für Biontologie, hopefully not too far in the future. Here, it is only intended to indicate the systematic position of the African stegosaur finds very shortly and preliminarily.

Excluding the excessively unlikely additions to the circle of relations of the Stegosauria roughly 25 genera erected so far remain, which range from the formations of the Lias to the uppermost Cretaceous. They encompass roughly 50 species. At closer inspection this number can be pared down to roughly 14 genera with ca. 21 species³⁾, because especially American authors dealt all too generously with names for sadly completely uncertain or insufficient finds.

Deplorably the publications partly are of a kind that an assessment is practically impossible without knowledge of the original material. For the case on hand the conclusion is sufficient that aside from all other classifications of the stegosaur group two forms stand out to which the African representative is intimately connected: *Stegosaurus* itself and *Omosaurus*. The former is a practically exclusively American form, the latter as far as has become known only in the English Middle and Upper Jurassic and in case on the northern French coast. The differentiation of the two genera is not very easy, and while VON HUENE wanted to make each the representative of a separate family they have finally been declared to be synonymous by others, including the catalogue of the British Museum! Because the real types of both genera have been given the species epithet *armatus* and because the older of the two generic names, *Omosaurus*, itself was already preoccupied by a crocodilian, in this case a taxonomic entanglement results that certainly won't be easy to solve without contradiction. It seems to me, how-

³⁾ See my survey in Fossilium Catalogus, ed. FR. FRECH.

ever, that both genera for now need to be kept separate:

The lack of a trochanter quartus on the femur of *Stegosaurus*, its presence in *Omosaurus* is, even if it needs to be confirmed as a rule, not completely without exception and probably anyways not sufficient as the sole separating character (Cat. Brit. Mus.).

The more slender or plumper overall shape of the femur can be used all the less as various authors totally contradict each other in this respect. Differences in the tail vertebrae, mentioned once by MARSH, have never been described in detail. As long as they have not been proven to exist they can thus not serve for a differentiation.

In contrast the differences in the skin armature should well be sufficient for a generic separation, especially if it concerns characteristic elements such as the mighty paired plates on the back that gave *Stegosaurus* its name. In *Omosaurus* they seem not to have been present, at least not in identical size and number, as far as the finds known so far⁴⁾ allow judgment.

Whether small differences in the outline of the pubis are specific or generic characters cannot be answered conclusively without study of the material itself. The sole known humerus of *Omosaurus* has a deep pit on its back at the distal end, above the unusually deeply indented trochlea. For *Stegosaurus* this is never mentioned. I would therefore assume that it is missing. Deplorably, there is not a single figure available – not to speak of a description! – from which information on this could be gleaned. For now a peculiarity of *Omosaurus* must be seen in this regard.

Overall the skeletons of *Omosaurus* and *Stegosaurus* are so similar to each other, but not identical, that a large systematic separation of the two is impossible to justify. They are closest relatives. *Omosaurus* is slightly older than *Stegosaurus*. The former belongs to the upper Jurassic (Dogger to Kimmeridgian),

⁴⁾ Two of its species are based on a femur each, one only on two dermal spikes. Another has even been erected based on a plate that later was interpreted as the operculum of a ganoid [fish]! There thus only remain three species, two of which are based on remains from one individual each.

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the latter with one exception that seems unproven to me (*Stegopricus* from the English Oxfordian) from the Wealden (transitional unit from Jurassic to Cretaceous). To this is added the geographic distribution in England in one case, North America in the other.

It is now certainly remarkable that our African representative is also so close to both that I was unsure for a long time if there is a new genus at such widely separated localities, respectively, to which of the two [genera] our finds must be counted. Detailed study, however, allowed the recognition of some differences that in part allow, in part demand a separation. Here I list the following:

1. Directly notable is the not insignificantly smaller size. A standard measure obviously can't be given based on such rich material that encompasses all stages of age. For the especially suitable bones of the legs, shoulder and pelvis I here give the upper and lower limits of longitudinal growth (at first ignoring the skeleton "bb" that will be treated later) next to some corresponding measurements from *Omosaurus armatus*, *Stegosaurus armatus* (= *ungulatus*) and *Stegosaurus stenops* given by Owen Marsh and Gilmore or calculated from figures (in cm)⁵⁾:

	<i>Stegosaurus ungulatus</i>	<i>Stegosaurus stenops</i>	<i>Omosaurus</i>		Tendaguru finds
			<i>armatus</i>	<i>durobrivensis</i>	
femur	133	101-108	104	100	33.2-73
tibia	72	64.3-69.6			24-45
fibula		61			21 to ca. 39 ⁶⁾
humerus	55-60	50.6-57.2	89.8		18.5-37.4 (46.6)
ulna	55	54	68		16-42
radius		38.4	56		9.2-29.5
scapula	(49.5)	62-68.7			27-49.5
ilium	120	100	104	85.5	Ca. 33-79.6

For more detailed comparisons more extensive measurements are obviously necessary, especially on the American material, for the description of which such detail so far hasn't been

⁵⁾ I prefer this designation compared to that favored by the Americans in millimeters - not to mention the antediluvian English one in feet and inches -, because preservation and measuring method easily introduce small differences, which behind the comma play the role that befits them.

