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MAMMUTHUS FROM LINCOLN COUNTY AND A REVIEW OF THE MAMMOTHS FROM THE PLEISTOCENE OF NEW MEXICO

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Abstract—Mammoths were nearly ubiquitous during the Pleistocene in New Mexico, and published records and accessible museum specimens document 32 localities statewide. Three species of *Mammuthus—M. meridionalis, M. imperator* and *M. columbi*—are represented, but the vast majority of New Mexican mammoths are *M. columbi*. The oldest New Mexican mammoth is *M. meridionalis* from Tijeras Arroyo and is of early Irvingtonian age, 1.4–1.2 Ma. The youngest New Mexican mammoths for which some numerical dates can be inferred are from Blackwater Draw and Sandia Cave. These may be as young as 10,000 B.P.

INTRODUCTION

Mammoths (genus *Mammuthus*) were common Pleistocene proboscideans in New Mexico whose fossils occur throughout most of the state (Fig. 1). Many of these occurrences have not, however, been documented in the published literature, and the literature that documents other New Mexican mammoths is diffuse and of uneven quality. Here, we document a mammoth from Lincoln County and review the Pleistocene occurrences of *Mammuthus* in New Mexico. Dental terminology and measurements of mammoth teeth used here follow Maglio (1973).

TAXONOMY OF *MAMMUTHUS*

In our review of New Mexican *Mammuthus*, we recognize three species: *M. meridionalis* (Nesti, 1825), *M. imperator* (Leidy, 1858) and *M. columbi* (Falconer, 1857). This follows long-established usage for three cranio-dental grades of North American *Mammuthus* (e.g., Maglio, 1973; Agenbroad and Mead, 1989), although there are technical taxonomic problems with these names, and other nomenclatures have been advocated (e.g., Kurtén and Anderson, 1980).

Mammuthus meridionalis is the oldest and most primitive North American mammoth. It is distinguished by relatively wide molars, which have thick, widely spaced plates and relatively thick enamel, among other features. *Mammuthus meridionalis* has been reported from a number of localities in Canada, the United States and Mexico that range in age from about 1.7–1.4 Ma or somewhat younger (Agenbroad and Mead, 1989).

One specimen of *M. meridionalis* is known from New Mexico, UNM 11,028 from Tijeras Arroyo (Fig. 2). This incomplete mandible bears left and right M_3, and its symphysis has a relatively short spout that is not significantly flexed ventrally. The horizontal rami are relatively long, low and narrow. What remains of the ascending rami suggests they were relatively low and inclined posteriorly. The right M_3 is heavily worn, relatively long (292+ mm) and preserves six plates, although at least two additional plates were present. Plate enamel is extremely thick (average enamel thickness = 3.8 mm), and the plate ratio (4.0) is very low. These features identify UNM 11,028 as a very primitive mammoth, assignable to *M. meridionalis* (=*M. hayi* of Madden, 1981).

Mammuthus imperator also has a wide geographic range in North America. Specimens for which numerical dates are available encompass about 40,000–15,000 years ago, but the actual temporal range of the species must be greater. *M. imperator* is an intermediate grade of *Mammuthus* evolution in North America with molar widths, enamel thicknesses and plate spacing intermediate between that of *M. meridionalis* and *M. columbi*. In New Mexico, we document two specimens of *M. imperator*, the specimen from Lincoln County discussed below (Fig. 3A–B) and NMMNH P-12,888, a left M^3 (Fig. 3C–D) from Tijeras Arroyo. This M^3 has 20+ plates, enamel of moderate thickness (3.0 mm) and a plate ratio of 6. It is 330+ mm long, 190 mm high and 103 mm wide. These metrics place it comfortably within the range of variation of *M. imperator* (Madden, 1981).

Mammuthus columbi has a broader geographic range than the two earlier species, and numerically dated specimens suggest a minimum age range of about 26,000–9000 years ago. Relatively short, broad molars, increased plate numbers and thin enamel are just a few of the features that distinguish *M. columbi* from the more primitive species *M. meridionalis* and *M. imperator*. The vast majority of New Mexican *Mammuthus* (e.g., Figs. 4, 5) pertain to *M. columbi* since they fall within the range of variation established for this species by Dutrow (1980) and Madden (1981).

