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A LATE PLEISTOCENE, HIGH ELEVATION RECORD OF THE AMERICAN MASTODON (*MAMMUT AMERICANUM*) FROM TREE SPRING, SANDIA MOUNTAINS, NEW MEXICO

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Abstract—Three teeth of the American mastodon, *Mammut americanum*, from Tree Spring on the eastern slope of the Sandia Mountains, Bernalillo County, New Mexico, document one of the highest-elevation occurrences of this species in North America at 2,582 m (8,470 ft). The fossils consist of three associated lower molars (left m2 and m3, and right m3) attributable to an adult based on size and tooth wear. The Tree Spring mastodon fossils were recovered from a thin, organic-rich surficial deposit overlying Pennsylvanian rock. The preservation and stratigraphic position suggest a latest Pleistocene (Rancholabrean) age, although the age remains provisional pending radiocarbon dating. The Tree Spring mastodon adds to a limited but significant montane record of ecological and elevation limits of *M. americanum* in the Intermountain region of western North America. Two other even higher elevation records of mastodons are from Utah and Colorado. The high-elevation setting implies that *M. americanum* occupied montane habitats during cooler, wetter intervals in the late Pleistocene when vegetation zones were depressed, likely supporting mixed conifer or spruce–fir communities consistent with its browsing ecology. The Tree Spring locality highlights the importance of taphonomic and sampling biases in shaping the apparent scarcity of high-elevation proboscidean records in the Southwest.

INTRODUCTION

The American mastodon, *Mammut americanum*, is an iconic species of large elephant-like mammal (Proboscidea: Mammutidae) that lived throughout North America during the late Pleistocene (Rancholabrean North American Land Mammal Age). More than 500 late Pleistocene records of *M. americanum* are from North America; the majority of which are from the forested region of eastern North America, with concentrations in the Great Lakes states and in Florida (Dreimanus, 1968; Kurtén and Anderson, 1980; Haynes, 1991; FAUNMAP Working Group, 1994; Saunders, 1996). Although previous accounts of *M. americanum* noted the close association of this species with coniferous forests (Kurtén and Anderson, 1980; Birks et al., 2019), the abundant records from Florida suggest that mastodons also frequented deciduous forests and wetlands (Rich and Smith, 2014). *Mammut americanum* became extinct throughout the North American continent at the end of the Pleistocene (~11.7 ka), together with most other members of the mammalian megafauna (Lindsey et al., 2025).

Mammut americanum is much less common in the Intermountain region of western North America, with most of the central and northern Rocky Mountain states having fewer than five records, including Colorado, Montana, Utah, and Wyoming; Idaho is somewhat of an outlier with eight records (G. McDonald, personal communication, 2026). Surprisingly, two states in the American Southwest have the most records of *M. americanum* in the Intermountain region, with 11 records from New Mexico (Lucas and Morgan, 1997; Morgan and Harris, 2015; Fig. 1) and 9 from Arizona (Pasenko, 2012).

Fossils of the American mastodon in New Mexico (Fig. 1) have been found primarily in open sites that would have been forested during the late Pleistocene, including mountains with coniferous forests and river valleys with riparian forests (e.g., bosque). Records of *M. americanum* from mountains in New Mexico are from Tree Spring in Bernalillo County and Sandia Cave in Sandoval County, both in the Sandia Mountains, and Piñon in Otero County, in the Sacramento Mountains. Fossils of *M. americanum* from river valleys in New Mexico have been reported from the following localities: Albuquerque in Bernalillo County (two records), Los Lunas in Valencia County, and Lemitar in Socorro County, all in the Rio Grande valley; Trapped Rock Draw, a tributary of the Zuni River in McKinley County; and Alma in the San Francisco River Valley in Catron County. There are also two records of *M. americanum* in New Mexico from lacustrine deposits: Lake San Agustín in Catron County and south of Jal in Lea County in southeastern New Mexico near the Texas border. At 907 m (2,975 ft), the Jal mastodon is the only record from the state under 1,000 m (3,268 ft) in elevation (Morgan and Lucas, 2006). Several incomplete teeth from Sandia Cave (Hibben, 1941; Morgan, 2017) represent the only cave record of *M. americanum* in New Mexico.

