

# AMERICAN MUSEUM NOVITATES

Number 41

July 8, 1922

56.9,61 E (119:7)

## SPECIES OF AMERICAN PLEISTOCENE MAMMOTHS

### *ELEPHAS JEFFERSONII*, NEW SPECIES

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It appears probable that all the elephants which arrived in America belong in the division of the MAMMOTHS, subfamily Mammontinæ. Six species of these large and interesting migrants have been successively proposed as follows:

*Elephas jacksoni* Mather, 1838. Type figured and described. Indeterminate until the type can be located.

*Elephas americanus* De Kay, 1842. Type figured and described; since destroyed by fire. Undoubtedly a synonym of *Elephas primigenius*.

*Elephas columbi* Falconer, 1857. Type in the British Museum 40769; cast in the American Museum 1747. Closely related to *Elephas imperator* Leidy.

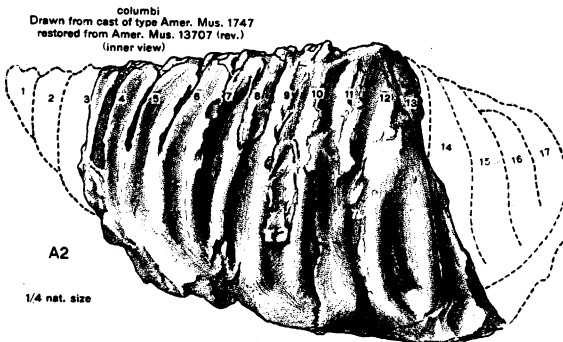


Fig. 1. Type molar of *Elephas columbi*, right M<sub>3</sub>, drawn from the inner side. One-fourth natural size.

*Elephas imperator* Leidy, 1858. Type in National Museum 185; cast in American Museum 2568.

*Elephas texianus* Owen, 1859. *Nomen nudum*; name only without definition or designation of type.

*Elephas hayi* Barbour, 1915. Excellent figure and description. Nebraska Museum. Regarded as a primitive form related to *Elephas imperator*.

The present article relates explicitly to the type characters of *Elephas columbi*, of *E. imperator*, and of the American specimens referred to *E. primigenius*, three species which have become more or less confused in all the previous literature because the characters of the type specimens

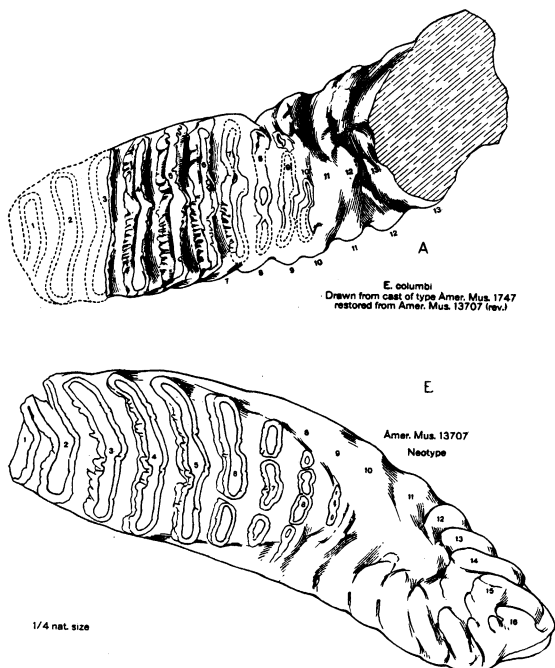


Fig. 2. A, Type molar of *Elephas columbi*, crown view. B, Neotype molar, M3, of the left side, crown view. One-fourth natural size.

have not been precisely determined and compared. The object of the present communication is to clear up this confusion and to propose ***Elephas jeffersonii*** as a new species of American Pleistocene mammoth.

#### TYPE CHARACTERS OF *Elephas columbi*

The type characters of this species are clearly shown in the accompanying figures. The type is a third lower molar of the right side, with portions of eleven ridge-plates out of an original total of sixteen or seventeen; this is shown by comparison with the neotype (Amer. Mus. 13707), which consists of non-associated upper and lower molars found in the phosphate beds near Charleston, S. C. In these specimens the ridge formula is:  $M\ 3\ \frac{17-18}{16-17}$ , as shown in Figs. 1-3. The ridge-plates do not exceed six in 100 mm. In the unworn condition (Fig. 3), in which only eight ridge-plates have come into use, the third superior and inferior molars are relatively short anteroposteriorly and deep vertically, because they contain so few ridge-plates.

We thus find by the characters of the type and neotype specimens that the real *Elephas columbi* is not the animal we have been describing under this name; it is a dwarf form, perhaps a dwarf female, of the animal which we have been describing under the name *Elephas imperator*.

