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Eocene mammal from the Bobcat Hill Conglomerate, Peloncillo Mountains, southwestern New Mexico

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Introduction

In several mountain ranges of the Basin and Range province of southwestern New Mexico, nonmarine red beds unconformably overlie Lower Cretaceous strata and are overlain by upper Eocene–Oligocene volcanic and volcaniclastic rocks. The age of these red beds is poorly constrained, although existing data and regional tectonic considerations suggest they are of latest Cretaceous–Eocene age (e.g., Seager and Mack, 1986). Here, I describe a mammalian fossil from red beds in the Peloncillo Mountains of Hidalgo County (Fig. 1) that suggests an Eocene age and discuss briefly its implications. In this article, NMMNH refers to the New Mexico Museum of Natural History, Albuquerque and USNM refers to the National Museum of Natural History, Smithsonian Institution, Washington, D. C. Chronology of the Eocene–Oligocene boundary employed here follows Swisher and Prothero (1990), who place the boundary at 34 Ma and thus identify the Chadronian land-mammal "age" as late Eocene.

Stratigraphy

Gillerman (1958) introduced the name Bobcat Hill Conglomerate for the red beds in the central Peloncillo Mountains. These strata include at least 760 m of volcanic and arkosic sandstone and conglomerate with minor amounts of siltstone and limestone (Smith, 1987). The only fossils Gillerman (1958) reported from the Bobcat Hill Conglomerate were algal ooids in a limestone bed. These fossils are of no precise chronological value, and Gillerman assigned the Bobcat Hill a Tertiary age because it is stratigraphically above Lower Cretaceous strata and because it contains volcanic detritus.

Smith (1987) re-evaluated the stratigraphy of the Bobcat Hill Conglomerate and recognized four informal members. The basal conglomerate member is as much as 60 m thick, consists mostly of clasts of Cretaceous sandstone and Paleozoic limestone, and overlies Lower Cretaceous strata at an angular unconformity. It contains highly silicified wood of no precise chronological significance.

The overlying member, named the lower volcaniclastic sandstone and conglomerate member by Smith (1987), is as much as 150 m thick. Marvin et al. (1978) reported fission-track dates of 27.5 ± 4.8 Ma and 32.7 ± 1.5 Ma from a supposed quartz-latite porphyry (Drewes and Thorman, 1980) that Smith (1987) reinterpreted as an extensively epidotized volcaniclastic rock in the lower volcaniclastic sandstone and conglomerate member. Smith (1987, p. 45) concluded that "the fission tracks have been reset by middle Tertiary intrusive and hydrothermal activity."

Smith's (1987) conglomerate member with volcanic clasts overlies the lower volcaniclastic sandstone and conglomerate member. It is as much as 50 m thick and is dominated by subrounded-to-rounded andesite clasts.

The overlying upper volcaniclastic sandstone and conglomerate member is as much as 500 m thick and consists of volcaniclastic sandstone, limestone-andesite-cobble conglomerate, minor siltstone and shale. The algal limestone first described by Gillerman (1958) is near the base of this unit (Smith, 1987). The andesite of Steins Pass (Hudson, 1984) overlies the Bobcat Hill Conglomerate with angular unconformity. It is 2500 to 2700 m of andesitic lavas, tuffs and volcaniclastic rocks (Smith, 1987).

The fossil vertebra described here was collected from the Bobcat Hill Conglomerate on the southeastern slope of Bobcat Hill at NMMNH locality 1421 in the SE1/4SW1/4NW1/4NW1/4 sec. 36 T24S R21W, Hidalgo County. This vertebra was found in place, encased in grayish-red sandy siltstone of Smith's (1987) upper volcaniclastic sandstone and conglomerate member (Fig. 1). Six person-days of searching for additional vertebrate fossils in the Bobcat Hill Conglomerate only produced unidentifiable bone fragments from volcaniclastic conglomerates.

