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Spencer G. Lucas and Wayne Oakes
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PLIOCENE (BLANCAN) VERTEBRATES FROM THE PALOMAS FORMATION, SOUTH-CENTRAL NEW MEXICO

SPENCER G. LUCAS and WAYNE OAKES
Department of Geology, University of New Mexico, Albuquerque, NM 87131

Abstract—Fossil vertebrates collected from the Palomas Formation near Cuchillo Negro Creek in south-central New Mexico are: *Geochelone* (*Hesperotestudo*) aff. *turgida*, Carnivora, *Borophagus diversidens*, Equidae, *Equus simplicidens*, Camelidae, *Hemiauchenia* sp., and *Stegomastodon rexroadensis*. These vertebrates constitute the Chuchillo Negro Creek local fauna of medial Blancan (Pliocene, about 3 Ma) age. They indicate a relatively frost-free climate and the presence of an open grassland habitat in the Chuchillo Negro Creek area during part of the Pliocene.

INTRODUCTION

Late Cenozoic vertebrates are found in strata of the Santa Fe Group throughout the Rio Grande rift basins of New Mexico. Indeed, these vertebrates are an important means by which the age relationships of strata of the Santa Fe Group are determined (Tedford 1981). Our purpose here is to add to the rich vertebrate fossil record of the Santa Fe Group by describing Blancan (Pliocene) vertebrates from the Palomas Formation in the Engle Basin near Truth or Consequences, New Mexico. In this paper, UNM refers to the Department of Geology, University of New Mexico.

GEOLOGICAL CONTENT

The fossil vertebrates described here were collected in 1983 and 1984 northeast of Cuchillo Negro Creek, T13S, R4W, Sierra County, New Mexico (Fig. 1). They are derived from strata in the Engle Basin of the Rio Grande rift that Lozinsky (1982, 1986) termed the Palomas Formation, but that were earlier referred to as the Palomas Gravel (Gordon & Graton 1907, Gordon 1910) or the Sierra Ladrones Formation (Tedford 1981).

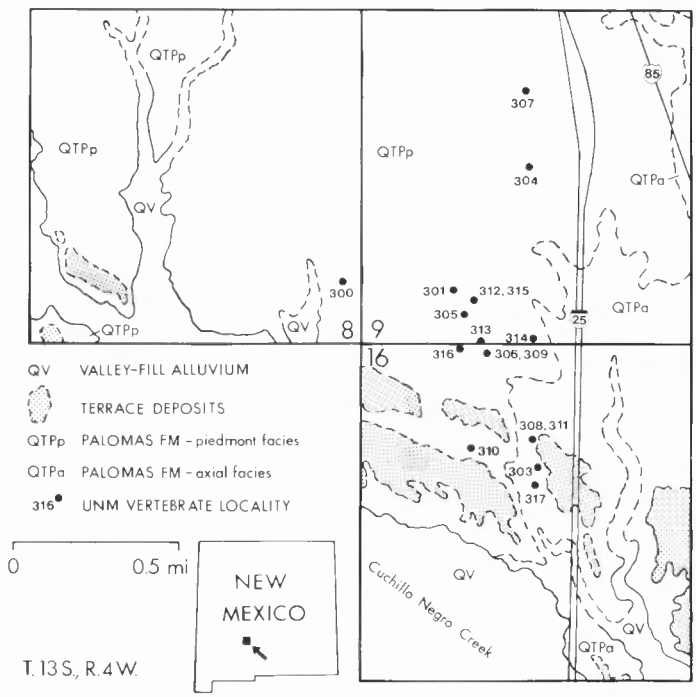


FIGURE 1—Generalized geologic map of the area immediately north of Cuchillo Negro Creek showing the UNM vertebrate localities in the Palomas Formation (geology after Lozinsky 1982: pl. 1).

Lozinsky (1982) recognized two facies (informal members) of the Palomas Formation in the Engle Basin. The axial facies (Figs. 1, 2A, 3) consists of at least 30 m of light-gray to buff, cross-stratified sand with lenses of gravel and green and red clay (Lozinsky 1982). The piedmont facies is at least 49 m of light-brown to reddish-brown sandy silt, conglomerate, and fanglomerate (Lozinsky 1982). The piedmont facies represents deposition of an alluvial-fan system fed by detritus derived from local uplifts (e.g. Black Range and Sierra Cuchillo), whereas the axial facies was deposited by an ancestral Rio Grande that was a braided-river system (Lozinsky 1982).

