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FOSSIL MAMMALS FROM THE PHILIPPINES

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(Abstract No. 16)

WITH SIX TEXT FIGURES AND SEVEN PLATES

The first mammals ever described in the Philippines were published by NAUMANN in 1887. There were two fragments of a fossil *Stegodon* obtained from local people in Mindanao. There are no reasons to doubt that these teeth have been found on the Island. In 1910 ADAMS mentioned a fossil tooth from the neighborhood of Manila. Shortly before the war my friend OTLEY BEYER entrusted to me the material which forms the principal subject of the present paper.

Also the material, though still very fragmentary, forms the basis of our knowledge of the fossil mammalian fauna of the Philippines. We hope that in the near future better and more complete finds will allow us to get a better picture of the various animals which once inhabited the Philippines. (Some notes on later finds have been added after the close of the Congress.)

I. FOSSIL MAMMALS FROM LUZON

(1) "*Antelope* sp."

1910 *Antelope* sp. ADAMS, PHIL. J. SC., p. 73, fig. 4.

The tooth of an antelope "cf. antelopes of the Siwalik pliocene of India" was "found at a depth of between 81 and 85 meters in drilling a well at Pasig".

The tooth in question is a worn upper molar, probably a first one. Judging from the figure this tooth might belong to a small bovid rather than to an antelope, but nothing definite can be said without the original specimen.

Fig. 1.—"*Antelope* sp." upper molar; Pasig. Nat. Size. Redrawn after ADAMS.

(2) cf. *Bubalus.*

1949 BEYER, PHIL. J. Sc., p. 231.

"In 1920 contractor Charles G. Wing found two fossil bovine teeth (carabao) in a deep excavation in San Juan." (Rizal Province.)

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(3) cf. *Cervus.*

1949 BEYER, PHIL. J. Sc., p. 231.

BEYER states: "while another fossil tooth found while boring an artesian well through the tufa in the same vicinity proved to be that of a prehistoric deer".

This find was made in 1920 by contractor Charles G. Wing in the vicinity of San Juan, Rizal Province.

Without examination of the original specimen no determination is possible.

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(4) *Rhinoceros philippinensis* nov. sp.

(See Plate I)

1949 BEYER, PHIL. J. Sc., p. 214.

From "Fossil bed, containing rhinoceros teeth and bones . . . and found by prospectors Alfonso Bagunu and Rodolfo Albano, in 1936, in the mountains just back of Laya, Cagayan (almost on the Cagayan-Isabela boundary line); and samples brought to their home in Cabagan, Isabela. (Later brought to Manila by Jose Datul.) This bed has not yet been properly explored."

The finders later orally stated to BEYER that the original find consisted of a large jawbone containing several teeth, but as they were unable to dislodge it they merely broke off some 14 large and small pieces with a geologist's hammer and took them home with them. Several of the best pieces are shown in Plate I; it is to be hoped that the site may be revisited in the near future.

Only two premolars are complete; fragments of the same molar from the right and the left side respectively indicate, that the find originally consisted of a more or less complete palate.

The first upper premolar (DM^1) has a nearly equilateral triangular outline. The tooth is rather hypsodont, with a faint parastyle fold, an incomplete medifossette and a well-developed postfossette.

In *Rh. sinensis* this tooth is rather elongated, with well-developed cingulum cusps (COLBERT & HOOIJER 1953, fig. 39). The same is the case with premolars of "*Rhinoceros* or *Dicerorhinus*" from Sumatra,

figured by HOOIJER (1946, pl. IV, figs. 10–13). Only *Rh. kendengindicus* (1946, pl. VI) and *Rh. sondaicus* (V. D. MAAREL 1932, fig. 13 and HOOIJER 1946, pl. VIII) show such shortened premolars, but in the first species the molars possess a well-defined medifossette, and in the last species a well-developed internal cingulum. Protocone and hypocone constricted; protocone fold apparently developed as in *Rh. sinensis* and *unicornis*.

MEASUREMENTS OF FIRST UPPER PREMOLARS (DM^1)

	L	W
Rhinoceros philippinensis	27	27
Rh. sinensis	25–34	20–28
Rh. unicornis	22–28	23–25
Rh. sondaicus	20–25	18–24 mm.

(After COLBERT & HOOIJER 1953.)

The most interesting specimen is a much worn premolar, which must be a right last premolar (P^4). The parastyle fold is well developed, but neither a paracone style nor a metacone style is recognizable. The postfossette is deep and nearly triangular in outline. There is a small oval medifossette, and some small enamel projections into the medisinus. In the valley is a small cusp developed from a weak cingulum.

The two much worn and much damaged molars are regarded as first molars. The border of the medisinus is smooth, there are no traces of a medifossette and only a remnant of the postfossette.

The occurrence of a medifossette in the premolar normally would indicate the development of the same structure in the molars, as in *Rh. kendengindicus* from Java and *Rh. platyrhinus* from India. This is not the case. About *Rh. sinensis* COLBERT & HOOIJER remark (p. 96): "While in many upper molars and premolars of *R. sinensis* there are several irregularly shaped, small enamel projections into the medisinus, there is never a well-defined crista that joins the crochet so as to enclose a medifossette. The latter condition is typical for *R. unicornis*, although in this species the crista may be rudimentary." The authors contradict themselves however on p. 97, where a specimen of *Rh. sinensis* is mentioned "in No. 18012 the two first molars show a junction of one of these small cristae with the crochet so that a medifossette will be formed upon wear." So, as a very great exception, a medifossette might occur in this species too.

"In *R. unicornis* there is often a crista which joins with the crochet so as to form a medifossette. This is only very exceptionally found in

R. sondaicus" (COLBERT & HOOIJER, p. 95). These conditions have been described by V. D. MAAREL (1932, fig. 14), who has found in *Rh. sondaicus* one case among 16 recent skulls of that species from the Leyden Collection. "It is remarkable that none of the other teeth in that cranium show any trace of a crista." The tooth in question is figured below.

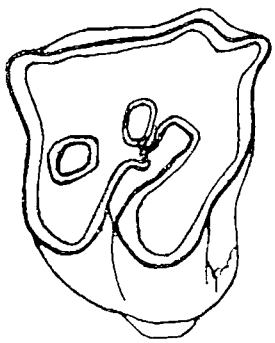

Fig. 2.—*Rhinoceros sondaicus*. Right upper third premolar, with abnormally developed medifossette. Museum Leyden (after V. D. MAAREL 1932).

In *Dicerorhinus sumatrensis* this tooth is much shorter (30–32 mm. after HOOIJER, 1946).

The dimensions of the tooth in question are:

MEASUREMENTS OF UPPER FOURTH PREMOLARS

	L	W	
		ANTERIOR	POSTERIOR
Rhinoceros philippinensis	40	45	43
Rh. sinensis	35–48	57–70	52–64
Rh. unicornis	37–39	60–69	56–60
Rh. sondaicus	35–42	51–62	77–59 mm.

(After COLBERT & HOOIJER, 1953.)

