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DIBELODON EDENSIS (FRICK) OF SOUTHERN CALIFORNIA, *MIOMASTODON* OF THE MIDDLE MIOCENE, NEW GENUS¹

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During the years 1916-1917, Mr. Childs Frick (1921, p. 279)² conducted field work in southern California as part of Professor John C. Merriam's comprehensive plan for the study of the geologic and faunal history of the Pacific coast. In the rich "Eden beds" were discovered proboscidean remains which the author (*op. cit.*, p. 405) determined as follows:

Trilophodon (*Tetrabelodon*) *shepardi edensis*, n. subsp. *Type specimen*.—The portion of a skull and posterior maxillaries, containing the last molar of the left side and a section of that of the right side, Univ. Calif. Coll. Vert. Pal. no. 23501 (fig. 160); two associated molars from the left and the right side respectively, Univ. Calif. Coll. Vert. Pal. 23503, 23504 (figs. 164, 162); and portions of premaxilla and tusks, Univ. Calif. Coll. Vert. Pal. no. 24047 (pl. 50), all from Univ. Calif. loc. 3269.

The Eden beds are correlated with the Snake Creek of Nebraska, the Rattlesnake of Oregon, the Thousand Creek of Nevada, and the Middle Etchegoin of California, namely, of Middle Pliocene age. Excavation in the Eden beds continued by Mr. Frick resulted in the recovery of the complete upper tusks of one of the cotype specimens which were figured by the author (*op. cit.*, Pl. 50): "Figs. 1 and 2. Portions of premaxillary and tusks of Eden type specimen, no. 24047, $\times \frac{1}{4}$." Under Mr. Frick's direction these cotype tusks have been carefully restored and mounted, as represented in the present article (Fig. 1). Mr. Frick has kindly offered this precious cotype to the present writer for redescription together with newly discovered grinding teeth found in the same ledge of the Eden beds, representing several individuals which probably belong to the same species. This new cotype and the associated material prove that the Eden proboscidean is very close indeed in all its characters to the classic *Mastodon andium* Cuvier of the valley of Tarija, Bolivia, and especially to the skull described by Nordenskiöld³ in 1903.

¹This is the eighth in the author's list of special papers on the evolution and classification of the Proboscidea since 1918, and the eighteenth in his total list of papers on this subject since 1907.

²Frick, Childs, 'Extinct Vertebrate Faunas of the Badlands of Bautista Creek and San Timoteo Cañon, Southern California,' Univ. Calif. Publ. Bull. Dept. Geol., XII, No. 5, pp. 277-424, Pls. XLIII-L, 165 text figures. December 28, 1921.

³Nordenskiöld, Erland, 1903, 'Über die Säugetierfossilien des Tarijatals, Südamerika. I. *Mastodon Andium* Cuv.,' Kungl. Svenska Vetensk.-Akad. Hand., Bd., 37, No. 4, pp. 1-30, Taf. I-VI.

The matter of chief interest and importance is that these notorostriine proboscideans migrated along the western coast of North America EN ROUTE to their habitat in the Andes. The generic name to be applied to this animal is not *Trilophodon* Falconer but *Dibelodon* Cope. Cope (1884)¹ founded *Dibelodon* on three species, namely, *Dibelodon (Mastodon) shepardi* Leidy, *Dibelodon tropicus* Cope, and *Mastodon humboldtii* Cuvier, the first being specified as type. Consequently, *Trilophodon (Tetralabodon) shepardi edensis* Frick = *Dibelodon edensis* (Frick).

***Dibelodon edensis* (Frick)**

CHARACTERS.—As shown in Fig. 1, *A*₁, *A*₂, *B*, the premaxillæ, the anterior portion of the palate, the dentition, and the enamel areas of the tusks are so similar to those of the Tarija skull referred to *M. andium* by Nordenskiöld, that if the Eden cotype had been found at Tarija it would without question have been referred to the species *Dibelodon andium*. The enamel ribbon in both the Eden and the Tarija specimens leaves the skull on the OUTER border of the tusk which by an inward rotation on its own axis carries the enamel (*e e e*) to the INNER border; in both photographic figures the enamel borders are artificially indicated with a faint white line. The *Dibelodon edensis* cotype is a male individual, consequently the tusks are more robust; it is a younger individual, hence the tusks are relatively shorter and the twisting of the enamel band does not extend quite so far. It appears probable that *Dibelodon edensis* is less progressive than *Dibelodon andium* in its tusk formation.

The teeth included by Mr. Frick as type and cotype specimens are the following:

Posterior maxillæ with left *M*³ and right *M*³, Univ. Calif. 23501 (fig. 160).

Associated molars right *M*² and left *M*², Univ. Calif. 23503, 23504 (figs. 164, 162).

Portions of premaxilla and tusks, Univ. Calif. 24047.

These types give the ridge formula *M* 2³, *M* 3⁴.

