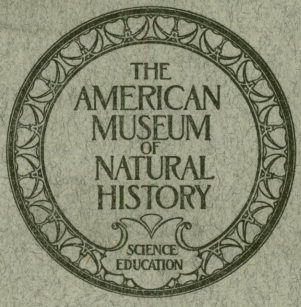
BULLETIN

OF

THE AMERICAN MUSEUM OF NATURAL HISTORY

VOLUME L, 1924



MATSUMOTO CHAPMAN-GRISCOM
MATTHEW MILLER
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NEW YORK
PUBLISHED BY ORDER OF THE TRUSTEES
1924

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EDITED BY

FRANK E. LUTZ

EDMUND OTIS HOVEY

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NATURAL HISTORY MAGAZINE

HERBERT F. SCHWARZ, A.M., Editor
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CONTENTS OF VOLUME L

DATES OF PUBLICATION OF SEPARATES[1]

The edition of separates is 300 copies, of which about 100 are mailed on the date of issue, and the others placed on sale in the Library.

Art. I, July 2, 1924.[2]
" II, July 3, 1924.[2]
" III, July 3, 1924.
" IV, July 8, 1924.
" V, October 31, 1924.
" VI, December 13, 1924.
" VII, December 31, 1924.

[1]The Title-page, Table of Contents, and Index to this volume (L) were published June, 1931.
[2]Edited by E. O. Hovey, who died September 1924.

LIST OF ILLUSTRATIONS

Text Figures

LIST OF NEW TAXONOMIC NAMES IN THIS VOLUME

Genera and Subgenera

Species and Subspecies

ERRATA

Page 65, line 16 from bottom, for *Hyænarctus* read *Hyænarctos*.
" 70, line 7 from bottom, for *Neotragoceras* read *Neotragocerus*.
" 100, lines 9 and 13 from bottom, for *Ælurodon haydenianus* read *Ælurodon haydeni*.
" 100, line 10 from top, for *Ælurodon haydenianus validus* read *Ælurodon haydeni validus*.
" 104, footnote, for *Daphœus* read *Daphœnus*.
" 104, footnote, for *Paradaphœnus* read *Paradaphænus*.
" 106, line 15 from top, for *Amphicyon americana* read *Amphicyon americanus*.
" 113, line 19 from top, for *Ælurodon mæandrimus* read *Ælurodon mæandrinus*.
" 115, line 2 from top, for *Hyænarctes* read *Hyænarctos*.
" 126, line 3 from top, for *Canis morenoi* read *Canis moreni*.
" 206, lines 3 and 5 from bottom, for *Craniocerus* read *Cranioceras*.
" 305, line 6 from bottom, for two-webs read toe-webs.
" 305, line 19 from bottom, for Megapodidæ read Megapodiidæ.
" 310, line 15 from top, insert comma after paper.
" 311, line 1 from bottom, for grand read ground.
" 317, first column after Anseres, insert parentheses before variable and after *Nesonetta*.
" 328, line 18 from top, for *leucolophi* read *leucolopha*.

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THE AMERICAN MUSEUM OF NATURAL HISTORY

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Article I.—A REVISION OF PALÆOMASTODON DIVIDING IT INTO TWO GENERA, AND WITH DESCRIPTIONS OF TWO NEW SPECIES[1]

BY H. MATSUMOTO

CONTENTS

I.—INTRODUCTION

The genus *Palæomastodon* was, as is well known, created by Andrews, consisting at first of only a single species, *P. beadnelli;* but subsequently he added three more species, *P. minor, parvus,* and *wintoni.* Then he made the fact sufficiently clear that two species, *P.*

[1]This is the third of a series of contributions on the Fayûm Vertebrata by Dr. Matsumoto based upon American Museum materials. The first was prepared by Professor H. F. Osborn from extracts from Dr. Matsumoto's manuscript made by C. C. Mook. This constituted American Museum Novitates No. 51; the second contribution is entitled 'A Contribution to the Study of *Mœritherium*' and has appeared in the American Museum Bulletin, XLVIII, pp. 97–139, 1923. A fourth contribution, on the Fayûm Hyracoidea, will appear shortly in the Bulletin.—C. C. MOOK.

beadnelli and *parvus*, differ very much from the other two species, *P. wintoni* and *minor*, in certain characters of the mandible and lower cheek teeth. But he did not make clear the parallel differences in the structures of the skull and upper cheek teeth, owing to the few specimens of the skull and upper cheek teeth of the genuine *beadnelli-parvus* type in his material.

As a result of my present study of the American Museum material of *Palæomastodon*, it has become clear that there are two distinct types of this genus, even in the structures of the palate (the skull as a whole is not yet known in one of the two types) and upper cheek teeth, corresponding to the two types in the structures of the mandible and lower cheek teeth, so that I have subdivided this genus into two distinct genera (or subgenera, if one be inclined to treat them so).

Schlosser was inclined to recognize only two species in this genus, corresponding to the two types just mentioned.

The difference in size between *P. beadnelli* and *parvus* and between *P. wintoni* and *minor* seems to me too great to be looked upon as sexual dimorphism, even when we admit that the genus had very high variability. I made an observation on the size variation of the cheek teeth by graphic method. Almost every molar of *P. wintoni*, material of which is the most abundant of all, shows a bimodal curve of variation. Thus we can recognize the presence of sexual dimorphism within this single species; and we have no need to consider *P. wintoni* and *minor* as the male and female types of the same species.

Andrews and Beadnell's genus *Phiomia* was afterwards proved by Schlosser and by Andrews himself to be merely a juvenile type, with deciduous dentition, of *Palæomastodon* (the paratype, however, is merely a hyracoid). Now I will try to solve the serious question as to which of the two subdivisions of *Palæomastodon* the misplaced genus *Phiomia* corresponds. According to Andrews' figures and my own observation of the type specimen of *Phiomia*, the largest and most conspicuous anterior mental foramen lies on the outer side of the symphysial region and another smaller one lies just below the anterior lobe of Dm_3, and this deciduous molar is typically bunodont in its structure, as well as in the mode of wearing. These features are characteristic of the *wintoni-minor* type in contrast to the *beadnelli-parvus* type. The latter type is typically *Palæomastodon*. Consequently, the former type should receive *Phiomia* as its generic name.

During my present study I have received much helpful advice from Professor Henry F. Osborn, President of the American Museum, Dr.

W. D. Matthew, Professor William K. Gregory, and Mr. Walter Granger, to all of whom my hearty thanks are due. I am likewise indebted to Dr. Charles W. Andrews of the British Museum, for advice and aid during my visit there.

II.—DESCRIPTION OF GENERA AND SPECIES

The old genus *Palæomastodon* should be subdivided into two genera as follows.

A.—Palate wide in proportion to the length of the cheek teeth series. Symphysis rather short, its posterior end lying at a considerable distance anterior to the first cheek tooth ($P_{\overline{3}}$); the most conspicuous one of the anterior mental foramina lying just below the first cheek tooth, as well as a considerable distance behind the posterior end of the symphysis. Ridge-formula: $Dm\frac{???}{???}$. $P\frac{1\cdot1\cdot2}{1\cdot2}$. $M\frac{2\cdot2\cdot2}{2\cdot2\cdot2\text{-}3}$. Last premolars and all molars bunolophodont, appearing like typically lophodont teeth when moderately worn; no trefoil pattern of cusps..... *Palæomastodon.*

B.—Palate long and narrow. Symphysis long, its posterior end lying only a little anterior to, or posterior to the anterior end of the first cheek tooth ($P_{\overline{3}}$); the most conspicuous one of the anterior mental foramina lying far anterior to the first cheek tooth, as well as to the posterior end of the symphysis. Ridge formula: $Dm\frac{1\cdot2\cdot3}{1\cdot2\cdot3}$. $P\frac{1\cdot1\text{-}2}{1\cdot2}$. $M\frac{3\cdot3\cdot2\text{-}3}{3\cdot3\cdot3\text{-}3}$. Lasts premolars and all molars typically bunodont; trefoil pattern of cusps well developed..... *Phiomia.*

Palæomastodon ANDREWS

Andrews, 1901; Andrews, 1903 (pars); Andrews 1904 (pars); Andrews, 1906 (pars).

This genus should be rediagnosed as follows.

A genus of Proboscidea. Skull imperfectly known. Palate rather short and wide, as compared with that of the next genus; judging from the form of the palate this genus might be less long-skulled than the next one. Mandible elongated anteroposteriorly; mandibular symphysis rather short as compared with that of *Phiomia;* posterior end of symphysis lying a considerable distance anterior to the first cheek tooth ($P_{\overline{3}}$); largest and most conspicuous one of mental foramina lying just below the first cheek tooth, and far behind the posterior end of the symphysis. Dental formula: $I\frac{1}{1}$. $C\frac{0}{0}$. $P\frac{3}{2}$. $M\frac{3}{3}$. Ridge formula: $Dm\ \frac{1\,1\,1}{1\,1\,1}$. $P\frac{1.1\,2}{1.\ 2}$. $M\frac{2.2.2}{2\,2.2\text{-}3}$. Cheek teeth markedly brachyodont; last premolars and all molars short and wide, bunolophodont, wearing like typically lophodont teeth, attaining rather sharp ridges and very widely open valleys when moderately worn; a rudimentary intermediate cusp is present in the anterior valley of each lower molar; no trefoil pattern of cusps; surface of enamel rather smooth; basal cingula neither very strong nor very rough.

GENOTYPE.—*Palæomastodon beadnelli* Andrews, 1901.

This genus, as emended here, is much less common than the next genus in the Fluvio-marine formation, as *Zygolophodon* is less common than *Trilophodon* in the Miocene of Europe. The three species which are to be included in this genus are distinguished as follows.

1.—Length of lower molar series measuring 130 mm.; that of lower premolar and molar series, 197 mm. (Andrews' type)..... *parvus.*

2.—Length of lower molar series measuring 159 mm. (type No. 14547); that of upper molar series, 150–152 mm. (paratype No. 13449); that of upper premolar and molar series, 250 mm. (ditto).. *intermedius.*

3.—Length of lower molar series measuring 194 mm.; that of lower premolar and molar series, 285 mm. (Andrews' type).. *beadnelli.*

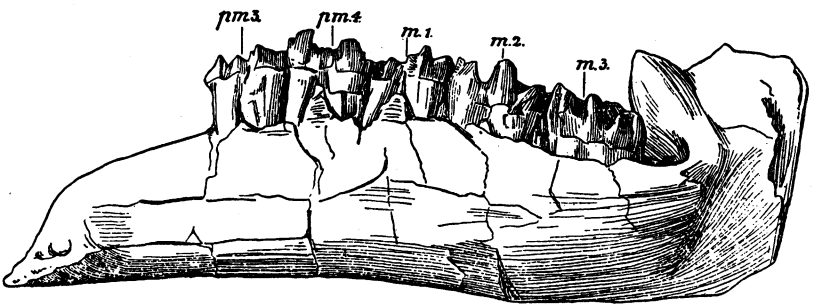

Fig. 1. Original type of *Palæomastodon parvus* Andrews, 1905.

"Right ramus of the mandible, with the premolars and molars *in situ*, though somewhat crushed." Brit. Mus. No. M. 8479*a*. One-fourth natural size. Lateral view, left side. After Andrews, 1906. Figure inserted by Professor H. F. Osborn.

Palæomastodon parvus Andrews

Fig. 2. *Palæomastodon parvus* Andrews, 1905.

Third lower molar tooth. Amer. Mus. No. 13497. Two-thirds natural size. Crown view.

P. parvus ANDREWS 1905, Geol. Mag., Decade V, II, pp. 562–563; 1906, 'Brit. Mus. Cat. Tert. Vert. Fayûm, Egypt,' pp. 162–168, text figs. 50C, 55–59; 1908, Phil. Transact. Roy. Soc. London, Ser. B, CXCI, p. 399, text. fig. 1 (2).

SPECIMEN.—No. 13497; a left lower third molar; Amer. Mus. Exp. 1907, Quarry B, Fluvio-marine formation, Fayûm, Eygpt.

This tooth measures 52 mm. in length and 32 mm. in width. It is longer than and as wide as the lower third molar of Andrews' type, which is stated by Andrews to be 46 mm. long and about 32 mm. wide.

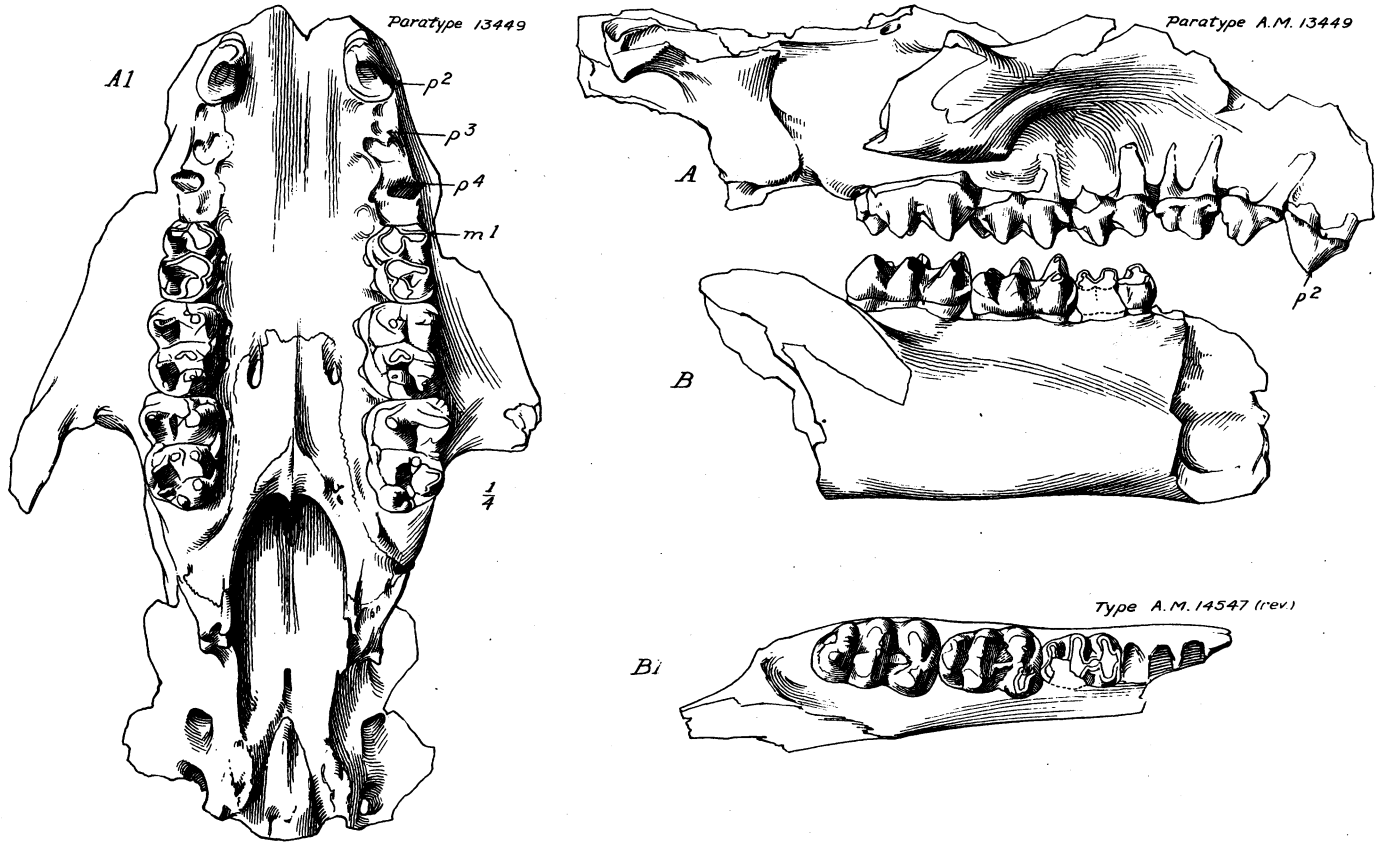

Fig. 3. *Palæomastodon intermedius* Matsumoto, 1922.

Type and paratype specimens. *A*, paratype specimen. Skull, Amer. Mus. No. 13449. One-fourth natural size. Lateral view, left side. *A1*, the same, inferior view. *B*, type specimen. Part of left ramus of jaw, Amer. Mus. No. 14547. One-fourth natural size. External view (reversed in drawing). *B1*, the same, superior view (reversed in drawing).

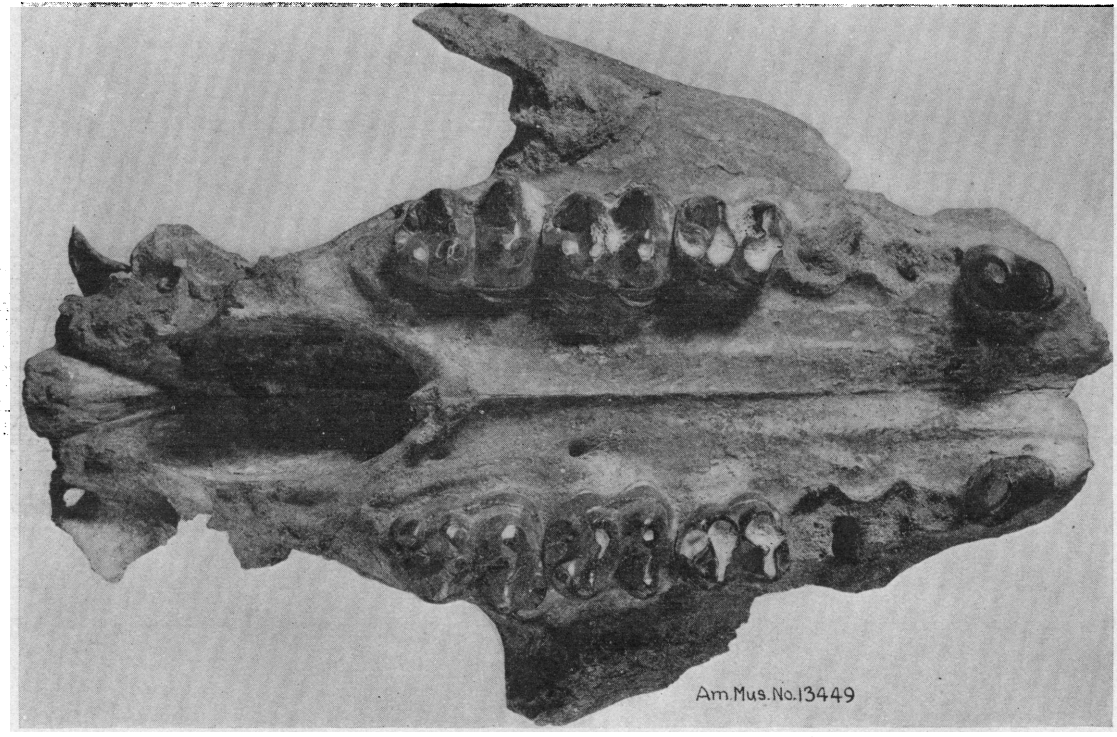

Fig. 4. *Palæomastodon intermedius* Matsumoto, 1922.
Paratype specimen. Skull. Amer. Mus. No. 13449. One-third natural size. Inferior view.