A glance not so much at the photographs but at the measurements—this might depend partly upon the way in which the measurements are taken—gives the impression, that the premolar of *philippinensis* is relatively narrow in comparison to its length. The difference between length and anterior width is 5 mm. only; for 10 specimens of *Rh. sinensis* we find, according to COLBERT & HOOIJER, values between 17 and 30 mm. Indeed it seems that the medisinus in the premolar as well as in the molars is much shorter than in any of the dentitions figured by

HOOIJER and COLBERT & HOOIJER respectively. So this might well turn out to be a characteristic feature of the Philippine species.

From several sites in Formosa HAYASAKA has described teeth of fossil Rhinoceroses, of which, due to the kindness of the author, I possess some original photographs. Although described by the author as "*Rhinoceros* sp. nov. (?)" the form in question most probably is identical (or closely related) to *Rh. sinensis* from the mainland of Asia. So what is said about the differences between *Rh. philippinensis* and *sinensis* is also true for a comparison with the specimen from Formosa.

Although our *Rhinoceros* from Luzon, due to the insufficient material, is not well defined, it is not identical with the species from China, Formosa or Indonesia. As with the Proboscidians from the Philippines, it most probably is an endemic species, of which the relations only will be known when more and better material is available.

(NOTE: After this paper was completed by von Koenigswald, the site was visited by two geologists in 1954 for a brief examination– but they found that the original fossil bed has been partially covered up by a recent landslide and will require considerable excavation before it can be again examined in a proper manner. However, they came to the conclusion that the site is likely early or middle Pleistocene, and they hope to re-examine it more thoroughly in 1956.–*H.O.B.*)

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(5) *Stegodon* cf. *trigonocephalus* MARTIN.

(See Plate II)

1935 *Stegodon* (cf. *trigonocephalus-ganesa*) VON KOENIGSWALD. PROC. KON. NED. AKAD., p. 877.

1949 *Stegodon* sp. BEYER, PHIL. J. SC., p. 233, pl. I, fig. 1.

About the *Stegodon* remains I have received the following notes from Prof. BEYER:

No. 1202: 1 brown-polished large piece of a stegodon tooth.

Found, together with a fossil deer-horn (No. 1201) and a large piece of fossil bone said to have been more than 50 cm. in length, in a small gravel-bed at the foot of Hill No. 1 at Site A–on the side toward the dam. The large bone was unfortunately broken up by the workmen, and had already been mixed in with the cement or concrete being used for the dam at the time that Mr. Boston first saw it. He was able to rescue the stegodon tooth and the piece of deer-horn, however, as they had already been picked out by the workmen on account of their peculiar appearance and shape. Brought by Boston to Beyer on April 6, 1926.

No. 63,350: 1 large piece of a fossil stegodon tooth, considerably decayed.

Found by my collector, Valeriano Laribo, on April 3rd, 1930, in a freshly plowed field on the McCrory Place (Site M), together with four whole tektites and a few probable pre-Neolithic stone-implements. The tooth was found near the boundary-line fence between the McCrory Place and the Hacienda Victorio; and Valeriano states that several similar small fragments lay about—as though one or two other teeth had been broken up and scattered by the plow—but that he did not gather them on account of their small size and broken appearance. (I sent this collector back to search more carefully in the same vicinity again—but he found no more pieces as the ground had been re-cultivated and planted in the interval. In another field, however, he did find the important specimens listed under the next number below.)

No. 63,351: 1 lot consisting of 2 large and 12 small fragments of fossil ivory from a stegodon tusk.

Found by my collectors, Valeriano Laribo and Apolinario de la Cruz, in a plowed field (in or near Site X) about half-way between our old Sites M and H, on July 21st, 1930. No stone implements, pottery, or other evidences of human occupation were found. (These specimens were all found near together in a single field—while the collectors were searching for teeth, or tooth-fragments, similar to No. 63,350, above.)

The situation of the sites is shown in Figure 3, according to a sketch kindly furnished by Prof. H. O. BEYER.

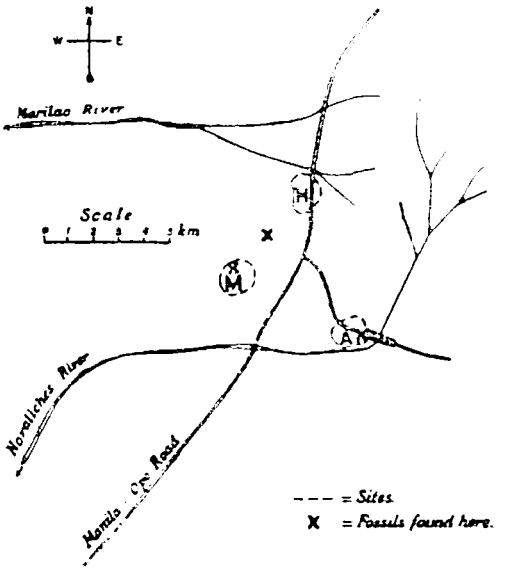

Fig. 3.—*Stegodon*-sites in the Novaliches-Marilao District, Luzon. (Road name should read "Manila-Ipo".)

Besides the *Stegodon* remains, the following additional finds have been made:

No. 1201: 1 piece of fossil deer-horn, found near stegodon tooth No. 1202 (q.v.).

No. 18,096: 1 boar's tusk; with artificial notches in base, showing it to have been used as an ornament.

Found by Beyer near the foot of Hill No. 2 at Site A, on October 8th, 1926. Undoubtedly came from an Iron-Age grave dating about the 5th or 6th centuries, A.D.

No. 1396: 1 piece of thick fossil bone (now broken into 3 large and 2 small fragments): identified by Dr. von Koenigswald as being from a large prehistoric turtle, of a land-tortoise variety not now found in the Philippines.

Found by Boston on April 7th, 1926, at a depth of 2 ft., in the dam-side slope of Hill No. 1 at Site A—about 50 ft. above the gravel-bed where specimens Nos. 1201 and 1202 were found. (The latter may have been in soil which caved off the same hill-side, as latter is very steep—in fact, almost vertical.)

Nos. 1397–1407: 4 large and 7 small pieces of fossil bone: identified by Dr. von Koenigswald as part of a large prehistoric land-tortoise not now found in the Philippines.

Found by Boston on April 8th, 1926, on dam-side slope of Hill No. 1 at Site A—a few meters to the right of No. 1396, above, and at about the same level and depth.*

The specimen 1202 most probably is the anterior part of a lower molar. The talon is compressed with only one large and a number of very small conelets; the first ridge shows seven and the second six conelets. The ridges are relatively broad, but as their basis is not preserved, the original height remains unknown. The cement is partly removed by erosion.

For the affinities of this poorly represented species the inner slope of the ridge-crest is important, of which BEYER (1949, fig. 1) has given a figure. This slope by vertical furrows is divided into three parts—"Dreipfeilerteilung der Joche" SOERGEL 1914, p. 23—which according to SOERGEL is typical for our Javanese *STEGODON* (vide SOERGEL 1914, pl. 1, fig. 5) and does not occur in the Indian species; it also seems absent in the Chinese form. This suggests a relationship between this Philippine and the Javanese species.