All of the UNM fossil localities except 304 and 307 are from strata of the axial facies of the Palomas Formation. Those localities in the

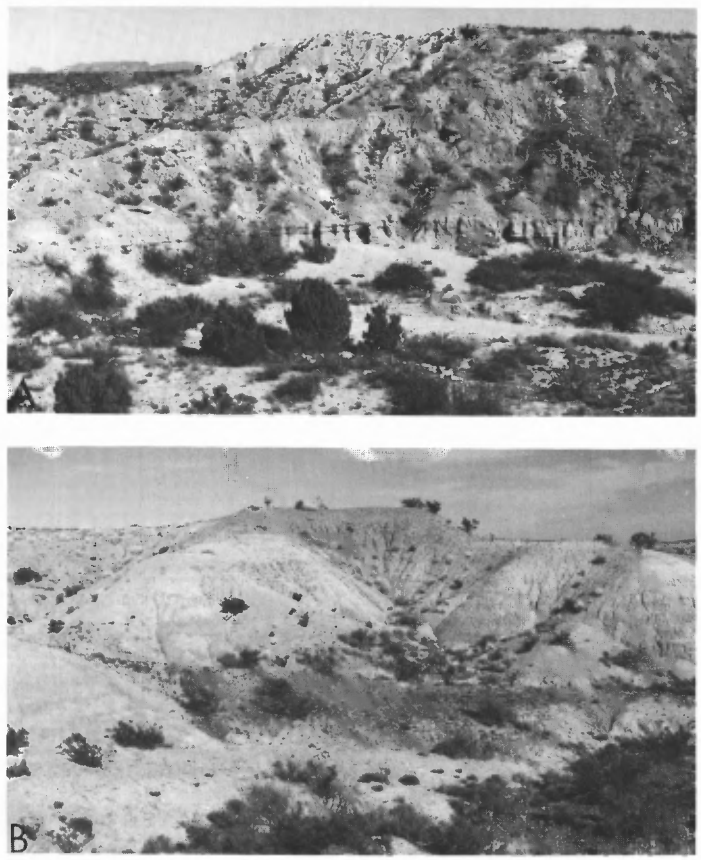


FIGURE 2—The Palomas Formation north of Cuchillo Negro Creek. **A,** Axial facies of the Palomas Formation between localities 303 and 317, SW¼SE¼ sec. 16, T13S, R4W. **B,** Piedmont facies of the Palomas Formation near locality 307, SE¼NE¼ sec. 9, T13S, R4W.