⁶⁾ exempting the coossified calcaneum

judged to be necessary. Only now, very recently, has GILMORE begun to at least fill this gap for *Stegosaurus stenops*. It is the enormous difference in size even so already visible. If other separating characters were missing, however, one would barely be able to grant it more than specific character.

2. Compared to the so much smaller body size it comes the more into consideration that our African form has not only the relatively, but even absolutely longest of all dermal spikes so far known from stegosaurs. GILMORE has just (1914) baptized a species described by him with the name *longispinus*, because of the longest American spike discovery. This spike measures 86 cm, according to him, but is apparently not complete and is estimated at 98.5 cm. In contrast at Tendaguru in ditch Kg (middle *Dinosaur* Beds) a spike of over 1 m length was found. This relation of dermal armour to body size would, in my eyes, only mark a new species.

3. More profound seem to me that aside from the absolute size there are differences in the proportions of the extremities compared to *Stegosaurus*. The ratio of femur to humerus, of femur to tibia was mentioned already and shows that the thigh of *Stegosaurus* is quite a lot longer than in our new form. In contrast the ratio apparently shifts even more in favor of the humerus in *Omosaurus*. OWEN does not give measurements for the femur, and I could therefore extract the length only from the figure, in the course of which small errors may easily have slipped in. Thus I gained for the ratio of femur to humerus:

<i>Stegosaurus</i>	Tendaguru form	<i>Omosaurus</i>
2 : 1	1.65 : 1	1.24 : 1

Our African stegosaur would be intermediate between its English and American relations in this regard, but would be different from both. It must be kept in mind, however, that we know the forelimb only of one single *Omosaurus* species, and for this from only a single individual!

4. Aside from this small individual differences in the shapes of certain skeletal elements occur, e.g., the humerus, pubis, radius, etc. Sadly, as soon as one hits the details of the skeletal anatomy, it is not possible to gain sufficient clarity on the rich American material. The English literature is much more thorough and dependable. Therefore, these issues need to be reserved for future study and

description. For a systematic application the differences in question singly are nearly

consistently too small, in sum they cannot remain unregarded.

5. Compared to *Stegosaurus* there is a rather significant contrast in the almost complete lack of those dermal plates,

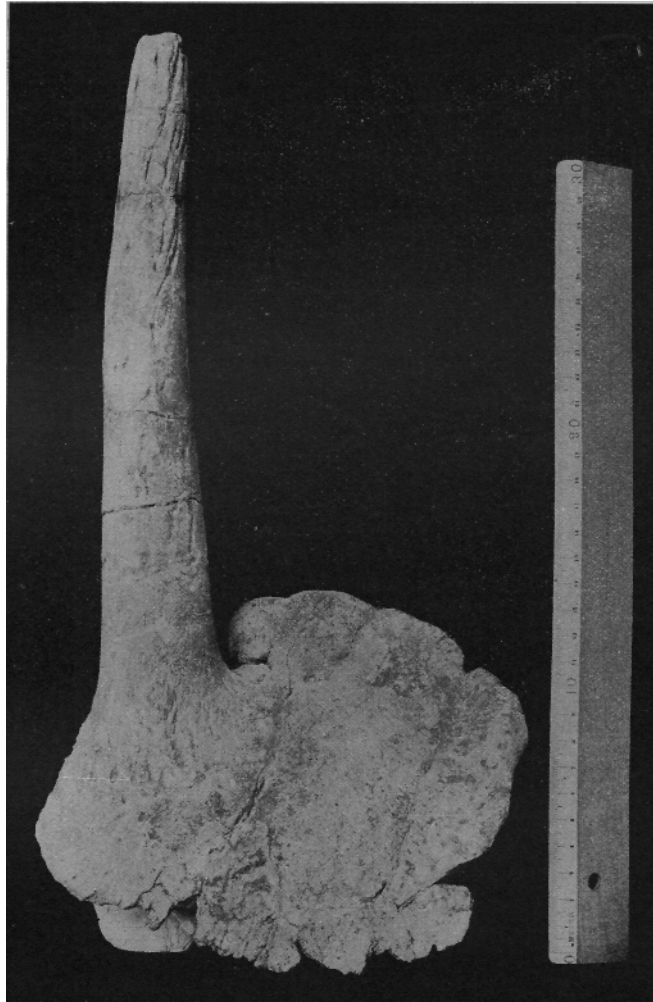


Fig. 1. Round spike with bony base (St 345).

that helped the American relative quite rightly to its name. In the great plethora of finds from Tendaguru [hill] I can find only two small, not even complete dermal

plates, in ditch St as the main locality none could be discovered. But this already indicates that we have to factor in losses during embedding.