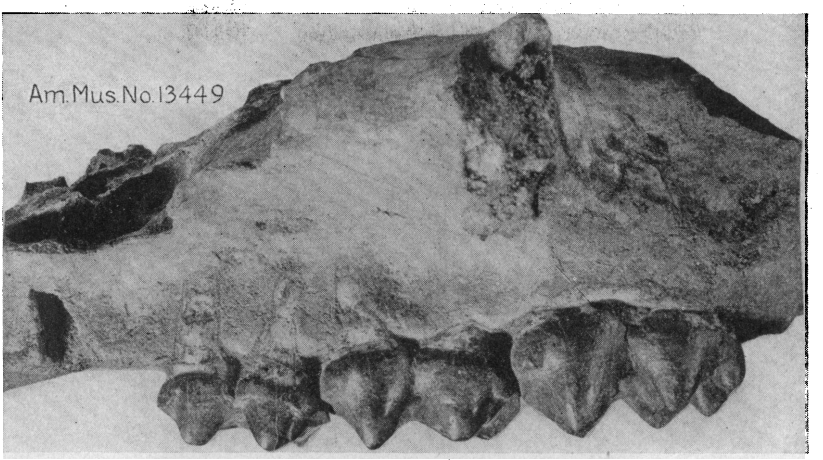

Fig. 5. *Palæomastodon intermedius* Matsumoto, 1922.

Paratype specimen. Skull. Amer. Mus. No. 13449. One-half natural size. Lateral view, left side.

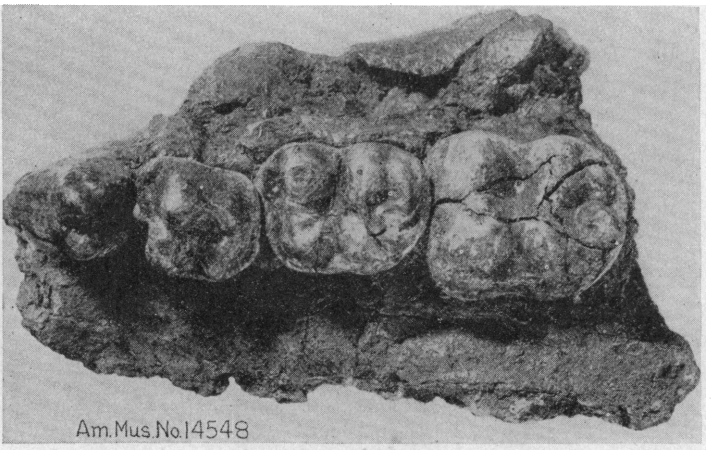

Fig. 6. *Palæomastodon intermedius* Matsumoto, 1922.

Paratype specimen. Portion of maxillary with teeth. Amer. Mus. No. 14548. One-half natural size. Inferior view.

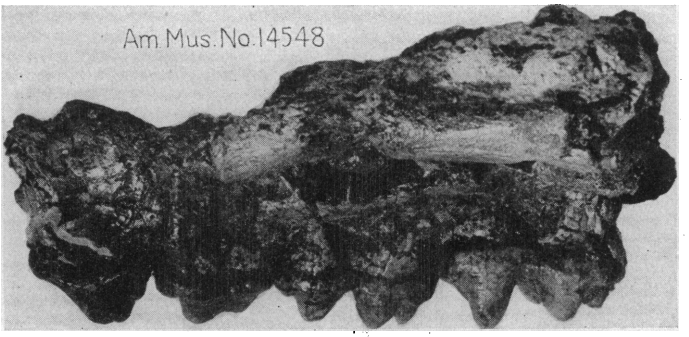

Fig. 7. *Palæomastodon intermedius* Matsumoto, 1922.

Paratype specimen. Portion of maxillary with teeth. Amer. Mus No. 14548. One-half natural size. Lateral view, left side.

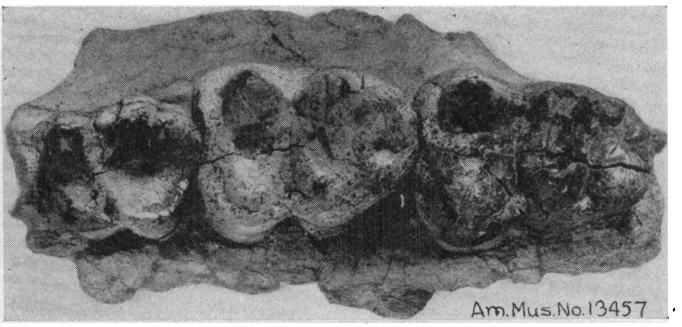

Fig. 8. *Palæomastodon intermedius* Matsumoto, 1922.

Part of maxillary with teeth Amer. Mus. No. 13457. One-half natural size. Inferior view.

Table A

	P. parvus		*P. intermedius*					*P. beadnelli*				
	Lower		Upper			Lower		Upper		Lower		
			13449									
	13497	Andrews	right	left	14548	13480	14547	Andrews	13481	Andrews		
$P_{\overline{2}}$ Length	....	....	38	37	....	....	....	....	....	....	....	....
$P_{\overline{2}}$ Width	....	....	23	23	....	....	....	....	....	....	....	....
$P_{\overline{3}}$ Length	....	35±	....	....	32	....	....	....	....	41±	....	....
$P_{\overline{3}}$ Width	....	....	....	....	26.5	....	....	....	....	....	....	....
$P_{\overline{4}}$ Length	....	35±	....	....	33	....	....	....	....	48	....	....
$P_{\overline{4}}$ Width	....	....	....	....	31.5	....	....	....	....	33±	....	....
$M_{\overline{1}}$ Length	....	38	44	44	44.5	....	42	....	....	48	....	....
$M_{\overline{1}}$ Width	....	30±	34	34	34	....	27.5	....	....	37±	....	....
$M_{\overline{2}}$ Length	....	45	51	51	51	....	53	56	....	65	....	....
$M_{\overline{2}}$ Width	....	32	42	41	43	....	36	48	....	51	....	....
$M_{\overline{3}}$ Length	52	46	57.5	59	....	59	63	65	81	78	87	82
$M_{\overline{3}}$ Width	32	32±	45.5	46	....	38	40	52	45	53	52	48
Length of P–M	....	197	250	250	....	....	....	....	....	285	....	....
Length of M–M	....	130	150	152	....	....	159	....	....	194	....	....

Palæomastodon intermedius, Matsumoto[1]

TYPE.—No. 14547; a fragment of left mandibular ramus, bearing all three molars *in situ*, and with parts of alveoli of penultimate and last premolars; Amer. Mus., 1909.

PARATYPES.—No. 13480; a fragment of left mandibular ramus, bearing last molar and posterior root of penultimate molar *in situ;* Amer. Mus. Exp. 1907, Quarry B. No. 13449; a large fragment of skull, consisting chiefly of the palate, bearing anterior premolars ($P^{\frac{2}{2}}$) and all molars of both sides *in situ*, and with alveoli of penultimate and last premolars of both sides; Amer. Mus. Exp. 1907. No. 14548; a fragment of skull and palate, bearing penultimate premolar to penultimate molar of left side *in situ;* purchase, 1909.

All the specimens, Fluvio-marine formation of the Fayûm, Egypt.

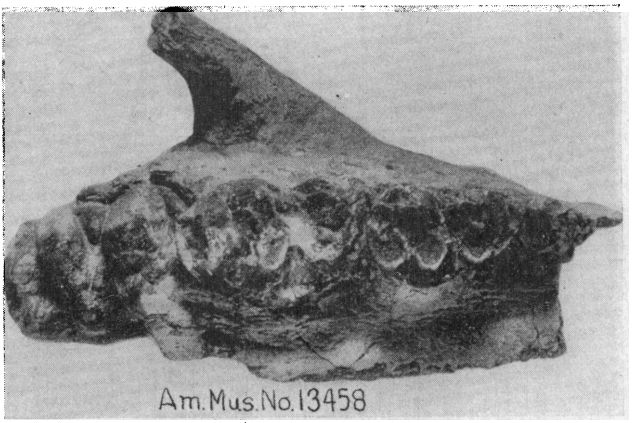

Fig. 9. *Palæomastodon intermedius* Matsumoto, 1922.
Part of skull. Amer. Mus. No. 13458. Two-thirds natural size. Inferior view.

The ramus of the type-specimen, No. 14547, measures as follows (in mm.).

Height of Ramus on Outer Side at First Ridge of $M_{\frac{1}{1}}$	94
Ditto at First Ridge of $M_{\frac{3}{3}}$	94
Width of Ramus at First Ridge of $M_{\frac{1}{1}}$	50
Ditto at Second Ridge of $M_{\frac{2}{2}}$	51

In all the lower molars the third ridge is rather poorly developed, being distinctly narrower than the first and second ridges; the posterior valley is distinctly narrower antero-posteriorly and shallower than the anterior valley; so that the third ridge looks simply like a talon. As a

[1]Amer. Mus. Novitates, No. 51, p. 2, 1922.

generic character, the very bottoms as well as the walls of the valleys were worn, even in the very earlier stages of wearing.

The palate of specimen No. 13449 measures as follows (in mm.).

Length from the Frontal Plane Tangential to the Anterior Limits of the Crowns of the two P^2 to the tip of the Posteriorly Directed Process at the Posterior Limit of the Median Suture between the Two Palatines.....250.
Distance between the Two P^2.....53.
Ditto between the Two M^1.....77.
Ditto between the Two M^3.....75.

All the upper molars are distinctly bilophodont, as a generic character, the rudiment of the third ridge being much feebler and much less conspicuous than that of the lower molars. The mode of wearing corresponds well to what is stated of the lower molars. Besides, all the generic characters of all the cheek teeth of this species are the same as those stated in the diagnosis of the genus.

The dimensions of the cheek teeth of this and other species of this genus at hand, in comparison with those stated by Andrews, are indicated, in millimeters, in Table A, p. 9.

Palæomastodon beadnelli Andrews

P. beadnelli Andrews, 1901, 'Tagebl. d. V. International Zool. Congr., Berlin,' No. 6, p. 4[1]; 1901, Geol. Mag., Decade IV, VIII, pp. 401–403, text-fig. 1; 1902, 'Verhandl. d. V. International Zool. Congr., Berlin,' p. 528[1]; 1903, Phil. Transact. Roy. Soc. London, Ser. B, CXCVI, pp. 110–113 (*pars*)[2]; 1904, Geol. Mag., Decade V, I, pp. 112–115 (*pars*)[2]; 1906, 'Brit. Mus. Cat. Tert. Vert. Fayûm, Egypt,' pp. 150–166 (*pars*),[3] text-figs. 50*A*, 51–52, Pl. xv, figs. 1–3, Pl. xvi, figs. 1–4; 1908, Phil. Transact. Roy. Soc. London, Ser. B, CXCI, p. 399, text-fig. 1 (4). Schlosser, 1911, Beitr. z. Pal. u. Geol. Österreich-Ungarns u. d. Orients, XXIV, pp. 135–139 (*pars*).

P. wintoni Andrews, 1906, *loc. cit.*, pp. 152–162 (*pars*).[4]

Specimen.—No. 13481; a right lower third molar attached to a small fragment of mandibular ramus; Amer. Mus. Exp. 1907, Quarry B, Fluvio-marine formation, Fayûm, Egypt.

This tooth measures 81 mm. in length and 45 mm. in width. It is narrower than the lower third molars described by Andrews under this species, and slightly narrower than a specimen provisionally described by him under *P. wintoni*, but which I, as well as he himself lately, look upon as belonging to *P. beadnelli*.

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[1]These reports were not actually seen by me.

[2]The greater portions of Andrews' descriptions and all the text-figures in these reports correspond, in my opinion as well as in later opinion of Andrews, not to this species but to *Phiomia wintoni*.

[3]All the principal specimens of skulls and upper jaws except that illustrated in his Pl. xv, fig. 2, in this report belong, in my opinion, as well as in later opinion of Andrews, not to this species but to *Phiomia wintoni*.

[4]Andrews' specimen numbered M. 8849*b* was lately labelled correctly by Andrews as *P. beadnelli*,

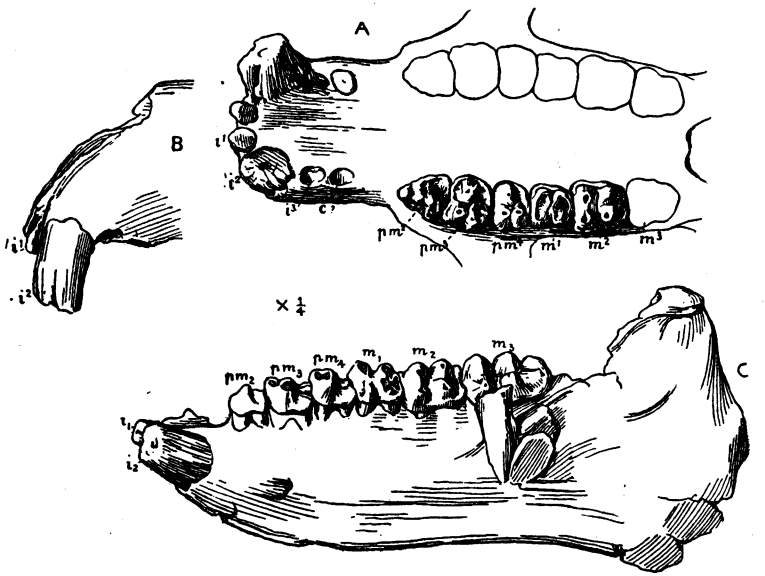

Fig. 10. *Palæomastodon beadnelli,* Andrews, 1901.

Original type figure. Type specimen "nearly complete left ramus of the mandible of a Proboscidean . . . " Geol. Mus. Cairo No. C10014. One-sixth natural size. *A*, superior view. *B*, external view. After Andrews, 1901. Figure inserted by Professor H. F. Osborn.

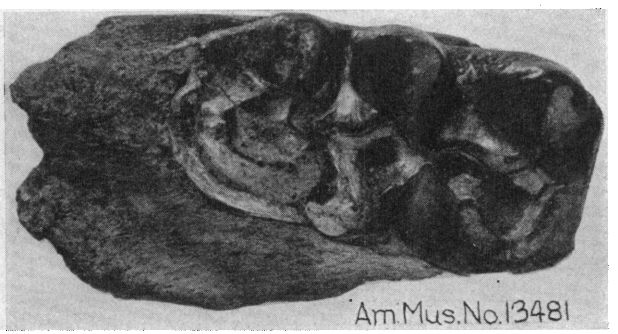

Fig. 11. *Palæomastodon beadnelli* Andrews, 1901.

Right third lower molar, with fragment of jaw. Amer. Mus. No. 13481. Two-thirds natural size. Superior view.

Among so many specimens of crania and upper jaws, which were provisionally referred to this species by Andrews, one shown in his Pl. xv, fig. 2, representing a fragment of palate with the second and third molars *in situ*, appears to me really to belong to this species. These teeth are clearly shown to be bilophodont, a generic character.

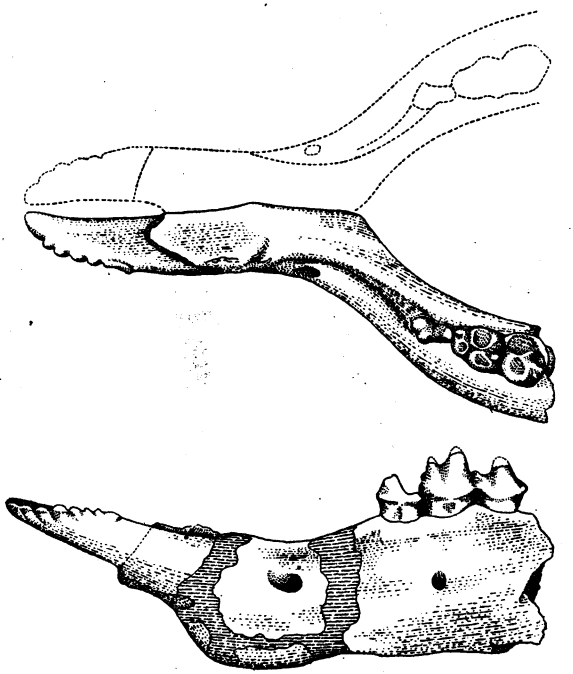

Fig. 12. *Phiomia serridens* Andrews and Beadnell, 1902.

Original type figure. Type specimen. Anterior portion of a left mandibular ramus, bearing DI_2 and DM_{2-3} *in situ*. Geol. Mus. Cairo No. C10007. One-half natural size. Upper figure, superior view. Lower figure, external view. After Andrews and Beadnell, 1902. Figure inserted by Professor H. F. Osborn.