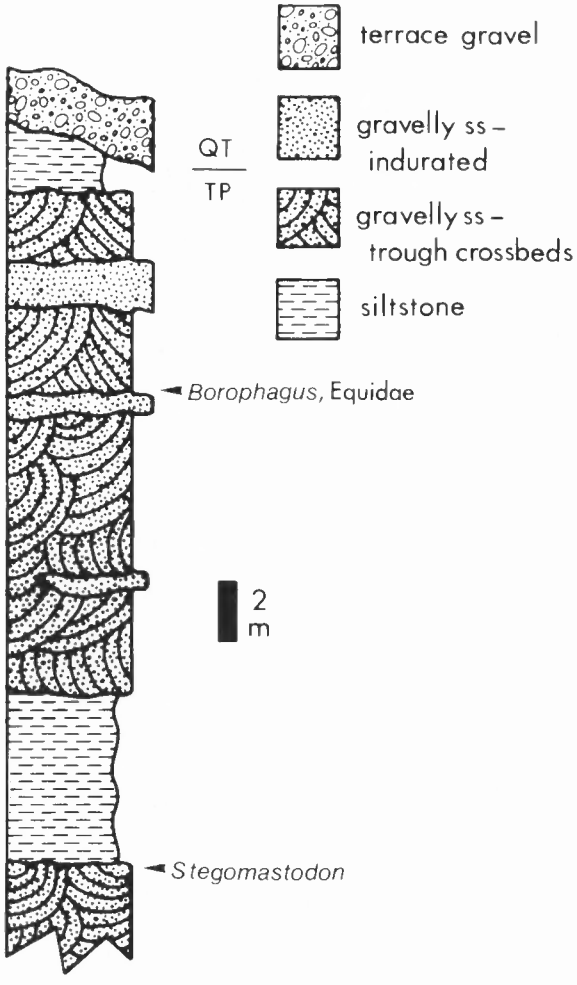


FIGURE 3—Measured stratigraphic section of part of the axial facies of the Palomas Formation at localities 317 (*Stegomastodon*) and 303 (*Borophagus*, Equidae), SW¼SE¼ sec. 16, T12S, R4W.

portions of secs. 8, 9, and 16, T13S, R4W that Lozinsky (1982) mapped as piedmont facies of the Palomas Formation (Fig. 1) are in an area where the two facies, axial and piedmont, interfinger extensively. The UNM localities in this area are from gray sand of the axial facies. The vertebrate fauna from the axial and piedmont facies of the Palomas Formation northeast of Cuchillo Negro Creek is here termed the Cuchillo Negro Creek local fauna.

VERTEBRATE PALEONTOLOGY

Geochelone (*Hesperotestudo*) aff. *turgida*

UNM P-057 from locality 301 is the anterior half of a tortoise plastron (Fig. 4A, B). This plastron has a projecting epiplastral beak that is not keeled ventrally or deeply notched anteriorly. Its entoplastron is wider than long, and the humero-pectoral sulcus crosses the plastral midline just behind the entoplastron. These features and small size (plastron width = 210 mm) place UNM P-057 in Auffenberg's (1963: 89) "*turgida* line" of *Geochelone*, so we identify this specimen as *Geochelone* (*Hesperotestudo*) aff. *turgida*. A more definite identification of so incomplete a shell seems unadvisable.

UNM P-056 from locality 300 consists of several fragments of a relatively small and thick carapace that is extremely rugose due to the large number of antero-posteriorly oriented grooves on its costals. These features and occurrence in the same deposits as UNM P-057 support tentative referral of UNM P-056 to *Geochelone* (*Hesperotestudo*) aff. *turgida* (Auffenberg 1963).

Carnivora

UNM P-067 from locality 311 is a small ungual phalanx of a carnivore, but cannot be more precisely identified.

Borophagus diversidens

UNM P-060 from locality 303 is a right dentary bearing I_{2-3}, C_1, P_{2-4}, and M_{1-2} (Fig. 4E–G). The I_1 and M_3 alveoli of UNM P-060 are well preserved, but the teeth are missing. This specimen clearly pertains to *Borophagus* Cope 1893, which differs from late Miocene–early Pliocene *Osteoborus* in its relatively large size, large canine, short M_1 talonid, and small M_2 (cf. Stirton & Vanderhoof 1933). Measurements of UNM P-060 are: I_2 length = 7.0 mm, width = 5.2 mm; I_3 length = 8.2 mm, width = 6.0 mm; C_1 length = 13.3 mm, width = 11.2 mm; P_2 length = 8.4 mm, width = 5.9 mm; P_3 length = 9.2 mm, width = 6.6 mm; P_4 length = 17.9 mm, width = 12.4 mm; M_1 length = 28.7 mm, width = 12.8 mm; M_2 length = 11.2 mm, width = 7.8 mm; and depth of ramus below P_4 = 27.7 mm. These measurements and the morphology of UNM P-060 clearly identify it as *Borophagus diversidens* (cf. Matthew & Stirton 1930, Dalquest 1968).

UNM P-061 from locality 305 is a left I^3 (Fig. 4C, D). Based on its morphology and size (length = 11.2 mm, width = 10.1 mm), we also assign this specimen to *Borophagus diversidens* (Matthew & Stirton 1930: pl. 28, Dalquest 1968: 126).