MAMMUTHUS FROM LINCOLN COUNTY

The *Mammuthus* from Lincoln County is UNM 11,027 (Fig. 3), a right dentary with M_3 collected near Salt Creek on the Marley Ranch east of Capitan Mountain. The M_3 has 11+ plates, is 218 mm long and 95 mm wide, and thus is a relatively broad tooth. The lamellar frequency is 5, an upper limit considering how worn the tooth is, and the average enamel thickness is 2.7 mm. We identify this specimen as

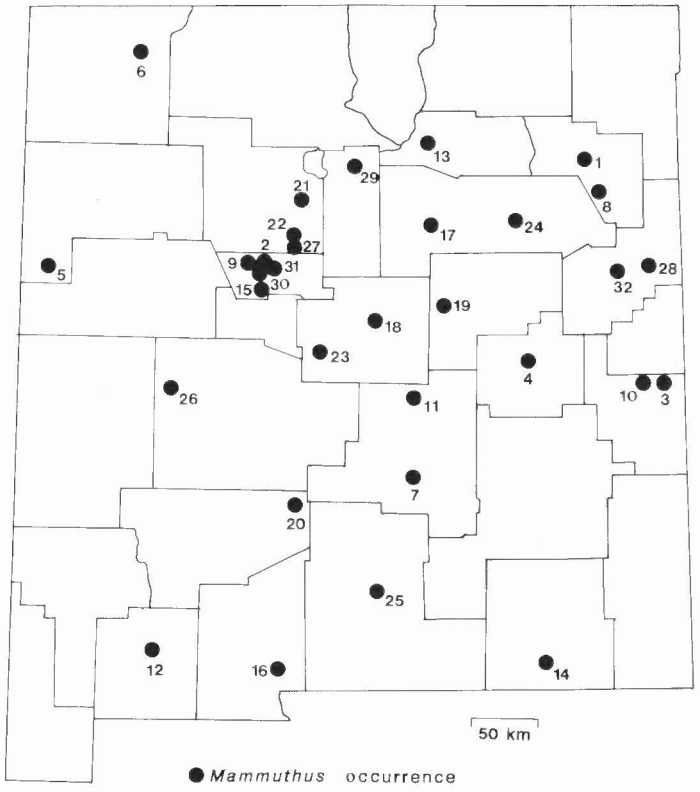


FIGURE 1. Distribution of *Mammuthus* fossils in New Mexico. See text for information on numbered localities.

