CORRESPONDENCE.

THE DEINOSAUR DEPOSITS AT TENDAGURU, TANGANYIKA TERRITORY.

SIR,—Dr. Kitchin's paper in the GEOLOGICAL MAGAZINE for May, 1929, on the vexed question of the age of the Deinosaurs at Tendaguru, sums up, I think, the whole of the palaeontological evidence at present published. The problem to be solved is the age of the *Smeei* beds, an affair for experts who have specialized in the Upper Jurassic and Lower Cretaceous faunas. As, however, I was in Tendaguru for about seven months in 1927 and for a few weeks in 1928 I may perhaps be allowed to add some comments from the point of view of the field-geologist. My contribution to the *Natural History Magazine* was intended to be nothing but a popular article. Later, I hope to publish such observations as I was able to make in more detail.

The almost horizontal attitude of the beds, the absence of contour maps and of any dominant bed such as a well-marked limestone or conglomerate, make it difficult to say which part of the series we may be in, e.g. whether any given bone deposit belongs to the Upper or Middle Saurian bed, supposing they are indeed distinct and separate. Also, although the strata are nearly horizontal, they are not quite, but are probably undulating with dips of one or two degrees, not easy to measure on the ground, especially in pits, where false-bedding is ever to be suspected. Failing the proximity of the *Smeei* fauna, or without definite evidence, it appears to me doubtfully wise unhesitatingly to accept the vertebrate fossils from certain pits as belonging to one of the Saurian horizons, as shown in the sketch-map, " Die Grabungsstellen am Tendaguru ", when by slightly shifting a geological boundary or by inserting a small dip the bones could be placed in the other, according to German authors, of considerably greater or less antiquity. There are minor difficulties as regards thickness. The occurrence of *Trigonia smeei* through more than 20 m. of consecutive sands and sandy clays appears evident in the Maimbwi Valley. In the stream section, the banks are high and covered with dense vegetation, the *Smeei* beds seem to pass downwards into some representative of the *Nerinaea* bed with no indication of an intercalated bone-bed, except for a small fragment embedded in the sandstones. In the Mtapaia-Kinjele sections, the thickness between two sandstones full of *T. smeei* and abundant corals was judged by eye (in the absence of a level) to be about 45 m.

One of these *Smeei* beds was slightly above the German locality " aa " or " Fundort 15a ", while close at hand were slabs of rock containing very many *Nerinaea* (and *Nerinella*, for field purposes

the writer did not distinguish). A little more than half a mile away, *Nerinaea* also occurs in quantity at a horizon a little lower than "Fundort 15a". In the midst of these marine beds was found the skeleton of a deinosaur. At Nguruwe, S.W. of the Hill, a very well-marked reptile bed is intercalated between two sandstones containing *T. smeei* and the usual associated corals, etc. Close to Nautope, the village is now non-existent, a mixed *Nerinaea* and *Smeei* fauna was noted, though poorly developed.

In the geological map by Dr. Hennig an east and west trending trough, the Niongala Schölle, cross-faulted on the east, embraces a portion of the Mbemkuru Valley and is shown as bringing the Middle Saurian beds on the South against the *Schwarzi* beds occupying the trough. As being in the midst of strata so very slightly disturbed, the proof of such a structure would need to be conclusive. Several days' work at Niongala gave, in the writer's opinion, no evidence for the southern fault; the northern part of the area was not examined. The characteristic deposit of the trough is alluvium, not shown on Hennig's map. Three "*Schwarzi*" localities were examined in this area; one, according to Dr. Spath, Aptian, probably falls within the faults as drawn; the others are some distance to the south. Nautope, in the middle of the trough, has been mentioned.

From this examination it appeared to the writer that erosion of the Upper Saurian and *Smeei* beds had probably taken place without faulting, and that subsidence had subsequently allowed for the deposition of the Schwarzi beds. Such a disconformity is in keeping with the vertical oscillatory movements of the East African coast. In the majority of cases the invertebrate fossils lie scattered or partly embedded along the slopes of hillsides or on undulating ground; otherwise, strewn along the dry stream beds. Exceptions are usual in the case of *T. smeei*, which now and again occurs in quantity embedded in rough sandstones, as in the Maimbwi and Tingutinguti Rivers. West of Niongala, *T. schwarzi* and other *Trigoniae* litter the ground, clearly not far from the original places of burial, but unfortunately in many instances (Matapua) the shells occur on a steep hill-side, lying near the surface, and many at least have travelled some distance from their original sites. Exact zoning is thus often rendered impossible. The writer formed the definite conclusion in the field that the *Schwarzi* beds are distinctly marked off from the lower faunas. The *Nerinaea* beds were examined in three localities W. of Tendaguru Hill and in the Kindope Valley, the *Smeei* beds at nine localities, the *Schwarzi* beds at three localities near Niongala and at five others widely scattered, but some of these were very unsatisfactory in results.

Collections from all these were sent to the Natural History Museum. In view of these facts, and in order to attempt some conclusions, the writer ran lines of levels from a datum point below the Hill to various invertebrate and vertebrate localities in the

immediate neighbourhood and placed these beds in a vertical section. Four localities showing the *Smeei* fauna were included. Failing extensive pit-digging for such purely structural purposes, the strata were assumed to be horizontal, an assumption to which objection has already been raised, but distances were small (the longest $1\frac{1}{4}$ miles) and minor oscillations tend to cancel one another, hence it is believed that the section shows conditions nearer the truth than the hard and fast classification of our predecessors depending on definite periods of marine and estuarine deposition.

Owing to fever and other matters this work finished earlier than had been hoped, and the Expedition temporarily terminated operations at the end of 1928.

The following are then tentative results:—

(1) That the *Nerinaea* bed is a lower and local phase only of the *Smeei* beds.

(2) That in ascending from the *Nerinaea* bed to the top of the Upper Saurian bed, estuarine conditions became increasingly prevalent until finally marine deposition ceased, or almost ceased, and that during the part of the sequence represented by the German *Smeei* bed fresh or brackish water conditions alternated with local episodes; in fact the two co-existed in adjacent neighbourhoods. That is, the two Saurian beds of our predecessors are one.

(3) That a disconformity occurs above the so-called Upper Saurian bed of an importance which palaeontologists must decide.

It is worthy to mention that, although constantly looked for, no ammonites were found in the *Smeei* beds, except doubtful and very large specimens N.N.W. of Matapua, the German localities 27 and 27a. Ammonites were, however, found by Mr. Cutler in a trench named "2x" cut in the middle of pits known as "M2", and without question in situ. Belemnites were also found by me at two or more horizons obviously buried with the very numerous deinosaur bones and the few pterosaurian bones, which made this locality one of the most interesting in Tendaguru.

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UFIPA HIGHLANDS,
TANGANYIKA TERRITORY.
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