Eocene mammal

The mammal fossil from the Bobcat Hill Conglomerate, NMMNH P-12998, is an incomplete vertebra (Fig. 2). This vertebra is sheared down its long axis so that only one-third to one-half of the centrum remains. The centrum is 96 mm long, and its maximum preserved ☞

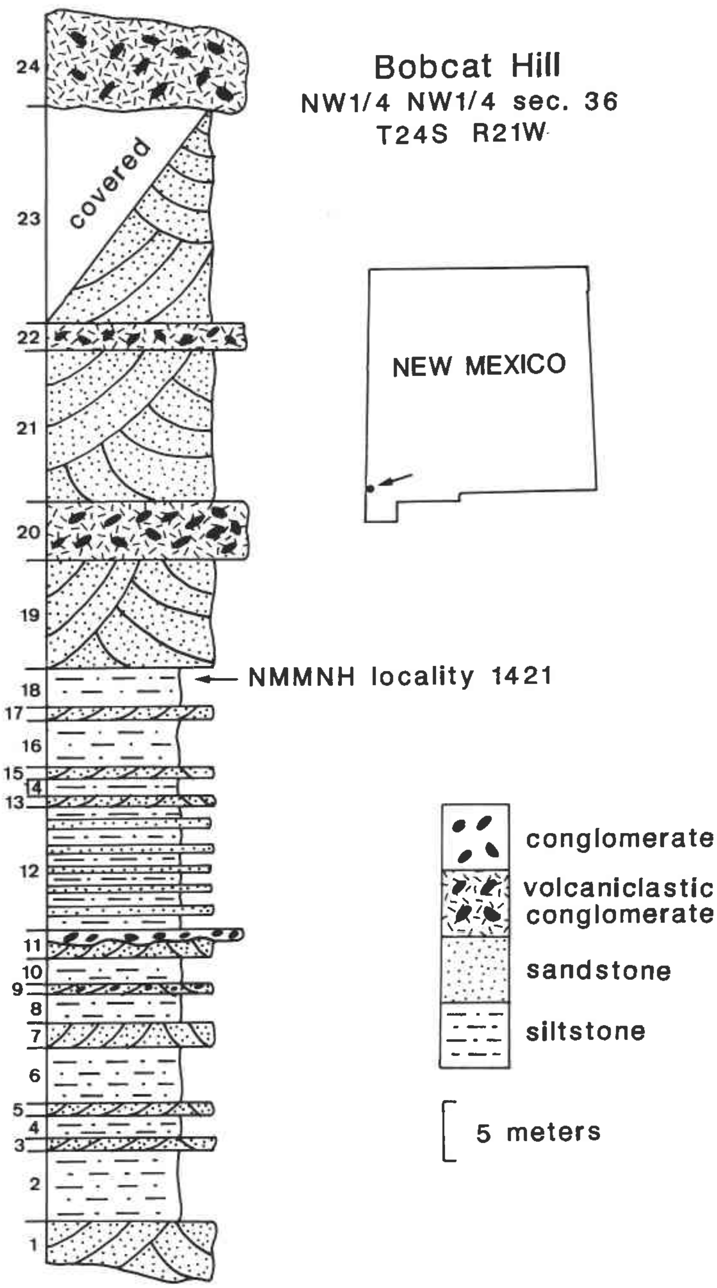

FIGURE 1—Measured stratigraphic section of part of the upper volcaniclastic sandstone and conglomerate member of the Bobcat Hill Conglomerate at NMMNH locality 1421. See Table 1 for descriptions of the lithologic units.

