On a New Archetypal Fossil Elephant from Mt. Tomuro, Kaga.

BY

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With one Plate and three Text-figures.

Introductory.

Fossil remains of the Proboscidea from Japan are recorded by LEITH-ADAMS, NAUMANN, BRAUNS, LYDEKKER, MARTIN, SH. TOKUNAGA, D. SATÔ, T. KATÔ and by the present writer.

LEITH-ADAMS[1] was the first writer, who reported the fossil Proboscidea from Japan. His paper was accompanied with additional comments by BUSK, in which fossil Proboscidea from China are recorded also for the first time. LEITH-ADAMS has identified his material from Japan as *Elephas indicus*, while BUSK has identified his material from China as *E. armeniacus*, both doubtless erroneously.

NAUMANN[2] in his monograph has described four species from Japan, viz., *Stegodon cliftii*, *St. insignis*, *Elephas namadicus* and *E. primigenius*. As to the identification of the two species of *Stegodon*, the present writer cannot agree with him.

BRAUNS[3] has referred NAUMANN's first three species just mentioned to *St. sinensis*, *E. meridinionalis* and *E. antiquus* respectively. His statements appear to the present writer to be very erroneous in the specific identification of *E. meridionalis* and *E. antiquus*.

LYDEKKER,[4] accepting NAUMANN's statements thoroughly, has referred LEITH-ADAMS's *E. indicus*, as well as BUSK's *E. armeniacus*, to *E. namadicus*.

MARTIN[5] has recorded a specimen from Japan, which is evidently conspecific with NAUMANN's *E. namadicus*, without however any definite opinion as to its specific reference.

TOKUNAGA,[6] following BRAUNS, has referred his material from Tabata to *E. antiquus* and stated *E. namadicus* to be a synonym for it, notwithstanding the fact that the latter specific name antedates the former. The idea that *E. namadicus* and *E. antiquus* are conspecific is maintained by several authors, who emphasize merely the evolutionary stages and neglect the evolutionary phyla.

Recent discoveries have added two more species to the fossil Proboscidea from Japan. SATÔ[7] has

1) Has the Asiatic Elephant been found in a Fossil State ?; Quart. Journ. Geol. Soc., London, XXIV., 1868.
2) Ueber Japanische Elephanten der Vorzeit; Palaeontographica, XXVIII., 1882.
3) Ueber Japanische Diluviale Säugethiere; Zeitsch. Deut. Geol. Ges., XXXV., 1883.
4) Catalogue of Fossil Mammalia in the British Museum, Part IV., Proboscidea, 1886.
5) Fossile Säugetierreste von Java und Japan; Samml. Geol. Reichs-Mus. Leiden, Ser. I., Bd. IV., 1886.
6) The Tertiary Fossils of the Environs of Tokyo; Journ. Coll. Sci., Imp. Univ. Tokyo, XXI., Art. 2, 1906.
7) On the Fossil Proboscidea from Mino; Journ. Geogr., Tokyo, XXVI., 1914 (in Japanese).

reported *Tetrabelodon* sp. from Kaminogô, Mino, and KATÔ[1] *Mastodon* sp. from Kuji, Hitachi, without specific determination.

The present writer has referred NAUMANN's two species of *Stegodon* to *St. sinensis* and *St. orientalis* respectively in the first paper of this volume, and maintained the correctness of NAUMANN's statements as to *E. namadicus* in the third paper of the same.

In Japan, *St. orientalis* is recorded from Ikadachi-mura (formerly Riuge-mura), Ômi, and from the districts of Shôzu-shima, Sanuki; and *St. sinensis* also from the latter locality. From Ikadachi-mura, *Buffelus* sp.,[2] which resembles the present writer's *Buffelus* sp. *a* in the very rough surface of the enamel of the molars and which almost coincides with his *Buffelus* sp. *b* in the size of the upper molars, is also recorded; and from the districts of Shôzu-shima, *Elephas namadicus* and *Bison* sp., the latter of which is described by the present writer in another paper of this volume, are also known. It is almost certain, that the fauna of Shôzu-shima belongs to Lower Pleistocene, though it is possible, that the fauna of Ikadachi-mura belongs to Uppermost Pliocene. Thus, the present writer's opinion[3] that, *St. sinensis*, as well as *St. orientalis*, is geologically younger than *St. cliftii*, evidently holds true also in the Japanese specimens.

