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Article IX.

NEW REMAINS OF TRILOPHODONT-TETRABELODONT MASTODONS

By Childs Frick

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FOREWORD

This paper presents a catalogue of additional remains of Rhynchotherine, Longirostrine, and Brevirostrine mastodonts and elephants from the Late Tertiary and Quaternary of America and includes the preliminary descriptions of six new genera or subgenera and twelve species or subspecies. Continued exploration must vastly increase the present available data. The new evidence was secured by the writer's field parties since the publication in 1926 of "Tooth Sequence in Certain Trilophodont Tetrabelodont Mastodons." The collection now includes some 400 catalogue numbers. The listing of this evidence forms the writer's second contribution to the amassed information being assembled by Professor Osborn as the basis of his great Memoir on the Proboscidea.

Tertiary Proboscidea, together with a tendency to adhesion to a few well-defined molar patterns and elongation of the posterior cheek teeth with attendant sacrifice of the more anterior teeth, exhibit an extraordinary inconstancy in the form of the symphysial area of the mandible. This inconstancy, the result, perhaps, of feeding adaptations and concomitant variation in the superior and inferior tusks, affords a possible means for summary grouping and contrasting of the known evidence. The extremes of symphysial and tusk form attained by different Proboscidean groups and the range of individual and sexual variation should long offer a fascinating field for exploration and study.

For the purpose of the present report, the mastodont remains are divided between "Rhynchorostrines,"[1] "Longirostrines" and "Brevirostrines."

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[1]As here used, the "Rhynchorostrines" include in addition to *Rhynchotherium* the new genus, *Blickotherium;* the "Longirostrines" include remains of the four Osborn (1925, Proc. Amer. Phil. Soc., LXIV, p. 23) races:

(a) Longirostrines proper—*Trilophodon* Falconer, (*Ocalientinus*, n.g., *Trobelodon*, n.g., *Tatabelodon*, n.g., *Aybelodon*, n.g., *Amebelodon* Barbour, and [*Eubelodon* Barbour]). Osborn Race V.
(b) Serridentines—*Serridentinus* Osborn, (*Serbelodon*, n.g.). Osborn Race VII.
(c) Tetralophodons—*Tetralophodon* Falconer. Osborn Race VI.
(d) Zygolophodons—[*Miomastodon proavus* (Cope)]. Osborn Race IV;

and the "Brevirostrines" include examples of the three Osborn races:

(e) Brevirostrines (proper)—*Stegomastodon* Pohlig, *Anancus* Aymard. Osborn Race X.
(f) Notorostrines—*Cuvieronius* Osborn, *Cordillerion* Osborn, (*Eubelodon* Barbour, according to H.F.O.). Osborn Race IX.
(g) Mastodons—*Mastodon* Cuvier. Osborn Race III.

Genera in ( ) described since 1925.
Genera in [ ] present writer's arrangement.

The three divisions may be briefly characterized as follows:

(1) "Rhynchorostrines"—symphysis strongly depressed (paralleling *Dinotherium*).

As seen in the new remains:

Both upper and lower tusks banded with enamel.

Upper tusks of oval cross-section and inward rotation, straight to curved and directed downward. Lower incisors laterally compressed, directed downward, upward and forward.

Molars with weak tending single trefoils.

By the writer tentatively considered to include:

Rhynchotherium proper, in which replacement premolars are undeveloped, and

Blickotherium, in which replacement premolars are developed. (Form of superior tusk unknown.)

(2) "Longirostrines"—symphysis variably elongated.

Upper tusks alone with enamel band (usually heavy), of triangular to oval cross-section and outward rotation, and directed downward.

Lower tusks of variable cross-section with tendency to dorsoventral flattening,—being: peg-like, buttress-like to large spatulate, or plate-like. (See *Fig. 13*.)

Molars of "Trilophodont" pattern with single (double unrepresented) trefoils or of "Zygolophodont" pattern (represented only in important Colorado remains); or of "Tetralophodont" pattern as shown in one Texas specimen.

For the purpose of the present report, the Longirostrines are hypothetically subdivided between:

(a) "Sublongirostrines"—symphysis moderate (long versus "Brevirostrines"),

(b) "Longirostrines," proper—symphysis elongate, and

(c) "Superlongirostrines"—symphysis greatly extended.

(3) "Brevirostrines"—symphysis short to extremely short.

Upper tusks with or without enamel, and straight or curving out and upward.

Lower tusks absent to reduced and without enamel.

Molars of "Zygolophodont," of "Trilophodont," of "Tetralophodont" or of "Multilophodont" pattern.

Adhering to the trifold grouping, the new data, which largely are supplementary to the data of the previous paper, are divided in the present report between five interdigitating parts or chapters:

Part I. *Rhynchotherium* of the Uppermost Pliocene deposits of Eden, California (Figs. 1, 3, 22, 23, 37 and 38).

Certain characters of Falconer's genus are first revealed in a unique example of the mandible, partial skull and skeleton of *R. edensis* Nobis, referred.

(Note an m^3 referred to *R. tlascalæ* Osborn, from Sonora, Mexico.)

Part II. *Blickotherium blicki*, n.g. and sp., and *Aybelodon hondurensis*, n.g. and sp., are first described from an Upper Pliocene deposit of Honduras (Figs. 3–5, 13, 18 and 24).

Part III. "Superlongirostrine," "Longirostrine," and "Sublongirostrine" remains from Late Tertiary horizons of New Mexico, Nebraska, Texas, Colorado, and California are referred to eleven genera or subgenera of which four are new, and fifteen species of which some eight are new (Figs. 2, 6–22, 23A–28 and 30–36).

[Note *Serridentinus filholi*, n.sp., from Gers, France.]

Specific, individual, and sex characters are suggested in a largely increased series of skulls, jaws, dental and skeletal remains of forms from the Mio-Pliocene of New Mexico and in certain allied forms from similar horizons of Nebraska, Texas, California, and Colorado (including unique Zygolophodont remains).

These Longirostrine remains are respectively referred as follows:

A. New Mexico
- (1) *Serridentinus productus* (Cope)
  - (1a) *S. productus*, Var.
- (2) (?) *Serridentinus pojoaquensis* Nobis, 1926
- (3) *Trilophodon cruziensis*, n.sp.
- (4) *Ocalientinus ojocaliensis*, n.g. and sp.
- (5) *Trobelodon taoensis*, n.g. and sp.
  - (5a) *T. taoensis*, Var. A.
- (6) *Tatabelodon riograndensis*, n.g. and sp.
- (7) (?) *Amebelodon joraki*, n.sp.

B. Nebraska
- (1) *Serbelodon barbourensis*, n.g. and sp.
- (2) *Trilophodon osborni* (Barbour), ref.
- (3) (?) *Ocalientinus* species
- (4) *Tatabelodon gregorii*, n.sp.
- (5) *Eubelodon morrilli* Barbour, ref.
  - (5a) *E. morrilli*, Var. A.

C. TEXAS
(1) *Serridentinus serridens* (Cope), ref.
(2) *Amebelodon* species
(3) (?) *Tetralophodon* species

D. CALIFORNIA
(1) (?) *Trilophodon barstonis*, n.sp.
(2) Trilophodont species

E. COLORADO
(1) (?) *Amebelodon paladentatus* (Cook), ref.
(2) *Miomastodon proavus* (Cope), ref.

Part IV. "Brevirostrine" mastodont and elephant remains from the Quaternary or Pre-Quaternary are tentatively interpreted as representative of seven genera and some nine species and subspecies as follows (Figs. 12A, 22, 25A, 29, 29A, 37 and 38):

(1) *Stegomastodon nebrascensis* Osborn, ref., from Nebraska.
(2) *Anancus bensonensis* Gidley, ref., from Arizona.
(3) *Cuvieronius humboldti* (Fischer), ref., from Ecuador.
(4) *Cordillerion andium* (Cuvier), ref., from Ecuador.
(5) *Mastodon raki*, n.sp., from New Mexico.
(6) *Mastodon americanus alaskensis*, n.subsp., from Alaska.
(7) *Archidiskodon* species, from New Mexico.
(7a) *Elephas primigenius alaskensis* Osborn, from Alaska.
(7b) *Archidiskodon imperator*, ref., from Nebraska.
(7c) *Archidiskodon imperator*, ref., from Texas.

Part V. Presents additional evidence as to the interesting problem of generic tooth form and sequence in the calf and adolescent individual (Figs. 19–22 and 30–38). The value of the Proboscidian premolars for the purpose of group diagnosis was discussed in 1926, it being shown that in contrast to the Tertiary Longirostrines, with their peculiar adaptation of the typical mammalian tooth sequence, the depressed beaked *Rhynchotherium*, and the much shorter-jawed Pleistocene mastodons and the elephants (with but one known exception) apparently never developed replacement premolars.

The more important of the new specimens are comparatively illustrated in forty-six attached figures prepared under the writer's direction by Miss H. de Berard. The illustrations are confined, with the exception

of four small specimens, to Frick collection material (F:A.M. numbers). The drawings in each case are based on pantographic outlines. For conformity, the skulls and jaws are reproduced at one-sixth, the m_3^3s at one-half natural size, and the deciduous and replacement premolars at natural size. The illustrations (at largest unit scales permitted by page size) depict the marked variations in the symphysial proportions, lengths and cross-sections of the incisors and form of the superior tusks, so well exampled in the material. Aided by the "keys" and tables of comparative measurements, these illustrations obviate in large degree the need of detailed description. The limb elements exhibit a wide range in size but broad unity of character. For the purpose of conserving space, they are unfigured. The forty-six full-page figures may be briefly résuméd as follows:

PARTS I–III. Skulls and mandibles, lateral views.	× 1/6	*Figs. 1, 2, 6–11, 27–28.*
Skulls, palatal views.	× 1/7	*Figs. 12–12C.*
Inferior incisors and superior tusks; cross-sections, etc.	× 1/2, 1/3, 1/6 and 1/8	*Figs. 3, 13–15.*
Mandibles, lateral views.	× 1/6	*Figs. 4, 5.*
Mandibles, dorsal views.	× 1/6	Mature, *Figs. 16–18;* immature, *Figs. 19–22.*
Last molars, occlusal and lateral views.	× 1/2	*Figs. 23–26.*
PART IV. Mandibles, dorsal views.	× 1/6 (teeth × 1/2)	*Figs. 29–29A.*
PART V. Deciduous and permanent premolars.	× 1	*Figs. 30–38.*

The preparation of the material has been carried out in the Frick laboratory. The housing of the collections has been in charge of Mr. Floyd Blair, the dissections have been executed by Mr. Joseph Rooney, and the preparation carried out by the latter and by Messrs. Charles Falkenbach and Charles Hoffman. The detailed measurements of the limbs have been made by Mr. Haakon Dehlin. Mr. Sydney E. Helprin has seen the manuscript through the press. The present mastodont remains of some 300 catalogue numbers[1] were collected by the late Joseph Rak and by Messrs. John C. Blick, Charles Falkenbach, Jackson Wilson, Morris Skinner, and their associates incidental to long continued explorations for evidence as to the camel, horse, rhinoceros, and carnivore forms of the Late Tertiary and Quaternary.

[1]The collection actually contains 365 numbered specimens: Eden, California, 29; Mexico, 1; Honduras, 24; New Mexico, 148; Nebraska, 98; Texas, 8; Barstow, California, 18; Colorado, 11; Arizona, 18; Ecuador, 10. (Not including Alaskan *Mastodon* A.C.–F:A.M. collection, and the etc. skulls and jaws and some 500 detached teeth and skeletal elements of *Elephas* in F:A.M. and A.C.–F:A.M. collections.)

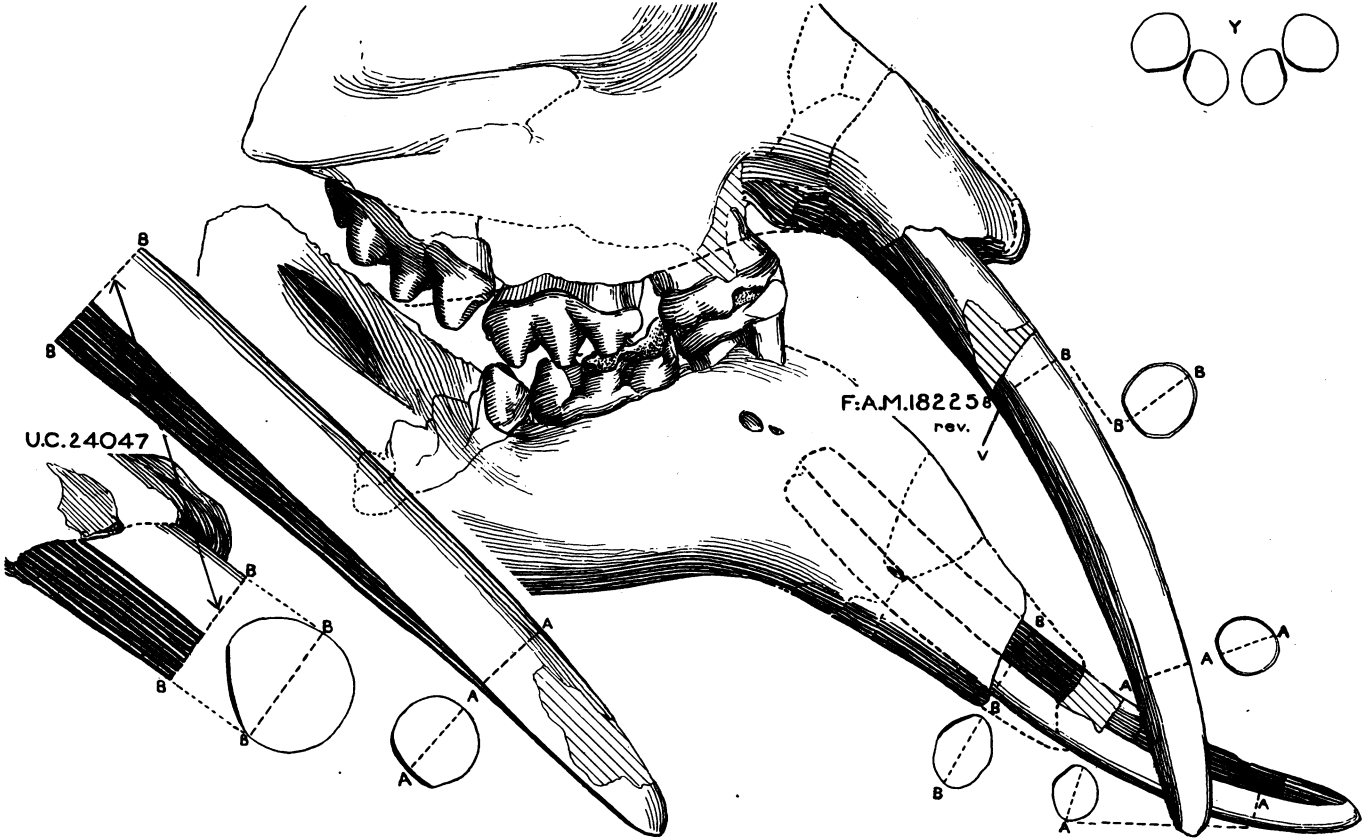

Fig. 1. F:A.M.18225, *Rhynchotherium edensis* Nobis, adolescent neotype (rev.) and U.C.24047, tusk problematically associated with the type specimen, from the Eden Pliocene, California.

× ⅙. AA and BB, cross-sections; Y, occlusion diagram of tusks. (See also Figs. 3, 23 and pages 519, 518.)

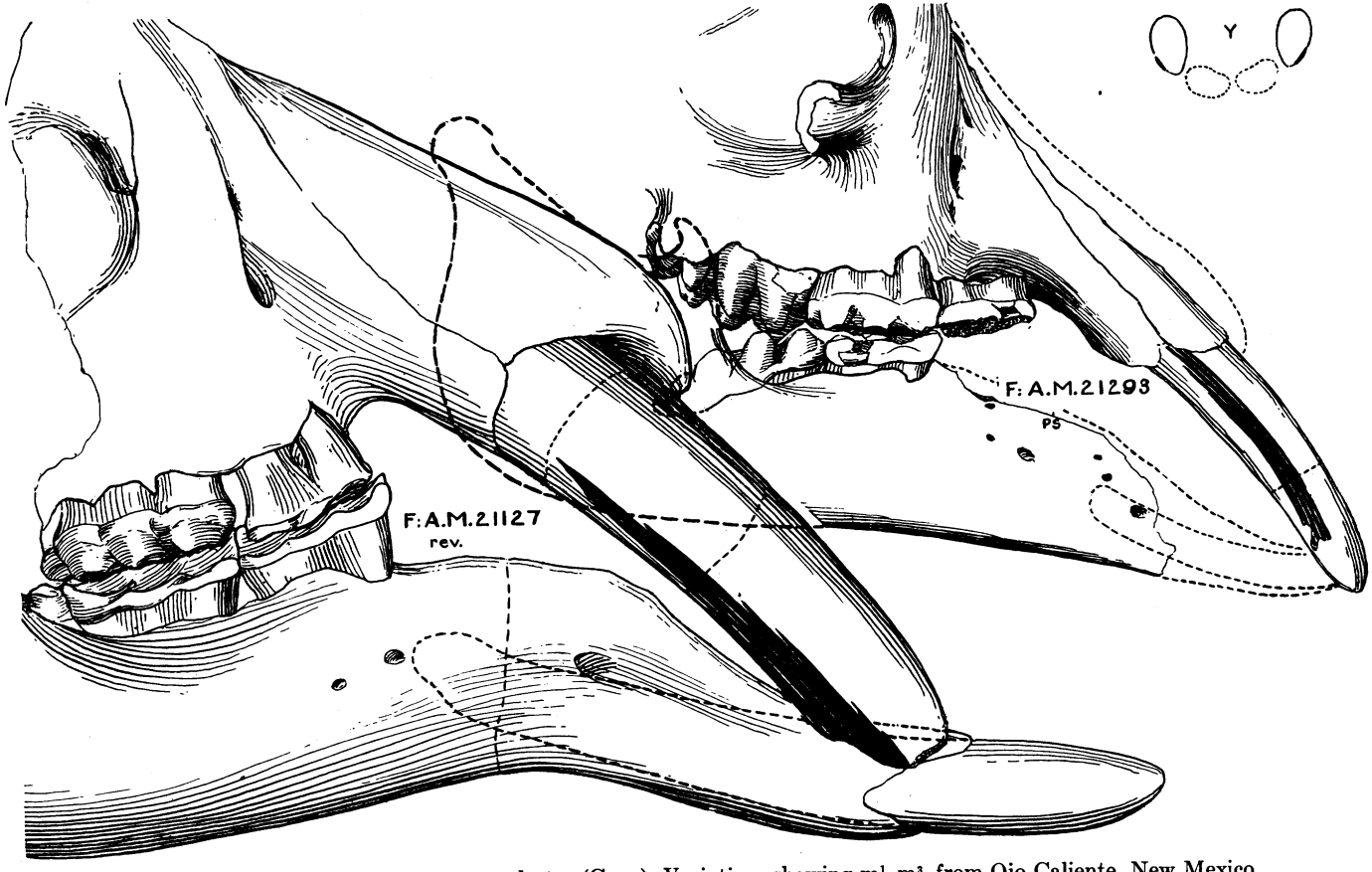

Fig. 2. F:A.M.21293, *Serridentinus productus* (Cope), Variation, showing $m\frac{1}{2}$–$m\frac{3}{3}$, from Ojo Caliente, New Mexico.
× ⅙. Y, occlusion diagram of tusks; PS, posterior border symphysis. (See also Figs. 23A, 25, 26 and page 578.)

F:A.M.21127, *Trobelodon taoensis*, n.g. and sp., genotype, showing $m\frac{2}{2}$–$m\frac{3}{3}$, from Santa Cruz, New Mexico.
× ⅙. Heavy incisors extending beyond posterior border of symphysis, which lies directly inferior to "v" of "rev." (See also Figs. 13, 18 and page 580.)

PART I

Rhynchotherium edensis Nobis

Figures 1 and 23, and (in part) 3, 22, 37 and 38

Statement

A partial skull with complete mandible and dentition (Fig. 1) and limb elements from the Uppermost Pliocene deposits to the east of Mt. Eden, southern California, affords the first evidence of several special characters of the peculiar mastodont genus, *Rhynchotherium*. The presence of *Rhynchotherium* in the Eden deposits was tentatively reported by the writer in 1926 on the evidence of an immature mandible and an immature maxilla with milk dentitions. These specimens were then referred to the Eden species (?) *Rhynchotherium edensis* Nobis, originally (1921) described under *Trilophodon shepardi edensis* Nobis. The type of the latter species consists in a mature palate (F.-U.C.23501) with which was found, in presumed association, a pair of upper tusks (F.-U.C.24047).

The general characters of the unerupted m_3^3 of the new specimen are those of the m^3s of the palate of the type and of other teeth from the Eden beds, and, therefore, seem to corroborate the specific unity of the Eden remains. The extreme slenderness of the superior tusks, combined with the size of the unerupted m_3^3 in the new specimen, as compared to the massiveness of the tusks and more moderate m^3 of the detached tusks and the maxilla of the type specimen, suggest the somewhat equivalent differences in tusk and m^3 size separating certain of the Longirostrine specimens from New Mexico (see Fig. 2). The skeletal elements of the neotype, fortunately enough, include a practically complete representation of the limbs (see measurement table, page 524). While the general interproportions of the elements seem very similar (save in the case of the tibia, which appears slightly shorter relative to the femur) to the interproportions in the Warren mastodon, the various bones of the adolescent Eden specimen are 25 per cent shorter than in the Warren mount.

The new partial skull and mandible are unique in exhibiting the existence of a heretofore unseen adaptation between the upper and lower tusks. This adaptation suggests an hypothesis as to there having been a shear-like action between the respective inferior and externolateral enamel bands of the opposed upper and lower tusks, and the original *raison d'être*, perhaps, of the enamel bands common to the superior incisors of Tertiary mastodonts. The enamel adaptation immediately recalls that of the rodent incisors. The retention of the enamel bands on

the inferior tusks may well be interpreted as a primitive character. Such retention affords a strong indication of the separation since before the Fayum Oligocene of the respective lines of *Palæomastodon-Trilophodon* (in which the lower tusks are enamelless) and of *Rhynchotherium*. An examination of the wear of the opposed tusk surfaces suggests that the upper pair of tusks crossed the lower pair some 6 inches behind the tips of the latter, and thus that the downward directed tips of the upper tusks only slightly cleared the external edges of the lower pair. The worn surfaces indicate that the tip of an upper tusk at times collided with the dorsal surface of a lower tusk and that an upper tusk at times was brought between the lower tusks. The relatively far greater wear of the upper right tusk (Fig. 3) shows that the particular individual was very definitely "right-handed." The study of the surfaces of the opposed pairs of incisors of this new Eden specimen (see Figs. 1 and 3) suggests that *Rhynchotherium* may have subsisted largely on the vegetation of marshes and ponds, its shear-like incisors and depressed mandibular symphysis possibly being adapted to the quick severing of the slimy roots of succulent water-plants.

The interesting manner in which this depressed-beaked genus differs from the earlier appearing and undepressed-beaked Longirostrine mastodonts through the apparent general absence of vertical successors to the milk premolars of both jaws was first observed in the writer's previous study (1926) of the referred immature Eden specimens.

The new specimen, in demonstrating the heretofore unobserved but extremely characteristic opposed curvatures and respectively circular and compressed-oval cross-sections of the upper and lower "defenses," affords a much-needed key to the allocation to the proper jaw of the detached and fragmental tusks of several referred Rhynchothere species. The only other mastodont known to the writer in which the lower tusks are of somewhat similar cross-section, or similarly banded with enamel, is that from Honduras described in the next section under *Blickotherium blicki*, n.g. and sp.

One cannot but marvel at the contrasted adaptations of the presymphysial area exhibited in the:

(1) snub-chinned *Mastodon americanus*,
(2) depressed and almost Dinothere-jawed *Rhynchotherium edensis*,
(3) moderately elongate-symphysised—peg-incisored *Serridentinus productus* and spatulate *Serbelodon barbourensis*, and plate-like-incisored "*Torynobelodon*" *barnumbrowni* or *Platybelodon grangeri*, and
(4) extremely long-symphysised, narrowed and tuskless (?)*Amebelodon joraki* or elongate and spatulate-tusked *Amebelodon fricki*.

The remarkable new Rhynchothere was excavated from deposits to the east of Mt. Eden by Messrs. Joseph Rak and Guy E. Hazen in December, 1931. The Pliocene fossil-bearing deposits of the Eden Springs and Lamb Canyon area were discovered by the late Joseph Rak and the writer in the early winter of 1916–1917. Our investigation of this area was resumed by my companion subsequent to the Armistice, at which time the distal ends of the tusks, which had been found earlier with the *R. edensis* type maxilla, and additional remains of *Rhynchotherium* and other mammals were secured. Güy E. Hazen, some years after the cessation of the writer's field-work in the Eden locality, discovered fossil plant-remains in the Eden area, and placed a representative loan collection of these in the Los Angeles Museum. In December, 1931, while enthusiastically following up his painstaking search for fossil plants, the latter came upon the broken bone fragments that led to Joseph Rak's and his unearthing of the present unusual trophy.

The total shipping weight of this specimen was 1,528 pounds. The new Eden *Rhynchotherium* has been skilfully prepared by Joseph Rooney, the preparation having been particularly difficult on account of the extreme softness of the bone and the flint-like hardness of the matrix.

The mammalian fauna associated with the *Rhynchotherium* of the Eden deposits (Nobis, 1921, 1926, and unpublished MS.) affords the best-known representation of the American Uppermost Pliocene and includes:

Pliohippus (an *Equus*-like species, *P. osborni* Nobis, and more typical *Pliohippus* species, *P. edensis* Nobis).
Teleocerine rhinoceros.
Two or more camel forms, notably the small *Prochenia edensis* Nobis and the huge *Pliauchenia merriami* Nobis.
Antelopine, and
(?) Cervine forms.
Two pigs, *Prosthenops edensis* Nobis and *Platygonus* species.
Two Edentates, (?) *Nothotherium* and (?) *Megalonyx* species.
Hypolagus edensis Nobis.
Feline
Hyænognathine
Hyænarctine (*H. gregorii* Nobis), and
Tremarctine-like (*Plionarctus edensis* Nobis) forms.
Procyonine, and
(?) Plesioguline species.

Dr. Ralph W. Chaney, who kindly has undertaken the study of that portion of Mr. Hazen's plant material which is in our own collection,

reports[1] the presence of eight or more different species, all of which he finds ". . . are closely related or identical to the species recorded by Dorf (Carn. Inst. Wash., Pub. 412, 1930, pp. 1–108) from the Pliocene of California:

Arbutus sp.
Ceanothus chaneyi Dorf
Pinus pieperi Dorf
Platanus paucidentata Dorf
Populus alexanderi Dorf
Quercus hannibali Dorf
Rhus sp.
Salix coalingensis Dorf."

Rhynchothere remains are extremely rare in collections and, following the Eden occurrence, seem to be largely confined to the Uppermost Pliocene. Professor Osborn in his great monograph on the Proboscidea (see MS. most kindly put at the writer's disposition) states that the genus, *Rhynchotherium*, has been correctly reported alone from the North American South and Southwest:

California (Eden and Contra Costa counties)
Mexico
Texas (Blanco)
Nebraska
Kansas, and
(?) Florida.

The known species, with the exception of the Kansas *Rhynchotherium euhyphodon* Cope, where the type consists of a partial maxilla with tusks and associated mandible, have been represented heretofore by only a few partial jaws, detached teeth, and inferior tusks. The laterally compressed lower tusks of the Eden neotype indicate that in the case of *Rhynchotherium shepardi* of California the tusks of the type are definitely of the lower (rather than of the upper) jaw. That considerable dissimilarity existed between certain of the referred species is vouched by an examination

[1] A Preliminary Report on the Eden Fossil Plants

Of the 6 floral elements differentiated by Dorf in the Pliocene flora of California, the riparian element comprising *Platanus paucidentata, Populus alexanderi* and *Salix coalingensis* is the most conspicuous; these 3 species are also the most numerous in the material studied by Dorf. The chaparral element, represented by *Ceanothus chaneyi, Pinus pieperi* and *Rhus* sp., and the broad-sclerophyll element, represented by *Arbutus* sp. and *Quercus hannibali*, are less abundant, and there are no representatives of the more humid elements of the flora as recorded from coastal California.

This flora appears to represent the vegetation in a region where the rainfall was 15 inches or less a year, and where the trees were largely restricted to the borders of streams with chaparral and pines on the slopes above. The modern equivalents of these plants are found today on the landward slopes of the Coast Ranges and in sufficiently moist habitats in the Great Valley of California.

The age of the flora may definitely be placed as Pliocene. All of the species are identical or closely related to those previously recorded in beds of this age in California. The modern aspect of the flora and its indication of a rather cool dry climate, are wholly consistent with this age reference.

Ralph W. Chaney
Letter of December 22, 1932.

of the remains. The combination of characters in the *Rhynchotherium euhyphodon* Kansas type specimen suggests that this form possibly should be regarded as subgenerically distinct from the Eden. Evidence of the occurrence of a divergent species, which in adolescence bore a very Rhynchothere-like mandible, is afforded by the mandible from Honduras described in the succeeding section of this paper.

The Eden mastodont remains, pending definite evidence that more than one form is represented, are referred by the writer to the first-described species, *Rhynchotherium edensis* Nobis. The fact that the type palate belongs to a slightly immature individual (m^3 first crest alone worn) casts some doubt on the question of actual association of the detached tusks, which in their large size might indicate a more aged individual than the type palate (see synonymy and footnote[1]).

Rhynchotherium edensis Nobis

Trilophodon (Tetrabelodon) shepardi edensis FRICK, 1921, Univ. Cal. Pub. Bull. Dept. Geol., XII, No. 5, p. 405.

TYPE A. Portion of palate including the posterior maxillæ with m^3 left and m^3 (br.) right, both m^2s and possibly the detached portions of the premaxillæ with tusks.

Dibelodon edensis (FRICK), OSBORN, 1922, Amer. Mus. Novitates, No. 49, p. 1.

TYPE A. As above.

Anancus edensis (FRICK), HAY, 1923, Pan-Amer. Geol., XXXIX, p. 110.

TYPE A. As above.

(?)*Rhynchotherium (Dibelodon) edensis* FRICK, 1926, Bull. Amer. Mus. Nat. Hist., LVI, p. 169.

TYPE A. As above.

REFERRED (C). Small immature mandible with both tusks and left maxilla of a younger individual.

Rhynchotherium paredensis OSBORN, 1929, Amer. Mus. Novitates, No. 393, p. 6.

TYPE C. As above.

TYPE.—Maxillary portion of skull with last molars (incompletely erupted), m^2, left, and right m^2 (broken); and, questionably, portions of the premaxilla and upper tusks presumably of the same individual.	F.-U.C.23501	Figured by Frick, 1921, Fig. 160 and Pl.L; Osborn, 1922, Figs. A1 and A2.
	F.-U.C.24047	Figured this paper, *Fig. 1.*

[1] Should the mature palate and detached tusks eventually prove to be not only not of one individual but of two distinct forms, the same become respectively the types of:

(A) *Rhynchotherium edensis* Frick and

(B) *Dibelodon* or other genus—

unless the mature maxilla itself should prove to be of a Longirostrine or Brevirostrine rather than Rhynchotherine—when *R. edensis* might become *Trilophodon edensis*. The latter transfer would necessitate the retention of:

(C) *Rhynchotherium paredensis* Osborn

for the referred depressed-beaked immature mandible and immature maxilla, and the present "neotype" specimen. (Compare A–C under synonymy.)

PREVIOUSLY REFERRED MATURE REMAINS: see Nobis, 1926, p. 171.

(Ulna, partial radius, part of fibula and one vertebra, F:A.M.18220, listed in 1926 under 18350.)

PREVIOUSLY REFERRED IMMATURE REMAINS (L. C.):

Immature mandible with left ramus with dp_2–dp_4 and m_1 in germ, and right ramus with alveolus dp_2, dp_3 and dp_4 (dp_4 third crest unerupted).	F:A.M.18216	Figured 1926, Figs. 2, 8. Figured this paper, *Figs. 22, 38.*
Fragment of ramus with dp_3 left and portion of alveolus of dp_2.	F:A.M.18216A	Figured 1926, Figs. 3, 9 Figured this paper, *Fig. 38.*
Left maxilla with dp^2–dp^4 (broken) erupting, and associated dp^3, right (posterior third missing).	F:A.M.18218	Figured 1926, Fig. 18. Figured this paper, *Figs. 22, 37.*

THREE REFERRED SPECIMENS DISCOVERED BY G. E. HAZEN, 1931–1932:

NEOTYPE.—Large portion of anterior skull with complete mandible and dentition, part of scapula, both humeri, ulna-radius and part of radius, both manus, femur, tibia-fibula, left pes, part of pelvis and etc. fragments. (First crests of m_3^3 erupting.)	F:A.M.18225	From southeast part of section 26, Beaumont, Eden horizon, California. Figured this paper, *Figs. 1, 3, 23.*
Portion of mandible with m_1–m_3 (broken). $m_3 = (197)$mm.	F:A.M.18226	From Beaumont, Eden horizon, California. Figured this paper, *Fig. 23.*
(m_1–m_2 resembling neotype, but unerupted m_3 noticeably narrow, i.e., as yet only partially formed.)		
Fragments of upper and lower jaws with m_1^1–m_2^2 and m^3 in germ, and upper and lower tusks in part. $\frac{m^2}{m_2} = \frac{129}{130}$mm.	F:A.M.18227	From center of section 29, second ridge west of Lamb Canyon.

Characters as Observed in the Adolescent Neotype

(a) Beak strongly depressed, the mandible closely approximating in form *Rhynchotherium tlascalæ*, referred (A.M.15550). The depression of the beak is somewhat *Dinotherium*-like.

(b) Upper tusks of circular cross-section and downward curvature, lower tusks laterally compressed and with slight upward and outward curvature. Enamel band placed inferiorly on upper tusks and externally on lower tusks. A similar banding of lower tusks is lacking in *Palæomastodon*, *Trilophodon*, etc., and is known alone to the author in the case of the new genus, *Blickotherium*.

(c) Apparent shear-like action between opposed and angulated enamel edges of upper and lower tusks, and the characteristic carriage of tusks in occlusion (see Fig. 1 and preceding statement).

(d) m^3 of general moderately elongate form, anterior crest broadest and tallest, fourth crest consisting of low tuberculated heel. m^3 in neotype of somewhat slenderer proportions than in referred and previously figured detached m^3, F:A.M.18219D (see Fig. 23)—neotype may represent a female and the detached tooth a male. m_3 broad-proportioned with wide outer basal cingulum, first crest tall and broad, third and small fourth crests notably lower-crowned than second crest, and second crest strongly angulated versus third crest. (m_3 perhaps less elongate relative to m_2 [78 per cent] than in the "Superlongirostrines" and more approximating the proportions in the "Sublongirostrines.") Main tooth valleys tending less blocked than commonly the case in the "Longirostrines."

(e) The apparent absence, at least in *Rhynchotherium edensis*, of replacement premolars already (1926, p. 172) has been discussed.

Condition of Neotype

The carriage of the tusks in the closed jaws, as shown in Figures 1 and 3, has been adjusted, as explained above, according to tusk-wear. The specimen is much crushed and somewhat fractured, exhibiting minor displacements. The skull is missing superior and posterior to the orbits and zygomatic arch. The mandible is complete. m_1^1–m_2^2 are much worn and the anterior crests of m_3^3 are alone erupted (but the posterior crowns have been dissected out). The upper tusks curve for-

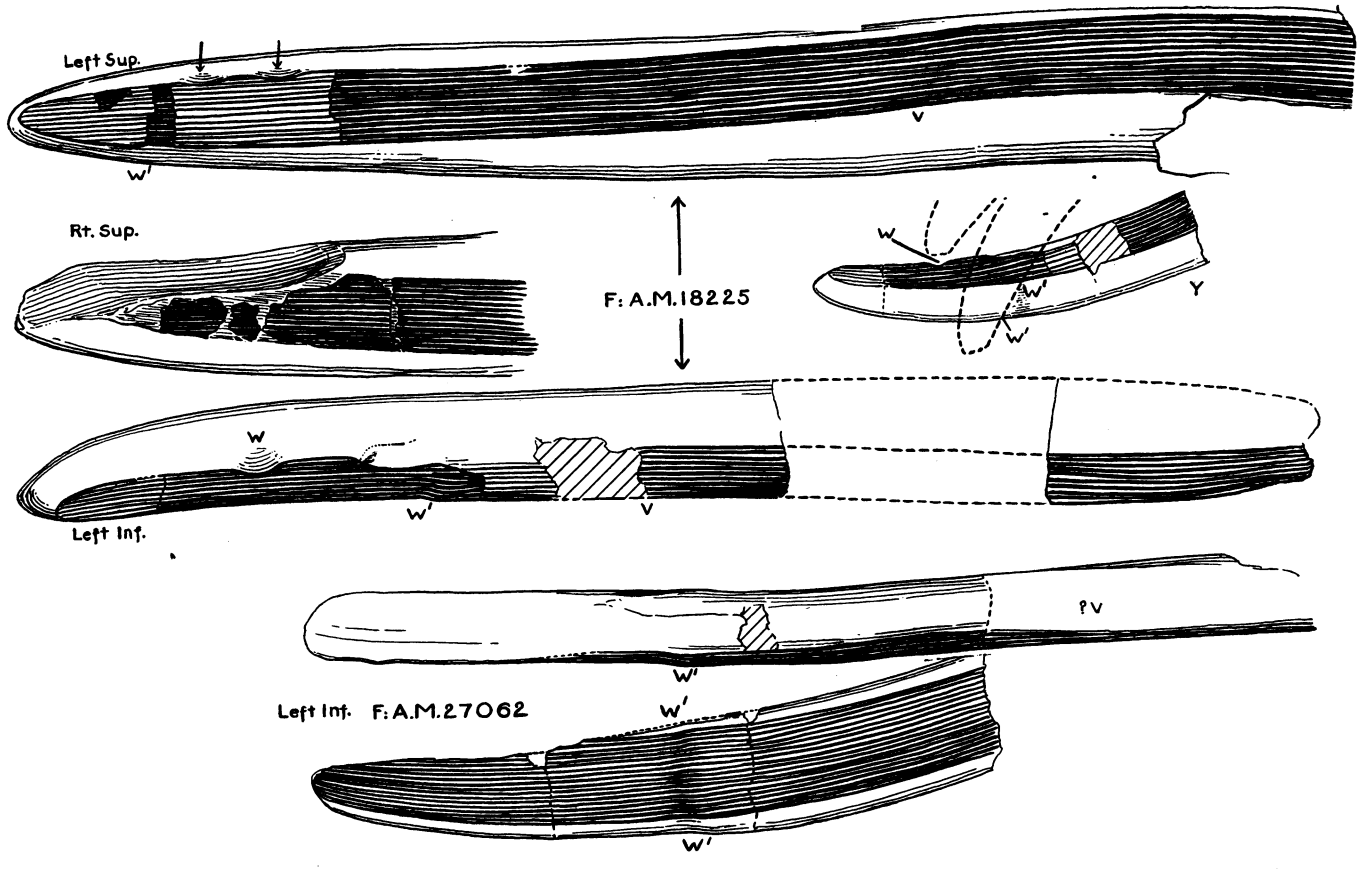

Fig. 3. F:A.M.18225, *Rhynchotherium edensis* Nobis, immature neotype, left and distal end of right upper tusks, inferior view, and left lower tusk, lateral view, from the Eden Pliocene, California.

(See also Figs. 1, 23 and page 519.)

F:A.M.27062, *Blickotherium blicki*, n.g. and sp., genotype, left lower tusk, superior and lateral views, from Honduras.

(See also Fig. 4 and page 529.)

Tusks × ⅛, diagram Y × ⅛. W, anterior and W^1, posterior points of greatest wear; V, probable alveolar line.

ward and slightly downward and have a forward and inward rotation, the twist of the enamel bands appearing to be more strongly inward anteriorly than posteriorly—the same possibly affording a longer and more efficient cutting edge. The downwardly directed lower tusks are curved slightly upward and outward. The right upper tusk, unlike the left (Fig. 3), is deeply worn away anteriorly, the worn area including a section of the enamel band. The animal was evidently "right-handed." The posterior groove on the left upper tusk lies approximately 100 mm., and that of the left lower tusk 170 mm. from their respective tips. The upper enamel band measures 28 mm. in width and tends to narrow slightly posteriorly. The lower band measures 31 mm. and even far within the symphysis tends to retain this width or become slightly broader. (Similar band in Honduras specimen measures 33 mm.) The base of the root of the inferior tusk (see dissection) lies adjacent to the posterior symphysis and the m_1. In *Blickotherium* the much more anterior position of the tusk-root would seem to accompany and parallel the retention of replacement premolars. The anterior position of the tusk-root in the latter possibly may be partially a condition of immaturity, but the tusk-root in both the Eden calf (F:A.M.18216) and the adolescent neotype is far posterior. The surface under the enamel bands in both upper and lower tusks is deeply striated.

The superior tusks of the adolescent neotype (see cross-sections), save for greater curvature and slenderness, seem to be of generally similar form to the detached tusks which may have formed part of the Eden type specimen, F.–Univ. Cal. 23501 and 24047. The greater curvature and slenderness of the tusks in the neotype in this case must be interpreted as due to immaturity, and probably to sex. The tusks in a slightly younger Santa Fé Longirostrine individual, F:A.M.21284, with slightly larger m_2^2, already are of considerably heavier cross-section.

The superior tusks of *Rhynchotherium* differ rather notably from those of *Trilophodon:*

In *Rhynchotherium*, as observed in the neotype, as well as in the problematically associated tusks of the type, the rotation is inward and forward with tendency to an approximation of the tusk-tips. The enamel bands lie somewhat outward at the base but become (directly) inferior at the tips. The cross-section is round-oval. As pointed out by Professor Osborn, the large detached tusks, problematically associated

with the Eden type, have a strong resemblance to *Cordillerion andium.* Similarly, the slender tusks of the neotype more resemble *C. andium* than they do *Trilophodon.*

In *Trilophodon,* the rotation is outward and forward and the tips flare broadly. The enamel bands are proportionately broad but lie more outwardly and do not rotate to the inferior surface. In cross-section the tusks are variably triangular—flattened inwardly (perhaps partly by the trunk) and distally. (See discussion in Part III.)

The prominent premaxillary bosses, which in *Trilophodon* commonly occur superior to the tusks, in the detached tusks of the Eden type specimen lie directly between the tusks, possibly through crushing. (The premaxillary boss, as seen in a specimen of *Cordillerion andium,* apparently is also distorted somewhat through crushing.)

A difference of 10 per cent is noticed between the lengths of several of the longest and shortest m^3s of the Eden collection.

A ten per cent difference likewise exists between the lengths of the radius of the adolescent neotype and the detached radius of a larger individual. The limbs of the adolescent neotype tend to approximate in length those of the Warren mount of *Mastodon americanus.*

COMPARATIVE MEASUREMENTS

	m^3	m_3	
Rhynchotherium edensis, referred, F:A.M.18219B.....	146		
type, F.-U.C.23501.....	150		Figured 1921, Fig. 160.
referred, F:A.M.18219D.....	154		Figured 1926, Figs. 21C, A. Figured this paper, *Fig. 23.*
referred, F:A.M.18219C (br.).	(163)		
referred, F:A.M.18219.....		162	Figured 1926, Fig. 21B.
Rhynchotherium shepardi, referred, A.M.12388.....		162	
Rhynchotherium edensis, neotype, F:A.M.18225.....	(163)	176	Figured this paper, *Figs. 1, 3, 23.*
Rhynchotherium tlascalæ, referred, F:A.M.23339.....		182	

	R. edensis, neotype, F:A.M.18225	*R. tlascalæ*, referred, A.M.15550
m^1	(101) rt.	
m^2	125	
m^3	(163) rt. ((156)) lt.	
m_1	(104)	99
m_2	128	((137))restored
m_3	176	((182))
Post symp. to m_3 pouch	400	396
Post symp. to ins. bord.	((310))	310+
$\frac{m_3}{\text{Post symp.—ins. bord.}}$	57%	59%
$\frac{\text{Post symp.—ins. bord.}}{\text{Post symp.—}m_3\text{ pouch}}$	78%	78%
$\frac{m_2}{m_3}$	73%	75%
Humerus	660	
Radius	500	
Metacarpal 1	70	
2	110	
3	125	
4	110	
5	90	
Femur	860	
Tibia	490	
Metatarsal 1	45	
2	70	
3	85	
4	80	
5	55	

$\frac{\text{Radius}}{\text{Humerus}} = 76\%$ $\frac{\text{Radius}}{\text{Tibia}} = 102\%$

$\frac{\text{Tibia}}{\text{Femur}} = 57\%$ $\frac{\text{Metacarpal 3}}{\text{Humerus}} = 19\%$

$\frac{\text{Humerus}}{\text{Femur}} = 77\%$

(( )) = estimated
See Longirostrine measurements, tables, Part III.

Rhynchotherium tlascalæ Osborn, referred

Mr. John C. Blick in March, 1932, visited Sonora, Mexico, for the purpose of running down the report of the finding of a nearly complete cranium of a mastodont. It was learned that the specimen had been discovered three years previously through the caving-in of a river-bank some miles southeast of Minas Prietas and, being too heavy for removal, had been broken up by the finders in their endeavor to obtain the teeth. All that remained of this specimen at the time of Mr. Blick's visit was the broken m_3 which is listed below.

Rhynchotherium tlascalæ Osborn, 1921, Amer. Mus. Novitates, No. 1, p. 6, Fig. 2-C.

Type.—Cast of left ramus and symphysis of lower jaw with m_3.	A.M.27003 [Cast]	From (?)Tlaxcala, southeast of Mexico City.
Referred.—		
Mandible with m_2–m_3 and incisors; and upper molar.	A.M.15550	Collected by Barnum Brown in 1911, San José de Pinas, Sonora, Mexico. Figured by Osborn, 1921, Fig. 2-C.
Newly Referred Specimen.—		
m_3 (broken).	F:A.M.23339	Collected by John C. Blick, 1932, from Sonora, Mexico.