Equidae

UNM P-071 (locality 315) and UNM P-065 (locality 309) (Fig. 5H) are distal ends of equid right tibiae. UNM P-069 from locality 313 is an equid first phalanx (Fig. 5F, G). Its size (length = 78.6 mm, width of proximal end = 42.0 mm, width of shaft at middle = 28.6 mm, width of distal end = 36.8 mm) is within the size range of specimens of *Equus* cf. *simplicidens* and *E. cumminsi* from the Blancan Red Light local fauna of southwestern Texas (Akersten 1972: tab. 14).

Equus simplicidens

UNM P-063 is a fragmentary and badly damaged equid palate bearing left P^4–M^3 (left M^{1-2}: Fig. 5A, B) and right M^{1-3} from locality 307. The enamel pattern and size (M^1 length = 27.5+ mm, width = 26.4+ mm; M^2 length = 31.3+ mm, width = 32.8+ mm) of these teeth justify referral to *Equus simplicidens* (e.g. McGrew 1944: figs. 19–20, Hager 1974: fig. 6A–C). UNM P-064 from locality 308 is an incomplete left M^3 of *E. simplicidens*. UNM P-062 from locality 306 is a left M_3 (Fig. 5D, E) that on the basis of size (length = 32.0 mm, width = 13.5 mm) and morphology (note especially the protoconid united to the metaconid by an antroisthmus, the hypoconid united to the metastylid by a post-isthmus, and the metaconid united to the metastylid by a meta-isthmus) can be assigned confidently to *E. simplicidens* (e.g. McGrew 1944: fig. 19, Skinner *in* Skinner et al. 1972: fig. 57B, C). UNM P-068 (locality 312) is part of a lower molar of *E. simplicidens*.

Camelidae

Several fragmentary postcrania of camelids were collected from the Palomas Formation. They are: (1) UNM P-058 (locality 302), distal end of a right radius–ulna; (2) UNM P-060 (locality 304), part of the proximal end of a right ulna; (3) UNM P-066 (locality 310), the proximal end of a metapodial; and (4) UNM P-070 (locality 314), a right ulna missing the proximal and distal ends. These bones are relatively large, and UNM P-070 is every bit as long (length at least 440 mm) and slender as the ulna of *Hemiauchenia blancoensis* illustrated by Hibbard & Riggs (1949: pl. 5/4).

Hemiauchenia sp.

UNM P-072 from locality 316 is part of a camelid skull consisting of the left side of the face from the orbit to the posterior portion of the premaxillary (Fig. 5C). The very worn lingual halves of M^1 and M^2 are present. This specimen is so badly damaged that it is difficult to interpret, but it appears to have two upper premolars, a deep maxillary fossa, and a small lacrimal vacuity. The size (M^2 length = 25.0+ mm, width = 21.0+ mm) and overall configuration of the specimen conform