One evidence noticeable is that the Stegodont species are usually found in couples. For example, *St. cliftii* and *bombifrons* are found associated with each other from the Dhok Pathan to the Tatrot horizon, *St. ganesa* and *insignis* from the Boulder Conglomerate horizon and the Lower Pleistocene of Narbana, *St. orientalis* and *sinensis* from the Uppermost Pliocene to Lower Pleistocene of China and Japan, and *St. airawana* and *trigonocephalus* from the Lower Pleistocene of Java. One may imagine the possibility, that each couple of species represent sexual dimorphism of one and the same species.

SATÔ's *Tetrabelodon* appears to the present writer to be referred to *Trilophodon angustidens* or a species allied to it, and KATÔ's *Mastodon* to *Tetralophodon latidens* or a species allied to it.

Finally, the present writer has one more species to be added to the fossil Proboscidea from Japan, which he purposes to describe here.

Description of the New Species.

The specimen to be described here long left undescribed is preserved in the Geol. Inst., Tôkyô. It is labelled as having been obtained from Mt. Tomuro, Kaga, and presented to the institute by a gentleman, whose name is unfortunately unknown, owing to the partially worn away label. As the present writer's attention was much attracted by this specimen, it was submitted to him by Prof. YOKOYAMA, to whom his hearty thanks are due. After a close examination, the present writer found that, this specimen represents a species new to science, being just as *Elephas planifrons* FALCONER & CAUTLEY a transitional form from *Stegodon* to *Elephas*; so that, he proposes here to name it as follows.

Elephas auroræ, sp. nov.[4]

(Pl. XX., figs. 1–3)

The unique type specimen corresponds to an upper, probably penultimate, molar of the right side. It measures 180mm. in length, 75mm. in maximum width and 48mm. in the maximum height of the crown. The dimensions of particular ridges are as follows.

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1) On the Fossil Proboscidea from Mt. Hanare, Prefecture of Ibaraki; Journ. Geo. Soc. Tokyo, XXI., 1914 (in Japanese).

2) Bubalina Remains from the Province of Ômi; Mem. Coll. Engin., Kyoto Imp. Uni. I., No. 5, 1915.

3) This Vol., p. 10.

4) Preliminary reports of this species were published by the present writer in the Scientific Gazette, Tokyo, Vol. III., No. 5, 1915, pp. 308-315, and the Journ. Geol. Soc. Tokyo, Vol. XXIII., No. 275, 1916, p. 294 (both in Japanese).

	Transverse length	Width	Hight
Anterior talon	50mm. + *a*	32mm.	—
First ridge...	70mm.		8mm.
Second ridge	73 ,,	20 ,,	17 ,,
Third ridge	75 ,,	18 ,,	28 ,,
Fourth ridge	74 ,,	17–18 ,,	35 ,,
Fifth ridge	73 ,,	17–18 ,,	46 ,,
Sixth ridge	70 ,,	15–18 ,,	48 ,,
Seventh ridge	67 ,,	13–17 ,,	47 ,,
Eighth ridge	64 ,,	12–17 ,,	44 ,,
Ninth ridge	60 ,,	9–11 ,,	35 ,,
Tenth ridge	50 ,,	8 ,,	25 ,,
Posterior talon	36 ,,	6 ,,	14 ,,

The anterior talon and the first ridge are almost entirely worn out to the base, so that they have a common surface of dentine. The second and the third ridge are also strongly, and the fourth and the fifth slightly, worn, while those beyond are entirely fresh. The plane of wear is very strongly oblique to the base of the crown. The enamel-layer of the worn ridges is finely indented, with five or six indentations in 10mm. In the moderately worn ridges, the worn surface is more or less divided into four or five parts by three or four more conspicuous indentations of the enamel-layer of either side; one of the indentations lies in the median line and corresponds to the median groove. The fifth to ninth ridges consist of nine or ten mammillæ of unequal size; the summit of these ridges is decidedly convex transversely, instead of being nearly straight. The tenth, viz., the last, ridge consists of eight mammillæ of unequal size and is very low and like a talon, though the true posterior talon is observable just behind it, as a very irregular row of seven irregular, insignificant, nodule-like mammillæ. The last two ridges and the posterior talon are peculiarly wavy, with a backward curve at the median part. The anterior ridges are nearly parallel to each other, but the middle to posterior ones are convergent outwards, being distinctly wider inwards than outwards at the base. The ridges taper toward the summit in a lateral view, but are well parted from each other even at the base. The valleys, which are very narrow, are filled up with cement. The enamel-layer is very thin, measuring only 2–2.5mm. and 3–3.5mm. at the anterior and posterior sides and at the inner and outer sides of the ridges respectively. The surface of the enamel is very rough, with prominent vertical grooves and very fine, wavy transverse striations.