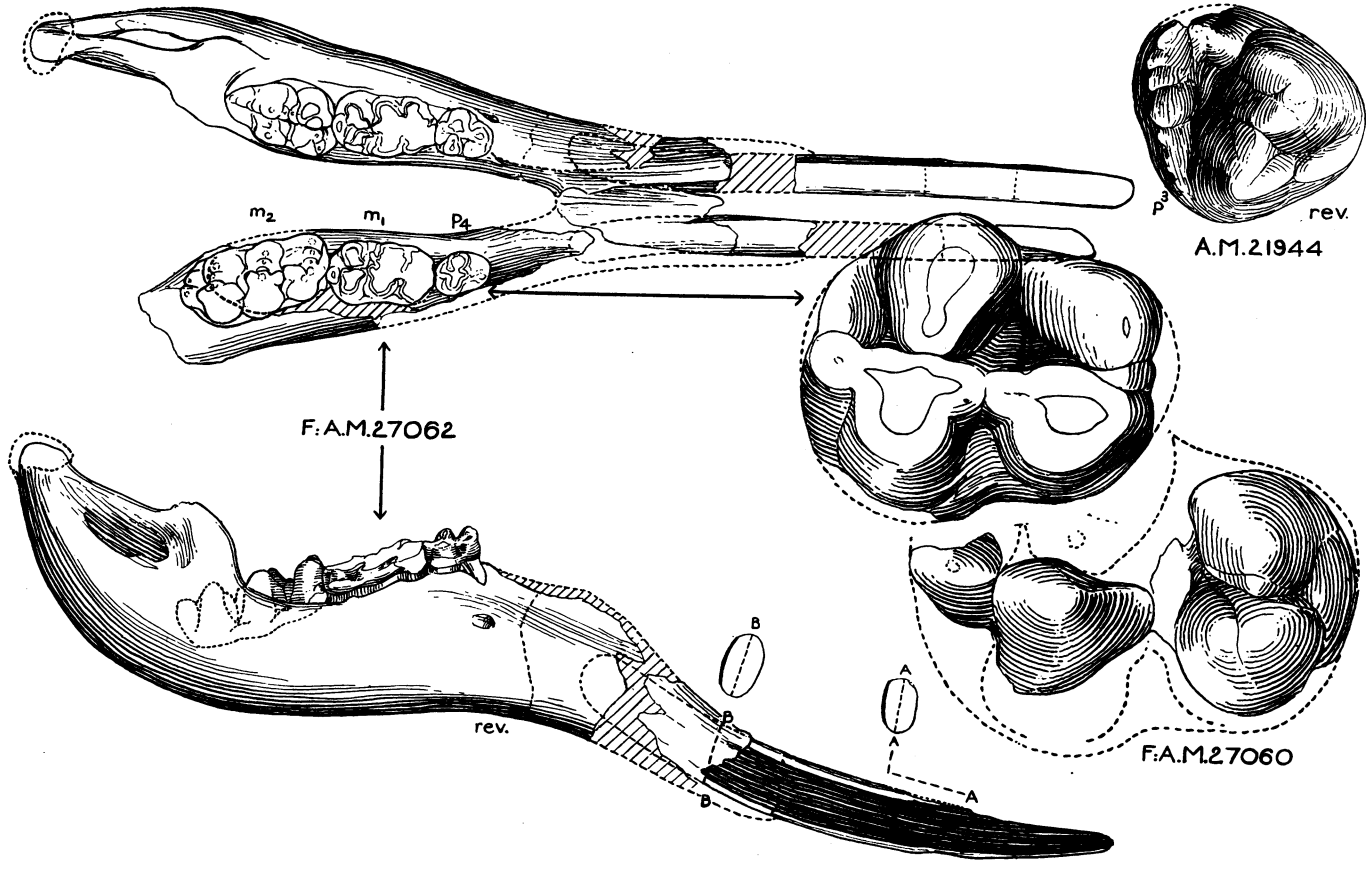

Fig. 4. F:A.M.27062, *Blickotherium blicki*, n.g. and sp., genotype (p_4 restored from opposite); A.M.21944, rev., and F:A.M.27060, *Aybelodon hondurensis*, ?ref., from the late Tertiary of Honduras.
× ⅙ (premolars × 1). AA and BB, cross-sections of tusk. (See also Fig. 3 and pages 529, 532.)

PART II

(1) **Blickotherium blicki,** new genus and species, and (2) **Aybelodon hondurensis,** new genus and species

Figures 4 and 5, and (in part) 3, 13, 18 and 24
From Honduras

Statement

Two extraordinary mandibles, the one an adolescent specimen with p_4–m_2 and peculiarly formed symphysis containing very Rhynchotherelike laterally compressed and enamel-banded incisors (Fig. 4), and the second a mature mandible with unusually elongated symphysis and extremely heavy buffer-like incisors (Fig. 5), were secured from an Honduras horizon of Upper Pliocene facies by Mr. John C. Blick in the winter of 1929.

The occurrence of Tertiary mammal remains in the vicinity of Tapasuma, Honduras, was first reported to the Museum by Mr. A. W. Anthony. The latter had visited this area in 1927 during the course of a collecting trip for the Department of Mammals, and had secured four teeth of a small *Hipparion*-like form and a mastodont premolar.

The combination of characters in the Blick adolescent mandible is unique—for while the laterally compressed and externally heavily banded incisors differ from all Longirostrine species, as at present known, and at once suggest *Rhynchotherium*, the wear of the incisors, the apparent presence of a replacement p_4 and the elongation and relatively but moderate depression of the symphysis separate the specimen very definitely from the genus, *Rhynchotherium*, as now understood. The inferior tusk of the adolescent specimen is not of corresponding cross-section with that of the aged mandible, the tusk of which in turn is without any visible suggestion of the extremely characteristic enamel band of the former. It is, of course, possible that in the aged specimen the enamel may have been once present and then lost in advanced maturity, much as the enamel of the upper tusks seems to tend to be reduced to lost with increasing age in certain Longirostrine individuals. (Compare specimens figured, Fig. 2.) Neither the cross-sections of the great tusks of the aged mandible, nor the elongation and straightness of its symphysis, nor the unusual keel of its ventral surface (see cross-sections) indicates that this large mandible might be of the same species as the adolescent specimen. The range of size in the entire Honduras

series, as observed in a comparison of the largest and smallest m^3s from the one locality, is 20 per cent.

The adolescent mandible of questioned "Rhynchorostrine" affinity is made the type of *Blickotherium blicki*, new genus and species, and the aged "Longirostrine" mandible the type of *Aybelodon hondurensis*, new genus and species. For convenience, to the latter species are tentatively referred detached mastodont remains from the same Honduras area. Such remains include an immature ramus with p_4 germ (possibly better referred to the first species), two toothless rami and some seventeen teeth and etc. specimens listed below. It is recalled that Joseph Leidy (1859, Proc. Acad. Nat. Sci. Phil., XI, p. 91) ascribed a last molar from Honduras to *Mastodon andium*. The specimen, known as the Tambla tooth, was figured by Leidy (1869, p. 242, Pl. XXVII, Fig. 14). Its anteroposterior length (150 mm.) would fall within the extremes of our Honduras teeth. (Professor Osborn has based *Serridentinus guatemalensis* on an m^3 (broken), A.M.15540, from the Pleistocene of Guatemala.)

The particular Tapasuma, Honduras, deposit, on the basis of the fragmental and as yet undescribed fauna secured by Mr. Blick, is interpreted as representing the Upper Pliocene:

Hyænognathus
Pliohippus
Hipparion
Merychippus
Protohippus
Teleocerine rhinoceros
Procameline and the
2 above mastodont forms.

MEASUREMENT TABLE

	Aybelodon hondurensis, type, F:A.M.27075	*Blickotherium blicki*, type, F:A.M.27062
p_4		47.7 mm.
m_1		86
m_2	((110)) mm.	119
m_3	173	
p.s.–alv. pouch	400	
p.s.–i.br.	((492+))	
$\frac{\text{p.s.–i.br.}}{\text{p.s.–alv. pouch}}$	((123+))%	
$\frac{m_3}{\text{p.s.–i.br.}}$	((35))%	

(( ))=estimated

(1) **Blickotherium blicki,** new genus and species

Figures (in part) 3 and 4

CHARACTERS OF THE ADOLESCENT TYPE MANDIBLE (FIG. 4)

The symphysis is elongate and somewhat depressed. The inferior tusks are strongly compressed laterally, deep dorsoventrally and provided with a heavy external band of enamel. The wear is confined to some five inches of the dorsal surface in the vicinity of the tips (see Fig. 3). While the enamel band is fully as heavy, the tusks are lighter, more compressed laterally and the wear is strikingly different from that of the neotype of *Rhynchotherium edensis* Nobis. The worn dorsal surface would seem to indicate an hitherto unobserved type of occlusion and to question the condition of the premaxillæ and incisors. The relative anterior position of the tusk-root, though perhaps partially a condition of immaturity, is in contrast to the extremely posterior position in both the calf and adolescent mandibles of *R. edensis*. The anterior position of the root in *Blickotherium* and the posterior position in *Rhynchotherium* seem to parallel the development in the one and the non-development in the other of the replacement premolars.

The alveolar border of the type mandible contains what are interpreted as p_4, moderately worn, m_1 and m_2 erupting. The m_2 at most is only 9 mm. shorter than in the but moderately more aged neotype of the preceding *Rhynchotherium edensis*. The roots of the tusks lie far removed from the anteromost tooth versus closely adjacent to the same in *R. edensis*. The presence of p_4 is at once suggestive of a somewhat larger p_4 represented by germ in a fragmental ramus from the same locality, here for matter of convenience listed with a peculiar p^3 and etc. detached remains under *Aybelodon hondurensis*, n.g. and sp.

TYPE.—Adolescent mandible with p_4, m_1, m_2 (erupting) of both sides, and major portions of both tusks.	F:A.M.27062	Figured this paper, *Figs. 3 and 4.*

Mr. Blick found the specimen broken, but the parts largely in place and closely associated. While certain contacts in the tusks of the reassembled specimen are lacking, the presence of a section of the compressed and banded left tusk "frozen" within the symphysis is definite testimony as to the character of the inferior tusk of this specimen. The right tusk is heavier than the left. A mid-section of the right and a slightly more posterior section of the left tusk are missing. The absence of contact in the case of the tips of both tusks makes it possible, though highly improbable, that the distal portions of one or both of the tusks actually represent the upper rather than the lower jaw.

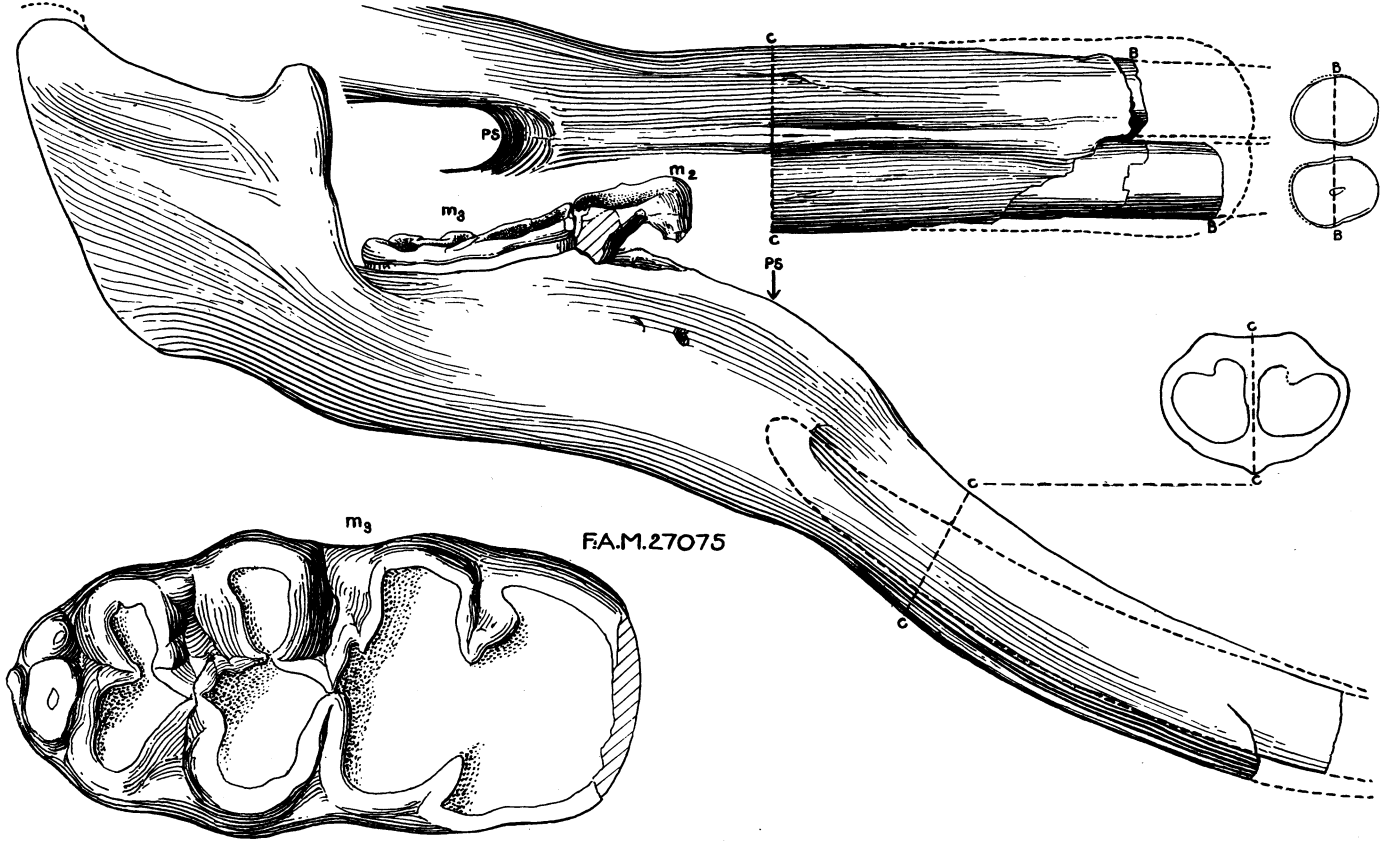

Fig. 5. F:A.M.27075, *Aybelodon hondurensis*, n.g. and sp., genotype, from Honduras.
×⅙ (m_3 × ½). BB, CC, cross-sections of tusks; PS, posterior border symphysis. (See also Figs. 13, 18 and page 532.)

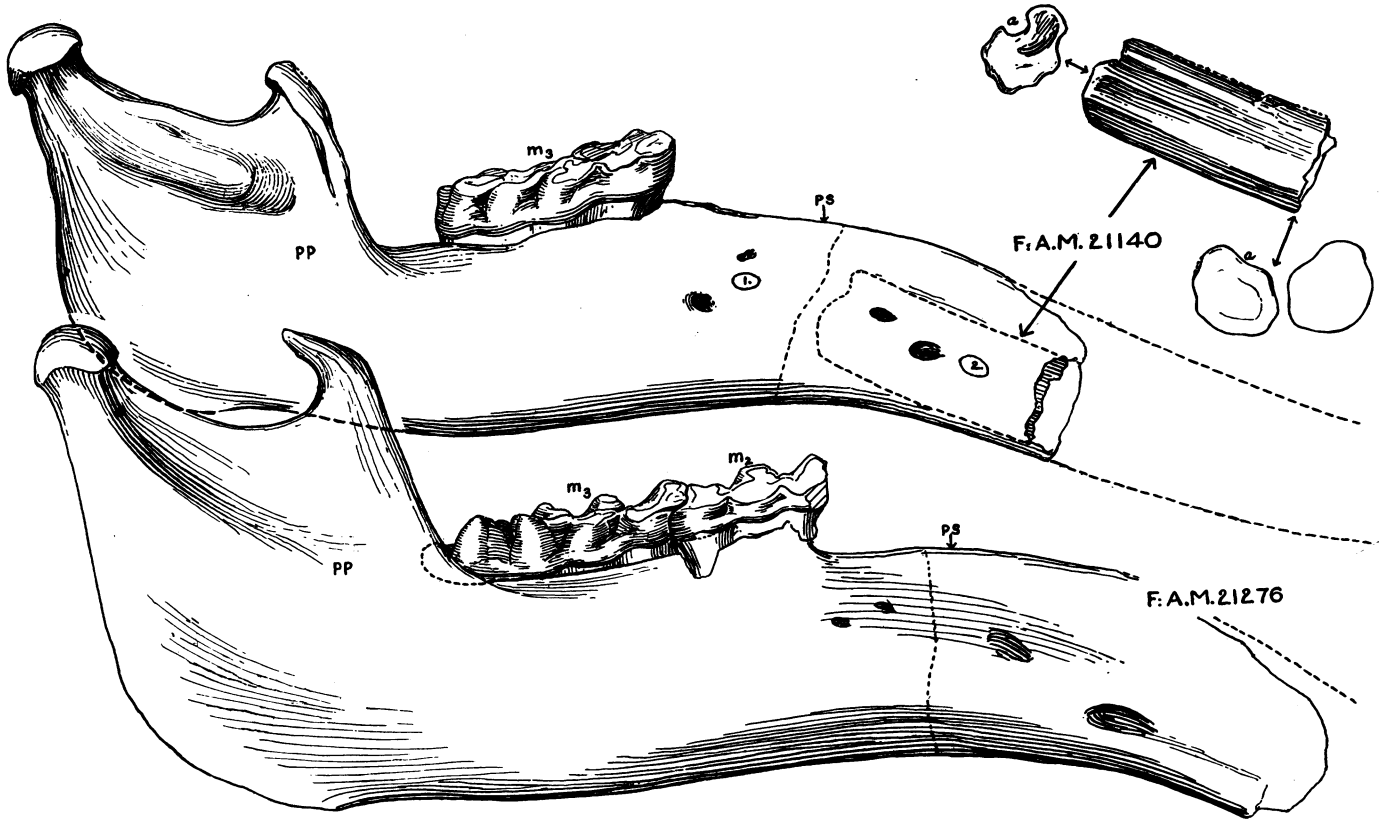

Fig. 6. F:A.M.21140, *Tatabelodon riograndensis*, n.g. and sp., genotype, from Battleship Mountain, New Mexico.
(See also Fig. 13 and page 581.)

F:A.M.21276, (?) *Serridentinus pojoaquensis* Nobis, ref., from Tesuque, New Mexico.
(See page 579.) (Compare Fig. 2, F:A.M.21127, and Fig. 19, F:A.M.21284, immature.)
× ⅛. PS, posterior border symphysis; PP, posterior edge pouch.

(2) **Aybelodon hondurensis,** new genus and species

Figures 5 and (in part) 4, 13, 18 and 24

Characters of the Type Mandible (Fig. 5)

The vertical ramus, condyle and coronoid process are low. The symphysis is strong and straight and very elongate, and the inferior surface is furnished with a peculiar keel. The inferior tusks are of unusually heavy cross-section, concave inwardly and with the depression of the superior outer contour continued to the dorsoventrally narrowed tusk-roots, which extend well posterior of the main mental foramen and to within 20 mm. of the posterior symphysis. There is no suggestion of the presence of an enamel band. The last molars and m_2 are retained and much worn. The absence of the distal extremity of the symphysis forbids exact determination of the elongation of the latter, which at the least must have been unusual.

An anterior section of a tusk (F:A.M.27075A), possibly representing a distal section of the upper left side, found in association with the mandible, is of somewhat smaller cross-section than the preserved posterior portions of the inferior tusks of the latter specimen. The particular tusk section exhibits a tendency toward inward and forward curvature. The presumed outer surface has the remnants of an enamel band. The presumed inner side is noticeably flattened (possibly through contact with the trunk) and the superior surface flat and seemingly somewhat gouged.

Type.—Large, aged, mandible with m_2, both m_3s and broken tusk bases.	F:A.M.27075	Figured this paper, *Figs. 5, 13 and 18.*

Tentatively Referred Remains (some of which may represent the preceding genus and species).—

(a) Portions of Immature Rami:

Fragment of immature ramus with broken germ of p_4, etc. roots.	F:A.M.27060	Figured this paper, *Fig. 4.*
Immature ramus with dp_4 and m_1 (erupting).	F:A.M.27061	
? Right p^3.	A.M.21944	Collected by Mr. A. W. Anthony, 1927. Figured this paper, *Fig. 4.*

(b) Mature Remains:

As noted above, detached teeth from the same deposit exhibit a considerable variation in form and actual size (20%), and may be grouped under three size variations (1) larger than mandible, F:A.M.27075, (2) approximating F:A.M.27075, and (3) smaller than F:A.M.27075. The percentage of the smallest m^3 (F:A.M.27069) relative to the largest m^3 (F:A.M.27076) is 80%.

(1) m^3.	F:A.M.27076	Figured this paper, *Fig. 24.*
Anteroposterior length = 173 mm.		
(2) Maxillary fragment with m^2–m^3 (erupting).	F:A.M.27070	
Moderate size.		
m^2 = 110 mm.		
m^3 = 154		
m^3 (worn).	F:A.M.27071	
Anteroposterior length = 168 mm.		
(3) m^3, small.	F:A.M.27069	Figured this paper, *Fig. 24.*
Anteroposterior length = 139 mm.		
m^3 (broken anteriorly).	F:A.M.27066	
(Etc.)		
Two fragments of m_3s.	F:A.M.27067, 27068	
Some ten intermediate molars.	F:A.M.27064, 27065, 27072, 27077, 27078, 27079A–E.	
Two partial rami without teeth:		
Left ramus.	F:A.M.27073	
Right ramus.	F:A.M.27074	

PART III

LONGIROSTRINES

Figures 2, 6, 7, 8, 9, 10, 11, 12, 12B, 12C, 14, 15, 16, 17, 19, 20, 23A, 23B, 25, 26, 27, 27A, 28, 33, 35, 36 and (in part) 12A, 13, 18, 22, 24, 25A

STATEMENT

Remains of Longirostrine mastodonts form a bulky proportion of the fruits of continued field work in several areas of New Mexico, Nebraska, Colorado, Texas, and California by the late Joseph Rak and his associates. These remains are broadly discussed and listed in detail below under their respective areas. The collection of Longirostrines now numbers some twelve associated skulls and jaws, twenty skulls or partial skulls, and thirty-one detached jaws. The ever-increasing series should eventually afford unique data for the determination of individual and sex variation in distinct but probably often closely allied and in large measure broadly contemporaneous genera, subgenera and species.

As noted in the foregoing introduction, some eleven genera and subgenera and fifteen species are tentatively recognized as present:

A. NEW MEXICO
- (1) *Serridentinus productus* (Cope)
  - (1a) *S. productus*, Var.
- (2) (?) *Serridentinus pojoaquensis* Nobis, 1926
- (3) *Trilophodon cruziensis*, n.sp.
- (4) *Ocalientinus ojocaliensis*, n.g. and sp.
- (5) *Trobelodon taoensis*, n.g. and sp.
  - (5a) *T. taoensis*, Var. A
- (6) *Tatabelodon riograndensis*, n.g. and sp.
- (7) (?) *Amebelodon joraki*, n.sp.

B. NEBRASKA
- (1) *Serbelodon barbourensis*, n.g. and sp.
- (2) *Trilophodon osborni* (Barbour), ref.
- (3) (?) *Ocalientinus* species
- (4) *Tatabelodon gregorii*, n.sp.
- (5) *Eubelodon morrilli* Barbour, ref.
  - (5a) *E. morrilli*, Var. A

C. TEXAS
- (1) *Serridentinus serridens* (Cope), ref.
- (2) *Amebelodon* species
- (3) (?) *Tetralophodon* species

D. CALIFORNIA
- (1) (?) *Trilophodon barstonis*, n.sp.
- (2) Trilophodont species

E. COLORADO
- (1) (?) *Amebelodon paladentatus* (Cook), ref.
- (2) *Miomastodon proavus* (Cope), ref.

(And see *Aybelodon hondurensis*, n.g. and sp., Part II.)

While it is too early to hazard conclusions, the similarity of the range of symphysial elongation and of actual size in the now known New Mexican and Nebraskan remains indicates that when the mastodonts of the two areas are even better known there will be near agreement as well in the range of symphysial and tusk adaptation. In the case of the relatively poorly represented Euro-Asiatic mastodonts, while the range of symphysial elongation and size is again approximately the same, the as yet observed range of symphysial and tusk adaptation is far less than in American forms.[1]

Pending Professor Erwin H. Barbour's full report on the splendid remains in the University of Nebraska collection and actual comparison of the specimens of the present series with those of the Nebraska collection, it may be remarked that:

The New Mexican *Serridentinus productus* is suggestive of the Nebraskan *Genomastodon willistoni*. The Nebraska parallel to *Serridentinus pojoaquensis* is not determinable. The New Mexican *Trilophodon cruziensis* evidently differs from *Trilophodon osborni*. *Ocalientinus ojocaliensis* is suggested in one Nebraskan specimen, F:A.M.25711. The New Mexican *Tatabelodon riograndensis* is, so far as visible, close

[1] I suggested (1926, pp. 141 and 177) that the mature and immature remains heretofore referred in entirety to the Cuvier species, *Trilophodon angustidens*, actually include at least three widely differing forms, the two more moderate of which broadly considered seem respectively to parallel (1) the long and (2) the moderately long symphysised forms of Santa Fé. . . .

(1) The first, long symphysised, and more typical form, is exampled amongst other material from Simorre now in the Muséum d'Histoire Naturelle, Paris, by a mandible with broken symphysis and associated skull fragment, by the mandible of the Laurillard mounted skeleton, and by the well-preserved immature mandible with p_4, m_2 and tusks figured by Filhol. . . . and also by remains from Tournan in the Muséum d'Histoire Naturelle. The specimens cover a large range in size, as well seen in comparison of the anteroposterior lengths of the m_3s, that of the largest m_3 exceeding the smallest by nearly 40 per cent of its own length, and thus suggesting the possible presence of more than the single species. . . .

(2) The second, a heretofore unremarked and evidently rarer form, with noticeably shorter proportioned symphysis, is definitely represented by a well-preserved mandible containing m_2, m_3, m_1 alveolus and the tusks of both sides. In this specimen, unlike in those above, the "alveolar distance" (330 mm.) definitely exceeds the symphysial length (303 mm.), and the m_3 is much less elongate relative to m_2. The anteroposterior diameter of the (particular) m_3 is but slightly greater than that of the smallest m_3 of the extremely long symphysised form. . . .

(3) A third and longer symphysised form, (?) *Megabelodon angustidens gaillardi* (Osborn, 1929) has been more recently based on the great Lyons mandible of which the writer was presented with casts by Dr. Claude Gaillard and wrote in 1926 (and see p. 141)—The extreme length of the symphysis is best exhibited by the great Lyons mandible in which this (symphysial length 830 mm. versus "alveolar distance" 420 mm.) and the m_3 (anteroposterior diameter 195 mm.), though of but the typical proportion relative to one another, are of record length. The specimen suggests the third and longest symphysised American group.

The problem as to the type of *Trilophodon angustidens* Cuvier (1806) was discussed in 1926:

The whereabouts of the first tooth mentioned by Cuvier under "Mastodonte à dents étroites de Simorre," an intermediate molar, said to measure 116 mm. (Cuvier, Plate I, Fig. 4—66 mm.) and therefore of a moderate-sized individual, is unknown. The second and third teeth cited and figured by the same author (the p^4 of Plate I, Fig. 2, and the intermediate molar of Plate III, Fig. 3) are both in the collection of the Muséum d'Histoire Naturelle, Paris. The size of these last two specimens indicates that they belonged to small individuals, but whether of the extremely long or of the moderately long symphysial form, I have been unable to determine. The two Gers forms not yet appearing to be definitely divisible on the characters of the average detached tooth, either as to cusp arrangement and form, or as to proportion and size, it is doubtful whether the Cuvier appellation, "angustidens," belongs to the extremely long, long, or moderately long symphysised form.

Because of the seeming prevalence of remains of the long symphysised form, it well may be considered that the latter includes the "angustidens" type and that the three symphysial subgroups are represented in the Gers deposits respectively by:

(1) *Serridentinus filholi*, n.sp.
(2) *Trilophodon angustidens* Cuvier.
(3) (?)*Megabelodon gaillardi* (Osborn).

to the better represented Nebraskan *Tatabelodon gregorii*. While the New Mexican *Trobelodon taoensis* is unobserved in the Nebraskan remains, the New Mexican (?) *Amebelodon joraki* would seem to be broadly referable to the Nebraskan *Amebelodon* group. Representatives of the Nebraskan *Serbelodon barbourensis*, *Eubelodon morrilli* and *"Torynobelodon" barnumbrowni* are unobserved in the New Mexican series. Such absence may point to a relative lateness in the particular Nebraskan horizons. *Miomastodon* and *Rhynchotherium*, reported from Nebraska, are as yet unrecognized at Santa Fé.

Longirostrine Characters and Differentiations

Before proceeding further, it may be well at this point to enumerate the major characters observed in the Longirostrine skull and mandible which include differences in:

(1) Symphysial length of the mandible relative to "pouch length" (Figs. 16–20), (l.c.1926)—whether
  (a) shorter as in the "Sublongirostrines"
  (b) approximate as in the "Longirostrines" proper, or
  (c) longer as in the "Superlongirostrines" (see percentage tables, pp. 584, 601).

(2) Size and form of the—
  lower incisors—whether light peg, buttress, spatulate, or plate-like (see Figs. 13 and 14, etc., and pp. 573, 591);
  upper tusks—whether depressed and heavily banded with enamel, or straighter, with narrowing enamel or of more round cross-section with enamel disappearing (see Fig. 15, etc., and pp. 573, 590).

  Note further discussion under remains from the Nebraska area. Incisorless individuals are relatively common, and these largely may represent females.

(3) Proportions of the cranium (Figs. 7–11), whether—
  (a) low with relatively long auditory meatal to infraorbital foramen distance and the zygomatic arch and frontal line forming an acute angle, as in *Serridentinus* and *Trilophodon*, or
  (b) tall with relatively short auditory meatal to infraorbital foramen distance and the zygomatic arch and frontal line forming a right angle, as in *Ocalientinus*, n.g.

  (The true cranial height is seldom indicated as the top of the cranium is usually crushed or missing. That cranial height is probably not wholly dependent on the size and heft of the tusks is witnessed by a comparison of the skulls of American *Mastodon* and African *Loxodonta*.) The striking variation in distance between the posterior edge of m^3 and the posterior nares is not diagnostic as this distance increases with age through the anterior progression of m^3. (Compare Figs. 12 to 12C.)

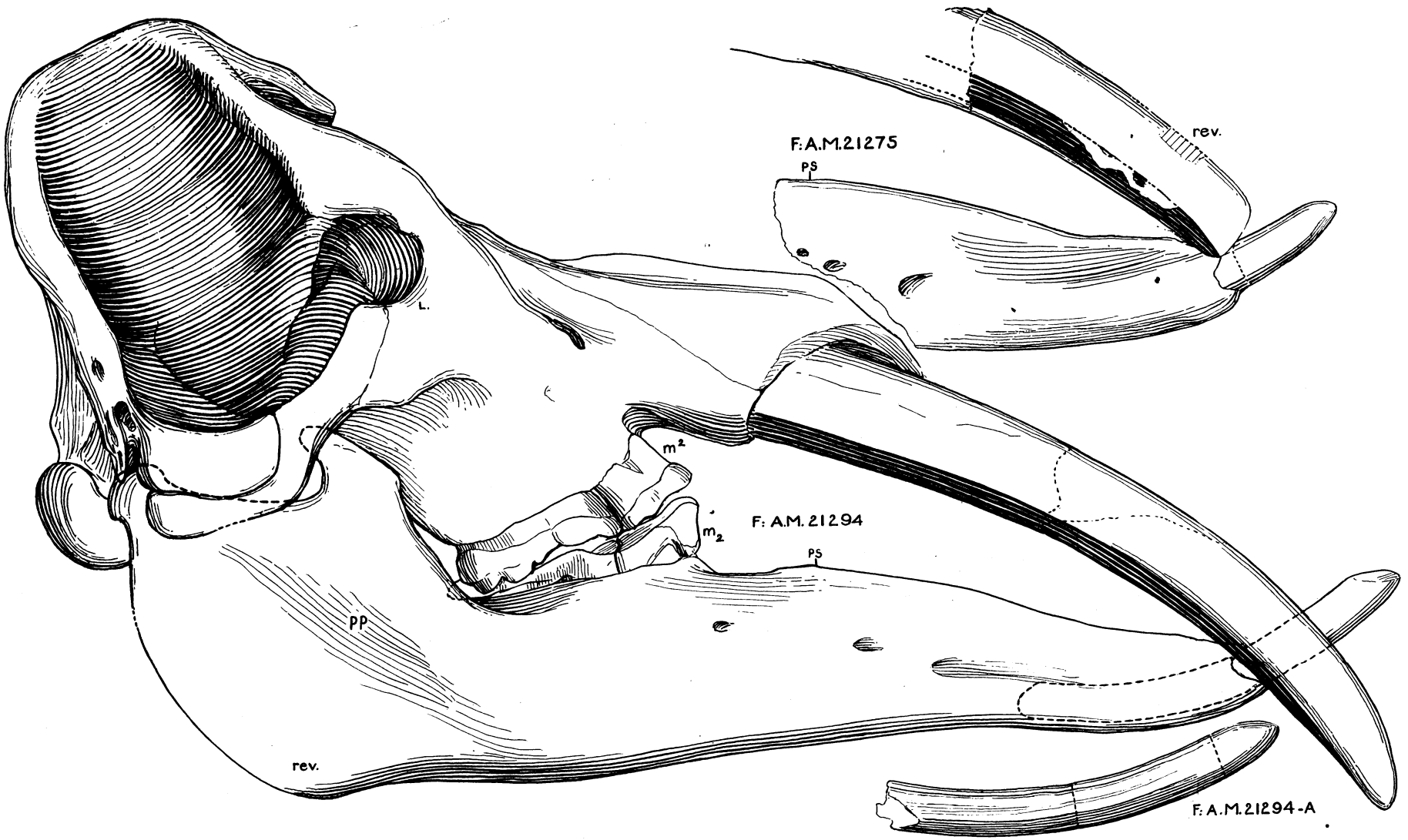

Fig. 7. F:A.M.21294 (type), and ref. 21275 (of partial skull and jaws), and 21294A, *Ocalientinus ojocaliensis*, n.g. and sp., from Ojo Caliente, New Mexico.

× ⅙. L, lachrymal; PS, posterior border symphysis; PP, posterior edge pouch. (See also Figs. 13 ,14, 18 and pages 579 ,580.)

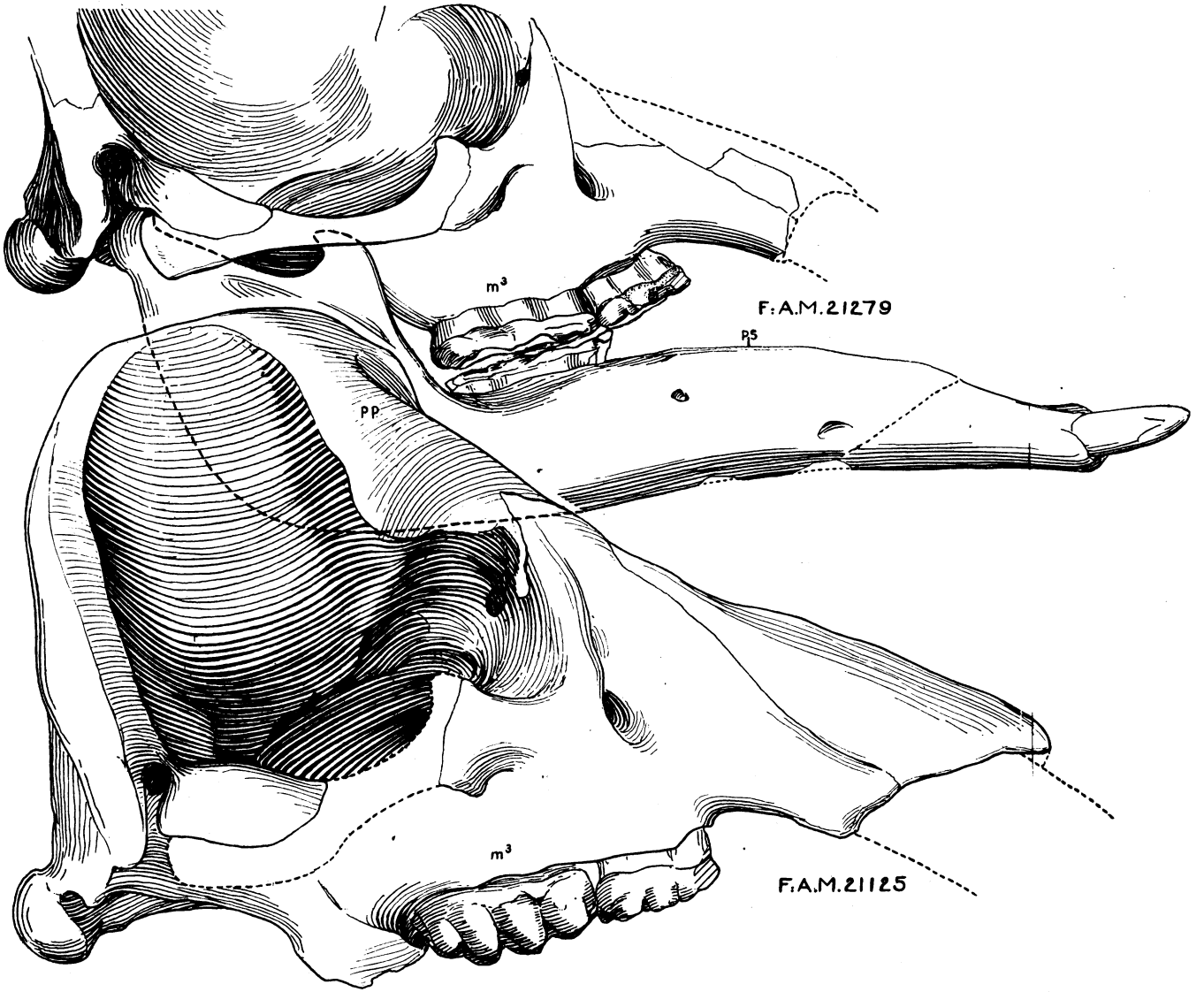

Fig. 8. F:A.M.21279, *Serridentinus productus* (Cope), ref., from Lower Pojuaque Bluffs, New Mexico.
× ⅙. PS, posterior border symphysis; PP, posterior edge pouch. (See also Fig. 17 and page 578.)

F:A.M.21125, *Ocalientinus ojocaliensis*, ref., from southwest of Pojuaque Bluffs, New Mexico.
× ⅙. (See also Figs. 12, 23A, 26 and page 579; 1926, Figs. 1A and 27.)

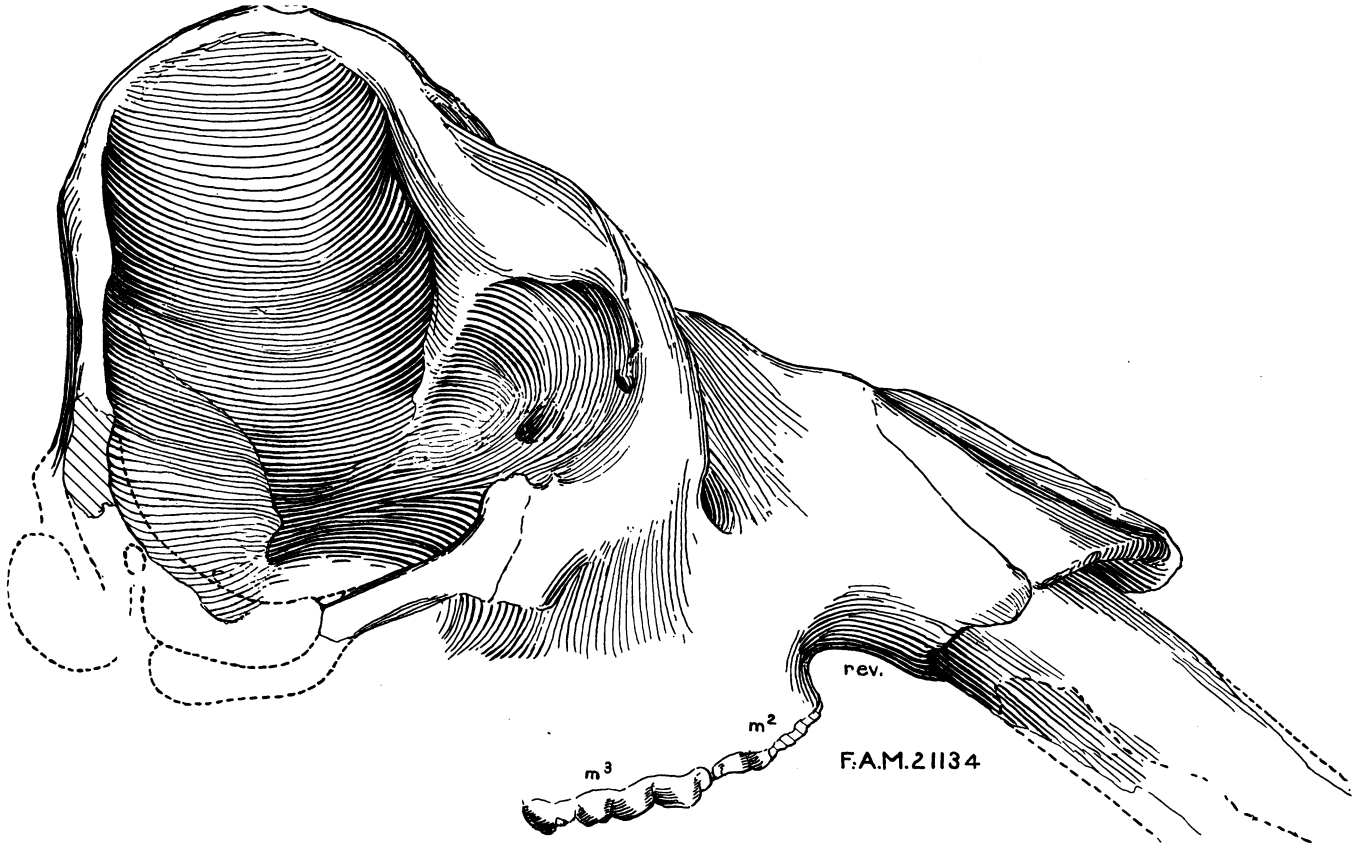

Fig. 9. F:A.M.21134, *Ocalientinus ojocaliensis*, ref., rev., from Ojo Caliente, New Mexico. × ⅙. (See page 580.)

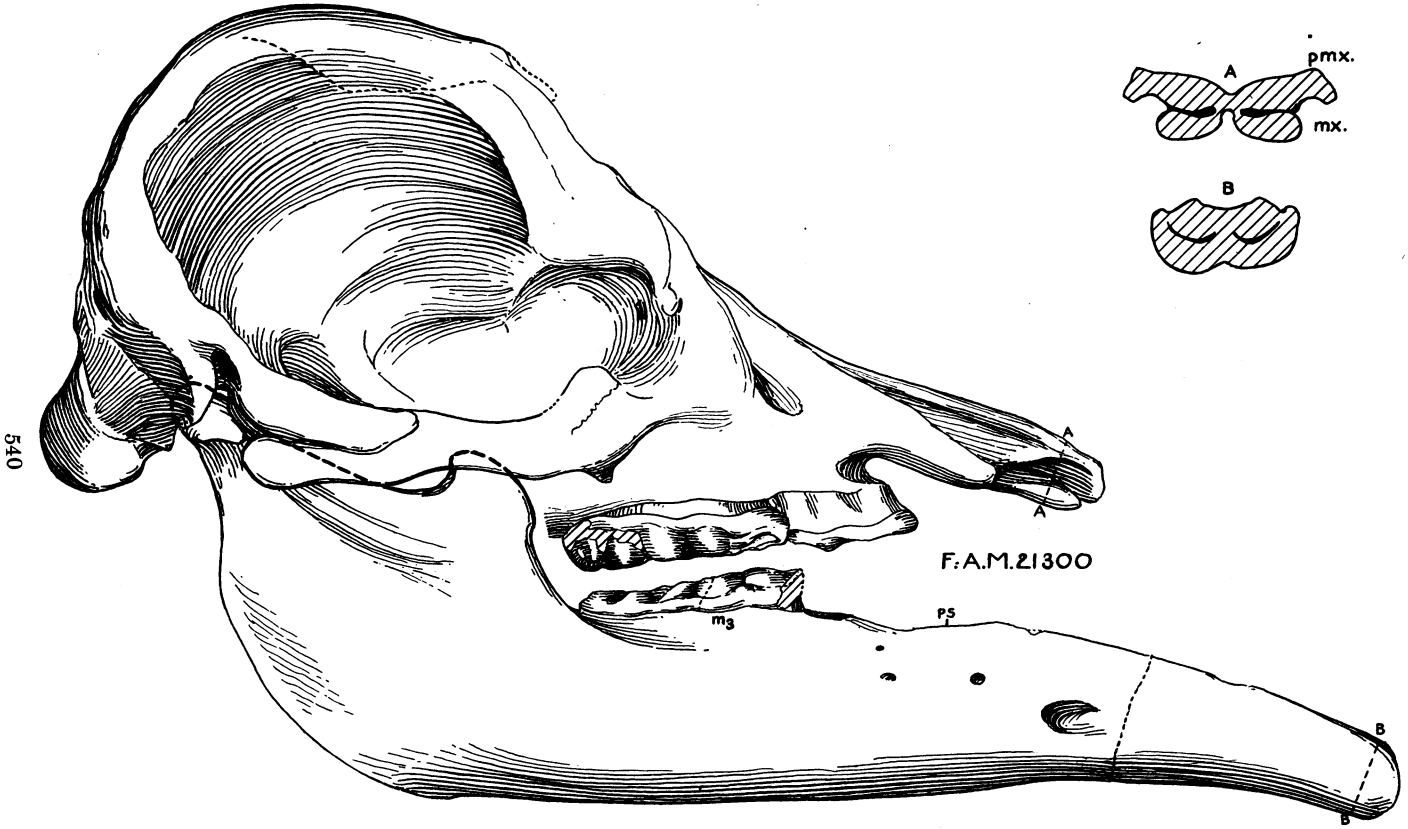

Fig. 10. F:A.M.21300, *Trilophodon cruziensis*, n.sp., type, from Santa Cruz, New Mexico.
× ⅙. A and B, cross-sections; PS, posterior border symphysis. (See also Figs. 12A, 17, 23A, 25 and page 579.)