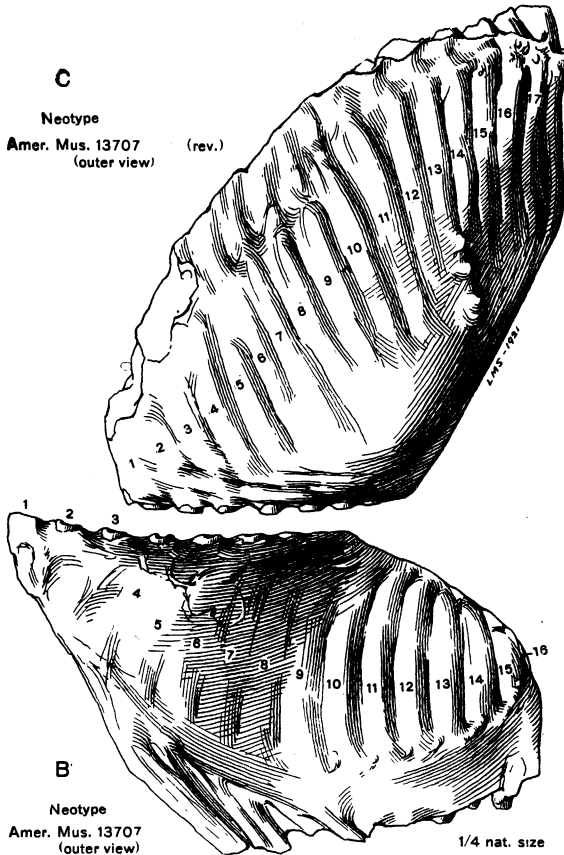


Fig. 3. Neotype molars of *Elephas columbi*. C, External view of M<sup>3</sup>. B, External view of M<sup>3</sup>; same tooth as Fig. 2, B. One-fourth natural size.

#### CHARACTERS OF THE *Elephas imperator* TYPE

We are indebted to the National Museum for the loan of the *Elephas imperator* type specimen (Fig. 4), enabling us to determine exactly to what portion of the complete neotype tooth (Fig. 5) this ancient and much battered type belonged; the eight ridge-plates of the type which are preserved, in comparison with those of the neotype (Amer. Mus.

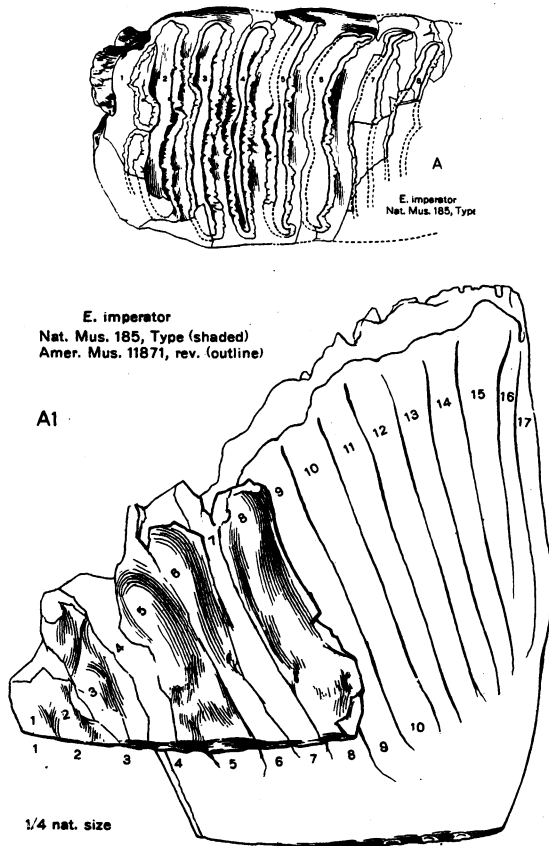


Fig. 4. A, Type molar, right M<sup>3</sup>, of *Elephas imperator* crown view. A1, Type molar (shaded) placed in position with less worn (unshaded) neotype molar, both belonging to M<sup>3</sup> of the right side.

11871), constitute the anteroposterior portion of a much-worn molar, M<sup>3</sup> of the right side, in which thirteen ridge-plates were in use out of an estimated total of seventeen. Of these plates five occupy a line 100 mm. long; this is because the ridge-plates are arcuate and widest apart in the middle portion of the crown. The neotype tooth (Amer. Mus. 11871), from Guadalajara, Jalisco, Mexico, appears to attain the full size of the superior grinders of this species of mammoth; the ridge formula may be written M 3  $\frac{17-18}{18-19}$ . This accords with the actual average count of the ridge-plates in *E. imperator* by Hay (1914) and by Osborn (1921-1922) in individuals which can without question be referred to *E. imperator*. Doubtless specimens may be found with the ridge-plate formula

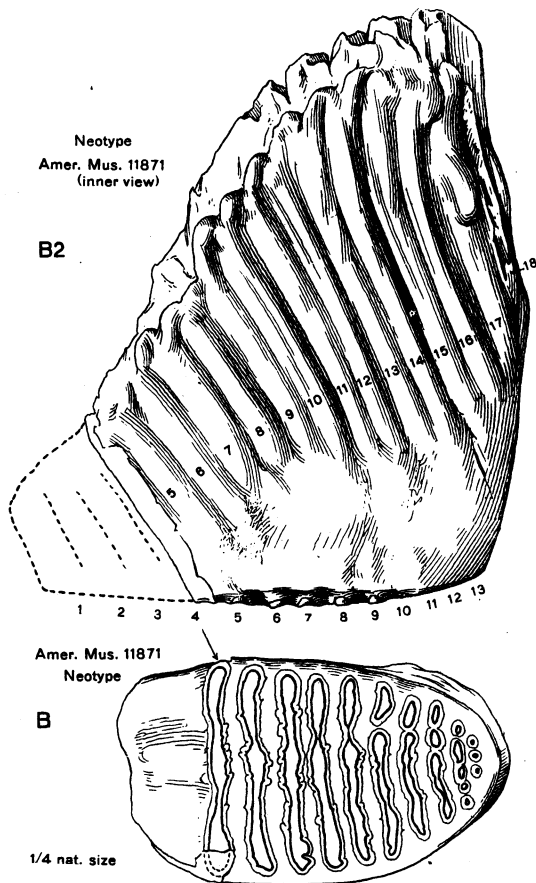


Fig. 5. B 2, Neotype molar of *Elephas imperator*,  $M_3$  of the right side, inner view. B, The same, crown view. One-fourth natural size.