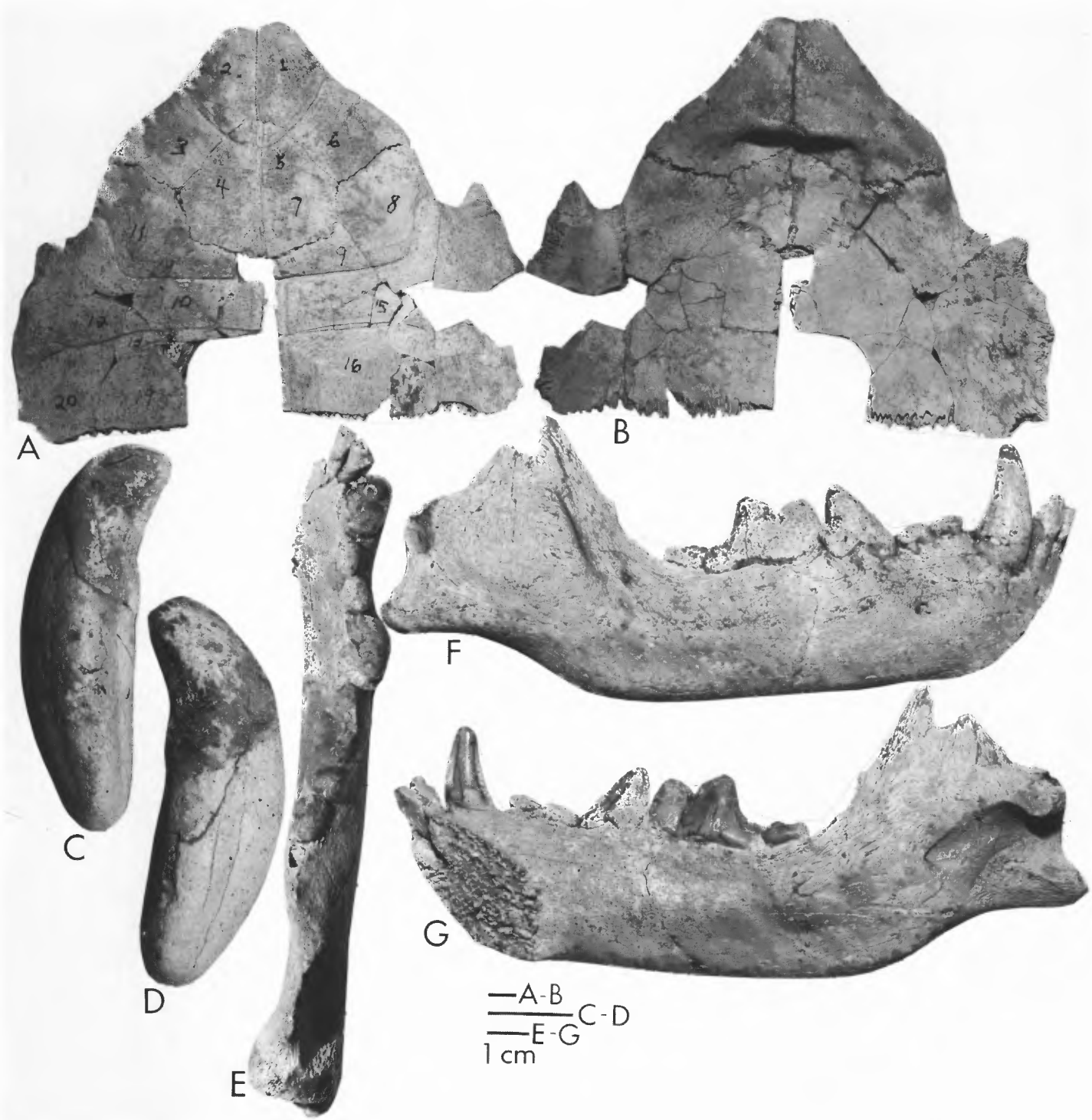


FIGURE 4—Fossil tortoise and canids from the Palomas Formation. **A, B,** *Geochelone* (*Hesperotestudo*) aff. *turgida,* UNM P-057, anterior half of plastron in ventral (A) and dorsal (B) views. **C, D,** *Borophagus diversidens,* UNM P-061, left I^3 in mesial (C) and distal (D) views. **E–G,** *Borophagus diversidens,* UNM P-060, right dentary fragment with I_{2-3}, C_1, P_{2-4}, and M_{1-2} in occlusal (E), labial (F), and lingual (G) views.

well to *Hemiauchenia* (Stock 1928, Webb 1965, 1974), but a species-level identification is impossible.

Stegomastodon rexroadensis

UNM P-041 is a lower jaw bearing heavily worn M_3's of a proboscidean (Fig. 6) collected from locality 317. Salient features of UNM P-041 are: (1) lower jaw relatively short; (2) symphysis short and spout-like; (3) no lower tusks; (4) M_3 length = 180+ mm, width = 75+ mm; (5) M_3 has six lophids; (6) M_3 crown is worn to a simple, single trefoil pattern; and (7) no enamel plication (ptychodonty). These features, especially the relatively small size, simple M_3 trefoil pattern, and lack of ptychodonty, make UNM P-041 most similar to *Stegomastodon rexroadensis* Woodburne 1961, and we assign the specimen to this species.