The roots are usually one to each ridge, save the eighth to tenth ridges, which correspond all together to a single common root. Each of the roots corresponding to the first to fifth ridges is more or less completely divided into inner and outer halves, which are irregularly subtriangular in horizontal sections. The outer half of the root of the fourth ridge, being the only nearly complete one, is about 77mm. high.

The enamel is yellowish brown in colour, with shades of gray; the dentine and the cement, as well as the fragment of the upper jaw to which this molar is attached, are all light gray. This specimen is strongly mineralised. The matrix is reddish brown, rather coarse sand-stone, which is cemented with limonite.

The present writer has never met with any other species of *Elephas*, which has such a *Stegodon*-like molar, except *E. planifrons*. The reasons, for which he has referred this new species to *Elephas* but not to *Stegodon*, are as follows.

(1) The ridge formula of this second upper molar corresponds to $\times 10 \times$, while that of the second upper molars of all the known species of *Stegodon* as a whole corresponds to $\times (6\text{–}9) \times$.

(2) The ridges of this molar are distinctly much narrower in a fore and aft direction and distinctly more close-set than those of the second molars of any known species of *Stegodon.*

(3) The ridges of this molar are well parted from each other, while those of the milk-molars and molars of *Stegoden* are sufficiently connected at their bases.

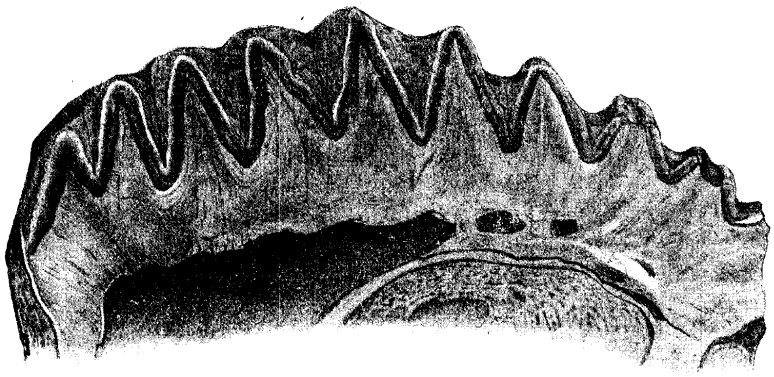


Fig. 1. Vertical and longitudinal section of M^3 of *stegodon insignis.* $\times \frac{1}{2}$.
[After FALCONER & CAUTLEY]

(4) The summit of the unworn ridges of this molar is perfectly rounded in both a front and a back view, while that of the milk-molars and molars of *Stegodon* is convex only in a lower degree.

(5) The unworn posterior ridges of this molar diminish backwards in height very rapidly, while those of the milk-molars and molars of *Stegodon* diminish only very gradually.

(6) The plane of wear of this molar is very strongly oblique, to the base of the crown, while that of the milk-molars and molars of *Stegodon* is only very slightly oblique, or rather nearly parallel, to the base of the crown.

(7) The enamel-layer of this molar is very thin, being distinctly much thinner than that of the molars of any known species of *Stegodon,* as well as even that of *E. planifrons* and *E. hysudricus.*

It is essentially a *Stegodon*-like feature, that the bases of the ridges of this molar are very prominent; but the present writer has observed that those of the molars of *E. planifrons* and *E. hysudricus* are also prominent in a more or less degree. Indeed, this new species appears to the present writer to be closely allied to *E. planifrons,* from which, however, it may be distinguished as follows.

(1) This second upper molar measures 180 mm. in length and 75 mm. in width, while the penultimate upper molars, described and figured by FALCONER & CAUTLEY (F. A. S.), of *E. planifrons* are 189–240 mm. long and 76–81 mm. wide, so that the former is smaller than the latter.