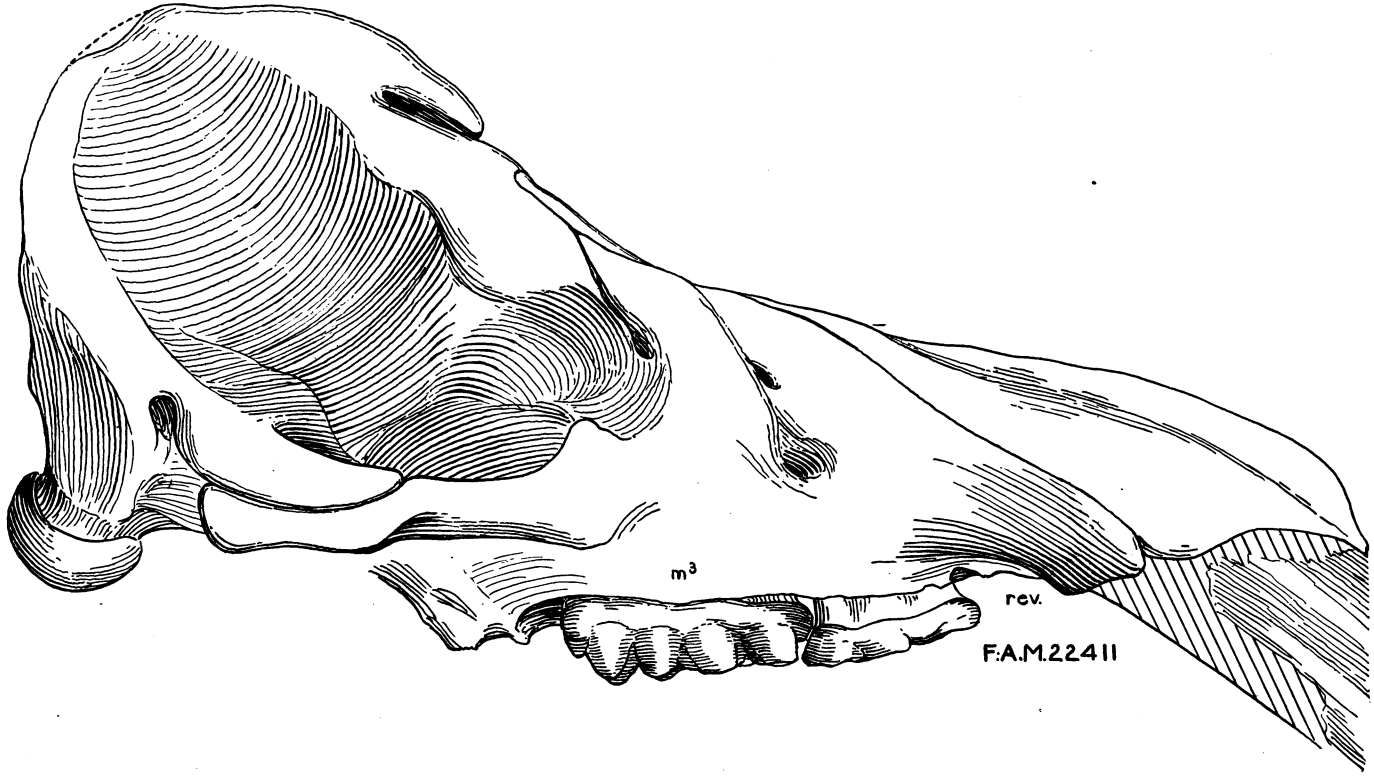

Fig. 11. F:A.M.22411, *Eubelodon morrilli* Barbour, ref., rev., from the vicinity of Ainsworth, Nebraska. × ⅙. (See page 599.)

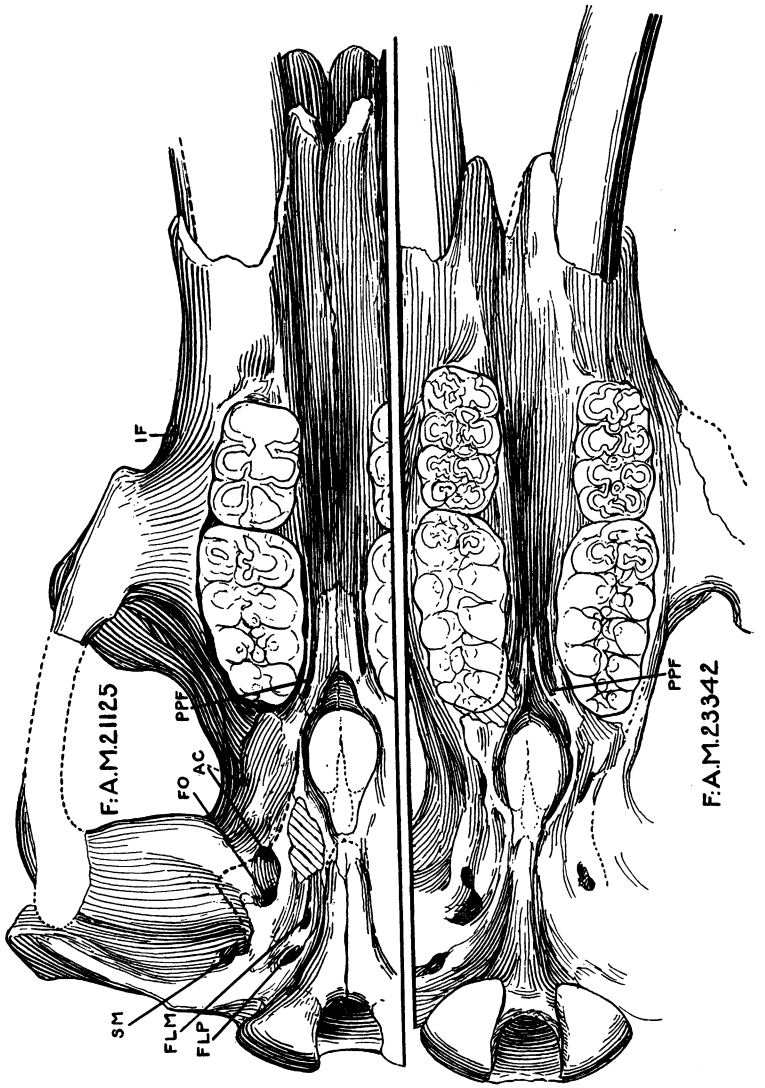

Fig. 12. Longirostrines from the late Tertiary of New Mexico and Texas. × ½. (See legend, page 546.)

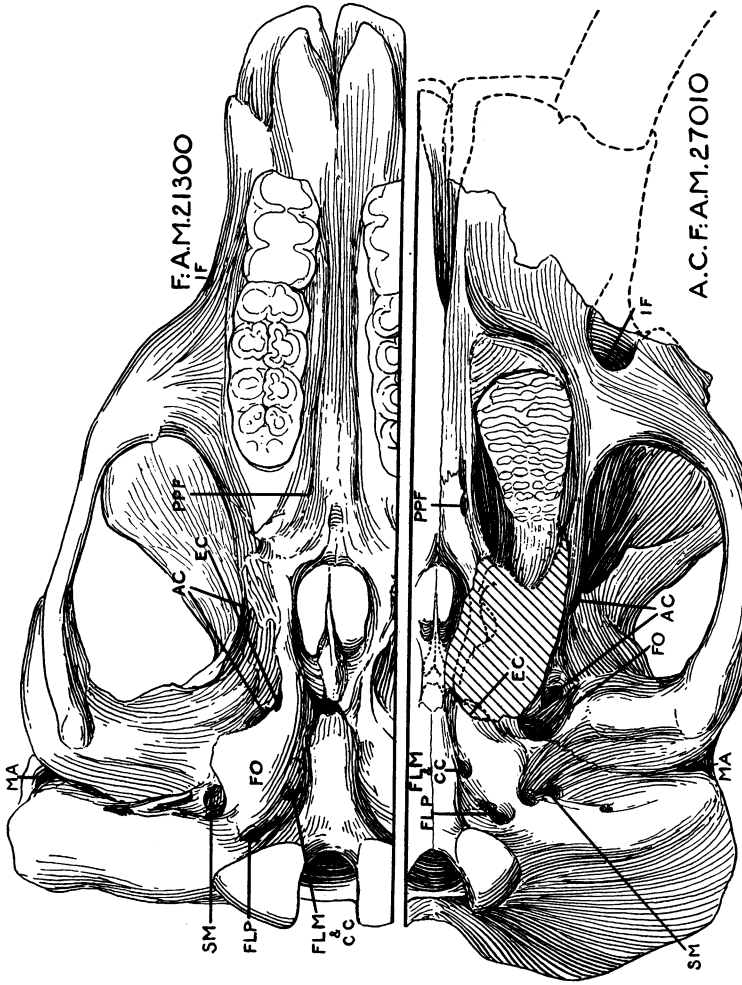

Fig. 12A. Longirostrine from the late Tertiary of New Mexico, and *Elephas* from the Quaternary of Alaska.
× ⅛. (See legend, page 546.)

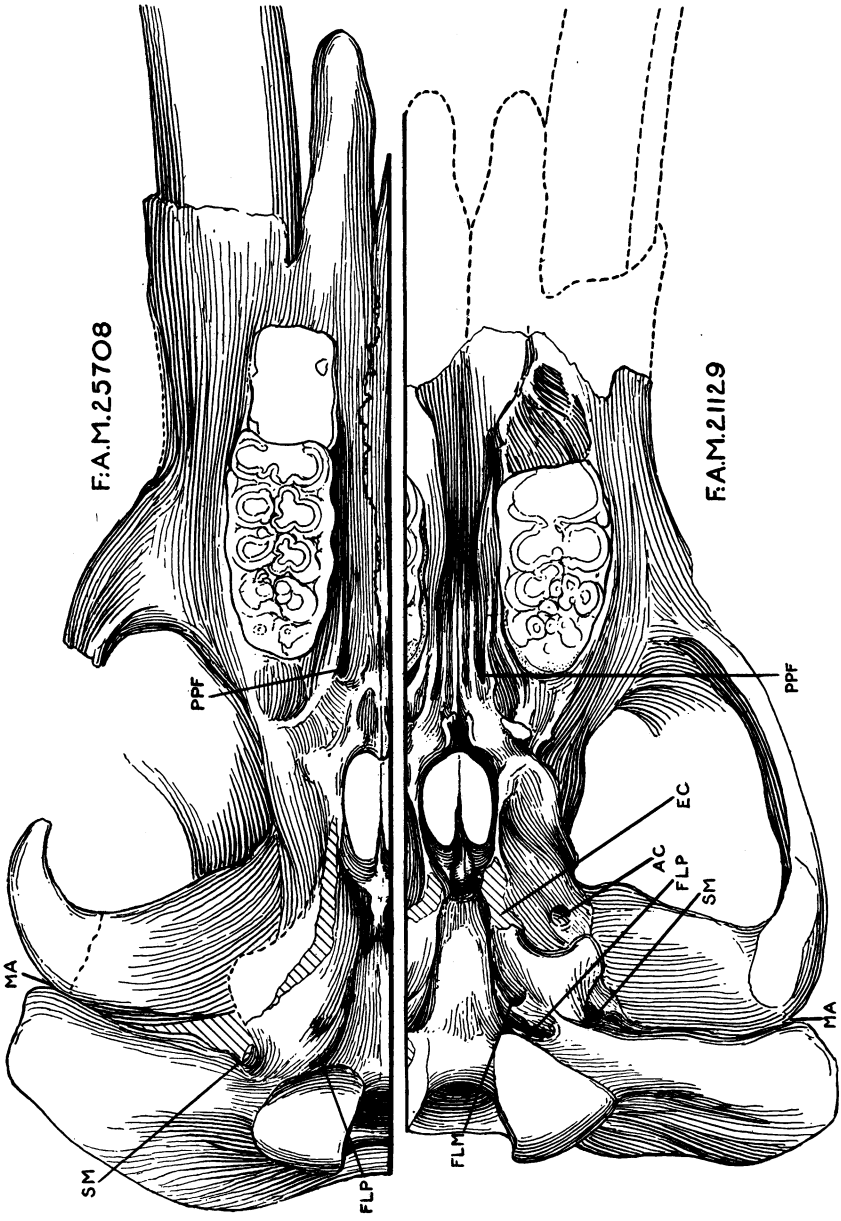

Fig. 12B. Longirostrines from the late Tertiary of Nebraska and New Mexico. × ⅓. (See legend, page 546.)

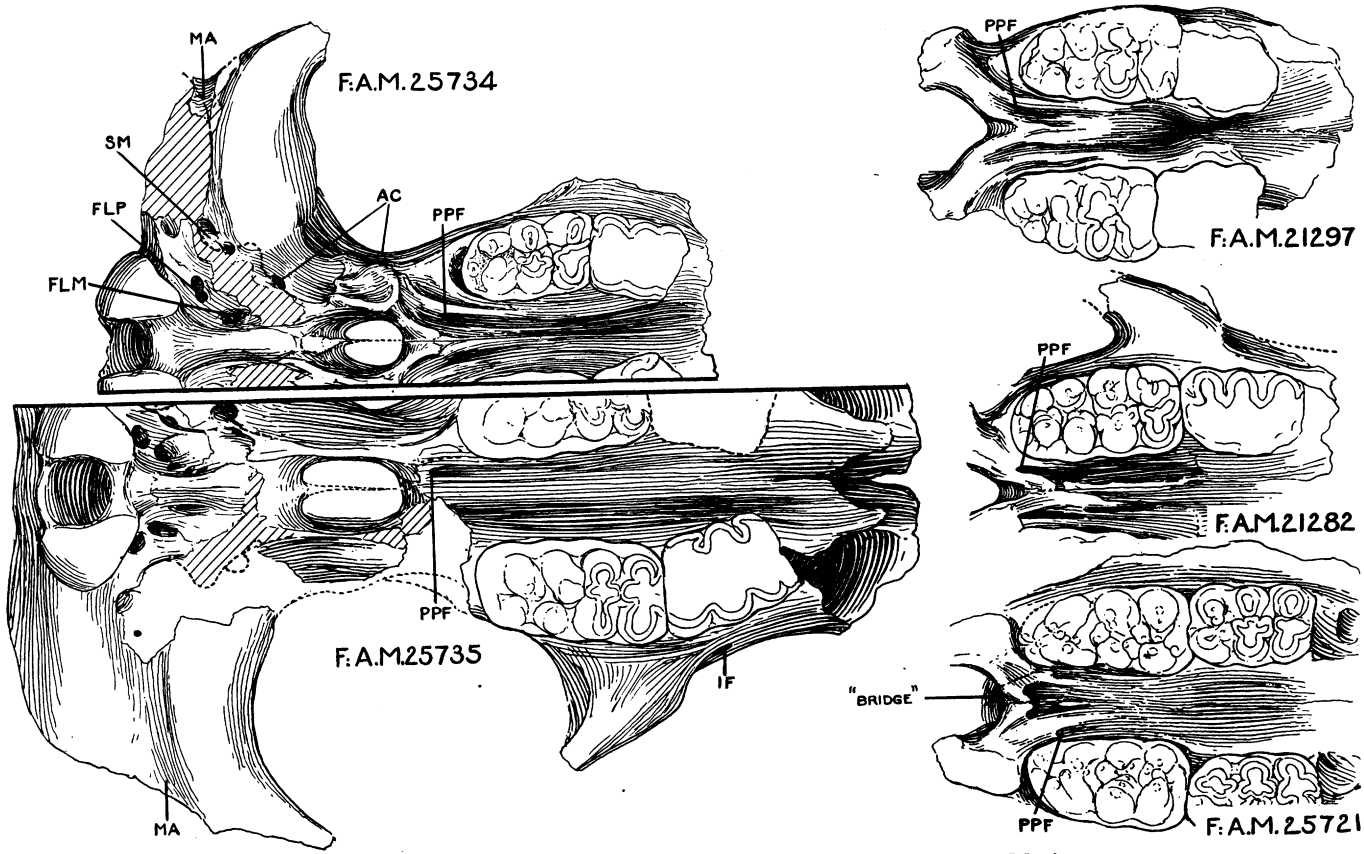

Fig. 12C. Longirostrines from the late Tertiary of Nebraska and New Mexico.
× ½. (See legend, page 546.)

(4) Proportions of the m3s relative to the m2s—m2 being apparently more elongate in the "Sublongirostrines" and less elongate in the more specialized "Longirostrines" and "Superlongirostrines." The true $\frac{m_2^2}{m_3^3}$ proportion is retained only in the unworn teeth of the adolescent individual, and is therefore seldom obtainable in any particular fossil, as the lengths of m_2^2 are considerably reduced by wear before the completion of the eruption of the m_3^3.

Pattern of the molars—molars of typical Trilophodonts with transverse valleys blocked and resulting "single trefoils" versus molars of Zygolophodonts, *Miomastodon proavus*, with valleys less blocked and trefoils tending absent, versus molars of Tetralophodonts with double trefoil pattern (unobserved in Trilophodonts of writer's collection). (Typical m_3^3s compared, Figs. 23–26.)

(5) Proportionate size and form differences in the replacement premolars which are lost in adolescence through the anterior progression of the molars (as discussed in Part V). (See Figs. 19–22, 30–38.)

(6) Absolute size of cranium, mandible, teeth and limb elements—presumably averaging large in males and moderate to small in females.

Figs. 12–12C. Longirostrines from the late Tertiary of New Mexico, Nebraska, and Texas, and *Elephas* from the Quaternary of Alaska.

PPF, post palatal foramen; AC, alar canal; EC, Eustachian canal; FO, foramen ovale; MA, auditory meatus; SM, stylomastoid foramen; FH, hypoglossal foramen; FLM and FLP, foramen lacerum medius and posterius; IF, infraorbital foramen.

Fig. 12. F:A.M.21125, *Ocalientinus ojocaliensis*, ref., from southwest of Pojuaque Bluffs, New Mexico.
(See also Figs. 8, 23A, 26 and page 579; 1926, Figs. 1A and 27.)

F:A.M.23342, (?) *Tetralophodon* species, from Texas.
(See also Fig. 23B and page 607.)

Fig. 12A. F:A.M.21300, *Trilophodon cruziensis*, n. sp., type, from Santa Cruz, New Mexico. (Tuskless individual.)
(See also Figs. 10, 17, 23A, 25 and page 579.)

A.C.–F:A.M.27010, *Elephas primigenius alaskensis* Osborn, ref., from the vicinity of Fairbanks, Alaska.
(See page 632.)

Fig. 12B. F:A.M.25708, *Eubelodon morrilli* Barbour, ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 15, 23B and page 598.)

F:A.M.21129, (?) *Serridentinus pojoaquensis* Nobis, ref., from Santa Cruz, New Mexico. (Largest skull.)
(See also Fig. 23B and page 579.)

Fig. 12C. F:A.M.25734 and 25735, *Serbelodon barbourensis*, ref., from the vicinity of Ainsworth, Nebraska.
(See also Fig. 27 and page 595.)

F:A.M.21297, *Serridentinus productus* (Cope), ref., from San Ildefonso, New Mexico.
(See also Fig. 23A and page 578.)

F:A.M.21282, *Ocalientinus ojocaliensis*, ref., from North Pojuaque Bluffs, New Mexico.
(See page 583.)

F:A.M.25721, *Tatabelodon gregorii*, n.sp., ? ref., from the vicinity of Ainsworth, Nebraska (exhibiting peculiar perforation of the posterior palate).
(See page 598.)

In the present report the Longirostrine remains are allocated on molar characters to three major groups: (1) "Trilophodonts," (2) "Tetralophodonts" and (3) "Zygolophodonts"; and these are further subdivided according as symphysial elongation is moderate, medium or extreme. In the case of the "Trilophodonts" the three latter groups are all represented. Here designated as "Sublongirostrines," "Longirostrines" and "Superlongirostrines," each is observed to exhibit, as discussed below (and noted again under the New Mexican and Nebraskan areas), a wide variation in the form of the superior and especially the inferior tusks. Such morphologic arrangement of the new material serves to throw the marked symphysial and tusk characters and variations into relief.

(1) "TRILOPHODONTS"—Valleys blocked and pattern developing single trefoils.

(A) Symphysis moderate—"Sublongirostrines":
Incisors slender, peg-like—*Serridentinus* Osborn (*Genomastodon* Barbour, unrepresented);
or heavy, spatulate-like—*Serbelodon*, n.g.
(or plate-like—"*Torynobelodon*" *barnumbrowni* Barbour, unrepresented).

(B) Symphysis long—"Longirostrines":
Incisors peg-like—*Trilophodon* Falconer, *Ocalientinus*, n.g.
or heavy to buttress-like—*Trobelodon*, n.g., *Tatabelodon*, n.g.;
or tending absent—*Eubelodon* Barbour, in which enamel band of upper tusks tends to disappear.

(C) Symphysis very long—"Superlongirostrines":
Incisors peg-like (*Megabelodon* Barbour questioned and unrepresented);
or heavy, buttress-like—*Aybelodon*, n.g.
or heavy, spatulate-like—(*Amebelodon* Barbour, unrepresented).

(2) "TETRALOPHODONTS"—Intermediate molars four-crested (versus three-crested in (1) and (3)).

(B) Symphysis long—*Tetralophodon* Falconer.

(3) "ZYGOLOPHODONTS"—Valleys largely unblocked and trefoils unformed. Remains abundant in Quaternary and rare in Tertiary.

(A) Symphysis moderate—Inferior incisors peg-like—*Miomastodon* Osborn (and *Pliomastodon* Osborn, unrepresented).

When an alternative four-fold arrangement, according to incisive form, is attempted of the some dozen American Late Tertiary Trilophodont Longirostrine genera (or subgenera), i.e., between (1) peg, (2) buffer, (3) spatulate and (4) flat incisive forms, it is observed (Fig. 13) that—

(A) peg, buffer and spatulate incisors occur in both the moderate and the long (to extremely long) symphysial phases, while the extremely

specialized flat (plate-like) incisors are confined to the single moderate symphysial phase; and further, that—

(B) the simple peg-like incisor might, through enlargement together with either accent of (a) dorsoventral thickening, pass into the moderate buffer to true buffer (*Aybelodon*) form, or (b) transverse extension, pass into the spatulate and on into the flat form. The great size range occurring in the incisors of a single species is shown in Fig. 14, which illustrates the incisors of a series of *Serbelodon* individuals from the Christmas quarry.

Omitting *Eubelodon* Barbour, which may be something apart, and *Megabelodon* Barbour, which is questioned, the ten remaining Longirostrine genera (or subgenera) align between the four incisive groups (Figs. 13 and 14, etc.) as follows:

(1) Peg-formed group, moderate symphysis—*Serridentinus* Osborn, *Genomastodon* Barbour
elongate symphysis—*Trilophodon* Falconer, *Ocalientinus*, n.g. (tall cranium)
and (1a) heavy peg-formed—*Trobelodon*, n.g.

(2) Buffer-formed group, elongate symphysis—*Tatabelodon*, n.g.
extremely long symphysis—*Aybelodon*, n.g. (true buffer)

(3) Spatulate-formed group, moderate symphysis—*Serbelodon*, n.g.
extremely long symphysis—*Amebelodon* Barbour.

(4) Flat (plate-like) group, moderate symphysis—*"Torynobelodon" barnumbrowni* Barbour

Discussion as to the relative importance of these symphysial and incisive characters and variations in forms which must have been largely contemporary, and whether certain of the so-called genera might not better be demoted to subgenera, as questions of phylogenetic relationships, may well await the publication of Professor Osborn's monograph.

In the pages immediately following, the new Longirostrine remains are taken up in succession according to the five areas:

A. New Mexico
B. Nebraska
C. Texas
D. California
E. Colorado

In the case of the large collections from the New Mexico and Nebraska areas the introductory discussion is followed by a résumé and key to the genera and species, and this in turn is followed by detailed lists of the species, synonymy, types and referred remains. Comparative measurement tables of the more important specimens of the maxillæ and mandibulæ are also given. The limb elements from the several areas are kept together and their measurements tabulated at the end of Part III. The immature Longirostrine remains, as before noted, are held for discussion

in Part V under Deciduous and Replacement Dentitions. This chapter being a preliminary enumeration and summary of results to date, the descriptions are confined to brief characterizations supported by comparatively drawn illustrations and compiled tables of comparative measurements.

Area A. New Mexican Longirostrines

Introductory

Remains of the Longirostrine group are relatively plentiful in the main upper horizon of the New Mexican area, and the more recent collections fill in certain of the gaps in our former series. The great collections made by Joseph Rak now include three fine skulls, two of these with associated mandibles, six partial skulls and mandibles, some twelve detached mature mandibles and rami with symphysis and alveolar pouch largely intact, numerous maxillary and mandibular dentitions, associated and unassociated limb elements, and an unusual representation of the immature dentition.

The deposits of the Santa Fé basin of northeastern New Mexico, widely known in the literature as the Santa Fé marls, have been currently interpreted as of Upper Miocene age. More recent investigation indicates that the accumulations of this portion of the Rio Grande basin range from the Mid-Miocene to Pleistocene. The Pleistocene occurs in remnants of æolian origin that here and there cap the irregular Pliocene-Miocene surface.[1] While no mastodonts have so far been encountered in limited exposures of probable Uppermost Pliocene facies, their remains are fairly common in the upper half of the earlier deposits. A possible time equivalent of the Little White River of South Dakota, the Republican River of Kansas and the Upper Snake Creek of Nebraska is indicated by the presence in certain localities of species of *Hipparion* and of advanced *Pliohippus*. The smallest of the Hipparions, *H. sanfondensis*, n.sp., is typified by the partial maxillary series from the San Ildefonso area, referred by Cope to *Hypotherium speciosum* Leidy.[2]

(Continued on page 571.)

[1] 1926, Nat. Hist., XXVI, p. 442.

[2] The *Hipparion* remains vary in size from moderate *H. gratum* to larger *H. dolichops*-like forms. The two New Mexican extremes may be known as *Hipparion sanfondensis*, n.sp., and *H. sanjuanensis*, n.sp. The type of the former is the maxilla which Cope referred to *Hypotherium speciosum* Leidy and the type of the second is a maxillary series from the vicinity of San Juan. An intermediate-sized form is exampled by a skull from Ojo Caliente. More detailed discussion of the faunal horizons of the Santa Fé basin must await the completion of the revisions long in progress of the North American Camelidæ and Equidæ.

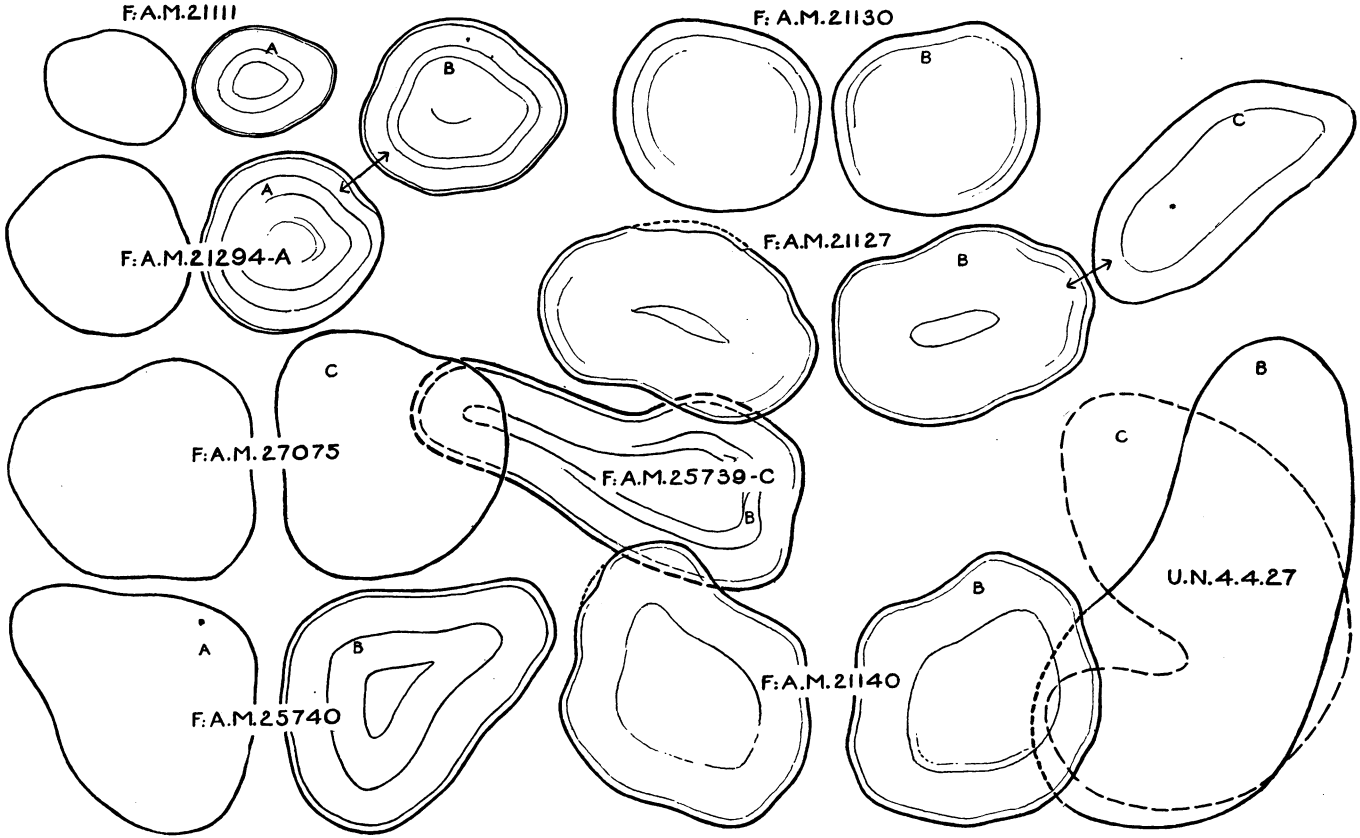

Fig. 13. Inferior incisor cross-sections. Taken: A, near end of symphysis; B, more posterior; and C, far posterior. × ½. (See legend, page 553.)

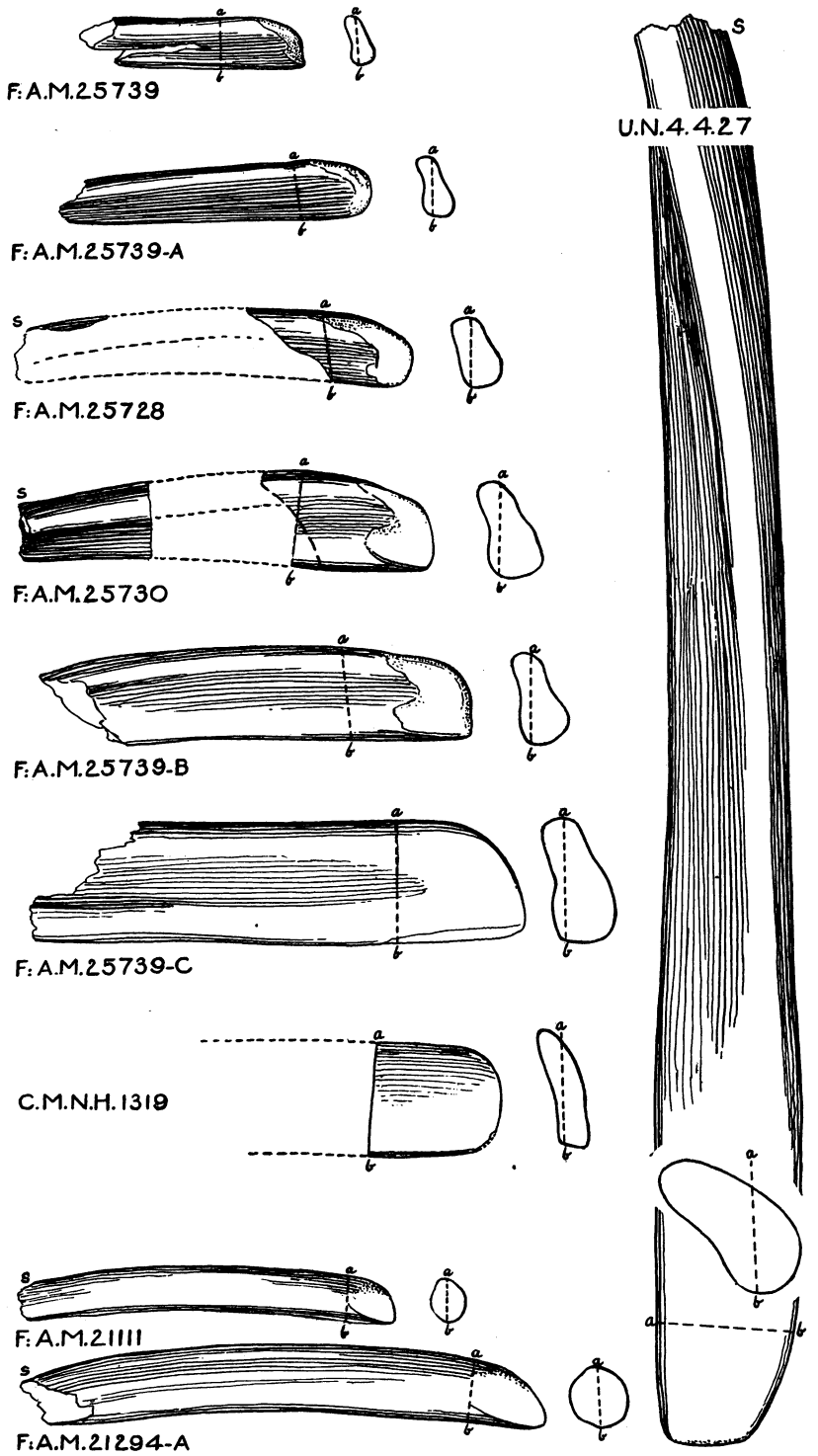

Fig. 14. "Sublongirostrine," "Longirostrine" and "Superlongirostrine" inferior incisors.

× ⅙. S, tusk root. (See legend, page 553.)

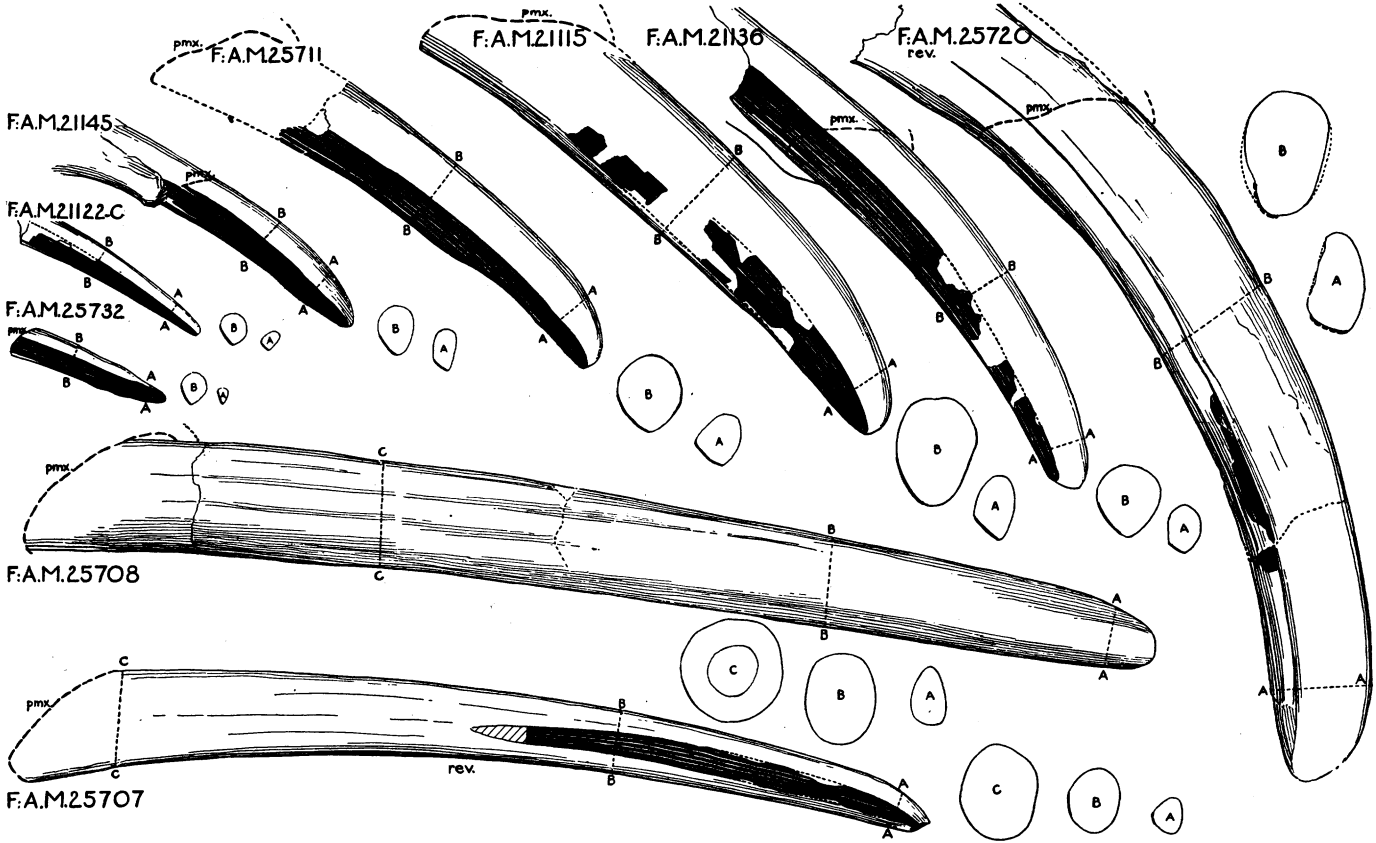

Fig. 15. Longirostrines, superior tusks and cross-sections A, B and C.
$\times \frac{1}{9}$. (See legend, opposite page.)

Fig. 13. F:A.M.21111, Section A, *Serridentinus productus* (Cope), neotype, from New Mexico.
(See also Figs. 14, 16 and page 577; 1926, Figs. 7A, 12 and 23.)

F:A.M.21294A, Sections A and B, *Ocalientinus ojocaliensis*, ref., from Ojo Caliente, New Mexico.
(See also Figs. 7, 14 and page 580.)

F:A.M.21130 and 21127, Sections B and C, *Trobelodon taoensis*, Var. "A" and genotype, from New Mexico.
(See also Figs. 2, 18 and pages 581, 580.)

F:A.M.27075, Section C, *Aybelodon honduensis*, n.g. and sp., type, from Honduras.
(See also Figs. 5, 18 and page 532.)

F:A.M.25740, Sections A and B, *Tatabelodon gregorii*, n.sp., type, from the vicinity of Ainsworth, Nebraska.
(See also Fig. 27A and page 597.)

F:A.M.21140, Section B, *Tatabelodon riograndensis*, n.g. and sp., genotype, from Battleship Mountain, New Mexico.
(See also Fig. 6 and page 581.)

F:A.M.25739C, Section B, *Serbelodon barbourensis*, ref., from the vicinity of Ainsworth, Nebraska.
(See also Fig. 14 and page 595.)

U.N.4.4.27 (N.S.M.4–4–27), Sections B+ and C, *Amebelodon fricki* Barbour, genotype in part, from Nebraska.
(See also Fig. 14 and page 595.)
Compare page 548.

Fig. 14. "Sublongirostrine": F:A.M.25739, 25739A, 25728 (in part), 25730 (genotype, in part), 25739B and C, *Serbelodon barbourensis*, n.g. and sp., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 16 and 27 [F:A.M.25730]; Fig. 13 [F:A.M.25739C]; and pages 595, 594.)

C.M.N.H.1319, *Amebelodon* sp., from Texas.
(See page 606.)

F:A.M.21111, *Serridentinus productus* (Cope), neotype, from New Mexico.
(See also Figs. 13, 16 and page 577.)

"Longirostrine": F:A.M.21294A, *Ocalientinus ojocaliensis*, ref., from Ojo Caliente, New Mexico.
(See also Figs. 7, 13 and page 580.)

"Superlongirostrine": U.N.4.4.27 (N.S.M.4–4–27), *Amebelodon fricki*, genotype in part, from Nebraska.
(See also Fig. 13 and page 595.)

Fig. 15. F:A.M.21145 and 21122C, (?) *Serridentinus productus* (Cope), ref., from New Mexico.
(See pages 586, 587.)

F:A.M.25711, *Trilophodon osborni* (Barbour), ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 17, 23B, 25A, 26 and page 596.)

F:A.M.25732, *Serbelodon barbourensis*, ref., from the vicinity of Ainsworth, Nebraska.
(See page 595.)

F:A.M.21115, (?) *Serridentinus pojoaquensis* Nobis, partial type, from New Mexico.
(See page 578; 1926, Figs. 22A and 26.)

F:A.M.21136, *Ocalientinus ojocaliensis*, ref., from New Mexico.
(See page 580.)

F:A.M.25720, *Serbelodon* Var., from the vicinity of Ainsworth, Nebraska.
(Compare F:A.M.21294 and 21275, Fig. 7, and see page 596.)

F:A.M.25708 and 25707 (Var. A), *Eubelodon morrilli* Barbour, ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 12B, 23B and pages 598, 599.)

Fig. 16. F:A.M.23345, *Miomastodon proavus* (Cope), ref., rev., from Pawnee Creek, Colorado.
(See also Fig. 28 and page 612.)

F:A.M.25730, *Serbelodon barbourensis*, n.g. and sp., genotype, rev., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 14, 27 and page 594.)

F:A.M.21283, *Serridentinus productus* (Cope), ref., from Pojuaque Bluffs, New Mexico.
(See page 578.)

F:A.M.21111, *Serridentinus productus* (Cope), neotype, from New Mexico.
(See also Figs. 13, 14 and page 577; 1926, Figs. 7A, 12 and 23.)

Fig. 17. F:A.M.21279, *Serridentinus productus* (Cope), ref., from Lower Pojuaque Bluffs, New Mexico.
(See also Fig. 8 and page 578.)

F:A.M.21300, *Trilophodon cruziensis*, n.sp., type, from Santa Cruz, New Mexico.
(See also Figs. 10, 12A, 23A, 25 and page 579.)

F:A.M.21277, *Ocalientinus ojocaliensis*, ref., from Lower Pojuaque Bluffs, New Mexico.
(See page 580.)

F:A.M.25711, *Trilophodon osborni* (Barbour), ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 15, 23B, 25A, 26 and page 596.)

Fig. 18. F:A.M.21127, *Trobelodon taoensis*, n.g. and sp., genotype, from Santa Cruz, New Mexico.
(See also Figs. 2, 13 and page 580.)

F:A.M.21294, *Ocalientinus ojocaliensis*, n.g. and sp., genotype, from Ojo Caliente, New Mexico.
(See also Fig. 7 and page 579.)

F:A.M.21296, (?)*Amebelodon joraki*, n.sp., type, from Santa Cruz, New Mexico.
(See page 582.)

F:A.M.27075, *Aybelodon hondurensis*, n.g. and sp., genotype, from Honduras.
(See also Figs. 5, 13 and page 532.)

Fig. 19. F:A.M.21284, *Ocalientinus ojocaliensis*, ref., from New Mexico.
(See page 650.)

Fig. 20. F:A.M.21124, (?) *Ocalientinus ojocaliensis*, small ref., from Santa Cruz, New Mexico.
(See page 650; 1926, Fig. 13.)

F:A.M.23340, *Serridentinus serridens* (Cope), ref., from Texas.
(See also Fig. 36 and pages 605, 649.)

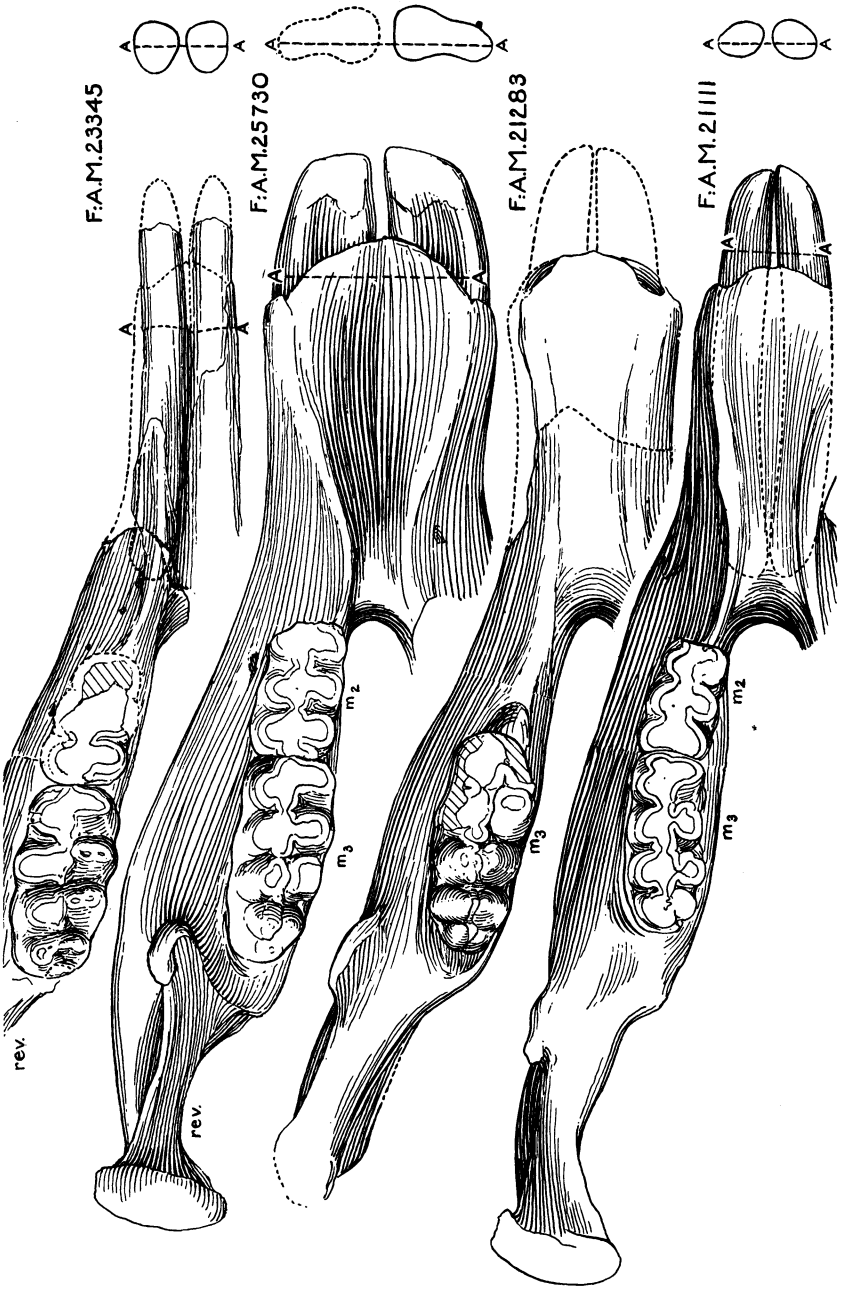

Fig. 16. Longirostrines from the late Tertiary of Colorado, Nebraska and New Mexico. × ⅛. AA, incisor cross-sections. (See legend, page 554, and compare Figs. 17 and 18.)