PHIOMIA Andrews and Beadnell

Andrews and Beadnell, 1902 (*pars*); Andrews, 1906.

This genus should be rediagnosed as follows.

A genus of Proboscidea. Skull long in proportion to its width, although less so than that of typical *Trilophodon* and *Megabelodon;* sagittal crest present; external nares located just anterior to orbits; palate long. Mandible elongated; mandibular symphysis very long, although less so than that of typical *Trilophodon* and *Megabelodon;* posterior end of symphysis lying but a little anterior or posterior to the

anterior limit of cheek tooth series; largest and most conspicuous one of the anterior mental foramina lying a considerable distance anterior to the first cheek tooth ($P_{\overline{3}}$), as well as to the posterior end of symphysis. Dental formula: $I\frac{1}{1}$. $C\frac{0}{0}$. $P\frac{3}{2}$ $M\frac{3}{3}$. Ridge formula: $Dm\frac{1.2.3}{1.2.3}$. P1. $\frac{1.1\text{-}1.2}{1.2}$. M3. $\frac{3.3.2\text{-}3}{3.3.3\text{-}3}$. Cheek teeth markedly brachyodont; last premolars and all molars rather long and narrow, typically bunodont; an intermediate cusp is present in the anterior valley of each lower molar; trefoil pattern of cusps well developed; surface of enamel very rough; basal cingula strong and very rough.

GENOTYPE.—*Phiomia serridens* Andrews, 1902, which appears to be identical probably with *Palæomastodon wintoni* Andrews, 1905, or possibly with *Palæomastodon minor* Andrews, 1904.

This genus, as emended here, is very common in the Fluvio-marine formation.

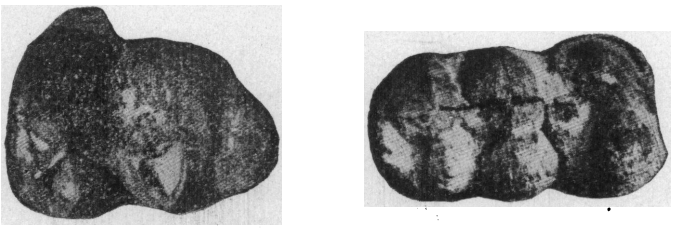

Fig. 13. *Palæomastodon barroisi* Pontier, 1907.
Original type figures. Type specimens. Last left superior and inferior molars. Three-fifths natural size. After Pontier, 1907. Figure inserted by Prof. H. F. Osborn.

The three species which are to be included in this genus are distinguished as follows.

1.—Posterior end of mandibular symphysis situated a little anterior to $P_{\overline{3}}$; in $M_{\overline{1.2}}$, the third ridge is distinctly feebler than the first and second; $M_{\overline{3}}$ not exceedingly long and narrow, three-ridged, the posterior talon being not exceedingly prominent; length of lower molar series measuring 126 (Andrews' type)—147 (No. 13471) mm.; that of lower premolar and molar series, 180 (Andrews' type)—202 (No. 13471) mm.; that of upper molar series, 125–130 mm. (Nos. 13455; 13448); that of upper premolar and molar series, 205–215 mm. (ditto)...*minor*

2.—Mandibular symphysis and lower molars similar to those of the preceding species except in size; length of lower molar series measuring 160 (No. 13474)—173 (Andrews) mm.; that of lower premolar and molar series, 225–250 mm. (Nos. 13474; 13477); that of upper molar series, 145–170 mm. (Andrews); that of upper premolar and molar series, 255–284 mm. (ditto).....*wintoni.*

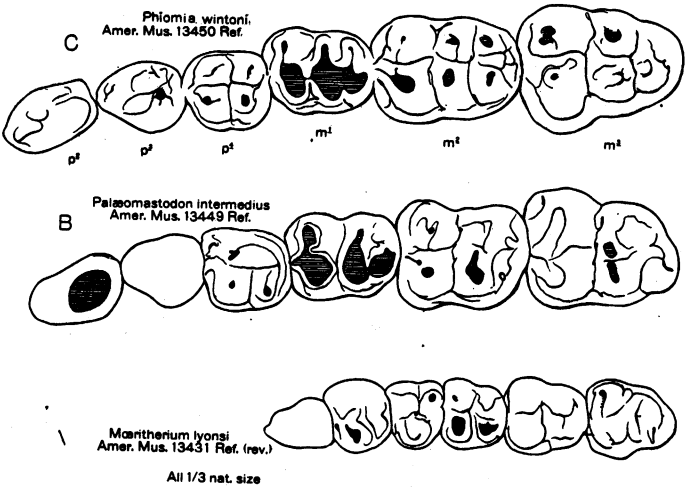

Fig. 14. *Mœritherium lyonsi* Andrews, Amer. Mus. No. 13431 (*A*); *Palæomastodon intermedius* Matsumoto, Amer. Mus. No. 13449 (*B*); and *Phiomia wintoni* (Andrews), Amer. Mus. No. 13450 (*C*).
Superior grinding teeth. One-third natural size. Crown views.

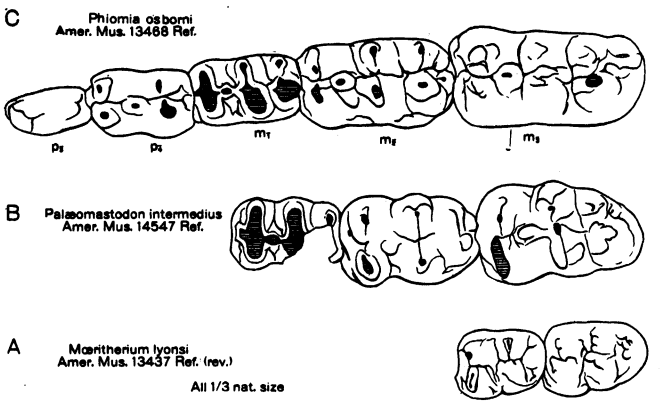

Fig. 15. *Mœritherium lyonsi* Andrews, Amer. Mus. No. 13437 (*A*); *Palæomastodon intermedius* Matsumoto, Amer. Mus. No. 14547 (*B*); and *Phiomia osborni* Matsumoto, Amer. Mus. No. 13468 (*C*).
Inferior grinding teeth. One-third natural size. Crown views.

3.—Posterior end of mandibular symphysis situated a little posterior to the anterior end of $P_{\overline{3}}$; in $M_{\overline{1,2}}$, the third ridge is almost as well developed as the first and second, the widest part of the tooth corresponding to the third ridge; $M_{\overline{3}}$ exceedingly long and narrow, nearly four-ridged, the fourth ridge corresponding to the prominently developed posterior talon; length of lower molar series measuring 177–180 mm.; that of lower premolar and molar series, 250–255 mm. (type: No. 13468).

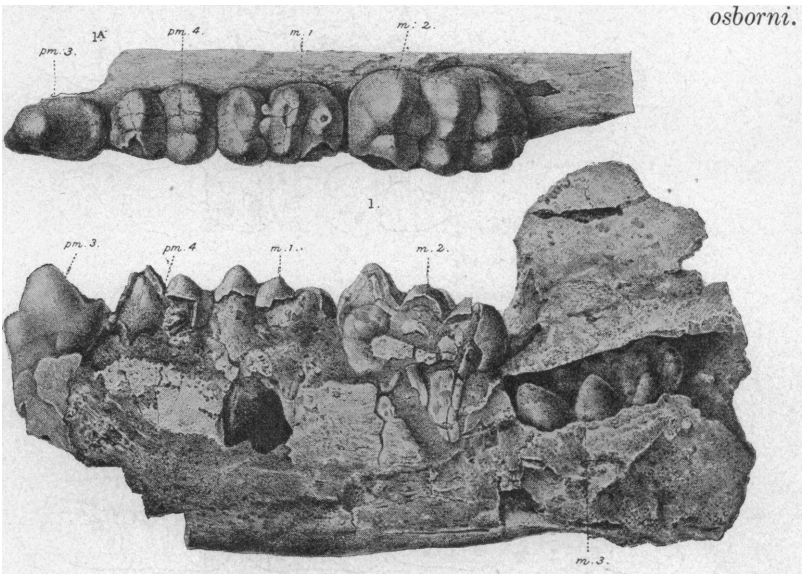

Fig. 16. *Palæomastodon minor* Andrews, 1904 = *Phiomia minor* (Andrews).

Original type figures. Type specimen. "Part of the ramus [right] and the coronoid process of an immature mandible, in which m.3 has not yet been cut, although it is completely developed." Brit. Mus. No. M. 8479*b*. One-half natural size. Upper figure, internal view. Lower figure, superior view. After Andrews, 1906. Figure inserted by Prof. H. F. Osborn.

Phiomia minor (Andrews)

Palæomastodon minor Andrews, 1904, Geol. Mag., Decade V, I, p. 115; 1906, 'Brit. Mus. Cat. Tert. Vert. Fayûm, Egypt,' pp. 168–169, text-fig. 50*D*, Pl. xiv, fig. 1.

Palæomastodon minus[1] Andrews, 1905, Geol. Mag., Decade V, II, p. 562.

Palæomastodon beadnelli Andrews, 1906, *loc. cit.*, pp. 150–156 (*pars*).[2]

Palæomastodon wintoni Andrews, 1906, *loc. cit.*, pp. 156–162 (*pars*).[3]

Palæomastodon barroisi Pontier, 1907, Ann. Soc. Geol. Nord., XXXVI, pp. 150–154 (*pars*),[4] text-fig. 2 (*non* text-fig. 1).

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[1]Evidently a misprint for "*minor*."

[2]Andrews' specimen numbered C. 9296, appears to me to belong to this species.

[3]Andrews' specimen numbered C. 8457, possibly as well as that numbered M. 8849*a*, appears to me to belong to this species.

[4]The last lower molar of Pontier's two cotypes falls within the limit of variation of *P. minor;* it may belong to the supposed male types of the same species.

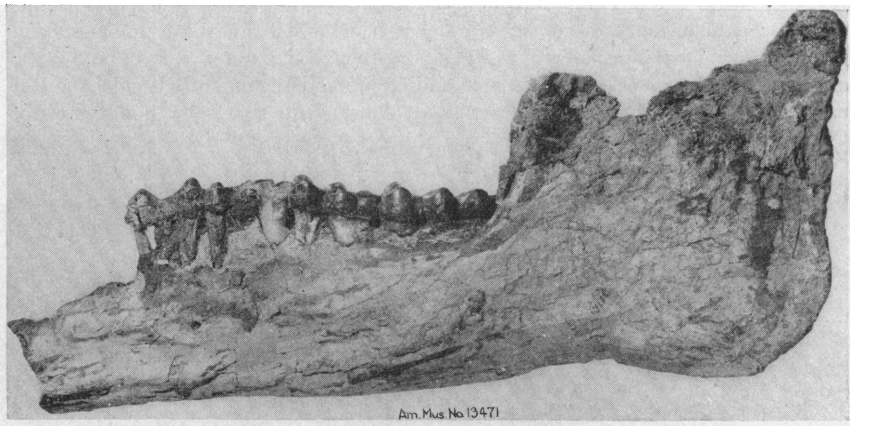

Fig. 17. *Phiomia minor* (Andrews).

Left ramus of mandible. Amer. Mus. No. 13471. One-fourth natural size. External view.

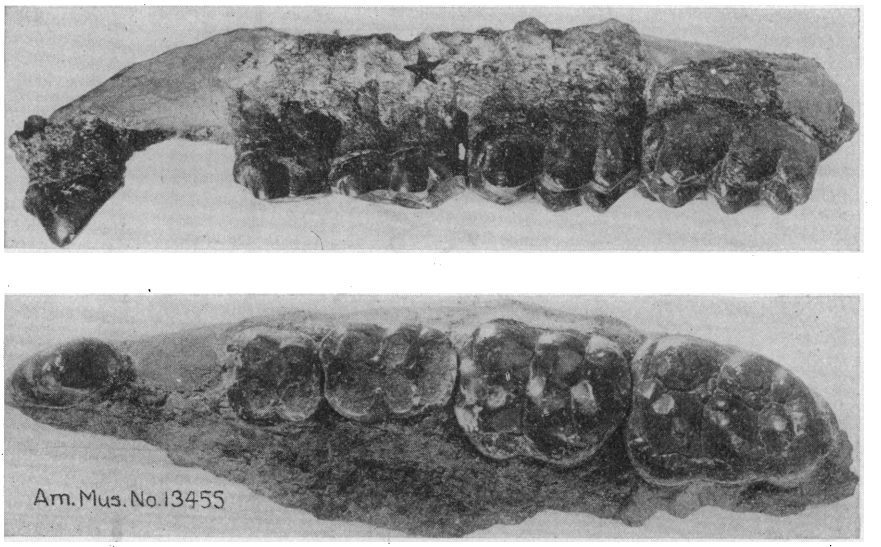

Fig. 18. *Phiomia minor* (Andrews).

Part of palate, with dentition. Amer. Mus. No. 13455. One-half natural size. Upper figure, external view. Lower figure, palatal view.

SPECIMENS.—No. 13469; a nearly complete mandible bearing supposed canine and last premolar and first and second molars of right side, and both premolars and first and second molars of left side *in situ*, and with alveoli of lower tusks of both sides, of anterior premolar ($P_{\overline{3}}$) of right side and of supposed canine of left side, the last molars of both sides having not yet erupted; Amer. Mus. Exp. 1907, 8 miles west of Quarry A.

No. 13471; a mandible bearing all the teeth *in situ;* Amer. Mus. Exp. 1907, Quarry B.

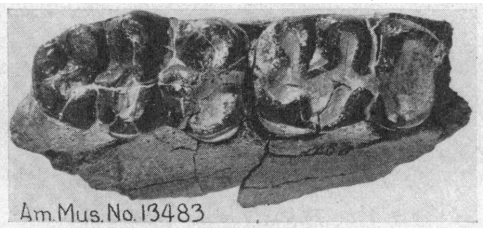

Fig. 19. *Phiomia minor* (Andrews).

Part of right mandibular ramus, with second and third lower molars. Amer. Mus. No. 13483. One-half natural size. Superior view.

Fig. 20. *Phiomia minor* (Andrews).

Part of right mandibular ramus. Amer. Mus. No. 13475. One-third natural size. Superior view.

No. 13475; a fragment of right mandibular ramus with last premolar and first and second molars *in situ*, besides roots of anterior premolar, and a much crushed last molar in the alveolus; Amer. Mus. Exp. 1907, Quarry B.

No. 13483; a fragment of right mandibular ramus bearing second and third molars *in situ;* Amer. Mus. Exp. 1907, Quarry B.

N o. 13486; a fragment of right mandibular ramus with roots of premolars *in situ;* Amer. Mus. Exp. 1907, near Quarries.

Extra No.; two isolated right lower third molars; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; an isolated right lower third molar, its crown being broken and imperfectly represented. Amer. Mus. Exp. 1907, near Quarries.

Extra No.; an isolated left lower anterior premolar; Amer. Mus. Exp. 1907.

No. 13448; a skull bearing all upper cheek teeth *in situ;* Amer. Mus. Exp. 1907.

No. 13455; a fragment of upper jaw with anterior and last premolars, and all molars of left side *in situ;* Amer. Mus. Exp. 1907, Quarry B.

Extra Nos.; three isolated, left upper third molars; Amer. Mus. Exp. 1907, Quarry A.

Extra No., an isolated right upper third molar; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; a fragment of upper jaw bearing anterior and next premolars of right side *in situ;* Amer. Mus. Exp. 1907, west of Quarries.

Extra No.; an isolated left upper penultimate premolar; Amer. Mus. Exp. 1907, Quarry B.

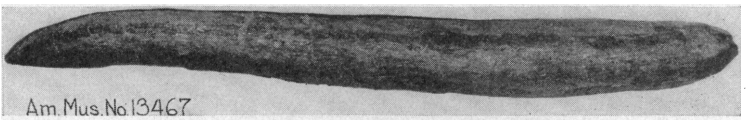

Fig. 21. *Phiomia minor* (Andrews).
Right upper tusk. Amer Mus. No. 13461. One-half natural size.

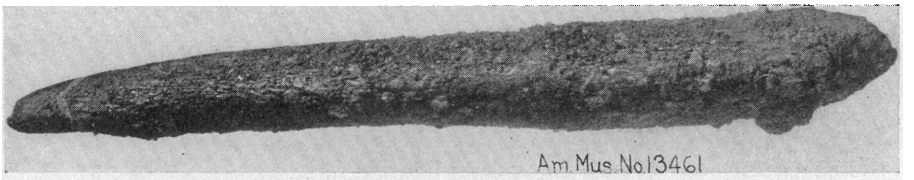

Fig. 22. *Phiomia minor* (Andrews).
Right upper tusk. Amer. Mus. No. 13467. One-half natural size.

The following upper tusks are provisionally referred to this species, according to their small size:

No. 13461; an isolated right upper tusk; Amer. Mus. Exp. 1907, Quarry B.

No. 13464; an isolated right upper tusk; Amer. Mus. Exp. 1907, 8 miles west of Quarry A.

No. 13465; a fragment of right upper tusk; Amer. Mus. Exp. 1907, Quarry A.

No. 13467; an isolated right upper tusk; Amer. Mus. Exp. 1907.

All the specimens: Fluvio-marine formation of the Fayûm, Egypt.