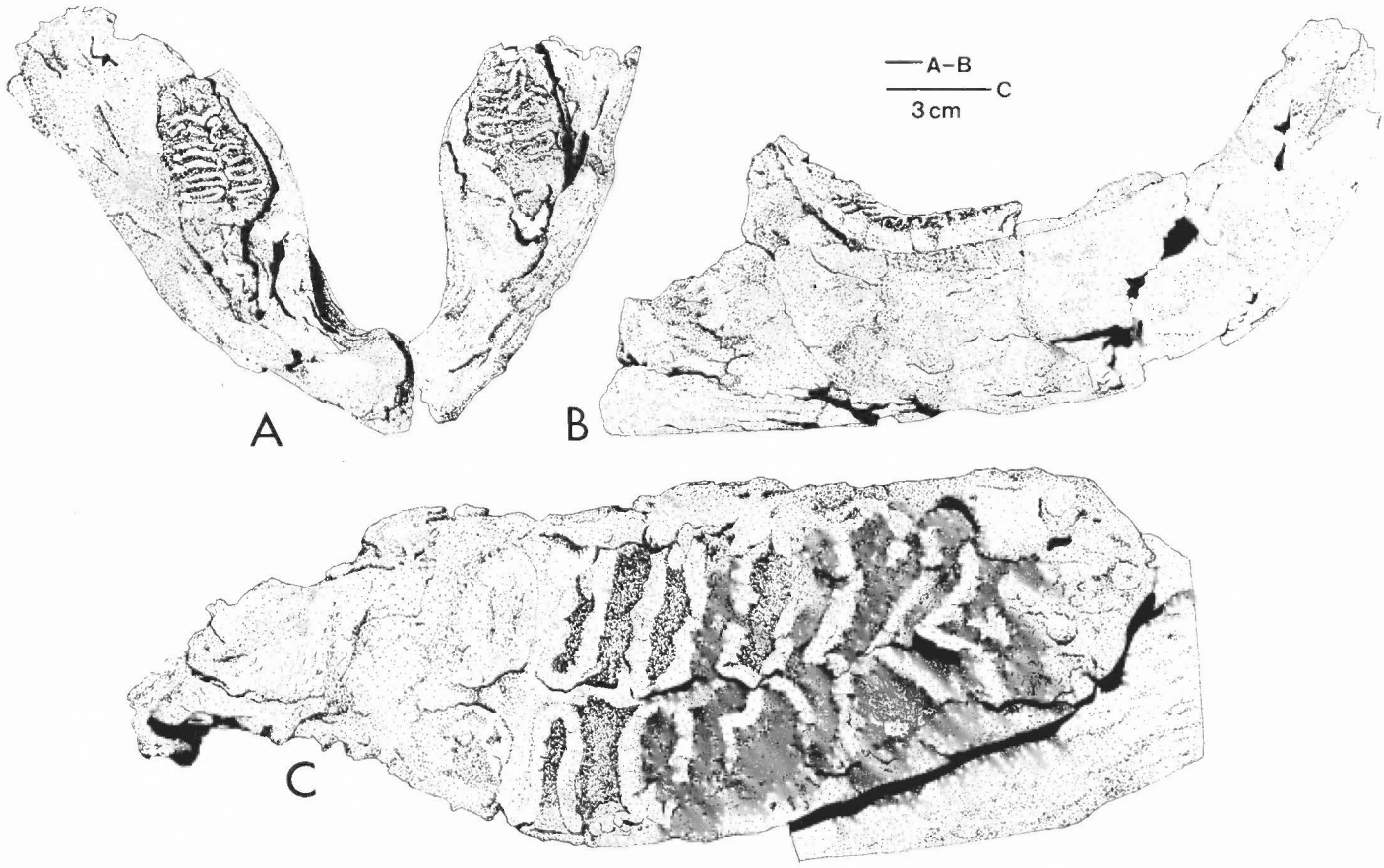


FIGURE 2. UNM 11,028, lower jaw with M_3's of *Mammuthus meridionalis* from Tijeras Arroyo, Bernalillo County (Fig. 1, locality 31). A, Occlusal view of lower jaw. B, Medial aspect of right ramus. C, Occlusal view of right M_3.

M. imperator, as did Logan and Lucas (1983), since it falls within the range of variation established for this species by Madden (1981).

ANNOTATED LIST OF LOCALITIES

We list here localities from which fossils of *Mammuthus* have been reported. The number assigned to each locality corresponds to the same number on Fig. 1. Institutional abbreviations used include: AMNH, American Museum of Natural History; ANSP, Academy of Natural Sciences, Philadelphia; F:AM, Frick Colllection, American Museum of Natural History; NMMNH, New Mexico Museum of Natural History; UM, University of Michigan; UNM, University of New Mexico; and USNM, United States National Museum. For each locality, the information is presented as follows: (a) location, (b) identified taxa, (c) specimens, (d) age, (e) references, and (f) comments, if any.

1. Albert—(a) Harding Co.; about 27.4 km east of Roy on Carrizo Creek, near Albert; (b) *M. columbi;* (c) tusk and two teeth; (d) not specified; (e) Hay (1924).

2. Albuquerque Gravel Products Quarry—(a) Bernalillo Co.; NW1/4 NW1/4 sec. 3, T10N, R3E; (b) *M. columbi;* (c) UNM 11,025, RM_3 (Fig. 5C–D), UNM 11,026, RM_3 (Fig. 5E–F); UNM P-095, proximal femur; UNM P-129, LM^3; UNM P-131, incomplete LM_3; (d) Wisconsinan, no older than Illinoian; (e) Lambert (1968); Kelley and Northrop (1975); Lucas et al. (1988).

3. Anderson/Circus/Elephant basins—(a) Roosevelt Co.; about 17.7 km south of Clovis; (b) *Mammuthus* sp. cf. *M. columbi;* (c) tusks and molars including ANSP 13,738 and 13,740; (d) not specified, but comparable to Clovis; (e) Stock and Bode (1936); Harris (1985); (f) this is an informal set of names for eolian "blow-outs" that expose the Brown and Gray Sands; see Clovis Gravel Pit for comments on nomenclature.

4. Blackdom Terrace—(a) De Baca Co.; west side of Pecos River, about 24 km south of Ft. Sumner, from the Dunlap area, and from the X-Bar-X Ranch about 40 km south of Ft. Sumner; SW1/4 SE1/4 SW1/4 sec. 4, T1S, R26E and T2S, R26E; (b) *M. imperator;* (c) UM 44,424, M_3; tusk, tusk portions, two molars, skeletal pieces; (d) mid-Wisconsinan or older; (e) Hay (1927); Northrop (1931); Jelinek (1967); Madden (1981).