$M_3 \frac{20}{19}$ . In the neotype (Fig. 5) thirteen plates were in use; in the referred skull (Amer. Mus. 14476) fifteen plates were in use (Fig. 6B); in the referred lower jaw (Amer. Mus. 14558) fifteen plates were in use (Fig. 6A). The total ridge-plates in  $M_3$  attain nineteen, as clearly shown in Fig. 6A; thus we have the following ridge formulæ:

Ancestral *Elephas meridionalis* of western Europe  $M_3 \frac{13-14}{11-14}$ ; *Elephas columbi* of southern United States  $M_3 \frac{17-18}{16-17}$ ; typical *Elephas imperator*  $M_3 \frac{17-18}{18-19}$ .

The cranial characters observed in three more or less complete skulls referred to *Elephas imperator* tend to support the direct descent of this animal from the *E. meridionalis* of the Val d'Arno, Upper Pliocene of Italy.

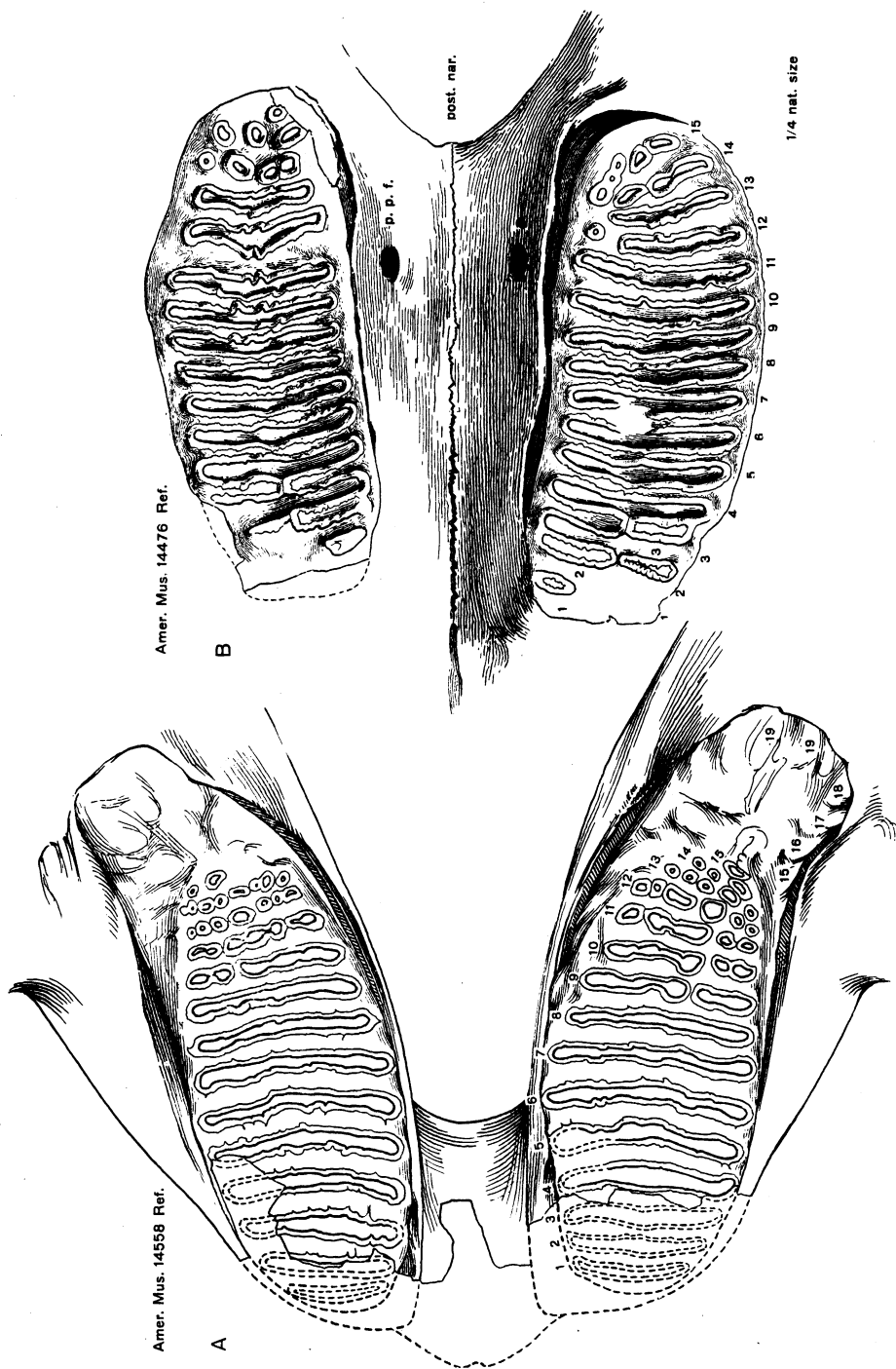


Fig. 6. Superior and inferior molars of *Elephas imperator*, referred American Museum specimens. A, Inferior molars with fifteen ridge-plates in use. B, Superior molars with fifteen ridge-plates in use. These two individuals are believed to be of corresponding age. They exhibit mechanical reversal of the convex and concave surfaces both in the crown contours, crown surfaces, and ridge-plates. One-fourth natural size.