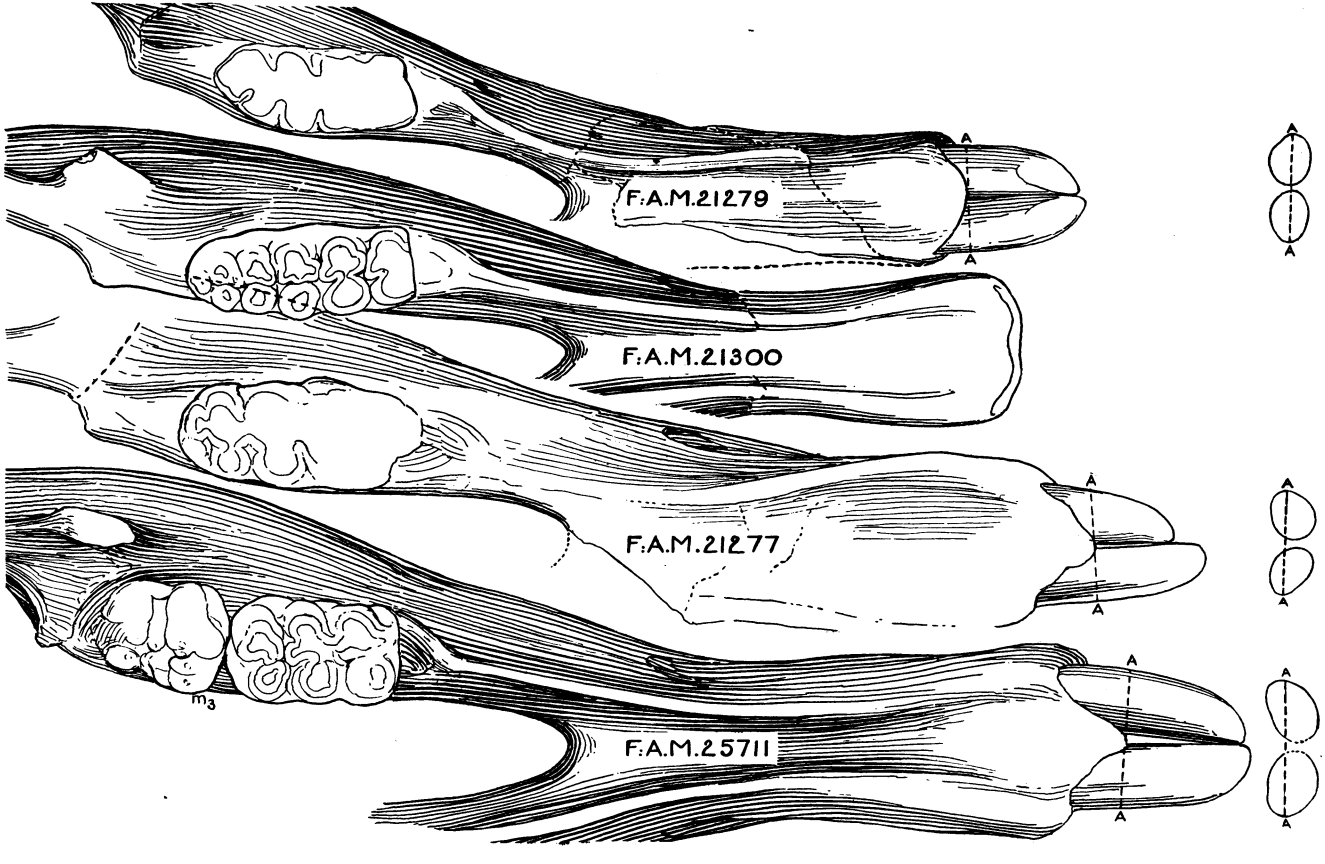

Fig. 17. Longirostrines from the late Tertiary of New Mexico and Nebraska.
× ⅙. AA, incisor cross-sections. (See legend, page 554.)

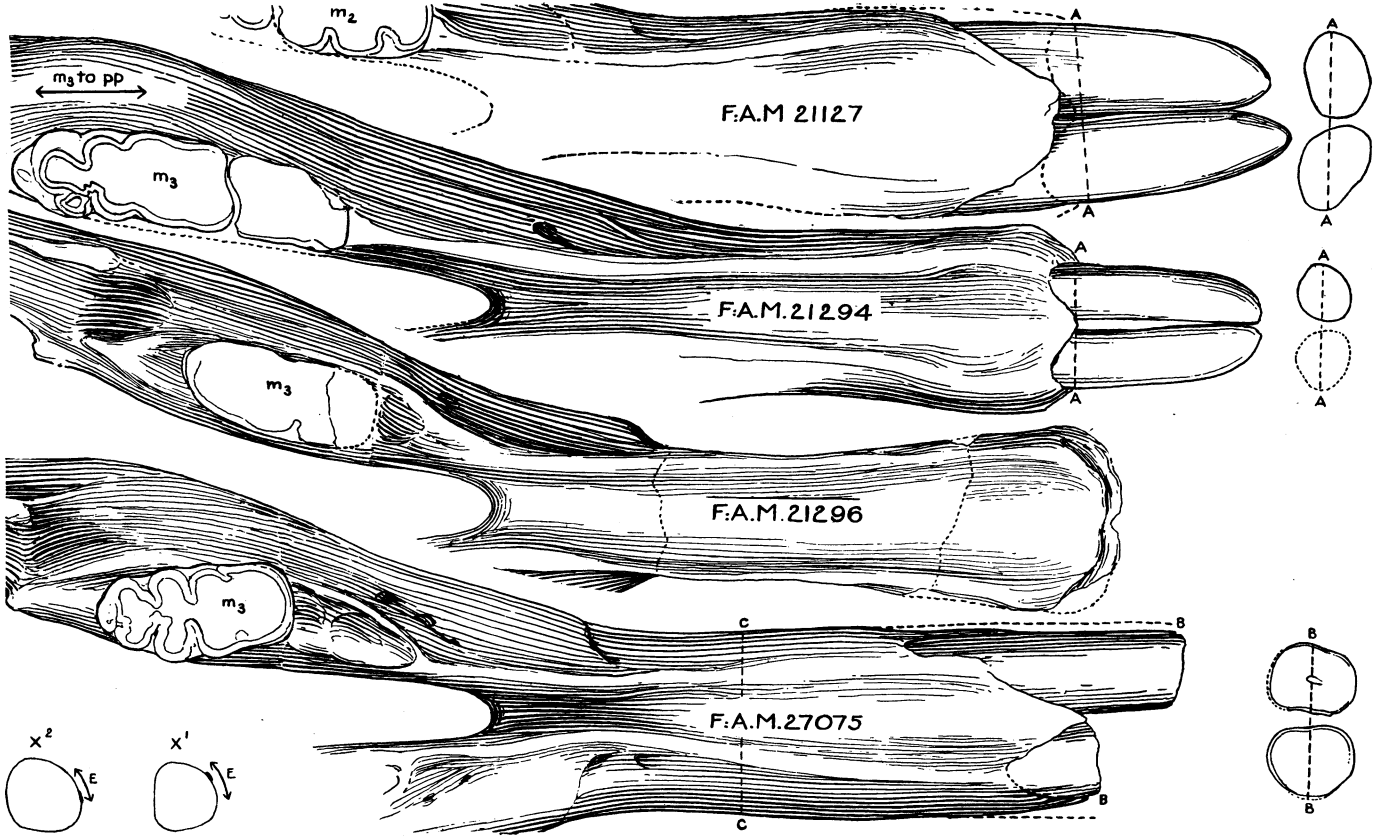

Fig. 18. Longirostrines from the late Tertiary of New Mexico and Honduras.
× ⅙. (See legend, page 554.) AA, BB, incisor cross-sections; X^1, X^2, superior tusk cross-sections (F:A.M.27075A); E, enamel band.

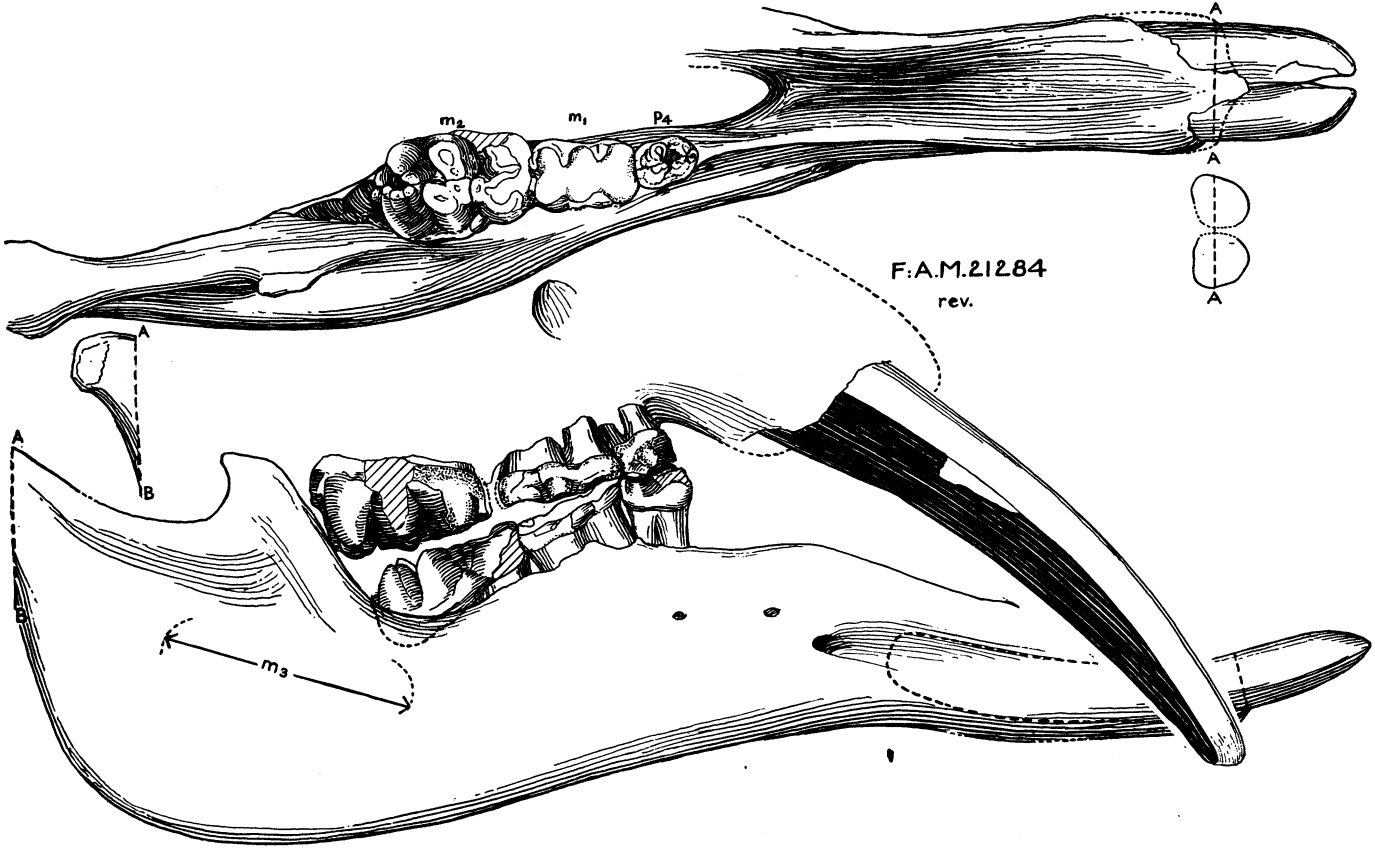

Fig. 19. Longirostrines, immature, from the late Tertiary of New Mexico.
× ⅙. AA, incisor cross-sections. (See legend, page 554.)

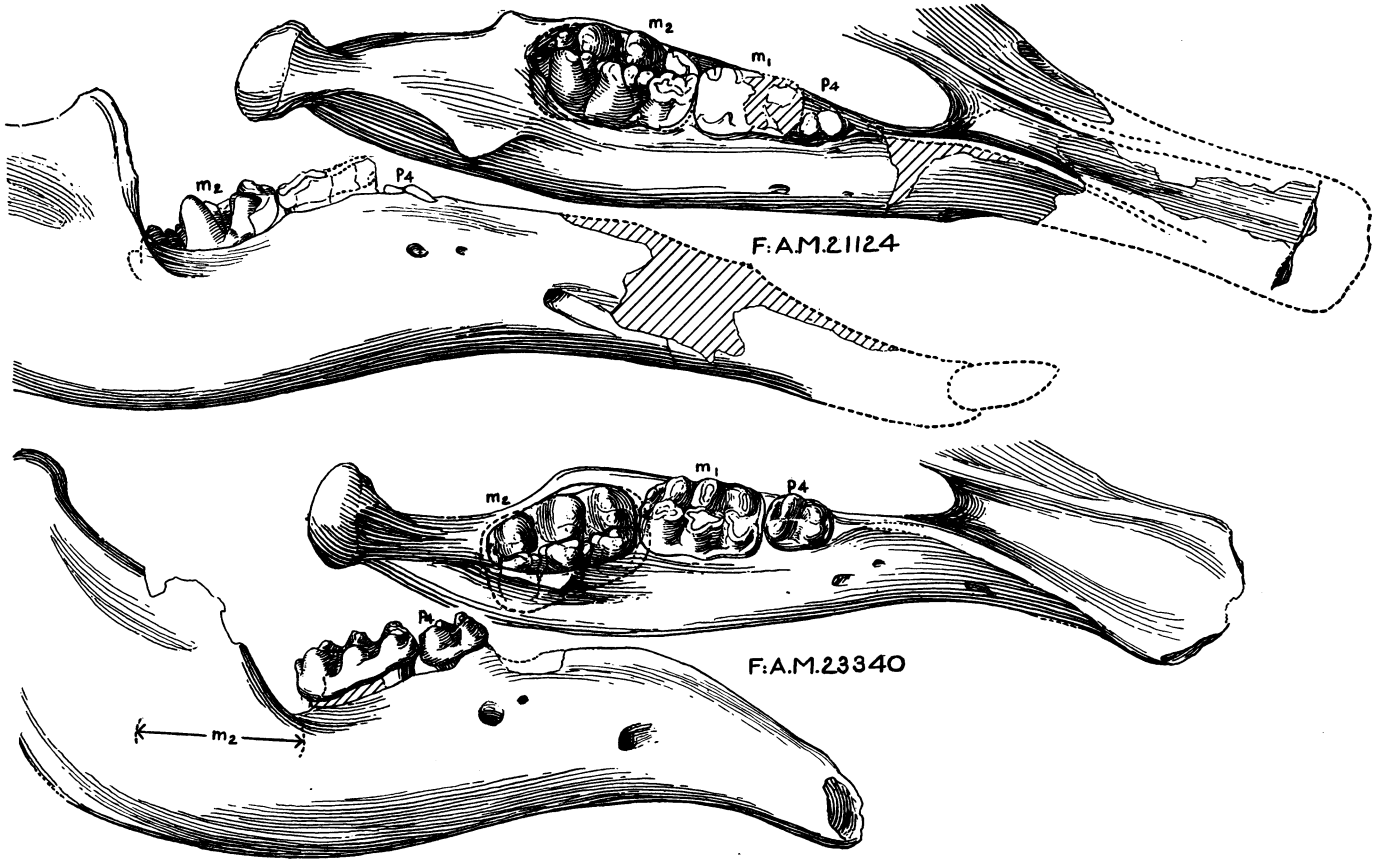

Fig. 20. Longirostrines, immature, from the late Tertiary of New Mexico and Texas.
× ⅙. (See legend, page 554.)

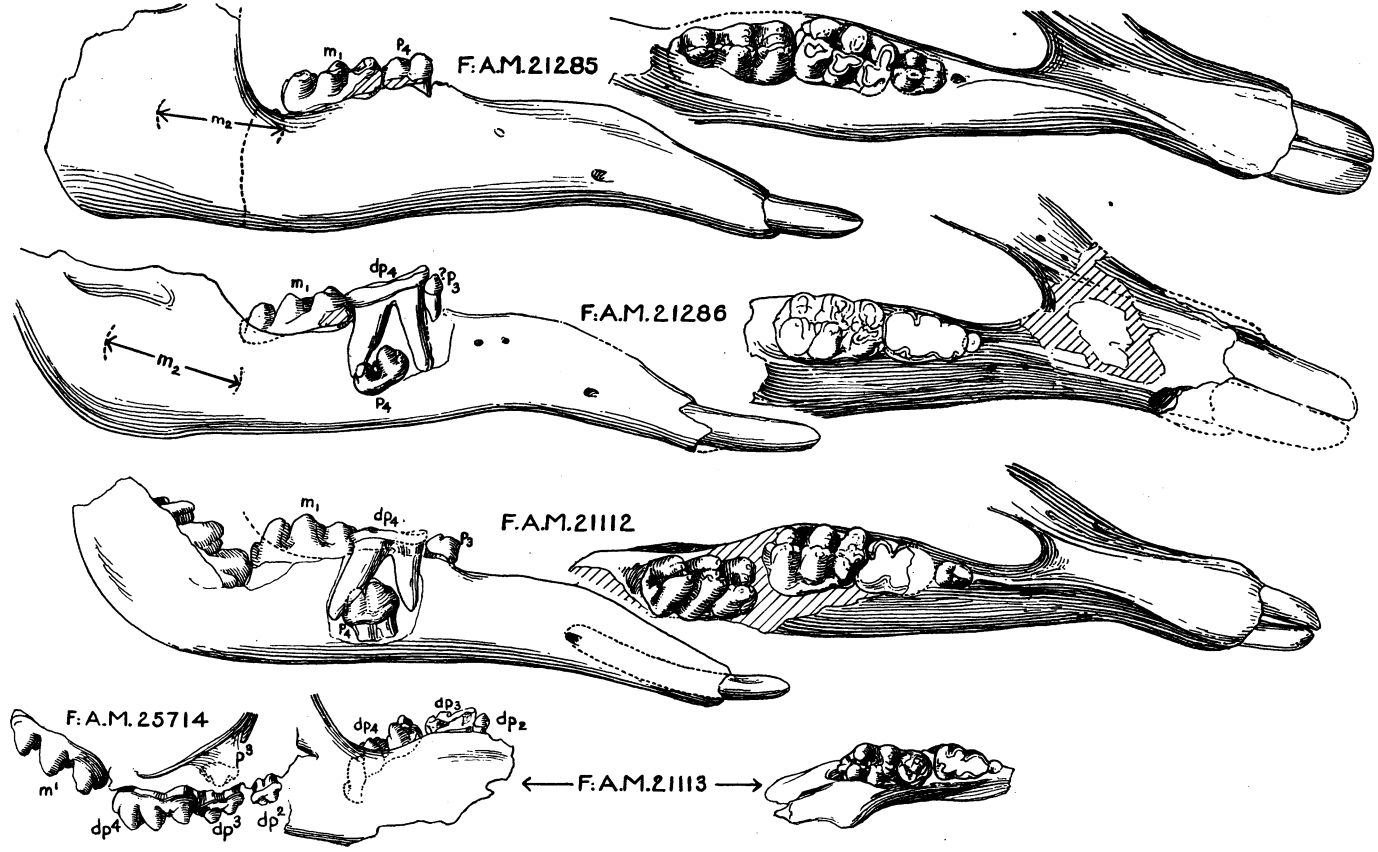

Fig. 21. Longirostrines, immature, from the late Tertiary of New Mexico and Nebraska.
× ⅙. (See legend, page 562.)

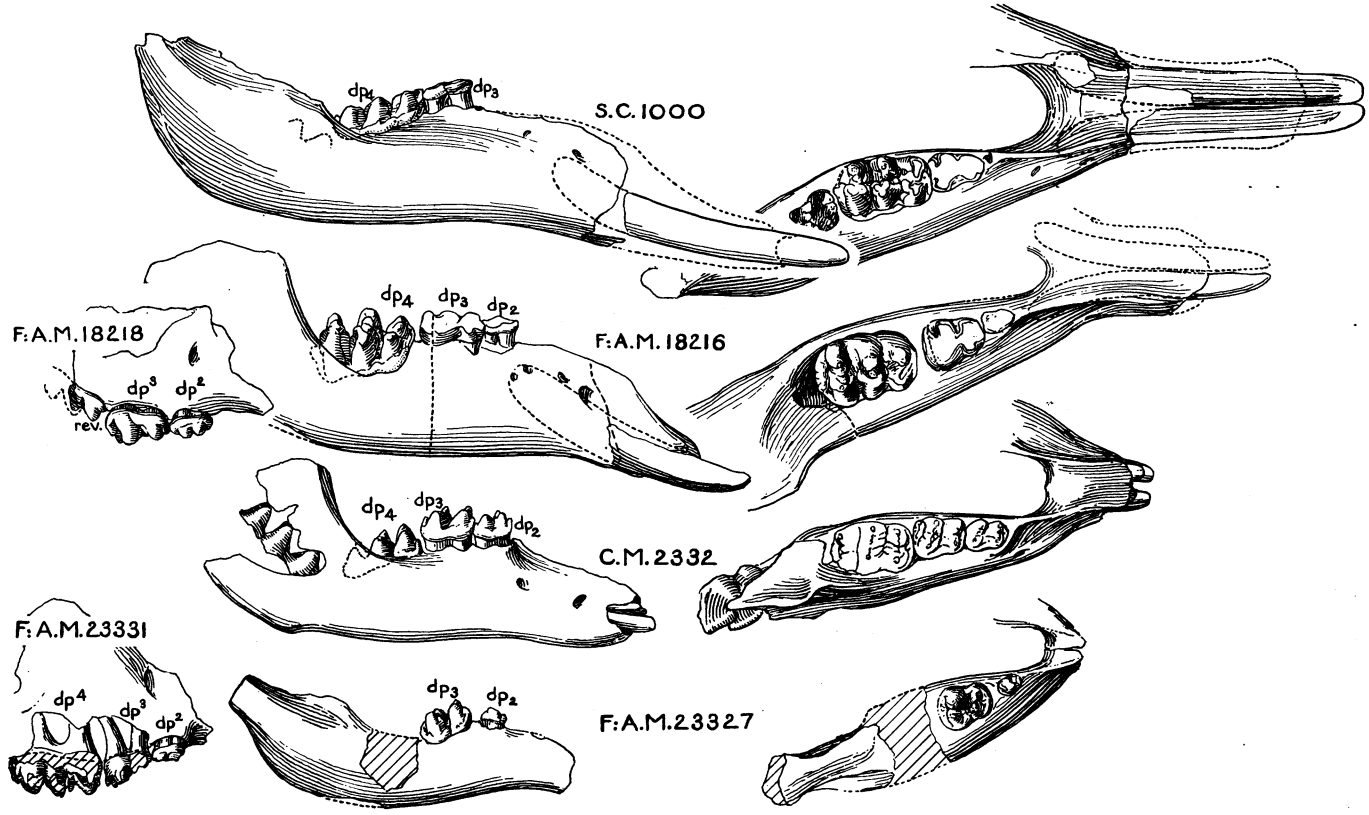

Fig. 22. Immature Longirostrine (S.C.1000), and Rhynchorostrines (F:A.M.18216 and 18218) from the late Tertiary of Kansas and California, and Brevirostrines (C.M. 2332, F:A.M.23331 and 23327) from the Quaternary of Pennsylvania and Arizona. × ⅙. (See legend ,page 562.)

Fig. 21. Immature mandibles from the late Tertiary of New Mexico, and maxilla from Nebraska.

F:A.M.21285, from Ojo Caliente, New Mexico.
(See also Fig. 32 and page 649.)

F:A.M.21286, from Santa Clara Canyon, New Mexico.
(See also Fig. 32 and page 649.)

F:A.M.21112, from north of Santa Fé, New Mexico.
(See also Fig. 31 and page 650; 1926, Figs. 6, 11 and 24.)

F:A.M.21113, from north of Santa Fé, New Mexico.
(See also Fig. 30 and page 649; 1926, Figs. 5 and 10.)

F:A.M.25714, from the vicinity of Ainsworth, Nebraska.
(See also Fig. 33 and page 649.)

Fig. 22. Immature mandibles and maxillæ from the late Tertiary of Kansas and California, and the Quaternary of Pennsylvania and Arizona.

S.C.1000 (A.M.cast), "Longirostrine" species, from Kansas.

F:A.M.18218 and 18216, *Rhynchotherium edensis* Nobis, ref., from Eden, California.
(See also Figs. 37, 38 and pages 519, 650; 1926, Figs. 2, 8 and 18.)

C.M.2332, *Mastodon americanus* (Kerr), ref., from Frankstown Cave, Pennsylvania.
(See also Fig. 38 and pages 632, 650; Peterson, 1926, p. 274 and Pls. XXII and XXIII.)

F:A.M.23331 and 23327, *Anancus bensonensis* Gidley, (?)ref., from the vicinity of Benson, Arizona.
(See also Figs. 37, 38 and pages 628, 650.)

Fig. 23. F:A.M.18219D (rev.), 18225 (rev.), and 18226, *Rhynchotherium edensis* Nobis, ref., from the Eden Pliocene, California.
(See also Figs. 1, 3, and page 519; 1926, Figs. 21A and C [F:A.M.18219D].)

Fig. 23A. F:A.M.21293, *Serridentinus productus* (Cope), Variation, from Ojo Caliente, New Mexico.
(See also Figs. 2, 25, 26 and page 578.)

F:A.M.21297, *Serridentinus productus* (Cope), ref., from San Ildefonso, New Mexico.
(See also Fig. 12C and page 578.)

F:A.M.21125, *Ocalientinus ojocaliensis*, ref., from southwest of Pojuaque Bluffs, New Mexico.
(See also Figs. 8, 12, 26 and page 579; 1926, Figs. 1A and 27.)

F:A.M.21300, *Trilophodon cruziensis*, n.sp., partial type, from Santa Cruz, New Mexico.
(See also Figs. 10, 12A, 17, 25 and page 579.)

Fig. 23B. F:A.M.23342, (?)*Tetralophodon* species, from Texas.
(See also Fig. 12 and page 607.)

F:A.M.25711, *Trilophodon osborni* (Barbour), ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 15, 17, 25A, 26 and page 596.)

F:A.M.21129, (?)*Serridentinus pojoaquensis* Nobis, ref., from Santa Cruz, New Mexico.
(See also Fig. 12B and page 579.)

F:A.M.25708, *Eubelodon morrilli* Barbour, ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 12B, 15 and page 598.)

Fig. 24. F:A.M.27069 and 27076 (rev.), (?)*Aybelodon hondurensis*, ref., from Honduras.
(See page 533.)

F:A.M.23337, *Miomastodon proavus* (Cope), ref., from Grover, Colorado.
(See also Fig. 28 and page 612.)

Fig. 25. F:A.M.21293, *Serridentinus productus* (Cope), Variation, from Ojo Caliente, New Mexico.
(See also Figs. 2, 23A, 26 and page 578.)

F:A.M.21287, *Ocalientinus ojocaliensis*, ref., from Ojo Caliente, New Mexico.
(See page 580.)

F:A.M.21300, *Trilophodon cruziensis*, n.sp., partial type, from Santa Cruz, New Mexico.
(See also Figs. 10, 12A, 17, 23A and page 579.)

F:A.M.21132, *Ocalientinus ojocaliensis*, ref., from Santa Cruz, New Mexico.
(See page 585.)

Fig. 25A. F:A.M.25711, *Trilophodon osborni* (Barbour), ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 15, 17, 23B, 26 and page 596.)

F:A.M.25705, *Eubelodon morrilli* Barbour, ref., from the vicinity of Ainsworth, Nebraska.
(See page 600.)

F:A.M.23335, *Mastodon raki*, n.sp., type, from Hot Springs, New Mexico.
(See also Fig. 29A and page 630.)

F:A.M.23333, *Anancus bensonensis* Gidley, (?)ref., from Benson, Arizona.
(See also Fig. 29 and page 627.)

Fig. 26. F:A.M.21293, *Serridentinus productus* (Cope), Variation, from Ojo Caliente, New Mexico.
(See also Figs. 2, 23A, 25 and page 578.)

F:A.M.21118 and 21125, *Ocalientinus ojocaliensis*, ref., from southwest of Pojuaque Bluffs, New Mexico.
(See also Figs. 8, 12, 23A and pages 585, 579; 1926, Figs. 1A, 22B and C, and 27.)

F:A.M.25711, *Trilophodon osborni* (Barbour), ref., from the vicinity of Ainsworth, Nebraska.
(See also Figs. 15, 17, 23B, 25A and page 596.)

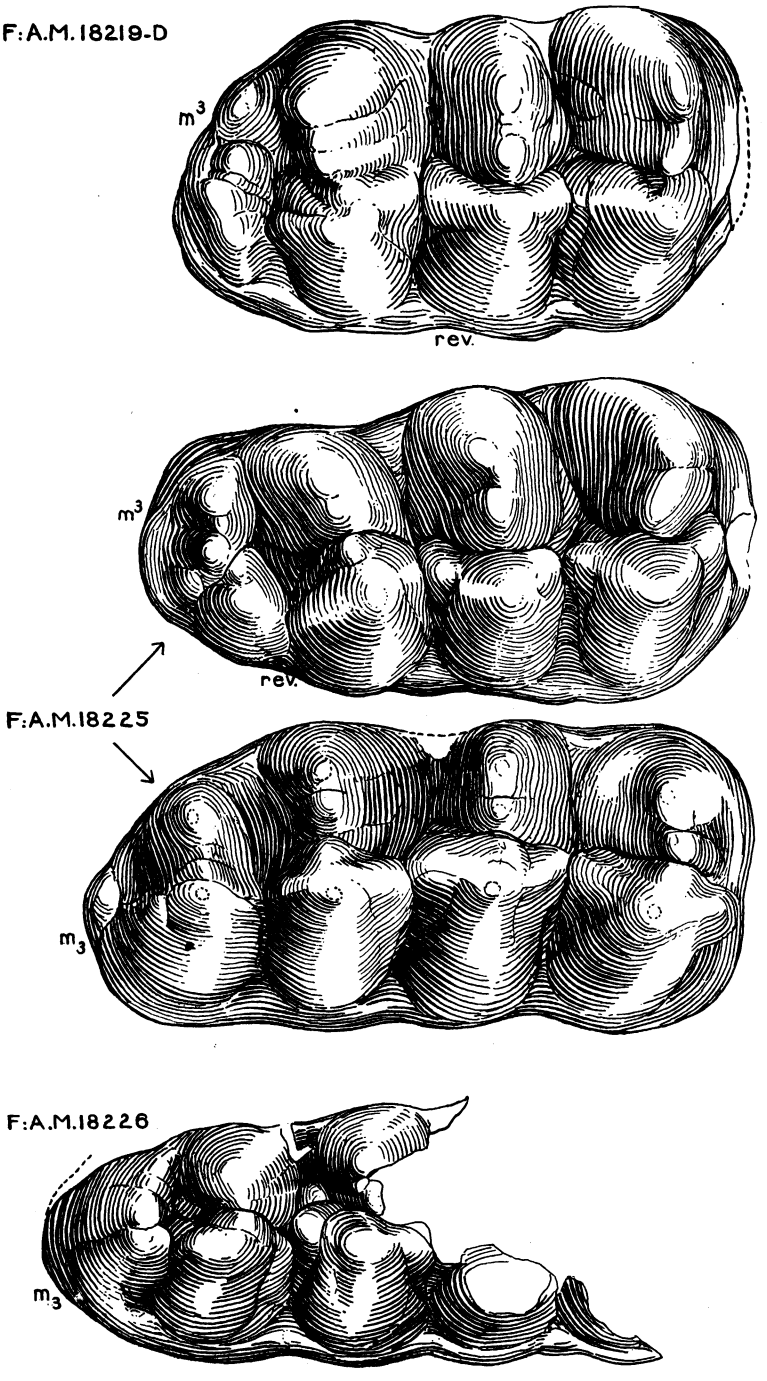

Fig. 23. *Rhynchotherium edensis* Nobis, ref., from the late Tertiary of California. $m_3^3 \times \frac{1}{2}$. (See legend, page 562.)

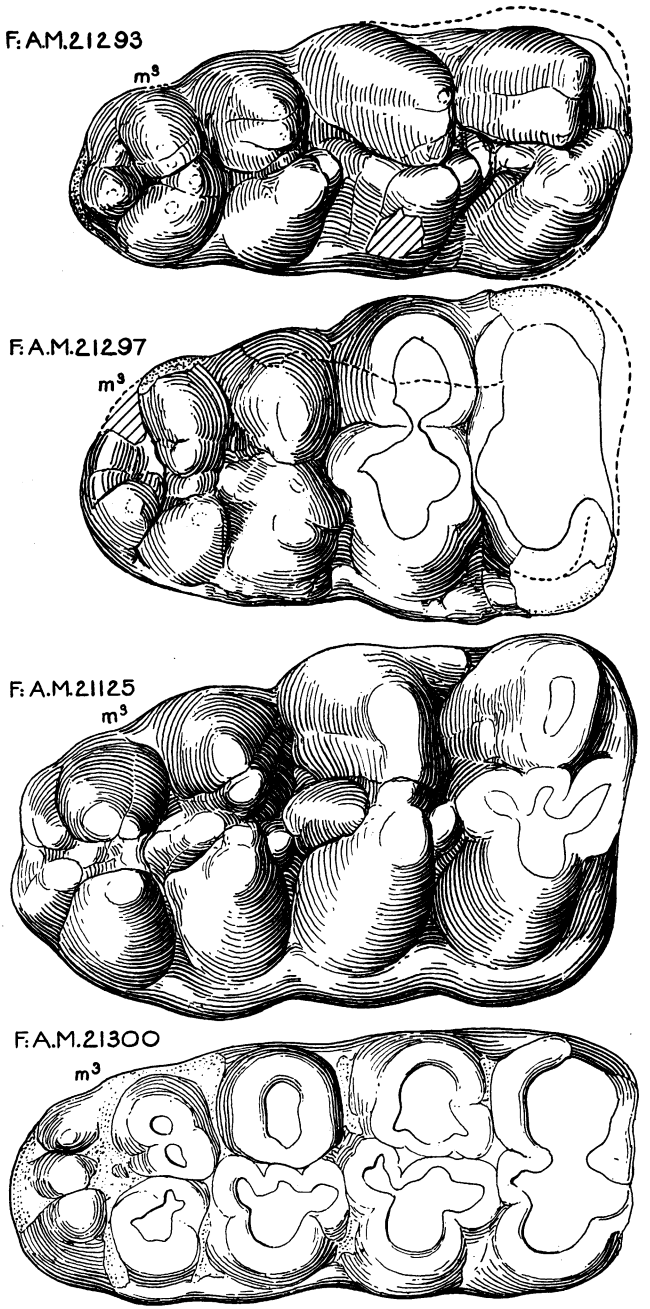

Fig. 23A. Longirostrine m³s from the late Tertiary of New Mexico. × ½. (See legend, page 562.)

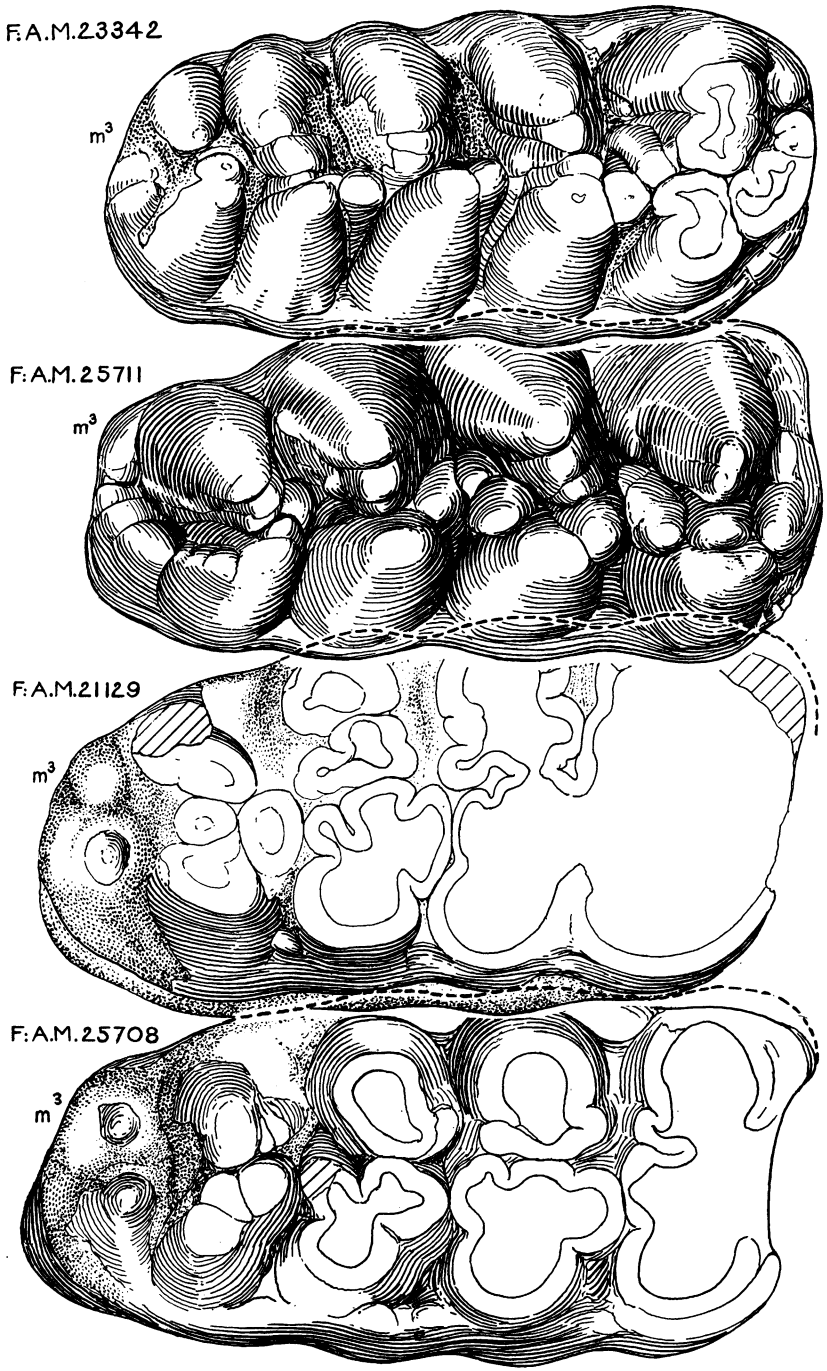

Fig. 23B. Longirostrine m³s from the late Tertiary of Texas, New Mexico and Nebraska.

× ½. (See legend, page 563.)

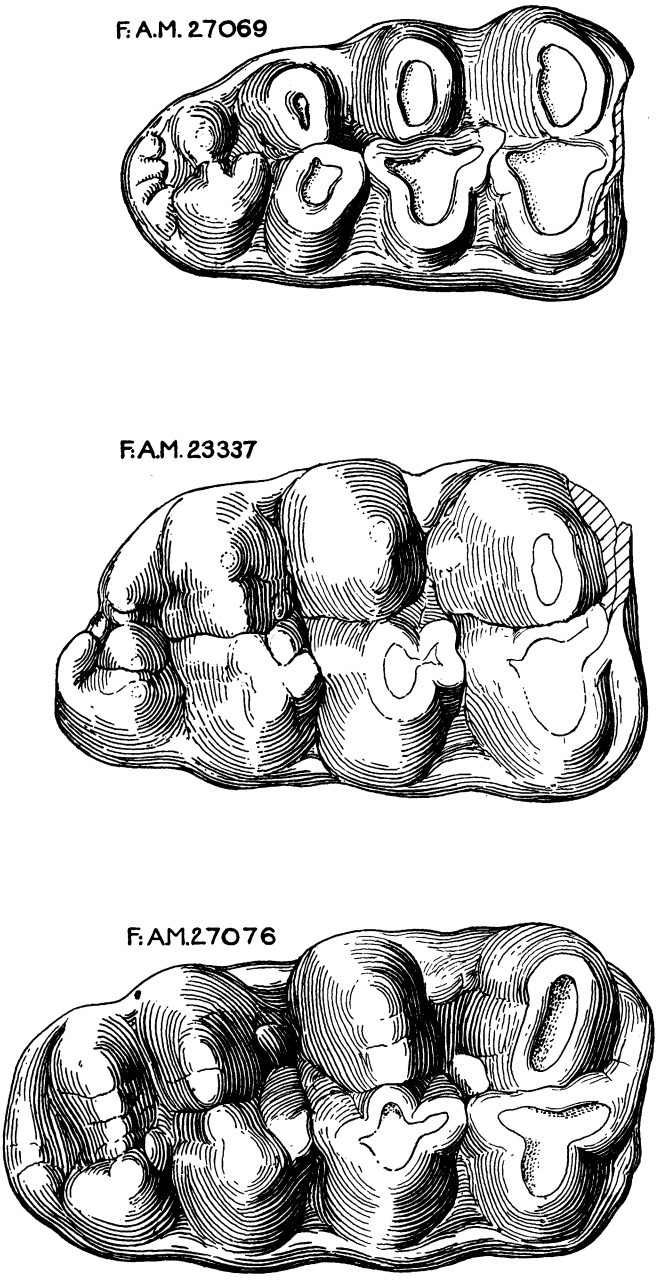

Fig. 24. Longirostrine m³s from the late Tertiary of Honduras (F:A.M.27069 and 27076) and from Colorado (F:A.M.23337).
× ½. (See legend, page 563.)

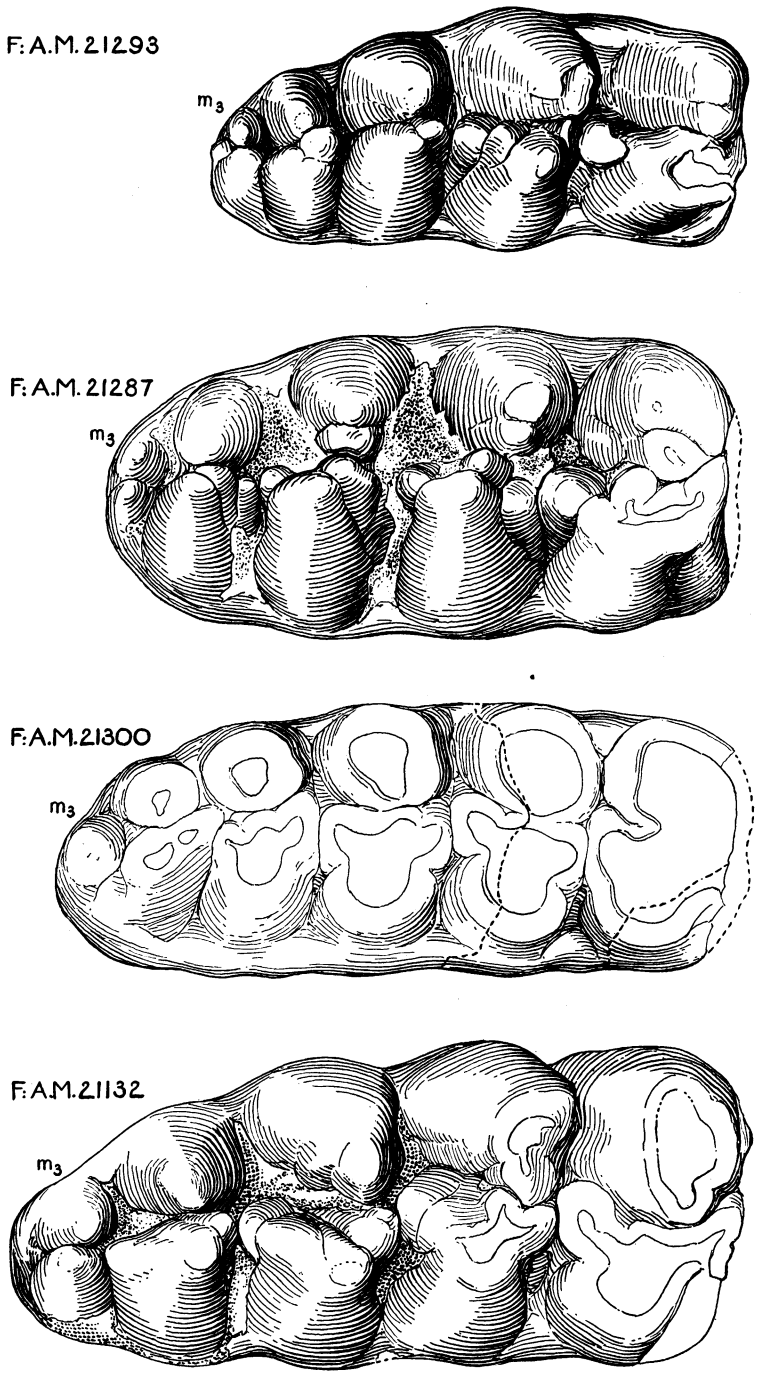

Fig. 25. Longirostrine m_3s from the late Tertiary of New Mexico. × ½. (See legend, page 563.)

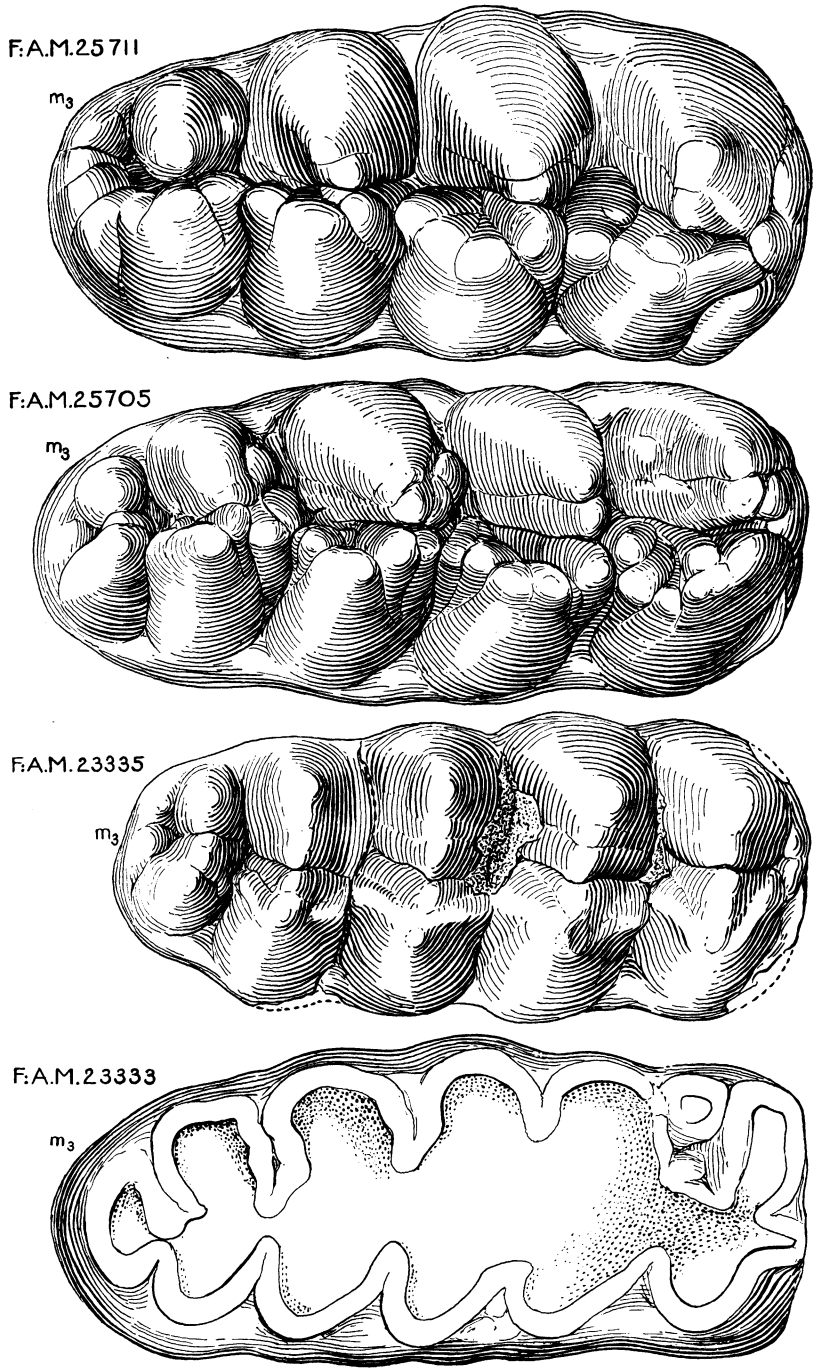

Fig. 25A. m_3s from the late Tertiary of Nebraska (F:A.M.25711 and 25705), and the Quaternary of New Mexico (F:A.M.23335) and Arizona (F:A.M.23333). × ½. (See legend, page 563.)