5. Black Rock—(a) McKinley Co.; about 8.0 km east of Zuni; sec. 23 or 24, T10N, R19W; (b) *M. columbi;* (c) LM^3 and RM_3; (d) not specified; (e) Hay (1924).

6. Bloomfield—(a) San Juan Co.; 7.2–8.0 km upstream (San Juan River) from Bloomfield; ?S1/2 sec. 20, T29N, R10W; (b) *M. columbi;* (c) "teeth and bones"; (d) not specified; (e) Stovall (1946).

7. Capitan—(a) Lincoln Co.; vicinity of Ft. Stanton and about 8.0 km N of Capitan; ?sec. 21, 22, or 23, T8S, R13E; also east of Capitan Mt. near Salt Creek, Marley Ranch; (b) *M. imperator;* (c) two molars, about 3 m of tusk, bones; UNM 11,027, dentary fragment with RM_3 (Fig. 3A–B); (d) not specified; (e) Hay (1924); Logan and Lucas (1983).

8. Casados Ranch—(a) Harding Co.; 7.6 km north of New Mexico Highway 39; SW1/4 NW1/4 sec. 36, T16N, R32E; (b) Elephantidae?; (c) 61-cm piece of tusk; (d) not specified; (e) McMullen and Zakrzewski (1972).

9. Chavez Quarry—(a) Bernalillo Co.; NE1/4 SE1/4 SW1/4 sec. 26, T10N, R2E; (b) *Mammuthus* sp.; (c) not specified; (d) Wisconsinan; (e) Kelley and Northrop (1975); Ratkevich and Pope (1975); Lucas et al. (1988).

10. Clovis Gravel Pit—(a) Roosevelt Co.; 16.1–24.1 km southwest of Clovis; SE1/4 SW1/4 sec. 25, T1N, R34E; (b) *Mammuthus columbi, Mammuthus* sp.; (c) numerous post-cranial material, some semi-articulated skeletons, tusks, molars, cranial fragments; UNM 11,032, partial molar (Fig. 5G–H); (d) Gray Sand level >15,000 B.P.; Brown Sand Wedge level, 11,170 ± 360 B.P. (Harris, 1985); (e) Stock and Bode (1936); Cotter (1937, 1938); Warnica (1966); Haynes and Agogino