* Above extracts are from "Catalogue of the Rizal Prov. Arch. Survey," 1926-30.

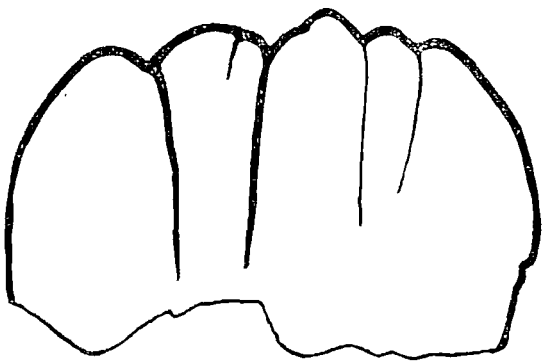

Fig. 4.—Inner view of ridge crest of *Stegodon* cf. *trigonocephalus* (specimen No. 1202). Actual size: redrawn from BEYER (1949).

The second fragment, No. 63.350, is part of a relatively high upper molar, probably a third one, with only one ridge and the talon completely preserved. It certainly belongs to an individual different from the tooth described above, and most probably to the same variable species. Cement is well developed.

The first fragment has a length of 42 mm., the breadth at the first ridge is 54, at the second 61 mm. The second fragment is 48 mm. long, with a greatest breadth of 64 mm. and a height at the second ridge of 46 mm.

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(6) *Stegodon luzonensis* n. sp.

(See Plates III and IV-a, b)

Shortly after the Pacific Science Congress Prof. H. O. BEYER kindly informed me, that part of a lower jaw of a *Stegodon* had been found in September 1954 near Fort McKinley. In a letter of March 30, 1955, Prof. BEYER gives the following details: "Last September, Mr. OTTO KAUFMANN (Asst. Superintendent of the big post-war Cemetery of the American Battle-Monuments Commission, at Ft. McKinley, Rizal Province) brought to me a remarkable fossil *stegodon* (?) tooth of medium large size, that had been uncovered and broken in bulldozing a new section of the Cemetery ground, for landscaping purposes. Upon cleaning off a part of the sand covering the surface of the tooth (I did not clean it completely, in order to avoid any possible damage to the surface markings and configuration), it has the exact size and general appearance shown in the three sketches that I am sending you here or under another cover, along with photographs. (The weight of the fossil must be between 2 and 3 kilos, and it would have to be very carefully packed if we were to attempt sending it to you.) You will find

a full description on the sketches, including the character of the deposit in which the fossil originally lay. On Sept. 12th, I visited the site accompanied by a geologist (Juan S. Teves) from the Bureau of Mines, and we were both of the opinion that the deposit is definitely Pleistocene, and consists of alternate layers of water-deposited tuffs and sand (see Sketch Figure 5, No. 3). Enclosed sketches, Figures Nos. 1 and 2, show the exact size of the fossil—which should be studied together with Photographs 1, 2, 3, and 4. The photos are not very good, but are the best that I can offer you at present. They look better when enlarged with a lens or reading glass.

Unfortunately more than half a meter of the surface had already been removed by the workmen, before I examined the site, and we could not find any further mammalian fossils or fragment—but did find a lot of pieces of petrified wood, leaves, and grass. Mr. KAUFMANN has been watching for further fossils, as the work progresses but so far has not reported anything except some shells and fossil plants."

According to Prof. BEYER the section at the site is as follows:

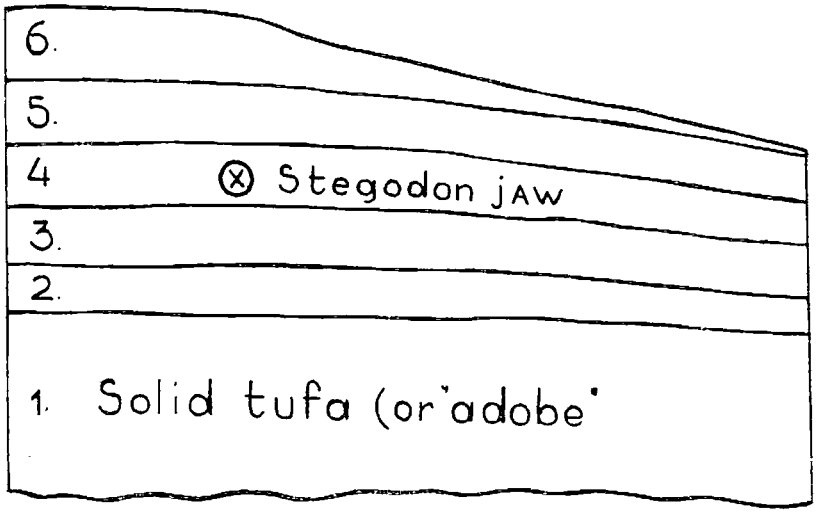

Fig. 5.—Cross-section of new Kaufmann Site at Ft. McKinley. (Drawn by H. O. Beyer.)

FORT MCKINLEY STEGODON SITE:

6. Surface mixture of loam, some gravel, and disintegrated tuff.
5. Water-deposited tuff (or *tufa*), showing stratified lines or layers. (Probably redeposited from erosion of solid tuff.)

4. Layer of grey or grey-black sand, containing many white streaks of fossilized leaves, grass, pieces of wood, etc. (Fossil stegodon tooth found completely embedded in this layer.)
3. Thick layer of water-deposited or redeposited tuff, with stratified layers showing an irregular mixture of a very fine black slate-like tuff with a coarser grey tuff (sometimes in partly altered or disintegrated lumps).
2. Lower layer of grey or grey-black sand, containing considerable fossilized vegetable matter. (This layer seems to vary considerably in thickness, from a few centimeters only up to 20 to 30 cm. or more, and directly overlays the solid tuff.)
1. Solid tuff or tuffaceous material, many meters in thickness (at least 4 to 5 meters, in the area where tooth was found); but borings down to 15 to 20 meters, in an adjoining area, indicate some stratification and sand layers further down.

[NOTE: The solid tuff becomes light grey upon exposure and drying; but the grey or black *sand*, in which the fossils occur, becomes yellow or orange-colored after drying and a few days exposure to the sun (probably through oxidation of contained iron).]

According to photographs and drawings at my disposal the find consists of the greater part of the right half of a mandible, containing a broken last lower molar. Cement is well developed, and the conules numerous. When complete, the tooth must have consisted of at least 13 ridge plates, with an anterior and posterior talon (x13x).

The tooth is of small size: the width is only 5 cm., while the total length can be estimated at about 20 cm. This, for a last molar of a *Stegodon,* is very small. In the Javanese species this tooth normally is about 30 cm. long, in *Stegodon sinensis* 36 cm.

The ridge formula is apparently the same as in the late Indian, Javanese and Chinese species; the age of that find can not be older than Middle Pleistocene.