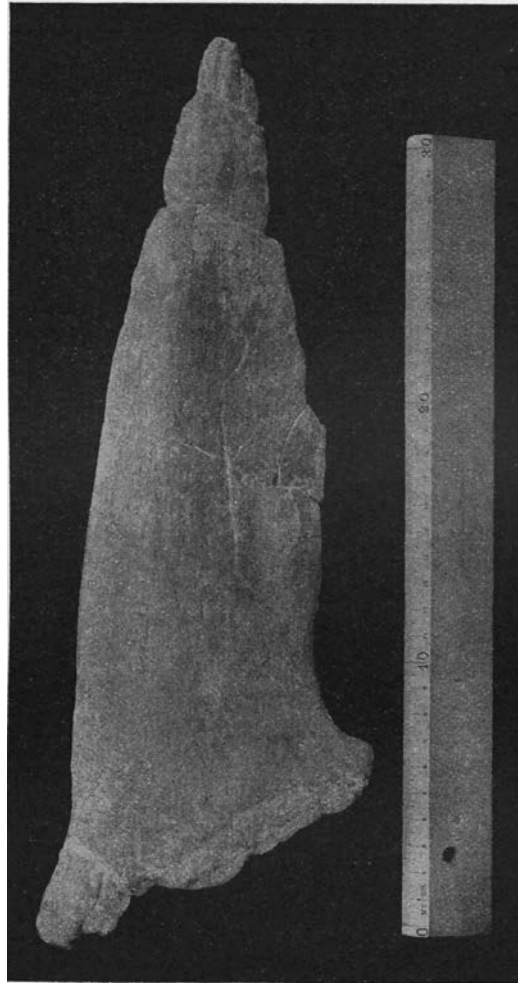


Fig. 2. Platelike, flattened spike (St 90).

On the other hand dermal spikes have been found in very large numbers, among them a kind that comes quite close to plate formation. It must be reckoned with a primary preponderance of them [the spikes], in abrupt contrast to the



**Two-edged spike
(St 575),
lateral view**

Fig. 3.

**Left femur (St 463),
anterior view.
right edge of the lower
articulation eroded**

known facts of *Stegosaurus*. It must, in my judgement, be assessed as a difference in genera. To *Omo-*



Fig. 4. Left humerus (St 106), posterior view.

saurus, in contrast, there is in exactly this regard a remarkable convergence. Some small plates have been found in England as well and been referred to *Omosaurus*. If this is correct is

unclear, because they were never found in recognizable connection with larger skeletal complexes. Overall the condition would



Fig. 5.
Right fibula (St 279). Left ulna (St 461), anterior view.

there be similar to that at Tendaguru [hill]. One could thus despite all be tempted to identify with *Omosaurus*.

6. One attribute of our African form, however, places it into contrast not only to the two closest relative, but to dinosaurs as a whole, yes even outside what

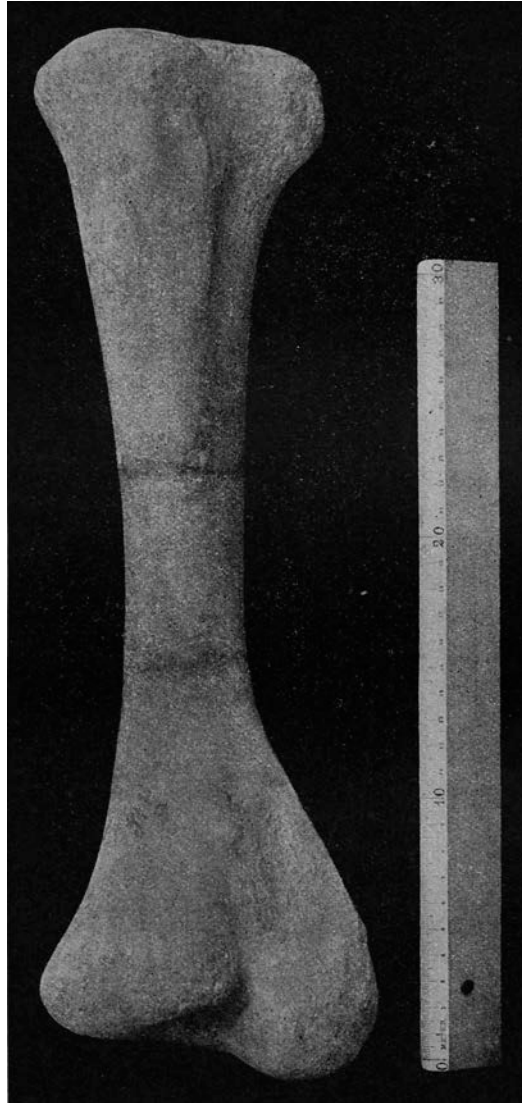


Fig. 6. Left tibia (St 152), anterior view.

is usual in reptiles. This is the arrangement of the neural spines of the caudal part of the vertebral column. Directly behind the sacrum, already within it, they stand quite as



Fig. 7.

Right radius (St 77).