The mandible of specimen No. 13469 is very aberrant in having an extra pair of front teeth just behind the alveoli of the normal tusks. These extra teeth cannot be looked upon as deciduous teeth because (1) this specimen, though young (the last molars not having yet erupted), is too old to bear deciduous front teeth; (2) the position of the extra teeth is quite different from that of either deciduous or permanent lower tusks; and (3) the shape and structure of the same are quite different from those of the deciduous lower tusks of this genus. The extra teeth might be either the last incisors or the canines, possibly the latter, re-

appeared through atavism. The right tooth preserved in this specimen *in situ* is short, stout, conical, with the tip pointed forward and upward; upper side slightly concave and lower side markedly convex in lateral view; it appears to be rootless; it measures 32 mm. in antero-posterior extension, about 21 mm. in estimated vertical width, and about 13 mm. in lateral width; its distal part is covered with enamel on all sides, the enamel extending farther backward on the outer surface than on the inner. The maximum diameter of the alveoli of the lower tusks is about 27 mm., and the shorter diameter of the same about 14 mm.

The mandibles of the specimens Nos. 13469, 13471 and 13475, in comparison with one described by Andrews, measure as follows (in mm.).

	13469 Young; prob. ♀	13471 prob. ♂	13475 Young; prob. ♀	Andrews prob. ♂
Length from Tip of Symphysis to Posterior Side of Angle	435±	590±	....	600
Length of Symphysis	137	215	....	226
Length from Tip of Symphysis to Posterior Side of $M_{\overline{3}}$	....	435	....	475
Minimum Antero-posterior Width of Ascending Bar	122	155	....	....
Maximum Width of Anterior Half of Symphysial Region	65	....	....	....
Minimum Width at the Constriction of Symphysial Region	60	....	....	55
Height of Ramus at $P_{\overline{3}}$	61	83	70	....
Ditto at $M_{\overline{1}}$	59	90	72	....
Ditto at Anterior Lobe of $M_{\overline{3}}$	....	82	....	....
Height of Ascending Bar at Condyle	112±	190	....	....

The mandible of specimen No. 13471 is rather large in its dimensions among the mandibles of the present species. It has rather large last molars; but closer examination leads one to witness the fact that the dimensions of all the other cheek teeth, as well as the length of symphysis, approach those of the present species, so that I have come to look upon this specimen, as well as others similar to this, as representing the male type of the present species. Andrews appears to have selected terminal individuals as the types of his species. For instance, his type of the present species does not stand at or near the average point of the smaller forms of this genus. Moreover, the last molars of his type were un-

doubtedly embryonic, having not yet erupted from their alveoli. Such an embryonic molar must be smaller than the size which should be attained by the tooth in full-grown condition. Each lower tusk of the present specimen measures 42 mm. in maximum diameter, and about 36 mm. in lateral extension *in situ*.

The dimensions of the lower cheek teeth at hand, as well as those reported by Andrews and by Pontier, are indicated, in millimeters, in Table B, p. 22.

The skull of specimen No. 13448, Prob. ♂, measures as follows (in mm.).

Basal Length (including a restored part to a short extent)	460±
Length from Anterior Ends of Nasals to Tips of Lambdoid Crest	290
Length of Palate along Median Line	290±
Width of External Nares	73
Minimum Interorbital Width	150
Distance between the Two P^2	58
Ditto between the Two P^3	56
Ditto between the Two M^1	44
Ditto between the Two M^3	51
Lateral Extension of the Two Occipital Condyles	120
Width of Foramen Magnum	46
Height of Occiput, including Condyles	162
Height of Foramen Magnum	35

The upper tusks of specimens Nos. 13461 and 13467 measure as follows (in mm.).

	13461 Prob. ♂	13467 Prob. ♀
Straight Length	241	197
Length Along Upper Anterior Curve	275	226
Maximum Longer Diameter	40	38
Maximum Shorter Diameter	26	20

The fragmentary upper tusk of the specimen No. 13464 is much less curved and much less compressed laterally than the two specimens just mentioned. It is about 24 mm. thick at the portion where it measures 33 mm. in longer diameter. There may be some possibility that it actually belongs to a genus other than that to which the two above-mentioned tusks belong.

The dimensions of the upper cheek teeth, in comparison with those stated by Andrews, are indicated, in millimeters, in Table C, p. 23.

Table B

	13469		13471		13475	13483	13486	ex.	ex.	ex.	ex.	Andrews			Pontier
	Young; prob. ♀		Prob. ♂		Young	Prob. ♀	Prob. ♂	Prob. ♀	Prob. ♂	Prob. ♂		Young prob. ♀	Prob. ♂	Prob. ♀	Prob. ♂
	right	left	right	left											
$P_{\overline{3}}$ Length	....	....	25.5	29	....	....	27±	....	....	....	31	28	29	....	....
$P_{\overline{3}}$ Width	....	....	16	16	....	....	(roots)	....	....	....	15.5	16	14	....	....
$P_{\overline{4}}$ Length	25.5	26	31	31	30.5	....	30±	....	....	....	....	26	35	....	....
$P_{\overline{4}}$ Width	18	20	23	23	21	....	....	....	....	....	....	20±	20	....	....
$M_{\overline{1}}$ Length	34	34	35	33.5	39	....	....	....	....	....	..	32	38	....	....
$M_{\overline{1}}$ Width	25	22	26	25±	24	....	....	....	....	....	....	21±	25	....	.....
$M_{\overline{2}}$ Length	48	46	47.5	49	48.5	47	....	....	....	....	....	45	54	....	....
$M_{\overline{2}}$ Width	31	30	30.5	31	28	30	....	....	....	....	....	29±	31	....	....
$M_{\overline{3}}$ Length	....	....	63.5	65	....	55	....	57	63±	63±	....	48	66	56	62
$M_{\overline{3}}$ Width	....	....	....	37	....	33	....	32	35	33±	....	29	35	....	35
Length of P–M	....	....	198	202	....	....	....	....	....	....	....	180	....	....	....
Length of M–M	....	....	145	147	....	....	....	....	....	....	....	126	....	....	....

Table C

	13448	13455	ex.	ex.	ex.	ex.	ex.	ex.	Andrews
	M^1 much worn Prob. ♂	Prob. ♀	Prob. ♂	M^3 embryonic Prob. ♂	M^3 embryonic	M^3 embryonic Prob. ♀			Prob. ♂
P^2 Length	34	28	.....	.....	.....	.....	32.5	.....	.....
P^2 Width	19	17	.....	.....	.....	.....	19	.....	.....
P^3 Length	30	.....	.....	.....	.....	.....	29	29	.....
P^3 Width	24	.....	.....	.....	.....	.....	24	25	.....
P^4 Length	27	25	.....	.....	.....	.....	.....	.....	.....
P^4 Width	26	26	.....	.....	.....	.....	.....	.....	.....
M^1 Length	30±	35	.....	.....	.....	.....	.....	.....	37
M^1 Width	.....	27	.....	.....	.....	.....	.....	.....	.....
M^2 Length	49	44	.....	.....	.....	.....	.....	.....	47
M^2 Width	35	35	.....	.....	.....	.....	.....	.....	.....
M^3 Length	52	49	52	51	52	46	.....	.....	53
M^3 Width	39	38	38	39	35	34	.....	.....	.....
Length of P–M	215	205	.....	.....	.....	.....	.....	.....	.....
Length of M–M	130	125	.....	.....	.....	.....	.....	.....	.....

Phiomia wintoni (Andrews)

? *Phiomia serridens* ANDREWS AND BEADNELL, 1902, 'Prelim. Note on N. Mamm. from Up. Eoc. of Egypt,' Geol. Mus., Cairo, pp. 3–5 (*pars*),[1] figs. 1, 2 (*non* fig. 3). ANDREWS, 1906, 'Brit. Mus. Cat. Tert. Vert. Fayûm, Egypt,' pp. 170–171, Pl. XVIII, fig. 4.

Palæomastodon beadnelli ANDREWS, 1903, Phil. Transact. Roy. Soc. London, Ser. B, CXCI, pp. 110–113 (*pars*), text-fig. 10–13; 1904, Geol. Mag., Decade V, I, pp. 112–115 (*pars*), text-fig. 2; 1906, 'Brit. Mus. Cat. Tert. Vert. Fayûm, Egypt,' pp. 150–156 (*pars*), Pl. XII, fig. 1, Pl. XIII, fig. 1, Pl. XIV, fig. 2.

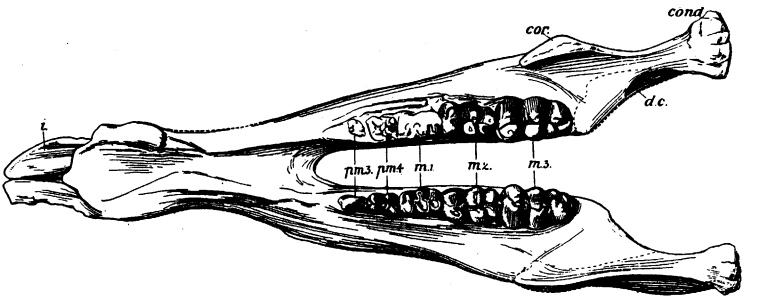

Fig. 23. *Palæomastodon wintoni* Andrews, 1905 = *Phiomia wintoni* (Andrews).

Original type figure. Type specimen, "a mandible with the incisors and posterior molars *in situ*." Brit. Mus. No. M. 8414. One-eighth natural size. Superior view. After Andrews, 1906. Figure inserted by Prof. H. F. Osborn.

Palæomastodon wintoni ANDREWS, 1905, Geol. Mag., Decade V, II, p. 563; 1906, 'Brit. Mus. Cat. Tert. Vert. Fayûm, Egypt,' pp. 156–162 (*pars*), text-figs., 50*B*, 53, 54, Pl. XIV, fig. 3; 1907, Geol. Mag., Decade V, IV, p. 97; 1908, Phil. Transact. Roy. Soc. London, Ser. B, CXCI, pp. 393–407, text-figs. 1 (3), 2, Pl. XXXI, figs. 1–4; Pl. XXXII, figs. 1–4. SCHLOSSER, 1911, Beitr. z. Pal. u. Geol. Österreich-Ungarns u. d. Orients, XXIV, pp. 135–139 (*pars*).

Palæomastodon barroisi PONTIER, 1907, Ann. Soc. Geol. Nord, XXXVI, pp. 150–154 (*pars*),[2] text-fig. 2 (*non* text-fig. 1).

SPECIMENS.—No. 13470; a mandible, bearing all premolars and first and second molars of both sides *in situ*, last molars having not yet erupted; Amer. Mus. Exp. 1907.

No. 13474; a fragment of right mandibular ramus, bearing second and third molars *in situ*, and with roots of all premolars and first molar; Amer. Mus. Exp. 1907, Quarry B.

No. 13476; a right mandibular ramus, bearing last premolar and all molars *in situ*, and with roots of anterior premolar; Amer. Mus. Exp. 1907, Quarry B.

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[1]The paratype (Andrews' fig. 3) of *Phiomia serridens* is merely a hyracoid, as subsequently referred to by Andrews himself.

[2]The last upper molar of Pontier's two cotypes appears to me to belong to the presumed female type of the species.

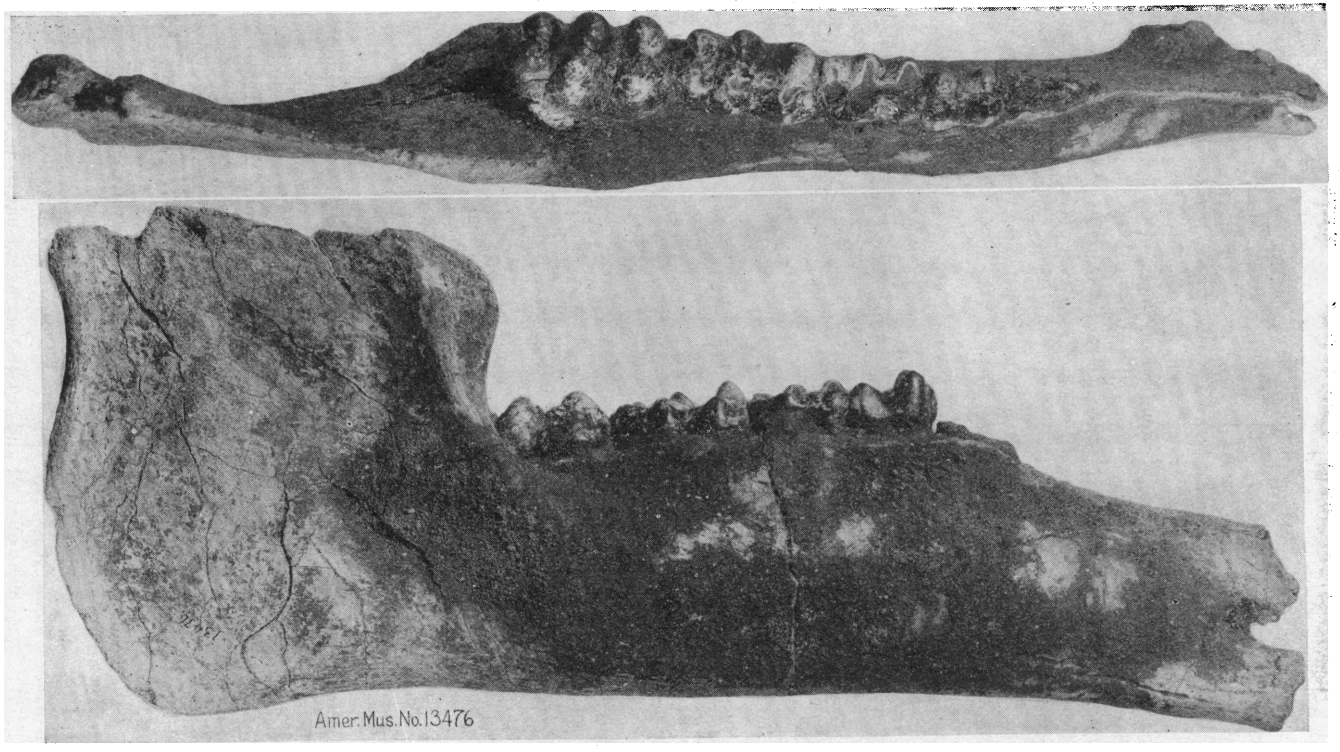


Fig. 24. *Phiomia wintoni* (Andrews).

Right ramus of mandible. Amer. Mus. No. 13476. One-third natural size. Upper figure, superior view. Lower figure, external view.

No. 13477; a horizontal bar, including part of symphysis, of left mandibular ramus, bearing first and second molars *in situ*, with alveoli of all premolars and first molar; Amer. Mus. Exp. 1907, Quarry B.

No. 13484; a fragment of left mandibular ramus, bearing last premolar and first molar *in situ*, and with roots of anterior premolar; Amer. Mus. Exp. 1907, Quarry B.

No. 13485; a fragment of right mandibular ramus, bearing last molar *in situ;* Amer. Mus. Exp. 1907, Quarry C.

No. 13494; fragment of left mandibular ramus, with part of symphysis, and bearing last premolar and first and second molars *in situ;* Amer. Mus. Exp. 1907, near Quarry B.

Extra No.; a fragment of left lower third molar, attached to a small fragment of mandible; Amer. Mus. Exp. 1907, Quarry B.

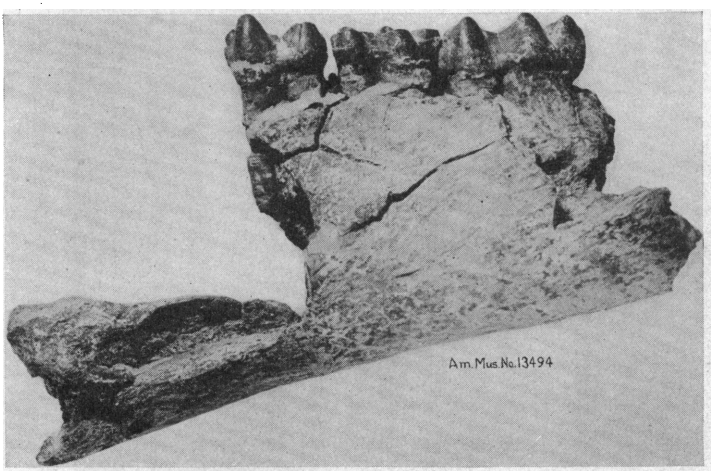


Fig. 25. *Phiomia wintoni* (Andrews).
Portion of left ramus of mandible. Amer. Mus. No. 13494. One-half natural size. External view.

Extra No.; an isolated right lower second molar; Amer. Mus. Exp. 1907, Quarry A.

Extra Nos.; two isolated left lower second molars; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; a fragment of right lower second molar; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; an isolated left lower first molar; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; a crown of embryonic right lower first molar; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; an isolated left lower last premolar; Amer. Mus. Exp. 1907, Quarry A.

Extra No.; an isolated left lower last premolar; Amer. Mus. Exp. 1907, Quarry B.

No. 13450; a fragment of skull and palate, bearing all premolars and molars of both sides *in situ;* Amer. Mus. Exp. 1907.

