

13. *On the PLIOCENE of MARAGHA, PERSIA, and its RESEMBLANCE to that of PIKERMİ in GREECE; on FOSSIL ELEPHANT REMAINS of CAUCASIA and PERSIA; and on the RESULTS of a MONOGRAPH of the FOSSIL ELEPHANTS of GERMANY and ITALY.* By Dr. H. POHLIG. (Communicated by Dr. G. J. HINDE, F.G.S.) (Read January 27, 1886.)

I.

IN 1884 I had the opportunity of making a geological tour in Persia, especially in the northern provinces, one of my principal objects being to excavate a deposit of Pliocene mammals discovered about 30 years ago by the Russian travellers Göbel and Khanikoff near Maragha, to the east of the lake of Urumia. Abich, Brandt, and Grewingk* have already published short notes upon the subject, but the locality where these fossil bones were found has not been exactly specified.

Arrived at Maragha I found several deposits of fossil bones, and excavated them as long as the season permitted. The results obtained I first announced in two letters sent from Maragha to Prof. von Lasaulx † and to Dr. Tietze ‡, including a preliminary list of the Pliocene mammals of Maragha which had been obtained up to that time, and so far as I could determine them on the spot without means of comparison. The collections made by me in Persia are now mostly deposited in the Museum of Prof. von Fritsch at Halle.

In the course of last year a young German residing in Persia successfully continued my excavations at Maragha, and it was a portion of the bones collected by him that M. Gaudry saw in the Museum at Vienna (see Geol. Mag. December 1885, p. 558).

As I am now engaged in preparing a monograph on the fossil mammals of Maragha, I wish in this paper to give a sketch of the deposits containing these remains and also a supplement to the list already published.

The Maragha valley owes its origin to a wide fissure of dislocation traversing in an equatorial direction the chain of Cretaceous (and Jurassic?) mountains bordering the great lake of Urumia on the east. Through that fissure the waters coming from the north-east, from the volcanic mountains of Sahend covered with snow, in Pliocene times already flowed into the Urumia lake, which was much higher then than now. At this time the valley of which Maragha is the centre was an inlet of the lake, traversed by the rapid streams flowing from the Sahend. Hence the Pliocene deposits of Maragha are of fluvio-lacustrine origin, like those of Pikermi, near Athens, with which I was able to compare them directly on my return journey from Persia, and like those of the Val d'Arno, near Florence, which I had previously visited.

* Verhandl. k.k. geol. Reichsanst. 1881, p. 296.

† Verhandl. Naturh. Ver. d. preuss. Rheinl. 1884, Sitzungsber. p. 174.

‡ Verhandl. k.k. geol. Reichsanst. 1884, p. 282.

The constitution of the Maragha Pliocene is very similar to that of the Pikermi beds, consisting of pale reddish marls, which are very hard below, but loose at the surface, with singular forms of erosion; they are the detritus of the volcanic ashes and tuffs of the Sahend, and accumulations of pumice stones are frequently found in them, usually associated with the bone-beds. The marls also contain numerous more or less considerable strata of pebbles, the *débris* of the Sahend rocks, and these are sometimes of respectable dimensions, up to more than 1 metre in diameter. Nearest to the Sahend the pebble-beds prevail, and the boulders are still larger, the whole being closely connected with the vast chaos formed by the erratic blocks of the earliest Pleistocene deposits. The intimate relation between the Pliocene and Pleistocene in Persia corresponds well with the correlations of the two groups in Europe, as on the Norfolk coast and in many other localities. The general form of the Pliocene hills of Maragha produced by Pleistocene erosion is that of table-mountains, seldom conical. Several small reefs of Cretaceous rocks penetrate the equally horizontal beds of the reddish marls, forming elevated banks. The Pliocene hills environing the town rise to more than 100 metres above the level of the torrent Safi-chahi, which passes close to Maragha.

The fossil bones have been found in the reddish marls at more than six places, at greater or less distances from the city (up to 30 miles), and at different horizons, which, however, do not differ from each other by any characteristics of the mammalian fauna.

The list of the Maragha Pliocene mammals formerly given by me may now be completed as follows:—

1. *Hipparion gracile*. Several complete skulls, with the mandibles, and nearly all the bones of the skeleton. This is the commonest form in the Maragha Pliocene.

2. *Onager*? sp. A smaller species of Equidæ.

3. *Rhinoceros persiæ*, Pohlig. Species with incisors, but otherwise closely allied to *R. tichorhinus*; this is also very common at Maragha*, no fewer than four adult skulls, another with the milk-dentition &c., having been found.

[3 a. *Rh. Blanfordi*, Lyd., according to Lydekker.]

4. *Mastodon*, sp. Less common. A tusk of this genus had a maximum length of 2·35 metres.

5. *Sus*, sp.

6. *Gazella brevicornis*.

7. *Palæoreus*, sp.

8. *Tragoceros*, sp. Allied to the Pikermi species. Very common in the Pliocene of Maragha.

9. *Antilope*, sp. *major* (*Antidorcas*?).

10. *Bubatus*? sp.

11. *Cervus*? sp.