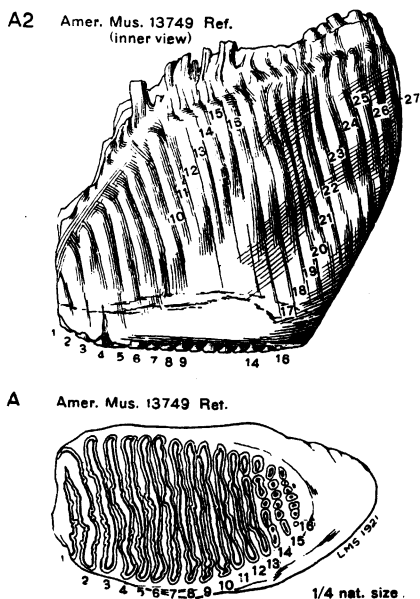


Fig. 7. Right third superior molar,  $M^3$ , of *Elephas primigenius*, Alaska, showing the maximum compression of the ridge-plates. One-fourth natural size.

#### CHARACTERS OF AMERICAN SPECIMENS REFERRED TO *Elephas primigenius*

*Elephas primigenius*, which ranged through the entire Pleistocene epoch, from the Lower Pleistocene forest-bed deposits of East Britain to the southerly range of this animal in the middle United States, is a collective species embracing an undoubted progressive evolution and intensification of its specific characters extending over a very long period of time. It exhibits various extremes of fore-and-aft compression of the cranium, with related fore-and-aft compression of the grinding teeth. The cranium is high, pointed at the summit, relatively narrow, and relatively deep. The forehead from the peak of the cranium to the extremity of the nasals is relatively elongate and slightly concave. Including within the definition all the specimens observed by Hay (1914) and by Osborn (1921-1922) which may certainly be included within this collective species, the collective ridge formula of the last two molar teeth is:  $M^2 \frac{18-19}{19}$ ,  $M^3 \frac{23-28}{23-24}$ .

COMPRESSION.—As compared with *E. columbi* and *E. imperator*, 10 ridge-plates are compressed into a line 100 mm. in length; the most highly compressed tooth observed by Osborn is an  $M^3$  from Alaska (Amer. Mus. 13749) in which 13 ridge-plates are compressed into a line 100 mm.

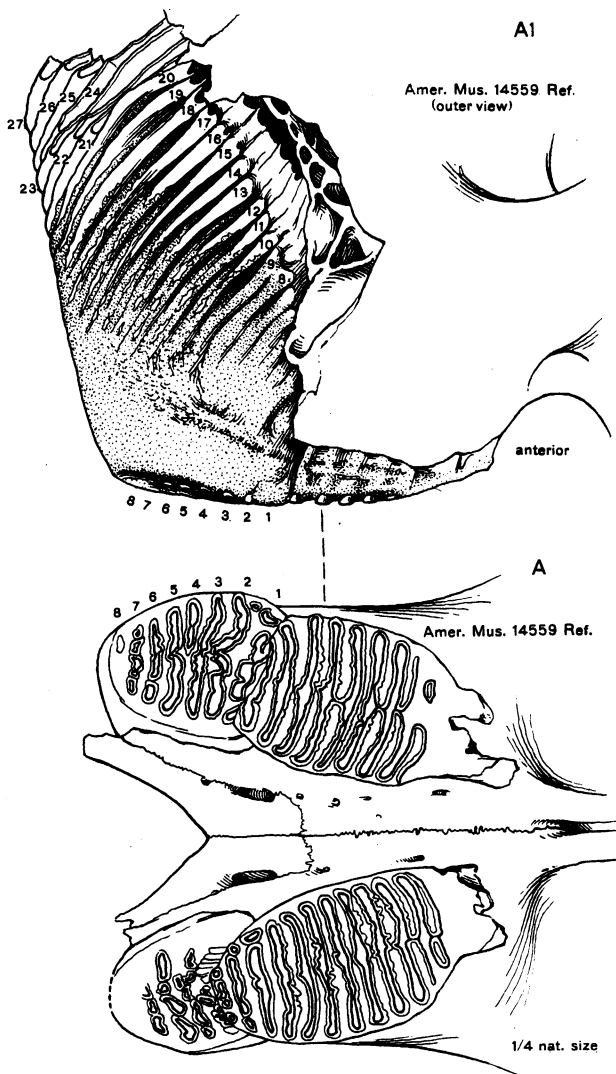


Fig. 8. Fourth and third superior molars of the right side of *Elephas primigenius*, Indiana. A 1, External view showing twenty-seven ridge-plates of M<sup>3</sup>. A, Crown view showing M<sup>3</sup> with eight ridge-plates in use, closely compressed to M<sup>2</sup> with nine ridge-plates in use. One-fourth natural size.