CONTEXT

The specimen of *M. americanum* reported here is from Tree Spring (Fig. 1, site 1), located on the eastern side of the Sandia Mountains in Bernalillo County, about 5 km (3 mi) northwest of Sandia Park at an elevation of 2,582 m (8,470 ft). The fossil was found in 1956 by a nine-year-old boy, J. Nicoll Durrie, Jr., and consisted of "…several remarkably well-preserved teeth and part of the jaw of *Mastodon* [= *Mammut*] *americanus*…" (Kelley and Northrop, 1975, p. 74). The fossil was excavated by Jerry Harbour, a University of New Mexico (UNM) student, and curated in the UNM paleontology collection. The

mastodon jaw was derived from a thin layer of dark-colored, organic-rich soil overlying Pennsylvanian bedrock (Lucas, 1987). Some of the original soil is still preserved in the roots of the teeth. The lack of mineralization observed in this specimen and its occurrence in a surficial soil deposit suggests a probable latest Pleistocene (late Rancholabrean) age. An attempt to radiocarbon date this specimen is currently being undertaken by Christina Ryder at Texas A&M University, as part of larger study on late Pleistocene extinctions of large mammals throughout North America (Lindsey et al., 2025).

The specimen of *M. americanum* from Tree Spring consists of two left lower molars, the m2 and m3, and a right m3, all from the same individual (Fig. 2). The specimen was originally cataloged in the UNM paleontology collection as number UNM P-088 (Lucas, 1987; Lucas and Morgan, 1997). After the UNM vertebrate paleontology collection was transferred to the New Mexico Museum of Natural History (NMMNH) in 2002,