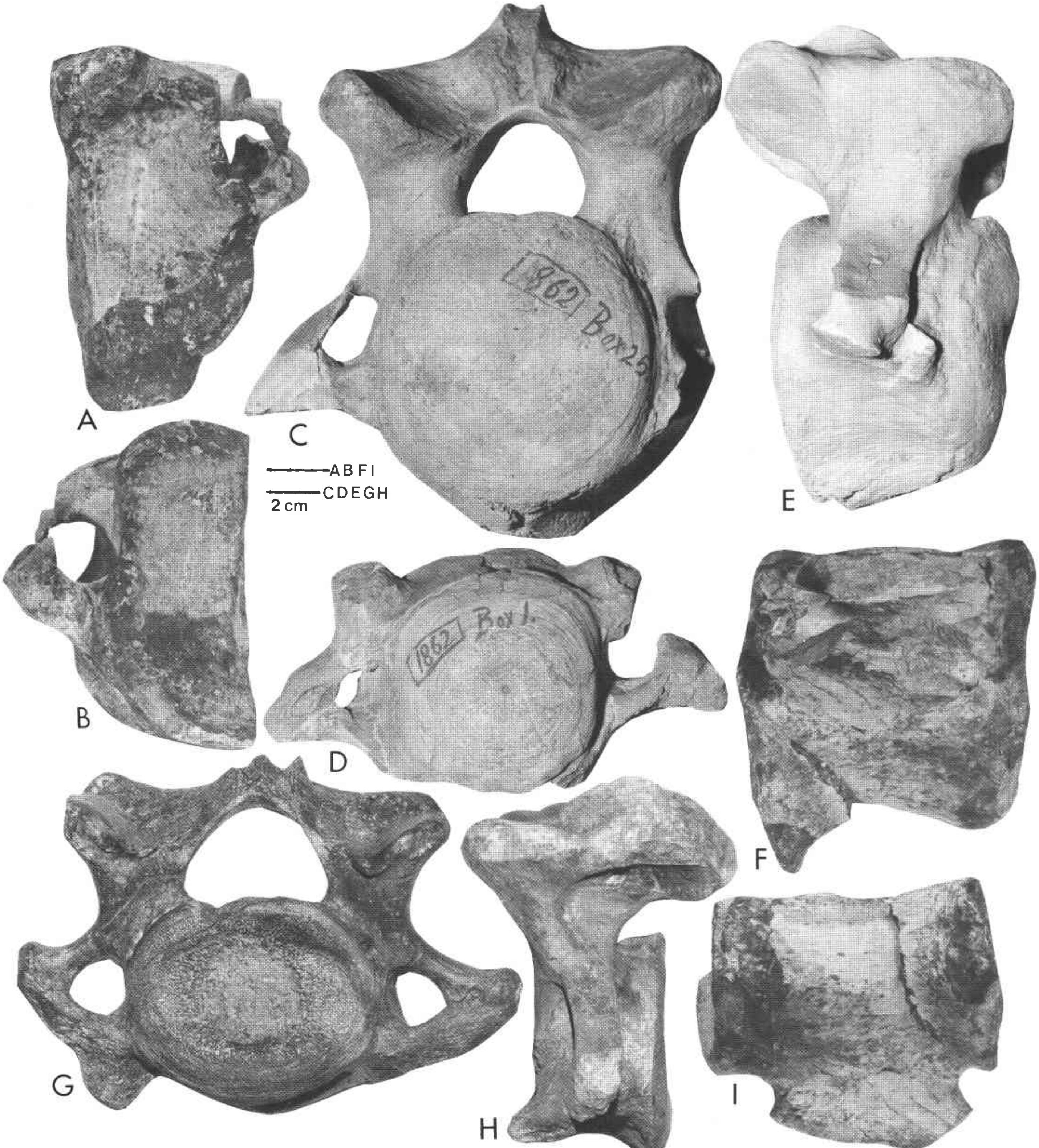

FIGURE 2—Mammal vertebra from the Bobcat Hill Formation (NMMNH P-12988) compared with cervical vertebrae of *Uintatherium* and a Chadronian brontothere. **A, B, F, I,** NMMNH P-12988, anterior (A), posterior (B), lateral (F) and inferior (I) aspects. **C, D, E,** USNM 1318 (C, E) and 1320 (D), posterior cervical vertebrae of Chadronian brontotheres from South Dakota, anterior (C, D) and lateral (E) aspects. **G–H,** USNM 26185, posterior cervical vertebra of *Uintatherium anceps* from the Bridgerian of Wyoming, anterior (G) and lateral (H) views.

diameter is 100 mm. The vertebra is very slightly amphicoelus and bears a large transverse foramen enclosed by a bony arch. This bony arch is both broken and weathered, but its superior portion appears to have supported one of the roots of the neural arch. The morphology of NMMNH P-12998, especially its enclosed transverse foramen, indicates it is an incomplete cervical vertebra of a large mammal.