in length (Fig. 7); a similar condition prevails in a female skull from Indiana (Amer. Mus. 14559) in which 13 ridge-plates are compressed into a 100 mm. space, the total number of ridge-plates rising to 27 (Fig. 8). The prevailing condition, however, is of the kind shown in Fig. 9, namely, Amer. Mus. 13752, from Alaska, in which the ridge formula is  $M\ 3\ \frac{23}{24}$ , here figured with a lower molar (Amer. Mus. 14371) in which the ridge formula is  $M\ 3\ \frac{24}{24}$ ; in these specimens there are 10 plates in a 100 mm. line; these less compressed molars are arcuate, thus the count of the ridge-plates is greater on the concave side of the tooth and smaller on the convex side.

For example, an  $M^3$  (Amer. Mus. 10656) from Germany is as follows:

- 10 ridge-plates in 100 mm. on the outer convex surface,
- 11 ridge-plates on the horizontal coronal surface,
- 12 ridge-plates on the inner concave surface.

In the highly compressed upper tooth (Amer. Mus. 13749),  $M^3$ , from Alaska, the count on all three measurements is the same, namely:

- 13 ridge-plates in 100 mm. on the outer convex surface,
- 13 ridge-plates in 100 mm. on the horizontal coronal surface,
- 13 ridge-plates in 100 mm. on the inner concave surface.

These  $M^3$  conditions are reversed in counting the ridge-plates in the lower molars,  $M_3$ , in which the outer surface is concave and the inner surface is convex. For example, in an  $M_3$  from Alaska (Amer. Mus. 14343) the count is as follows:

- 10 ridge-plates in 100 mm. on the outer concave surface,
- 10 ridge-plates in 100 mm. on the horizontal coronal surface,
- 8-9 ridge-plates in 100 mm. on the inner convex surface.

It follows from the above observations that the horizontal coronal section gives, as a rule, an average between the inner and outer sides; the average in *E. primigenius* is 10 ridge-plates in 100 mm., the minimum observed is 8 in 100 mm., the maximum observed is 13 in 100 mm. This range of compression applies to fifteen specimens ranging through England, Germany, Siberia, Alaska, Ohio, and Indiana.

The worn coronal surface is sometimes fully horizontal, i. e., at right angles to the perpendicular ridge-plates; in such case it registers the exact distance between the plates. In other cases the wear is obliquely horizontal; in which case it increases the actual distance between the plates. It is important to note also that the ridge-plates are arcuate and more closely compressed towards their summits; thus more ridge-plates may be counted in 100 mm. at the summit of the crown than

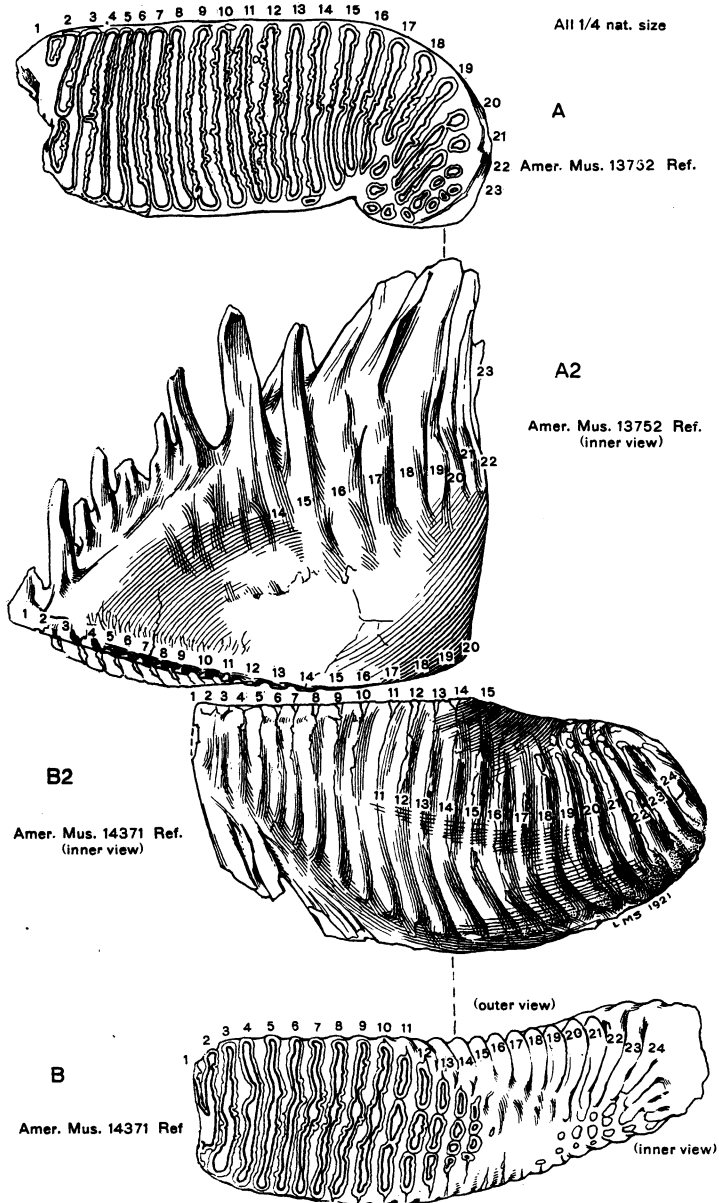


Fig. 9. Posterior superior and inferior molars of *Elephas primigenius*, Alaska, of less compressed type than the molars shown in Figs. 7 and 8. A, Crown view, twenty-three ridge-plates. A 2, Inner view of same. B 2, Inner view of M<sub>3</sub> of another individual. B, Crown view of same.