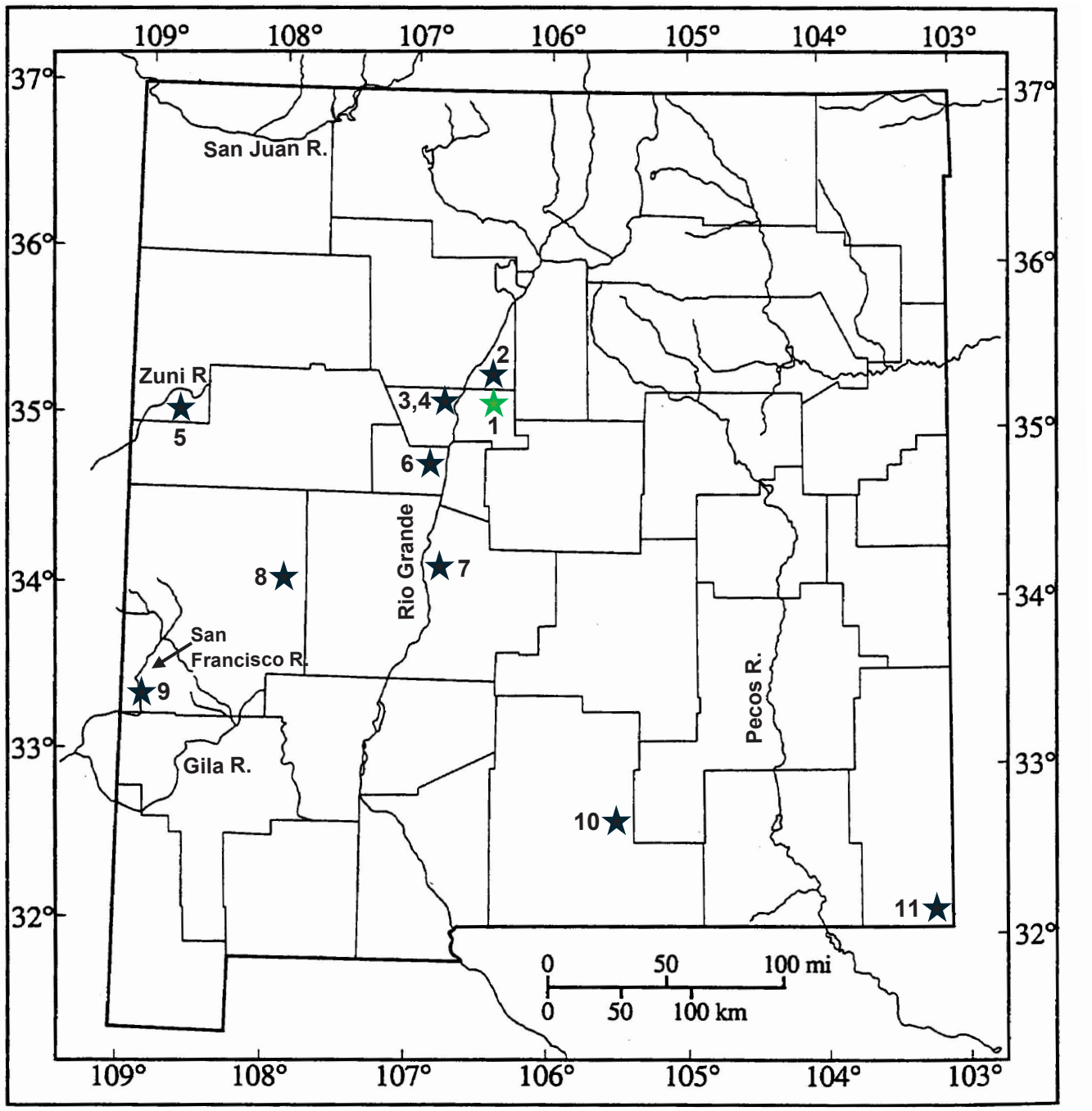


FIGURE 1. Late Pleistocene records of the American mastodon *Mammut americanum* from New Mexico. 1: Tree Spring (green star), Sandia Mountains, Bernalillo County. 2: Sandia Cave, Sandia Mountains, Sandoval County. 3 and 4: Albuquerque, Bernalillo County (two records). 5: Trapped Rock Draw, McKinley County. 6: Los Lunas, Valencia County. 7: Lemitar, Socorro County. 8: Lake San Augustín, Catron County. 9: Alma, Catron County. 10: Piñon, Sacramento Mountains, Otero County. 11: Jal, Lea County. Major rivers labeled (R.), as are several smaller rivers with nearby mastodon records.

the Tree Spring specimen of *M. americanum* was recataloged as NMMNH 43391 (NMMNH locality L-5718).

Although Kelley and Northop (1975, p. 74) noted that this specimen consisted of the "…teeth and part of the jaw," the specimen as currently preserved in the NMMNH paleontology collection consists only of three isolated lower teeth with no preserved bone. In addition to an associated left lower m2 and m3 (Figs. 2A and 2B) reported by Lucas (1987) and Lucas and Morgan (1997), this specimen also includes an associated right m3 (Figs. 2C and 2D) that had been on loan to Vance Haynes at the University of Arizona for radiocarbon dating. As noted above, this specimen is only now in the process of being dated. The preservation of the m2 and m3 from the left side and the m3 from the right side appear to be very different (Fig. 2), with the left m2 and m3 being light in color, and the right m3 much darker. Closer examination of the teeth reveals that is a result