No. 13451; a fragment of skull and palate bearing all molars of both sides *in*

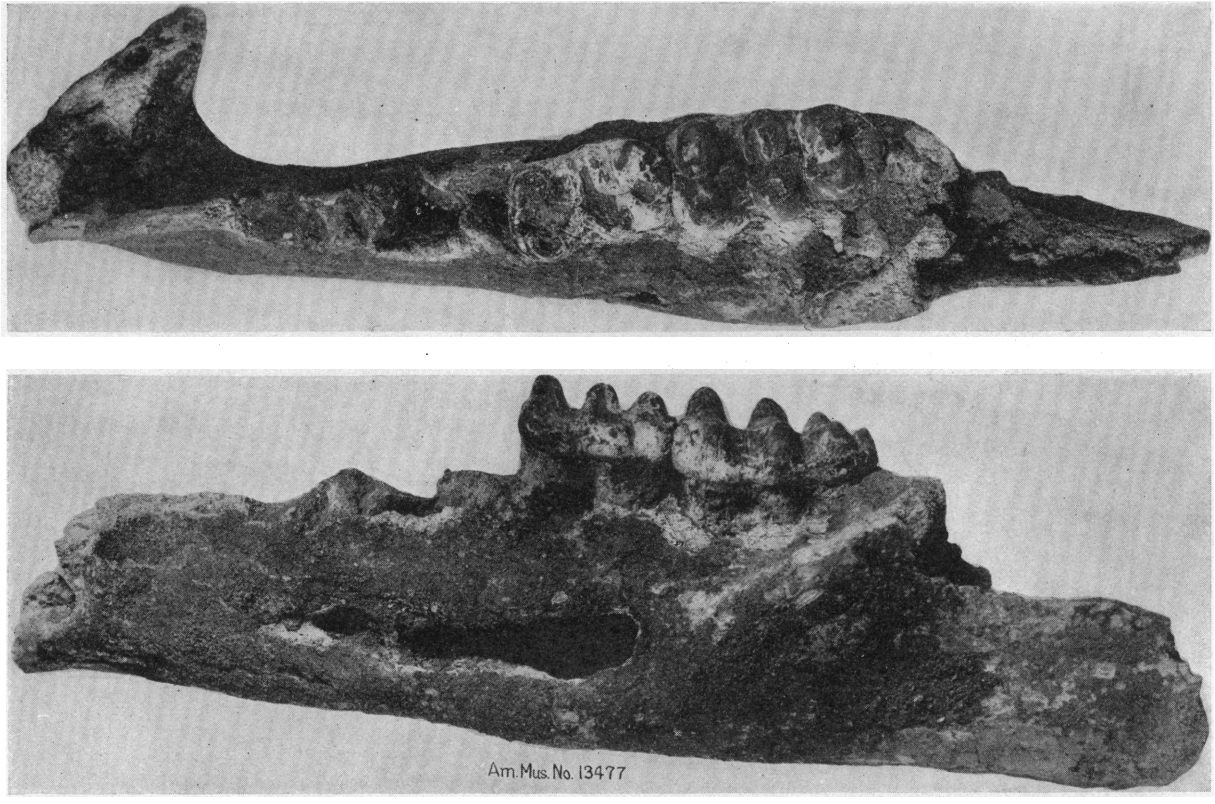


Fig. 26. *Phiomia wintoni* (Andrews).

Portion of left ramus of mandible with symphysis. Amer. Mus. No. 13477. One-third natural size. Upper figure, superior view. Lower figure, external view.

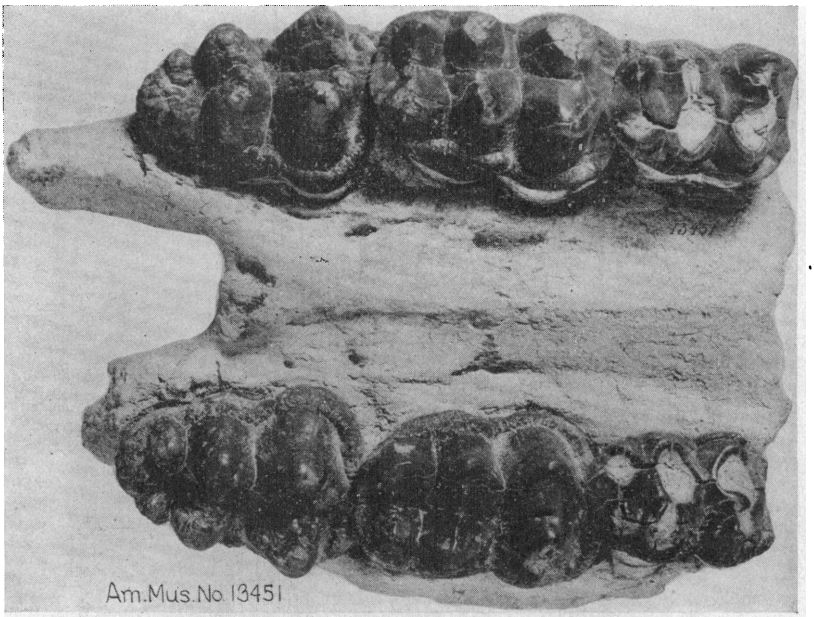


Fig. 27. *Phiomia wintoni* (Andrews).

Portion of skull, including palate. Amer. Mus. No. 13451. One-half natural size. Palatal view.

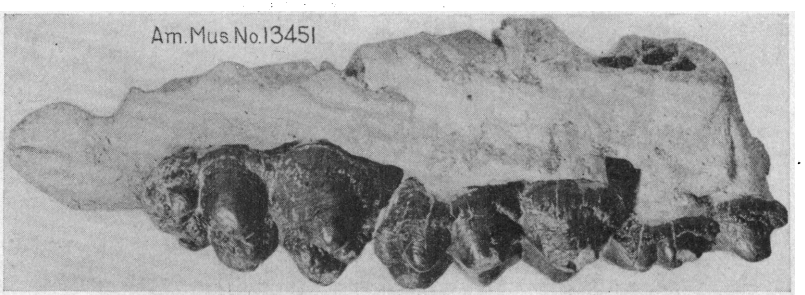


Fig. 28. *Phiomia wintoni* (Andrews).

Palate with molar teeth. Amer. Mus. No. 13451. One-half natural size. External view, right side.

situ; Amer. Mus. Exp. 1907, Quarry A.

No. 13452; a fragment of skull and palate bearing second and third molars of left side *in situ;* Amer. Mus. Exp. 1907, Quarry C.

No. 13453; a fragment of skull and palate bearing last premolar and second molar of left side *in situ,* and with alveoli of first molar of the same side; Amer. Mus. Exp. 1907, Quarry B.

No. 13454; a fragment of skull and palate bearing second and third molars of right side *in situ;* Amer. Mus. Exp. 1907, Quarry B.

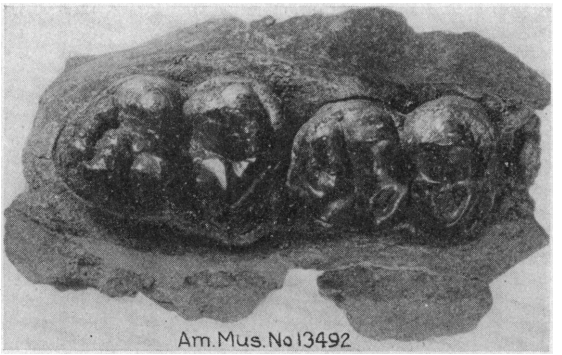


Fig. 29. *Phiomia wintoni* (Andrews).
Fragment of skull, with second and third right upper molar teeth. Amer. Mus. No. 13492. One-half natural size. Palatal view.

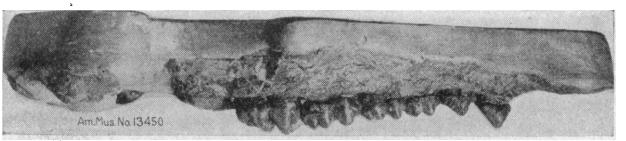


Fig. 30. *Phiomia wintoni* (Andrews).
Portion of skull, with grinding teeth. Amer. Mus. No. 13450. One-sixth natural size. External view, right side.

No. 13456; a fragment of skull and palate bearing last premolar and first and second molars of left side *in situ;* Amer. Mus. Exp. 1907, Quarry A.

No. 13457; a fragment of skull and palate bearing all molars of left side *in situ;* Amer. Mus. Exp. 1907, Quarry A.

No. 13458; a fragment of skull and palate bearing all deciduous molars and first molar of right side *in situ,* the last-named tooth being just on the way to eruption; Amer. Mus. Exp. 1907, Quarry B.

No. 13459; a fragment of skull bearing last molar of right side *in situ;* Amer. Mus. Exp. 1907, Quarry B.

No. 13460; a fragment of upper jaw bearing right third molar *in situ*, which is much weathered; Amer. Mus. Exp. 1907, north of Qasr-el-Sagha.

No. 13479; a fragment of upper jaw bearing penultimate and last premolars and first molar of left side *in situ;* Amer. Mus. Exp. 1907, Quarry B.

No. 13482; upper anterior and next premolar of left side attached to a fragment of upper jaw; Amer. Mus. Exp. 1907; Quarry B.

No. 13488; a fragment of skull bearing second and third molars of left side *in situ;* Amer. Mus. Exp. 1907, Quarry B.

No. 13489; a fragment of skull and palate bearing last premolar and first and second molars of left side *in situ;* Amer. Mus. Exp. 1907, Quarry B.

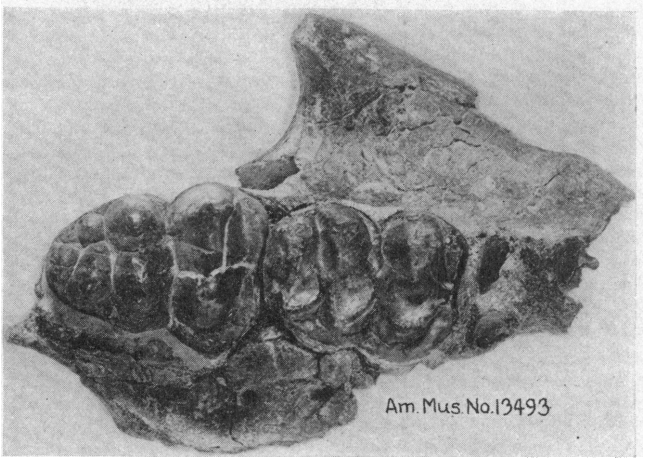


Fig. 31. *Phiomia wintoni* (Andrews).
Fragment of skull containing second and third molars of the right side Amer. Mus. No. 13493. One-half natural size. Palatal view.

No. 13491; a fragment of skull bearing second molar of left side *in situ*, and with roots of third molar and parts of roots of first molar of the same side; Amer. Mus. Exp. 1907, Quarry B.

No. 13492; a fragment of skull and palate bearing second and third molars of right side *in situ;* Amer. Mus. Exp. 1907, Quarry A.

No. 13493; a fragment of skull and palate bearing second and third molars of right side *in situ*, and with alveolus of first molar of the same side; Amer. Mus. Exp. 1907, Alexandria Trail.

No. 13527; a fragment of skull bearing second and third molars and roots of last premolar and first molar of left side *in situ;* Amer. Mus. Exp. 1907, Quarry B.

Extra No.; an isolated right upper third molar; Amer. Mus. Exp. 1907, Quarry A.

Extra Nos.; two isolated left upper third molars; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; a fragment of upper jaw bearing fragmentary left third molar; Amer. Mus. Exp. 1907, Quarry B.

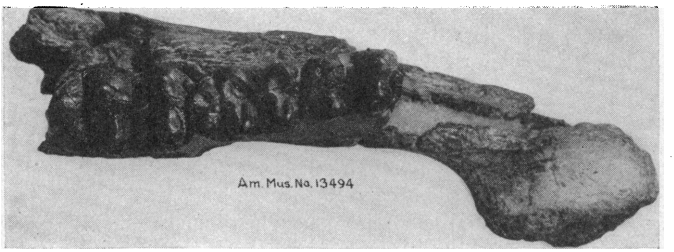


Fig. 32. *Phiomia wintoni* (Andrews).

Portion of left ramus of mandible, with last premolar and first and second molars. Amer. Mus. No. 13494. One-third natural size. Superior view.

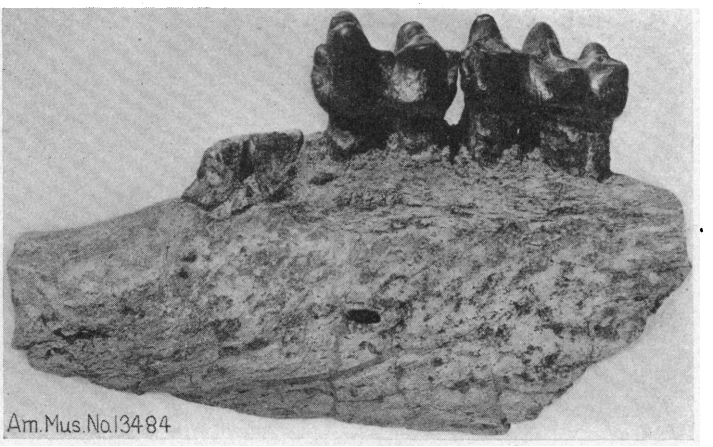


Fig. 33. *Phiomia wintoni* (Andrews).

Portion of left ramus of mandible, containing the last premolar and the first molar. Amer. Mus. No. 13484. One-half natural size. External view.

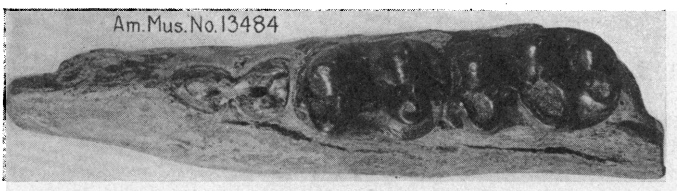


Fig. 34. *Phiomia wintoni* (Andrews).

Portion of left ramus of mandible, containing the last premolar and the first molar. Amer. Mus. No. 13484. One-half natural size. Superior view.

Extra No.; an isolated right upper third molar; Amer. Mus. Exp. 1907, Quarry C.

Extra No.; an isolated right upper third molar; Amer. Mus. Exp. 1907, west of Quarries.

Extra No.; a set of isolated left upper last premolar and first and second molars, all being much weathered; Amer. Mus. Exp. 1907, Quarry B.

Extra Nos.; three isolated upper third molars, two being of right side and one of left side; Amer. Mus. Exp. 1907, Quarry B.

Extra Nos.; two isolated left upper posterior premolars, one of which is fragmentary; Amer. Mus. Exp. 1907, Quarry A.

Extra Nos.; three isolated upper posterior premolars, two being of right side and one of the left side; Amer. Mus. Exp. 1907, Quarry B.

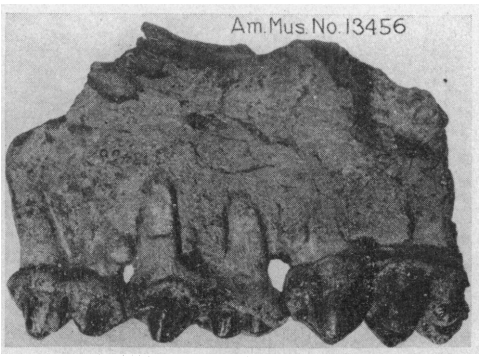


Fig. 35. *Phiomia wintoni* (Andrews).

Fragment of skull and palate containing the last premolar and the first and second molars of the left side. Amer. Mus. No. 13456. One-half natural size. External view, left side.

Extra No.; an isolated right upper penultimate premolar; Amer. Mus. Exp. 1907, 8 miles west of Quarry A.

Extra Nos.; two isolated upper penultimate premolars, one being of right side and the other of left side; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; an isolated right upper penultimate premolar; Amer. Mus. Exp. 1907, Quarry C.

Extra No.; an isolated left upper penultimate premolar; Amer. Mus. Exp. 1907, west of Quarries.

Extra No.; a fragment of upper jaw bearing anterior premolar of left side; Amer. Mus. Exp. 1907, 8 miles west of Quarry A.

Extra Nos.; five isolated upper anterior premolars, one of which being of right side and all the rest of the left side; Amer. Mus. Exp. 1907, Quarry B.

Extra No.; an isolated right upper anterior premolar; Amer. Mus. Exp. 1907, west of Quarries.

The following tusks are provisionally referred to this species according to their large size.

No. 1362[1]; a right lower tusk; Amer. Mus. Exp. 1907, Quarry B;
Extra No.; a fragment of very large right lower tusk; Amer. Mus. Exp. 1907.
No. 13463; a right upper tusk; Amer. Mus. Exp. 1907, Quarry B;
No. 13466; a right upper tusk; Amer. Mus. Exp. 1907, west of Quarry A.
Extra No.; a fragment of left upper tusk; Amer. Mus. Exp. 1907, west of Quarry A.
Extra No.; a fragment of right upper tusk; Amer. Mus. Exp. 1907, Quarry B.
All the specimens: Fluvio-marine formation of the Fayûm, Egypt.

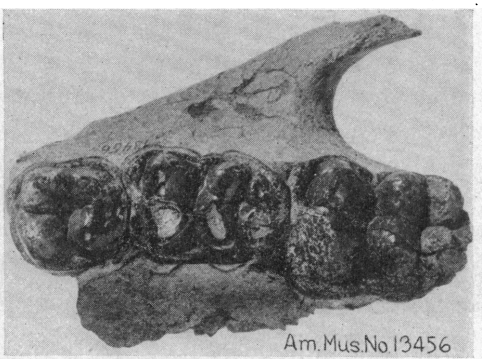


Fig. 36. *Phiomia wintoni* (Andrews).
Fragment of skull and palate containing the last premolar and the first and second molars of left side. Amer. Mus. No. 13456. One-half natural size. Palatal view.

Andrews considers that the type-specimen of *Phiomia serridens* may belong to a very juvenile individual of a smaller species than *Ph. wintoni*, and probably of *Ph. minor*. The mandibular ramus, symphysis, and lower tusk of the type-specimen of *Ph. serridens* are, of course, much smaller than those of the juvenile mandible of *Ph. wintoni*, illustrated by Andrews in his Pl. XXXII, figs. 1–4, 1908. But it must be reckoned here that the former specimen is much younger than the latter, and that the tusk of the former is evidently a milk-tooth, while that of the latter, I consider, very probably represents a very young stage of the permanent tusk. The proper parts of these two mandibles to be reasonably compared must be only the penultimate milk-molars; and these two teeth of these two mandibles appear to be exactly alike in structure and nearly similar in size, although that of the type-specimen of *Ph. serridens* is only very slightly smaller than that of the other specimen.

[1]An error; 1362 refers to a specimen of *Anthracotherium*. 13462 consists of an upper incisor of "*Palæomastodon*." Evidently the reference is to this.—C. C. Mook.