It is of great interest, that besides a *Stegodon* of normal proportions a dwarfed species also occurs in Luzon. The same has already been stated for Mindanao, but for geographical reasons it seems preferable to keep the specimens of the two Islands apart.

A more detailed description of this find will be published later.

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(7) *Elephas beyeri* n. sp.

(See Plate V)

1935 *Elephas* sp. VON KOENIGSWALD, PROC. KON. NED. AKAD., p. 877.

1949 *Elephas* sp. BEYER, PHIL. J. SC., p. 211.

A fragmentary lower molar of small size represents what is known of the first fossil elephant found in Luzon. The specimen, which is now preserved in the collection of the Museum of Archaeology at 1668 Aviles Street, Manila, was possibly collected by the late Andrew Benitz (a Cuban prospector) who made an important mineral and fossil collection in northwestern Pangasinan in 1911. This specimen is plainly labelled as being from the Anda area of Cabarruyan Island; and it lay neglected in a drawer containing fossils and minerals from Pangasinan Province—in the old Bureau of Science—until rediscovered there by Professor Beyer in 1935.

Ten ridge plates are preserved; how many are missing is difficult to estimate, at the least one plate and a talon, so the minimum ridge-formula can be tentatively given as 11x. The length measured is 89 mm., the length of the complete molar is estimated at about 9.5 cm.

The tooth is very little worn, only the first five plates are slightly abraded. The fourth plate shows six, the fifth five conelets. There is no talon in front. Cement is well developed, especially in the anterior half of the tooth. The height is quite considerable, about 45 mm. at the fourth and 67 mm. at the eighth plate. The breadth, measured at the fifth plate, is 32 mm. The lamellar-frequency is 5-6 in 5 cm.

The height of the tooth is an indication that we are dealing with a form of the *Elephas namadicus*-group, which is often called *Palaeoloxodon*. As this species is not so well known, for comparison we are mainly referring to *Elephas antiquus* from Europe—called *Hesperoloxodon* by OSBORN—which has about the same ridge-formula as *namadicus*.

Our tooth is a molar of the left side. Because of its small size we first will compare it to the last deciduous molar ($d\overline{4}$). In *Elephas antiquus* this tooth not only has less plates (x8-10x), but the width is already considerably more, 43–60 mm. against 32 in our specimen. Besides this, for a deciduous molar our tooth is suspiciously high.

This first comparison already suggests that we are dealing with a *pigmy* elephant. The Probosidean-*Elephas* and, as we will see later, *Stegodon* as well—seem to develop quite easily pigmy races when isolated on islands. Pigmy elephants are known since a long time from various islands in the Mediterranean: Sicily, Malta, Cyprus, Delos, Creta and Sardinia. They are generally regarded as descendants of *Elephas antiquus*, and by VAUFREY regarded merely as races or subspecies of *antiquus*. From three islands off the coast of California—Santa Rosa, Santa Cruz and San Miguel—we know the small *Elephas exilis*, a dwarfed form of *Elephas imperator*.

For the pigmy elephant from Luzon I propose the name *Elephas beyeri* n. sp., in honor of my old friend Prof. H. O. BEYER, who kindly drew my attention to this interesting specimen and enabled me to undertake this study.

If the estimate of 11x ridge-plates is right—this is the minimum number of ridges—then we are most probably dealing with a first or second permanent molar.

We now compare our specimen mainly with the pigmy elephants of the Mediterranean:

NUMBER OF PLATES

	M 1	M 2	M 3
El. antiquus falconeri	x10x	x11x	x14
El. antiquus melitensis	10-11x	x13?	x13-14x
El. antiquus nmaidriensis	12x	x12x	x17?
El. antiquus (normal)	x10-12x	x10-13x	x15-20x
El. namadicus	x13x	?15	15-16

(x indicates the presence of a talon.)

If our molar is a first one ($M\overline{1}$), then the width of the tooth is smaller than in the first molar of *falconeri* (25–28 mm.), but would agree with the second molar (30–32 mm.). For *melitensis* the figures are 31–32 mm. and 34–46 mm. respectively, but both molars are longer than *beyeri*. So if we are dealing with a first molar, then *beyeri* would in size be intermediate between the two forms just mentioned.

LENGTH OF THE LOWER MOLARS

	M 1	M 2	M 3
El. antiquus falconeri	7.5	11.5	14.3 (?)
El. antiquus melitensis	10.85	14.6	15.25
El. antiquus nmaidriensis	17.6	21.1	<29.0
El. antiquus (normal)	16.45	23.5	37.0

(After VAUFREY)

According to OSBORN (1942, p. 1258) the estimated shoulder height would be:

Elephas antiquus falconeri	0.9 m.
Elephas melitensis	1.4 m.
Elephas nmaidriensis	1.9 m.
Elephas antiquus (of Upnor)	3.7 m.

So *Elephas beyeri* would probably have had a shoulder height of about 1.20 m. only.

Elephas beyeri must be regarded as a descendant of *Elephas namadicus*, which has a wide distribution in the Middle Pleistocene of India, Java, Borneo, Malaya, China, Japan and Formosa. About this period it must have reached the Philippines too and might have produced this pigmy species through insular isolation in the Late Middle or Upper Pleistocene.

II. FOSSILS FROM MINDANAO

(8) *Stegodon mindanensis* NAUMANN.

(See Plate VI)

1887 *Stegodon trigonocephalus* NAUMANN, ABH. U. BER. MUS. DRESDEN, p. 5, pl. 1, figs. 1 and 2.

1886 *Stegodon* non *trigonocephalus* MARTIN, SAMMLG. LEIDEN, p. 100.

1890 *Stegodon mindanensis* NAUMANN, Z. DEUTSCH. GEOL. GES. 42, p. 166.

1911 cf. *Elephas* JANENSCH, PROBOSCIDIERSCHADEL, p. 100.

1924 *Parastegodon mindanensis* MATSUMOTO, J. GEOL. SOC. TOKYO.

1942 *Stegodon* (*Archidiskodon?*) *mindanensis* OSBORN, PROBOSCIDEA, p. 833, fig. 706; p. 892, fig. 778.

1949 *Parastegodon* HOOIJER, ZOOL. MEDEDEEL., p. 222.

The tooth is a fragment of a lower molar, kept in the Ethnographical collections at Dresden, No. 2679. The specimen was collected by SEMPER in Northwest Mindanao. It was labeled by SEMPER as "Zahn des Kriegsgottes Tagbusau der Manobos, darf nur von Bagani getragen werden". (Bagani = Anführer, Priester, Fürst.) "Der Zahn war als Talisman verwendet (s. Semper, Skizzen v.d. Philippinen, p. 62) und ist mit bunten Schnüren umwickelt." (NAUMANN, p. 5.)

Attached to the tooth are some pieces of a grey limestone of grained to oolithical structure, containing some Radiolaria. Cement and enamel of the tooth are black coloured, on fractures greyish or greenish.