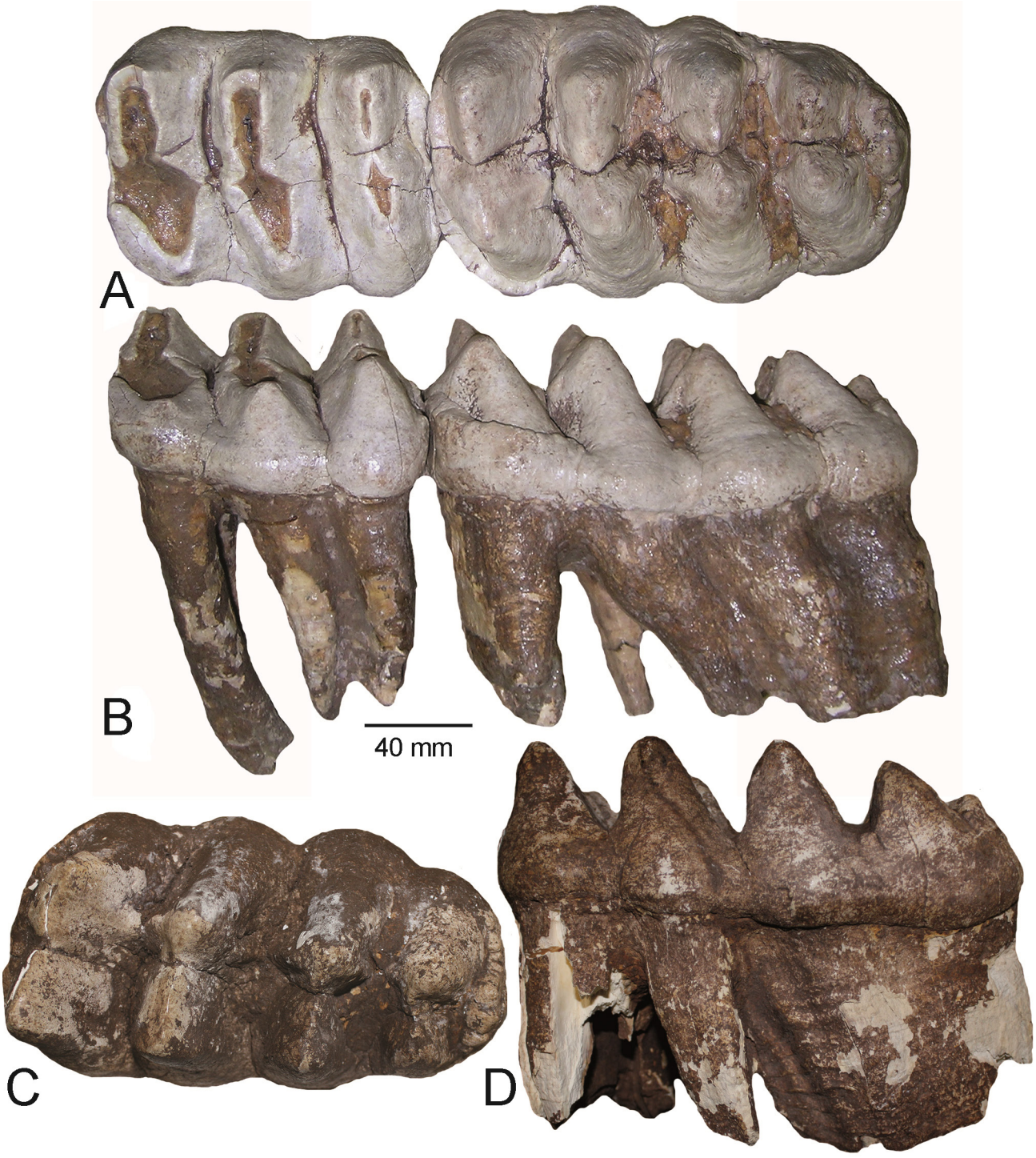


FIGURE 2. Lower molars of the American mastodon *Mammut americanum* (NMMNH 43391) from Tree Spring. A and B, left m2-m3: A) Occlusal view; and B) Labial view. C and D, right m3: C) Occlusal view; and D) Lingual view.

of differing preparation methods used on the specimens. The two lighter-colored teeth were thoroughly cleaned, whereas the right m3 still has a thin adhering layer of the dark organic soil. A layer of a consolidant or glue was applied to this tooth before it was cleaned, thereby rendering it very difficult to remove the underlying layer of soil. However, this lack of cleaning may prove to be advantageous, as the consolidant may have preserved pollen in the soil still adhering to the tooth.