Anterior caudal (St 856), right side.

e.g., in *Stegosaurus* sharply inclined backwards. Roughly around the tenth to twelfth the lower end begins to extend from the centrum in a more vertical direction, while the upper end still bends backwards, quasi forced. Then

the neural spine manages to place itself truly vertically, and now it slowly transitions into the inverse, forward inclined position. At the same time the prezygapophyses reach far over the



Fig. 8. Two dorsals (St 694/95), right side.

entire preceding vertebral centrum, and the base of the neural spine, which initially rested over the middle of the corresponding vertebral centrum, move forward up to its anterior articular

surface and beyond. The meaning of this remarkable aspect may remain undiscussed for now. It is however probably ruled out that something similar was ever observed in *Omosaurus* or *Stegosaurus*⁷⁾, as even GILMORE in his most deserving of thank monograph mentions nothing of it, to the contrary from his figures lets the normal state of the neural spines be recognized at least to the middle of the tail. Here we thus have a morphologically and physiologically fundamental difference, so that according to it any unification of the African finds with the genera *Stegosaurus* and *Omosaurus* can be excluded.

We have therefore to choose a new name for our form. The characteristic of the family (and the subtaxa) is the curious dermal armor, in the closer relationship [of the African stegosaur] especially the presence of mighty dermal spikes. This armament has been expressed in many names: the species epithet *armatus* occurs no less than three (four?) times. *longispinus*, *hastiger* and *horridus* also belong here. The generic names *Polacanthosaurus*, *Acanthopholis*, *Hoplosaurus* (besides *Anoplosaurus*), *Hoplitosaurus* and *Dacentrurus*⁸⁾ have been selected based on the same aspect. *Stegosaurus* fortunately expresses a main characteristic, the preponderance of plates versus the spikes (that this name should not be understood literally as referring to the family needs not be emphasized here). Thus I would like to choose the name to be newly created in this vein, too, in order to make evident the membership in this group. I therefore suggest the name *Kentrosaurus* (kentros = spike) and in the species epithet *aethiopicus*⁹⁾ express the peculiarity of the habitat in contrast to all previously found types (in the northern hemisphere only), because I cannot summarize the characteristic peculiarity of the tail in one word.

⁷⁾ As far as *Stegosaurus* is concerned a figure in MARSH (Am. J. Sci. Arts 1880, pl. VII, fig. 7) could be understood in exactly this sense. However, no trace of any hint of such an important characteristic is to be found in the only superficially short type of the accompanying texts of MARSH. To preserve the honor of him and later authors I need to assume that the drawing is clumsy (it is not noted and practically unrecognizable what is front and what is back).

⁸⁾ I do not fully understand the derivation. *Dicentrurus* would at most hint at the paired presence of tail spikes of *Omosaurus*, for which the name was suggested for nomenclatorial reasons.

⁹⁾ Purely Latin *africanus* has already been amply used for saurians from South and East Africa.

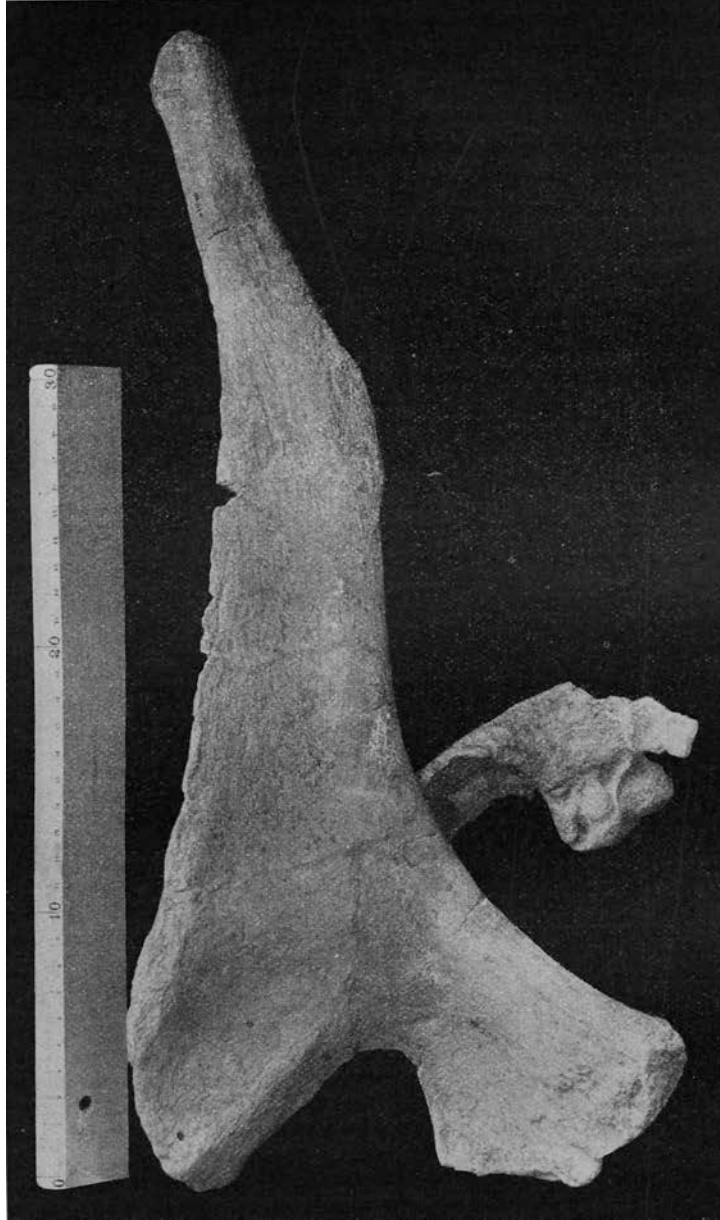


Fig. 9. Ischium (St 335).
Ignore the bone piece in the background.