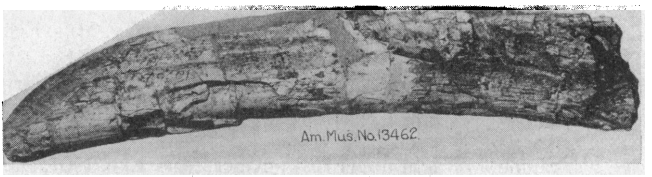


Fig. 37. *Phiomia wintoni* (Andrews).

Right lower tusk. Amer. Mus. No. 13462. One-third natural size. External view.

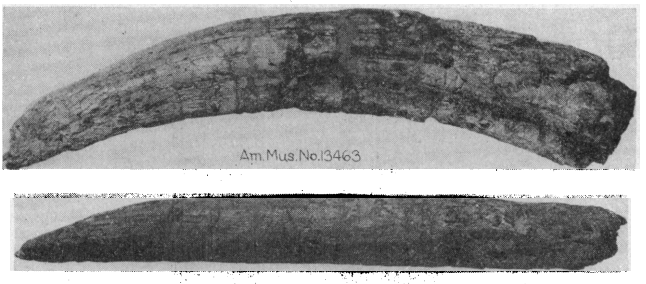


Fig. 38. *Phiomia wintoni* (Andrews).

Right upper tusk. Amer. Mus. No. 13463. One-third natural size. Upper figure, lateral view. Lower figure, superior view.

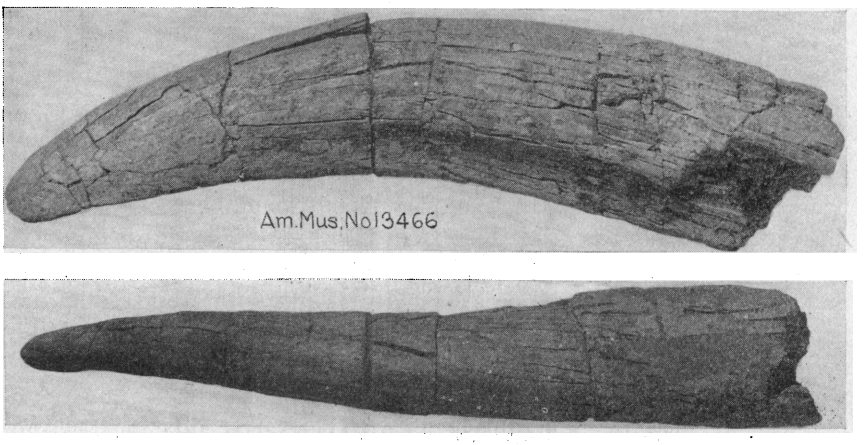


Fig. 39. *Phiomia wintoni* (Andrews).

Right upper tusk. Amer. Mus. No. 13466. One-half natural size. Upper figure, lateral view. Lower figure, superior view.

Table D

	13470	13474	13476	13477	Andrews				
	Young Prob. ♀	Prob. ♀	Prob. ♀	Prob. ♂	Prob. ♂	Prob. ♀	Prob. ♂	Prob. ♂	Very juvenile
Length from Tip of Symphysis to Posterior Side of Angle	470	.....	.....	.....	.....	642	.....	735[2]	.....
Length of Symphysis	152	.....	.....	.....	275[1]	245	270	273	140
Length from Tip of Symphysis to Posterior Side of $M_{\overline{3}}$	.....	.....	.....	.....	545	490	.....	.....	.....
Minimum Antero-posterior Width of Ascending Bar	117	.....	175	.....	.....	.....	.....	185	118
Maximum Width of Anterior Half of Symphysial Region	76	.....	.....	.....	.....	.....	115	.....	55±
Minimum Width at the Constriction of Symphysial Region	65	.....	.....	.....	80±	80	85	90±	.....
Height of Ramus at $P_{\overline{3}}$	63	.....	98	.....	.....	.....	.....	.....	.....
Ditto at $M_{\overline{1}}$	65	95	101	100	.....	.....	.....	.....	.....
Ditto at Anterior Lobe of $M_{\overline{3}}$	.....	90	93	95	.....	.....	.....	100±	.....
Height of Ascending Bar at Condyle	170	.....	210±a	.....	.....	230	.....	238	.....

[1]Misprinted once as "21 cm." and another time as "21.5 cm." in the original reports.
[2]Misprinted as "45.8 cm." in the original report.

Table E

		13470	13474	13476	13477	13484	13485	13494	ex.	ex.	ex.	ex.	ex.	ex.
		Young Prob. ♀	Prob. ♀	Prob. ♀	Prob. ♂		Prob. ♀	Prob. ♂		Prob. ♀	Prob. ♂	Prob. ♀		
$P_{\overline{3}}$	Length	29	.....	.....	.....	....	.....	.....	....	.....	.....	.....	....	....
($Dm_{\overline{3}}$)	Width	14.5	.....	.....	.....	....	.....	.....	....	.....	.....	.....	....	....
$P_{\overline{4}}$	Length	34	.....	36.5	.....	38	.....	40	....	.....	.....	.....	....	....
($Dm_{\overline{4}}$)	Width	24	.....	23	.....	26	.....	25.5	....	.....	.....	.....	....	....
$M_{\overline{1}}$	Length	43	.....	40.5	.....	44	.....	44	....	.....	.....	.....	....	43.5
	Width	26	.....	26.5	.....	27	.....	29	....	.....	.....	.....	....	29.5
$M_{\overline{2}}$	Length	58	54	56.5	59	....	.....	57	....	53	60	55.5	....	....
	Width	33	34	32.5	37	....	.....	36.5	....	34	36	34	34.5	....
$M_{\overline{3}}$	Length	.....	70	69	77	....	69	.....	....	.....	.....	.....	....	....
	Width	.....	37	38.5	44.5	....	38	.....	38.5	.....	.....	.....	....	....
Length of P–M		.....	225±	230±	250±	....	.....	.....	....	.....	.....	.....	....	....
Length of M–M		.....	160±	165	.....	....	.....	.....	....	.....	.....	.....	....	....

Table E (Continued)

		ex.	ex.	ex.	Andrews											
		$M_{\overline{1}}$ embryonic			Prob. ♂	Prob. ♀	Prob. ♀	Prob. ♂	Prob. ♀	Prob. ♀						Prob ♂
$P_{\overline{3}}$ ($Dm_{\overline{3}}$)	Length	.....	....	....	....	27	30	37	31	33	....	....	....	....	....	33
	Width	.....	....	....	....	17	18	....	17	17	....	....	....	....	....	....
$P_{\overline{4}}$ ($Dm_{\overline{4}}$)	Length	.....	37	37	....	37	39	46	34	37	38	....	....	....	....	42
	Width	.....	24.5	24	....	24	26	....	24	25	....	....	....	....	....	....
$M_{\overline{1}}$	Length	44	....	....	....	45[1]	41	50	41	41	43	....	....	....	....	40
	Width	25.5	....	....	....	28	28	30	28	28	....	....	....	....	....	....
$M_{\overline{2}}$	Length	.....	....	....	....	57	56	65	55	55	....	....	....	....	....	61
	Width	.....	....	....	55	35	33	42	35	34	....	....	....	....	....	....
$M_{\overline{3}}$	Length	.....	....	....	35	70	69	....	73	....	....	75	69	75	65	73
	Width	.....	....	....	74	41	40	....	41	....	....	....	....	....	....	....
Length of P–M		.....	....	....	44	....	....	....	....	....	....	....	....	....	....	....
Length of M–M		.....	....	....	....	....	....	....	....	....	....	....	....	....	....	....

[1]Misprinted as "3.5 cm." in the original report.

Table E (Continued)

		Andrews													Andrews
		Prob. ♀	Prob. ♀		Young Prob. ♂							Very juvenile	Prob. ♂	Very juvenile	Type of *Phiomia serridens*; very juvenile[3]
$P_{\overline{3}}$ (Dm$_{\overline{3}}$)	Length	31	29	....	33	....	....	....	....	....	....	.....	33	36 (29.5)[2]	(27)
	Width	....	....	....	.....	....	....	....	....	....	....	.....	20	(14.5)[2]	(13)
$P_{\overline{4}}$ (Dm$_{\overline{4}}$)	Length	34	33	....	40	....	....	....	....	....	....	(42)	41	41 (43)	.....
	Width	....	....	....	.....	....	....	....	....	....	....	.....	29	(21)	.....
$M_{\overline{1}}$	Length	39	37	50	51	42	40	....	....	....	....	.....	42	47	.....
	Width	....	....	....	.....	....	....	....	....	....	....	.....	30	28	.....
$M_{\overline{2}}$	Length	53	54	....	[56?][1]	....	....	58	57	60	....	.....	57	58	.....
	Width	....	....	....	.....	....	....	....	....	....	....	.....	39	.....	.....
$M_{\overline{3}}$	Length	73	....	....	.....	....	....	....	....	....	72	.....	71	.....	.....
	Width	....	....	....	.....	....	....	....	....	....	....	.....	45	.....	.....
Length of P–M		....	....	....	.....	....	....	....	....	....	....	.....	246	.....	.....
Length of M–M		....	....	....	.....	....	....	....	....	....	....	.....	173	.....	.....

[1]Although this measurement is stated by Andrews as "4.6 cm.," it might perhaps be a misprint for "5.6 cm."
[2]These measurements were misprinted as "1.95 cm." and "14.5 cm." respectively in the original report.
[3]This specimen bears also Dm$_{\overline{3}}$ *in situ*, which, according to Andrews' statements, measures 12 mm. and 5 mm. in length and width respectively.

Then there may be some probability that the type-specimen of *Ph. serridens* belongs to a very juvenile individual of *Ph. wintoni*. If any definite specific reference of *Ph. serridens* to either *Ph. minor* or *Ph. wintoni* be actually proved, then the specific name "*serridens*" is naturally to replace that of "minor" or "*wintoni*," according to the law of priority. At present, however, our knowledge of *Ph. serridens* is too incomplete to arrive at any definite conclusion about its specific reference.

The mandibles of specimens Nos. 13470, 13474, 13476 and 13477, in comparison with those described and figured by Andrews, measure as indicated, in millimeters, in Table D, p. 35.

The lower cheek teeth at hand, in comparison with those reported by Andrews, are indicated, in millimeters, in Table E, pp. 36–38.

The lower tusks of specimens No. 13462 and extra-number measure as follows (in mm.).

	13462	Ex.
Straight Length, as Preserved	250	..
Maximum Longest Diameter	44	60
Maximum Shortest Diameter of the Thickening along the Inner Side	21	24

The first specimen more or less approaches in its lower tusks of the mandible the specimen No. 13471, which I have just described under *Ph. minor*, in the maximum longest diameter; but it is decidedly longer than it, appearing to me too long to suit to the symphysis of that mandible, so I am inclined to refer the tusk in question not to *Ph. minor*, but provisionally to the present species. It may be possible that this tusk belongs to the female type, and that of the extra number to the male type of the present species. According to Andrews' statement, the lower tusks of his type specimen measure 52 mm.; those of another mandible, 45 mm.; those of another mandible, 83 mm.; and those of still another mandible, representing a very young stage, 28 mm.[1] The three former of these specimens of Andrews seem to me to belong to the male type. Further, he reported under the present species three isolated lower tusks, which measures 43 mm., 75 mm., and 45 mm. in width respectively.

The fragments of the skulls and palates of specimens Nos. 13450, 13451, 13453 and 13454, in comparison with those described by Andrews, measure as indicated, in millimeters, in Table F. p. 41.

The upper tusks of specimens Nos. 13463, 13466 and extra No. measure as follows (in mm.).

[1]This measurement is stated by Andrews as "1.8 cm." Judging from his figures of this specimen, as well as from his statement of the combined width of the two tusks measuring "6.2 cm.," it evidently is a misprint for "2.8 cm."

	13463	13466 Prob. ♂	ex.
Straight Length, as preserved	250	220	...
Length along Upper Anterior Curve, as preserved	278	236	...
Maximum Longest Diameter	44	50	43
Maximum Shortest Diameter	28.5	31	26

Andrews reported under "*P. beadnelli*" a number of upper tusks, one of which measures 47 mm. and 26 mm.; one, 52 mm. and 35 mm.; and one, 60 mm. and 39 mm. in longest and shortest diameter respectively. At least the second and last ones appear to belong to the male type. Further, he reported one skull of the male type of the present species with upper tusks *in situ* which measure 38 mm. in longer diameter.

The dimensions of the upper cheek teeth at hand, in comparison with those reported by Andrews and by Pontier, are indicated, in millimeters, in Table G, pp. 42–46.

Phiomia osborni, Matsumoto[1]

TYPE.—No. 13468; a nearly complete mandible, bearing all the teeth *in situ;* Amer. Mus. Exp. 1907.

Judging from the large premolars and large last molars, as well as from the large symphysial region and tusks, this mandible might belong to a male. It measures as follows, (in mm.).

	13468 Prob. ♂
Length from Tip of Symphysis to Posterior Side of Angle	640
Length of Symphysis	275
Length from Tip of Symphysis to Posterior Side of $M_{\overline{3}}$	510
Minimum Antero-posterior Width of Ascending Bar	160
Maximum Width of Anterior Half of Symphysial Region	90
Minimum Width of the Constriction of Symphysial Region	84
Height of Ramus at $P_{\overline{3}}$	92
Ditto at $M_{\overline{1}}$	95
Ditto at Anterior Lobe of $M_{\overline{3}}$	90
Ditto of Ascending Bar at Condyle	210

In comparing this mandible with that of specimen No. 13476, which belongs to the supposed female type of *Ph. wintoni*, one may easily recognize the fact that the former is much larger than the latter in the dimensions of the cheek teeth, while the former is distinctly smaller than the latter in the dimensions of the mandibular ramus behind the

[1]Amer. Mus. Novitates No. 51, p. 3, 1922.

Table F

	13450	13451	13453	13454	Andrews				
	Prob. ♂	Prob. ♂	Prob. ♀	Prob. ♀	Prob. ♀	Prob. ♂	Prob. ♀	Poss. ♀	Prob. ♂
Length from Anterior End of Skull to Occipital Condyles	.....	.....	.....	.....	635±a	.....	605	660±a	700
Length of Palate from the Posterior End of Median Suture Line Forward	350	.....	.....	.....	.....	.....	.....	.....	430
Length from Posterior End of Median Suture Line of Palate to Occipital Condyles	.....	.....	.....	.....	.....	231	260	.....	340
Bizygomatic Width	377	.....	.....	.....	420	380	.....	.....	447
Width at External Auditory Openings	.....	.....	.....	.....	322	.....	.....	.....	370
Width Between Inner Ends of Glenoid Fossæ	.....	.....	.....	.....	140	.....	.....	.....	.....
Width of Glenoid Fossa	.....	.....	.....	.....	92	91	.....	.....	97
Distance Between the Two M_1	69	67	2×32 =64	.....	.....	.....	.....	75	.....
Ditto Between the Two M_2	57	53	2×27 =54	2×33 =66	70	56	.....	.....	.....
Ditto Between the Two M_3	47	48	2×28 =56	2×28 =56	.....	.....	.....	.....	88
Lateral Extension of the Two Occipital Condyles	.....	.....	.....	.....	162	170	.....	.....	200
Width of Foramen Magnum	.....	.....	.....	.....	63	70	.....	.....	86
Height from Junction of Basi-occipital and Basi-sphenoid to Saggittal Crest	.....	.....	.....	.....	220	.....	.....	.....	.....
Height of Foramen Magnum	.....	.....	.....	.....	37	45±	.....	.....	.....

Table G

		13450 right	13450 left	13451 right	13451 left	13452	13453	13454	13456	13457	13458	13459	13479	13482	13488
		Prob. ♂		Prob. ♂		Prob. ♀	Prob. ♀	Prob. ♀	Young Prob. ♀	Poss. ♀	Very juvenile Prob. ♀	Prob. ♀	Prob. ♀		Prob. ♀
P^2 (Dm^2)	Length	37	37	....	....	....	....	....	....	....	.....	....	....	35	....
	Width	22	21	....	....	....	....	....	....	....	(12)	....	....	22.5	....
P^3 (Dm^3)	Length	34	34	....	....	....	....	....	....	....	(29)	....	33	32	....
	Width	28	27	....	....	....	....	....	....	....	(20)	....	26	28	....
P^4 (Dm^4)	Length	36	33	....	....	....	32.5	....	31.5	....	(39)	....	31	....	....
	Width	33	30.5	....	....	....	30	....	28.5	....	(25)	....	28	....	....
M^1	Length	43	43	49	49	....	....	....	42.5	42	42.5	....	42	....	....
	Width	37	32.5	35	35	....	....	....	29	33.5	30	....	30.5	....	....
M^2	Length	49	58	65	65	61	58	59	....	57.5	.....	....	....	....	52±
	Width	56	43	46	45	41	39	42	37	43.5	.....	....	....	....	38±
M^3	Length	65	64	63	64	60	....	60	....	61	.....	62	....	....	60
	Width	47.5	51	46	48	42	....	42	....	45.5	.....	43	....	....	43
Length of P–M		265	267	....	....	....	....	....	....	....	.....	....	....	....	....
Length of M–M		163	163	168	168	....	....	....	....	158	.....	....	....	....	....