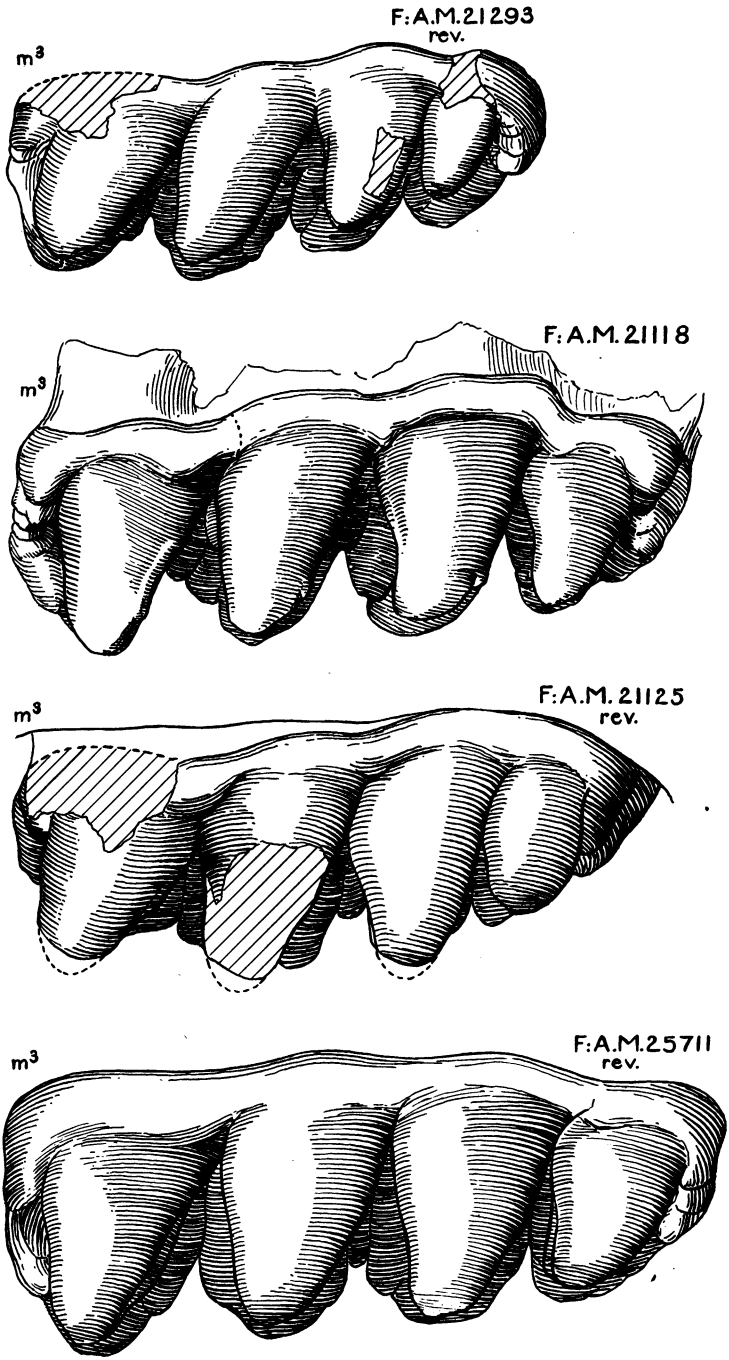

Fig. 26. Longirostrine m³s from the late Tertiary of New Mexico and Nebraska. × ½. (See legend, page 563.)

(Continued from page 548.)

The mastodont forms of the Ojo Caliente and the Santa Cruz sections of the Santa Fé basin are tentatively interpreted as of the *Hipparion* zone. Probably of as fully as late age is the peculiar type mandible of *Tatabelodon riograndensis*, n.g. and sp., discovered in place directly beneath the burnt rhyolitic contact in Battleship Mountain.[1] While time may well prove that the deposits of the Santa Fé area contain a cross-section of the greatly varied Proboscidian life of the Upper Tertiary, the absence from the Santa Fé collection of mastodont forms common to the near-by badlands of Nebraska, and vice versa, indicates that the securing of an anyways nearly adequate representation of the extinct forms of this portion of the Rio Grande basin will entail far more than the past eight seasons of collecting. Interestingly enough, with the exception of the fragmentary mandible and teeth figured and described in 1883 by Cope and now in the National Museum, our own New Mexican collection contains all of the mastodont remains from the area known to the writer. Had there been preserved but a fair percentage of the fossilized remains brought to light and destroyed by erosional forces in this New Mexican area during the uncollected fifty years from 1873–1923, how immensely might have been advanced the present generation's understanding of the broader problem and of many of the minor conundrums of the extinct mastodonts and their contemporaries. The need for painstaking and coördinated scouring of far-stretching badland wastes for their seasonal crops of remains of the past comes ever into greater prominence.

Résumé of New Mexican Genera and Species

The New Mexican mastodont material is interpreted, as noted above, as representing seven forms—

(1) *Serridentinus productus* (Cope)
(2) (?) " *pojoaquensis* Nobis, 1926
(3) *Trilophodon cruziensis*, n.sp.
(4) *Ocalientinus ojocaliensis*, n.g. and sp.
(5) *Trobelodon taoensis*, n.g. and sp.
(6) *Tatabelodon riograndensis*, n.g. and sp.
(7) (?) *Amebelodon joraki*, n.sp.

The apparent marked difference in proportionate symphysial length and considerable difference in size observed in the 1926 collection were considered to imply the presence of two distinct groups, typified by

[1] See writer's photograph of this specimen in cinches, and members of Joseph Rak's 1926 field party, including the discoverer of the specimen, Charles Christman, reproduced, opposite page 199, in "Cope: Master Naturalist," by H. F. Osborn, 1931.

Serridentinus productus (Cope) with moderate symphysis and *Trilophodon pojoaquensis* Nobis with more elongate symphysis. The more recently secured mandibles witness the presence of yet a third group with still greater elongation of symphysis paralleling *Amebelodon* Barbour.

While in 1926[1] a huge maxilla with m^3 and tusks (F:A.M.21115) was taken as the type of *Trilophodon pojoaquensis*, this species was in large part interpreted and characterized (1926, p. 161) in the light of an unusually fine referred skull (F:A.M.21125, figured 1926, Fig. 1A, and this paper, Fig. 8). A similarly proportioned cranium with attached mandible (F:A.M.21294, Fig. 7) more recently secured, points to the desirability of separating out both of these crania and other remains in a new genus, *Ocalientinus*. The proportions of the associated mandible are those previously hypothesized for *T. pojoaquensis*. The *T. pojoaquensis* type specimen now is provisionally transferred to the moderate-lengthed symphysial group typified by *Serridentinus* where certain new remains of proportionately large size are placed with it. *Ocalientinus* is characterized particularly by the extremely tall and anteroposteriorly narrow cranium, the cranial outline differing notably from the low-domed New Mexican specimen (F:A.M.21300, Fig. 10) and the two well-known Texan crania of *Serridentinus*, referred. [Compare lateral views, Figs. 7–11 and palatal views, Figs. 12–12C.] A finely preserved tuskless skull which likewise differs from *Ocalientinus* in its low-domed occiput is questionably referred as a species to the genus *Trilophodon*. A specimen with elongate symphysis and heavy superior and peculiarly robust inferior tusks is taken as the type of a new genus, *Trobelodon*. Finally, two widely differ-

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[1] Childs Frick, 1926, Bull. Amer. Mus. Nat. Hist., LVI, Art. II—see Santa Fé remains: discussion, pp. 142–150; measurements, pp. 154–158; synonymy, descriptions and lists, pp. 158–165 etc., and note errata as follows:

Page 129, 2d line. Insert after "being" two-crested and the dp^4.
Page 135, 1st paragraph, 5th line. "probable" should read improbable.
Page 136, 3d line from bottom. "18213" should read 18113.
Page 139, 2d paragraph, last line. "1.19 per cent" should read 119 per cent.
Page 140, 2d paragraph, 3d line. Change "1828" to 1867–1870.
Page 141, 4th paragraph, 6th line. "1.19 per cent" should read 119 per cent.
footnote 3, 3d line. "m^3s" should read m_3s;
4th line. "m_3s" should read m^3s; "m^2" should read m^3, and "m^3" should read m^2.
Page 143, 2d paragraph, 8th line. "tetralophodonts" should read tetrabelodons.
Page 154, 3d paragraph, last line. "tetralophodon" should read trilophodon;
"Kansas" should read South Dakota.
Page 156, last line of 1st column. Should read $m^3 = m^2 + (m^2 \times -\%)$.
Page 159, 3d paragraph from bottom, 2d line. "page 157" should read "footnote 1, page 161."
Page 162, 3d paragraph, 6th line. "m_2" should read m_3.
Page 167, 3d paragraph, 3d line. Omit "as type." "*A. braziosus*" should read *A. brazosius*.
Page 168, 1st paragraph, 5th line. "trilophodon" should read trilophodont.
4th line from last. "page 151): *T. lulli*" should read "page 134, footnote 3), and *T. lulli*."
Page 169, 3d paragraph, 5th line. "C" should read B.
11th line. Omit "16A–D"; and "20A–C" should read 20A–B.
Page 173, 2d paragraph, 21st line. "m^3s" should read m_3^3.
3d paragraph, 2d line. "2B" should read 2A.
Page 174, 1st paragraph, 7th line. "Fig. 1" should read Figs. 2 and 2A.

ing mandibles, the first with extremely elongate and tuskless symphysis and the second with an unfortunately broken but massive and evidently once elongate symphysis and heavy incisor bases, are referred respectively to *Amebelodon* Barbour and *Tatabelodon* of this paper.

In the New Mexican remains, the inferior incisors vary from:

(a) slender peg-like, exampled by F:A.M.21294, to

(b) heavy and more spatulate tending, exampled by F:A.M.21130, F:A.M. 21127, and to

(c) heavy buttress-like, exampled by F:A.M.21140, which is very suggestive of *Aybelodon hondurensis*, n.g. and sp.
The Nebraskan short-heavy, heavy-elongate spatulate and plate-like adaptations of the incisors are so far unseen. (Note diagram of incisor cross-sections, Fig. 13.)

The observed superior tusks conform to one generalized kind of rotation, curvature, cross-section and typical heavy externolateral enamel band, but vary greatly as to size according to age and individual. The heavy externolateral enamel band is universally present. Thinning and diffusion of enamel, such as noted in the Nebraskan Eubelodons, is unknown in the New Mexican series, in certain individuals of which, however, the band posteriorly and in the vicinity of the alveolus may become attenuated as exampled in slender specimen (F:A.M.21145) and in the extremely aged and heavy tusk stubs (F:A.M.21127).

Two specimens of the hyoid (see F:A.M.21300) in the New Mexican collection resemble two in the Nebraska collection by differing from the same bone in recent *Elephas* in the seeming greater attenuation and flexion of the lateral edges.

The study of molar tooth characters is ever complicated by the greatly worn condition of many of the specimens and the extreme variation in size. The extreme variation occurring between last molars of the New Mexican series is shown by several examples of unworn, or but slightly worn, teeth figured in the adjacent plates (Figs. 23A–26). The length of the shortest specimen (F:A.M.21119 = ((136)) mm.) is but 60.4% of the longest (F:A.M.21276 = 225 mm.). Hypothetically the writer has considered that the less elongate last molars may represent the "Sublongirostrines" and the more elongate molars the more highly specialized "Longirostrines" and "Superlongirostrines." The shorter-proportioned molars, at first glance, are suggestive of what seem to be the proportions of *Serbelodon* and even of *Rhynchotherium*, but in *Rhynchotherium* the main valleys may be less blocked by accessory tubercles than in the

"Longirostrines," the teeth perhaps occupying a somewhat intermediate position between the latter and *Miomastodon.*

As previously pointed out (1926), the premolar form differs very definitely in several of the widely separated mastodont genera. New evidence as to the variation in form of the replacement premolars is discussed in section V of this paper.

The New Mexico collection contains a number of tuskless rami and a unique and definitely tuskless skull. Such tuskless individuals may largely represent females. The low-domed, tuskless cranium with tuskless jaws of specimen F:A.M.21300 (Fig. 10) is interpreted as possibly representing the female of a normal, moderately elongate jawed, low-browed species. A large tuskless mandible (F:A.M.21276, Fig. 6) in which the m_3 (225 mm.) is slightly longer than in any other New Mexican specimen, may represent a large individual of the first and more moderate symphysial group. The latter mandible is apparently of proportionate size to the great skull, F:A.M.21129 (Fig. 12B), and to the maxillary type of (?)*S. pojoaquensis*, F:A.M.21115. As observed above, the much elongated mandible (F:A.M.21296, Fig. 18) of the type of the new species, (?)*Amebelodon joraki*, is also tuskless.

The limb and foot elements from New Mexico exhibit a wide size range, the length of the shortest femur (62 cm.) being but 63 per cent of that of the longest (97 cm.). These remains are tabulated at the end of the present section, III.

The New Mexican remains, considered largely on the mandibular evidence, and to less degree on that of the lower incisors and the crania, in this paper as noted above are divided tentatively between three symphysial groups and seven species. A provisional interpretation of the evidence indicates that in each of the three symphysial groups the inferior incisors may vary in different forms from more slender peg-like to either heavy buffer or spatulate-like[1]. (Heavy spatulate and plate-like variations occurring in Nebraskan remains of the first and shorter-jawed group are as yet unrepresented in the known remains from New Mexico.) Examples of the several groups and tusk forms are depicted in the adjacent figures (Figs. 13–18) of mandibles and tusk cross-sections. The fine series of immature jaws exampling different stages in growth and tooth replacement are considered apart in Part V.

[1]And see pages 547, 548 and 573, and discussion of superior and inferior tusk form under Nebraska area, pages 590, 591, 595, etc.

Résumé

of

Three Symphysial Groups

and

Seven Tentatively Recognized New Mexican Longirostrine Species

[For details as to type specimens and list of referred remains, see page 577.]

A. Symphysis Moderate—"Sublongirostrines"

[Symphysis approximating 70–90% of the post symphysis—pouch length.]

Species 1. *Serridentinus productus* (Cope).

Type.—Partial mandible, Nat. Mus. Coll.

Neotype.—Mandible, F:A.M.21111 (*Figs. 13, 14, and 16;* 1926, Figs. 7A, 12 and 23).

Normal size range exampled by the m_3s of small F:A.M.21119 (anteroposterior diameter $m_3 = ((136))$ mm.) and moderate F:A.M.21283 (anteroposterior diameter $m_3 = ((175))$ mm.), a difference of 22%.

This species seems to include most of the smaller-sized New Mexican remains. The top of the cranium is unrepresented but the skull was apparently low-domed like the Museum's two fine Texas skulls referred to *Serridentinus serridens*. The inferior incisors are peg-like.

Variation. Exampled by partial skull and mandible (F:A.M.21293, *Figs. 2, 23A, 25, 26* and F:A.M.21119, figured 1926, Figs. 13 and 22D).

Species 2. (?) *Serridentinus pojoaquensis* Nobis.

Type.—Maxilla with m^3 and tusk, F:A.M.21115 (figured 1926, Figs. 22A and 26; tusk figured this paper, *Fig. 15*).

The species is interpreted as represented in addition by a large skull, F:A.M.21129 ($m^3 = (201+)$ mm.), and a large mandible with peculiarly depressed, spatulate and tuskless symphysis, F:A.M.21276 ($m_3 =$ 225 mm.), *Fig. 6*.

(It is possible that one or both of the cranial specimens may represent Groups B or C.)

B. SYMPHYSIS LONG—"LONGIROSTRINES" PROPER

[Symphysis approximating 90–110% of the post symphysis—pouch length.]

The great majority of the New Mexican remains seem referable to this more elongate-jawed subsection. The series includes several fine crania and mandibles. The crania may be either low, as exampled in F:A.M.21300, or, which is commoner, tall and narrow with longer mandibular symphysis, as exampled in F:A.M.21294 and 21125, etc.

Cranium Low—Exampled by

Species 3. *Trilophodon cruziensis*, n. sp.

TYPE.—Skull and elongate jaws of a tuskless individual with low-domed cranium, F:A.M.21300 (*Figs. 10, 12A, 17, 23A and 25*).

(Molars narrow, with incipient fifth crest. The molars, in the latter character, differ from the usual and are partially suggestive of the condition of *Eubelodon*.)

Cranium Tall—Exampled by

Species 4. *Ocalientinus ojocaliensis*, n.g. and sp.

TYPE.—Tall narrow skull and elongate jaws with peg-like incisors, F:A.M.21294 (*Figs. 7 and 18*).

NEOTYPE.—F:A.M.21125, *Figs. 8, 12, 23A and 26* (1926, referred to *T. pojoaquensis*, Figs. 1A and 27).

[REFERRED.—F:A.M.21134, *Fig. 9*.]

Size range as seen in the m_3s (shortest, F:A.M.21287 = 170 mm., longest, F:A.M.21277 = ((205)) mm.) is 17%.

[Form of cranium unknown.]

Species 5. *Trobelodon taoensis*, n.g. and sp.

TYPE.—Crushed maxilla and mandible, F:A.M.21127 (*Figs. 2, 13 and 18*). Elongate symphysis with heavy flattened to spatulate tending incisors, roots extending well posterior to p.s. and adjoining m_2. Superior tusks reduced by wear to large stubs, enamel band moderate and proximally attenuated.

Variant "A." Exampled by crushed mandible with somewhat lighter incisors, F:A.M.21130 (*Fig. 13*).

Species 6. *Tatabelodon riograndensis*, n.g. and sp.

TYPE.—Crushed maxilla and mandible, F:A.M.21140 (*Figs. 6 and 13*). Symphysis bearing bases of extremely heavy incisors, roots extending posterior to p.s.; symphysial length while indeterminate evidently considerable.

[BB—Eubelodons of Nebraska (absent or so far unrecognized in New Mexico—but see notes under Species 3 and 7).]

C. SYMPHYSIS VERY LONG—"SUPERLONGIROSTRINES"

[Symphysis approximating 120+% of the post symphysis—pouch length.]

The group is represented in the New Mexican collection by two or more forms which differ greatly in the relative size and shape of the inferior incisors. The characters of the superior tusks are unknown.

Species 7. (?)*Amebelodon joraki*, n.sp.

TYPE.—Mandible with extremely elongate and tuskless symphysis, F:A.M.21296 (*Fig. 18*). $m_3 = ((180))$ mm.

[Note partial resemblance of symphysis to that of larger tuskless mandible from Nebraska referred to *Eubelodon*.]

Detailed Lists of the Here Recognized Seven New Mexican Species and Variants, Their Types and Synonymy, and Hypothetically Allocated Remains

(For localities and measurements, see following Tables 2 and 3, and for limbs and limb measurements, see Tables 6 and 7 at the end of Part III.)

A. SYMPHYSIS MODERATE—"SUBLONGIROSTRINES"

(1) **Serridentinus productus** (Cope)

Mastodon productus COPE, 1877, Rept. U. S. Geogr. Surv. W. 100th Meridian (Wheeler), IV, Pt. 2, p. 306, Pl. LXX, Figs. 1–3; Pl. LXXI, Fig. 3.

Tetrabelodon productus COPE, 1884, Proc. Amer. Phil. Soc., XXII, p. 5.

Serridentinus productus (COPE), OSBORN, 1923, Amer. Mus. Novitates, No. 99, p. 2.

Trilophodon (Serridentinus) productus (COPE), NOBIS, 1926, Bull. Amer. Mus. Nat. Hist., LVI, p. 142.

TYPE.—(L.C.1926)

Mandible with m_2–m_3, tusks and broken symphysis. $m_3 = 158$ mm.	Nat. Mus. Coll.	Figured by Cope, 1877, Pl. LXX, Figs. 1–3; Pl. LXXI, Fig. 3.

NEOTYPE.—

Mandible with m_2–m_3 and ♦tusks. $m_3 = ((153))$ mm.	F:A.M.21111	Figured 1926, Figs. 7a, 12 and 23. Figured this paper, *Figs. 13, 14, and 16.*

NEW REMAINS OF THE MODERATE SIZE OF THE TYPE.—

(a) Palate with m^2–m^3, worn. $m^3 = (146)$ mm.	F:A.M.21297	Figured this paper, *Figs. 12C and 23A.*
(b) Partial skull and ramus with m^2–m_3^3. $m_3 = ((165))$ mm.	F:A.M.21279	Figured this paper, *Figs. 8 and 17.*
(c) Mandible with m_2 alveolus—m_3 and tusks (specimen somewhat disintegrated). $m_3 = ((175))$ mm.	F:A.M.21283	Figured this paper, *Fig. 16.*

(1a) *Serridentinus productus* (Cope), Variation

SMALLER SIZE THAN THE TYPE.—

(d) Partial skull and right ramus with m_2^1–m_3^3; atlas and 2 vertebræ. $m^3 = (146)$ mm. $m_3 = (146)$	F:A.M.21293	Figured this paper, *Figs. 2, 23A, 25 and 26.*
(Note fragmental ramus. $m_3 = ((136))$ mm.	F:A.M.21119	Figured 1926, Figs. 13 and 22D.)

(2) (?)**Serridentinus pojoaquensis** Nobis

Trilophodon (*Serridentinus*) *pojoaquensis* NOBIS, 1926, Bull. Amer. Mus. Nat. Hist., LVI, p. 161, Figs. 22A and 26.

(Of much larger size than the type of *S. productus*.)

TYPE.—Maxilla with m^3 and tusks; and atlas. $m^3 = 194$ mm.	F:A.M.21115	Figured 1926, Figs. 22A and 26. Tusk figured this paper, *Fig. 15.*

NEW MATERIAL TENTATIVELY REFERRED.—

It must remain in question whether the following large mandible (F:A.M.21276) and cranium (F:A.M.21129) are actually referable to the same species as maxilla, F:A.M.21115. In the mandibular specimen, though the distal end of the symphysis is lacking, what is preserved of the symphysis points to the moderate proportions, spatulate form and tendency to depression, typical of *Serridentinus*. (The tall, narrow-proportioned cranium (F:A.M.21125), previously referred to *T.* (*S.*) *pojoaquensis*, is here transferred to the new genus

and species, *Ocalientinus ojocaliensis*, so well exampled by other remains.)

Tuskless mandible with m_2–m_3 (end of symphysis missing). $m_3 = 225$ mm.	F:A.M.21276	Figured this paper, *Fig. 6.*
Large skull. $m^3 = (201+)$ mm.	F:A.M.21129	Figured this paper, *Figs. 12B and 23B.*

B. Symphysis Long—"Longirostrines Proper"

(a) Cranium Low

(3) **Trilophodon cruziensis,** new species

Type.—Fine tuskless low-domed skull and mandible with m^2–m_3^3; 2 scapulæ, 2 humeri, and partial hyoid. $m_3^3 = \frac{(165)}{180}$ mm.	F:A.M.21300	Figured this paper, *Figs. 10, 12A, 17, 23A and 25.*

Cranium relatively low, elongate narrow symphysis of moderate to long Longirostrine proportions. The narrow, elongate-tending m_3 with incipient fifth crest is not unsuggestive of *Eubelodon.*

(b) Cranium Tall

(4) **Ocalientinus ojocaliensis,** new genus and species

Type.—Skull and jaws with m_2^2–m_3^3 and tusks; atlas, scapula, partial manus, pes, and series of vertebræ. $m_2 = ((191))$ mm.	F:A.M.21294	Figured this paper, *Figs. 7 and 18.*
Referred.—Fine skull with m^2–m^3 and tusk. $m^3 = 172$ mm.	F:A.M.21125	Figured 1926, Figs. 1A and 27. Figured this paper, *Figs. 8, 12, 23A and 26.*

(This specimen in 1926, correctly characterized as to tall narrow cranium, etc., and as to probable elongation of symphysis, was placed with the maxillary type of *T. (Serridentinus) pojoaquensis*, which is now tentatively interpreted as of the preceding shorter symphysial subgroup.)

Skull with both m^2–m^3s and disintegrated left tusk, fragmentary vertebral column and pelvis.	F:A.M.21134	Figured this paper, *Fig. 9.*
Mandible with m_2–m_3 and tusk alveoli. $m_3 = 170$ mm.	F:A.M.21287	Figured this paper, *Fig. 25.*
Crushed ramus and symphysis with m_3 and tusks. $m_3 = ((205))$ mm.	F:A.M.21277	Figured this paper, *Fig. 17.*

[Mandible (slightly immature and distal end of symphysis missing), F:A.M.21124, figured this paper, *Fig. 20;* 1926, Fig. 13.]

Upper tusk, symphysis with incisors; partial radius, tibia, and metatarsal 4. (Largest superior tusk—important.)	F:A.M.21281	
Premaxillæ–maxillæ and tusks with m^2–m^3.	F:A.M.21136	Figured this paper, *Fig. 15.*
Two sets of detached lower incisors.	F:A.M.21294A and 21294B	A figured this paper, *Figs. 7, 13 (section) and 14.*

(5) **Trobelodon taoensis,** new genus and species

TYPE.—Crushed maxilla and mandible with m_2^2–m_3^3, superior tusks and inferior incisors. $m_3 = ((185))$ mm.	F:A.M.21127	Figured this paper, *Figs. 2, 13, 18.*

The mandibular proportions of this interesting specimen approximate those of the "Longirostrines" proper. The specimen represents an extremely aged individual, the large superior tusks being worn to short stubs. (The tusk condition is nearest approached in the Santa Cruz specimen, F:A.M.21275.) The wear of the right differs from that of the left tusk, the greatest wear of the right tusk being on the outer upper side, and that of the left on the inner and lower side. The enamel bands are somewhat narrowed and become even more attenuated in the vicinity of the alveolus. (Somewhat similar attenuation of the bands is observed in a New Mexican tusk, F:A.M.21145, and in a number of variably

differing specimens from Nebraska.) The type specimen is particularly interesting on account of the heaviness of the inferior incisors, the cross-section of these being exceeded only in the New Mexican collection by the Battleship Mountain specimen, F:A.M.21140 (see Species 6).

(5a) *Trobelodon taoensis*, Variant A

EXAMPLE. — Much crushed ramus and symphysis with m_2–m_3 and tusks. $m_3 = ((166))$ mm.	F:A.M.21130	Figured this paper, *Fig. 13.*

The inferior incisors of this smaller specimen, while much lighter than in F:A.M.21127, are notably heavier than in typical *Trilophodon* and *Ocalientinus*. The specimen may represent the female of F:A.M.21127, or may possibly prove to belong to a heavier-incisored individual of one of the preceding species.

(6) **Tatabelodon riograndensis,** new genus and species

TYPE.—Mandible with m_3s and extremely heavy incisor bases, distal end of symphysis missing. $m_3 = 199$ mm. right, 203 left.	F:A.M.21140	Figured this paper, *Figs. 6 and 13.*

Characterized by the extreme heaviness, indentation and posterior position of the incisor root, unusual lightness of posterior mandible relative to symphysis and apparent tendency to deflection of symphysis.

In the referred Nebraskan species the mandibular symphysis is of peculiar form, the inferior incisors are elongate and of extremely massive cross-section, and the upper tusks are large, with wide bands.

As elsewhere explained, the apparent elongation of the symphysis points to the allocation of F:A.M.21140 to the intermediate symphysial group with *Trilophodon* and *Ocalientinus*. The heaviness of the lower incisors exceeds *Serbelodon*, of the first moderate symphysial group, and parallels *Aybelodon* of the third and much elongated symphysial group. While this mandible is selected as the type of the genotypic species, *Tatabelodon riograndensis*, the peculiar characters of the genus would seem to be better portrayed in the below referred Nebraska species, *Tatabelodon gregorii*.

C. SYMPHYSIS VERY LONG—"SUPERLONGIROSTRINES"

(7) (?)**Amebelodon joraki,** new species

TYPE.—Tuskless mandible with m_3s. F:A.M.21296 Figured this paper, *Fig. 18.*

m_3 (much worn) = ((180+)) mm.

Characterized by elongation (122–127%) and considerable breadth of symphysis and anterior position of main mental foramen, etc.

(This specimen should be compared with the Nebraska specimen, F:A.M. 25707, referred to *Eubelodon morrilli*, Var. A.)

Tables

As an aid to further study, six tables are attached, giving:

Table 1. Summary enumeration of major specimens of—
(a) crania, and
(b) mandibles.

Table 2. Measurements of major mandibular specimens grouped according to species, approximate mandibular proportions and last molar lengths.

Table 3. Mature specimens of dentition arranged according to m_3^3 lengths, with species and localities.

Table 4. Summary of etc. dental remains not included in the foregoing tables.

Table 5. Immature and replacement dentitions, also listed and discussed under Part V.

Tables 6 and 7. Limbs and limb measurements, at the end of Part III.

TABLE 1

SUMMARY ENUMERATION OF MAJOR SPECIMENS FROM NEW MEXICO

(a) Twelve partial to largely perfect crania, which include:

Two fine skulls and associated mandibles:

F:A.M.21300, tuskless, Fig. 10, *T. cruziensis*, type
F:A.M.21294, unusual skull and jaws, Fig. 7, *O. ojocaliensis*, type

Three skulls without jaws:

F:A.M.21125, beautiful skull, Fig. 8, *O. ojocaliensis*, referred
F:A.M.21134, Fig. 9, *O. ojocaliensis*, referred
F:A.M.21129 (top of cranium missing), Fig. 12B, (?) *S. pojoaquensis*, referred

Skull portions associated with rami:

F:A.M.21293, Fig. 2, *S. productus*, Variation
F:A.M.21279, Fig. 8, *S. productus*, referred
F:A.M.21135, *O. ojocaliensis*, referred
F:A.M.21275, Fig. 7, *O. ojocaliensis*, referred
F:A.M.21284, Fig. 19, adolescent, *O. ojocaliensis*, referred
F:A.M.21127, Fig. 2, *T. taoensis*, type

A partial cranium without ramus:

F:A.M.21282, Fig. 12C, *O. ojocaliensis*, referred

(b) Fifteen specimens showing proportions, or approximate proportions, of the mandibular symphysis:

F:A.M.21111, Fig. 16, *Serridentinus productus* (Cope), neotype
*F:A.M.21279, Fig. 8, *S. productus* (Cope), referred
F:A.M.21283, Fig. 16, *S. productus* (Cope), referred
*F:A.M.21135, *Ocalientinus ojocaliensis*, referred
(())F:A.M.21287, Fig. 25, *O. ojocaliensis*, referred (prop. estim.)
*F:A.M.21300, Fig. 10, *Trilophodon cruziensis*, type
*F:A.M.21275, *O. ojocaliensis*, referred
*F:A.M.21294, *O. ojocaliensis*, type
*F:A.M.21284, Fig. 19, *O. ojocaliensis*, referred
F:A.M.21277, Fig. 17, *O. ojocaliensis*, referred
(())F:A.M.21276, Fig. 6, (?) *S. pojoaquensis*, referred (prop. estim.)
F:A.M.21296, Fig. 18, (?) *Amebelodon joraki*, type
(())F:A.M.21130, *Trobelodon taoensis*, Var. A (prop. estim.)
*F:A.M.21127, Fig. 2, *T. taoensis*, type
(())F:A.M.21140, Fig. 6, *Tatabelodon riograndensis*, type (prop. estim.)

*associated with crania of list (a) above.
() approximate.
(()) estimated.

TABLE 2

APPROXIMATE MEASUREMENTS OF MAJOR MANDIBULAR SPECIMENS GROUPED ACCORDING TO THE HERE RECOGNIZED SPECIES, AND ACCORDING TO APPROXIMATE MANDIBULAR PROPORTIONS AND LAST MOLAR LENGTHS

		Mandibular Proportions	$\frac{m^3}{m_3}$	Localities
Serridentinus productus (Cope), neotype.	F:A.M.21111	81%	$\frac{\overline{((153))}}{}$ mod.	Santa Fé area, 1924
" referred.	F:A.M.21279	89%	$\frac{((154))}{((165))}$ much worn	Lower Pojuaque Bluffs, 1927
"	F:A.M.21283	91%	$\frac{\overline{((175))}}{}$ mod., br.	Pojuaque Bluffs, 1928
(?)*Serridentinus pojoaquensis* Nobis, referred	F:A.M.21276	((80%))	$\frac{\overline{225}}{}$ mod.	Tesuque territory, 1927
Trilophodon cruziensis, n.sp., type	F:A.M.21300	91%	$\frac{(165)}{\overline{180}}$ mod.	Santa Cruz, 1930
Ocalientinus ojocalientensis, n.g. and sp., referred	F:A.M.21287	((96%))	$\frac{\overline{170}}{}$ erupt	Ojo Caliente, 1928
"	F:A.M.21135	(100)%	$\frac{((170))}{172}$ worn	North Pojuaque Bluffs, 1926
"	F:A.M.21275	107%	$\frac{((190))}{((190))}$ mod., br.	Santa Cruz, 1927
" type	F:A.M.21294	103%	$\frac{177}{((191))}$ much worn	Ojo Caliente, 1929
" referred	F:A.M.21277	102%	$\frac{\overline{((205))}}{}$ much worn	Lower Pojuaque Bluffs, 1927
Trobelodon taoensis, n. g. and sp., type	F:A.M.21127	(100)%	$\frac{((176))}{((185))}$ worn	Santa Cruz, 1930
(?) *Amebelodon joraki*, n.sp., type	F:A.M.21296	126%	$\frac{\overline{((180+))}}{}$ much worn	Santa Cruz, 1930

( ) approximate; (( )) estimated.

TABLE 3

LIST OF MATURE DENTAL SPECIMENS
ARRANGED ACCORDING TO M_3^3 LENGTHS, LONGEST TO SHORTEST
(For immature dentitions and limb elements see separate lists)

m_3	m^3	See Table No.		Localities
225		1b, 2	F:A.M.21276, (?)*S. pojoaquensis*, ref.	Tesuque territory, 1927
[221]	(201+) much worn	1a	F:A.M.21129 "	Santa Cruz, 1931
((220+)) br.			F:A.M.21139 "	Battleship Mt., 1926
[217]	194 mod.		F:A.M.21115 " type	Black Mesa road, 1924
((205))		1b, 2	F:A.M.21277, *O. ojocaliensis*, ref.	Lower Pojuaque Bluffs, 1927
[205]	((187))		F:A.M.21291, (?)*S. pojoaquensis*, ref.	Pojuaque Bluffs, 1929
203 worn		1b	F:A.M.21140, *T. riograndensis*, type	Battleship Mt., 1926
200 germ	((180)) germ	1a, b	F:A.M.21284, *O. ojocaliensis*, ref.	North Pojuaque Bluffs, 1928
[200]	182 mod.		F:A.M.21136 "	Santa Fé area, 1926
198 sl. worn			F:A.M.21132 "	San Juan, 1926
[198]	180 germ		F:A.M.21118 "	E. of Black Mesa, 1924
((191))	177	1a, b, 2	F:A.M.21294, *O. ojocaliensis*, type	Ojo Caliente, 1929
((190))	((190))	1a, b, 2	F:A.M.21275 " ref.	Santa Cruz, 1927
[189]	172 mod.	1a	F:A.M.21125 "	S. W. Pojuaque Bluffs, 1924
187			F:A.M.21280	Lower Pojuaque Bluffs, 1928
((185))	((176))	1a, b, 2	F:A.M.21127, *T. taoensis*, type	Santa Cruz, 1930
180	(165)	1a, b, 2	F:A.M.21300, *T. cruziensis*, type	Santa Cruz, 1930
[180]	165		F:A.M.21290	Santa Cruz, 1929
((180+))		1b, 2	F:A.M.21296, (?) *A. joraki*, type	Santa Cruz, 1930
177 germ			F:A.M.21137, *O. ojocaliensis*, ref.	West of Pojuaque Bluffs, 1926
176			F:A.M.21128A	Santa Cruz, 1931
[176]	((160)) br.	1a	F:A.M.21134, *O. ojocaliensis*, ref.	Ojo Caliente, 1926

[ ] hypothetical; (( )) estimated; ( ) approximate.

TABLE 3—LIST OF MATURE DENTAL SPECIMENS, continued

m_3	m^3	See Table No		Localities
((175))		1b, 2	F:A.M.21283, *S. productus* (Cope), ref.	Pojuaque Bluffs, 1928
174			F:A.M.21128	Santa Cruz, 1931
[173]	(157) mod.	1a	F:A.M.21282, *O. ojocaliensis*, ref.	North of Pojuaque Bluffs, 1928
172	((170))	1a, b, 2	F:A.M.21135 "	North Pojuaque Bluffs, 1926
170		1b, 2	F:A.M.21287 "	Ojo Caliente, 1928
((166)) worn		1b	F:A.M.21130, *T. taoensis*, Var. A	Ojo Caliente, 1931
((165))	((154))	1a, b, 2	F:A.M.21279, *S. productus* (Cope), ref.	Lower Pojuaque Bluffs, 1927
[160]	(146) much worn		F:A.M.21297 "	San Ildefonso, 1930
((153))		1b, 2	F:A.M.21111 " neotype	Santa Fé area, 1924
(146)	(146) erupt	1a	F:A.M.21293, *S. productus*, Var.	Ojo Caliente, 1929
145 germ			F:A.M.21124, (?)*S. pojoaquensis*, ref.	Santa Cruz, 1924
((136)) br.			F:A.M.21119, *S. productus*, Var.	Santa Fé area, 1924

[ ] hypothetical; (( )) estimated; ( ) approximate.

TABLE 4

SUMMARY OF ETC. DENTAL REMAINS NOT INCLUDED IN THE FOREGOING TABLES

Three specimens listed in 1926 paper:

F:A.M.21123, left ramus, paratype of *S. pojoaquensis*

F:A.M.21118B, partial right ramus with m_2–m_3 (broken)

F:A.M.21120, fragment of palate with posterior portions of m^3s

Miscellaneous teeth, skull and ramal fragments:

Four last molars listed in 1926 paper, F:A.M.21116, 21117A, 21118A, 21122A

Eleven teeth and fragments, F:A.M.21142, 21272A and B, 21288, 21292 and A, 21295, A and B, 21128B and C.

Six etc. broken skull and ramal fragments, F:A.M.21148 (skull fragment), 21274, 21279A (large left ramus), 21299, Box 85 No. 37, Box 129 No. 71

Two detached tusks, F:A.M.21144, 21145 (*Fig. 15*)

TABLE 5

NEW MEXICAN IMMATURE DENTAL SPECIMENS

(And see Part V)

Specimens listed in 1926 paper:

F:A.M.21112, mandible
21113, right ramus
21124, adolescent mandible and associated broken p^3–m^2
*21121, dp_3 (worn)
*21114, ? dp_4–m_1
*21124E, ? dp^4
*21124C, p^3
21124D, p^4
*21124B, p_4 germ, 46.2 mm.
*21122B and C (*Fig. 15*), two small superior tusks
*21122, small inferior tusk

Specimens more recently secured:

F:A.M.21131, partial palate with p^3–p^4
21272, partial palate with p^4–m^1 (br.)
21278, partial mandible with p_4–m_1
21284, partial skull and mandible with $p\frac{1}{4}$–$m\frac{2}{2}$
21285, mandible with p_4–m_2 (germ)
21286, mandible with "p_3"–m_1
21298, maxilla with dp^2–dp^3
*21141, dp_3 (slightly worn), (43) mm.
*21271, ? p^4 (br.)
*21273, p_4, ((50)) mm.
*21289, p_4, (44.5) mm.

*Not listed in Part V.

(For limbs and limb measurements, see Tables 6 and 7 at end of Part III.)

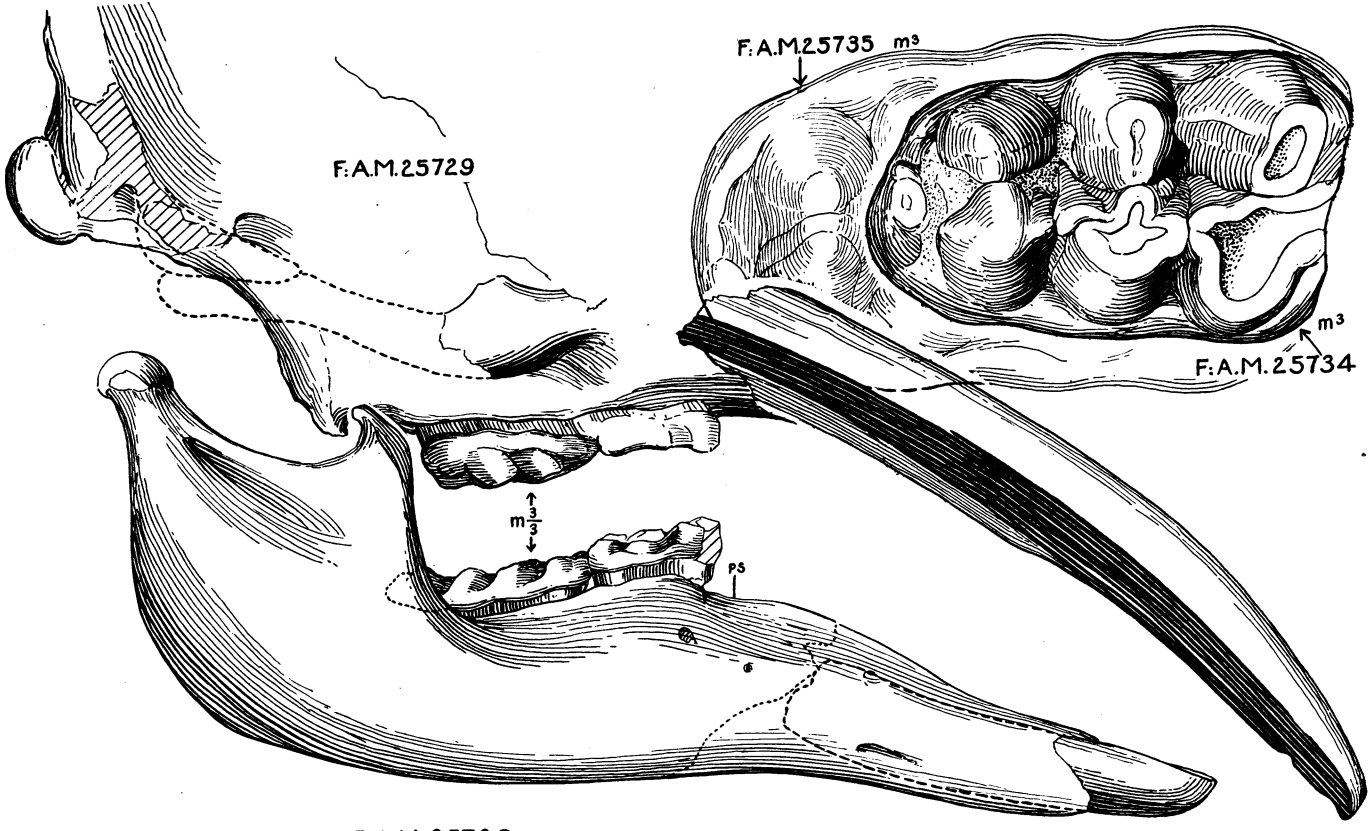

Fig. 27. F:A.M.25729, 25735 and 25734 (small individual), referred, and 25730, type, *Serbe'odon barbourensis*, n.g. and sp., from the vicinity of Ainsworth, Nebraska. (Position of superior tusk adjusted.)
× ⅙ (m^3s × ½). PS, posterior border symphysis. (See also Figs. 12C, 14, 16 and pages 595, 594.)

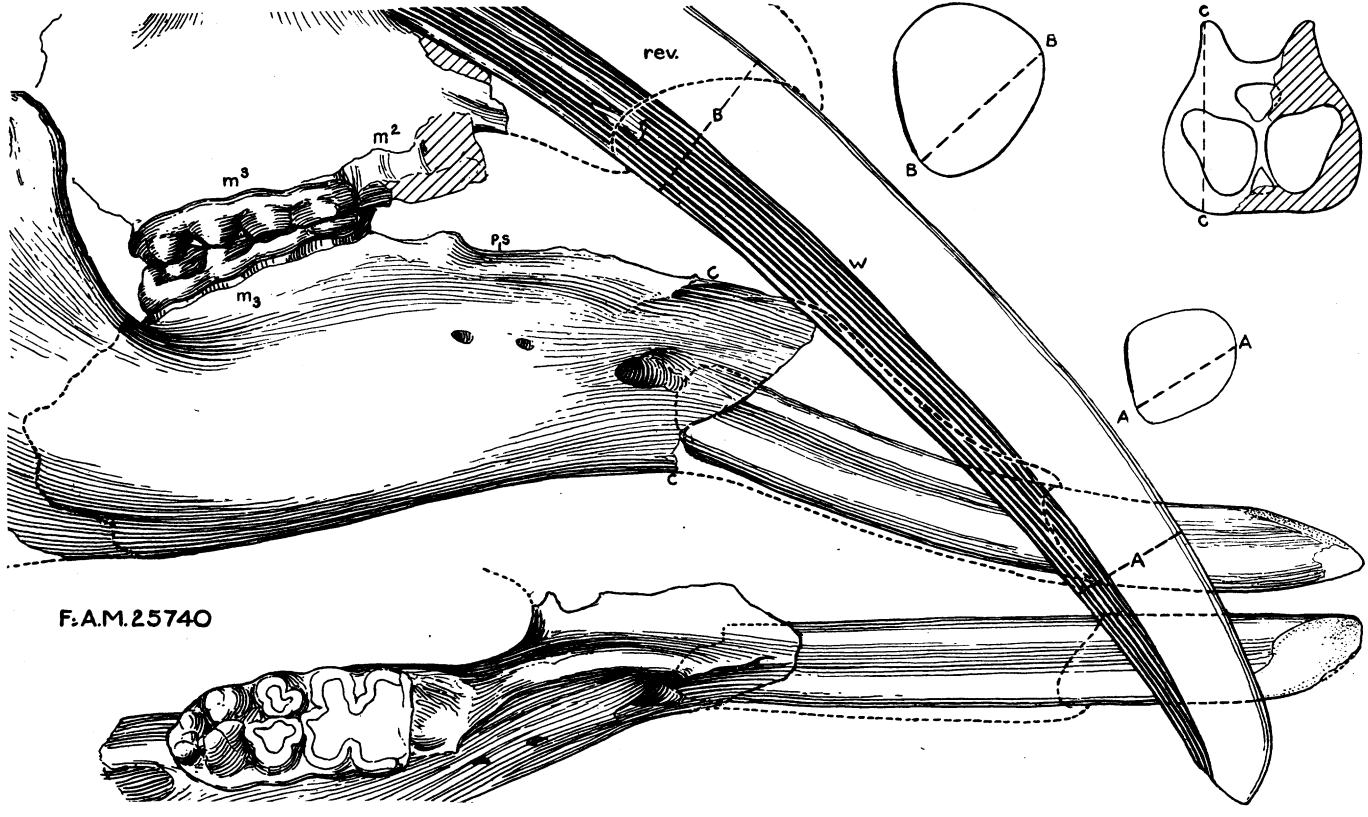

Fig. 27A. F:A.M.25740, *Tatabelodon gregorii*, n.sp., type, from the vicinity of Ainsworth, Nebraska.
(Vertical ramus supplied from opposite; position of superior tusk adjusted.)