Lucas et al. (1984) originally assigned UNM P-041 to *Stegomastodon mirificus* (Leidy 1858), following the admonishment of Kurtén & An-

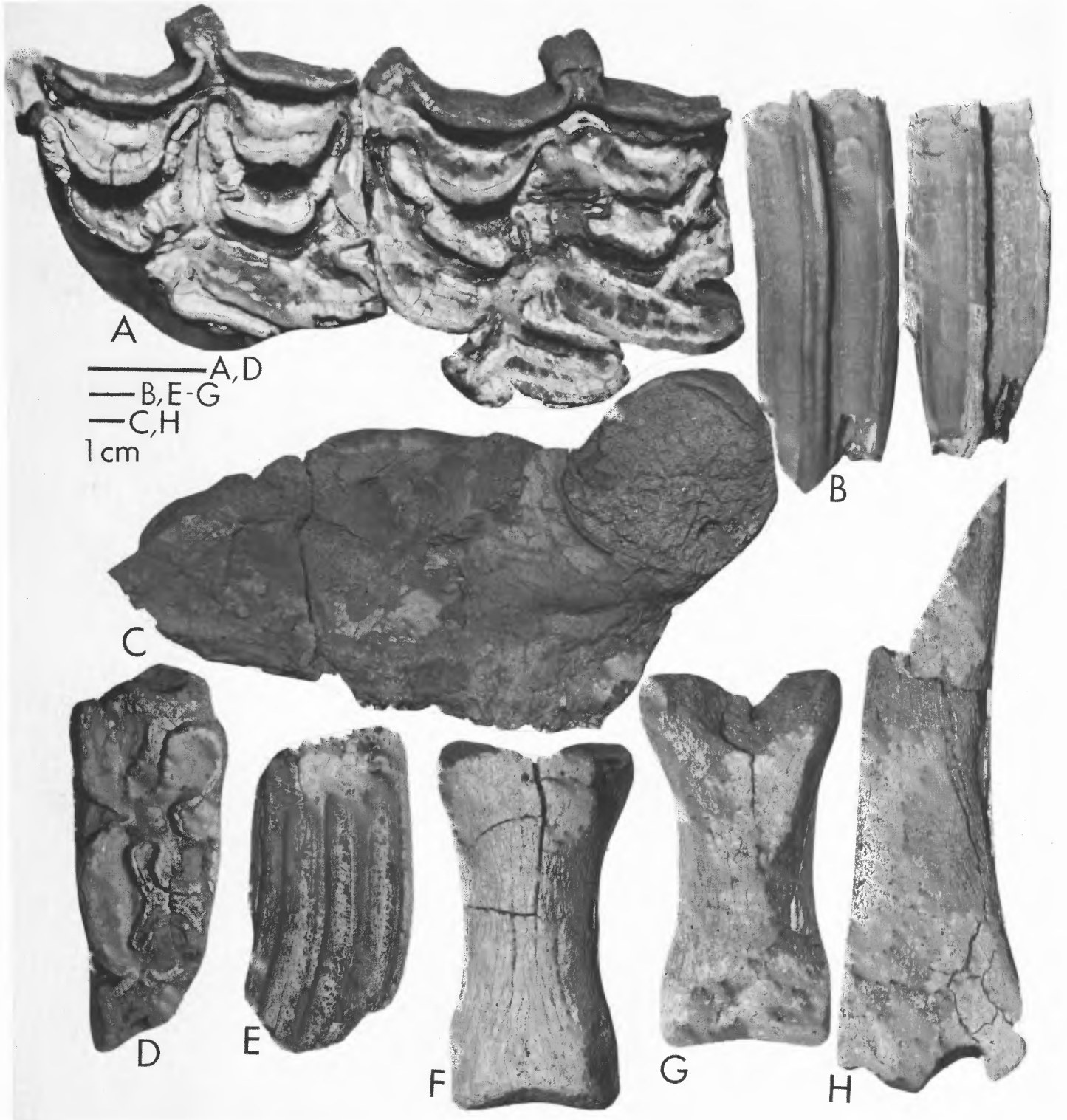


FIGURE 5—Equids and camelid from the Palomas Formation. **A, B,** *Equus simplicidens,* UNM P-063, left M^{1-2} in occlusal (A) and labial (B) views. **C,** *Hemiauchenia* sp., UNM P-072, part of skull in left lateral view. **D, E,** *Equus simplicidens,* UNM P-062, left M_3 in occlusal (D) and lingual (E) views. **F, G,** Equidae, UNM P-069, first phalanx in anterior (F) and posterior (G) views. **H,** Equidae, UNM P-065, distal portion of right tibia in anterior view.

