

## NEW VERTEBRATE LOCALITY OF LATE HEMPHILLIAN AGE IN TEOCALTICHE, JALISCO, MEXICO

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### ABSTRACT

Recently, near the town of Teocaltiche, state of Jalisco, vertebrate remains were recovered from a sequence of sands and gravels. The recognized taxa are: hyaena-like dog *Osteoborus cyonoides*, antilocaprid cf. *Hexobelomeryx fricki*, equids *Dinohippus? mexicanus* and *Astrohippus? stockii*, and an indeterminate gomphothere. This faunal association suggests a latest Hemphillian age for the assemblage and adds a new locality to the poorly known Hemphillian of Jalisco. Comparisons based on the faunal association indicate that it correlates with Yepómera, Rinconada and Rancho El Ocote local faunas.

Key words: Paleontology, mammals, Hemphillian, Teocaltiche, Jalisco, Mexico.

### RESUMEN

Recientemente, en los alrededores de la población de Teocaltiche, estado de Jalisco, fueron recolectados restos de vertebrados de una secuencia de arena y grava. Los taxa identificados son: perro tipo hiena *Osteoborus cyonoides*, antilocáprido cf. *Hexobelomeryx fricki*, équidos *Dinohippus? mexicanus* y *Astrohippus? stockii*, y un gonfoterio indeterminado. Esta asociación faunística sugiere una edad henfiliana tardía y agrega una nueva localidad al tan poco conocido Henfiliano de Jalisco. Las comparaciones basadas en la asociación faunística indican que se correlaciona con las faunas locales de Yepómera, Rinconada y Rancho El Ocote.

Palabras clave: Paleontología, mamíferos, Henfiliano, Teocaltiche, Jalisco, México.

### INTRODUCTION

Few Hemphillian mammal localities are known in Mexico (Figure 1). The best studied are: Yepómera, Chihuahua, in northwestern Mexico (Lance, 1950; Lindsay, 1984); and Rancho El Ocote and Coecillo, Guanajuato, in central Mexico (Miller and Carranza-Castañeda, 1984). Other isolated local faunas in northwestern Mexico (Matachic and Basuchil in Chihuahua) have been reported by Lindsay (1984). Recently, in the state of Hidalgo, near the town of Zietla, a new local fauna was discovered and is being studied by Jesús Castillo-Cerón and Oscar Carranza-Castañeda (Castillo-Cerón [1994]; Carranza-Castañeda [1994]; Carranza-Castañeda and Castillo-Cerón [1992]); it is considered early late Hemphillian in age.

During a field season in 1990, a team from the Instituto de Geología recovered vertebrate fossils in different road cuts of a highway that joins Teocaltiche and Jalostotitlán in the state of Jalisco. The sample is small but the taxa identified are significant and diagnostic for age assignment. Recovered taxa include the hyaenid-like dog (*Osteoborus cyonoides*), an antilocaprid (cf. *Hexabelomeryx fricki*), the equids (*Astrohippus? stockii* and *Dinohippus? mexicanus*), and an undetermined gomphothere. This local fauna is geographically intermediate between central and northwestern parts of Mexico.

### STUDY AREA

Teocaltiche is in the northeastern part of the state of Jalisco (Figure 1). Earlier geologic map (CETENAL, 1973) indicates that this area is covered by continental Tertiary gravel and sandstone; no more detailed information was provided. The fossils were collected along the road from Teocaltiche to Jalostotitlán (Figure 2). A stratigraphic section of the Miocene deposits exposed nearby is about 6-m thick. It is a sequence of sandstone and gravel. Four lithologic units are recognized; for better understanding, they are lettered. The lowest unit (unit A), which is 1.90-m thick, is a poorly sorted light-colored fine- to coarse-grained sandstone. This basal unit yielded vertebrate remains of *Astrohippus? stockii*, *Osteoborus cyonoides*, and cf. *Hexabelomeryx fricki*. Overlying the basal unit, there is a dark-green sandy unit (unit B), 1.50-m thick, where a tooth of *Astrohippus? stockii* was recovered. Above this, there is a green-yellowish sandy clay (unit C), 1.50-m thick, with calcite concretions, where the gomphothere material and a lower jaw that belongs to a young *Dinohippus? mexicanus*, were recovered. At the very top, there is a 1.00-m thick dark-brown sandy clay (unit D). All the fossils were found *in situ*.

### ABBREVIATIONS

The following abbreviations and acronyms are used throughout: DP, deciduous premolar; Gto., Guanajuato; I, in-

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Figure 1. Location of Teocaltiche study area and the latest Hemphillian local faunas in Mexico.

cisive; IGM, Instituto de Geología, México; LACM, Los Angeles County Museum Natural History; MWSU Midwestern State University, Texas; m, meter; mm, millimeter; P, premolar; M, molar; Ma, million years ago; UCMP, University of California, Museum of Paleontology, Berkeley; w, width.

