student follow the zigzag and tortuous nomenclature of the Ammonites, as he views them to-day by the light of modern writers on this group? Or, to take a less perplexing branch, the British non-marine Mollusca (as recorded by B. B. Woodward, 1903). What becomes of our knowledge, derived from the past, if out of 167 names defined by Forbes and Hanley, only 51 remain intact? Such metamorphoses are too startling.

One pressing matter remains to be mentioned, that is, a GENERAL INDEX to the forty annual volumes of the GEOLOGICAL MAGAZINE.

The Index is prepared in MS. by Mrs. Woodward. The question is, *shall it be printed?* If, say, 300 of our readers are prepared to subscribe one guinea each for a copy, this work of reference might be published. It would unquestionably prove of the greatest value to all workers in geology and palæontology.

Every year Time strikes off some name from our list of old and valued friends, and each year gives us some new ones to add, but we crave *more* subscribers in order to be able to give more illustrations and so add new interest to our journal. In conclusion, we trust that the fifth decade may be brighter and more successful than the four already completed, for our readers and subscribers as well as for our kind-hearted and always encouraging and helpful friend the Publisher, and lastly for ourselves that we may be permitted to witness the Jubilæum of the GEOLOGICAL MAGAZINE.

H. W.

II.—FURTHER NOTES ON THE MAMMALS OF THE EOCENE OF EGYPT.

By C. W. ANDREWS, D.Sc., F.G.S., British Museum (Natural History).

PART II.

(PLATE VI.)

Arsinoitherium.

THE *skull* of one species (*A. Zitteli*) of this remarkable ungulate has already been figured by Mr. Beadnell, and also in this Magazine (December, 1903), where its general form is well shown. Details of the structure of the skull and skeleton will be given in the monograph, so that only a few of the more important characters need be referred to here.

The pedunculate occipital condyles are very large and prominent; the occipital surface slopes strongly forwards and is bordered by a massive lambdoidal ridge, which on either side (in old animals at least) rises into a prominent backwardly directed boss of bone, almost like a blunt horn. The parietal region of the cranial roof is flat and is at right angles to the side walls of the skull, being sharply marked off from them by well-defined ridges, which form the upper limits of the temporal fossæ. The suture between the parietals is obliterated in the youngest skull examined. The pair of small posterior horns over the orbits are borne exclusively by the frontals, while the great anterior pair seem to be formed entirely by the enormously developed nasals.

The squamosal takes a large share in the formation of the side

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wall of the cranium. It bears a large post-tympanic and also a large post-glenoid process, the two approaching one another, though not meeting, beneath the auditory meatus. The glenoid surface is very broad from side to side, but narrow and deeply concave from before backwards. The orbits are not marked off in any way from the temporal fossæ; there are large antorbital foramina. The pre-nasal buttress of bone, running from the pre-maxillæ to the nasals and helping to support the front of the great horns, seems to be formed mainly by the premaxillæ. The pterygoids form extremely large palatine plates, and the palate is very deeply concave from side to side, particularly in front.

In the *mandible* the ascending ramus is high, and the coronoid process rises considerably above the transversely elongated condyle.