New specimens in the American Museum collection from the same Eden ledge referred to *Dibelodon edensis* are the following: *A*. 18219, left *M*³; *B*. 18219, jaw with left *M*₂₋₃; *C*. 18219, palate with well-worn right *M*²⁻³; *D*. 18219, right *M*³; *E*. 18219, right *M*³; *F*. 18219, maxillary with right *M*²⁻³ (frag.); 18218, left *DM*³⁻⁴, *M*¹; 18217, left *M*₂; *B*. 18216, juvenile inferior maxillary with *DI*₂, *DM*₂₋₄, *M*₁. The latter specimen contains a small tusk apparently enamelled.

These referred specimens belong to several different individuals and the determination of the superior and inferior grinding teeth is provisional. The lower jaw with milk incisor (*B*. 18216) is of great interest if it proves to present us with the juvenile characters of the *Dibelodon edensis* jaw, as appears probable.

¹Cope, E. D., 1884, 'The Extinct Mammalia of the Valley of Mexico,' Proc. Amer. Phil. Soc., XXII, pp. 1-21.



Fig. 1. Comparison of rostrum and tusks of female *Dibelodon andium* of Tarija, Bolivia, and male *Dibelodon edensis* of southern California.

All figures are reduced to approximately $\frac{1}{4}$ nat. size.

A₁, Superior view of cotype specimen of *Dibelodon edensis* Frick. This is probably a male individual.
 B, Palatal view of "Mastodon" *andium* of Tarija, described by Nordskiöld (1903, p. 26, Taf. I, fig. 2) as a female individual.
 A₂, Palatal view of the same cotype of *Dibelodon edensis* Frick showing the remarkable similarity of detail to the palate of "M." *andium*.
 The spiral course of the enamel bands in both specimens may be observed in all the figures.

Miomastodon, new genus

GENOTYPIC SPECIES.—*Mastodon merriami* Osborn, 1921,¹ from the Virgin Valley formation, Middle Miocene of Nevada.

GENERIC CHARACTERS.—A member of the true Mastodontinæ phylum leading into the *Mastodon americanus* type, distinguished from the true *Palæomastodon beadnelli* of the Lower Oligocene of the Fayûm, Egypt, by rounded, greatly enlarged, upcurved superior tusks; form of inferior tusks not certainly known, probably rounded and more or less encased in enamel; distinguished from the true Pleistocene *Mastodon americanus* by the presence of a broad enamel band extending from the base to the summit of the tusk. Ridge formula: $M\ 2\ \frac{3}{8}$, $M\ 3\ \frac{3\frac{1}{2}}{4}$, as compared with the *Palæomastodon beadnelli* ridge formula: $M\ 2\ \frac{2\frac{1}{2}}{3}$, $M\ 3\ \frac{2\frac{1}{2}}{3}$; as compared with the *Mastodon americanus* ridge formula: $M\ 2\ \frac{3}{8}$, $M\ 3\ \frac{4}{12}$.

To this genus may at present be referred four species, namely: Genotypic species, *Mastodon merriami*, Middle Miocene, Nevada = *Miomastodon merriami*

Mastodon proavus Cope, 1873, late Middle Miocene, Pawnee Creek, Colorado = *Miomastodon proavus*

Mastodon matthewi Osborn, 1921, Middle Pliocene, western Nebraska = *Miomastodon matthewi*

Also probably *Mastodon tapiroides americanus* Schlesinger, Lower Pliocene of Hungary = *Miomastodon tapiroides americanus*.

The distinctive grinding tooth characters in all these Mastodontinæ are: (1) that each loph (protoloph, metaloph, *et seq.*) is composed of a main internal and external bunoid cone; (2) the intermediate conule region does not develop; (3) the earliest grinder is tetrabunodont; (4) as the third loph is added it becomes hexabunodont; (5) as the fourth loph is added it becomes octobunodont; (6) whereas these four, six, and eight cones heighten (hypsodonty), they never unite transversely into a crest; thus none of the Mastodontinæ becomes zygolophodont.

The broad enamel band of the tusks is apparently placed on the CONCAVE surface of the tusk in *Miomastodon merriami*, on the CONVEX surface of the tusk in *Miomastodon tapiroides americanus*.

The occurrence of *Miomastodon merriami* in the Virgin Valley, Nevada, in Middle Miocene time demonstrates that these true mastodons arrived in this country much earlier than we have hitherto supposed. It is probable that the so-called "*Mastodon*" *proavus* of Cope from the Middle Miocene of Pawnee Creek, Colorado, is another representative of the genus *Miomastodon*; on the other hand, "*Mastodon*" *brevidens* Cope, 1889, from the late Middle Miocene, from the Deep River beds of Montana, probably belongs to the genus *Rhynchotherium*, distinguished by short molar teeth (hence *R. brevidens*) and internal lobes bearing trefoils on crests one and two.

¹Osborn, H. F., 'First Appearance of the True Mastodon in America,' Amer. Mus. Novitates, No. 10, June 15, 1921, pp. 1-6, Figs. 1 and 2.