* The occurrence of remains of large herbivorous animals in the Maragha Pliocene proves the occurrence of an abundant vegetation at that period on the Persian highlands, now so barren where not artificially irrigated.

12. *Helladotherium*, sp. Probably the same as at Pikermi.
- [13. *Giraffa attica*
- [14. *Felis brevirostris* } according to Lydekker.]
15. *Hyæna*, cf. *eximia*.
16. *Canis*? sp.*

The list will doubtless be increased by material recently received.

As regards the remains of Pleistocene and cave-mammals (such as *Rhinoceros tichorhinus*, *Hyæna spelæa*, &c.) cited by Brandt and Grewingk as coming from Maragha according to the reports of Göbel and Khanikoff, no traces of them have been found either by myself or my successor. It is true that there are several caverns or grottos in the environs of the city, but they are labyrinths or chambers made artificially in the compact marls or in the volcanic tuffs of the Pliocene; it seems to me therefore that a Pleistocene fauna does not really occur in the Maragha valley, and that its supposed presence must be founded upon some confusion in the statements of Russian travellers.

II.

In the same journey I visited the Caucasian Museum at Tiflis and found in it several fossil remains of Elephants from both sides of the chain of the Caucasus. For the most part they are remains of the true Mammoth (*Elephas primigenius*, Blum.), so that it is evident that that cosmopolitan monster passed over the high Caucasus as well as, in Europe, the Alps and Pyrenees; this is interesting also with regard to the so-called *E. armeniacus* of Falconer, found at Erzeroum.

The Tiflis museum contains a last true molar of *E. primigenius* from the Sundsha river, north of the Caucasus; it is the broadest proboscidian molar hitherto found, having an extreme breadth of 0·13 to 0·14 metre. From Daghestan, in Transcaucasia, there is, among others, an *os innominatum* of *E. primigenius*, having a very typical foramen ovale of 0·195 × 0·1 metre; and a large calcaneum, of 0·27 × 0·19 metre was found at Alexandropol, at an altitude of 5000 feet. There are also some very heavy bones and fragments of molars from the Kuban river, north of the Caucasus; the molars have the characters of those of *E. meridionalis*, Nesti, containing three ridges in 0·05 metre of the length of the crown.

In the preceding section I have already recorded the fossil remains of Proboscidia found in the Maragha Pliocene. At Teheran I heard that Dr. Tholozan, physician to the Shah, possessed fossil Elephant remains found in Persia; unfortunately he was absent at the time, but he has since written to me that he has a fossil elephant's tooth (*E. primigenius*) from Radechane in Khorassan.

* The state of preservation of these bones is very similar to that of those from Pikermi; they are generally white, sometimes reddened by the marls containing them, and rendered very heavy by the presence in them of a considerable amount of vivianite.

III.

The collections of Pleistocene mammals in German and Italian museums being very rich and generally but little known, I resolved to examine them with the view of preparing a general memoir. For this purpose I worked in the museums of Munich, Jena, Halle, Dresden, Leipzig, Stuttgart, Karlsruhe, Mannheim, Darmstadt, Frankfort, Wiesbaden, Bonn, and Münster, in Germany; in those of Verona, Padua, Bologna, Florence, Rome, Pisa, Genoa, Milan, and Turin, in Italy; and I also studied in the museums of Lyons, Brussels, and Tiflis, and in several private collections. For the same purpose I visited the museums of London, Paris, Leyden, Berlin, Prague, Brunn, Vienna, and Odessa; and in the coming spring I intend visiting the collections in Spain and Portugal.

I have commenced with a monograph of the German and Italian fossil Elephants, the first part of which, embracing the dentition and craniology, is now completed, and the principal results of that work are as follows:—

1. *Elephas antiquus*, Falc., was the largest of all terrestrial mammals hitherto known. One of the most remarkable peculiarities of that species is the extreme divergence of its incisor alveoli, amounting to about 1 metre. In craniology, as in dentition, *E. antiquus* has several relations with *E. africanus*.

2. The pigmy insular fossil races of the Mediterranean (Malta &c.) cannot be considered specifically distinct from *E. antiquus*; we must rather regard them as several gradations of a diminutive race of that species produced by degeneration, and designate them *E. (antiquus) melitæ*, Falc.

3. *Elephas meridionalis*, Nesti, emend. Pohl., did not quite attain the dimensions of *E. antiquus**, and differs widely from the latter in dentition and craniology. The opinions published by Nesti and Falconer on this species, as also their figures, are incorrect in several points, and will be amended in my monograph. The skull of *E. meridionalis* presents several resemblances to that of *E. indicus*, and especially to that of *E. primigenius*.

4. The fossil remains from the Siwalik hills figured by Falconer and Cautley under the name of "*E. hysudricus*" can no longer be regarded as distinct from *E. meridionalis*, in accordance with the emendations of the latter species made in my monograph.