× ⅙. PS, posterior border symphysis; W, posterior limit of worn external surface; AA, BB, CC, cross-sections of tusks. (See also Fig. 13 and page 597.)

Area B. Nebraskan Longirostrines

Introductory

A very notable series of Longirostrine remains from deposits about Ainsworth has been brought together during the past four summer seasons by Mr. Morris F. Skinner[1]. The series includes six largely complete or partial skulls and associated mandibles, etc., as well as six partial skulls, some ten jaws and numerous limb elements. The Nebraska evidence is particularly interesting in comparison with that from New Mexico (see under New Mexico, page 549). The Nebraska remains, interpreted as representative of only the "Sublongirostrine" and "Longirostrine" proper groups, are referred to five genera or subgenera and five species—

(1) *Serbelodon barbourensis*, n.g. and sp.
(2) *Trilophodon osborni* (Barbour)
(3) (?) *Ocalientinus* species
(4) *Tatabelodon gregorii*, n. sp.
(5) *Eubelodon morrilli* Barbour

A great variation is observed in the remains (at times fragmentary) in the form of the superior and inferior incisors; and, considered as to these particular characters, alternative four-fold subdivisions are indicated as follows:

Thus, the superior tusks are—

A. Broadly wedge-shaped in cross-section; moderately curved downward and outward; enamel band heavy—*Trilophodon*, *Ocalientinus* (and *Serridentinus*). (See *Fig. 15.*)

EXAMPLE.—F:A.M.25701 (enamel band 55 mm.)

Variation a. Similar, but lower edge of enamel band not directly inferior to tusk axis and tusk cross-section worn unsymmetrical.

EXAMPLE.—F:A.M.25711 (enamel band 70 mm.). *Fig. 15.*

[1] Mr. Skinner estimates the total depth of the Late Tertiary deposits in the Ainsworth area (Brown and southern Cherry and Keya Paha counties) at some 240 feet. His field observations place the Christmas quarry Serbelodons and the Horsethief Canyon Eubelodons referred towards the top of the section (the Quinn Canyon quarry Eubelodons, somewhat lower), the Rock Ledge *Trilophodon osborni* referred specimen, about the middle of the section, and the Rocky Ford *Tatabelodon* at the bottom of the section (questionably referred specimen, F:A.M.25721, from Rattlesnake Canyon is correlated with the highest level).

B. Compressed wedge-shaped in cross-section; curved down and outward; enamel band broad, anteriorly wearing away abruptly and in cases posteriorly narrowing—including *Serbelodon*, n.g.

EXAMPLE.—F:A.M.25729 (enamel band 45 mm.) *Figs. 15 and 27.*
F:A.M.25729B (enamel band 45 mm.)

Variation a. Similar but peculiarly flattened cross-section and unusually large and strongly decurved.

EXAMPLE.—F:A.M.25729C (enamel band 65 mm.)
F:A.M.25729A

(?) Variation aa.

EXAMPLE.—F:A.M.25720 (Cub Creek)
Extremely heavy, strongly decurved (disintegrated and with no present evidence of abrupt wear). *Fig. 15.*

(?) Variation b. Straighter and enamel band narrower.

EXAMPLE.—F:A.M.25716A (enamel band 30 mm.)

(?) Variation bb.

EXAMPLE.—F:A.M.25723D
Disintegrated long and rather straight pair with remnant of enamel band, possibly referable to *Eubelodon*.

Variation c.

EXAMPLE.—F:A.M.25729D (enamel band 53 mm.)
Distally flattened transversely.

C. Base tending round in cross-section, shaft strongly curved, enamel band heavy.

EXAMPLE.—F:A.M.25740 (enamel band 67 mm.) *Fig. 27A.*
F:A.M.25721 (enamel band 50 mm.)
(Peculiar post-palate suggests generic separation.)

D. Round-tending in cross-section; shaft straight or slight outward downward curvature; enamel band disappearing in maturity—*Eubelodon*.

EXAMPLE.—F:A.M.25708 and 25707. *Fig. 15.*

While the inferior incisors are—

A. Peg-shaped—*Trilophodon, Ocalientinus* (and *Serridentinus*). (See *Fig. 13.*)

B. Heavy spatulate—length short—*Serbelodon* of Christmas quarry. Exhibiting a great variation in width (according to age and sex, 43–105 mm.). Recent evidence points to generic and possibly subgeneric identity with the fragmentary *Torynobelodon loomisi*. Extremely elongate, but similarly spatulate incisors—*Amebelodon fricki* of Frontier County. See *Fig. 14.*

C. Unusually heavy buffer-like—*Tatabelodon*. (Incisor form somewhat paralleling that of Honduras *Aybelodon*.) (See *Fig. 27A.*)

D. Absent or so tending—*Eubelodon* of Mastodon quarry.

E. Plate-like—"dredge-tuskers"—"*Torynobelodon*" (*Platybelodon*) *barnumbrowni* unrecognized in our collection.

The outline of the known Nebraska crania, with the possible exception of a single specimen (F:A.M.25711) which is suggestive of the tall *Ocalientinus* type, appears to be of the more usual low-browed contour. The data of the new Nebraskan collection are of very particular interest in so largely representing forms which seem to be unknown to the New Mexican area (see page 535). While at least two of the remarkable genera, *Platybelodon* and *Amebelodon*, are as yet unrepresented in the new Nebraskan series, the same includes the heretofore unrecorded *Tatabelodon* and *Serbelodon* (unless *S. barbourensis* proves subgenerically equivalent to *Torynobelodon loomisi*).

Pending Professor Erwin H. Barbour's full report on the Nebraska Proboscidea, a tentative résumé of our Ainsworth Longirostrine remains and those of the Nebraska literature considered as to symphysial elongation and inferior and superior tusk form, for the purpose of comparison with New Mexican data, is as follows:

Résumé
of
Three Symphysial Groups
and
Tentatively Recognized Nebraskan Longirostrine Species

(The five species represented in the present collection are starred.)

A. SYMPHYSIS MODERATE—"SUBLONGIROSTRINES"

(a) "Sub-peg-tuskers" (including *Serridentinus* Osborn)

Genomastodon willistoni Barbour, [1913] 1914.

GENOTYPE.—Adolescent skull and mandible, etc., from Devil's Gulch.

(b) "Sub-shovel-tuskers"—short, spatulate lower incisors

Torynobelodon loomisi Barbour[1], 1929.

GENOTYPE.—Inferior incisor from Harlan County.

*Species 1. *Serbelodon barbourensis*, n.g. and sp.

GENOTYPE.—Mandible, F:A.M.25730 (*Fig. 27*).

(c) "Dredge-tuskers"—short, plate-like lower incisors

(?) *Platybelodon* (*Torynobelodon*) *barnumbrowni* (Barbour), 1931.

[1]Should the detached tusk of the genotype of *Torynobelodon loomisi* prove to be of the "Sub-shovel-tuskers" rather than the "Dredge-tuskers" group, the resultant transfer of *Serbelodon barbourensis* to *Torynobelodon* would indicate the transfer of the American equivalent or near equivalent of the Asiatic *Platybelodon grangeri* to a new genus, *Paraplatybelodon*.

B. Symphysis Long—"Longirostrines Proper"

"Peg-tuskers"

*Species 2. *Trilophodon osborni* (Barbour, 1916).

Type.—Skull and jaws, etc., from Boyd County.

Referred.—Skull and mandible, F:A.M.25711.

(?) *Trilophodon abeli* (Barbour, 1925).

Type.—Mandible with double incisors.

*Species 3. (?) *Ocalientinus* species only questionably represented, see F:A.M.25701.

"Buffer-tuskers"

*Species 4. *Tatabelodon gregorii*, n.sp.

Type.—Palate with m^2–m^3, tusks and partial mandible with m_3 and incisor, F:A.M.25740 (*Figs. 13 and 27A*).

BB. "Eubelodons"

Inferior tusks absent to so tending, superior tusks tending to lack definite enamel band, cross-section rounder, deflection tending less and protrusion beyond alveolus greater. m_3^3 tending longer.

*Species 5. *Eubelodon morrilli* Barbour, 1913 (and 1931).

Genotype.—Skull, mandible, etc., from Devil's Gulch, Brown County. The tuskless and distally attenuated but broken symphysis of the type might approach the proportions of either *G. willistoni* or *T. osborni*.

Referred.—Skull, F:A.M.25708.

(?) *Eubelodon phippsi* (Cook, 1928), may be synonymous with the above. The describer observes that this species "is most closely related among described types to *T. giganteus* Osborn found a short distance away in South Dakota. . ."

Referred.—Skull and mandible, F:A.M.22411.

C. Symphysis Very Long—"Superlongirostrines"

Megabelodons

Megabelodon lulli (Barbour, 1914).

Genotype.—Mandible, etc., from Cherry County.

Had incisors been developed in the *M. lulli* type mandible, such as are seen in *A. fricki*, this could have been only at the expense of the attenuated symphysis, and the resultant might have been extremely like *A. fricki*.

Amebelodons—"Long shovel-tuskers"

Amebelodon fricki Barbour, 1927.

Genotype.—Mandible from Frontier County, Nebraska.

Amebelodon sinclairi Barbour, 1930.

It should be noted that Professor Osborn cites as present in the Nebraskan Tertiary *Pliomastodon matthewi* Osborn, 1921 (based on an m_3 from Snake Creek); *Rhynchotherium anguirivalis* Osborn, 1926 (based on molars from Snake Creek); *Trilophodon progressus* Osborn, 1923 (based on a ramus from Hitchcock County), and the Tetralophodonts—*T. precampester* Osborn, 1923 (type, a lower molar from Harlan County) and *Morrillia barbouri* Osborn, 1921 (based on an m_3 from Snake Creek). It might be remarked that an undescribed form with a moderate lengthed and definitely depressed symphysis and non-enamel banded inferior tusks represented by a Kansas specimen in the University of Nebraska collection is as yet unreported from that state.

Detailed Lists of Remains of the Five Here Recognized Species from the Vicinity of Ainsworth, Brown County

(For résumé and measurements, see Tables 1–7.)

A. Symphysis Moderate—"Sublongirostrines"

(*Genomastodon* and *Torynobelodon* are unrepresented in our collections.)

"Sub-shovel-tuskers"—mandibular symphysis heavy and short, inferior incisors short, heavy, spatulate, superior tusks with strong enamel band, superior tusks worn deeply against opposed pair, last molars noticeably short.

(1) **Serbelodon barbourensis,** new genus and species

Genotype.—Mandible with m_2–m_3 and tusks. F:A.M.25730 Christmas quarry. Figured this paper, *Figs. 14, 16 and 27.*

	F:A.M.25730	F:A.M.25728	F:A.M.25731	*Amebelodon fricki*
Length symphysis	298 mm.	247		788
Length post symphysis	315	(320)		
Symphysial proportion	76%	77%		170–200%
p_4			52	(as figured)
m_1		80 (useless)	87	
m_2	(107+ +)	121+ good	112	
m_3	170	173 germ		230

A recently secured and unusually large-sized referred lower incisor of transverse width of 105 mm. (F:A.M.25739C), while suggestive of the fragmental type of *Torynobelodon loomisi* Barbour (transverse width 114 mm.), bears no resemblance to the plate-like incisor of "*Torynobelodon*" *barnumbrowni* (transverse width 159 mm.).

REFERRED.—

Adolescent mandible with m_1–m_2, m_3 germ and incisors.	F:A.M.25728	Christmas quarry. Figured this paper, *Fig. 14.*
Partial cranium with m^2–m^3 and right tusk with enamel band.	F:A.M.25729	Christmas quarry. Figured this paper, *Fig. 27.*

Tusk deeply worn, teeth much worn.

(Compare New Mexican palate, F:A.M.21297, with m^3.)

Inferior area of skull with m^2–m^3 and tusk alveoli. m^3 = (176) mm.	F:A.M.25735	From Christmas quarry. Figured this paper, *Figs. 12C and 27.*

Specimen somewhat disintegrated, teeth worn, and cross-section of tusks evidently moderate.

Anterior ⅔ immature skull with tusks, dp^2 alveolus, dp^3–m^1 and p^3–p^4 germs.	F:A.M.25732	From Christmas quarry. Figured this paper, *Fig. 15 (tusk).*

(For other immature specimens from the Christmas quarry, F:A.M.25714, 25731, 25733, 25737, 25738 and 25738A, see Table 5 and discussion and measurements in Part V.)

Partial skull with both m^2–m^3s. m^3 = 129 mm.	F:A.M.25734	Figured this paper, *Figs. 12C and 27.*
m^3. (205) mm.	F:A.M.25736A	From Christmas quarry.
Partial jaw with m_3. m_3 = (212) mm.	F:A.M.25736	From Christmas quarry.

Referred lower incisors exhibit a size variation (see *Fig. 14*) as follows:

F:A.M.25739, transverse width 43 mm.

F:A.M.25739A, transverse width 54 mm.

(F:A.M.25728, transverse width 63 mm., length 314 mm.)

F:A.M.25739B, transverse width 76 mm.

(F:A.M.25730, type, transverse width 85 mm., length 343 mm. Compare *Amebelodon sinclairi*, transverse width 89 mm., length 712 mm., from Frontier County.)

F:A.M.25739C, transverse width 105 mm. Parallels *Torynobelodon loomisi* Barbour, transverse width 114 mm. (*Figs. 13 and 14.*)

And compare

C.M.N.H.311, *Amebelodon paladentatus* (Cook), transverse width 102 mm., length ((700)) mm.

C.M.N.H.1319, *Amebelodon* species, transverse width 100 mm.

N.S.M.4–4–27 (U.N.4.4.27), *Amebelodon fricki* (Barbour), transverse width 140 mm., length 1144 mm., from Frontier County.

(?)**Serbelodon** Variations

The superior tusk is extremely heavy and decurved; the cross-section is narrow; and the enamel band is apparently broad.

EXAMPLE.—Left and portion of right ramus exhibiting broken m_3s, and associated portion of palate with m^3 and large left curved tusk with trace of enamel; 2 humeri and pelvis. m^3 (useless) = 183 mm. p.s.–p.p. = 510 m_3 (useless) = ((205))	F:A.M.25720	From Cub Creek. Figured this paper, *Fig. 15 (tusk)*.
EXAMPLE.—Extremely large left upper tusk.	F:A.M.25729A	Christmas quarry.

B. SYMPHYSIS LONG—"LONGIROSTRINES PROPER"

Upper tusks projecting but moderately beyond alveolus, with heavy enamel band, last molars tending short.

(a) Cranium Low

(2) **Trilophodon osborni** (Barbour)

Tetrabelodon osborni BARBOUR, 1916, Amer. Journ. Sci., XLI, p. 522, Figs. 1–4.

TYPE.—Partial skull and jaws.	Univ. Nebr. Coll.	Figured by Barbour, 1916, Figs. 1–4.
NEWLY REFERRED REMAINS.—Skull, excepting top of cranium, and jaws with m_2–m_3^3 (erupting) and tusks. m^1 = 100 mm. m^2 = (130+) m^3 = 192 (erupting) p.s.–p.p. = 443 p.s.–I.br. = 452 m_2 = 145 m_3 = 206	F:A.M.25711	Rock ledge, mastodon quarry. Figured this paper, *Figs. 15, 17, 23B, 25A, 26*.
Parts 2 ulnæ, 2 scapulæ, proximal portion of femur and 1 vertebra.	F:A.M.25711A	Rock ledge, mastodon quarry.
Symphysis with heavy incisor and partial ramus with alveolus.	F:A.M.25700	Fairfield Creek, 1928.

Heavy, peg-like incisor, while thicker dorsoventrally, is suggestive of *Trobelodon*, referred, Santa Fé F:A.M.21130. Reference of specimen must remain in question.

(b) Cranium ?Tall

(3) (?)**Ocalientinus** species

EXAMPLE.—Right side of skull with m^2–m^3 (br.) and tusk; and right symphysis and ramus with m_2–m_3 and tusk base. F:A.M.25701 Fairfield Creek, 1928.

$m^2 = ((117))$ mm. (useless)
$m^3 = ((180))$ (worn)
$m_2 = 111$ (useless)
$m_3 = 207$ (worn)
(Symphysial proportion approximately 100%.)

This specimen of tall-domed suggestiveness, and possibly representative of *Ocalientinus* species (see New Mexico, page 576).

(4) **Tatabelodon gregorii,** new species

TYPE.—Palate with m^2–m^3, tusks, and partial mandible with m_3 and heavy incisor. F:A.M.25740 From the vicinity of Ainsworth. Figured this paper, *Figs. 13 and 27A.*

$\frac{\text{p.p.–p.s.}}{\text{ant. symp.}} = (100)$ %
$m^3 = (190)$ mm.
$m_3 = (205)$

(Specimen received some time after this report had gone to press and is not included in Tables 1–3.)

The superior tusks are proportionately as heavy as the inferior incisor, tending to be round in cross-section and strongly curved, and are provided with a broad band of enamel. The preserved inferior incisor is of the same extremely heavy cross-section of the genotype, in this being partially suggestive of the Honduras genotype of *Aybelodon*, n.g. In the mandible the superior lateral margin of the symphysial gutter exhibits a marked flare; the usual weakness of symphysis occurs in the vicinity of the major mental foramina and the incisive root bases; superior to the incisive roots (see cross-section) there is an inverted triangular area free of bone; the depression in the vertical ramus posterior and inferior to the coronoid process is considerably less than in the New Mexican genotype, F:A.M.21140.

(And see under discussion of inferior incisor characters, page 591.)

QUESTIONABLY REFERRED.—

Palate with m^2–m^3 (erupting) and sections of right and left curved tusks with enamel bands narrowing posteriorly. Posterior palate peculiarly "bridged" over.	F:A.M.25721	Rattlesnake Canyon. Figured this paper, *Fig. 12C*.

$m^2 = 123$ mm.
$m^3 = 180$ (erupting)

Molars lighter and slenderer transversely and tusks lighter than in F:A.M. 25740.

BB. "EUBELODONS"

(5) **Eubelodon morrilli** Barbour, 1913

GENOTYPE.—Skull, mandible, etc. Univ. Nebr. Coll.

Professor Barbour observes upper tusk to be without enamel, tips chisel-shaped; mandibular symphysis tuskless, contracted laterally anterior to p.s. and with two depressions paralleling the lingual groove; m_3^3 approximately 203 mm., much worn and furnished with "double trefoils." Symphysis length 393 mm., total length of the tusk 1220 mm.

Upper tusk without definite enamel band but tendency to variable diffusion of enamel over surface, cross-section round to oval, chisel-shaped at tip, further extruded beyond alveolus and tending less decurved than in typical Longirostrines; m_3^3 long; inferior incisors missing, symphysial gutter broad, and paralleled by lateral depressions. (Questioned whether *Trilophodon phippsi* Cook is not referable.)

Professor Osborn refers *Eubelodon morrilli* to the subfamily, Notorostrinæ.

NEWLY REFERRED REMAINS.—

Large partial skull with m^2–m^3 and tusks, and probably associated limb elements (25708A).	F:A.M.25708	From Horsethief Canyon. Figured this paper, *Figs. 12B, 15 and 23B*.

Largest of the individuals here listed.
Tusks large and after initial flare are unusually straight.
$m^2 = 120$ mm.
$m^3 = 203$

Two humeri, 1 femur, scapula, 2 ilia, etc. vertebræ and ribs.	F:A.M.25708A	From Horsethief Canyon.
Ulna, and atlas, 24.8 cm.	F:A.M.25708C	

(5a) *Eubelodon morrilli*, Variant A

Partial skull including right orbit, both tusks, and left m^2–m^3 (broken and erupting); and mandible, distal end of symphysis missing, with m_2–m_3 (erupting) (cross-section of symphysis indicates tusks never present).	F:A.M.25707	From Horsethief Canyon. Figured this paper, *Fig. 15* (*tusk*).

m^2 (br.) = 143 mm.
m^3 = 221
m_2 = 136
m_3 = 220 (unworm, erupting)

Tusks very suggestive of F:A.M.25708, but more curved, and with disappearing remnant of true enamel band.

(An interesting comparison, F:A.M.25711 and 25701 versus F:A.M.25707.)

Etc. remains, exhibiting variable characters, are, for present convenience, tentatively held together under *Eubelodon morrilli:*

Skull and jaws, distal end of symphysis missing; etc. ribs.	F:A.M.22411	Mastodon quarry, found with *E. phippsi* type. Figured this paper, *Fig. 11.*

m^2 = 140 mm.
m^3 = 198
p.s.–p.p. = 508
p.s.–I.br. = ((490+))
m_2 = (120+) (useless)
m_3 = 202+

Portion of mandible with m_3.	F:A.M.25723	Spring View.

m_3 = 245 mm. (worn)

Possibly associated tusk or tusks, including left tusk of large size and straightness suggestive of F:A.M.25708. Specimen differs in presence of definite enamel band. Second tusk in poor condition and showing no enamel.

Two fragmental specimens of different sized individuals:

(a) Smaller than F:A.M.25723:

m_3 in jaw fragment.	F:A.M.25723A

m_3 = 198 mm., much worn.

(b) Approximating F:A.M.25723:

Fragment with portions of m_2–m_3.	F:A.M.25723B

Three partial rami:

(a) Left ramus with m_3, symphysis missing.	F:A.M.25710	From Plum Creek, Johnstown.
(b) Partial left ramus with m_2–m_3, and right m_3, unworn. $m_2 = 130$ mm. $m_3 = 208$	F:A.M.25705	Fairfield Creek, 1928. Figured this paper, *Fig. 25A*.
(c) Partial left ramus with broken m_3. (Poor.)	F:A.M.25715	From north side Plum Creek, 2 miles above Horsethief Canyon.

[C. Symphysis very long, "Superlongirostrines."
Megabelodons and Amebelodons unrecognized in the present collection.]

Tables

As an aid to further study, six tables are attached, giving:

Table 1. Summary enumeration of major specimens of—
(a) crania, and
(b) mandibles.

Table 2. Measurements of major mandibular dentitions grouped according to species, approximate mandibular proportions and last molar lengths.

Table 3. Mature specimens of dentition arranged according to m_3^3 lengths, with species and localities.

Table 4. Summary of etc. dental remains not included in the foregoing tables.

Table 5. Immature and replacement dentitions, also listed and discussed under Part V.

Tables 6 and 7. Limbs and limb measurements, tabulated at the end of Part III.

TABLE 1

SUMMARY ENUMERATION OF MAJOR SPECIMENS FROM NEBRASKA

(a) Crania

There are nine partial skulls, five of which are associated with mandibles:

F:A.M.25707, *Eubelodon morrilli*, Var. A
F:A.M.25708, *E. morrilli*, referred
F:A.M.25720, *Serbelodon* Variation (fragmentary)
F:A.M.22411, *E. morrilli*, referred
F:A.M.25711, *T. osborni*, referred
F:A.M.25721, *Tatabelodon gregorii*, referred
F:A.M.25701, (?) *Ocalientinus* sp.
F:A.M.25729, *Serbelodon barbourensis*, referred
F:A.M.25735, *S. barbourensis*, referred

(b) Mandibles

There are six specimens which exhibit the proportions, or approximate proportions, of the mandibular symphysis:

*(())F:A.M.25707, *Eubelodon morrilli*, Var. A
*F:A.M.25701, (?) *Ocalientinus* sp.
*(())F:A.M.22411, *E. morrilli*, referred
*F:A.M.25711, *T. osborni*, referred
F:A.M.25728, *Serbelodon barbourensis*, referred
F:A.M.25730, *S. barbourensis*, type

*associated with crania of list (a) above.
(())estimated

TABLE 2

APPROXIMATE MEASUREMENTS OF MAJOR MANDIBULAR SPECIMENS GROUPED ACCORDING TO THE HERE RECOGNIZED SPECIES, AND ACCORDING TO APPROXIMATE MANDIBULAR PROPORTIONS AND LAST MOLAR LENGTHS

		Mandibular Proportions	$\frac{m^3}{m_3}$	Localities
Serbelodon barbourensis, n.g. and sp., type	F:A.M.25730	76%	$\frac{}{170}$ worn	Christmas quarry, 1932
" referred	F:A.M.25728	77%	$\frac{}{173}$ erupt	Christmas quarry, 1932
Trilophodon osborni, referred	F:A.M.25711	102%	$\frac{192}{206}$ erupt	Mastodon quarry, 1931
(?) *Ocalientinus* sp	F:A.M.25701	98%	$\frac{}{207}$ worn	Fairfield Creek, 1928
Eubelodon morrilli, Var. A	F:A.M.25707	97%	$\frac{}{220}$ erupt	Horsethief Canyon, 1929
Eubelodon morrilli, referred	F:A.M.22411	(96%)	$\frac{198}{202+}$ worn	Mastodon quarry, 1927

( )approximate.

TABLE 3

LIST OF MATURE DENTAL SPECIMENS
ARRANGED ACCORDING TO M_3^3 LENGTHS, LONGEST TO SHORTEST

m_3	m^3	See Table No.		Localities
245 worn			F:A.M.25723, *Eubelodon morrilli*, Var. A	Spring View, 1932
232	216		C.M.N.H.1261, *E. phippsi*, type	Devil's Gulch, near Ainsworth
[223]	203 worn	1a	F:A.M.25708, *E. morrilli*, referred	Horsethief Canyon, 1929
(221) worn			F:A.M.25710 "	Johnstown, 1930
220 erupt	221 erupt	1a, b, 2	F:A.M.25707 " Var. A	Horsethief Canyon, 1929
208 erupt			F:A.M.25705, *E. morrilli*, referred	Fairfield Creek, 1928
207 worn	((180)) br., worn	1a, b, 2	F:A.M.25701, (?) *Ocalientinus* sp.	Fairfield Creek, 1928
206 erupt	192	1a, b, 2	F:A.M.25711, *Trilophodon osborni*, referred	Mastodon quarry, 1931
((205)) gr. worn	183	1a	F:A.M.25720, (?) *Serbelodon* Var.	Cub Creek, 1932
202+ worn	198	1a, b, 2	F:A.M.22411, *E. morrilli*, referred	Mastodon quarry, 1927
198 br., worn			F:A.M.25723A "	Spring View, 1932
[198]	180 erupt	1a	F:A.M.25721, *Tatabelodon gregorii*, referred	Rattlesnake Canyon, 1932
173 germ		1b, 2	F:A.M.25728, *Serbelodon barbourensis*, n.g. and sp., referred	Christmas quarry, 1932
170 worn		1b, 2	F:A.M.25730 " type	Christmas quarry, 1932
[155]	(141) much worn	1a	F:A.M.25729 " referred	Christmas quarry, 1932

( ) approximate; (( )) estimated; [ ] hypothetical.

TABLE 4

SUMMARY OF ETC. DENTAL REMAINS NOT INCLUDED IN THE FOREGOING TABLES

From the vicinity of Ainsworth:

Two fragments of rami without teeth, Box 10.

One m_3, F:A.M.25713.

Two worn and one unworn m_2, and fragment of ramus with molar and anterior alveolus, F:A.M.25724B, 25738C and E, 25724A.

Six worn or broken (?) m_1s, F:A.M.25727, 25724C and D, 25733A and B, 25738D.

Two fragments (?) dp_1s, Boxes 2 and 11.

Superior tusks:

Five tips and two fragments, F:A.M.25716B–H.

Two tips greatly worn, F:A.M.25716–I–J.

Immature tusk, F:A.M.25716.

F:A.M.25716A.

TABLE 5

IMMATURE NEBRASKA LONGIROSTRINE REMAINS CONSIDERED IN PART V

(a) Vicinity of Ainsworth, collected by Morris F. Skinner, including:

Specimens from Christmas quarry:

Portion of immature skull with dp^2–dp^4, m^1 and p^3 germ.	F:A.M.25714	Tunnel rock locality. Figured this paper, *Figs. 21, 33.*
Anterior ⅔ immature skull with tusks, dp^2 alveolus, dp^3–m^1 and p^3–p^4 germs.	F:A.M.25732	Figured this paper, *Fig. 15* (*tusk*).
Both maxillæ with p^4–m^1.	F:A.M.25737	Figured this paper, *Fig. 35.*
?dp^3.	F:A.M.25738	
p^4.	F:A.M.25738A	

Maxilla with p^3, dp^4–m^1 and p^4 germ.	F:A.M.25733	Figured this paper, *Fig. 35.*
Partial mandible with dp_3 alveolus, dp_4, m_1 and germs of p_4 and m_2.	F:A.M.25731	Figured this paper, *Fig. 35.*

Specimens from etc. localities:

Detached dp^2 and dp^3.	F:A.M.25703A and B	Fairfield Creek, 1928.
Two dp_3s.	F:A.M.25703C and 25724E	Fairfield Creek, 1928.
dp^4.	F:A.M.25726	Devil's Gulch.

(b) Sandstone layers underlying the Hay Springs Pleistocene of Turtle Canyon have yielded Charles Falkenbach remains of *Hemicyon* and *Amphicyon*, and of Longirostrines including:

p_4 (br.).	F:A.M.25719
? dp^4.	F:A.M.25717
Etc. worn dps.	F:A.M.25717A, 25718, A and B

(c) Note for comparison with the above, from:

(1) Snake Creek, collected by Albert Thomson.

A moderate and a larger sized dp^2; a p_3 measuring 28 mm.; a moderate sized p^3 and part of a second specimen; a larger sized p^3 and part of a second specimen; and a ramal fragment with a large p_4 (A.M.19224).

(2) University of Nebraska collection, from various localities.

An immature left ramus from Smith County, N.U.4–11–7–31 (broken anterior to p.s.) with dp_2–dp_3 (? p_3 alveolus) and dp_4 in alveolus.

Much worn dp_2 = 22 mm.
Partially broken dp_3 = (45)
Unworn dp_4, say = 70+

Right ramus from Cherry County, N.U.2.9.8.29.S, with dp_2 alveolus, dp_3 partially erupted, vacant alveolus of dp_4 (missing).

dp_3=((38)) mm.
Symphysis straight and showing tusk alveolus. While ramus is very small, dp_3 size near Smith County specimen.

Three dp_3s:

(a) From Boyd County, unworn, mid-valley open, ?*Pliomastodon matthewi*. Length 49 mm.
(b) Slightly worn, pattern complex. Length 49 mm.
(c) Very slightly worn, pattern complex. Length 60 mm.

(3) Vicinity of Ainsworth, collected by Morris F. Skinner.

Immature mandible with dp_3–dp_4 (erupting), F:A.M.25722, here referred to *Stegomastodon nebrascensis*.

Area C. Texan Longirostrines

Introductory

A few Proboscidean remains contained in our small collections from several Texas localities are interpreted as representative of the three Mastodont genera:

Serridentinus
(?)*Amebelodon* and
(?)*Tetralophodon*
(and of *Archidiskodon*, see sp. 7c, Part IV).

(1) **Serridentinus serridens** (Cope), referred

Tetrabelodon serridens Cope, 1889, Amer. Nat., XXIII, p. 205, Text-Fig. 8.
Serridentinus serridens (Cope), Osborn, 1923, Amer. Mus. Novitates, No. 99, p. 2.
Trilophodon (*Serridentinus*) *serridens* (Cope), Frick, 1926, Bull. Amer. Mus. Nat. Hist., LVI, p. 167.

Type.—Second molar. A.M.14297 From Texas.

Referred by Osborn.—

Two moderate symphysised *Trilophodon* skulls from the Clarendon of Texas (discussed Nobis, 1926, p. 167):

(1) immature specimen A.M.10673 and
(2) adolescent specimen A.M.10582

Newly Referred Remains (secured by members of the writer's staff passing through the Panhandle of Texas).—

Immature skull and mandible with p^3 and p_4^4–m_2^2.	F:A.M.23340	Figured this paper, *Figs. 20 and 36.*
Ramal fragment and m_3 (br.).	F:A.M.23341	
Femur of large size. 103 cm.	F:A.M.23341A	

The extremely interesting immature skull and mandible (see Part V) which are of general "Sublongirostrine" form are tentatively held under the Cope species as interpreted in the two fine referred Clarendon skulls and jaws. These two latter skulls may well represent an adolescent bull and largely mature cow of one species. The mandibular incisors of the

first are somewhat spatulate formed, those of the second more peg-like and seemingly unduly heavy relative to the slender tusks of the skull. While the writer (1926, p. 167) tentatively referred the first Texas specimen to *S. serridens* (Cope) and the second to *S. cimarronis* (Cope), the difference in size between the actual type (m^3) of *S. cimarronis* and m^3s referred to the larger species might be interpreted as representing no more than individual variation.

(2) **Amebelodon** species

From Miami Quarry, Texas

The end of a wide and dorsoventrally thin inferior incisor of indeterminate length, a fragment of enamel-banded tusk and an extremely large m_3 may or may not represent a single Miami quarry *Amebelodon* species. William D. Matthew (1930, Univ. Cal. Pub., pp. 366–367) reports the presence (evidence unrecorded) in the same quarry of a species of *Rhynchotherium.*

EXAMPLE.—Distal section of a broad and flat inferior tusk. C.M.N.H.1319 Figured this paper, *Fig. 14.*

Transverse width = 100 mm. (versus 102 mm., Yuma County type specimen).

TENTATIVELY REFERRED.—

Portion of left superior tusk of moderate size, slender transverse section and furnished with prominent enamel band. F:A.M.23349

Right m_3 (heel missing), anterior crest alone worn. F:A.M.23343

Anteroposterior diameter = ((240)) (versus 200+ to 210 mm. of Yuma County m_3s).

The specimen is of huge size and exhibits five main cusps and indication of usual heel (broken). The fifth crest is very notably attenuated, as compared to the first crest.

(Specimen in size and general outline approximates the Ecuador specimen, F:A.M.28293. The Miami molar is as fully contracted posteriorly but exhibits somewhat different arrangement of the tubercles from the more worn 28293.)

Smaller m_3 (broken and worn), and a fragment much worn. F:A.M.23343A and B

(3) (?)**Tetralophodon** species

From Northern Texas

The inferior area of a skull with enamel-banded tusks and Tetralophodont dentition, obtained from a deposit in northern Texas, is interpreted as of a Tetralophodont-Longirostrine.

EXAMPLE.—Partial skull with enamel-banded tusks and m^2-m^3, dorsal half of cranium missing.	F:A.M.23342	Figured this paper, *Figs. 12 and 23B.*

AREA D. CALIFORNIAN LONGIROSTRINES

(1) (?)**Trilophodon barstonis,** new species

From the Barstow Mio-Pliocene, Mohave Desert, California

Mastodont remains are extremely scarce in the Barstow deposits, and so far known only in a dp^3, p_4, a femur, and etc. fragments from the Uppermost horizon. The specimens seem typical of the Longirostrines. (See figures in Part V.) Dr. John C. Merriam (1919) has tentatively referred etc. tooth fragments from this area to *Tetrabelodon*? species.

Tetrabelodon? sp. MERRIAM, 1919, Univ. Cal. Pub. Bull. Dept. Geol., XI, p. 548, Figs. 161, 162.

Trilophodon (*Serridentinus*) species NOBIS, 1926, Bull. Amer. Mus. Nat. Hist., LVI, p. 166.

TYPE.—dp^3, right, in maxillary fragment. (Size large.)	F:A.M.20850B	Figured this paper, *Fig. 33.*
p_4, left, worn. Size of smallest Santa Fé p_4.	F:A.M.20850A	Figured this paper, *Fig. 36.*
REFERRED.—		
Femur. (111) cm.	F:A.M.20850C	
Three (?)carpals and one phalanx.	F:A.M.20850C	

(2) Trilophodont species

From the Pliocene of the Mohave Desert, California

A fragment of an upper tusk with enamel band, a premolar and several last molars, etc., recently secured by Messrs. John C. Blick and Jackson Wilson from the Pliocene of the Mohave Desert, may or may not represent the species recorded by Messrs. John C. Merriam and Chester Stock from the upper portion of the Ricardo beds of that area. The relative anteroposterior shortness, lowness and great reduction of the third crest in the shortest of the m^3s is at once suggestive of the New Mexican *Trobelodon taoensis* type (F:A.M.21127), the California *Rhynchotherium* (F:A.M.18219D) and in only less degree of *Miomastodon*. (It should be observed that the previously described Ricardo remains include a relatively small peg-formed lower incisor.)

Tetrabelodon ?sp. MERRIAM, 1919, Univ. Cal. Pub. Bull. Dept. Geol., XI, No. 5, p. 548, Figs. 161, 162.

Trilophodon sp. STOCK, 1928, Carn. Inst. Wash. Pub. No. 393, p. 43, Text-Fig. 1; Pl. I, Figs. B–D; Pl. II, Figs. A, D; Pl. III, Fig. B; Pl. IV, Figs. A–C.

NEW EXAMPLES.—Fragment of upper tusk with enamel band.	F:A.M.18229A
p^4.	F:A.M.18229
Four m^3s, anteroposterior length 165–170 mm.:	
m^3, right, heel rudimentary.	F:A.M.18230A
m^3s, right and left, heel less rudimentary.	F:A.M.18230
m^3, right, heel tubercular.	F:A.M.18230B
m_2–m_3, right. m_3 = 184 mm. (versus 172.7 mm., Univ. Cal. 22681).	F:A.M.18231
Partial m_3, right.	F:A.M.18232
Seven second molars.	F:A.M.18232A–G
First molar.	F:A.M.18232H

Area E. Colorado Longirostrines

(1) (?)**Amebelodon paladentatus** (Cook), referred

From Colorado

A lone Colorado m_3, left (F:A.M.23336), in which the mid-valleys are definitely blocked, as common in Trilophodonts, is held below tentatively in the *Amebelodon* genus. It is very possible that the tooth may represent some such form as (?) *Amebelodon paladentatus* (Cook)[1], in which the m_3 of the type happens to be of greater length. The specimen was secured by the John C. Blick party from deposits several miles to the east of the quarry which yielded the party the remains of *Miomastodon proavus* (Cope), referred, described on ensuing pages.

Trilophodon paladentatus Cook, 1922, Proc. Col. Mus. Nat. Hist., IV, No. 1, p. 6, Figs. 5, 6.

Type.—Mandible with right m_3 and tusk.	C.M.N.H.311	From Yuma County, Colorado. Figured by Cook, 1922, Figs. 5, 6.

Possible New Example.—

Left m_3. $m_3 = 171$ mm.	F:A.M.23336	East of Quarry.

(Size approximating m_3 of New Mexican tuskless skull and jaws, F:A.M 21300.)

Tentatively Referred (but possibly of *Miomastodon proavus*):

dp_3 fragment.	F:A.M.23345A	From Quarry, 1932.
Incomplete femur of small size.	F:A.M.23337A	W. of Blick Quarry.
Etc. metacarpals of large size.	F:A.M.23337B–E	10 miles E. of Quarry.
Two phalanges.	F:A.M.23337F and G	"

[1]According to the writer's 1927 penciled notes regarding the Colorado Museum types of:
(?) *A. paladentatus* (Cook), m_3=200+ mm. say (actually 170 mm., but greatly worn).
(?) *A. hicksi* (Cook), m_3=210 approx.
$\frac{\text{symphysis}}{\text{pouch}} = \frac{460}{380} = 121\%$

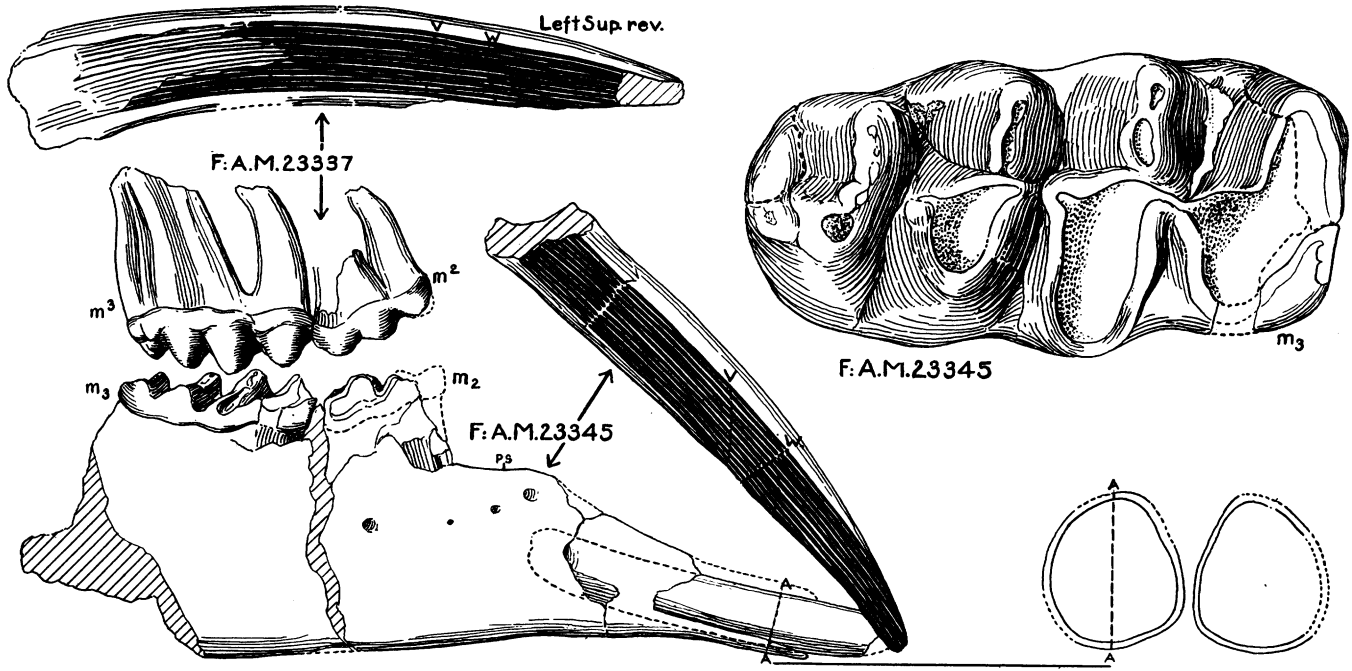

Fig. 28. *Miomastodon proavus* (Cope), ref., from Pawnee Creek, Colorado.

F:A.M.23345, right ramus with m_2–m_3 and tusks and associated superior tusk.

(See also Fig. 16, superior view, and page 612.)

F:A.M.23337, maxilla with m^2–m^3 and superior tusk.

(See also Fig. 24, occlusal view of m^3, and page 612.)

× ⅙ (m_3 and cross-section × ½). PS, posterior border symphysis; W, possible gum line; V, probable alveolar line. AA, cross-section of incisors.

(2) **Miomastodon proavus** (Cope), referred

Figures 28 and (in part) 16, 24

From Pawnee Creek, Colorado

Mastodon proavus Cope, 1873, Synopsis of New Vertebrata from the Tertiary of Colorado obtained during the summer of 1873, p. 10.

Tetrabelodon angustidens proavus Cope, 1889, Amer. Nat., XXIII, pp. 195, 202, Text-Fig. 6, Pl. xi.

Miomastodon proavus (Cope), Osborn, 1922, Amer. Mus. Novitates, No. 49, p. 4.

Trilophodon proavus (Cope), Frick, 1926, Bull. Amer. Mus. Nat. Hist., LVI, p. 168.

Of unusual importance is the discovery by the John C. Blick 1932 party of remains which for the first time evidence the definite presence in the North American Tertiary of a Longirostrine-Zygolophodont toothed mastodon. It is recalled that "Zygolophodonts" have so far been represented in the western Tertiary alone by largely unidentifiable detached teeth. The new material exhibits upper tusks with heavy enamel band, and strong lower incisors, which are in cross-section ovoid and laterally rather than dorsoventrally compressed. The shape of the incisors is perhaps more as in Pleistocene mastodon than in peg-formed Longirostrines. The symphysis apparently was proportionately shorter than in *Serridentinus productus*. While the symphysis of the Blick specimen (unfortunately broken across and apparent contact not positive) is at least as long, the size of the particular individual, as gauged by the m_3, was considerably greater than in the *Serridentinus* New Mexican neotype (F:A.M.21111). The superior tusks in the new specimen are rather suggestive, in the enamel banding, curvature and seeming shortness of their projection (5–6 inches) beyond the folds of the lip, of the tusks of mature *Serridentinus*.

Miomastodon-like forms must have had a wide range, as detached molars have been reported from Colorado, California, Montana, and Nevada, though the rarity of known remains is strange. It may well be questioned whether any "Zygolophodont" ever attained to the degree of symphysial elongation of the "Amebelodonts."

Great credit is due to the Blick party for their perseverance in following up the clue which secured us this unique mandibular specimen at the close of the second season's quarry operations on the site where they obtained the maxillary specimen the year previous.

Cope (1873) took a moderately worn p^4 with an unblocked main valley, from Colorado, as the type of his *Tetrabelodon angustidens proavus*. The main valleys of the new m_2^2–m_3^3 tend to be somewhat open

Mastodon americanus-like, as in the genotypes of *Miomastodon* and *Pliomastodon* Osborn[1]. The new remains are referred to the Cope species transferred to the former Osborn genus. The teeth of the Colorado form are very similar to *Mastodon turicensis* Schinz from Elgg (as figured by von Meyer, 1870). In the latter, the premolars appear to have been largely functionless, as pointed out by the writer in 1926. The Colorado form seems less like the remains figured by Gaudry from Pikermi.

An m^1–m^2 from Yuma County, Colorado, in the collection of the Denver Museum (C.M.N.H.330) is recalled as of somewhat generally similar character to the Pawnee specimens.

TYPE.—p^4, and etc. fragments including an astragalus. A.M.8523 Figured by Cope, 1889, Text-Fig. 6.

p^4 anteroposterior length = 51 mm.

The astragalus, while differing from New Mexican examples, is nearer F:A.M.21268E and F than F:A.M.21268C.

FOUR REFERRED SPECIMENS (secured in 1931 and 1932 by the John C. Blick party from H.Q. quarry, Pawnee Creek, Colorado):

The superior tusks of the new specimens indicate that the Pawnee Creek detached tusks (A.M.9366, type of *Rhynchotherium rectidens*) belonged to a small or adolescent individual of *M. proavus*.

(1) Left maxillary portion with m^2–m^3, detached left superior tusk, and right m^2–m^3. F:A.M.23337 Figured this paper, *Figs. 24 and 28.*

m^3 with second crest slightly worn. Specimen less aged, but judged by the heaviness of the tusk and m^3s, represents a larger individual than the following mandibular specimen.

m^2 = (125) mm.
m^3 = 155
m^3 width first crest = 92

(2) Right ramus with m_2 (br.)-m_3, detached left m_3, symphysis with inferior tusks, heel of right m^3 and of m^2 ?, and right and tip of left superior tusks. F:A.M.23345 Figured this paper, *Figs. 16 and 28.*

m_3 all crests worn. Per above, specimen represents a smaller individual than F:A.M.23337.

m_3 = 163 mm. (rt) and 157 mm. (lt).