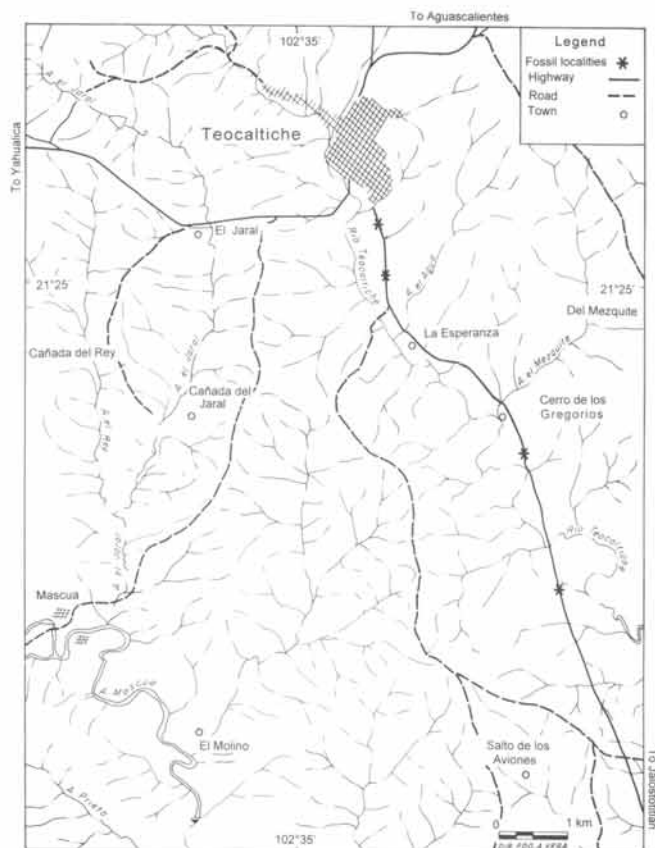


Figure 2. Location of the fossil localities along the road that joins Teocaltiche and Jalostotitlán, Jalisco, México.

All measurements of specimens are in millimeters. Upper and lower premolars and molars were measured along the occlusal surface. The collections used for comparison were Yepómera and Rancho El Ocote, housed at the Museo de Paleontología, of the Instituto de Geología. Cast of *O. cyonoides*, from the University of Texas and fossil material from Coffee Ranch, Texas housed at the Museum of Paleontology, UC, Berkeley; and the specimen from Jalisco belongs to a private collection.

## SYSTEMATIC PALEONTOLOGY

Class Mammalia Linnaeus, 1758

Order Carnivora Bowdich, 1821

Family Canidae Gray, 1821

Subfamily Borophaginae Simpson, 1945

Genus *Osteoborus* Stirton and Vanderhoof, 1933

### *Osteoborus cyonoides* Martin, 1928

**Distribution and age**—North and Central America. Late Hemphillian.

**Referred material**—IGM 6677, a left lower jaw with P/3-M/2, alveoli for canine, P/2 and M/3.

**Horizon**—Lower part of the Unit A, lowest unit of the measured section.

**Description**—The specimen is well preserved (Figure 3). The P/3 is a small, oval tooth, unworn, and has small cusps joined by a low ridge. The P/4 is a strong, thick tooth, triangular on lateral view and posteriorly inclined. A small cusp on the posterior face and a developed posterior cingulum are present. The M/1 is a large, strong tooth. The talonid is well developed and deeply basined. Small metaconid, entoconid and hypococonid are present, the posterior edge of the protoconid rises from the base of the trigonid, and the paraconid is two thirds the height of the protoconid. The talonid of M/2 is less than one half the length of the tooth. The paraconid is placed at the mid-line of the anterior edge of the tooth. The anterior labial cingulum is well developed. The deep mental foramen is placed below the posterior root of P/3 at one third the depth of the lower jaw.

The jaw is short, deep and thick, the ascending ramus is strongly developed. The most-anterior part of the jaw is broken but the alveolus of a strong canine is preserved. The ventral margin is straight, but posterior to M/2, it curves upward and backward, so the angular process is above the inferior border of the horizontal ramus. The articular condyle is strong and heavy. The coronoid process is almost complete.