The *teeth* (Plate VI, Figs. 1–3). The dental formula is i. $\frac{3}{3}$; c. $\frac{1}{1}$; pm. $\frac{4}{4}$; m. $\frac{3}{3}$. The tooth series is closed, and in the mandible at least the crowns all wear to a common level, and there is no clear line of distinction between the premolars, canines, and incisors; but, on the other hand, in both upper and lower jaws the difference between the premolars and molars is most striking. The molars are especially remarkable for the height of their crown, particularly on the outer side. Each molar (see Figs. 1 and 3) consists of two columns (*pc.* and *ac.*) flattened antero-posteriorly, and with the posterior face slightly concave from side to side. The enamel-covered portion of the outer side of these elements is very much higher than on the inner side. These main columns are united on the inner side of the tooth only, where also are developed the smaller accessory crests marked *x* and *y* in the figures. In wear (see m. 2 of Fig. 1) these accessory elements, together with the inner ends of the main columns, unite to form an inner wall, which, except just at first, is not covered with enamel (Fig. 1). The premolars present a totally different appearance. In them there is an outer wall covered with enamel and consisting of two, or more probably three, united elements. There are two inner cusps, the anterior of which soon becomes united with the ectoloph, as in very worn teeth the posterior one does also; anteriorly the element marked *x* in the molar is present. The peculiar arrangement of the roots in the cheek teeth and the probable homologies of their cusps will be described later. It seems probable that we have here an extreme modification with great hypselodonty of one of the types occurring among the earlier Amblypoda. The canines and two posterior incisors are simple columnar teeth with a cingulum on the inner side, wearing to a flat surface continuous with that of the cheek teeth. The anterior pair of incisors are not well known to me, but they appear to have been separated by a considerable interval in the middle line, and to have possessed curved and pointed crowns with a shelf-like development of the cingulum posteriorly.

The lower molars are at first bilophodont, each consisting of a pair of obliquely transverse crests, the anterior faces of which are slightly concave from side to side and not covered by enamel. The outer angle of the posterior crest is united by a ridge with the inner

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angle of the anterior one, from the outer angle of which another ridge runs forwards and inwards to the anterior face of the tooth. The pattern assumed in wear is shown in Fig. 2. These molars in some respects resemble those of some species of *Coryphodon* (e.g. *C. simus*[1]), but are more hypselodont.

The premolars are much more compressed laterally than the molars; they seem to consist essentially of a pair of crescents, but the details of their structure cannot be discussed here. The canines and incisors are simple columnar teeth wearing to a common level and forming a closed series both in the middle line and with the premolars. Altogether the dentition in this genus seems to be one of the most remarkable known, at least among the Ungulata. The teeth here specially referred to and figured are those of the type-specimen of *Arsinoitherium andrewsi*, Lankester.

The skeleton is almost completely known, but in the case of some of the bones there may be some danger of confusion with those of *Palæomastodon*.

The axis has a blunt peg-like odontoid process; its centrum and still more those of the cervical vertebræ behind it are very broad and short, so that the neck must have been nearly as short as in the elephants.

The scapula is much like that of *Dinoceras* as figured by Marsh in his monograph of the Dinocerata.

The humerus differs considerably both from that of *Elephas* and of *Dinoceras*. It is especially remarkable for the extreme antero-posterior compression of the lower part of its shaft and distal end, and for the presence of a very prominent deltoid process.

The radius and ulna are very short and stout, and do not differ widely in their main features from those of *Elephas*, while in some points, e.g. the distal articulation of the radius, they are unlike the corresponding parts of *Dinoceras*. The distal articulation of the ulna is still larger in proportion to that of the radius than in the elephants. In these latter, in some cases, the lunar has a surface for the trapezoid as well as for the magnum, there being apparently some displacement of the proximal row of carpals to the pre-axial side, instead of post-axially as usual. Whether this is so in *Arsinoitherium* or not in the case of the lunar is not known at present, but there is some evidence that the cuneiform extended pre-axially a short distance over the magnum. Weithofer ascribes the peculiar displacement in the elephants to the preponderating size of the ulnar articulation, and the same cause may have been efficient here.

The short stout metacarpals are somewhat displaced outwards; the third has a small contact with the unciform which entirely supports the fourth and fifth.

The femur is chiefly remarkable for the great antero-posterior compression of its shaft, the outer border of which is a thin sharp edge without any distinct projection representing the third trochanter. The distal articulation is much as in *Dinoceras*.

[1] See Osborn, "Evolution of the Amblypoda," pt. i: Bull. Amer. Mus. Nat. Hist., vol. x (1898), p. 192, fig. 16.