Namely, of dermal armor pieces very many spikes are at hand. It is only natural that the formation of these dermal elements varies in different places of the body. It is therefore not acceptable to assume for individual pieces generic or

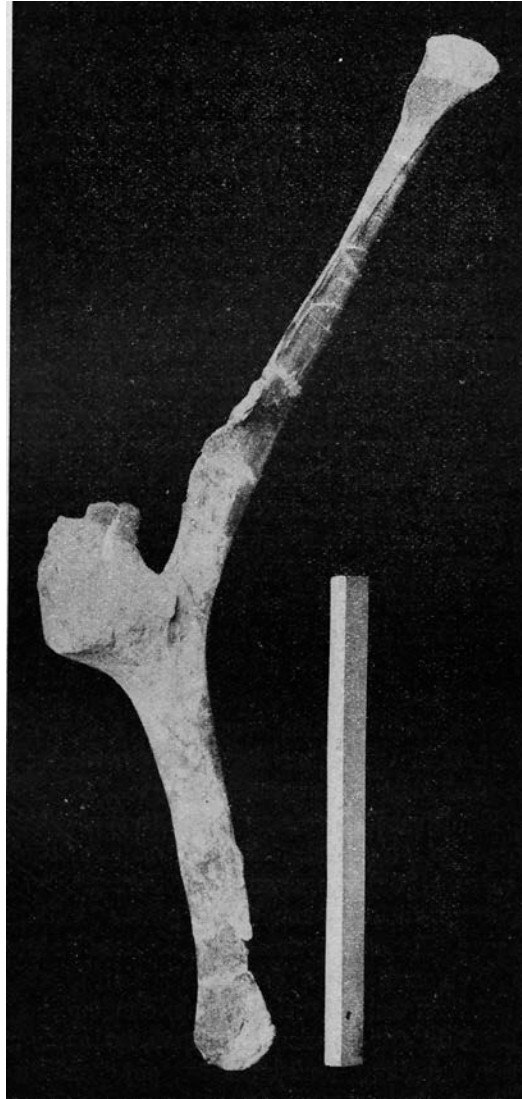


Fig. 10. Pubis (St. 758).

specific importance, as has been done previously. It will rather be important to determine the placement of these dermal ossifications and the approximate number on a single animal. Because of the lack of in situ finds both is difficult. But we are not totally without clues. Here, be it only mentioned that 13 spikes with a totally circular cross section occur, that in some two opposing ridges develop, that these ridges then can move further apart so that instead of a long slender spike flatter forms with a broad base develop, and thus is reached a very obvious convergence to real, triangular and narrow plates. In two cases there are shapes to which the name spike cannot be applied anymore. But they are of minor importance compared to the remaining plentitude and also have in their dimensions not the importance as in *Stegosaurus*. The focus of development rested in every aspect on the partly very long spikes. Not few of the spikes rise out of a broad, rounded bony base. Much as the skin plates develop out of the long spike by broadening, so can the bony base turn into a dermal scute resting flat on the body by reduction and total remission of the spike. Only one of these has been found, but it is very obvious in its relations. It rested at the end of an articulated tail vertebral column, overlying three or four of the vertebrae in obviously original or barely altered position.

It seems to me – so much may be said here – that the greatest development of the spikes is to be found in the pelvic region, that the tail carried several smaller pairs of spikes, as can be seen clearly from some finds, too, which posteriorly transitioned into a kind of sledge or laterally covering scutes, that in contrast toward the trunk these spikes transitioned more into a crest on the back-like, platy objects, and true small plates may have sat on the neck. Of smaller dermal ossifications, possibly located on the throat or the sides of the animal, no trace was found. Also, the number of specimens found is not so large that one would be driven to the assumption that the spikes themselves had had a greater distribution, e.g., in several rows on the back. Rather, the development of paired elements is here also,

along the line of the back, the characteristic of stegosaurs.

One may not – I don't wish to omit emphasizing this –, because of the highlighted systematically important characteristics of the new form from Tendaguru, forget the in my eyes much more interesting and symptomatic similarity of the English-European and the North American type. It is indeed surprising to see how far the similarity, yes despite the different size measures equality, of the forms reaches. I figure here a number of representative skeletal parts for a preliminary characterization, reserving further leading details for later. A comparison with the corresponding bones of *Omosaurus* and *Stegosaurus* depicted by earlier authors will excuse me of detailed comparisons at this place.