Table G (Continued)

		13489	13491	13492	13493	13527	ex.	ex.	ex.	ex.	ex.	ex.	ex.
		Prob. ♀	Poss. ♀	Prob. ♀	Prob. ♀	Prob. ♀	Prob. ♂	Prob. ♂	Prob. ♀	Prob. ♀	Prob. ♂	Prob. ♂	Prob. ♀
P^2 (Dm^2)	Length	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Width	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
P^3 (Dm^3)	Length	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Width	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
P_4 (Dm_4)	Length	32	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Width	29	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28.5±
M_1	Length	39	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	26.5
	Width	31	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	46±
M^2	Length	57	61	54	52	55	.....	.....	.....	.....	.....	.....	34.5
	Width	41	42	38.5	40.5	39	.....	.....	.....	.....	.....	.....	54±
M^3	Length	.....	.....	60	56	60	65.5	66	59	59.5	65	65	37±
	Width	.....	.....	44.5	44	45	45.5	46	42.5	.....	46	48	.....
Length of P–M		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Length of M–M		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Table G (Continued)

		ex.	ex.	ex.	ex.	ex.	ex.	ex.	ex.	ex.	ex.	ex.	ex.
$P\frac{2}{}$ ($Dm\frac{2}{}$)	Length	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Width	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
$P\frac{3}{}$ ($Dm\frac{3}{}$)	Length	.....	.....	.....	.....	.....	.....	.....	33	30±	34	33	33
	Width	.....	.....	.....	.....	.....	.....	.....	27	26.5	27	27	7.5
$P\frac{4}{}$ ($Dm\frac{4}{}$)	Length	.....	.....	.....	32.5	34	36	32	.....	.....	.....	.....	.....
	Width	.....	.....	.....	31	.....	30.5	30.5	.....	.....	.....	.....	.....
$M\frac{1}{}$	Length	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Width	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
$M\frac{2}{}$	Length	58	56.5	60	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Width	40.5	40.5±	39.5	.....	.....	.....	.....	.....	.....	.....	.....	.....
$M\frac{3}{}$	Length	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	Width	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Length of P–M		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Length of M–M		.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

Table G (Continued)

		ex.	ex.	ex.	ex.	ex.	ex.	Andrews					
								Prob. ♀	Prob. ♂		Prob. ♀	Prob. ♀	
$P\frac{2}{}$	Length	35	39	36.5	37.5	34	35	.....	40	.....	.....	37	.....
($Dm\frac{2}{}$)	Width	23	23	21	21	20.5	21.5	.....	23	.....	.....	.....	.....
$P\frac{3}{}$	Length	.....	.....	.....	.....	.....	.....	31±	38	.....	30	30	.....
($Dm\frac{3}{}$)	Width	.....	.....	.....	.....	.....	.....	30	29	.....	.....	28	.....
$P\frac{4}{}$	Length	.....	.....	.....	.....	.....	.....	30	38	.....	31	34	.....
($Dm\frac{4}{}$)	Width	.....	.....	.....	.....	.....	.....	30	35	.....	.....	32	.....
$M\frac{1}{}$	Length	.....	.....	.....	.....	.....	.....	39	45	.....	44	45	.....
	Width	.....	.....	.....	.....	.....	.....	31	34	.....	.....	34	.....
$M\frac{2}{}$	Length	.....	.....	.....	.....	.....	.....	55	61	.....	54	63	.....
	Width	.....	.....	.....	.....	.....	.....	39	47	.....	.....	43	.....
$M\frac{3}{}$	Length	.....	.....	.....	.....	.....	.....	62	61	.....	61	58	.....
	Width	.....	.....	.....	.....	.....	.....	44	51	.....	.....	44	.....
Length of P–M		.....	.....	.....	.....	.....	.....	255±	284	.....	.....	255±	.....
Length of M–M		.....	.....	.....	.....	.....	.....	155	170	157	156	155	145

Table G (Continued)

		Poss. ♀	Young	Very juvenile	Prob. ♂						Pontier	
											Prob. ♂	Prob. ♀
$P^{\underline{2}}$	Length	38	34	(24)	.....	.....	.....	.....	.....	.....	40	.....
($Dm^{\underline{2}}$)	Width	21	.....	(11)	.....	.....	.....	.....	.....	.....	23	.....
$P^{\underline{3}}$	Length	31	32	(29)	37	36	31	33	.....	.....	33	.....
($Dm^{\underline{3}}$)	Width	25	.....	(20)	.....	.....	.....	.....	.....	.....	30	.....
$P^{\underline{4}}$	Length	32	35	(40)	35	.....	.....	35	33	.....	37.5	.....
($Dm^{\underline{4}}$)	Width	31	.....	(23)	.....	.....	.....	.....	.....	.....	33	.....
$M^{\underline{1}}$	Length	42	45	.....	48	.....	.....	.....	44	41	45	.....
	Width	29	.....	.....	.....	.....	.....	.....	.....	.....	36	.....
$M^{\underline{2}}$	Length	56	59	.....	62	.....	.....	.....	.....	58	60	.....
	Width	40	.....	.....	.....	.....	.....	.....	.....	.....	44	.....
$M^{\underline{3}}$	Length	70	.....	.....	.....	.....	.....	.....	.....	.....	70	57
	Width	47	.....	.....	.....	.....	.....	.....	.....	.....	51	40
Length of P–M		272±	.....	.....	.....	.....	.....	.....	.....	.....	275	.....
Length of M–M		170	.....	.....	.....	.....	.....	.....	.....	.....	167	.....

symphysial region. I especially compared these two mandibles because they are nearly of the same age, as indicated by the almost similar degree of wearing of the cheek teeth. The same relation in size appears to hold true also in the comparison of the present mandible with one described by Andrews and illustrated in his text-fig. 54, which also belongs to the supposed female type of *Ph. wintoni*, though the latter appears to be slightly older than the former. A comparison in size of the present mandible with that of the specimen No. 13476 is made as follows (in mm.).

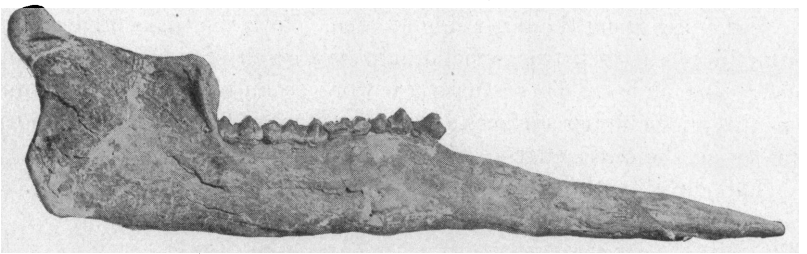


Fig. 40. *Phiomia osborni* Matsumoto.
Original type figure. Type specimen. Amer. Mus. No. 13468. One-seventh natural size. External view, right side.

	13468 *Ph. osborni* Prob. ♂	13476 *Ph. wintoni* Prob. ♀
Length of Premolar and Molar Series	255 250	230±
Length of Molar Series	180 177	165
Length from the Anterior Mental Foramen to Posterior Side of Angle	450	475
Length from Anterior Side of $P_{\overline{3}}$ to Posterior Side of Angle	395	395±
Length from Posterior Side of Symphysial Region to Posterior Side of Angle	385	425±
Minimum Antero-posterior Width of Ascending Bar	160	175
Height of Ascending Bar at Coronoid Process	163	185
Minimum Height of Coronoid Process	158	183
Height of Symphysial Region at Posterior Side of Anterior Mental Foramen	67	76
Height of Ramus at $P_{\overline{3}}$	92	98
Ditto at $M_{\overline{1}}$	95	101
Ditto at Anterior Lobe of $M_{\overline{3}}$	90	93

Thus the supposed male type of the present species appears to be smaller than even the supposed female type of *Ph. wintoni* of almost similar age in the size of the mandibular ramus behind the symphysial

region. This species was very probably less bulky than *Ph. wintoni*. If my identification of the sex of this type mandible be erroneous, then the difference of this species from *Ph. wintoni* in dental characters should be much greater than that expected under the present identification.

The left lower tusk of this type mandible protrudes about 58 mm. from the anterior end of the symphysis, and the right one about 83 mm. from the same; the condition seen in the latter might be due to a secondary displacement of the tooth to a certain extent. They measure 47 mm. in longest diameter at base and 20 mm. in shortest diameter of the thickening along the inner side at base. Both the tusks have each a distinct notch at their tips, which might be a result of wearing in digging and rooting plants. These tusks are worn to an extent of 45–55 mm. from tips on the upper surfaces and to an extent of 95–105 mm. from the same along the outer edges.

The cheek teeth of this mandible measure as follows (in mm.).

		13468 right—left Prob. ♂	
$P_{\overline{3}}$	Length	34.5	34
	Width	18.5	17
$P_{\overline{4}}$	Length	42	43
	Width	27	27
$M_{\overline{1}}$	Length	44	42
	Width	28	26.5
$M_{\overline{2}}$	Length	62	62
	Width	35.5	35.5
$M_{\overline{3}}$	Length	76	73
	Width	41.5	38
Length of P–M		255	250
Length of M–M		180	177

The symphysis extends as far backward as the middle part of the anterior premolars ($P_{\overline{3}}$). At the posterior end of the symphysis there is a prominent median tubercle projected backward; this condition might possibly be unusual.

The lower premolars are comparatively large and long, and the last lower molar is very long and comparatively narrow, though I do not recognize that they are beyond the limit of variation of the lower cheek teeth of the male type of *Ph. wintoni*. The increase in size posteriorly of the series of the cheek teeth seems to be more gradual in this mandible than in the majority of the mandibles of *Ph. wintoni*.

In the last premolar of this mandible, the posterior lobe is distinctly wider than the anterior. *Ph. minor* and *Ph. wintoni* have both types of

the last lower premolar; in one type, the anterior lobe is distinctly wider than the posterior, and in the other type it is just the reverse. In the first molar the posterior lobe is well developed and is almost as wide as, or even slightly wider than, the middle lobe. In almost all the first lower molars at hand of *Ph. minor* and *Ph. wintoni*, the posterior lobe is not so well developed and is distinctly narrower than the middle lobe.

In the second molar of the type, the posterior lobe is very well developed, being distinctly wider than the middle lobe. In all the second lower molars at hand of *Ph. minor* and *Ph. wintoni*, the posterior lobe is much weaker and distinctly narrower than the middle lobe.

The last molar is very long and rather narrow, as already stated, and consists of three lobes and a prominent posterior talon, which forms an imperfect fourth lobe. The posterior talon, or imperfect fourth lobe, consists of two prominent cusps, besides a few smaller crenules. In all the last lower molars at hand of *Ph. minor* and *Ph. wintoni*, the posterior talon is much less prominent than that just observed. The basal cingula of all the molars of this type of mandible are strong, and the intermediate cusps of the same are also well developed.

This species appears to be more progressive than *Ph. minor* and *Ph. wintoni* in the better developed posterior ridge of the first and second lower molars and in the better developed posterior talon of the last lower molar; and to be more archetypal than those species in the more gradual increase in size posteriorly of the lower cheek teeth.

Nothing is yet known about the skull and upper teeth. It is of course possible that some of the fragments of the skulls and some of the upper teeth reported under *Ph. wintoni* may really belong to this species, though it is impossible at present to be certain of this.

III.—SUMMARY AND GENERAL DISCUSSION

Variation of Cheek Teeth

To show the variation in size of the cheek teeth of *Palæomastodon* and *Phiomia*, I have made a number of graphs. In these graphs the length of the teeth is indicated by asymptote and the width of the same by ordinate. One tooth is represented by one dot. Right and left teeth of the same individual are shown by two dots connected by a line; if the two teeth of the same individual be equal both in length and in width, they are shown only by a single dot.

The disadvantage of this method is due chiefly to the following. (1.) The teeth vary in size according to their age and especially to the degree of wear; for instance, embryonic teeth are smaller than full-

grown teeth, and very heavily worn teeth are smaller than those less worn. This disadvantage is especially serious in $M\frac{1}{1}$, because the range in the degree of wear is extremely great in these teeth. In $M\frac{2}{2}$-$\frac{3}{3}$, however, this disadvantage is less serious, so far as we admit only one case, that the last lower molar of Andrews's type of *Ph. minor* is embryonic so as to be unusually small. (2.) There are personal errors in taking measurements. This disadvantage might be serious in those branches of study which need strict accuracy, such as human anatomy or physical anthropology. In palæontology, and especially that of large animals like the Proboscidea, such strict accuracy may not be needed, though, of course, the more accurate, the better.

The Indications in the Tables

Blank dots: teeth of *Palæomastodon.*

Black dots: teeth of *Phiomia.*

Round dots: the writer's measurements of the material of the American Museum.

Triangular dots: Andrews's and Pontier's measurements.

A: *Palæomastodon beadnelli.*

B: *Palæomastodon intermedius.*

C: *Palæomastodon parvus.*

D: *Phiomia osborni.*

E: *Phiomia wintoni.*

F: *Phiomia minor.*

m: Supposed male type.

f: Supposed female type.

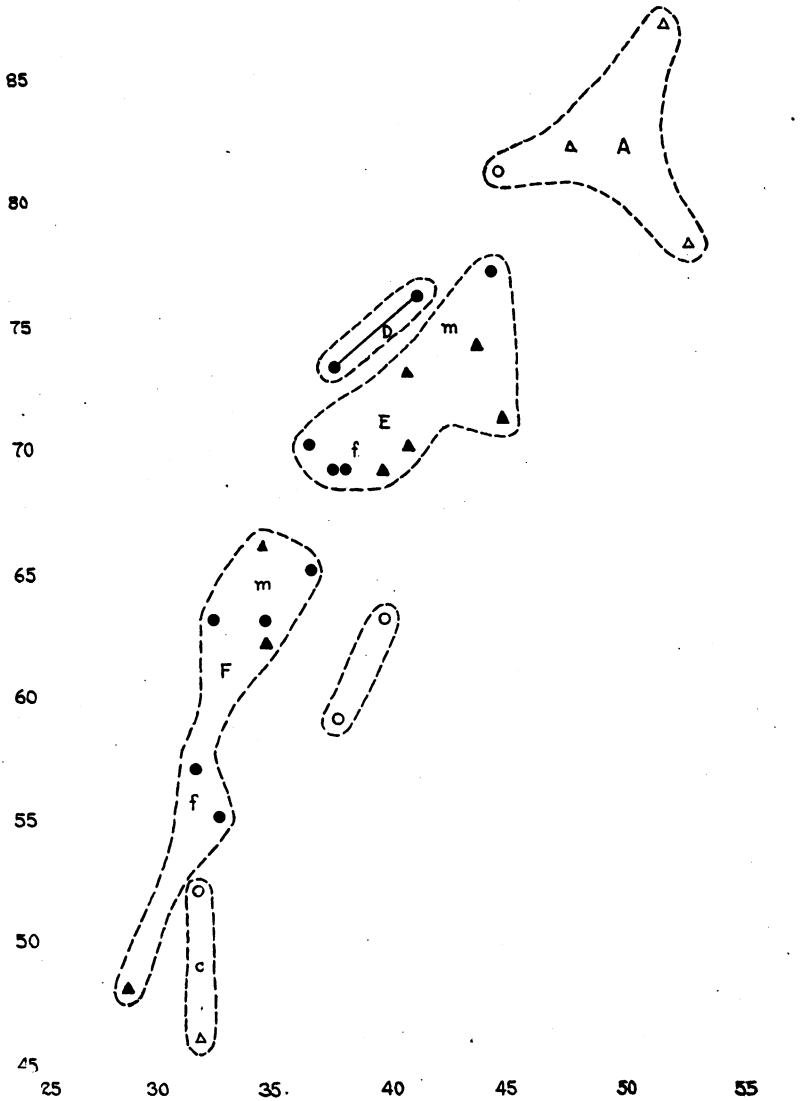


Fig. 41. Diagram indicating variations in size of $M_{\overline{3}}$.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli; B, Palæomastodon intermedius; C, Palæomastodon parvus; D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor. m,* Supposed male type; *f,* supposed female type.

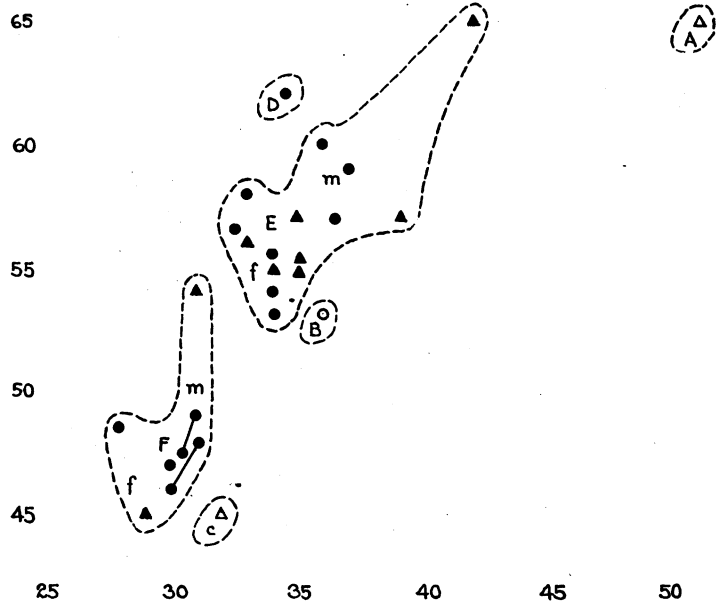


Fig. 42

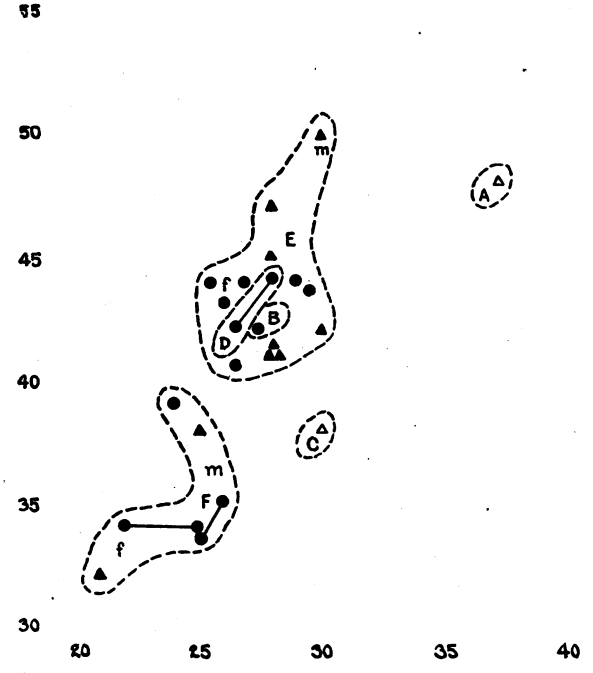


Fig. 43

Fig. 42. Diagram indicating variations in size of $M_{\overline{2}}$.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli. B, Palæomastodon intermedius; C, Palæomastodon parvus; D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor. m,* Supposed male type; *f,* supposed female type.