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The tibia is extremely similar to that of *Dinoceras*.

It is in the tarsus that the relationship with the Amblypoda is most apparent. The astragalus in general shape is much like that of an elephant, but closer examination shows that its distal articulation is divided by a well-marked ridge and angle into two surfaces, one, much the larger, for the navicular, the other for the cuboid. Internal to the navicular surface there is a small facet which seems to indicate the presence of a distinct *tibiale*. In all essential respects the astragalus is very nearly like that of *Coryphodon* or *Dinoceras*. The calcaneum is very short and stout; there is a large fibular facet, and the surface for the cuboid is small. A navicular attributed to this animal is very similar to that of *Coryphodon*. Detailed descriptions and figures of the foot-bones and other parts of the skeleton will be given in the monograph.

The dimensions of the figured specimens (Figs. 1 and 2) are:—

Length of upper molar series	23·5 cm.
Length of the three posterior upper premolars ...	11·5 ,,
Length of lower molar series	23 ,,
Length of lower premolar series	14 ,,

All that is at present known of the structure of *Arsinoitherium* leads me to believe that it is a highly specialised, probably terminal, member of a subdivision of the Amblypoda, probably most nearly related to the Coryphodontidæ, though belonging to a separate family, the Arsinoitheriidæ. I am also inclined to think that *Barytherium*, though widely different in many respects, may have somewhat similar relationships, and may belong to still another family of the same sub-order.

Geniohyus mirus, gen. et sp. nov.

During the season 1902–3 a large part of the right ramus of the mandible of a pig-like animal was collected by Mr. Beadnell. This specimen, which is the anterior part of the right ramus of the mandible together with the symphysis, presents some very remarkable characters. The symphysial region is narrow both from side to side and from above downwards and behind it, just where the rami begin to diverge; the ventral border of the jaw is produced downwards on either side into a long decurved and backwardly directed process of bone, quite unlike anything I am acquainted with in any other animal. The hinder border of the base of this process is connected with the outer edge of the ramus itself by a thin plate of bone. The ramus is incomplete ventrally, but was evidently very narrow from above downwards. The function of this remarkable paired ventral process is very doubtful, but possibly it may have served as a protection for the projecting portion of a long upper tusk like the similarly situated process on the mandible of the *Dinoceras*.

The molars and premolars are in an excellent state of preservation, the only part wanting being the greater portion of the talon of m. 3. The characters of the molars are those of a primitive member of the Suidæ in which the selenodont character of the outer cusps is very well marked. Each molar consists of two pairs of cusps,

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the outer one of each pair being distinctly selenodont. In the first molar the antero-external cusp is somewhat worn. It consists of the main tubercle, which is the apex of a V of which the arms are slight ridges, which rise at their ends into small tubercles; of these the anterior is situated on the anterior border of the tooth, while the posterior is connected by a slight ridge with the postero-external angle of the inner cusp. The postero-external cusp shows the selenodont character still more plainly: its small anterior accessory tubercle partly closes the main transverse valley; the posterior accessory tubercle is on the hinder border of the tooth. The internal cusps are trihedral in form, so that in wear they also show a tendency to a V-shaped surface, the opening of the V of the anterior cusp looking backwards and outwards, that of the posterior forwards and outwards. There is a slight development of the cingulum on the outer side of the tooth, most marked opposite the opening of the transverse valley and near the anterior end of the tooth. The next molar is similar, except that on the hinder border there is a minute additional tubercle lying internal to the posterior accessory tubercle of the posterior cusp. In the last molar the structure is similar as far as it is preserved, but the talon is almost entirely wanting.