at the base of the crown, and as a rule the ridge-plate count should be taken midway between the summit and the base, both on the inner and outer sides.

***Elephas jeffersonii*, new species**

The above diagnoses of the real specific characters of the grinding teeth of *Elephas columbi* (closely related to if not identical with *E. imperator*) and of the true *E. primigenius* leaves without a name the animal which previously has been described in all the literature (excepting Soergel's recent Memoir) as *Elephas "columbi."*

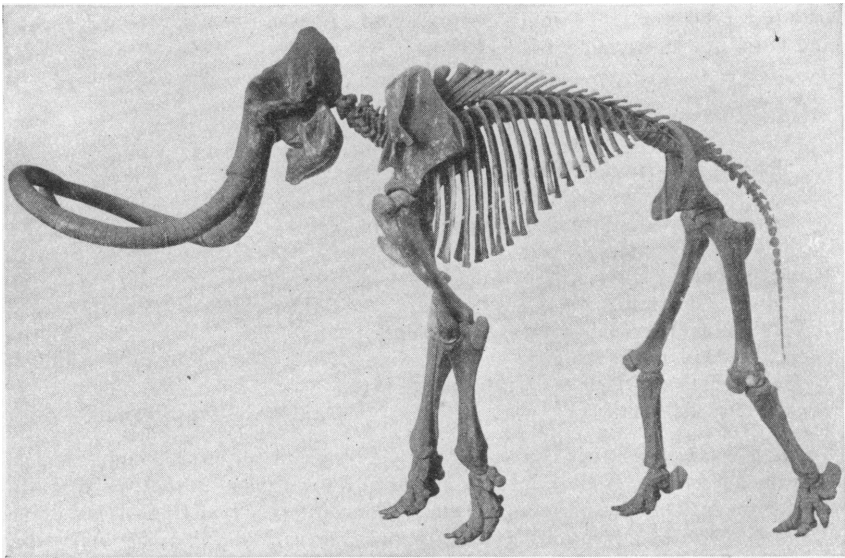


Fig. 10. Type skeleton of *Elephas jeffersonii* (Amer.Mus. 9950) as mounted in the American Museum. Reduced to one-fifty-second natural size.

This animal is better known than either of the others; it is represented in all the collections of the principal museums of the United States, as described by Hay (1914), and particularly in the American Museum by four especially fine specimens. Of these we select as the type Amer. Mus. 9950, including the skull, jaws, and greater part of the skeleton (Fig. 10), found near Jonesboro, Indiana, on the farm of Dora S. Gift; purchased for the Museum with the Jesup Fund in 1904, restored and mounted in 1906; described by Osborn in 1907 as *Elephas columbi*, determined by Hay (1914) as *Elephas primigenius*.

As the paratype of this species we select a pair of upper and lower grinding teeth of both sides (Amer. Mus. 10457) acquired with the Warren Collection in 1906 and described by Warren in 1855 (p. 163, Pl. xxviii, fig. C) as *Elephas "primigenius."*

This typical American species is named in honor of the third president of the United States, Thomas Jefferson, in commemoration of his long-continued devotion to mammalian palæontology.

The paratype (Amer. Mus. 10457) best affords comparison with the species diagnosed above; the ridge formula is  $M\ 3\ \frac{30}{24\frac{1}{2}-26}$  the right lower  $M_3$ , (Fig. 11 B2) presenting the last lower ridge-plates more fully developed than in the left lower molar (Fig. 11 B1). It is interesting to observe (Fig. 12 A, B), that these same paratype molars show eighteen ridge-plates in use in both  $M^3$  and  $M_3$ , but that the superior molars show four to five ridge-plates in excess of the inferior molars, the formula being  $M\ 3\ \frac{30}{24-26}$ . The compression of the ridge-plates is directly intermediate between that of *E. columbi-E. imperator* and that of *E. primigenius*, namely, 7 ridge-plates in 100 mm.; in order to compare this compression with the ridge-plate measurement given by Hay (1914) in his description of "*Elephas columbi*," the inner, outer, and horizontal measurement is as follows:

PARATYPE	TYPE
$M^3$ outer convex surface, 7-8 ridge-plates in 100 mm.	
oblique mid-coronal surface, 8-8½ ridge-plates in 100 mm.	
inner concave surface, 9-10 ridge-plates in 100 mm.	
$M_3$ outer concave surface, 6½-7 ridge-plates in 100 mm.	8 ridge-plates in 100 mm.
oblique mid-coronal surface, 7-7½ ridge-plates in 100 mm.	7-7½ ridge-plates in 100 mm.
inner convex surface, 6-6½ ridge-plates in 100 mm.	7 ridge-plates in 100 mm.