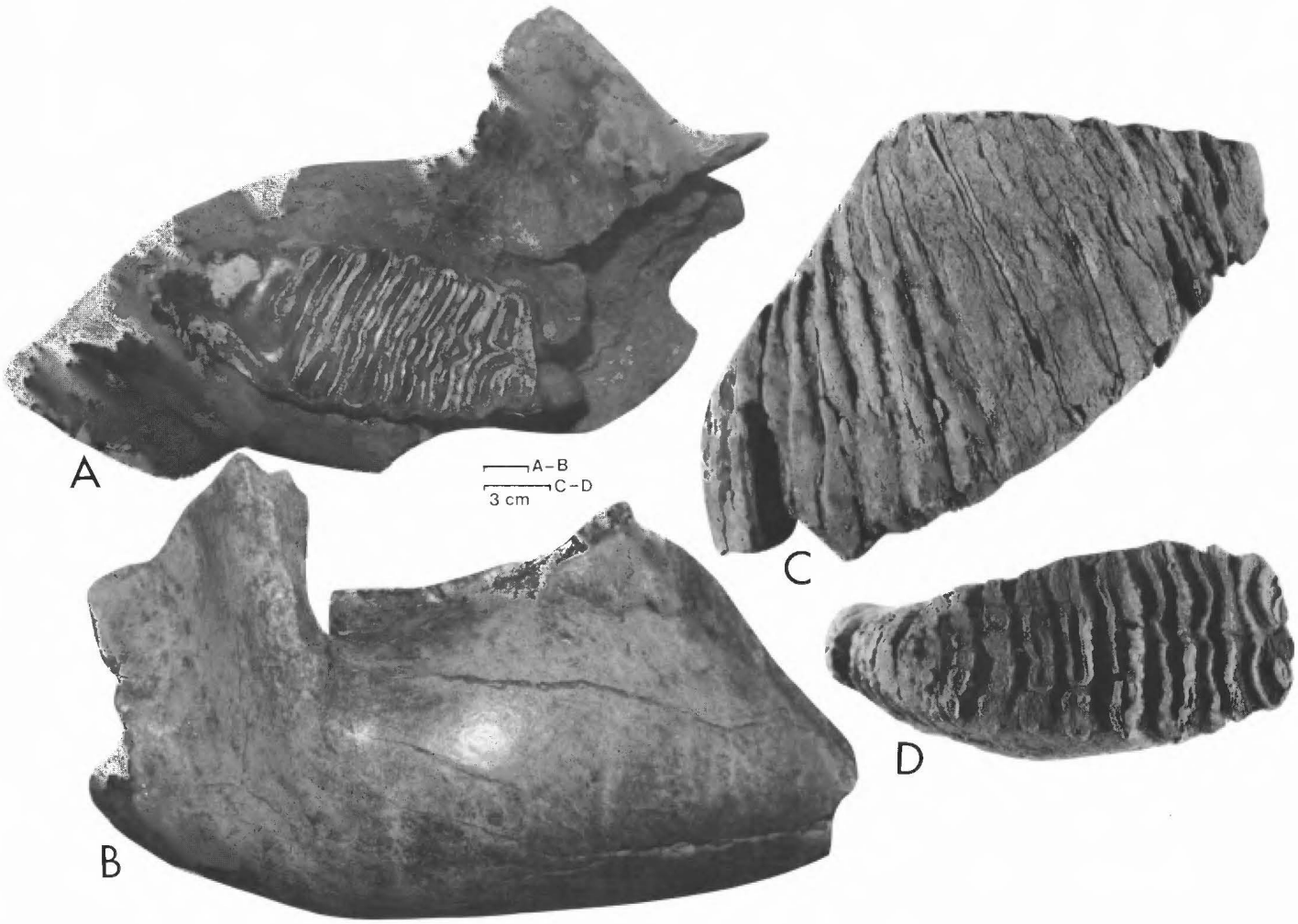


FIGURE 3. *Mammuthus imperator* from New Mexico. A–B, UNM 11,027, right dentary with M_3 from Salt Creek, Lincoln County (Fig. 1, locality 7), occlusal (A) and right lateral (B) views. C–D, NMMNH P-12,888, left M_3 from Tijeras Arroyo, Bernalillo County.

(1966); (f) known also as Blackwater Locality No. 1, this is by far the most prolific of the New Mexican mammoth localities. Based on the age of the specimens, Kurtén and Anderson (1980) indicated that mammoths from this locality (e.g., Fig. 5G–H) should be referred to *M. jeffersonii*, even though none of the authors for this locality do so.

11. Corona—(a) Lincoln Co.; about 24.1 km south of Corona; near line between SE¼ sec. 28 and NE¼ sec. 33, T3S, R15E; (b) *Mammuthus* sp.; (c) LM_2; (d) not specified; (e) Hay (1927); (f) Hay identified this as *Elephas boreus*, but this species is not recognized; Madden (1981) recognized *M. jeffersonii* from this locality, but it is unclear whether the specimen to which he referred is the same as Hay's *E. boreus*.

12. Deming—(a) Luna Co.; gravel pits north of Deming airport; N½ sec. 36, T23S, R9W; (b) *Mammuthus* sp., Proboscidea indet.; (c) USNM 8089, dorsal vertebra; UNM P-183, right femur; (d) not specified; (e) Hay (1924); Lucas (1988).

13. Guadalupita—(a) Mora Co.; 14 km NNE of Mora at elevation of 2286 m in Guadalupita Canyon; (b) *M. columbi;* (c) bones, tooth fragments, M^2; (d) not specified; (e) Gillette et al. (1985b).

14. Hermit's Cave—(a) Eddy Co.; east slope of Guadalupe Mts.; (b) *M. columbi;* (c) not specified; (d) about 12,400 B.P.; (e) Harris (1977).

15. Isleta Caves—(a) Bernalillo Co.; about 13 km west of Isleta; N½ sec. 31, T8N, R1E; (b) *Mammuthus* sp.; (c) not specified; (d) Late Pleistocene; (e) Hibben (1941); Harris and Findley (1964); (f) reported by Hibben (1941), but Harris and Findley did not actually see mammoth specimens from this site.