DESCRIPTION

The left m2 of NMMNH 43391 (Figs. 2A and 2B) has three transversely oriented lophids, each of which consists of two large, equal-sized conical cuspids or conids, one labial cuspid and the other lingual. The three lophids are about equal in width, with the maximum width at the second lophid (see Table 1). The lophids are separated from one another by deep transverse valleys. Although similar, the main cuspids on the three lophids are not identical, with the lingual cuspids somewhat compressed or flattened anteroposteriorly and the labial cuspids more conical. Wear has caused the lingual and labial cuspids on the first and second lophids to coalesce into a transverse crest extending from the lingual to the labial margins of the tooth crown. The two cuspids on the third lophid are worn but are separated along the midline by a shallow, anteroposterior-oriented valley. The labial (or pretrite) cuspids on the three lophids show heavier wear than the lingual (or posttrite) cuspids, which is typical of lower molars of mastodons. The labial cuspids have small triangular processes that extend anterior and posterior to the cuspids just labial to the midline. These processes are formed from low anteroposterior-oriented ridges in the transverse valleys that connect the first and second lophids and second and third lophids just labial to the midline. The anterior margin of the m2 is slightly damaged, but a small cuspid is present below the lingual cuspid. A low transverse ridge is present at the posterior edge of the tooth, ventral to the third lophid and extending from near the lingual margin to midway beneath the labial cuspid. The enamel is smooth with no small cuspules in the transverse valleys between the main lophids or along the margins. A labiolingually oriented and anteroposteriorly compressed root is present ventral to the first lophid. A narrower, rounded, and partially separate root ventral to each of the cuspids on the second lophids are fused to the anterior edge of the larger, labiolingually oriented, and anteroposteriorly compressed root ventral to the third lophid.

As would be expected from the same tooth in the same individual, the right and left m3s of NMMNH 43391 (Figs. 2A–2D) are virtually identical (see Table 1). These two teeth are described together, with minor differences between them mentioned at the end of the description. The m3s are composed of four transversely oriented lophids, each of which consists of two large, equal-sized conical cuspids, one labial cuspid and the other lingual. The first three lophids are about equal in width, with the greatest width at the second lophid. The fourth lophid is noticeably narrower. The four lophids are separated from one another by deep transverse valleys. The main cuspids on each of the first three lophids differ slightly, with the lingual cuspids somewhat compressed or flattened anteroposteriorly and the labial cuspids more conical. Both main cuspids on the fourth lophids are conical. The labial and lingual cuspids on each lophid are separated at the midline by a shallow, anteroposteriorly oriented valley. With wear, this midline valley would disappear, and the labial and lingual cuspids would coalesce into a single transverse crest, as observed on the first and second lophids of the m2. The tooth is very lightly worn, with wear only on the labial cuspid of the first lophid of

TABLE 1. Measurements of the left m2 and m3 and right m3 of *Mammut americanum* from Tree Spring, Sandia Mountains, New Mexico; m2 and m3 measurements of other specimens of *M. americanum* from New Mexico are provided for comparison. Localities are in Figure 1.

Locality, catalog number, and tooth position	Anteroposterior length (mm)	Transverse width (mm)
Tree Spring, Bernalillo County		
NMMNH 43391		
Left m2	129	89
Left m3	192	102
Right m3	189	102
Trapped Rock Draw, McKinley County[1]		
Uncataloged, left m3	178	93
Los Lunas, Valencia County[2]		
NMMNH 25546, right m3[3]	153	80
Lemitar, Socorro County[2]		
NMMNH 25098		
Left m2	98	68
Left m3	168	95