The tooth consists of 4 relatively high ridge-plates and the talon. The length of the fragment is 50.6 mm. greatest width 37.3 mm., height of the crown 33 mm. Cement is well developed. According to the figures the talon exhibits 9, the first ridge 7, the second ridge 7, the third ridge 8 and the fourth ridge 7 conelets.

This species is only known from a fragment, supposed by its discoverer to be the second deciduous molar of the right lower jaw. He first described it as belonging to the Javanese species, *Stegodon trigonocephalus*, and after some discussion with MARTIN, made it the type of a new species, *Stegodon mindanensis*.

As can be judged from the literature cited, the interpretation is not easy. In his Memoir on the Proboscideans, OSBORN gives the following statements:

OSBORN 1924: "It is very difficult to determine the characters of this type without examination of the original specimen. The type lower molar is far more progressive in the direction of *Archidiskodon* or *Elephas* than the types of either *Stegodon insignis* or *S. ganesa;* it is, in fact, a true-crested tooth in which the ridges are closely compressed and the valleys closed. Consequently this tooth should be compared with that of a primitive species of elephant or of *Archidiskodon*."

OSBORN 1942, p. 892: "If a true Stegodon, *Stegodon mindanensis* is even more progressive than *S. airawana,* because the valleys between the ridge-crests are entirely closed up; it compares somewhat more closely with *Stegodon aurorae,* also an imperfectly known species possibly referable to *Archidiskodon*."

Let us first regard the genus *Parastegodon,* the type of which is *Parastegodon aurorae* from Mt. Komuro, Kaga, Japan. According to OSBORN, 1942, p. 892, this form is "either a highly progressive *Stegodon* or a primitive *Archidiskodon,* a point to be determined positively by the discovery of a cranium". One of the reasons, which have influenced MATSUMOTO to create a new genus, seems to be the high ridge-formula, 10x for an upper second molar.

According to observations in Java the tooth belongs most probably to a true *Stegodon* of a late Pleistocene type. The tooth is hardly distinguishable from the large molars we have found in the Upper-Pleistocene of Ngandung and Watualang, and there is no reason to place these terminal forms into a separate genus. The Javanese teeth have also 10½ for the second and even x12x in the third upper molar, while the ridges are a little more elevated than in the Middle-Pleistocene forms. The third upper molar of *Stegodon orientalis* from the Pleistocene of China has the same number of ridges.

JANENSCH seems to have been the first who has compared the tooth in question with *Elephas,* influenced by the height of the crown. He too believes the tooth to be a deciduous molar.

First of all the tooth can never be the second deciduous tooth of a *Stegodon*. Not only is the crown too high, in *Stegodon* the outline of this particular molar is different, being relatively small at the an-

terior and broad at the posterior end. Our tooth is far more like a permanent *Stegodon* molar, having half the size of a normal specimen (Plate VI, No. 2).

A dwarfed specimen of *Stegodon* (cf.) *trigonocephalus* from Java has been described by SOERGEL (1914, p. 17, pl. 2, fig. 2) from Kedung Brubus. "Die Masse zeigen, dasz dieser Zahn einer Diminutivform angehört, wie sie unter den Stegodonten Javas, geschweige denn denen des Indischen Festlanded niemals nachgewiesen wurde."

Also among the author's collection from Sangiran there are such dwarfed specimens. Of the molars only an upper third molar is complete.

LENGTH OF THIRD MOLARS

	NORMAL	DWARFED
Stegodon trigonocephalus	28.7 / 30.0	—
Stegodon cf. *trigonocephalus*	—	17.0 / 22.0-23.0
Elephas antiquus	30.5 / 37.7	—
Elephas nmaidriensis	—	23.0 / ca.29.0

The measurements for *Elephas* after VAUFREY (1929, p. 138); *Elephas nmaidriensis* is regarded as a race or subspecies of antiquus.

As is evident from this list, the differences between the normal and the dwarfed *Stegodon* are about the same as in *Elephas antiquus*. That we are not merely dealing with variable third molars, can be concluded from a complete upper second deciduous molar from Sangiran, which is about half the size of a normal tooth. This molar is of the same proportions as the corresponding tooth of *Elephas falconeri*, the smallest "race" of *antiquus*, and would indicate a third lower molar of only 15.0 cm.!

The three specimens mentioned allow the following observations in comparison with normal molars:

(1) The number of ridges is the same as in a normal specimen;

(2) Length and breadth of the teeth are diminished, but not the height, so the ridges are more crowded;

(3) Strong development of cement, which seldom covers the crest of the ridges, except the talon;

(4) Tendency towards the development of a sinus (vide SOERGEL, Pl. 2, fig. 2a).

These observations lead to the conclusion, that the fragment from Sangiran described by the present author as cf. *Elephas* (von KOENIGSWALD, 1934, p. 192, pl. IV, figs. 8 & 9) belongs to a dwarfed *Stegodon*. There is more undescribed material from Sangiran—however, no complete molars. This specimen, by the way, is very close to *Stegodon mindanensis*, which, according to what is said above, must be regarded as a dwarfed *Stegodon*.

Another *Stegodon* of small size is a Proboscidean from Celebes, described recently by HOOIJER (1949: 1953) as *Archidiskodon celebensis*. There can be no doubt (according to material available) that a corresponding form also existed in Java. The specimen figured by HOOIJER 1949, pl. IX, fig. 5 from Desa Beru, Southern Celebes, possesses the typical simple ridgeplate of *Stegodon*. The conelets are hardly separated from each other; in *Elephas* resp. *Archidiskodon* they generally form three distinct groups, divided by deep fissures (vide OSBORN 1942, fig. 846; DIETRICH 1942, figs. 71–76). The tooth in question shows horizontal furrows, but lacks every indication of a vertical subdivision, which is characteristic for the elephants, but generally absent in *Stegodon*, except for some Javanese specimens (SOERGEL 1914; "Dreipfeilerteilung der Joche", p. 13, pl. I, fig. 5). The teeth from Celebes have a height-width index of around 100, which ridge-formula of x11x for $M\overline{3}$ and of x8x for $M\overline{2}$ (according to HOOIJER this last specimen might probably be an $M\overline{1}$, for which I see no reason) is also within the range of *Stegodon*. A slight sinus is indicated in the dwarfed *Stegodon* from Kedung Brubus. The last lower molar from Sompoh, Southern Celebes, has a total length of 164 mm.; as we have seen, the deciduous molar from Sangiran indicates a form which was probably even smaller! The material from Java will be fully described in a separate paper.

We have to distinguish in South East Asia three different regions with dwarfed Stegodons: Mindanao with *Stegodon mindanensis*, Celebes with *Stegodon celebensis*, and Java with *Stegodon* cf. *trigonocephalus*. Here the conditions are not so clear, as dwarfed forms seem to occur in two levels, viz., in the Djetis Beds and in the lower Trinil Beds. They indicate, as SOERGEL already has pointed out, an early isolation of Java. Neither the age of the Philippine and Celebes species nor their relationship is known; most probably an independent development took place in all those regions mentioned.

. . . . . .