derson (1980: 347) that only one species of the genus, *S. mirificus,* is valid. Subsequently, Madden (1984) argued that the Palomas Formation specimen represents a new species of *Stegomastodon.* Madden (1984: 246) apparently based this conclusion on the supposition that the M_3's of UNM P-041 "have only five ridges." This is clearly not the case (Fig. 6C, D), so Madden's (1984) contention that UNM P-041 represents a new primitive of *Stegomastodon* of late Hemphillian to early Blancan age can be discounted.

There are two divergent views of the speciosity of *Stegomastodon:* there are four or more species (e.g. Osborn 1936, Madden 1984) or only one species (Kurtén & Anderson 1980). Nevertheless, as Kurtén & Anderson (1980: 347) pointed out, "the range of variation in ste-

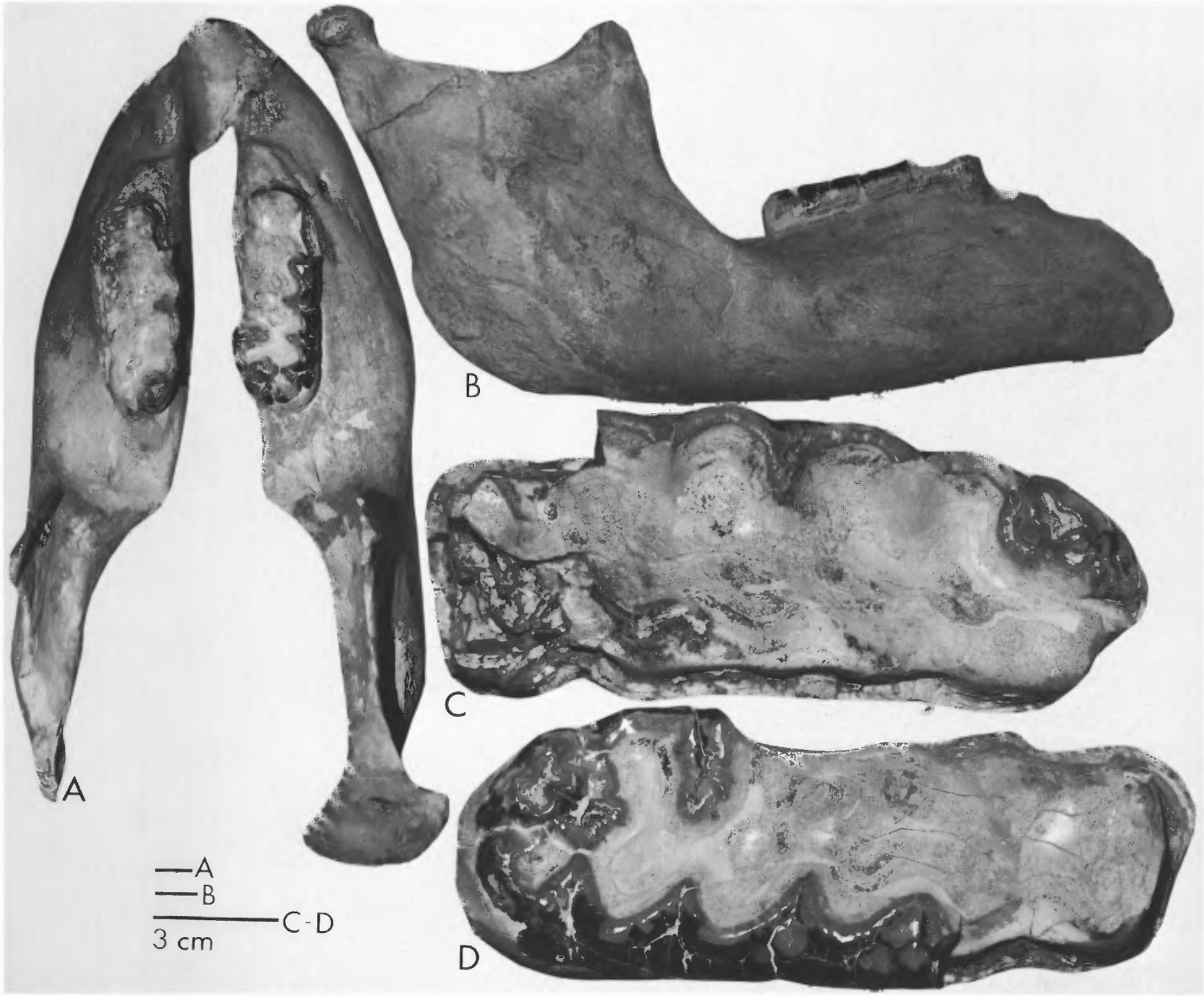


FIGURE 6—*Stegomastodon rexroadensis*, UNM P-041, from the Palomas Formation, lower jaw with left and right M_3's in occlusal (A) and right lateral (B) views, plus occlusal views of left M_3 (C) and right M_3 (D).

gomastodonts is unknown." Thus, we continue to recognize *S. rexroadensis* as a distinct, primitive species of the genus.

AGE

The fossil vertebrate taxa of the Cuchillo Negro Creek local fauna are: *Geochelone* (*Hesperotestudo*) aff. *turgida*, Carnivora, *Borophagus diversidens*, Equidae, *Equus simplicidens*, Camelidae, *Hemiauchenia* sp., and *Stegomastodon rexroadensis*. There is no question that the mammals from this fauna indicate a Blancan age, most likely medial Blancan, a correlative of the Rexroad fauna of Kansas, about 3 Ma (Savage & Russell 1983: fig. 7-4). This means that the Cuchillo Negro Creek local fauna is slightly older than the Hudspeth faunas from the upper Fort Hancock and lower Camp Rice Formations of the Hueco bolson in southwestern Texas (Strain 1966, Tedford 1981) and about the same age as the Benson fauna from the St. David Formation in the San Pedro Valley of southeastern Arizona (Gazin 1942, Tedford 1981).