(3 and 4) Two phalanges. F:A.M.23337F and G

[1] Type (A.M.18237) of *Pliomastodon matthewi* Osborn from Snake Creek, apparently represents a right m_3. The specimen is slender and the anteroposterior length is but ((163)) mm. Superior tusks are reported to be without enamel bands.

Limb Elements

(See Tables 6 and 7)

The accompanying collection of limb elements includes certain examples that were associated with dentitions. Approximately an equal range in size is exhibited by the remains in the well-represented collections from New Mexico and Nebraska and, oddly enough, in the very scanty collection from Colorado. The total range, as seen in the femur (longest 111 cm., shortest 62 cm.) is 56%, or as seen in the humerus (longest 82 cm. and shortest 52 cm.), 63%.

For better comparison of the various limb elements, these are here allocated (see following lists and measurement tables) to four tentative Size Groups and Size Variants A–F, etc. Slightly the largest element in the collection is a lone femur from Barstow, California. The length of the latter exceeds that of the femur of the Warren mastodon, approximates that of a specimen of the Alaskan mammoth, and is nearly twice the length of the smallest femur from the Santa Fé marls. The smallest specimen is a humerus from Ainsworth, Nebraska. It is interesting to observe limbs of the New Mexico, California and Colorado Longirostrines, proper, reaching the size of the Nebraskan *Eubelodon*. Large Texas and Arizona femurs probably do not represent the Longirostrines proper.

The largest New Mexican Size Group I remains are hypothetically allocated to *Serridentinus pojoaquensis* (compare huge type maxilla and proportionately large referred skull and mandible). New Mexican Size Groups II and III are particularly well represented by limb elements, the same including certain elements found in definite association with skulls and jaws, as exampled: Size Variant B, *Ocalientinus ojocaliensis*, referred large individual, F:A.M.21281; Size Variant B, type, F:A.M.21294, and much aged F:A.M.21275; and Size Variant D, *Trilophodon cruziensis*, type, F:A.M.21300. New Mexican Size Group IV—A, elements are hypothetically allocated to *Serridentinus productus*, Var. The lengths of the known limb elements and of the m_3 of the neotype mandible, F:A.M.21111, approximate those of the mounted *Serridentinus cimarronis* of Texas.

The collection's most completely represented skeleton is that of the adolescent Eden Rhynchothere neotype of Size Group III–A.

A recapitulation of the Size Groups represented and their several localities shows:

BARSTOW, CALIFORNIA
(?) *Trilophodon barstonis*, referred, single femur . . . . . Size Group I-A

EDEN AREA, CALIFORNIA
Rhynchotherium edensis, neotype and referred . . . . . Size Group III-A

TEXAS
Serridentinus serridens, femur . . . . . Size Group I-C

BENSON, ARIZONA
(?) *Anancus bensonensis*, referred, partial femur . . . . . Size Group I-F

PAWNEE CREEK, COLORADO
(?) *Trilophodon* species, metacarpals . . . . . Size Group I-D
femur . . . . . Size Group IV-C

NEBRASKA
Eubelodon morrilli, referred . . . . . Size Group I-B
Trilophodon ?osborni, referred . . . . . Size Group II-A
(?) *Trilophodon* species, metatarsal 3 . . . . . Size Group III-E
(?) *Serbelodon barbourensis*, referred . . . . . Size Groups II-A & IV-B

NEW MEXICO
(?) *Serridentinus pojoaquensis*, referred . . . . . Size Group I-E
Ocalientinus ojocaliensis, referred, F:A.M.21281 . . . . . Size Group II-B
F:A.M.21275, 21294 . . . Size Group III-B
(?) *Serridentinus* species . . . . . Size Group III-C
Trilophodon cruziensis, n.sp., type, F:A.M.21300 . . . . . Size Group III-D
Serridentinus productus (Cope), referred . . . . . Size Group IV-A

The limb elements are listed in detail, as measured by Haakon Dehlin, together with localities and measurements in the following tables 6 and 7, and see lists throughout the paper for association of material.

Measurements of Tertiary Mastodont Limb Elements of F:A.M. Collection

(Quaternary *Mastodon* and Recent *Elephas* for Comparison)
(See detailed measurement and tentative size-group tables following)
[Centimeters]

		Humerus	Radius	Metacarpals					Femur	Tibia	Metatarsals					Radius/Humerus	Tibia/Femur	Humerus/Femur	Radius/Tibia	Metac. 3/Humerus	Size Group
				1	2	3	4	5			1	2	3	4	5	%	%	%	%	%	
Elephas columbi	A.M.8681	112	94	13	23	24	21	17	128	68	8	15	18	17	11	(84)%	53%	87%	139%	21%	
Loxodonta (Recent African)	A.M. (M.) coll.	104	86		18	19	17	16	123	71		11.5	14	14	8	83%	58%	85%	121%	18%	
Elephas (Recent Indian)	A.M. (M.) coll.	82	68		16	18	17	14	105	56		11.5	13.5	13	8.5	83%	54%	80%	120%	22%	
Alaskan Mammoth		98	59						113	68											
(different individuals)		79								49.5											
Mastodon americanus	A.M.9951	91	67	11	15	16	15	10	107	66	7.5	9.5	12	12	7	75%	62%	85%	102%	18%	
Stegomastodon arizonæ	N.M.10707	85	63			13			101	64.5						74%	63%	84%			
(?) *Trilophodon barstonis*, n.sp., Calif	F:A.M.20850C								(111)												I–A
Eubelodon morrilli, referred, Neb	F:A.M.25708A	82							105												I–B
Serridentinus serridens, referred, Texas	F:A.M.23341A								103												I–C
Eubelodon phippsi, referred, Neb. (partially associated)	C.M.N.H.1261	77	65						102	60						unassociated					
(?) *Serbelodon barbourensis*, referred, Neb	F:A.M.25714F	76.5																			II–A
(?) *Trilophodon osborni*, referred, Neb	F:A.M.25720	75																			II–A
(?) *Serridentinus pojoaquensis*, referred, N. Mex	F:A.M.21283C								97												I–E
"	F:A.M.21300A									58											

Table 6. Measurements of Tertiary Mastodont Limb Elements of F:A.M. Collection, continued

		Humerus	Radius	Metacarpals					Femur	Tibia	Metatarsals					Radius/Humerus	Tibia/Femur	Humerus/Femur	Radius/Tibia	Metac. 3/Humerus	Size Group
				1	2	3	4	5			1	2	3	4	5	%	%	%	%	%	
(?) *Serbelodon barbourensis*, referred, Neb	F:A.M.25714B								(86)												II–A
(?) *Megabelodon giganteus*, type, S. D.	A.M.17359	80	60	9	14	(15)	14	11	(90)	(52)	5	11	12	12	8	75%	(58)%	(88)%	(114)%	(19)%	
(?) *Serridentinus pojoaquensis*, referred, N. Mex.	F:A.M.21283D	(70)																			II–B
(?) *Ocalientinus ojocaliensis*, referred, N. Mex.	F:A.M.21281									50.5				11.2							II–B
(?) *Serridentinus pojoaquensis*, referred, N. Mex.	F:A.M.21135D	72				•															II–B
Rhynchotherium edensis, neotype, Calif.	F:A.M.18225	66	50	7	11	12.5	11	9	86	49	4.5	7	8.5	8	5.5	76%	57%	77%	102%	19%	III–A
(?) *Serridentinus productus*, referred, N. Mex.	F:A.M.21135E	62	53																		III–B
"	F:A.M.21291A	(65)																			
"	F:A.M.21140D								(84)												
"	F:A.M.21274A								83												
"	F:A.M.21145A								79												
"	F:A.M.21276A	63										10.4									III–C

		Humerus	Radius	Metacarpals					Femur	Tibia	Metatarsals					Radius/Humerus	Tibia/Femur	Humerus/Femur	Radius/Tibia	Metac. 3/Humerus	Size Group
				1	2	3	4	5			1	2	3	4	5	%	%	%	%	%	
Trilophodon cruziensis, type, N. Mex.	F:A.M.21300	60																			III–D
Trilophodon osborni, type, Neb. (immat.)	Neb. S. Mus.	66	56						76							84%					IV–A
(?) *Serridentinus productus*, referred, N. Mex.	F:A.M.21274B								73												
"	F:A.M.21290B								72												
"	F:A.M.21136D								71												
"	F:A.M.21280B									35.3											
(?) *Trilophodon* species, referred, Neb.	F:A.M.25705A	52																			IV–B
(?) *Serbelodon barbourensis*, referred, Neb.	F:A.M.25714G	55.5																			
"	F:A.M.25714A	(54)	(42)																		
(?) *Serridentinus serridens*, referred, Texas	A.M.10582	(54)	(45)	(6)	(10)	(10.5)	(10)	(8)	66	35	(5.5)	(7.5)	(10)	(9)	(5)	(83)%	53%	(82)%	(129)%	(20)%	
(?) *Serridentinus productus*, referred, N. Mex.	F:A.M.21146A									35											IV–A
"	F:A.M.21284A								62												IV–A

Table 7

Lists of Limb and Foot Bones from California, Arizona, Colorado, Texas, Nebraska, and New Mexico

F:A.M. Numbers		Length in centimeters	
	SIZE GROUP I		
Variant A			
20850C	Partial femur	(111)	North end, Barstow, California
Variant B			
25708A	Two humeri (see skull 25708 ?)	82	Ainsworth area, Nebraska
25708C	Ulna		"
25711A	Part of ulna (see skull-jaws, 25711)		Mastodon quarry, Nebraska
25711A	Part of ulna (see skull-jaws, 25711)		"
25708A	Femur	105	Ainsworth area, Nebraska
25705F	Metacarpal 2	15.3	Fairfield Creek, Nebraska
25706A	Metacarpal 5	11.6	Ainsworth area, Nebraska
25705B	Humerus		Fairfield Creek, Nebraska
25705E	Humerus		"
25705C	Part of femur		Ainsworth area, Nebraska
25705D	Part of femur		"
Variant C			
23341A	Femur	103	Texas
Variant D			
23337D	Metacarpal 2	14	West of Pawnee Buttes, Colorado
23337E	Metacarpal 3	16.3	"
23337B	Metacarpal 4	14.5	"
23337C	Metacarpal 5	10	"
Variant E			
21283C	Femur	97	San Ildefonso, New Mexico
21276B	Part of femur		Santa Cruz, New Mexico
21300A	Tibia	58	"
21145C	Metatarsal 4	11.3	South of White Operation, N. M.
21268G	Astragalus		San Ildefonso, New Mexico
Variant F			
23326B	Partial femur		Benson, Arizona

Table 7—List of Limb and Foot Bones, continued

F:A.M. Numbers		Length in centimeters	
	SIZE GROUP II		
Variant A			
25714F	Humerus	76.5	Christmas quarry, Nebraska
25720	Two humeri (see skull and jaw)	75	Cub Creek, Nebraska
25714B	Part of femur	(86)	Christmas quarry, Nebraska
25714E	Two femurs (immature)	(81)	"
25714C	Metacarpal 3	13.1	"
25714D	Metacarpal 4	11.8	"
25706B	Metatarsal 3	11.3	Horsethief Canyon, Nebraska
Variant B			
21135D	Humerus	72	North of North Pojuaque Bluffs, New Mexico
21283D	Humerus	70	"
21281	Part of radius (see partial ramus)		North Pojuaque Bluffs, N. M.
	Tibia	50.5	"
	Metatarsal 4	11.2	"
21283G	Fibula		San Ildefonso, New Mexico
	SIZE GROUP III		
Variant A			
18225	Both humeri (see skull-jaws)	66	Eden area, California
	Ulno-radius	(radius) 50	
	Part of radius		
	Both manus, metacarpal 1	7	
	metacarpal 2	11	
	metacarpal 3	12.5	
	metacarpal 4	11	
	metacarpal 5	9	
	Femur	86	
	Tibia-fibula	(tibia) 49	
	Left pes, metatarsal 1	4.5	
	metatarsal 2	7	
	metatarsal 3	8.5	
	metatarsal 4	8	
	metatarsal 5	5.5	
18220	Ulna and part radius		Eden area, California

Table 7—List of Limb and Foot Bones, continued

F:A.M. Numbers		Length in centimeters	
Variant B			
21291A	Fragmental humerus	(65)	Upper Pojuaque Bluffs, N. M.
21135E	Humerus	62	West of North Pojuaque Bluffs, New Mexico
21135E	Radius, part ulna	53	"
21275	Part ulno-radius (see skull)		North Pojuaque Bluffs, N. M.
21136E	Ulna		Santa Fé area, New Mexico
21294	Right metacarpal 2 (see skull-jaws)	12	Ojo Caliente, New Mexico
	metacarpal 3	14.5	
	metacarpal 5	10	
	Left metacarpal 3	14.5	
	metacarpal 4	13.4	
	metacarpal 5	10	
21145B	Metacarpal 4		High Pojuaque Bluffs, N. M.
21283A	Metacarpal 4		"
21291C	Metacarpal 3		Lower Pojuaque Bluffs, N. M.
21274A	Femur	83	Near Battleship Mt., New Mexico
21145A	Femur	79	Pojuaque Bluffs, New Mexico
21140D	Partial femur	(84)	Near Battleship Mt., New Mexico
21282A	Tibia		North Pojuaque Bluffs, N. M.
21268A	Astragalus		Santa Fé area, New Mexico
21268H	Astragalus		San Ildefonso, New Mexico
21269E	Two calcanea		North Pojuaque Bluffs, N. M.
21294	Metatarsal 3 (see skull-jaw, etc.)	11.1	Ojo Caliente, New Mexico
	Metatarsal 4	11	
21291F	Metatarsal 3	10.9	Lower Pojuaque Bluffs, N. M.
21270A	Metatarsal 3	10.8	Santa Cruz, New Mexico
21145B	Metatarsal 5	6.7	Santa Fé area, New Mexico
Variant C			
21276A	Humerus (see metatarsal 2)	63	Second wash, Santa Cruz, New Mexico
21283B	Part humerus		W. slope, High Poj. Bluffs, N. M.
21271A	Part of radius		North Pojuaque Bluffs, N. M.
21140E	Part of ulna		W. slope, N. Poj. Bluffs, N. M.
21276A	Metatarsal 2	10.4	Second wash, Santa Cruz, N. M.
21268B	Astragalus		Near Santa Fé, New Mexico
21142D	Calcaneum		Santa Clara Canyon, New Mexico

Table 7—List of Limb and Foot Bones, continued

F:A.M. Numbers		Length in centimeters	
Variant D			
21300	Two humeri (see skull)	60	Second wash, Santa Cruz, N. M.
25714H	Radius	42	Christmas quarry, Nebraska
21283K	Radius	42	Skull Ridge, New Mexico
21130A	Ulna		Santa Cruz, New Mexico
21276C	Part of ulno-radius		E. of Black Mesa, New Mexico
	Metacarpal 3	10.6	
	Metacarpal 4	9.8	
21126A	Metacarpal 4	12	Santa Fé area, New Mexico
21126C	Metacarpal 3 (br.)		"
21146B	Metatarsal 3	9.4	Third district, Santa Fé, N. M.
21191E	Metatarsal 3	9.7	Pojuaque Bluffs, New Mexico
21283H	Metatarsal 5	6.6	Santa Fé area, New Mexico
21291D	Metatarsal 2	9.8	Lower Pojuaque Bluffs, N. M.
21268–I	Astragalus		San Ildefonso, New Mexico
21268D	Astragalus		Second Division, New Mexico
21269D	Calcaneum		Santa Fé area, New Mexico
21269F	Part calcaneum		North Pojuaque Bluffs, N. M.
Variant E			
25708B	Metatarsal 3	11.1	Ainsworth area, Nebraska
	SIZE GROUP IV		
Variant A			
21280A	Ulno-radius	(radius) (39)	North Pojuaque Bluffs, N. M.
21146	Ulna		Santa Fé area, New Mexico
21280A	Metacarpals 3 (br.), 4 (Immature) 5	(10) (7.5)	North Pojuaque Bluffs, N. M.
21283E	Metacarpal 3	11.8	Skull Ridge, New Mexico
21136D	Femur	71	Santa Fé area, New Mexico
21274B	Femur	73	"
21290B	Femur	72	Santa Cruz, New Mexico
21284A	Femur	62	N. W. Pojuaque Bluffs, N. M.
21146A	Tibia	35	Third Division, Santa Fé, N. M.
21280B	Tibia	35.3	Santa Fé area, New Mexico
21291B	Part of tibia		Upper Pojuaque Bluffs, N. M.
21126B	Fibula		Santa Fé area, New Mexico
21268E	Astragalus		San Ildefonso, New Mexico
21268C	Astragalus		Santa Fé area, New Mexico
21268F	Astragalus		"
21269B	Calcaneum		North Pojuaque Bluffs, N. M.
21269C	Calcaneum		"
21269A	Calcaneum		¼ mile North of Santa Fé, N. M.
21283F	Metatarsal 3	9.7	Santa Fé area, New Mexico

Table 7—List of Limb and Foot Bones, continued

F:A.M. Numbers		Length in centimeters	
Variant B			
25714G	Humerus	55.5	Christmas quarry, Nebraska
25714A	Humerus	54	"
25714A	Ulno-radius	(radius) 42	"
25705A	Humerus	52	Ainsworth, Nebraska
Variant C			
23337A	Part of femur		Two miles W. of Mastodon quarry, Grover, Colorado

In addition to the skeletal elements listed in the foregoing table, the collection includes the following miscellaneous remains from New Mexico and Nebraska:

(A) New Mexico

One partial hyoid (Box 134) (and note hyoid with skull, F:A.M.21300)
Three atlases, measuring 17.8, 17.2, 18.6 cm. (Boxes 46, 49, 158 No. 42)
(There is a total of six atlases, the largest, F:A.M.21294, 21 cm., the smallest, F:A.M.21293, 16.5 cm.)
Etc. vertebrae and series of vertebrae
Pelvis
Six patellas
Some forty carpals and tarsals
Etc. phalanges

(B) Nebraska

Two partial hyoids (Boxes 107 and 124)
Three atlases, measuring 24.8, 20.6, 15.6 cm. (F:A.M.25708C and Box 112)
Five scapulae and partial scapula (Boxes 19.20, 115, 117)
Proximal end of radius (Box 113)
Fibula, proximal end missing (Box 115)
Portions of two metapodials (Boxes 20, 53)
Carpal bone (Box 113)
Four phalanges (Boxes 20, 66, 86, 107)
Pelvis and three partial pelves (Boxes 78, 93, 115)
Three patellas (Boxes 111, 114)
Etc. trays of vertebrae, ribs and fragments

PART IV

Pre-Pleistocene to Pleistocene

BREVIROSTRINES

Mastodonts and *Elephas*

Figures 29, 29A and (in part) 12A, 22, 25A, 37 and 38

(See limb measurements, Tables 6 and 7, at the end of Part III.)

In addition to the above listed Late Tertiary forms the present collection includes remains from Pre-Pleistocene to Pleistocene deposits of abbreviated symphysised mastodons—"Brevirostrines"—from the vicinity of:

(1) Ainsworth, Nebraska—referred to *Stegomastodon nebrascensis* Osborn

(2) Benson, Arizona—referred to *Anancus bensonensis* Gidley

(3) Ecuador—referred to *Cuvieronius humboldti* (Fischer) (double trefoils and no enamel)

(4) Ecuador—referred to *Cordillerion andium* (Cuvier)

(5) Hot Springs, New Mexico—type of *Mastodon raki*, n.sp.

(6) Fairbanks, Alaska—*Mastodon americanus alaskensis*, n.subsp.;

and of *Elephas* forms from the vicinity of:

(7) Santa Fé area, New Mexico—*Archidiskodon* species

(7a) Fairbanks, Alaska—*E. primigenius alaskensis* Osborn

(7b) Hay Springs and Ainsworth, Nebraska—*Archidiskodon imperator* and

(7c) Texas—(?) *Archidiskodon imperator*, referred

These remains are briefly discussed and listed in the following pages according to the above order.

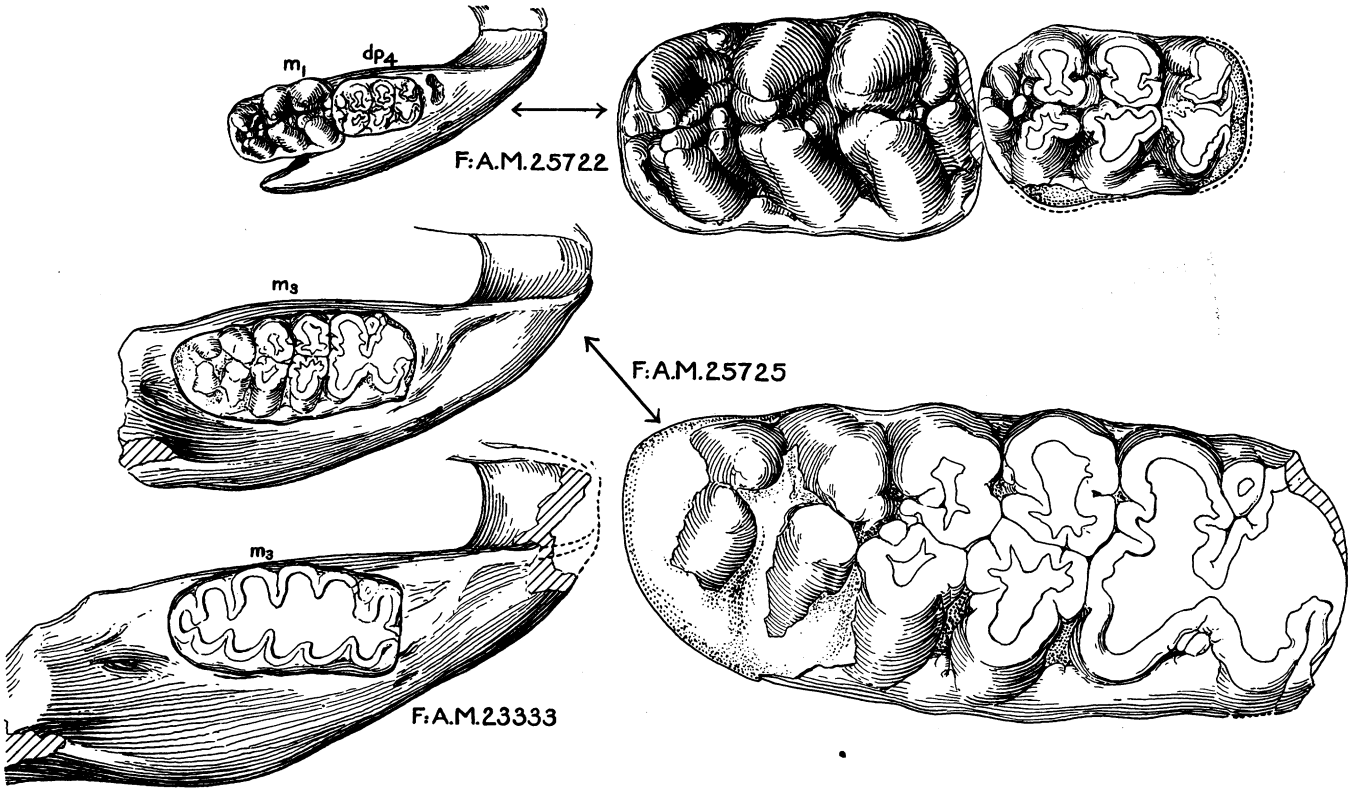

Fig. 29. F:A.M.25722 (immature) and F:A.M.25725 (mature), *Stegomastodon nebrascensis*, ref., Long Pine, Nebraska. × ⅙ (teeth × ½). (See page 626.)

F:A.M.23333 (mature), *Anancus bensonensis* Gidley, (?)ref., from near Benson, Arizona. × ⅙. (See also Fig 25A and page 627.)

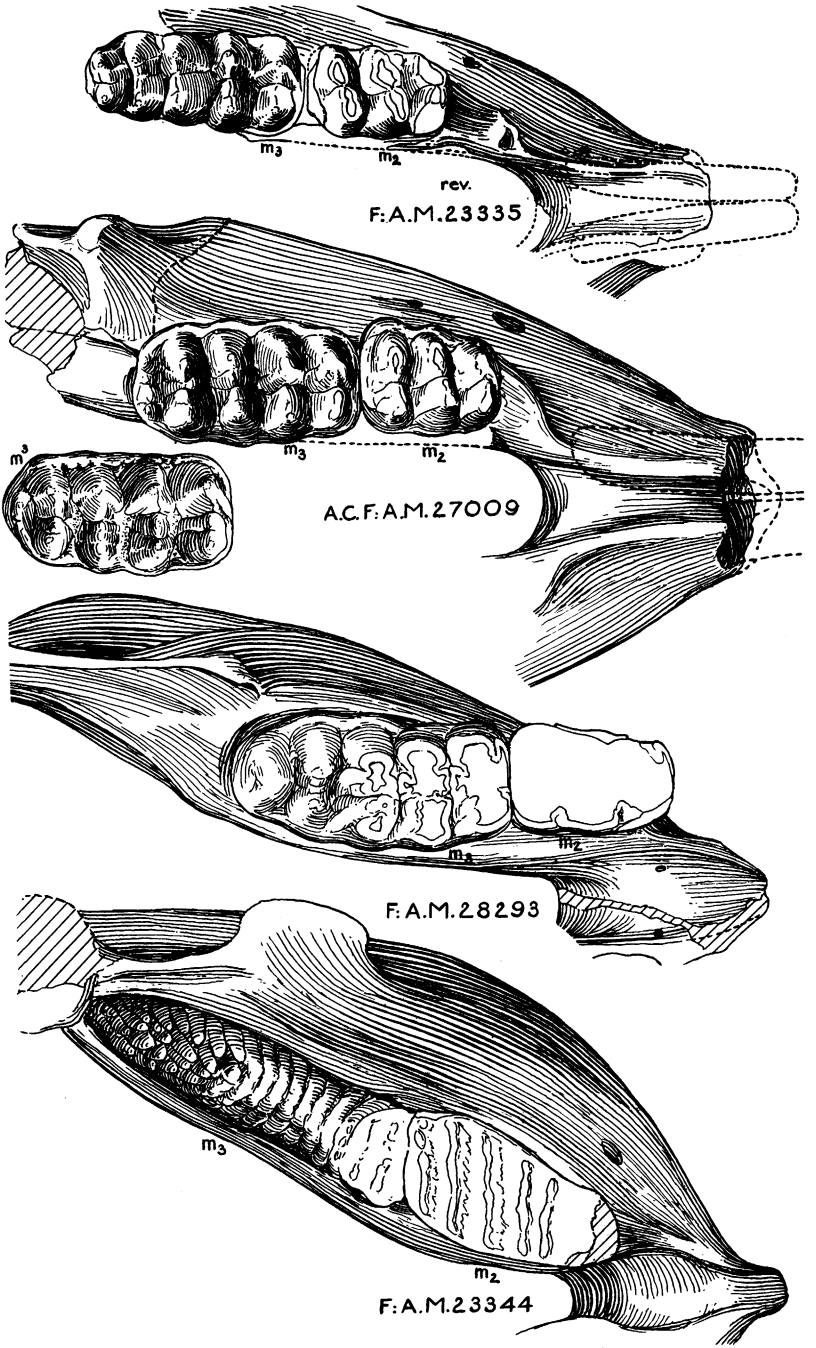

Fig. 29A. Brevirostrines from the Quaternary of New Mexico, Alaska, Ecuador and Texas.
× ⅙ (teeth × ½). (See legend, next page.)

(1) **Stegomastodon nebrascensis** Osborn

Figure 29

From Nebraska

A mature and an immature mandible, secured by Morris F. Skinner in the 1932 season in the vicinity of Ainsworth, with greatly abbreviated symphyses and double trefoils, are referred to *Stegomastodon nebrascensis.* It is uncertain whether the gravels containing the latter remains are earlier than, or contemporary with, somewhat similar deposits of the same area bearing fragmental molars of *Archidiskodon.*

Stegomastodon nebrascensis OSBORN, 1924, Amer. Mus. Novitates, No. 154, p. 5, Fig. 2B.

TYPE.—Right dp_4, worn. A.M.18240 From Snake Creek, Sioux County, Nebraska.

Specimen slightly smaller than dp_4 of F:A.M.25722.

REFERRED.—

Mandible with m_3s. $m_3 = 193$ mm.	F:A.M.25725	From C & NW gravel pits one-half mile west of Long Pine. Figured this paper, *Fig. 29.*
Immature mandible with dp_4-m_1 (erupting) and alveolus of dp_3. $dp_4 = 71$ mm. $m_1 = 97$	F:A.M.25722	From C & NW gravel pits one-half mile west of Long Pine. Figured this paper, *Fig. 29.*
m_3, 210 mm., and fragment of heavy curved tusk with circumference of 15 inches.	F:A.M.25725A and B	Pleistocene gravels, vicinity of Ainsworth, 1929 and 1932.

Fig. 29A. F:A.M.23335, *Mastodon raki*, n.sp., type, from Hot Springs, New Mexico. (See also Fig. 25A and page 630.)

A.C.–F:A.M.27009, *Mastodon americanus alaskensis*, n.subsp., type, from the vicinity of Fairbanks, Alaska. (See page 631.)

F:A.M.28293, *Cuvieronius humboldti* (Fischer), ref., from south of Guayaquil, Ecuador. (See page 629.)

F:A.M.23344, (?)*Archidiskodon imperator*, ref., from northern Texas. (See page 634.)

(2) **Anancus bensonensis** Gidley, (?) referred

Anancus bensonensis Gidley, 1926, U. S. Geol. Surv. Prof. Paper No. 140–B, p. 83, Pl. xxxii.

Certain remains secured from the Late Pliocene to Early Pleistocene deposits in the vicinity of Benson, Arizona, previously worked by James W. Gidley, are tentatively held under the species described from the same area by Doctor Gidley. A seven-foot tusk is of the long, nearly straight, and twisted enamel-banded character of the genus, *Anancus* Aymard, of *Cordillerion* (*Mastodon*) *andium* and of the tusk from the same Benson locality described by Gidley (1926, p. 85, footnote). An m^3 in a newly secured partial skull measures 220 mm. versus 191 mm. of the Gidley type (N.M.10538, figured Pl. xxxii).

Among the new Benson remains are several immature dentitions. These are of particular interest, the mandible of the calf having the same abbreviated symphysis, but its lower deciduous premolars having the valleys more blocked than in *Mastodon americanus* (see Carnegie Museum figured mandible of calf of similar age). *Stegomastodon arizonæ* Gidley is also reported from the Benson area.

The new remains are as follows:

(a) Referred Mature Individuals:

Posterior one-half crushed cranium with both m^3s (br.). F:A.M.23330

m^3 = ((220)) mm.

Mandible with both m_3s, symphysial area broken. F:A.M.23333 Figured this paper, *Figs. 25A, 29.*

The portion of an anterior symphysis of longer proportions than typical of *Mastodon americanus* was collected with the above specimen.

m_3, left = 207 mm.
m_3, right = 202

Smaller than F:A.M.23333:

Left ramus with m_2 (br.) $-m_3$. $m_3 = ((120+))$ mm.	F:A.M.23338	From Duncan, Arizona.
Three greatly worn and broken intermediate teeth.	F:A.M.23325 (unworn), 23326, 23334A	
Upper tusk.	F:A.M.23326A	

Seven feet in length with strong curvature and trace of enamel band.

Pair of small (immature) upper tusks.	F:A.M.23328	
Partial femur.	F:A.M.23326B	
Manus.	F:A.M.23329	

(b) Referred Immature Individuals:

Possibly of one individual:

Right maxilla with dp^2–dp^4 (erupting).	F:A.M.23332	Figured this paper, *Fig. 37.*
Mandible with dp_2 and dp_4 (in ? alveolus); scapula, humerus.	F:A.M.23327	Figured this paper, *Figs. 22 and 38.*
Right maxilla with dp^2–dp^4.	F:A.M.23331	Figured this paper, *Figs. 22 and 37.*

The anterior two teeth are much worn.

Right dp^3; partial tibia.	F:A.M.23334	
dp fragments.	F:A.M.23330A and B	
Fragment with tusk.	F:A.M.23329A	

(3 and 4) **Cuvieronius humboldti** (Fischer) and **Cordillerion andium** (Cuvier)

From Ecuador

Among the considerable collection of interesting Pleistocene remains secured in Ecuador in 1929 by Messrs. John C. Blick and Charles Falkenbach are a number of specimens which Professor Osborn refers to (3) *Cuvieronius humboldti* and to (4) *Cordillerion andium:*

(3) **Cuvieronius humboldti** (Fischer)

F:A.M.28289, Maxilla with parts of two teeth, from Alangesi.

28290, Scraps of immature teeth found with above.

28291, Symphysis, from Alangesi.

28293, Mandible with m_2–m_3, from south of Guayaquil. Figured this paper, *Fig. 29A.*

28294, Symphysis and ramus with m_1 alveolus and m_3, from the coastal area.

28295, Portion of tooth, from the coastal area.

28296, Portion of tooth, from the coastal area.

28297, Fourth milk premolar, from the coastal area.

28298, Metapodial, from the coastal area.

(4) **Cordillerion andium** (Cuvier)

F:A.M.28292, m_3, (?) possibly from Alangesi (donated by Quito Museum).

(5 and 7) **Mastodon raki,** new species, and **Archidiskodon** species

From the Pleistocene of New Mexico

A right and broken left ramus with m_1 alveolus, m_2–m_3 and partial symphysis, from the Pleistocene of New Mexico, is of the general proportions typical of *Mastodon americanus*-like forms. On the character of the heel and the m_3 crown, which is narrower and taller than usual, the specimen is referred to a new species. The mandible was collected by Joseph Rak in the fall of 1927 from beds bearing teeth of Pleistocene *Equus*. Cope (1874, p. 221) reports *Elephas primigenius* var. *columbi* from the Pleistocene below the Zandia Mountains. Among remains secured from Pleistocene remnants of æolian origin in the Santa Fé basin proper is the portion of a mammoth molar.

(5) **Mastodon raki,** new species

TYPE.—Right ramus and symphysis and part of left ramus with m_2–m_3.	F:A.M.23335	From Hot Springs. Figured this paper, *Figs. 25A and 29A*.

TABLE OF COMPARATIVE MEASUREMENTS OF THE NEW MEXICAN SPECIMEN AND THREE EASTERN SPECIMENS OF *Mastodon americanus*

	F:A.M.23335 New Mexico	A.M.21920 New York	A.M.17771 Indiana	A.M.2595 "Shawangunk" New York
m_1		88		77.5+
m_2	114 mm.	113	114	103
m_3	184	181	180	155
Width at 2d crest.	80 (crown tall)	93 (crown low)	96	84

(7) **Archidiskodon** species

EXAMPLE.—Partial last molar.	F:A.M.21265	From Pleistocene remnant, Skull Ridge area, New Mexico.

(6 and 7a) **Mastodon americanus alaskensis,** new subspecies, and **Elephas primigenius alaskensis** Osborn

From Fairbanks area, Alaska

Through the courtesy of President Charles E. Bunnell and the officers of the Fairbanks Exploration Company, collecting, for the past four seasons, has been carried on jointly by the American Museum and Alaska College in the vicinity of the company's stripping operations in the area about Fairbanks. Amongst the material secured are the associated remains of a mastodon and the large series of remains of mammoth listed below. President Bunnell has kindly permitted all of this material together with other specimens, including the College's skull of an unusually large mammoth, to be temporarily deposited in the American Museum for exhibition and study. Mr. Peter Kaisen, of the Museum preparation staff, was in charge of the collecting during the first two seasons, Dr. Wilkerson, of Alaska College, the third season, and Messrs. Hendricksen and Waalton, of the College, the past season.

(6) **Mastodon americanus alaskensis,** new subspecies

Mastodon itself so far has been exampled in the Fairbanks area alone by a few detached molars. As associated remains of any of the extinct forms are almost unknown in the particular area, the present season's find of a mastodon mandible associated with m^3, superior tusk and a representation of the limb elements, is remarkable. The individual, while of as large size as the Warren Mammoth, was immature, the epiphyses being unconsolidated. The specimen is made the type of a new subspecies, *Mastodon americanus alaskensis.*

TYPE.—Partial mandible with left m_2, both m_3s, partial alveolus of m_1 and incisive alveoli; left m^3, superior tusk, humerus, both radii, ulnæ, manus, and distal end of femur. A.C.–F:A.M.27009 Figured this paper, *Fig. 29A.*

The mandible exhibits a heavier vertical ramus and symphysis and narrower symphysial trough, the alveoli suggest much larger incisors, and the molar tooth-crowns are lower than in the American *Mastodon,* as seen in A.M. 14345, from Illinois. The limbs approximate those of the Warren mount. The tusk measures 7 ft. 1 in. on curve, and 19.5 in. circumference at base.

COMPARATIVE MEASUREMENTS

	M.a.alaskensis A.C.-F:A.M.27009	*M.americanus* A.M.14345	*M.americanus* A.M.9951
m_2	109+ mm.	123	
m_3	187	196 (left) (176, right)	
Humerus	905		910
Radius	680		670
Ulna	675		
Metacarpal 1	107		110
2	148		150
3	175		160
4	152		150
5	123		100

REFERRED.—Two partial molars. (A.M. casts) Collection of Alaska College.

[NOTE.—For the matter of comparison the writer refigures with other immature mandibles an immature mandible with deciduous teeth secured by Mr. O. A. Peterson from Frankstown Cave (Figs. 22 and 38).

Mastodon americanus (KERR), PETERSON, 1926, Ann. Carn. Mus., XVI, No. 2, p. 274, Pls. XXII, XXIII.

REFERRED.—Immature mandible. C.M.2332 Figured by Peterson, 1926, Pls. XXII and XXIII. Figured this paper, *Figs. 22 and 38.*]

(7a) **Elephas primigenius alaskensis** Osborn

Among the twenty-six tusks secured of the Northern Mammoth there is one of unusual size, the same weighing in the neighborhood of 300 pounds. The average number of laminæ in the normal m^3 is twenty-five and the length of the crown in use varies between 157–207 mm. A mandible of an aged cow is remarkable in that the last molars have been extruded and the alveoli healed over. Another mandible exhibits a somewhat produced symphysis.

LIST OF MATERIAL FROM THE VICINITY OF FAIRBANKS, ALASKA

26 tusks (largest, on curve 12 ft. 10 in., base circumference 24 in.)
Large bull skull with m^3s and tusk (9 ft. 8 in. x 18.5 in.), Alaska College Collection
Large cow skull with m^3s and tusk (6 ft. 5 in. x 13 in.)
4 smaller skulls, including 2 of calves
6 partial palates

Some 24 mandibles or partial mandibles
204 detached molars or partial molars
31 partial scapulæ
7 complete and 5 partial humeri (largest 98 cm., smallest 75 cm.)
16 complete and 5 partial ulnæ
2 complete and 12 partial radii (largest 61 cm., smallest 56 cm.)
8 complete and 8 partial femurs (largest 113 cm., smallest 96.5 cm.)
12 complete and 14 partial tibiæ (largest 68 cm., smallest 44 cm.)
3 complete and 2 partial fibulæ
37 metapodials
17 astragali
16 calcanea
60 carpal or tarsal bones
6 patellæ
Numerous vertebræ
Several ribs, partial ilia

(7b) **Archidiskodon imperator,** referred

From Hay Springs, Nebraska

During the course of three partial seasons of collecting in the vicinity of Hay Springs, Nebraska, Charles Falkenbach secured a number of teeth of mammoth (including unworn and worn molars and premolars) which Professor Osborn notes represent some nine individuals of *A. imperator.*

dp_2.	F:A.M.25503
2 dp_{3s} (broken) and 4 fragments of milk molars.	F:A.M.25505A–D
2 dp_{4s} (broken).	F:A.M.25503A and B
2 m_{1s} and 3 fragmental m_{1s}.	F:A.M.25506 and A, 25501, A and B
3 m_{2s}.	F:A.M.25500, A and B
m_3.	F:A.M.25507

A similar form is apparently represented by a few limb and foot bones from the vicinity of Ainsworth, Nebraska.

Fourth metacarpal. 127 mm.	F:A.M.25704A
Broken second and third right metacarpals: right second metatarsal (103 mm.).	F:A.M.25704

It should be noted that *Mastodon americanus* is also reported from the Hay Springs area.

(7c) (?)**Archidiskodon imperator,** referred

From the Deposits of Northern Texas

Mandible of huge size with m_2–m_3 (erupting), atlas, 3 phalanges, 1 rib, 1 scapula and part of another, humerus, and part of pelvis.	F:A.M.23344	Figured this paper, *Fig. 29A*
Tusk, measuring 9 ft. 2½ in. on curve, 7¾ in. diameter at base.	F:A.M.23344A	
Part of tusk.	F:A.M.23344B	
Scapula.	F:A.M.23344C	
2 metapodials, and phalanges.	F:A.M.23344D	
Part of pelvis.	F:A.M.23344F	
Etc. boxes of ribs and unopened blocks.		
Series of vertebræ.		(El Paso, 1927)

PART V

TOOTH SEQUENCE

A thorough and general comparison of the true premolar teeth of representative Tertiary mastodont types unfortunately cannot even yet be attempted because of the absence of sufficient representative material. A fertile field awaits some future investigator. The general problem of tooth sequence in the Proboscidea and the value of the premolars for the purpose of diagnosis was discussed in 1926, p. 138. "As contrasted with the peculiar but vastly more typical mammalian tooth sequence of the . . . (Longirostrine) genera, the depressed-beaked . . . *R. edensis* (as presumably *R. shepardi* Cope of the Blanco), and such short-jawed mastodon forms as *M.* [*Cordillerion*] *andium* and *M. americanus*, apparently never develop vertical successors to the three milk molars ($dp\frac{2}{2}$–$dp\frac{4}{4}$ present in all forms), the replacement of the teeth taking place alone from back to front and thus being entirely horizontal. That these Plio-Pleistocene forms, however, which have no true premolars, were represented in earlier times by forms that had true premolar teeth, is indicated by the figures of von Meyer of the somewhat *M. americanus*-like-toothed *M.* [? *Pliomastodon*] *turicensis* from the Mid-Miocene of Elgg, which display p^3 and p^4 present, but manifestly functionless, being unworn and crowded forward out of position over the tusk-roots. Similarly, the premolarless elephantoid species were evidently once represented by more normally toothed ancestors, as is witnessed by the rudimentary premolar germs present in the Siwalik specimens referred to *E.* (*A.*) *planifrons.*"

The available immature dentitions, now increased by a number of new examples from New Mexico and other areas, check the findings of 1926 and at the same time afford several additional interpretations. The various data are carefully illustrated in Figs. 19–22, the rami at $\frac{1}{6}$ scale, and in Figs. 30–38, the replacement premolars at natural size. (See table of measurements.)

Of major interest are:

(1) Two examples of the dp^2, which was unrepresented in the previous material. This tooth conforms to that of the Guntersdorf maxilla. Whether a p^2 was ever developed in the later American mastodonts, as in *Phiomia* and questionably in Schlesinger's European form (see 1926, p. 134, footnote), is yet to be determined.

(2) The larger size of p^3, as compared to p_3, paralleling the larger size (noted 1926, p. 153) of dp^2 relative to dp_2.

(3) The occurrence of differences in proportion and form of the premolar teeth exampled in:

(a) The replacement premolars—as indicated in the p^4 and p^3 of the New Mexico versus the (?) Texas and particularly the Florida and Colorado remains and the suggestion that such differences are those of generic groups. (Note widely open transverse valley in p^4 of *Pliomastodon proavus* (Cope) and of *M.* (? *Pliomastodon*) *turicensis* von Meyer, referred.)

(b) The last premolars—and the suggestion that the same are more compressed and that tubercles rather than ridges lie opposite to the lozenges in the longer symphysised versus the less elongate-jawed and less progressive forms. (Recall again that in the Brevirostrines replacement premolars are entirely absent.)

(c) The penultimate premolars—a p_3 of typical form lies immediately anterior to p_4 in F:A.M.21112, New Mexico, as in *T. leidii* of Florida, and *T. angustidens* of Europe, versus the p_2-formed tooth which substitutes for the more usual formed tooth in at least one New Mexican specimen (F:A.M.21286), and see alveoli in a second specimen (F:A.M.21285). (New Mexican individuals with p_3 of typical form tentatively might be referred to *Ocalientinus* and those with non-typical p_3 to *Serridentinus*.)

(The Florida p^3 relative to p^4 is seemingly larger than the New Mexican F:A.M.21131.) And

(4) The occurrence of larger and smaller p^3, p^4 and p_3 and p_4 amid remains from:

(a) New Mexico and Nebraska,

(b) Florida, and

(c) Sansan, France. It is taken for granted that such variations in size are largely individual and sexual rather than of species. The occurrence of larger and smaller premolars, paralleling the occurrence of larger and smaller posterior molars, would be expected.

The material shows that before the loss of p_4^4 the mastodont individual was largely grown and the tusks had reached considerable size.

The p_4 of the calf mandible very tentatively referred to *Ocalientinus-Trilophodon* differs from the p_4s of the several mandibles similarly referred to *Serridentinus*, and a further difference is observed in the $\frac{p_4}{m_1}$ proportions. The New Mexican p^3–p^4 differ still more notably from the Florida *T. leidii* p^3 and p^4. The von Meyer (1867) Haggbach p^3 and p^4 are larger relative to m^1 (actually small) than in the case of New Mexican remains. The von Meyer *Miomastodon* (? *Pliomastodon*) *turicensis* p^3 and p^4 notably differ from all of the above in the form of the crests

and in the evidence of the two teeth being largely functionless. A somewhat similar p^4 to that of *M. turicensis* is seen in *Miomastodon proavus* (Cope). As above remarked, numerous specimens in the writer's collection (see table) are witness to the occurrence in the premolars of size variations compatable with that observed in the m_3^3.

As noted in 1926 (p. 154), in the Longirostrines ". . . each milk molar is to a certain degree prophetic of the permanent tooth of the next posterior position; the two posterior milk molars (at least) of each jaw are replaced vertically by smaller and simpler true premolars; m^3 may be much more elongate than m^2, m_3 is presumably slightly longer than m^3, and the cheek-tooth series in advanced maturity consists alone of the elongate . . . m_3^3 . . . "

Examples of the Deciduous and Replacement Premolars in the F:A.M. Collection

(See accompanying figures and table of comparative measurements)

The Longirostrine Adolescent and Calf

dp^2, heretofore unrepresented in our collection, corresponds (as suggested as probable in 1926), excepting for slightly different size and proportion, with the Guntersdorf specimen figured by Schlesinger (1917, Pl. III, Fig. 1; Pl. II, Fig. 2). dp^2 (large) is exampled in New Mexican fragment (F:A.M.21298), Fig. 33, and in Nebraskan partial skull (F:A.M.25714), Figs. 21 and 33. dp_2 is exampled in a single New Mexican ramus (F:A.M.21113), Figs. 21, 30. The partial skull (F:A.M. 25714) is particularly interesting in comparison with a partial skull of a slightly older individual (F:A.M.25732) from the same Nebraska quarry, in which the homologous teeth are approximately of the same length but considerably heavier. The—

dp_3^3 are shown in the same specimens as the dp_2^2 (see above), also dp_3 is shown in a number of detached, unworn teeth.

dp_4^4 are shown in the same examples (see above), also dp^4 is exhibited (greatly worn) in two partial maxillæ and dp_4 in two rami (F:A.M.21286 and 21112) from New Mexico, of Figs. 21, 31 and 32, and ramus, F:A.M. 25731 from Nebraska, Fig. 35.