(9) *Stegodon* cf. *mindanensis* NAUMANN.

(See Plate VI, figs. 3 & 4)

1887 *Stegodon* aff. *insignis* NAUMANN, ABH. U. BER. MUS. DRESDEN, p.b., pl. 1, figs. 3 & 4.

1912 *Stegodon* OSBORN, PROBOSCIDEA, p. 890, fig. 776.

A single ridge crest, collected by SEMPER in Mindanao, in the collection of the Ethnographical Museum at Dresden, No. 2678. By an error the specimen is mentioned in OSBORN as "A single crest from Java".

No measurements are given by the author; his figures are not exactly natural size ("Fast natürliche Grösze").

Already in his first description NAUMANN has referred this *Stegodon* tooth from Mindanao to a species different from the fragment first mentioned, and attached the new name of *Stegodon mindanensis* explicitly to the other tooth. His reasons to keep the two specimens apart were that in this specimen the ridge is relatively lower, the outer walls are less steep, there are less conelets (only 4; in the lower specimen 6 to 8), while the preservation is different: " . . . zeigt der Schmelz eine fleckig gelbe bis orangebraune Färbung. Das Cement ist hellbraun, ebenso das Dentin. Der Schmelz hat einen höheren Glanz als der des vorhergehend beschriebenen Milchzahnes . . .", indicating a different site: "Beide Zähne stammen sicher von verschiedenen Lagerstätten". It is for the same reasons that we keep this find separate here.

A single crest like this is difficult to determine: most probably it is part of a lower molar. In my collection I have a fragment of a lower molar of a dwarfed *Stegodon* from Java, also with 4 large conelets, but this tooth is relatively higher.

Most probably both molar fragments from Mindanao represent the same species.

III. REMARKS ON SUB-FOSSIL AND RECENT MAMMALS FROM THE PHILIPPINES

(10) *Elephas maximus* L.

1919 *Elephas maximus* (*indicus*) BEYER, PHIL. J. SC., p. 355.

About the proper name of this elephant there is some confusion: according to WEBER the name is *E. maximus*, while OSBORN is using the name *indicus*.

Prof. BEYER has kindly sent to me the photographs of an enormous molar of an elephant, "found in the deep excavations made when the S. J. Wilson and Trade and Commerce buildings were being built on Juan Luna Street", Manila. The tooth was found at a depth of about 10 feet.

The tooth, having a weight of "nearly 15 kilos", has, when we judge from the photograph, a length of about 42 cm.! It is a last lower molar

of the left side, consisting of 24 ridge-plates, including the two small ones in front and in back of the tooth.

According to OSBORN (1942, p. 1315) of the Indian elephant "the last true molar, $M\overline{3}$, never shows less than 20 ridge-plates, commonly about 22 ridge-plates, but sometimes in the lower jaw attaining as much as 27 ridge-plates". The number of ridges, their configuration, the large size and the freshness of the non-fossilized tooth clearly indicate the modern Indian species. A molar of similar size (40 cm.) has been figured by OSBORN, Fig. 1176.

Most probably the tooth in question was brought (before the 16th century) to Manila by Chinese, who often keep such teeth as charms in their houses. An upper molar of the same species was acquired by NAUMANN at Makassar in the Island of Celebes.

BEYER is also mentioning another fragmentary elephant tooth, excavated at the Luneta, Manila (photographed in the Bureau of Science), and the broken half of an elephant tusk, excavated at the Santa Ana Site. "Just how these three specimens came into the Manila area can now be only a matter for conjecture."

. . . . . .

(11) *Cervus* sp.

1910 *Cervus* sp. ADAMS, PHIL. J. SC., p. 97.

"Smith collected some fragments of a mammalian tooth near the Loboo Mountains at a considerable elevation, which, however, was not determined by measurements. He believed the tooth to belong to the Bovidae. An examination of the pieces which have been preserved showed that they correspond fairly well with the teeth of the Cervidae and do not differ much from those of the living Philippine deer. This tooth may have been buried in late subaërial deposited tuff and the presence of plant impressions, especially of blades of grass or rice in the same beds, is corroboratory evidence."

IV. THE PALAEOZOOLOGICAL POSITION OF THE PHILIPPINE ISLANDS

A comparison between the fauna from the Middle Pleistocene rock-fissures in Southern China and the present fauna of the Greater Sunda Islands reveals, that the original home of many of the most typical representatives of that assemblance was China, where we observe the orang-utan, the Gibbons, the Malayan bear and the tapir. Via landbridges, at the period between the Lower and the Middle Pleistocene, this fauna has moved southwards.

A reconstruction of the Pleistocene land connections can be found on Fig. 6 (after H. MOVIUS. The lower palaeolithic cultures of Southern and Eastern Asia. *Trans. Am. Phil. Soc.* 38. (1948), fig. 2). There are two possible routes, along which the fauna could have reached Java and the other great islands, (naturally at a time when the sea level was lowered): either via Indochina and Malaya to Sumatra, or directly via Formosa, Luzon, Palawan to Borneo. On the mainland the fossil orang is known from Southern China and the adjacent part of Indochina, but not from the regions further south; in Indonesia a fossil orang occurs in Java, while the species is still living on Sumatra and Borneo.

A glance at the map Fig. 6 will show that the Philippine Islands occupy a central position. The present day faunal relationship seems to be more marked with the Indonesian region– "no evidence to be gleaned from a study of the faunas shows definite relationship with Formosa and the islands to the north" (TAYLOR, p. 60)–but this might very well be due to a shift in fauna to the south by climatic changes during the Pleistocene, while a deterioration of the landbridges prevented a return of the southern elements.

The only real gap in the old land connection China-Formosa-Philippines-Borneo lies between Formosa and Luzon. The distance between these two Islands is not great, and the volcanic activity might very well be responsible as well for the formation as for the destruction of such a connection. The difficulties here are not greater than for the former land connections of the various Islands in the Mediterranean–also with dwarfed elephants–which are generally accepted. The fossil fauna of Formosa (HAYASAKA) contains virtually the same elements as that of the Philippines.

There are, in the modern fauna of the Philippines, two facts which might be taken as a sign of this proposed connection:

1) The Tamarau is, according to YOUNG related to *Bubalus mephistopheles* from China (TAYLOR, p. 510).

2) In Japan, Southern China, the Philippines, and Celebes a parasite is to be found, which causes a sickness called Bilharziosis (I am greatly indebted to Prof. SARDJITO from Djakarta for this information. A joint paper about this problem is in press). This parasite needs as a host certain fresh water shells (mainly *Lymnala*). Salt water would form a natural barrier to these snails, so that the curious distribution might be taken in favour of an old land connection.