Here needs to be especially indicated already the – as mentioned sadly sole – tooth that so intimately associates with *Stegosaurus-Palaeoscincus* that based on it, as an organ that is certainly sensitive to adaptation, a specific difference can hardly be deducted; furthermore the mold of the brain and the extension of the neural canal in the sacrum, which caused such great surprise especially in *Stegosaurus*. Even if one does not want to assume that really the entire widening of the canal at this place was filled with nervous matter, the repetition of nearly all details in a geographically so separate form is perhaps the more wondrous.

Finally, the question may not be ignored if there isn't more than one species represented in the rich material. The question is the more obvious as two Dinosaur layers, separated by a typical marine layer (Smei-horizon) of ca. 20 m thickness, and belonging to the Kimmeridgian and the Wealden, have contributed to the haul. Of all previously known forms only certain tooth types like *Palaeoscincus* apparently persist through several horizons of the North American Upper Cretaceous, while the other forms are tied to certain, narrowly defined layers, although they thus far have been found largely only as spot samples. It should be emphasized already that no **morphological-systematical difference** between the stegosaur remains of the middle and upper Dinosaur Beds of the Tendaguru **could so far be found**. The same forms exist through both

horizons. Despite this, remains of one or more species could obviously be found next to one mainly preserved species. This, however, does not suggest itself, it may be emphasized. Arguably one could, as is often the case, be tempted to see the extremes of series of variability on limited material as funda-



Fig. 11 a. Occiput (St 460) from the left.

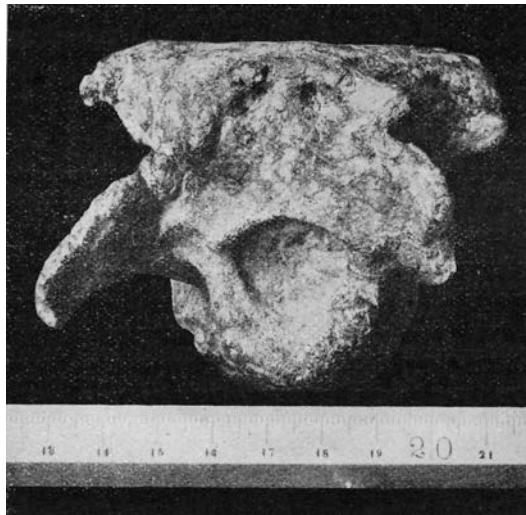


Fig. 11 b. Occiput (St 460) from back.

mentally different. I also tended initially to this view, as is evident from the recounting of my view in Janensch's overview of vertebrate remains of the Tendaguru¹¹⁾. The more preparation progresses, however, the more do apparent opposites merge by addition of intermediate links. Aside from that variability can't even be called large. However, a certain margin

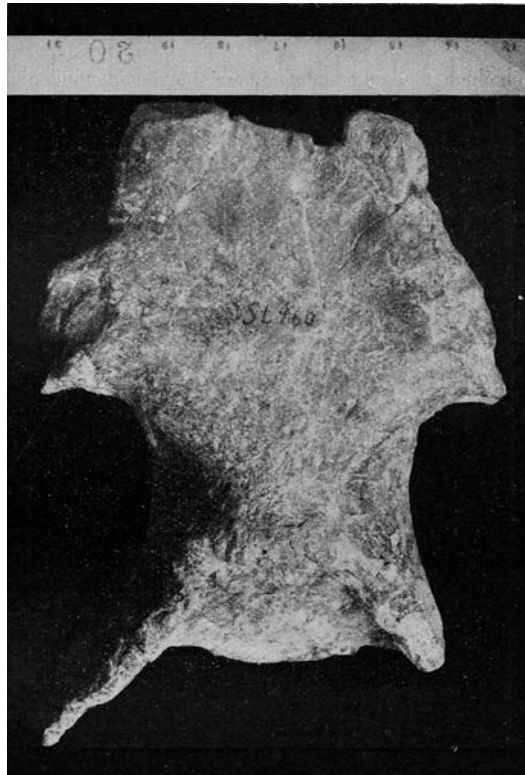


Fig. 11 c. Occiput (St 460) from top.

within the individual growth is given. As all stages of age are present a certain richness in forms exists. I will have to show later, however, if and in how far such discrepancies on earlier described, much

¹¹⁾ Archiv für Biontologie Bd. III, H. 1

more sparse material may possibly have led to false conclusion on the systematics.