(2) The crown of this molar is distictly much lower than that of the penultimate molars of *E. planifrons.*

(3) The width at the base of the ridges of this molar is distinctly less than that of the penultimate molars of *E. planifrons.*

(4) The ridges of this molar consist of more numerous mammillæ than those of the molars of *E. planifrons.*

(5) The ridge formula of this molar corresponds to $\times 10 \times$, while that of the penultimate upper molars of *E. planifrons* corresponds to $\times (8\text{–}9) \times$.

(6) The enamel-layer of this molar is thinner and more finely plicated than that of the molars of *E. planifrons.*

The present species appears to the present writer to be more archetypal and more *Stegodon*-like than *E. planifrons* in the second distinctive characteristic, but just the opposite in the third, fifth and sixth distinctive characteristics. At any rate, the discovery of the present species is worthy be considered as an additional datum to prove the very intimate alliance of *Stegodon* and *Elephas*.

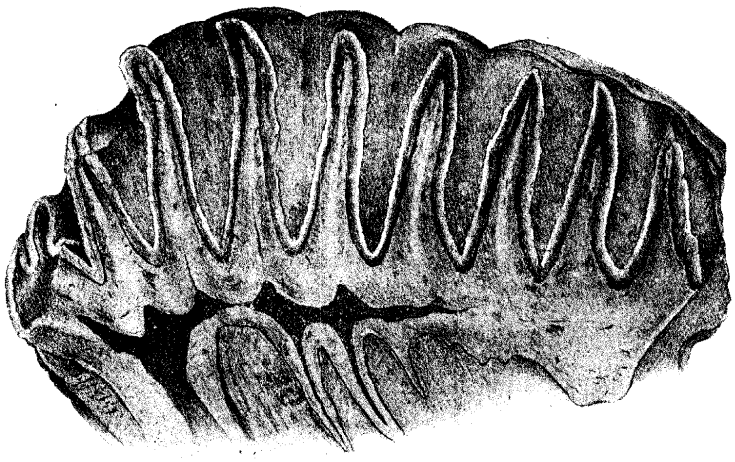


Fig. 2. Vertical and longitudinal section of M^2 of *Elephas planifrons*. $\times \frac{1}{2}$.
[After FALCONER & CAUTLEY]

Following PILGRIM,[1] *E. planifrons* is a characteristic of the Pinjor horizon, which is referred to Middle to Upper (but not Uppermost) Pliocene by the same author. Lately, two important discoveries were made by PAVLOW[2] and by SCHLESINGER[3] as to the occurrence of *E. planifrons*, or a species allied to it, in Europe. PAVLOW has considered it as belonging to Lower Pliocene and SCHLESINGER to Middle Pliocene or even an earlier age. By PILGRIM, SCHLESINGER's latest age limit, viz., Middle Pliocene, is assumed for the European horizon of the species in question. As the Japanese species, *E. auroræ*, is evidently a near ally of *E. planifrons*, it may not be very unreasonable to assume the geological age of the latter for that of the former. Then, the bed of Mt. Tomuro, which has yielded the present species, may probably belong to Middle Pliocene or a slightly higher horizon.

The eminent author of *Eoanthropus dawsoni*, SMITH WOODWARD, has included *Stegodon* sp. among the fossil Mammals found associated with these human remains. If his determination be at all reliable, it might be a very important discovery, since the Stegodonts have hitherto been known only from the Oriental Region of zoogeographers and its neighbourhood (SCOTT's record of *Stegodon* from North America is now believed to be erroneous). But, judging from his figures, the real referrence of his "*Stegodon* sp." appears to the present writer, as well as to FREUDENBERG,[4] to be otherwise than that stated by WOODWARD. WOODWARD's material consists of several fragments of molars, of which the ridges appear to be too high and too narrow and the valleys too deep and too narrow to be referred to the Stegodonts. WOODWARD has compared it with molars of *E. meridionalis* but not of *E. planifrons*. The present writer suspects that, if one compare WOODWARD's material with molars of *E. planifrons* and of the Stegodonts, one may

1) The Correlation of the Siwaliks with Mammal Horizons of Europe; Rec. Geol. Surv. India, XLIII., 1913.
2) Les Elephants de la Russie; Mem. Acad. Sci. St. Petersburg, 1910.
3) Studien über die Stammesgeschichte der Proboscidier; Jahrb. d. K. Geol. Reichs., Vienna, LXII., 1912.
4) Neu. Jahrb. f. Min. Geol. u. Pal., Bd. I., Heft 3, 1915:—FREUDENBERG, referating WOODWARD's papers on *Eoanthropus dawsoni*, has pointed out that, WOODWARD's "*Stegodon* sp." is not refered to genuine *Stegodon* but to *Elephas* cf. *planifrons*.