A single, incomplete cervical vertebra of a mammal is not sufficient for a precise identification. Nevertheless, I have compared this vertebra with similar-sized vertebrae of several types of mammals and offer the following conclusions:

1. NMMNH P-12998 is too large to belong to any known land mammal of Paleocene or early Eocene (Wasatchian) age. The largest Paleocene–early Eocene land mammal from North America is the pantodont *Coryphodon*, but the maximum diameter of its cervical vertebrae never exceeds 60 mm (Lucas, 1984).
2. NMMNH P-12998 is about the size of a cervical vertebra of middle Eocene (Bridgerian–Uintan) *Uintatherium* (Fig. 2). However, the cervical centra of *Uintatherium* are very short relative to their diameter, unlike NMMNH P-12998.
3. NMMNH P-12998 is about the size of and morphologically similar to posterior cervical vertebrae of late Eocene (Duchesnean–Chadronian) brontotheres (Fig. 2).
4. However, NMMNH P-12998 also is about the right size and morphology to pertain to a Chadronian entelodont (Peterson, 1909).
5. The possibility that NMMNH P-12998 represents a post-Eocene mammal cannot be excluded on the basis of its morphology. However, the oldest volcanic rocks that overlie the Bobcat Hill Conglomerate are no younger than early Oligocene (see below).

I thus conclude that NMMNH P-12998 is of Eocene age, definitely post-Wasatchian. It is possible, though not certain, that it represents a brontothere or entelodont of late Eocene (Duchesnean–Chadronian: 42–34 Ma) age.

Discussion

The fission-track ages reported by Marvin et al. (1978) from the lower part of the Bobcat Hill Conglomerate suggest an Oligocene age that can now be discounted, especially since an Eocene mammal occurs stratigraphically above the fission-track-dated rocks.

The rhyolite of Steins overlies with angular unconformity the andesite of Steins Pass, which is above the Bobcat Hill Conglomerate (Hudson, 1984; Smith, 1987). The rhyolite of Steins has yielded a zircon fission-track age of 31.4 Ma and is cut by latite-porphyry dikes dated at about 27 Ma (Hoggatt et al., 1977; Drewes and Thorman, 1980). Furthermore, Drewes et al. (1985) reported an age of 34.3 Ma (method not stated) for a rhyolitic and rhyodacitic unit of flows, domes and breccias associated with the Steins' volcano. Granite and rhyolite-porphyry intrusions that cut folds and faults that, in turn, cut the Bobcat Hill Conglomerate and andesite of Steins Pass (Smith, 1987) have been dated at 31–32 Ma (Hoggatt et al., 1977; Drewes and Thorman, 1980). These dates, which suggest a minimum age of about 31–32 Ma (early Oligocene) for the Bobcat Hill Conglomerate, are consistent with the post-Wasatchian Eocene age suggested by the mammal fossil described above. In contrast, fission-track dates of 44.7 ± 2.7 Ma and 27.3 Ma from the same unit of intensively altered flow rocks near a fault in the lower part of the andesite of Steins Pass (Hoggatt et al., 1977; Marvin et al., 1978; Drewes and Thorman, 1980) appear to be too old and too young, respectively.

Whether the Eocene age advocated here for the Bobcat Hill Conglomerate can be applied to other red-bed units that occupy a similar stratigraphic position in southwestern New Mexico is problematic. These units are the Lobo Formation in the southern Cooke's Range and northern Florida Mountains (Darton, 1928; Lemley, 1982; Mack and Clemons, 1988); the Skunk Ranch Formation in the Little Hatchet Mountains (Lasky, 1947; Lucas et al., 1990); the Little Hat Top fanglomerate in the southern Big Hatchet Mountains (Zeller, 1958, 1965); and the Cowboy Spring Formation/Timberlake Fanglomerate in the central Animas Mountains (Zeller and Alper, 1965). Age constraints on these units are very poor; paleomagnetic data suggest a late Paleocene or younger age for the Lobo Formation (Lemley, 1982), and possible Paleocene–Eocene ostracodes have been reported from the Skunk Ranch Formation (Lawton et al., 1990). Some of these units are overlain by volcanic rocks that may be as old as 44 Ma and are no younger than about 37 Ma (Seager and Mack, 1986). Although these units

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TABLE 1—Measured section of part of upper volcaniclastic sandstone and conglomerate member of the Bobcat Hill Conglomerate at Bobcat Hill, NW $^1/_4$NW$^1/_4$ sec. 36 T24S R21W, Hidalgo County, New Mexico.