[1]Measurements from Lucas and Morgan (2003). This specimen is currently housed in the collections of the Zuni Cultural Resource Enterprise, Black Rock, New Mexico.
[2]Measurements from Lucas and Morgan (1997).
[3]No roots are present and the crown is completely unworn, indicating this tooth was probably unerupted and represents a juvenile.

the right m3. There are low anteroposteriorly oriented ridges in the transverse valleys between the first and second lophids and between the second and third lophids, connecting the bases on the labial cuspids. With wear, as observed on the first two lophids of the m2, these ridges would form small triangular processes that would extend anterior and posterior from the first three lophids just labial to the midline. Anterior to the first lophid is a low cingulum composed of a ridge ventral to the main lingual cuspid and a series of small cuspules ventral to the labial cuspid that extend almost to the labial edge on both m3s. This cingulum extends completely around the labial base of the first lophid on the left m3, terminating at its posterolabial edge. Posterior to the fourth lophid on the posterior margin are three small rounded cuspids, two lingual to the midline and one labial. The right m3 also has four much smaller cuspules labial to the midline that extend almost to the labial edge.

Each m3 has a slightly different arrangement of the roots (Fig. 2). The right m3 has large, labiolingually oriented and anteroposteriorly compressed roots ventral to the first and second lophids, and a very large root ventral to the posterior half of the tooth, ventral to third and fourth lophids. The left m3 has a large, labiolingually oriented and anteroposteriorly compressed root ventral to the first lophid, a smaller separate root ventral to the lingual cuspid on the second lophid, and the labial root on the second lophid fused to the anterior edge of the very large root ventral to the third and fourth lophids.

Overall, the enamel on the teeth of *M. americanum* from Tree Spring is smooth with no small cuspules in the transverse valleys between the main lophids or along the margins, except for the small cuspules on the anterior and posterior basal margins. Trefoils formed by small accessory conulids just labial to the midline anterior and posterior to the primary cuspids are characteristic of gomphotheres (Proboscidea: Gomphotheriidae) molars, but are absent in true mastodons (Mammutidae), including the teeth of the Tree Spring mastodon.

HIGH ELEVATION MASTODON RECORDS

The two records of *M. americanum* from the Sandia Mountains (Fig. 1, sites 1 and 2) are the highest elevation records of this species in New Mexico, with Tree Spring at 2,582 m (8,470 ft) and Sandia Cave at 2,210 m (7,250 ft). These are among the highest elevation records of the American mastodon in North America. Only two other late Pleistocene records of *M. americanum* are from higher elevations than Tree Spring; both are also from the Intermountain region of western North America: the Huntington Reservoir site in Sanpete County, central Utah, at an elevation of 2,981 m (9,780 ft; Miller, 1987), the highest elevation record of the American mastodon reported to date, and the Ziegler Reservoir site near Snowmass Village in Colorado at an elevation of 2705 m (8,875 ft; Fisher et al., 2014; Sertich et al., 2014).

Tree Spring is currently in the transitional zone between the ponderosa pine forest and the higher elevation mixed conifer forest ("Canadian"). Located about 6 km (3.7 mi) north of Tree Spring and about 370 m (1,214 ft) lower in elevation, Sandia Cave is in the transitional zone between the lower piñon-juniper woodland ("Upper Sonoran") and the ponderosa pine forest. However, during the cooler and wetter climate of the late Pleistocene in New Mexico (Polyak et al., 2012), vegetation zones in the mountains would have extended lower in elevation by as much as 1,000 m (3,280 ft) or more (Dick-Peddie, 1993; Jiménez-Moreno et al., 2008), suggesting that in the late Pleistocene, Tree Spring would have been in the upper mixed conifer forest or possibly the higher spruce-fir forest ("Hudsonian"). The sparse record of *M. americanum* from higher elevations in the Intermountain West, such as Tree Spring, Huntington Reservoir, and Ziegler Reservoir, is probably in part a taphonomic bias, reflecting the overall rarity of late Pleistocene fossil sites from montane coniferous forest habitats in this region.

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