This compression, with an average of 7-8 ridge-plates in 100 mm., concurs with the measurements given by Hay in nine of the specimens in the National Museum, namely, 7-8 ridge-plates in 100 mm.<sup>1</sup> Comparing the type ridge-plate formula of *E. jeffersonii*,  $M\ 3\ \frac{30}{24-26}$ , with that of *E. primigenius*,  $M\ 3\ \frac{23-28}{23-24}$ , we observe that the number of ridge-plates is similar but the lesser compression of ridge-plates in *E. jeffersonii*, namely, 7:100, as compared with *E. primigenius*, 10:100, is correlated with the relatively long, gently arcuate grinders of *E. jeffersonii* as compared with the short, deep, strongly concavoconvex grinders of *E. primigenius*. The paratype molars of *E. jeffersonii* in which eighteen upper and lower plates simultaneously come into use compare closely in measurement and character with the type molars of *E. jeffersonii* in which only sixteen plates have come into use. In the lower molars of the type (Amer. Mus. 9950) the sixteen plates in use indicate that the animal was of about the same age as the paratype in which eighteen plates were in use:

7 ridge-plates in 100 mm. on the convex inner side,  
 7-7½ ridge-plates obliquely worn on mid-coronal surface,  
 8 ridge-plates in 100 mm. on the concave outer side.

<sup>1</sup>Dr. O. P. Hay writes March 14, 1922: "In counting the ridge-plates I try to count the ridges on the side of the tooth, about half way down and at right angles with the plates." He does not state whether his count is uniformly made on the inner or on the outer side of the tooth, which makes a difference of from one to three plates in the count, as shown above.

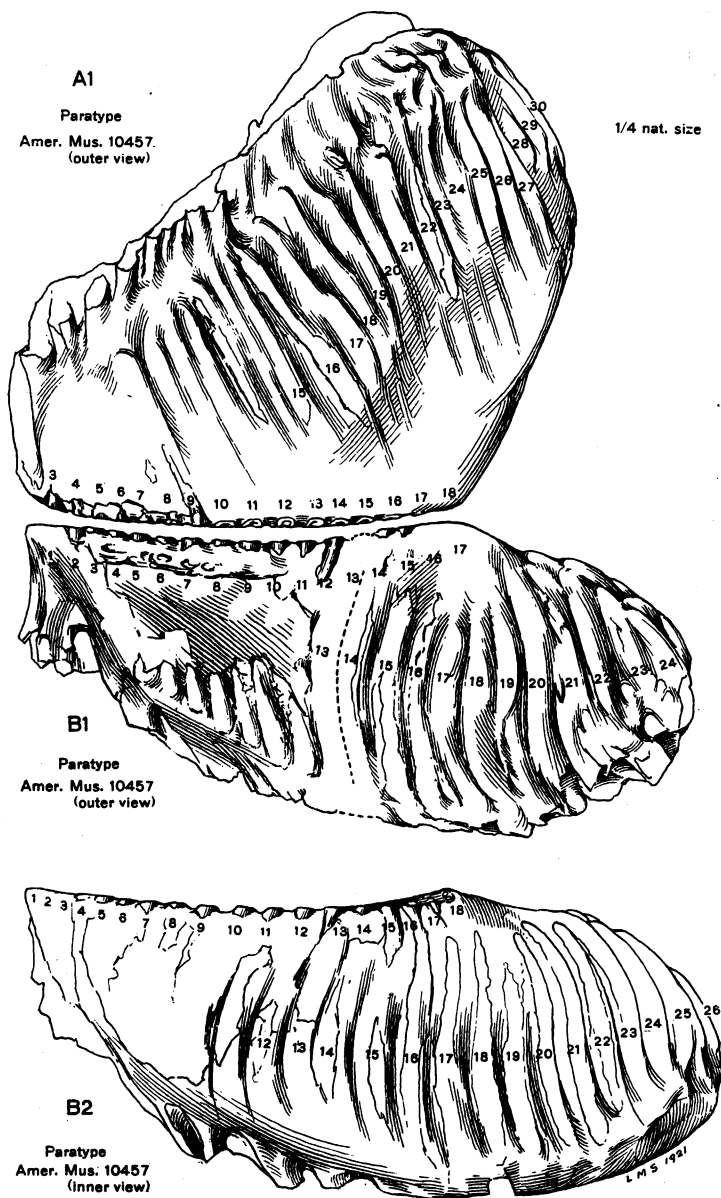


Fig. 11. Paratype molars of *Elephas jeffersonii*, M<sup>3</sup>, M<sub>3</sub>, of the same individual, Amer. Mus. Warren Coll., Zanesville, Ohio.