16. Las Cruces—(a) Doña Ana Co.; 6.4 km northeast of Las Cruces on sides of US-70; SE¼ sec. 29, T22S, R2E; (b) *Mammuthus* sp.; (c) plates of upper tooth; (d) Irvingtonian; (e) Hawley et al. (1969); Hawley (1975).

17. Las Vegas—(a) San Miguel Co., otherwise not specified; (b) *Mammuthus* sp.; (c) AMNH 15,544, part of M^3; (d) not specified; (e) Hay (1924); (f) this locality was kept separate from Rio Conchas because the specimens are different, and the author who first noted both (Hay) also kept them separate.

18. Lucy—(a) Torrance Co.; 11.3 km south and 1.6 km west of Lucy; sec. 24, T4N, R10E; (b) *Mammuthus* sp., according to Roosa (1956); (c) not specified; (d) possibly approximately 11,000 B.P. based on archeological evidence; (e) Roosa (1956).

19. Milagro—(a) Guadalupe Co.; sec. 9, T8N, R16E; (b) *Mammuthus* sp.; (c) NMMNH P-15,018, upper molar; (d) not specified; (e) unpublished (donated to NMMNH).

20. Mockingbird Gap—(a) Sierra Co.; NW¼ sec. 9, T9S, R5E; (b) *M. columbi;* (c) not specified; (d) not specified; (e) Harris (1977).

21. Peña Blanca—(a) Sandoval Co.; "from Pleistocene marls"; SW¼ sec. 32, T16N, R6E; (b) *M. columbi;* (c) "teeth and bones"; (d) not specified; (e) Reagan (1903); Hay (1924); (f) both authors identified the specimens as *"Elephas primigenius."*

22. Placitas—(a) Sandoval Co.; near village of "Placita"; ?sec. 6, T13N, R4E, or possibly west-central area of Antonio de las Huertas Grant; (b) *M. columbi;* (c) USNM 4180, LM^3 (Fig. 5A–B) and bones; (d) not specified; (e) Cope (1875); Hay (1924).

23. Quarai—(a) Torrance Co.; N of NE¼ sec. 10, T4N, R6E; (b)

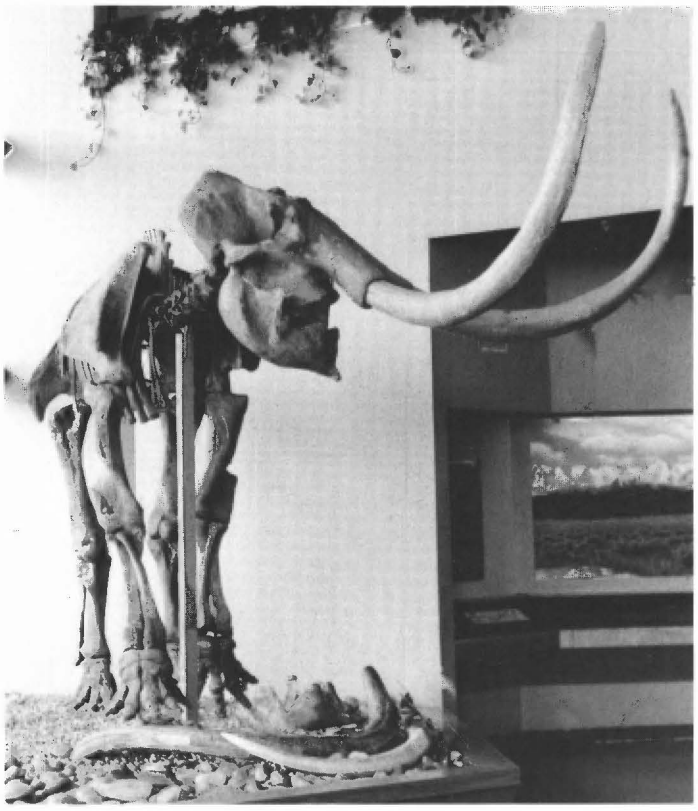


FIGURE 4. The only mounted skeleton of *Mammuthus* in New Mexico is this *M. columbi* from Mesa Redonda, Quay County (Fig. 1, locality 32), on display in the New Mexico Museum of Natural History, Albuquerque.

Mammuthus sp.; (c) complete, disarticulated mammoth skeleton; isolated teeth; (d) not specified; (e) Hibben (1941); (f) this locality includes specimens found at nearby Punta de Agua and Scholle.