The real proof, however, should come from the fossil fauna of the Philippines. The basis for a definite decision is still too small, as most fossil forms from the Philippines are not well defined and seem to con-

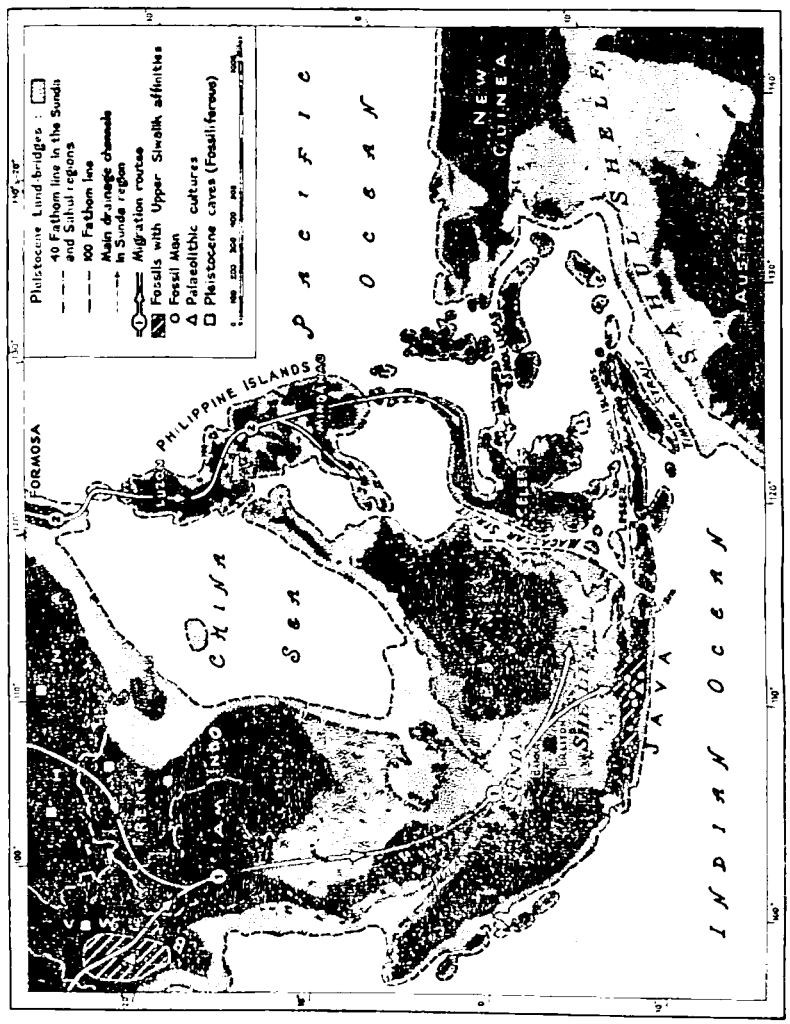
Pleistocene Land-bridges :
40 Fathom line in the Sunda and Sahul regions
100 Fathom line
Main drainage channels in Sunda region
Migration routes
Fossils with Upper Siwalik affinities
Fossil Man
Palaeolithic cultures
Pleistocene caves (Fossiliferous)
FORMOSA
PHILIPPINE ISLANDS
CHINA SEA
PACIFIC OCEAN
INDIAN OCEAN
JAVA
NEW GUINEA
AUSTRALIA
SUNDA SHELF
SAHUL SHELF

FIGURE 6

sist of endemic forms rather than the primary species, which intruded into our region.

All the specimens, mentioned or described in this paper, are isolated finds. Till now from one region only, the Island of Anda, Pangasinan, a small fauna is known. In December 1953, thanks to Prof. BEYER, President TAN and Prof. VALENZUELA, the National Research Council of the Philippines kindly made it possible for me to visit the site of *Elephas beyeri*. On Anda I greatly enjoyed the guidance of Mr. L. WILSON (from Baguio) and the hospitality of Mr. L. WIANT of Anda. As it had been first reported that the elephant's tooth had been found in a cave, we visited some caves, which, however, contained guano, but no bones.

Excursions on the Island made it clear, that it consists of Tertiary marls and limestones (Miocene or Pliocene), of which the limestones form prominent ridges. On the marls and between the limestone ridges there is a terrestrial formation with sand and gravels, and it is this formation which contains the mammalian remains. Besides this we found a number of tektites, deeply etched and grooved, of a type till now not known from the Philippines.

The best exposures we found around the town of Anda and especially along the coast, facing the mainland. The fauna collected consists of:

Stegodon sp.
Elephas sp.
Cervus sp. I
Cervus sp. II
Bubalus sp.

Of *Stegodon*—a middle sized species—many ridge fragments were collected, but no complete teeth. A fragment, still in the possession of one of the inhabitants of Anda, comes from Zaragossa, which is proof, that the same fauna also exists on the mainland. Of *Elephas* fragments of incomplete molars have been found (the best fragment, discovered later by Mr. WILSON, consists of 7 ridge plates, see Plate VII). The Cervidae are indicated by broken antlers; the *Bubalus* (one upper molar) might be related to the Tamarau.

The fauna will be described later. The combination of tektites with *Elephas, Stegodon*—as in Java—is an indication for an (Upper) Middle Pleistocene age.

Our knowledge of the fossil mammals from the Philippine Islands is still insufficient, but it is more than we might have expected and sufficient to have great expectations for the future.

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ILLUSTRATIONS

PLATE I

Rhinoceros philippinensis n. sp.

Fig. 1.—Left upper first premolar (d/DP 1).
Fig. 2.—Right upper fourth premolar (P/4).
Fig. 3.—Fragment of upper right first molar.
Fig. 4.—Fragment of upper left first molar.
(Actual size.)

PLATE II

Stegodon cf. *trigonocephalus* MARTIN.

Figs. 1 & 2.—Fragment of upper molar.
Figs. 3 & 4.—Fragment of lower molar.
(Actual size.)

PLATE III

Stegodon luzonensis n. sp.

Side view and part of jawbone; from the Kaufmann site at Ft. McKinley, Rizal Province. (Photo by Charles Miller.)

PLATE IV-a, b

Two top views of part of same tooth shown in Plate III. (Photos by V. G. and Charles Miller.)

PLATE V

Elephas beyeri n. sp.

Figs. 1 & 2.—Fragment of left lower molar.
(Actual size.)

PLATE VI

Stegodon mindanensis NAUMANN.

Figs. 1 & 2.—Fragment of right lower molar.

Stegodon cf. *mindanensis* NAUMANN.

Figs. 3 & 4.—Isolated ridge-plate.
(From Mindanao; after NAUMANN. About actual size.)

PLATE VII

Side view of part of the new fossil *Elephas* tooth from Anda, found by L. L. Wilson. (Photo by V. G. Miller.)