5. The knowledge of *Elephas primigenius*, Blum., has also been considerably augmented by the description and representation of a vast series not hitherto published. In dimensions the Mammoth was

* In the discussion on the present paper (see page 181) Messrs. Boyd Dawkins and Lydekker seem to have been uncertain as to the sense in which I understand the names *E. antiquus* and *E. meridionalis*; I understand them in the usual manner, as that of Nesti, Falconer, and L. Adams, but excepting about one tenth of the specimens of these authors, and, as regards *E. antiquus*, adding the enormous continental series hitherto unknown. The above statements are not mere *theses*, but facts, proved in my monograph by numerous admeasurements and numbers, attained by a study of nearly seven years, but which it is impossible to repeat here.

inferior to *E. meridionalis*, and still more to *E. antiquus*. The pigmy forms existing of *E. primigenius*, as well as of *E. antiquus*, have partially or entirely lost the characters of a distinct local race, having anew communicated with the primitive form over a wide territory. The Mammoth is most nearly allied to the existing Indian species, but nevertheless it is quite distinct specifically from the latter.

6. Under the name of *Elephas trogontherii*, Pohlig, I have described European molars which hold a middle place, both zoologically and geologically, between those of *E. primigenius* and *E. meridionalis*, most closely approaching those of *E. antiquus* in the ridge-formula, but differing more from them than from the other two in the form of the crown. The position of *E. trogontherii* with regard to *E. armeniacus*, Falc., and *E. namadicus*, Falc., still remains to be investigated. In craniology and dentition *E. meridionalis* and *E. primigenius* are directly allied by *E. trogontherii*.

7. The supposition of a "præantepenultimus" in the milk-molar series inferred by Falconer and Leith Adams, has no foundation.

8. I distribute the Elephants, in accordance with the forms of the tooth-crowns and the ridge-formulæ, into:—

ARCHIDISCODONTS (*E. planifrons*, *meridionalis*); LOXODONTS (*E. africanus*, ? *antiquus*); and POLYDISCODONTS; (*E. primigenius*, *indicus*, &c.); arranging the Stegodonts, like Clift, with *Mastodon*.

DISCUSSION.

Prof. W. BOYD DAWKINS referred to the difficulty of discussing species from names only without seeing the specimens. With regard to Mr. Lydekker's paper he said that the Maragha mammalia belonged to the same fauna as those of Pikermi, and that it was interesting to find them occurring so far to the east. He felt doubtful, however, whether they belonged to the Pliocene, which is always defined by the appearance of a few living species of the higher mammalia among the extinct species. There are no living mammals in Prof. Pohlig's list. He stated that he is at present engaged in the examination of a large collection formed by Mr. Calvert in the Troad, and this he found to contain Giraffes, Mastodons, and Hipparions identical with Pikermi forms. This discovery connected the find in Attica with that near the Caspian. The speaker agreed with Prof. Gaudry in regarding this deposit as Upper Miocene rather than Lower Pliocene. The occurrence at Maragha of Rhinoceroses with low crowns, like *R. Schleiermacheri*, which are Miocene in France and Spain, seemed to be conclusive upon this point, as that form is Lower Miocene. The absence of the genus *Elephas* was also of importance. Mr. Lydekker had mentioned the *Hypopotamus*. This animal is found only in the Lower Miocene deposits of Europe and America, and it has not as yet been found in association with any animals belonging to the same fauna as that of Pikermi.

Prof. Boyd Dawkins further remarked that in his paper Prof. Pohlig had pointed out distinctions between different species of Elephants. The speaker thought that the Pigmy Elephants of Malta, Corinth, &c. cannot be considered forms of *E. antiquus*. Nor could he agree with Prof. Pohlig's statement as to *E. meridionalis*. Especially he was not prepared to admit that *E. antiquus* was the largest of the Elephants, and he thought that any one who had seen the specimen of *E. meridionalis* from the south of France which had been set up by Prof. Gaudry in the Museum of the Jardin des Plantes, would agree with him. At the same time he admitted that further information was necessary before criticizing Prof. Pohlig's remarks.

Mr. LYDEKKER observed that he was glad to find that his own views as to the Maragha species accorded in the main with those of Dr. Pohlig, although he thought it probable that the form named *Rhinoceros persia* was really *R. Blanfordi*. With regard to the Elephants, it appeared to him almost as though Dr. Pohlig had reversed the application of the names *E. meridionalis* and *E. antiquus*. In connection with the proposed identification of the Euelephine *E. hysudicus* with one of the European species (*E. meridionalis*, Pohlig), he should observe that Leith Adams had proposed to identify *E. antiquus* with *E. namadicus*, and that the affinity of *E. hysudicus* appeared decidedly nearer to the latter than to the Val d'Arno Elephant. Neither was he prepared to accept the proposed identification of *E. melitensis* with one of the larger European species. The reversion to Clift's association of the stegodonts with *Mastodon* appeared to be a retrograde proposal. In reply to Prof. Boyd Dawkins, he pointed out that the age of the Pikermi beds has been determined by Pliocene molluscs being found in the lowest of them. He therefore classed both Pikermi and Maragha as Pliocene. The case of *Hyopotamus* was as follows:—It occurs in Beluchistan with *Rhinoceros Blanfordi*, in beds overlying others, the age of which has been shown by Prof. Duncan, from the examination of the Echinodermata and corals, to be Upper Miocene.