24. Rio Conchas—(a) San Miguel Co.; about 88 km east of Las Vegas on or near Rio Conchas; secs. 14 and 15, T13N, R25E; (b) *M. columbi;* (c) RM_3; (d) not specified; (e) Hay (1927).

25. Sacramento Mountains—(a) Otero Co.; "the Rincon" on specimen label, otherwise not specified; (b) *M. columbi;* (c) LM_3; (d) not specified; (e) Hay (1924).

26. San Agustin—(a) Socorro Co.; from San Agustin plains east of Datil, otherwise not specified; (b) *Mammuthus* sp.; (c) "large numbers of teeth and bones"; (d) not specified; (e) Herrick and Johnson (1900); Hay (1924).

27. Sandia Cave—(a) Sandoval Co.; 5.6 km south of Placitas on east side of Las Huertas Canyon; SW¼ sec. 22, T12N, R5E; (b) *Mammuthus* sp.; (c) "large numbers of teeth"; (d) Sandia level, 20,000–25,000 B.P.; Folsom level, 8000–10,000 B.P.; (e) Hibben (1941); Kelley and Northrop (1975).

28. San Jon—(a) Quay Co.; SE¼ sec. 29, T9N, R34E; (b) *Mammuthus* sp.; (c) bones, teeth, and tusks; (d) not specified; (e) Roberts (1942).

29. Skull Ridge—(a) Santa Fe Co.; just north of Pojoaque in vicinity of Three Sisters Buttes, but otherwise not specified; T20N, R9E; (b) *Mammuthus* sp.; (c) F:AM 21,265, partial last molar; (d) not specified; (e) Frick (1933); Galusha and Blick (1971).

30. Springer Quarry—(a) Bernalillo Co.; formerly at Mountain Road at the railroad tracks; (b) *Mammuthus* sp.; (c) UNM P-037, incomplete humerus; (d) Wisconsinan; (e) Lucas et al. (1988).

31. Tijeras Arroyo—(a) Bernalillo Co.; NMMNH localities 1452 (SE¼ NW¼ NW¼ sec. 10, T9N, R3E), 1453 (SE¼ NE¼ SE¼ sec. 16, T9N, R3E) and 1455 (NW¼ NE¼ SE¼ sec. 4, T9N, R3E); (b) *Mammuthus meridionalis, M. imperator* and *Mammuthus* sp.; (c) UNM 11,028, lower jaw of *M. meridionalis* from NMMNH loc. 1452 (Fig. 2); NMMNH P-12,888, left M_3 of *M. imperator* from NMMNH loc. 1455 (Fig. 3C–D) and NMMNH P-12,893, a pelvis of *Mammuthus* sp. from NMMNH loc. 1453; (d) Irvingtonian, younger than 1.4 Ma, Sierra Ladrones Fm.; (e) Logan et al. (1984); Logan (1984).

32. Tucumcari—(a) Quay Co.; eastern base of Mesa Redonda; NE¼ SW¼ sec. 26 and NE¼ sec. 35, T9N, R31E; (b) *M. columbi;* (c) 5 mandibles, pelvis, partial skull with tusk, humerus, partial sacrum; most of the specimens are now mounted in a composite skeleton at the New Mexico Museum of Natural History, Albuquerque (Fig. 4); (d) not specified; (e) Northrop (1931); Gillette et al. (1985a).

DISCUSSION

Chronological constraints on the New Mexican *Mammuthus* occurrences vary widely, and it is difficult to determine precisely the age of many of the occurrences. The oldest New Mexican *Mammuthus* is the *M. meridionalis* jaw from Tijeras Arroyo, early Irvingtonian, about 1.4–1.2 Ma. The youngest reasonably dated occurrences are those at Clovis (Blackwater Draw) and Sandia Cave, about 10,000–11,000 B.P., or possibly slightly younger.

As can be seen in Fig. 1, there is no readily recognizable pattern of distribution of *Mammuthus* in New Mexico except its near-ubiquity. Because mammoths were grassland animals, the majority of their remains are found, not surprisingly, in the plains of the east-central part of the state, most notably near Clovis, as well as in the Rio Grande Valley and other, scattered localities. It is important to note that many other New Mexican *Mammuthus* specimens must exist that are not in the literature or accessible collections, and it is likely that *Mammuthus* was much more widespread in the New Mexican Pleistocene than our survey indicates.