The p^3 is shown in germ in the Nebraska maxillæ (F:A.M.25714 and 25733), Figs. 21, 33 and 35, and in place in the Texas specimen F:A.M. 23340), Figs. 20 and 36. While the p^3 form is seemingly much the same,

its size, like that of the p^4, seems smaller proportionate to the m^1 in some American than in the Haggbach specimens (p^4 relative to m^1 being respectively 53% versus 59%). The p^3–p^4 proportions in Nebraska F:A.M.25733 differ notably as compared to the Florida type of *T. leidii*, in which the p^4 is approximately of the same dimensions but the p^3 very small. The Florida teeth are somewhat more of the relative proportions of the Texas F:A.M.23340. The New Mexican p_4 germ of mandible F:A.M.21112 is of more compact build than other New Mexican and Nebraskan examples. A p_3 of typical form is exhibited in New Mexico mandible F:A.M.21112, and of but slightly different form in the detached Florida specimens and in the European specimens figured by von Meyer. A (?) p_3 of p_2 form is shown in New Mexico mandible F:A.M.21286, and further suggested by the alveoli of mandible F:A.M.21285.

The p_4^4 are found in germ beneath the dp_4^4 in several of the specimens and the erupted p_4^4 are seen in other specimens (see Figs. 19 and 20, etc.). A slight difference in form possibly distinguishes the p_4^4 of *Ocalien-*

Figs. 30–34. Longirostrine deciduous and replacement premolars from the late Tertiary of New Mexico, California and Nebraska.

Fig. 30. F:A.M.21113, from north of Santa Fé, New Mexico.
(See also Fig. 21 and page 649; 1926, Figs. 5 and 10.)

Fig. 31. F:A.M.21112, from north of Santa Fé, New Mexico.
(See also Fig. 21 and page 650; 1926, Figs. 6, 11 and 24.)

Fig. 32. F:A.M.21285, from Ojo Caliente, New Mexico.
(See also Fig. 21 and page 649.)

F:A.M.21278, from opposite Alcalde, New Mexico.
(See page 650.)

F:A.M.21286, from Santa Clara Canyon, New Mexico.
(See also Fig. 21 and page 649.)

Fig. 33. F:A.M.21298, from San Ildefonso, New Mexico.
(See page 650.)

F:A.M.20850B, from Barstow, California.
(See page 650.)

F:A.M.25714, from the vicinity of Ainsworth, Nebraska.
(See also Fig. 21 and page 649.)

Fig. 34. F:A.M.21131, from San Juan, New Mexico.
(See page 650.)

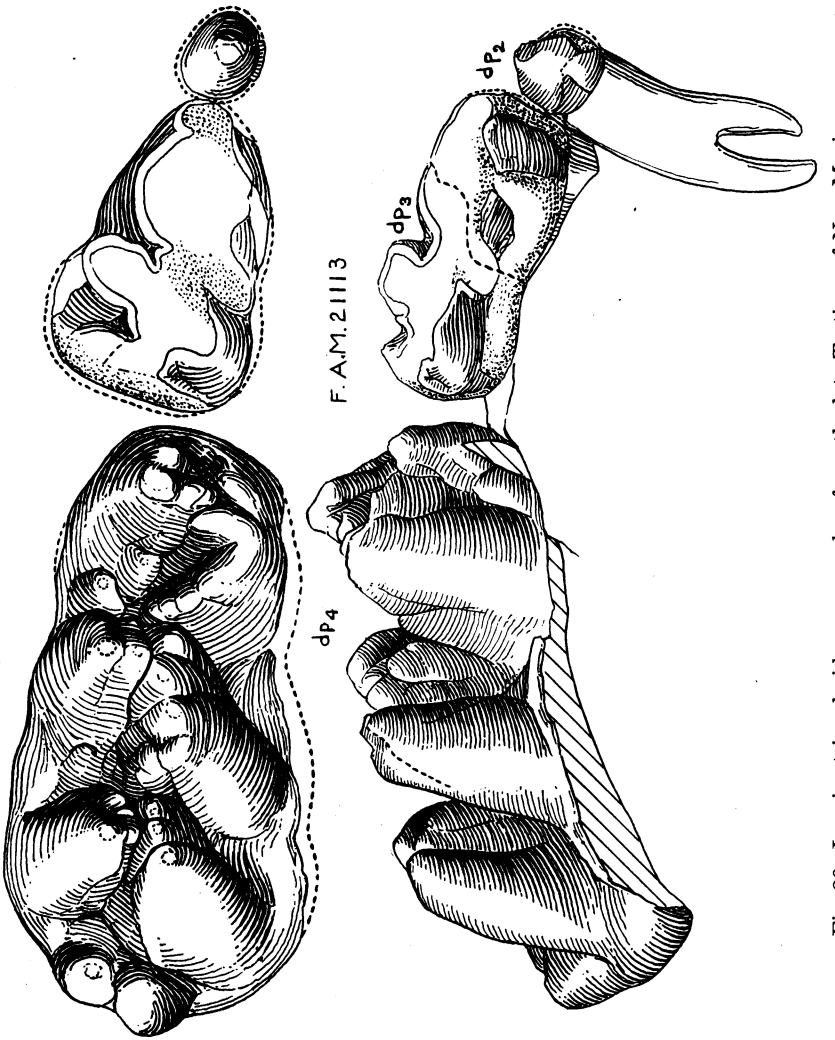

Fig. 30. Longirostrine deciduous premolars from the late Tertiary of New Mexico.
× 1. (See Figs. 19–22 and legend, page 638.)

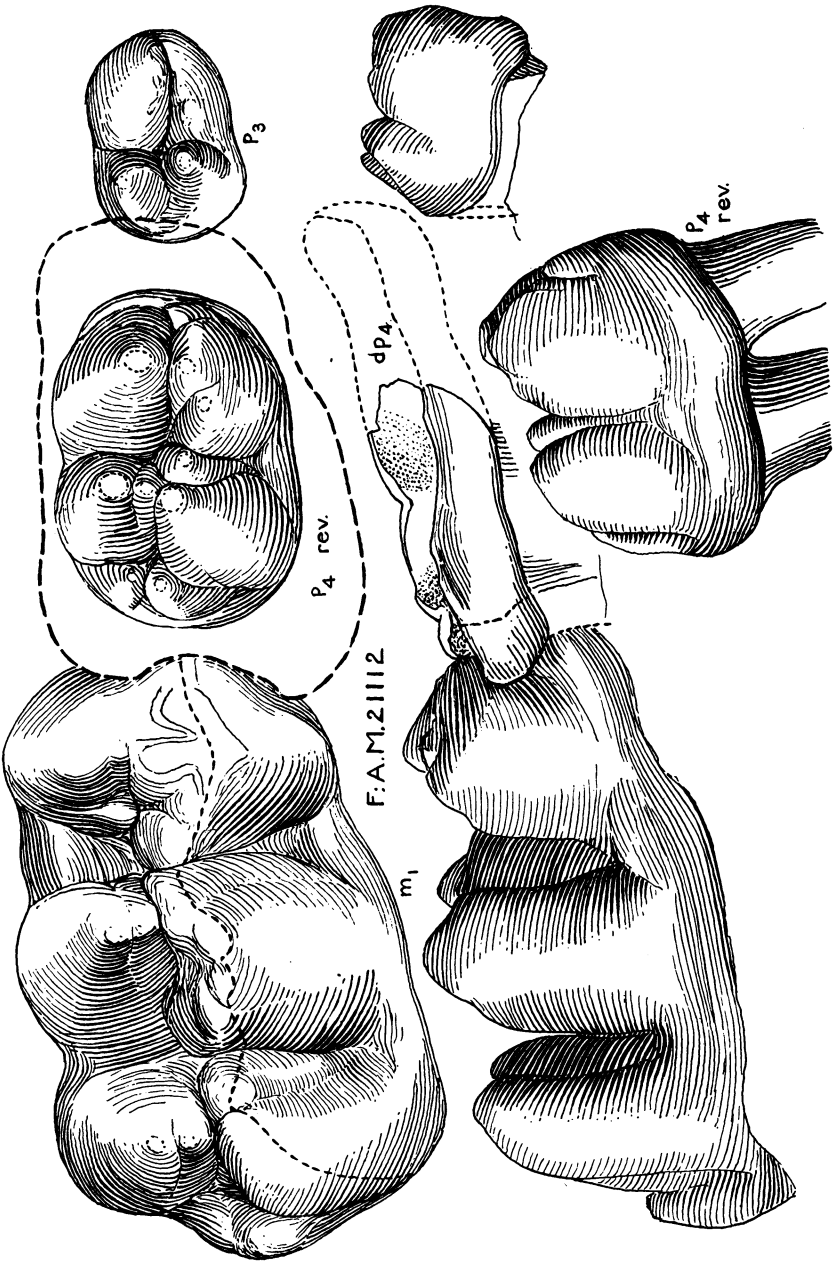

Fig. 31. Longirostrine deciduous and replacement premolars from the late Tertiary of New Mexico. × 1. (See Figs. 19–22 and legend, page 638.)

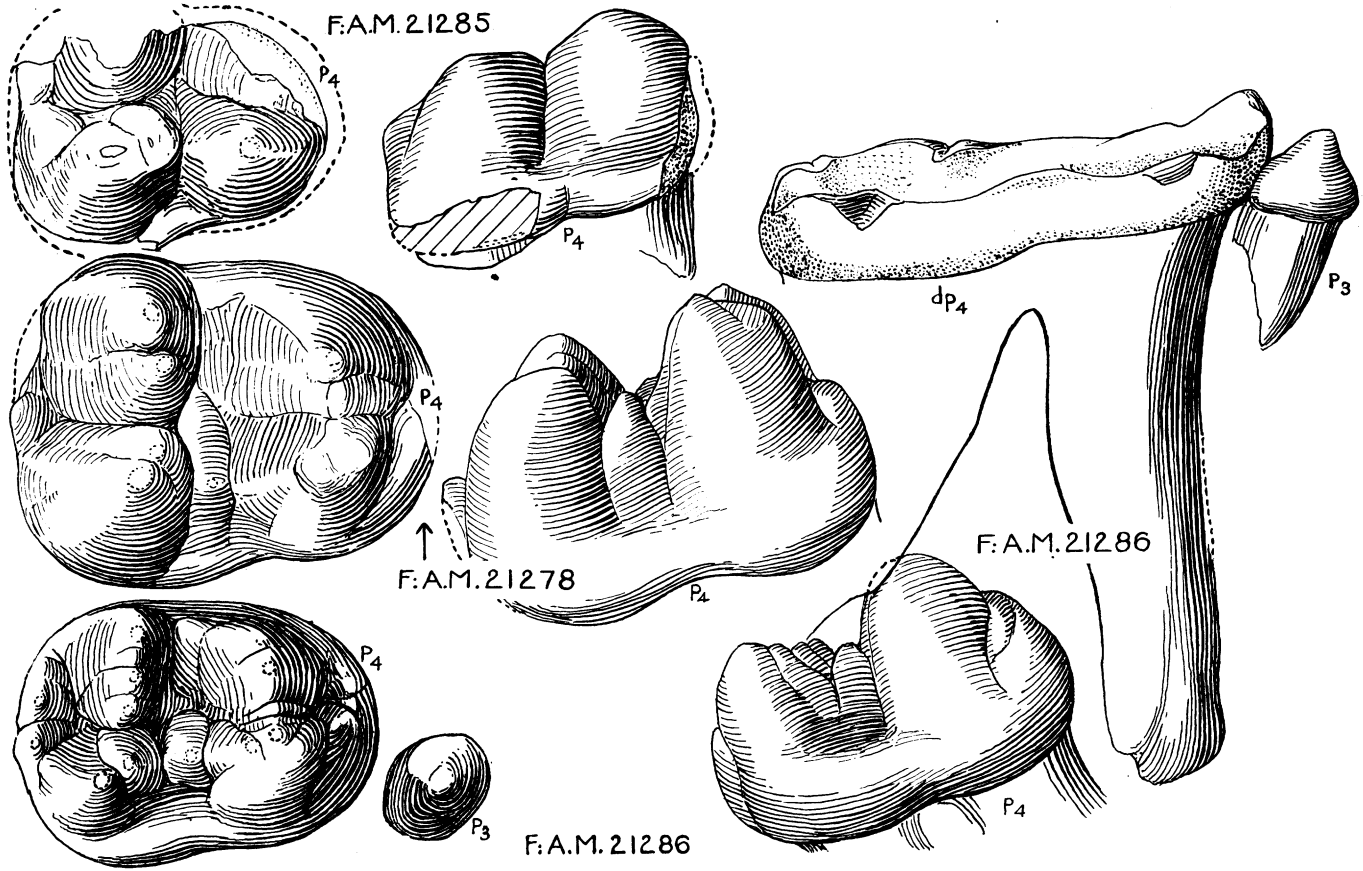

Fig. 32. Longirostrine deciduous and replacement premolars from the late Tertiary of New Mexico.
× 1. (See Figs. 19–22 and legend, page 638.)

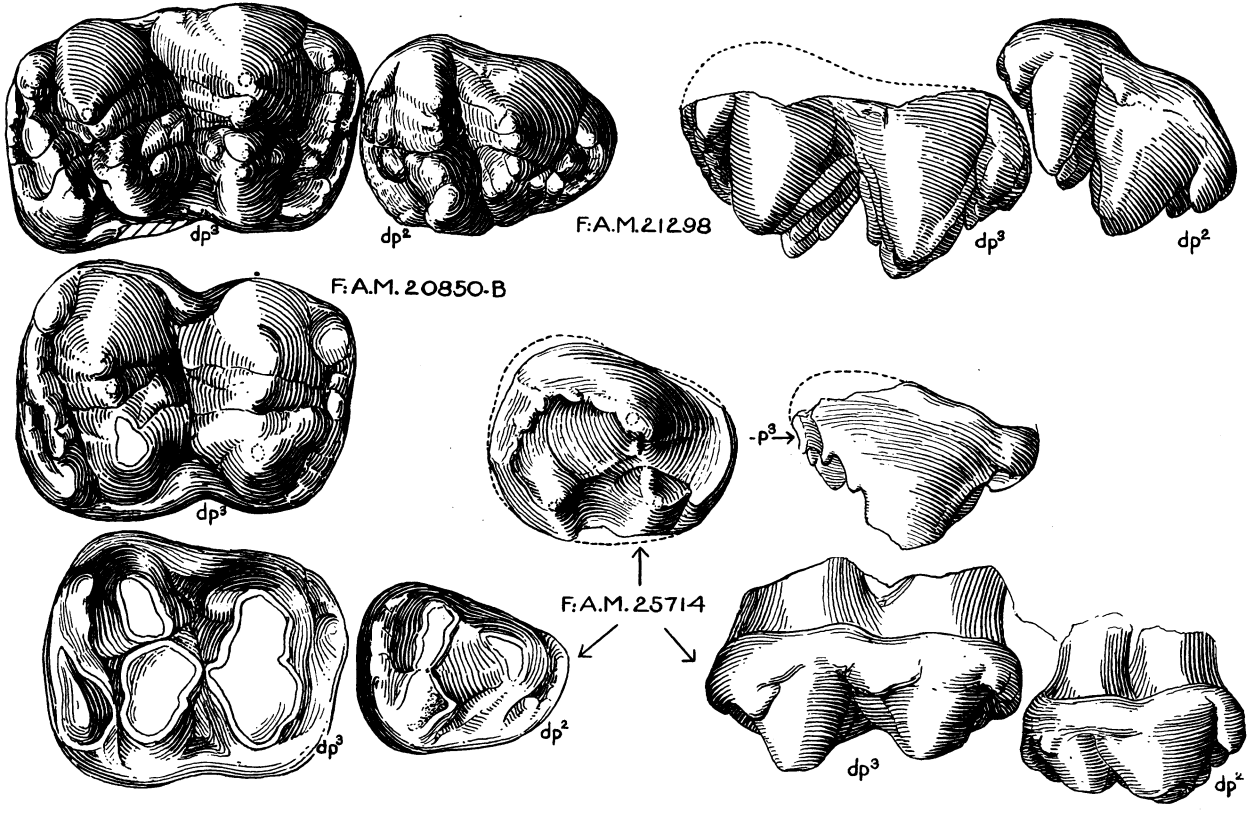

Fig. 33. Longirostrine deciduous and replacement premolars from the late Tertiary of New Mexico, California, and Nebraska

× 1. (See Figs. 19–22 and legend, page 638.)

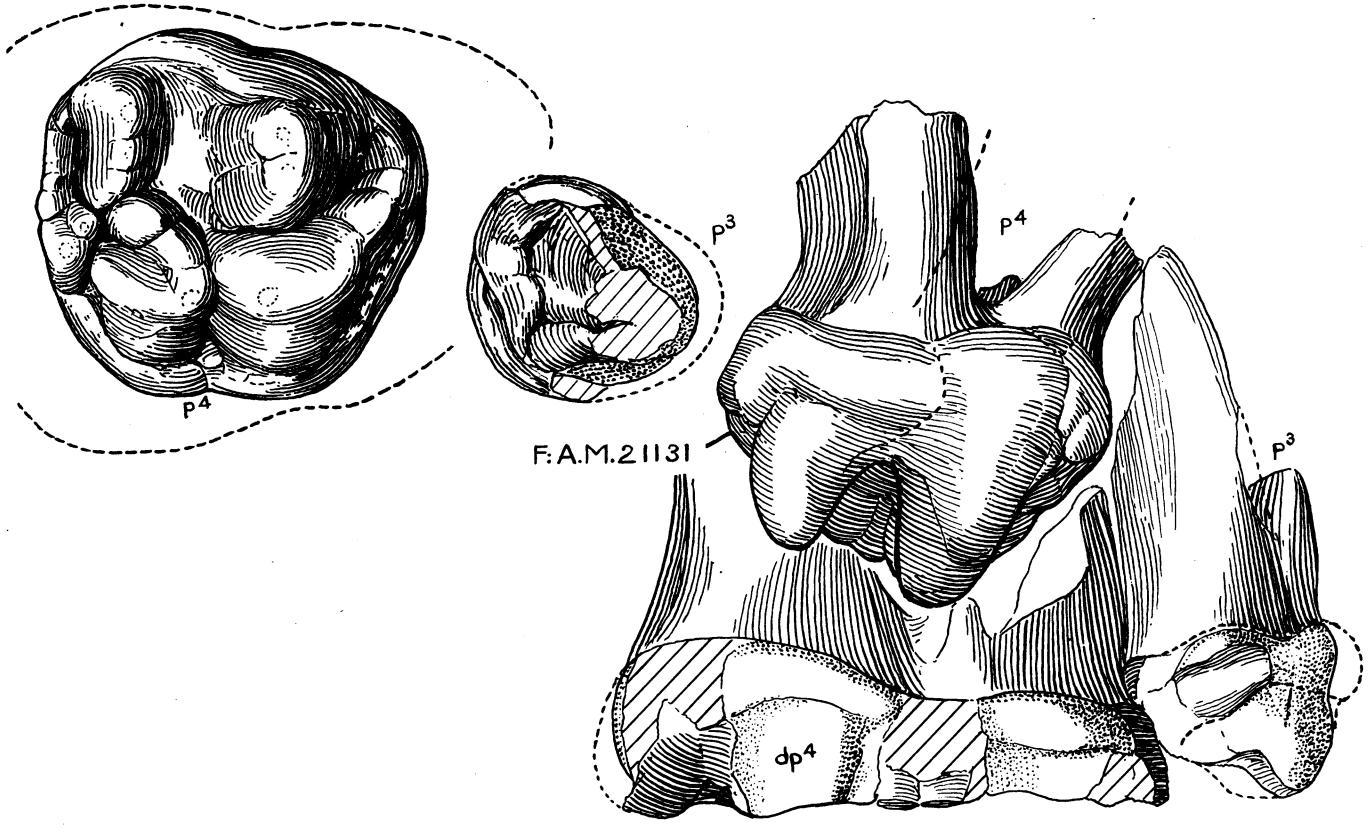

Fig. 34. Longirostrine deciduous and replacement premolars from the late Tertiary of New Mexico.
× 1. (See Figs. 19–22 and legend, page 638.)

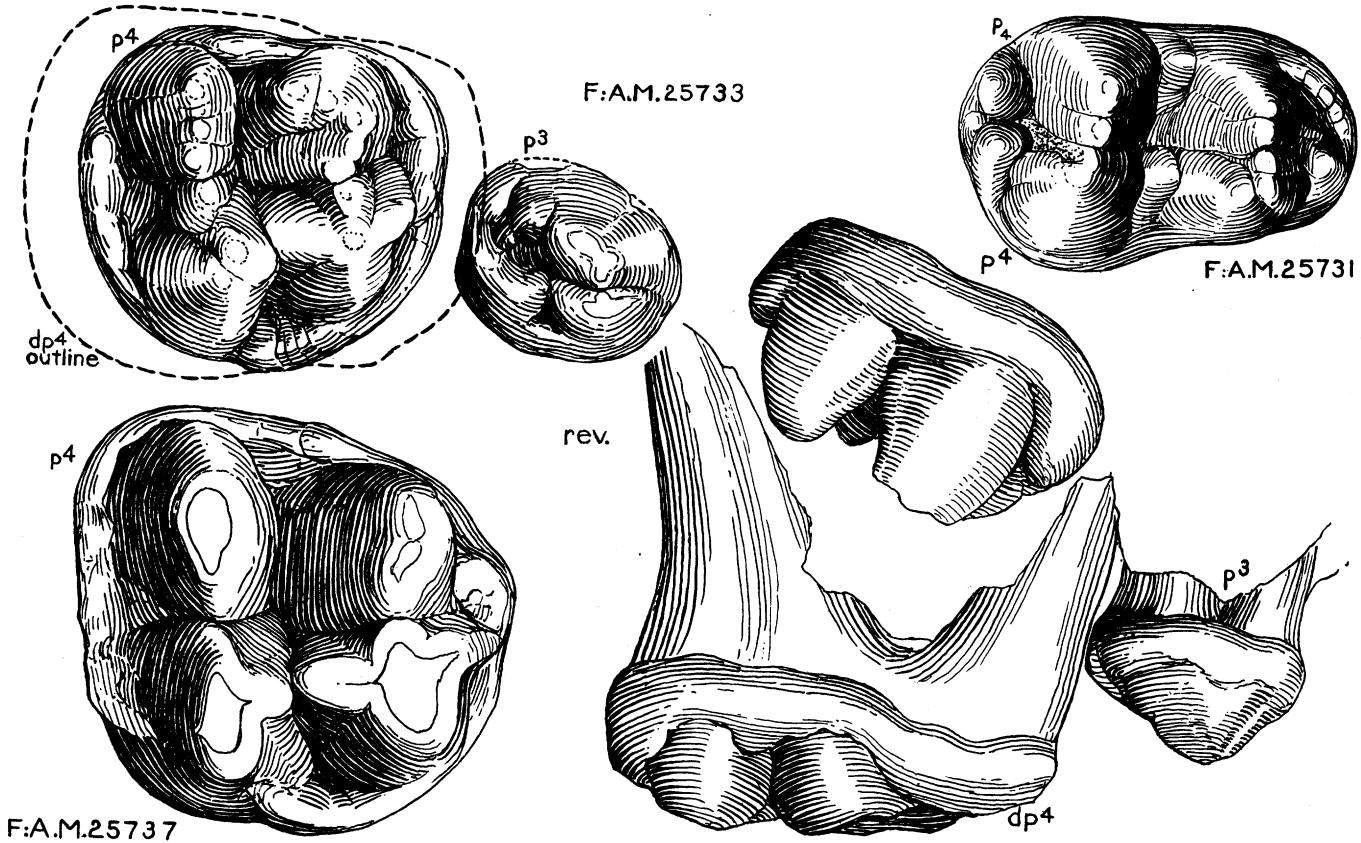

Fig. 35. Longirostrine deciduous and replacement premolars from the late Tertiary of Nebraska.
× 1. (See Figs. 19–22 and legend, page 648.)

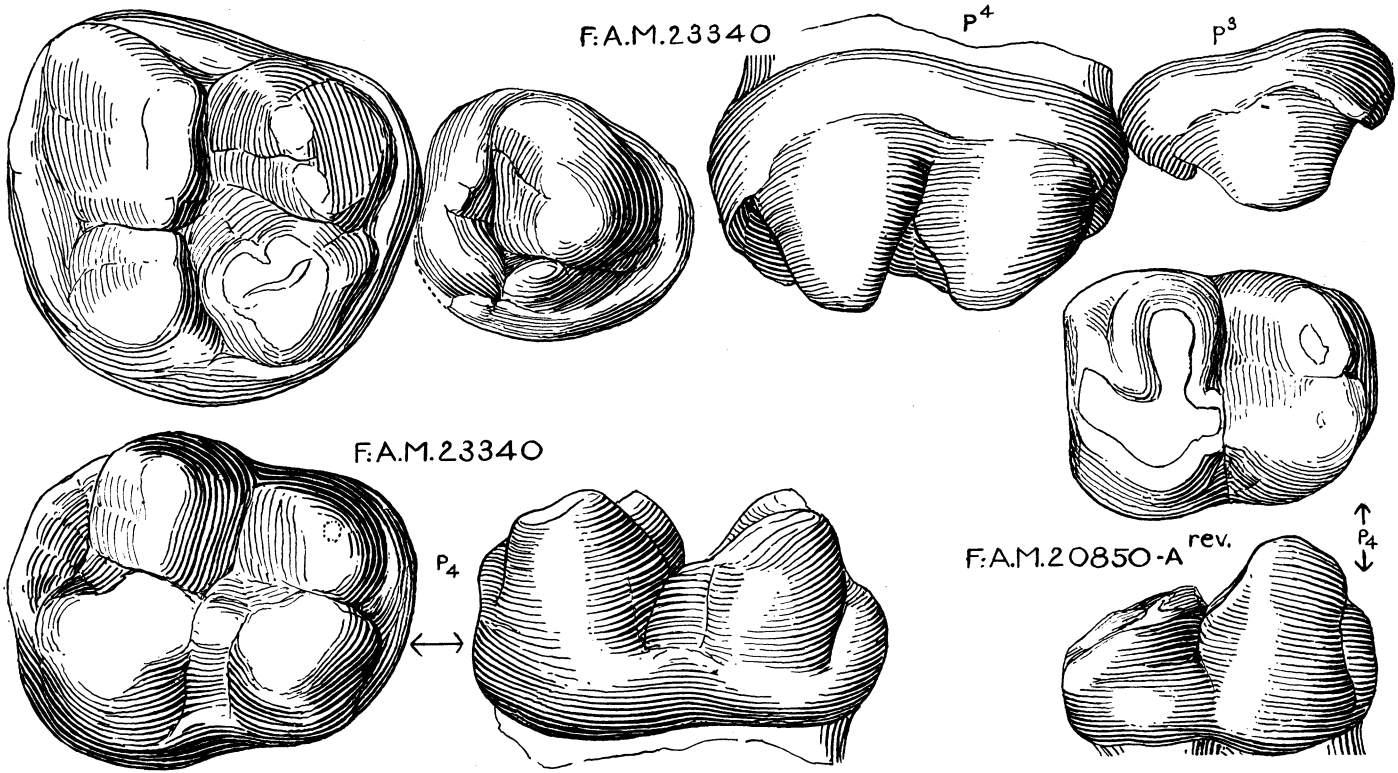

Fig. 36. Longirostrine deciduous and replacement premolars from the late Tertiary of Texas and California. × 1. (See Figs. 19–22 and legend, page 648.)

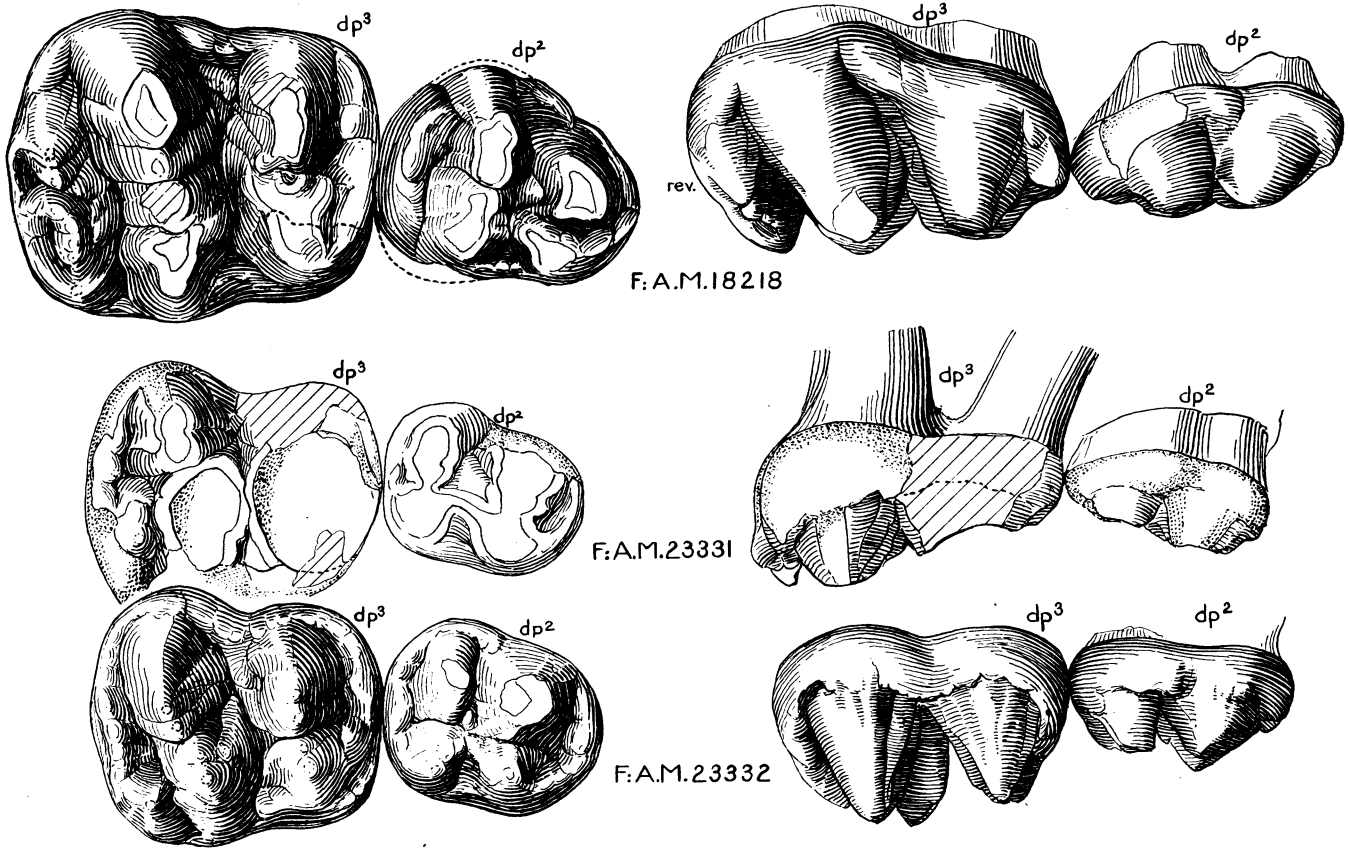

Fig. 37. Rhynchorostrine and Brevirostrine deciduous premolars from the late Tertiary of California and the Quaternary of Arizona.

× 1. (See Figs. 19–22 and legend, page 648.)

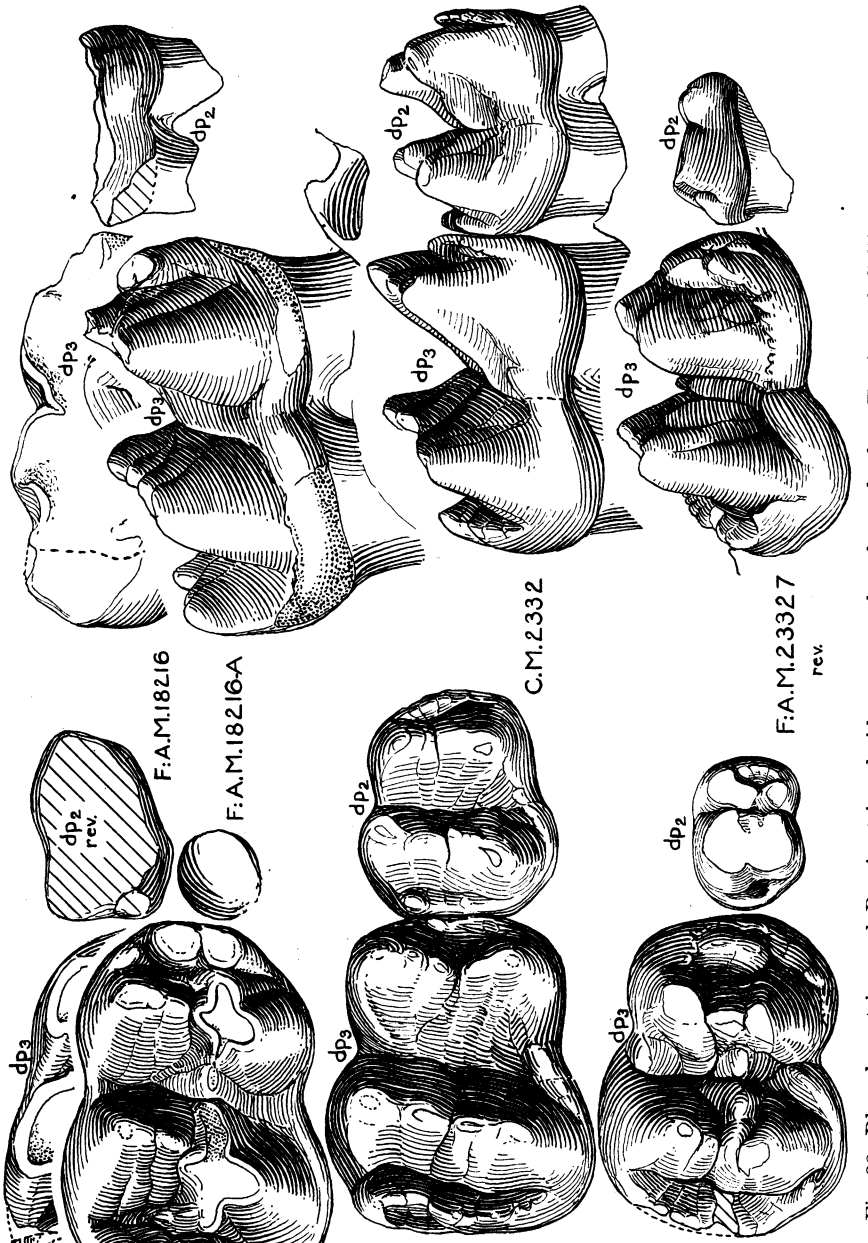

Fig. 38. Rhynchorostrine and Brevirostrine deciduous premolars from the late Tertiary of California and the Quaternary of Pennsylvania and Arizona.
× 1. (See Figs. 19–22 and legend, page 648.)

tinus and *Serridentinus*. The p^4 exhibits in: Texas F:A.M.23340 (slightly worn), a moderate development of the cingulum and under-development of the postero-internal cone; Nebraska F:A.M.25733 (germ), a prominent cingulum and prominent postero-internal cone; New Mexico F:A.M. 21124D (worn), more like preceding, and New Mexico F:A.M.21131, a moderate cingulum, prominent postero-internal cone, unusual posterior accessory heel crest and tall crown (Nebraska p_4, A.M.19248, being of somewhat similar proportions). The Snake Creek, Nebraska, A.M.19248J, represents the smallest p^4 known to the writer. The p^4 of the type of *Miomastodon proavus* differs from all of the above in exhibiting a typically open zygolophodont mid-valley. Certain of the p_4^4s differ rather notably in size—see table.

Figs. 35–38. Longirostrine, Rhynchorostrine and Brevirostrine premolars from the late Tertiary and the Quaternary.

Fig. 35. F:A.M.25731 and 25733 (moderate-sized individuals), and 25737 (large-sized individual), *Serbelodon barbourensis*, n.sp., ref., from the vicinity of Ainsworth, Nebraska.
(See pages 604, 603, 649.)

Fig. 36. F:A.M.23340, *Serridentinus serridens* (Cope), ref., (p^3 and p^4 rev.), from Texas.
(See also Fig. 20 and pages 605, 649.)

F:A.M.20850A, (?) *Trilophodon barstonis*, n.sp., ref., rev., from Barstow, California.
(See page 607.)

Fig. 37. F:A.M.18218, *Rhynchotherium edensis* Nobis, ref., from Eden, California.
(See also Fig. 22 and pages 519, 650; 1926, Fig. 18.)

F:A.M.23331 and 23332, *Anancus bensonensis* Gidley, (?) ref., from the vicinity of Benson, Arizona.
(See also Fig. 22 and pages 628, 650.)

Fig. 38. F:A.M.18216, rev., and 18216A, *Rhynchotherium edensis* Nobis, ref., from Eden, California.
(See also Fig. 22 and pages 519, 650; 1926, Figs. 2, 3, 8 and 9.)

C.M.2332, *Mastodon americanus* (Kerr), ref., from Frankstown Cave, Pennsylvania.
(See also Fig. 22 and pages 632, 650; Peterson, 1926, p. 274 and Pls. XXII and XXIII.)

F:A.M.23327, *Anancus bensonensis* Gidley, (?) ref., from the vicinity of Benson, Arizona.
(See also Fig. 22 and pages 628, 650.)

The immature examples may be conveniently divided according to three stages, A–C, of tooth eruption and according as to whether larger individuals (hypothetically males) or smaller individuals (hypothetically females).

(Detached premolars not included—compare measurement table following.)
(Stage A, p_4^4 in place, Stage B with dp_4^4 and Stage C with dp_3^3.)

Those immature examples exhibiting variably elongate symphysis and typical mammalian tooth replacement are tentatively subdivided between the "Longirostrine" subgroups, (A) "Sublongirostrines" and (B–C) "Longirostrines"-"Superlongirostrines."

(A) "Sublongirostrines"—*Serridentinus serridens* (Cope), referred, from Texas,
S. productus (Cope), referred, from New Mexico, and
Serbelodon barbourensis, n.sp., from Nebraska.

STAGE A.

Immature bull.

Texas, F:A.M.23340, p^3–p^4, $m_{\frac{1}{2}}$. *Figs. 20 and 36.*
(p^4 large while p^3 approximates Florida specimen, figured 1926, Figs. 20A and B. Symphysis notably short versus same aged and tooth-sized "Longirostrine," F:A.M.21284, *Fig. 19.*)

Texas, A.M.10673, p_4^4–m_2^2 (unfigured).
(p^4 slightly larger.)

Nebr. F:A.M.25737, p^4–m^1. *Fig. 35.*

Immature cow.

N. Mex. F:A.M.21285, p_4–m_1, m_2 germ and alveolus p_3. *Figs. 21 and 32*
(Small–medium sized mandible.)

STAGE B.

Bull calf.

Nebr. F:A.M.25731, dp_4, m_1 and germ of p_4. *Fig. 35.*

Nebr. F:A.M.25733, p^3, dp^4, m^1 erupting, and germ of p^4. *Fig. 35.*

N. Mex. F:A.M.21286, "p_3," dp_4, p_4 germ, m_1, and partial m_2 germ. *Figs. 21 and 32.*
Heavy, broad symphysis and relatively strong tusk, (?) *Trobelodon* possibly.

[Note p^4 of Cope specimen (N.M.4179) slightly smaller than F:A.M. 21286.]

STAGE C.

Cow calf.

Ainsworth, Nebr. F:A.M.25732, dp^3–m^1 (erupting).
The p^3–p^4 germs lie on the lingual side of the dp^3–dp^4.

F:A.M.25714, dp^2–m^1 (unerupted), p^3 germ and partial tusk. *Figs. 21 and 33.*

Small cow calf.

N. Mex. F:A.M.21113, dp_2–dp_4 (erupting). *Figs. 21 and 30* and 1926, Figs. 5 and 10.

(B–C) "Longirostrines"-"Superlongirostrines"—*Ocalientinus*, *Trilophodon*, *Trobelodon*, etc. species from New Mexico, Nebraska and possibly California.

STAGE A.

Immature bull.

N. Mex. F:A.M.21284, p_4^1–m_2^2 (two crests worn) and m_3 in germ. *Fig. 19.* p_4–m_1 size approximating, but ramus and symphysis much longer than in *Serridentinus*, referred, Texas, F:A.M.23340. *Figs. 20, 36.*

N. Mex. F:A.M.21278, both p_4s–m_1s. *Fig. 32.*

N. Mex. F:A.M.21131, both p^3s, dp^4s and m^1s (br.) and p^4 germs. *Fig. 34.*

N. Mex. F:A.M.21272, p^4 (br.), m^1–m^2 (br.).

N. Mex. F:A.M.21124, p_4^1 (root)–m_2^2, germ m_3. *Fig. 20* and 1926, Fig. 13.

STAGE B.

Immature cow.

N. Mex. F:A.M.21112, p_3–dp_4, p_4 germ, m_1 and m_2 germ. *Figs. 21 and 31* and 1926, Figs. 6, 11 and 24.

Mandible slender but nearly as long as F:A.M.21285, in which p_4 is erupted. At the same state as the latter the 21112 mandible would be noticeably more elongate and slender.

Symphysis more compressed laterally, typical p_3 retained and tusks smaller versus 21286 of same state under (A), Stage B.

STAGE C.

Small bull calf.

N. Mex. F:A.M.21298, dp^2–dp^3. *Fig. 33.*

Barstow, Calif. F:A.M.20850B, dp^3. *Fig. 33.* (? Smaller.)

(D) "Rhynchorostrines"—Replacement premolars apparently retained —*Blickotherium*, n.g.

STAGE A.

Immature cow.

Honduras, F:A.M.27062, mandible with p_4, *Fig. 4.*

Replacement premolars absent—*Rhynchotherium.*

STAGE C.

Bull calf.

Eden, Calif., F:A.M.18218, maxilla with dp^2-dp^4, *Fig. 37*, and F:A.M.18216 and 18216A, *Fig. 38.*

(E) "Brevirostrines"— Replacement premolars absent.

STAGE C.

Small cow calf.

Arizona, (?) *Anancus*, F:A.M.23331 and 23332, *Fig. 37*, and (??)F:A.M.23327, *Fig. 38.*

Pennsylvania, *Mastodon americanus*, ref., C.M.2332, *Fig. 38.*

Trilophodont Deciduous and Permanent Premolars
Comparative Measurements

(See 1926, Table, p. 155.)

Largest:				
Nebraska	mm.			
p^4	60.5	*Fig. 35* × 1	F:A.M.25737	maxilla (A), stage A, see p. 649.
Honduras				
p_4 germ (br.)	((59))	*Fig. 4* × 1	F:A.M.27060	ramal fragment, p. 532.
California (Barstow)				
dp^3 unworn	45	*Fig. 33* × 1	F:A.M.20850B	(B–C), stage c, see p. 650.
Texas				
p_4^1	57 / 59		A.M.10673	(A), stage A, see p. 649.
m_1^1	100 / (100)			
New Mexico				
p_4	56	*Fig. 32* × 1	F:A.M.21278	ramal fragments (B–C), stage A, see p. 650.
m_1	99.5			
dp^2	35.4	*Fig. 33* × 1	F:A.M.21298	partial maxilla (B–C), stage c, see p. 650.
dp^3	46			
Nebraska				
p_4	56		A.M.19248	ramal fragment
p_4	(55+)		F:A.M.25719	
California (Ricardo)				
p^4	((55))		F:A.M.18229	
Large:				
Texas				
p^3	36	*Fig. 20* × 1/6	F:A.M.23340	skull and jaws (A), stage A, see p. 649.
p_4^4	54.5 / 55	*Fig. 36* × 1		
m_1^1	98 / 99			
New Mexico				
p_4^4 (br.)	((54+)) / ((54+))	*Fig. 19* × 1/6	F:A.M.21284	partial skull and mandible (B–C), stage A, see p. 650.
m_1^1	95.5+ / ((95.5))			
p^3 (br.)	((31))	*Fig. 34* × 1	F:A.M.21131	partial palate (B–C), stage A, see p. 650.
p^4	52.5			
p_4^4	(50+) / br.	*Fig. 20* × 1/6 (Figured 1926, Fig. 13)	F:A.M.21124	mandible, etc. (B–C), stage A, see p. 650.
m_1^1	(100) / br.			
p^4	50		F:A.M.21124D	

() approximate; (()) estimated

TRILOPHODONT DECIDUOUS AND PERMANENT PREMOLARS, continued

	mm.			
Nebraska				
p^4 worn	53.3		F:A.M.25738A	
Colorado				
p^4	52	Fig. Cope	A.M.8523	*M. proavus* Cope, type
MODERATELY SMALL:				
Nebraska				
p_4	51.4	*Fig. 35* × 1	F:A.M.25731	ramus (A), stage B, see p. 649.
p^3	28	*Fig. 35* × 1	F:A.M.25733	maxilla
p^4 germ	49			(A), stage B, see p. 649.
m^1	89.5			
New Mexico				
p_3	15.3			
p_4 germ	48.5	*Fig. 21* × 1/6	F:A.M.21286	mandible
m_1	90	*Fig. 32* × 1		(A), stage B, see p. 649.
Nebraska				
dp^2	28	*Fig. 21* × 1/6	F:A.M.25714	maxilla
dp^3	41	*Fig. 33* × 1		(A), stage C, see p. 649.
dp^4	68			
p^3 germ	(32+)			
m^1	94			
Honduras				
p_4 worn	47.7	*Fig. 4* × 1	F:A.M.27062	mandible, p. 529.
m_1	86.5			
New Mexico				
p^3 (br.)		Fig'd 1926, Fig. 19A, and Cope	N.M.4179	
p^4	45	(1877), pl. LXXI, Figs. 1 and 2		
SMALL:				
California (Barstow)				
p_4 worn	41	*Fig. 36* × 1	F:A.M.20850A	
Honduras				
p^3	29	*Fig. 4* × 1	A.M.21944	
New Mexico				
p_3	27.2	*Fig. 21* × 1/6	F:A.M.21112	mandible
p_4 germ	44	*Fig. 31* × 1		(B–C), stage B, see p. 650.
m_1	86			
dp_2	(11)	*Fig. 21* × 1/6	F:A.M.21113	right ramus
dp_3	41	*Fig. 30* × 1		(A), stage C, see p. 649.
dp_4	77			
p_4	(41)	*Fig. 21* × 1/6	F:A.M.21285	mandible
m_1	81.5	*Fig. 32* × 1		(A), stage A, see p. 649.
Nebraska (Snake Creek)				
p^4	41.6		A.M.19248J	

() approximate; (()) estimated