Obviously, systematic judgments by their very nature are arbitrary. It would be possible to draw separating lines within the available plentitude with apparent justification, to create groupings to be given special names. By such a method we would, I believe,

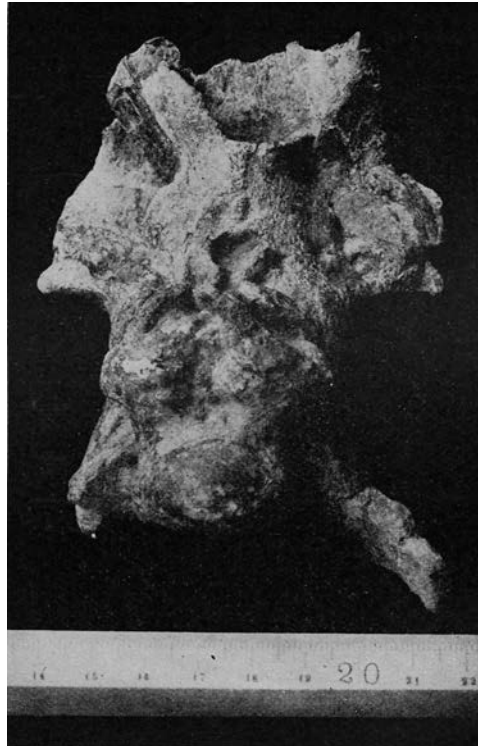


Fig. 11 d. Occiput (St 460) from below.

rob ourselves of the very special advantage that the overly rich collection offers: to study the changes throughout growth, which are otherwise hidden from us, and thus determine the direction of the development of this curious form.

It would , above all things, seem quite unnatural to me to split a herd, as was obviously present in pit St,

through artificial borders. This would, however, be the unavoidable consequence if we wanted to group purely morphologically. It is not really likely that in a biological community, in troops of reptiles grazing together, there will be several “true species”.

Two cases I do not wish to be seen as finally decided in this respect. The first deals with the only three skull pieces found. Two of them stem from ditch St, one

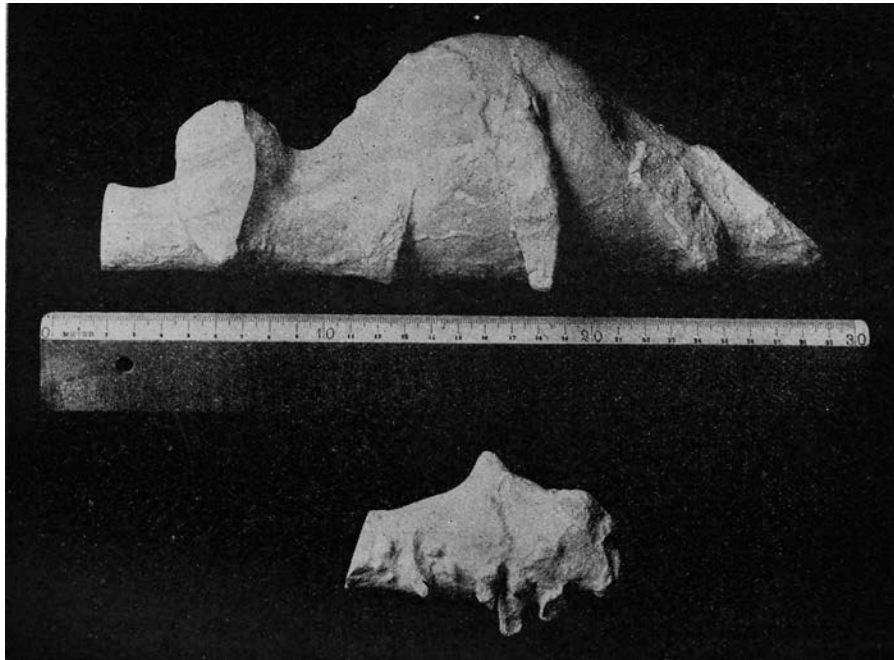


Fig. 12. Top: cast of the sacral neural canal (of St 508).
Below: cast of the brain cavity (of Ki 124).

from ditch Ki, also from the middle *Dinosaur* Bed. All three display the occiput and exquisitely show, in part from the inside, in part from the outside, the arrangement of nerves in the skull. The specimen numbered Ki 124 even gives the highly desired opportunity to create a cast of the brain cavity, allowing a comparison to *Stegosaurus* in this respect as well. It is the largest of the three specimens. One can also, in the proportions, recognize small

alterations, whereas the two specimens from St are fully congruent with each other, as far as a very small distortion of hasn't later falsified the state to a barely measurable degree. On the basis of the two schemes of the preserved skull part I would like to

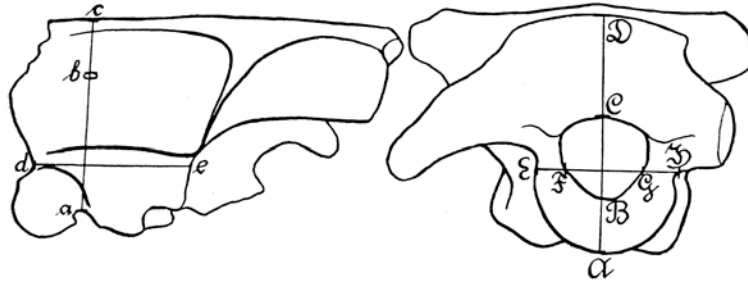


Fig. 13.

explain the state by contrasting some measurements of the finds numbered St 460 and Ki 124 (in cm):

		Ki 124	St 460	Nr.
lateral view	length a-b	5.-	4.1	1
	height c-d	8.1	5.6	2
	thickness of condylus occip. A-B	2.4	1.5	3
posterior view	height of foramen magnum B-D	2.7	2.-	4
	total height ¹²⁾ A-D	9.7	6.3	5
	width of foramen magnum E-F	2.7	2.2	6
	total width G-H	4.5	3.2	7
ratio of 1:2		1.62 : 1	1.33 : 1	
ratio of 5:7		2.16 : 1	1.97 : 1	

A certain discrepancy certainly exists. But I hesitate to account for this fact by raising a new species, until further separating characters emerge. So far I cannot find any of these. The difference is so small that probably the age difference, most certainly a sexual dimorphism is sufficient to explain it.