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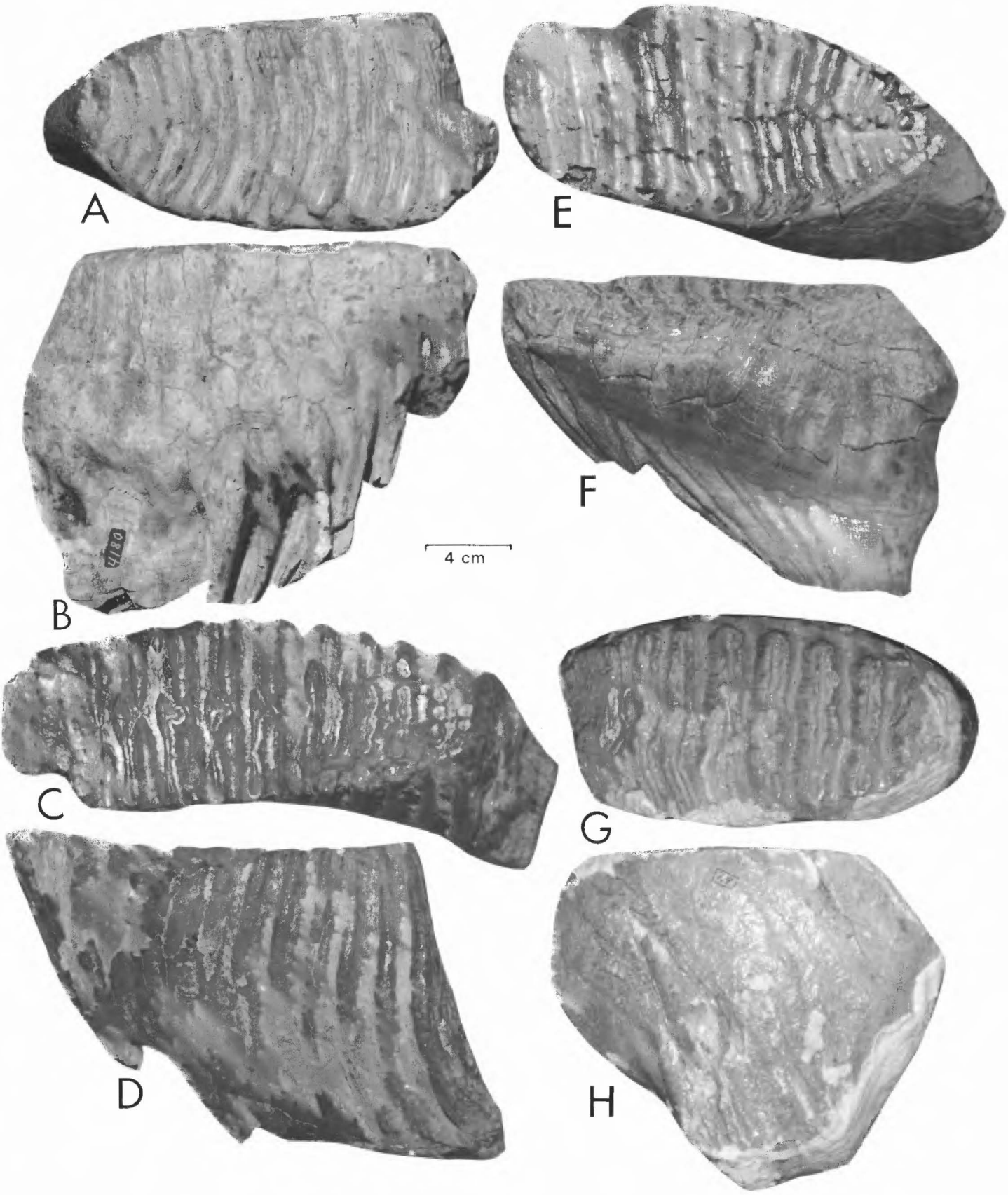


FIGURE 5. Selected isolated teeth of *Mammuthus columbi* from New Mexico. A–B, USNM 4180, left M^3 from Placitas (Fig. 1, locality 22) originally reported by Cope (1875). C–D, UNM 11,026, right M_3 from Albuquerque Gravel Pits (Fig. 1, locality 2). E–F, UNM 11,025, right M_3 from Albuquerque Gravel Pits. G–H, UNM 11,032, partial molar from Blackwater Draw (Fig. 1, locality 10).

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