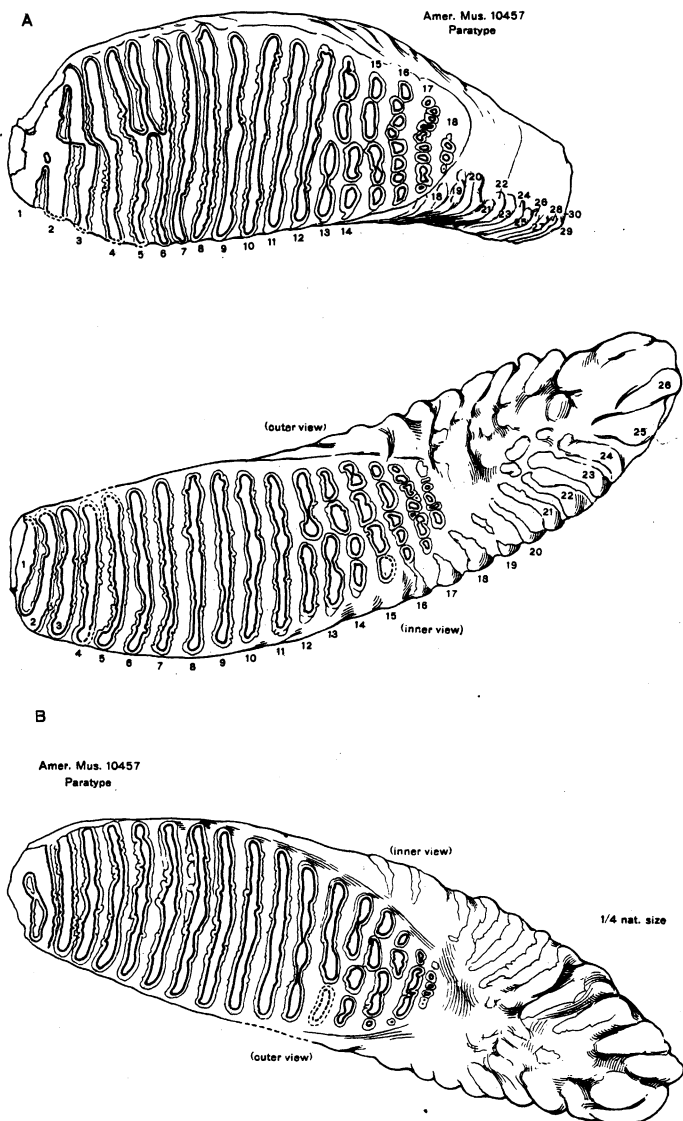


Fig. 12. Paratype molars of *Elephas jeffersonii*, the same specimens as in Fig. 11. A, Crown view of left superior molar, M<sup>3</sup>. B, Crown views of right and left inferior molars. Both upper and lower molars with eighteen ridge-plates in use. One-fourth natural size.

CRANIAL CHARACTERS.—Still more obvious are the differences between the relatively long, broad, and shallow crania of *E. jeffersonii* and the relatively short, narrow, and deep crania of *E. primigenius*, proportions which are correlated respectively with the corresponding proportions just described and figured in the teeth.

The four complete skulls of this species known to the writer are those of (1) in the type mounted skeleton (Amer. Mus. 9950); (2) the fine male skull associated with the jaws and a large part of the skeleton (Amer. Mus. Cope Coll. 8681) from Whitman County, Washington, now labeled "*Elephas columbi*"; (3) the young male skull (Amer. Mus. Cope Coll. 14475) from Dallas, Texas, also labeled "*Elephas columbi*." (4) To these should be added the very large male skull (Nat. Mus. 10261) collected near Cincinnati, Ohio; in this specimen the ridge formula is  $M\ 3\ 2\ 0$ ; seventeen plates were in use; the compression of the grinding teeth is greater, namely:

9 ridge-plates in 100 mm. on the outer side, at the worn edge,

9 ridge-plates in 100 mm. on the worn mid-coronal surface.

The cranial characters of this specimen are entirely similar to those of the three skulls in the American Museum collections, except that it is larger and more robust.

#### CONCLUSION

The American elephant heretofore widely known as "*Elephas columbi*," the Columbian Mammoth, will hereafter be known as *Elephas jeffersonii*, the Jeffersonian Mammoth. The question whether the animal heretofore known as *Elephas imperator*, the Imperial Mammoth, shall hereafter become known as the Columbian Mammoth under the law of priority, must remain open for the present. Certainly the real type of *Elephas columbi* represents an animal very close to the real type of *Elephas imperator*, but inasmuch as the type and neotype of *Elephas columbi* belong to dwarfed individuals, it is possible that when these animals become more fully known we shall find that *Elephas columbi* and *Elephas imperator* may be maintained distinct, as it is eminently desirable they should.

BIBLIOGRAPHIC NOTE.—The first revision of the Pleistocene mammoths and mastodons of America by Dr. O. P. Hay is to be found in 'The Pleistocene Mammals of Iowa,' Iowa Geological Survey, Vol. XXIII, Annual Report, 1912, by O. P. Hay, Research Associate of the Carnegie Institution of Washington, published in 1914. The second revision by the same author is entitled 'Descriptions of Some Pleistocene Vertebrates Found in the United States,' Proceedings of the United States National Museum, Vol. LVIII, No. 2328, by O. P. Hay, Associate of the Carnegie Institution of Washington, published in 1920. The section devoted to the Proboscidea in the 1914 Memoir, pp. 328-449, Pls. XLIII-XLIX, was prepared after the author had examined all the

chief collections in the United States including the Pleistocene collections in the American Museum.

The manuscript of the present article in the American Museum Novitates was sent to the American Museum Press in its present form on June 12, 1922.