Fig. 43. Diagram indicating variations in size of $M_{\overline{1}}$.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli; B, Palæomastodon intermedius; C, Palæomastodon parvus; D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor. m,* Supposed male type; *f,* supposed female type.

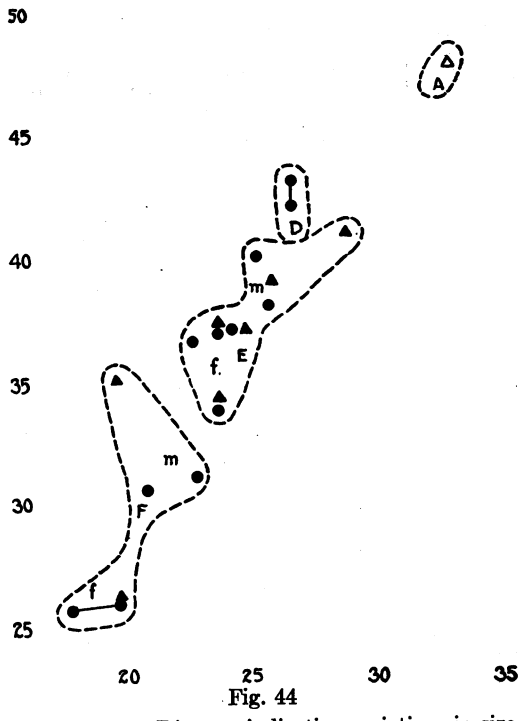


Fig. 44

Fig. 44. Diagram indicating variations in size of $P_{\frac{4}{4}}$.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli; B, Palæomastodon intermedius; C, Palæomastodon parvus; D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor.* *m*, Supposed male type; *f*, supposed female type.

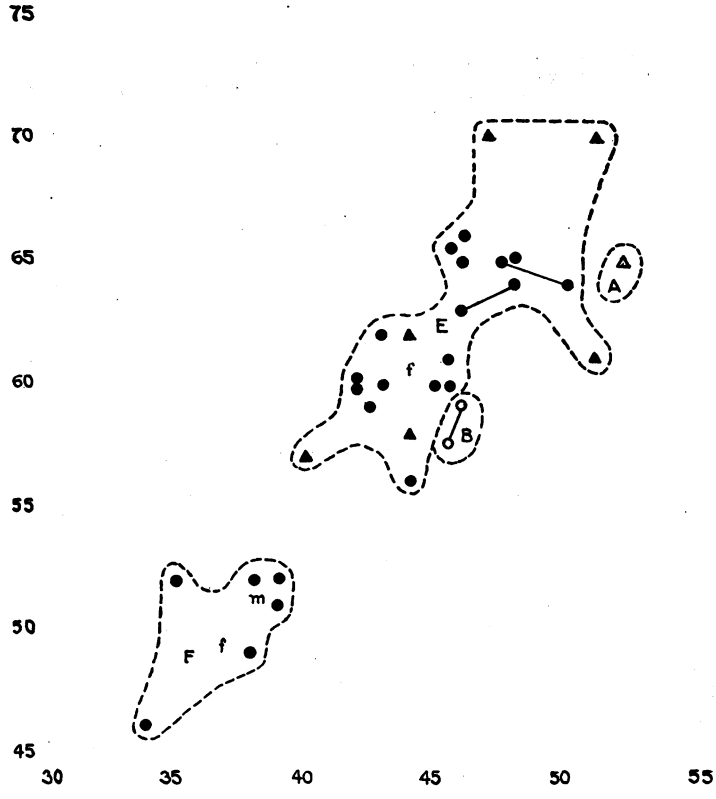


Fig. 45

Fig. 45. Diagram indicating variations in size of $M^{\frac{3}{3}}$.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli; B, Palæomastodon intermedius; C, Palæomastodon parvus: D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor.* *m*, Supposed male type; *f*, supposed female type.

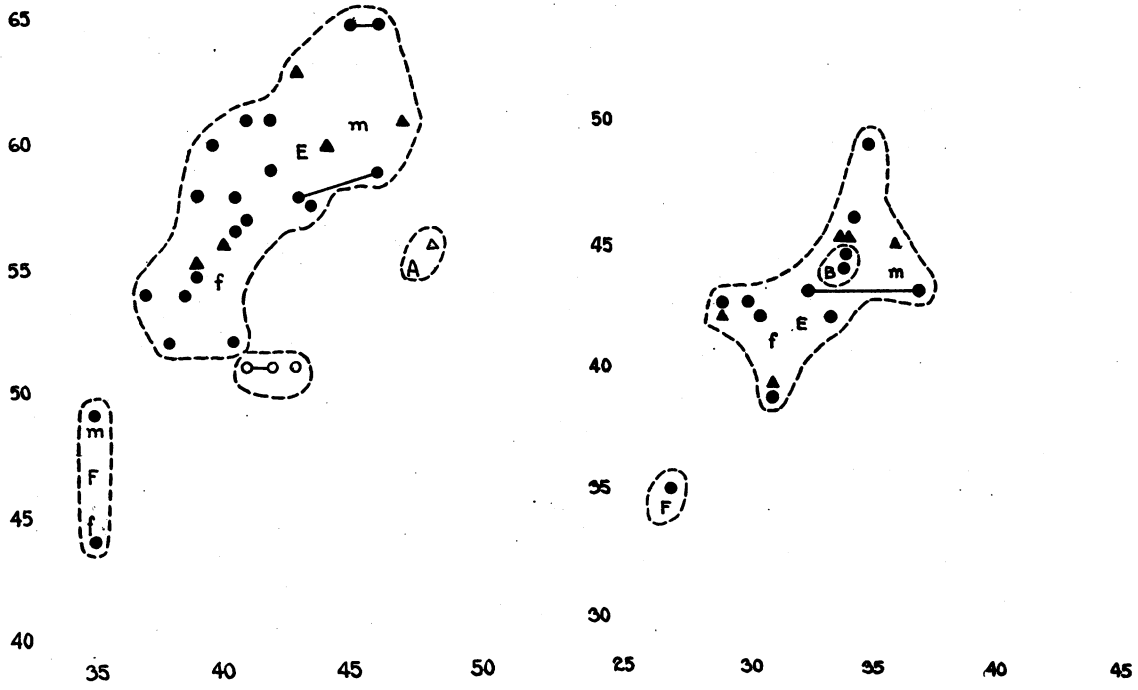


Fig. 46 Fig. 47

Fig. 46. Diagram indicating variations in size of M^2.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli; B, Palæomastodon intermedius; C, Palæomastodon parvus; D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor. m,* Supposed male type; *f,* supposed female type.

Fig. 47. Diagram indicating variations in the size of M^1.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli; B, Palæomastodon intermedius; C, Palæomastodon parvus; D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor. m,* Supposed male type; *f,* supposed female type.

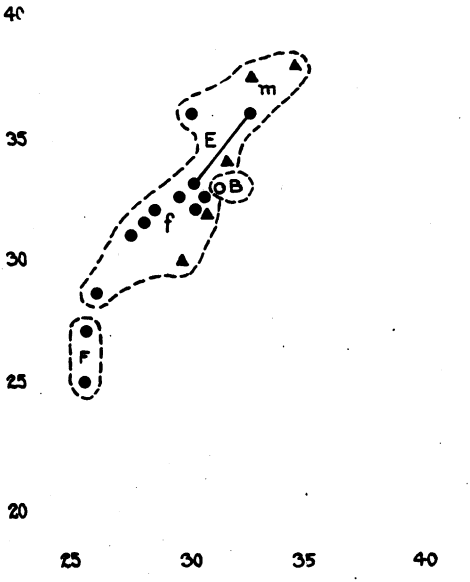


Fig. 48. Diagram indicating variations in size of $P\frac{4}{}$.

Blank dots = teeth of *Palæomastodon;* black dots = teeth of *Phiomia;* round dots = the writer's measurements of the material of the American Museum; triangular dots = Andrews' and Pontier's measurements. *A, Palæomastodon beadnelli; B, Palæomastodon intermedius; C, Palæomastodon parvus; D, Phiomia osborni; E, Phiomia wintoni; F, Phiomia minor. m,* Supposed male type; *f,* supposed female type.

Suggestion as to the Phylogeny of Earlier Proboscidea

A number of the differences observed to exist between *Palæomastodon,* as just restricted above, and *Phiomia,* as just revised above, appear to be parallel with those between *Zygolophodon-Mastodon, s.s.,* and *Trilophodon-Megabelodon.* Further, a number of the characters of *Palæomastodon* in contrast to *Phiomia* appear to be represented also in *Mœritherium.* The more important characters with regard to the present question can be enumerated as follows.

(1.) The skull of *Palæomastodon* is not yet clearly known; but, judging from the shape of the palate, it may probably be more short-skulled than *Phiomia,* which is distinctly long-skulled. The skull of *Zygolophodon* of the European Vindobonian is not yet clearly known; *Mastodon* is distinctly short-skulled, while both *Trilophodon* and *Megabelodon* are distinctly long-skulled. *Mœritherium* is distinctly short-skulled, quite unlike *Phiomia.*

(2.) The palate of *Palæomastodon* is very wide in comparison with the length of the cheek teeth, while that of *Phiomia* is rather narrow. That of *Zygolophodon* of the European Vindobonian is not yet known;

that of *Mastodon* is very wide, while those of *Trilophodon* and *Megabelodon* are distinctly narrow. That of *Mœritherium* is neither very wide nor very narrow.

(3.) The mandibular symphysis of *Palæomastodon* appears to be, most probably, rather short, while that of *Phiomia* is very long. That of *Zygolophodon* of the European Vindobonian is not yet known; that of *Mastodon* is short, while those of both *Trilophodon* and *Megabelodon* are extremely long. That of *Mœritherium* is short.

(4.) The largest and most conspicuous of the anterior mental foramina lies, in *Palæomastodon*, just below the first cheek tooth ($P_{\overline{3}}$) and far back from the posterior end of the symphysis; and, in *Phiomia*, on either side of the symphysial region and far anterior to both the first cheek tooth and the posterior end of the symphysis. In the last-named genus, another smaller one lies just below the anterior cheek tooth. In *Zygolophodon* of the European Vindobonian, the mental foramina are not yet clearly known; in *Mastodon*, the largest and most conspicuous one of these foramina lies just below the anterior part of the series of the cheek teeth and back from the posterior end of the symphysis, though usually two more foramina, which are smaller, are present anterior to the largest one; while in both *Trilophodon* and *Megabelodon* the condition of the anterior mental foramina is quite similar to that which is observed in *Phiomia*, though the smaller one lies just below the anterior part of the series of the cheek teeth, as the anterior cheek teeth themselves are no more persistent in these genera. In *Mœritherium*, two anterior mental foramina, nearly of equal size, are present on either side of the mandible, either just below the anterior and the penultimate premolars ($P_{\overline{2,3}}$) respectively, or just below the penultimate and the last premolars ($P_{\overline{3,4}}$) respectively. In many short-jawed mastodonts and elephants, the largest and most conspicuous of the anterior mental foramina lies just below the anterior part of the series of the cheek teeth. The position of the largest and most conspicuous of the mental foramina might be correlated with the development of the symphysial region and lower tusks, probably as well as with the development of the lower lip.

(5.) The cheek teeth of *Palæomastodon* are proportionately shorter and wider than those of *Phiomia*. Those of *Zygolophodon* and *Mastodon* are also proportionately shorter and wider than those of *Trilophodon* and *Megabelodon*. Those of *Mœritherium* are of proportionately shorter and wider type.

(6.) The cheek teeth of *Palæomastodon* show a lower ridge-formula than those of *Phiomia*. Those of *Zyglolophodon* and *Mastodon* show a

ridge-formula almost similar to those of *Trilophodon*, but a lower ridge-formula than those of *Tetralophodon* and *Megabelodon*. Thus the potentiality of getting a higher ridge-formula was lower in the *Zygolophodon-Mastodon* phylum than in the *Trilophodon-Megabelodon* phylum. The cheek teeth of *Mœritherium* show a lower ridge-formula even than those of *Palæomastodon*.

(7.) The cheek teeth of *Palæomastodon* are bunolophodont, attaining a typically lophodont feature when moderately worn; while those of *Phiomia* are typically bunodont. Those of both *Zygolophodon* and *Mastodon* are lophodont; while those of *Trilophodon*, *Tetralophodon*, and *Megabelodon* are bunodont. Those of *Mœritherium* are bunolophodont, attaining a typical lophodont feature when moderately worn.

(8.) In the cheek teeth of *Mœritherium*, *Palæomastodon*, *Zygolophodon* and *Mastodon* no trefoil pattern of cusps is developed; while in those of *Phiomia*, *Trilophodon*, *Tetralophodon*, and *Megabelodon* a trefoil pattern of cusps is well developed.

(9.) In the cheek teeth of *Mœritherium*, *Palæomastodon*, *Zygolophodon*, and *Mastodon* the ridges are not very thick antero-posteriorly, the valleys are widely open, and even the walls and bottoms of the valleys are worn since very early stages of wearing; while in those of *Phiomia*, *Trilophodon*, *Tetralophodon*, and *Megabelodon* the ridges are very thick antero-posteriorly, the valleys are not so widely open, and the worn surface is almost even.

(10.) In the cheek teeth of *Mœritherium*, *Palæomastodon*, *Zygolophodon*, and *Mastodon*, the surface of the enamel is rather smooth; while in those of *Phiomia*, *Trilophodon*, *Tetralophodon*, and *Megabelodon* the same is very rough.

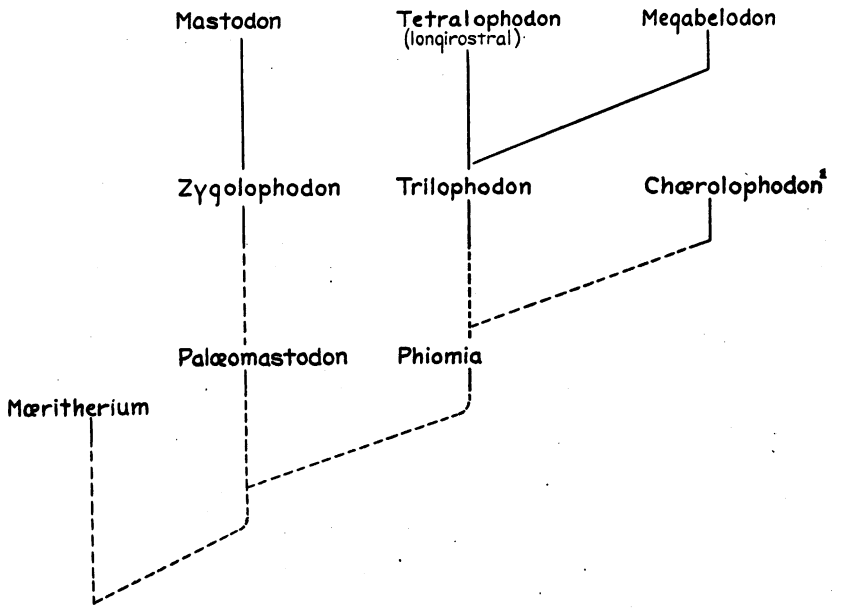
(11.) The basal cingula of the cheek teeth are more or less strong in *Mœritherium;* rather feeble in *Palæomastodon*, *Zygolophodon*, and *Mastodon;* and very strong and rough in *Phiomia*, *Trilophodon*, *Tetralophodon*, and *Megabelodon*.

Judging from these facts, *Phiomia* appears to me to have nothing to do with the ancestry of the *Zygolophodon-Mastodon* phylum, while *Palæomastodon* appears nearly to correspond to a theoretical ancestral type of this phylum.

Again, judging from these facts and others, *Palæomastodon* stands structurally between *Mœritherium* and *Phiomia*. Then, do the three genera, *Mœritherium*, *Palæomastodon* and *Phiomia*, form together a fair evolutionary phylum? It is their stratigraphical occurrence that is against such a view, the first occurring in both the Qasr-el-Sagha and

the overlying Fluvio-marine formations, and both the second and third occurring only in the Fluvio-marine formation. If I judge aright, *Mœritherium* might represent the first wave of earlier proboscidian dispersal which arrived in the districts of the Fayûm, while both *Palæomastodon* and *Phiomia* may represent the second wave of the same. Such an explanation is in harmony with the view that *Mœritherium* might correspond to a slightly altered descendant of an ancestral type, or a close ally of an ancestral type, of *Palæomastodon*, and *Palæomastodon* might correspond to a little altered descendant of an ancestral type, or a close ally of an ancestral type, of *Phiomia*. *Mœritherium* itself appears not to have yielded its successor, while *Palæomastodon* and *Phiomia* appear to correspond just to the beginnings of the two very great phyla, namely the *Zygolophodon-Mastodon* phylum and the *Trilophodon-Megabelodon* phylum (*Trilophodon-Tetralophodon* phylum in the Old World), respectively.

In my opinion, the phylogenetic relationship of the genera just referred to, can be diagrammatically shown as follows:



[1]This genus is practically a *Trilophodon* with polymastodont cheek teeth; besides the genotype "*Mastodon*" *pentelici* of Pikermi of Greece and Maragha of Persia, it appears to me also to include "*Mastodon*" *pandionis* of the Gaj and Lower Siwaliks of India, as well as of China. The Gaj form was once erroneously stated as "*Mœritherium*?" by Pilgrim.