The *premolars*. The anterior premolar is a compressed tooth consisting of small anterior and posterior tubercles and a high main cusp. In the next there is a small cingular ridge in front of the tooth, and the main cusp is much larger and shows a tendency towards division into an outer and an inner tubercle. In wear it gives a triangular surface, from the outer angle of which a ridge runs down the outer face of the tooth, while from its front angle there is a small ridge connecting it with the anterior cusp, and similarly posteriorly a small crest unites it with the posterior cusp. The next tooth is similar, except that the posterior lobe is larger and shows a tendency to give a V-shaped surface in wear. In pm. 4 the division of the main cusp is complete; the inner element is small and rounded, the outer larger and V-shaped in wear. From the anterior point of the V a ridge runs to the small anterior cusp, while from the posterior a low ridge unites it with the anterior limb of the V-shaped hinder lobe. To the inner side of this last there is a trace of an inner cusp corresponding in position to the postero-internal cusp of the molar. This remarkable mammal is clearly entitled to generic distinction, and it may be called *Geniohyus mirus* in allusion to the remarkable character of the process on its mandible.

The dimensions of the teeth in the type-specimen are:—

	Length.	Breadth.
pm. 1	12 mm.	7 mm.
pm. 2	12 ,,	9 ,,
pm. 3	13 ,,	10 ,,
pm. 4	13 ,,	11 ,,
m. 1	15 ,,	11 ,,
m. 2	17 ,,	13 ,,
m. 3	? ,,	15 ,,

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Geniohyus fajumensis, sp. nov.

Another specimen, consisting of a portion of the mandible containing the premolars in a perfect state of preservation, was also collected. This may be taken as indicating the existence of a second species of *Geniohyus*, since the teeth, though similar in general form, differ considerably in many details. The chief of these differences are that the main cusp is already distinctly divided in pm. 2, and the hind lobe in all the teeth is much larger and more distinctly selenodont.

The structure of the teeth is as follows:—Pm. 1 is strongly compressed with a very small anterior cusp and a high main cusp, from which three ridges diverge posteriorly, one running down the outer face of the tooth, a second back to the anterior arm of the V-shaped posterior cusp, the third inwards down the inner face of the tooth. The posterior lobe is distinctly selenodont.

In pm. 2 the anterior cusp is larger, and the ridge running inwards from the main cusp bears a small tubercle at its inner end. The posterior lobe is larger than in pm. 1. Pm. 3 has a larger anterior tubercle, and the cusp on the inner side of the main cusp is now nearly as large as that element and is clearly separated from it. The posterior V is still larger. Pm. 4 is similar, except that the small anterior cusp is doubled, the posterior lobe is still larger, and there are traces of a small postero-internal cusp.

The dimensions of the premolars are:—

	Length.	Breadth.
pm. 1	13 mm. ...	7 mm.
pm. 2	13 ,, ...	8 ,,
pm. 3	15 ,, ...	10 ,,
pm. 4	16 ,, ...	12 ,,

EXPLANATION OF PLATE VI.

Fig. 1.—Left upper molars and premolars of *Arsinoitherium andrewsi*, Lankester.

,, 2.—Left lower molars and premolars of the same.

The two specimens figured belong to one individual, which is the type of the species. About one-fourth nat. size.

,, 3.—Outer face of last upper molar of the left side of *Arsinoitherium zitteli*, Beadnell.

In Figs. 1, 2, and 3: *a.c.* anterior column of molar; *p.c.* posterior column of molar; *x*, anterior inner cusp; *y*, posterior inner cusp.

,, 4.—Upper and side views of part of the mandible of *Geniohyus mirus*, gen. et sp. nov. Type-specimen. About two-thirds nat. size.

sym. symphysis of mandible; *x*, backwardly directed process on lower border of mandible.

III.—Note on the species '*Am. plicatilis*' and '*Am. biplex*' of Sowerby.

By Rev. J. F. Blake, M.A., F.G.S.

THE old question of the proper interpretation of these names, which was raised by Professors Nikitin and Pavlov, after their visit to this country for the Geological Congress in 1888, to whom no reply was made, for their conclusions could scarcely be denied, has been raised again by Miss Healy in a communication

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