1a

2a

1b

2b

3

4

PLATE I

1

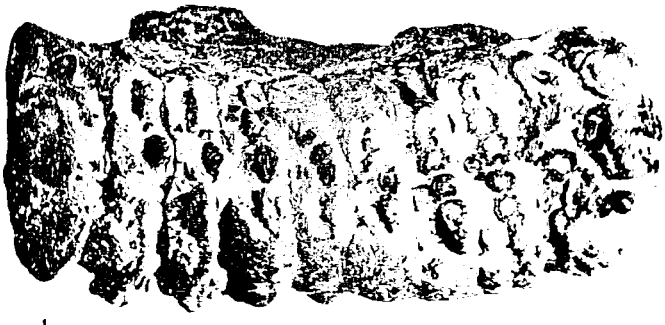
2

3

4

PLATE II

PLATE III



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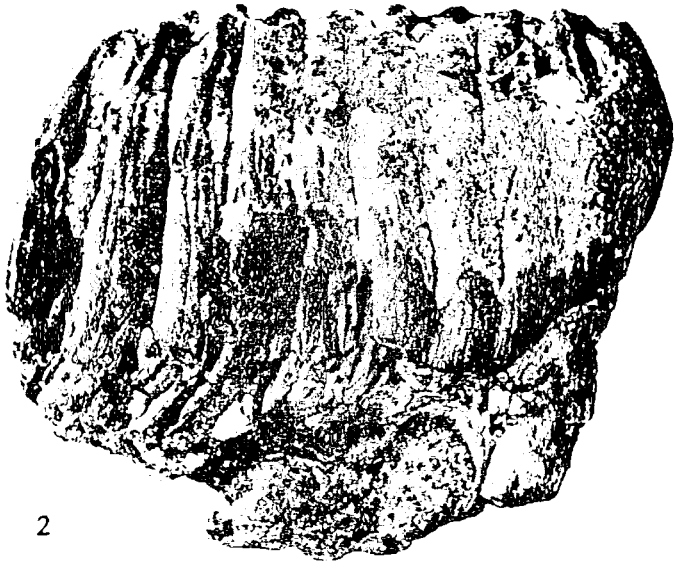

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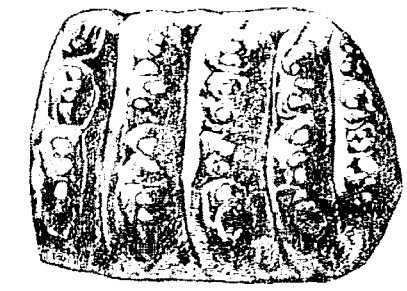
PLATE V



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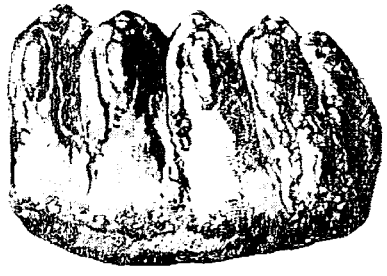

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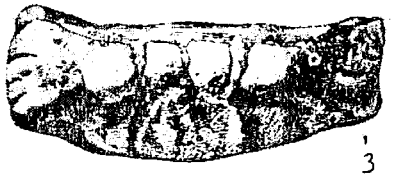

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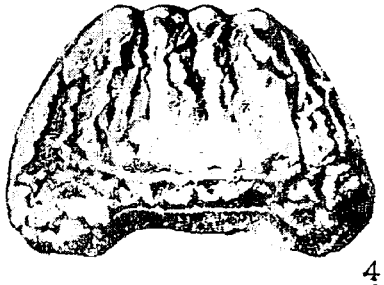

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PLATE VI

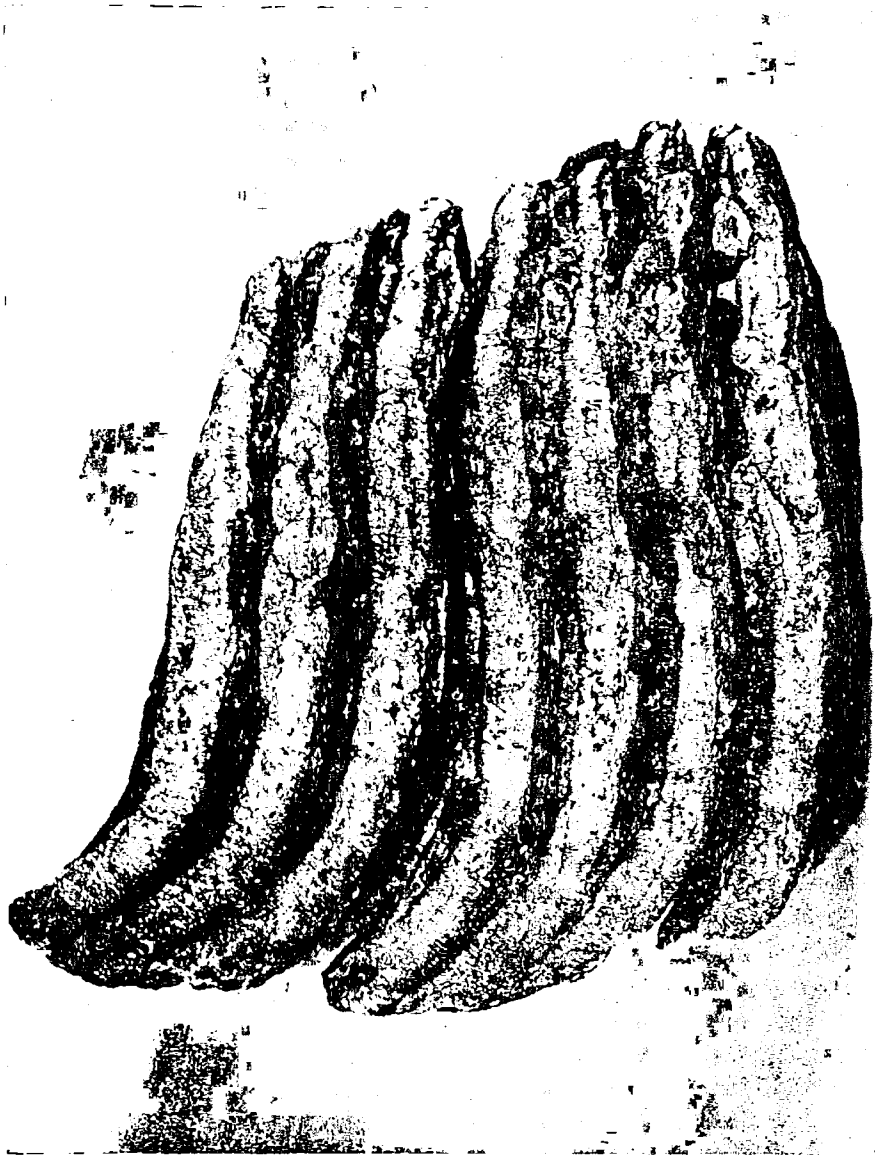

PLATE VII

PROCEEDINGS OF THE EIGHTH PACIFIC SCIENCE CONGRESS
AND THE FOURTH FAR-EASTERN PREHISTORY CONGRESS

PROCEEDINGS OF THE FOURTH FAR-EASTERN PREHISTORY AND THE ANTHROPOLOGY DIVISION OF THE EIGHTH PACIFIC SCIENCE CONGRESSES COMBINED

PART I: PREHISTORY, ARCHAEOLOGY AND PHYSICAL ANTHROPOLOGY

(Second Fascicle: Section 1)

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