A further case presents itself in skeleton "bb". Already at the site this individual, found in the upper Dinosaur Beds and special among all Tendaguru stegosaurs in occurring in isolation, stood out because of its size. The measurements of the few skeletal parts found and collected are the following (in centimeters):

¹²⁾ measured in a position somewhat inclined parallel to the posterior surface

Skeleton bb		Next-largest stegosaur find of the Tendaguru area
right femur	78.5	} 73 (St 134)
left " "	ca. 74.- (different preservation)	
Ilium	78,-	} 49.5 (St 319) 25.5 x 21.2 (St 680)
Scapula	57.5	
Coracoid	30.5 x 23	

In light of the previously given enormous variation in size the step from the next-largest finds is not that significant. But it is larger than within the other remains. If one wanted to assume a very old individual, this would be supported by the circumstances of discovery: an individual found without associating with others. However, it must be taken into account that not even scapula and coracoid have coossified in this case, and that the ilium, otherwise apparently easily and firmly coossifying element, does not show any sign of it [coossification with the sacrum]. The possibility must thus be seen that it is a not unusual adult of a slightly larger species or subspecies. The stratigraphically high position close to the upper border of the upper Dinosaur Beds could well be brought into agreement with this.

Finally, the scapula (Fig. 14) shows not insignificant specialties in its shape. The upward-pointing blade is wider than in other cases. In its anterior margin is a projecting kink that can't be observed in others. The angle between it and the upper rim of the downward and forward extending blade base is acute. The latter characteristic is also always seen in *Stegosaurus*, as far figures show, and is an important distinction compared to other stegosaurs from the Tendaguru. In the this angle forms at most a right angle at higher age, in earlier stages it is greater than 90°. That is, new bone mass is added on the so-called upper rim during individual development. The state of skeleton bb here again is one in the direction of higher growth and cannot easily be decisive for a specific separation. If the same state in *Stegosaurus* really has become permanent this would well be in agreement with the larger body size. For the protracted, slightly bent upper rim of the upper blade and its thus caused greater width one could

refer to corresponding additions of the encompassing connective tissue. Here, however, is missing an analogue in *Stegosaurus*, whose

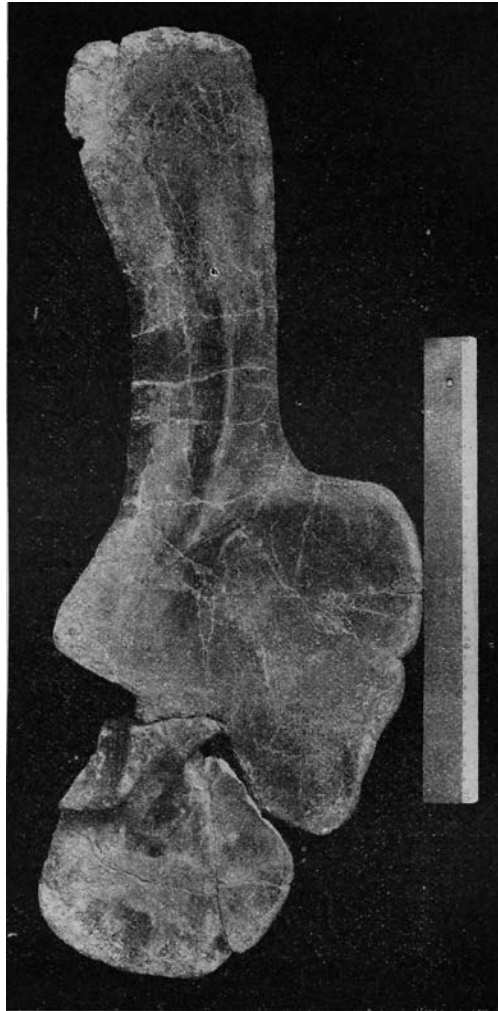


Fig. 14. Right scapula along with coracoid (St 687). *Kentrosaurus* sp.?

upper scapular end in contrast has the same shape as our other finds. In this, therefore, skeleton bb would be isolated.

A statement on all this is not really easy. The mentioned discrepancies to me do not seem sufficient

to characterize a new species clearly. The influence of growth conditions cannot be sufficiently recognized and separated from a specific difference, which is to be expected. Under these circumstances I refrain from giving a new name. For systematic clarification there still is time one more material is known, hurried classification in contrast has all too often caused confusion instead of clarification.