easily recognise its closer resemblance to the former rather than to the latter. Thus, the present writer, quite as well as FREUDENBERG, remembers here PAVLOW's and SCHLESINGER's records of *E.* cf. *planifrons* from Europe. As to WOODWARD, his *Mastoden* sp. and "*Stegodon* sp.", of which association with these human remains may perhaps be secondary, have very probably been due to earlier—Tertiary—strata; and the former species is probably to be referred to *M. arvernensis.* Now, the age of European *E.* cf. *planifrons* is included in that of *M. arvernensis*; so that it is highly possible, that these two species are found from one and the same deposit either primary or secondary.

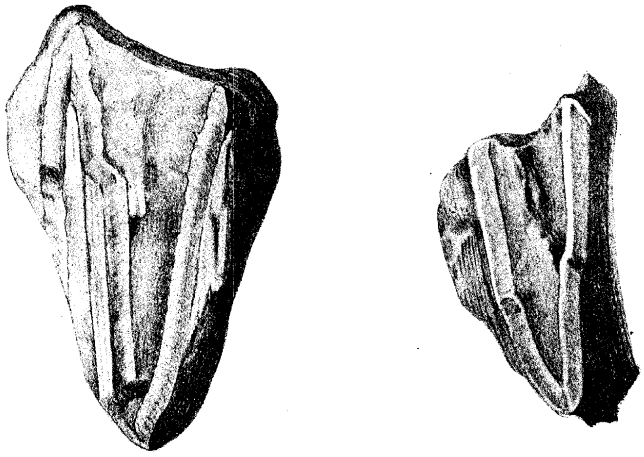


Fig. 3. Fragments of M of "*Stegodon* sp." SMITH WOODWARD = *Elephas* cf. *planifrons*. Natural size. [After SMITH WOODWARD]. Compare this figure with figs. 1 & 2.

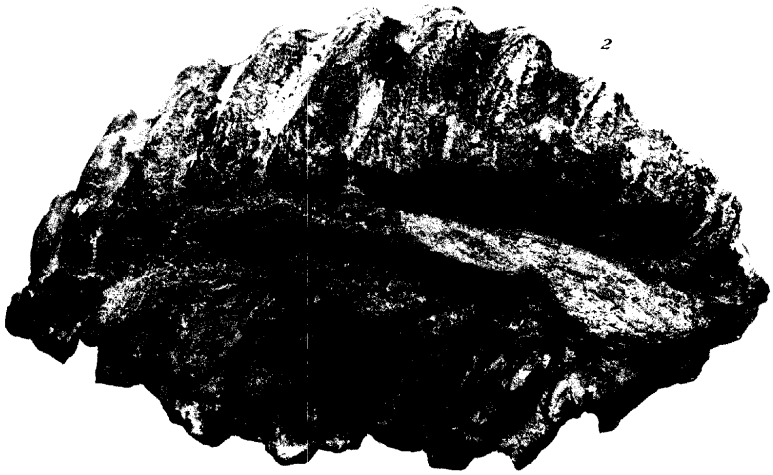
SŒRGEL[1] seems not to regognise the occurence of *E* cf. *planifrons* in Europe, emphatically referring SCHLESINGER's material to *E. meridionalis trogontherii.* Though the present writer does not like to enter into this very difficult theme, he is inclined to believe at least the fact that there might be present in Europe a species of *Elephas* with primitively structured molars next to those of the Stegodonts.

The extensive distribution of the elephants with primitively structured molars, say the *planifrons*-type, such as those of India, Japan, Russia, Austria and Britain, may throw light on the problem of the geological correlation of the Pliocene of these distant lands.

1) Pal. Zeitschr., Bd., II., Heft 1, 1915; Centralbl. f. Min. Geol. u. Pal., Jahrg. 1915, Heft 6.

Explanation of Plate XX.

Fig. 1. *Elephas auroræ.* Type specimen. Right M^2, viewed from outer side.
Fig. 2. Ditto, viewed from inner side.
Fig. 3. Ditto, viewed from below.
All figures, $\times \frac{2}{3}$.



Ōtaki photo.