Tedford (1981: 1019) reported that mastodont, *Equus simplicidens*, *Gigantocamelus* sp., and *Tapirus* sp. had been collected from the axial river facies of the Sierra Ladrones Formation (= axial facies of Palomas Formation of Lozinsky 1982, 1986, and this paper) on the western side of Elephant Butte Reservoir. Tedford (1981) assigned a medial Blancan age to these mammals, an age assignment identical to the age we assign to the Cuchillo Negro Creek local fauna. The 2.9 ± 0.3 Ma age reported for the basalt flow at Mitchell Point at the northern end of Elephant Butte Reservoir (Bachman & Mehnert 1978: tab. 1), a flow that interfingers with the axial facies of the Palomas Formation (Lozinsky 1982, 1986), is very close to the age we assign the Cuchillo Negro Creek local fauna.

PALEOECOLOGY

The number of specimens that make up the Cuchillo Negro Creek local fauna is small, and they all belong to relatively large vertebrates. This renders paleoecological interpretation of this local fauna limited, although a few inferences can be made. First, the presence of *Geochelone* indicates a frost-free climate (Hibbard 1960, Brattstrom 1961). Second, the fact that the collection from the Cuchillo Negro Creek area is dominated by equids and camelids suggests that open grassland was most prevalent near this area (Shotwell 1958, 1970, Gustafson 1978). However, the browser *Stegomastodon* also suggests the probable existence of wooded areas along streams (Hibbard 1941). Thus, a frost-



FIGURE 7—Reconstruction of the Elephant Butte area during medial Blancan time, showing *Stegomastodon rexroadensis* (left) and *Equus simplicidens* (on right) being startled by the bone-eating dog *Borophagus diversidens*. Photograph of a painting by Ellen Garvens done under the direction of S.G. Lucas; by permission of the Department of Natural Resources, State of New Mexico.

free climate in an area dominated by grasslands with possible wooded areas along watercourses is indicated for the Cuchillo Negro Creek area during the medial Blancan (Fig. 7).

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