Unit	Lithology	Thickness (m)
	Bobcat Hill Conglomerate:	
24.	Volcaniclastic conglomerate; clasts are mostly greenish-gray (5 G 6/1) andesite; matrix is dark reddish-brown (10 R 3/4) subarkose.	not measured
23.	Sandstone; same colors and lithology as unit 1; unit partly covered by talus.	19.5
22.	Conglomerate; same colors and lithology as unit 20.	2.1
21.	Sandstone; same colors and lithology as unit 1.	14.3
20.	Volcaniclastic conglomerate; matrix is pale-brown (5 YR 5/2) and grayish-red (10 R 4/2), medium- to coarse-grained subarkose; clasts are andesite.	5.2
19.	Sandstone; same colors and lithology as unit 1.	10.4
18.	Sandy siltstone; same color and lithology as unit 2; NMMNH locality 1421 is 2.4 m above base of unit.	3.0
17.	Sandstone; same colors and lithology as unit 1.	0.8
16.	Sandy siltstone; same color and lithology as unit 2.	4.3
15.	Sandstone; same colors and lithology as unit 1.	0.6
14.	Sandy siltstone; same color and lithology as unit 2.	1.5
13.	Sandstone; same colors and lithology as unit 1.	0.6
12.	Sandstone and sandy siltstone, same colors and lithology as units 1 and 2, respectively; interbedded in 0.3- to 1.0-m-thick beds.	7.5
11.	Sandstone and conglomerate; sandstone (lower half of unit) is same color and lithology as unit 1; conglomerate is yellowish gray (5 Y 7/2) and dominated by clasts of Paleozoic limestone, granite, and quartzite as much as 15 cm in diameter in a subarkosic sandstone matrix.	1.4
10.	Sandy siltstone; same color and lithology as unit 2.	2.4
9.	Conglomerate; clasts are very coarse grained to pebbly quartzite, chert, chalcedony, and jasper in a grayish-red (5 R 4/2) matrix of subarkose; trough-crossbedded.	0.6
8.	Sandy siltstone; same color and lithology as unit 2.	2.7
7.	Sandstone; same colors and lithology as unit 3.	2.4
6.	Sandy siltstone; same color and lithology as unit 2 except contains some grayish-red–purple (5 RP 4/2) banding.	5.8
5.	Sandstone; same colors and lithology as unit 1.	0.8
4.	Sandy siltstone; same color and lithology as unit 2.	1.6
3.	Sandstone; pale-brown (5 YR 5/2) and grayish-red (10 R 4/2), medium- to coarse-grained, subrounded, moderately sorted, subarkosic; many calcite veins and hydrothermally altered splotches.	0.9
2.	Sandy siltstone; grayish-red (5 R 4/2 and 10 R 4/2); slightly calcareous.	7.9
1.	Sandstone; grayish-red (5 R 4/2 and 10 R 4/2), very fine to fine-grained, subangular to subrounded, moderately sorted, subarkosic, trough-crossbedded.	4.9+

occupy a stratigraphic position similar to that of the Bobcat Hill Conglomerate and are superficially similar lithologically, they mostly differ in one important respect: they lack the abundant volcanic detritus characteristic of the Bobcat Hill Conglomerate.

It seems reasonable to speculate that the Bobcat Hill Conglomerate could be an early volcaniclastic apron deposit of the Mogollon–Datil volcanic field. Its age and lithology support correlation with similar deposits that are included in the Rubio Peak Formation and lower Datil Group in south-central and west-central New Mexico, deposits which yield Chadronian mammals and radiometric ages that establish confidently their late Eocene age (Lucas, 1986; Cather et al., 1987). The Bobcat Hill Conglomerate probably post-dates other red-bed units of uncertain age in southwestern New Mexico.

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