**Discussion**—*Osteoborus* is a hyaenid-like dog, included in the Subfamily Borophaginae. Species of *Osteoborus* have been

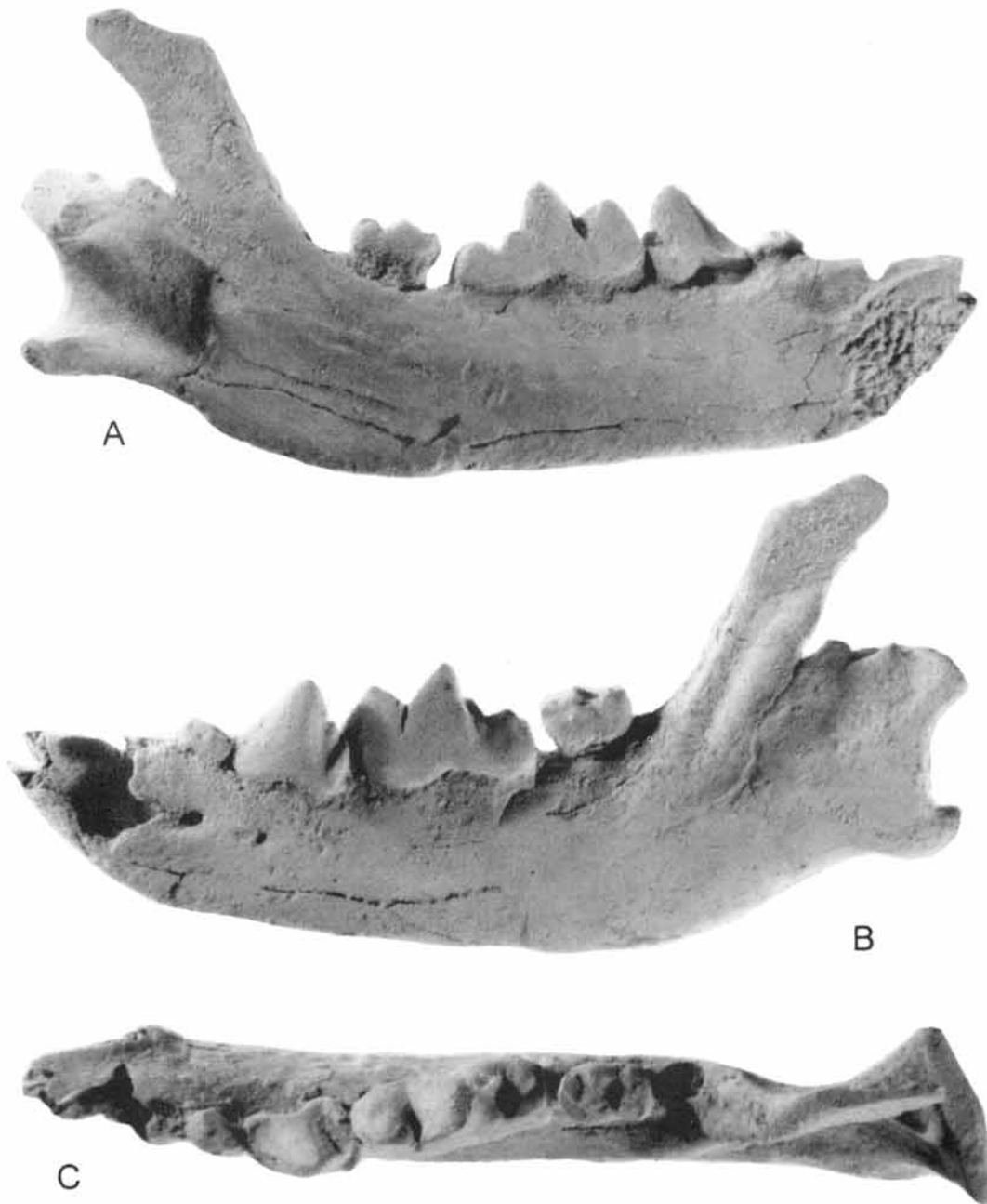


Figure 3. Left lower jaw with P/3-M/2 of *Osteoborus cyonoides* (IGM 6677): A, lingual view; B, labial view; C, occlusal view. Natural size.

described from Clarendonian and Hemphillian faunas but *cyonoides* is only known from the late Hemphillian (Tedford *et al.*, 1987). Fossils of *Osteoborus* are widely distributed, occurring in northern California, western Nevada, Arizona, New Mexico, northern and southern Great Plains, and Florida. Outside of North America, Olson and McGrew (1941) collected remains referred as *Hyaenognathus*, from the Gracias Formation in Honduras; later, this material was described and identified by McGrew (1944) as *O. cyonoides*. Webb and Perrigo (1984) reported the presence of *Osteoborus cyonoides*, from the Gracias Formation in Honduras and El Corinto in El

Salvador, which they considered early Hemphillian in age (roughly 7-8 Ma), based on the overlapping age ranges of the large mammals.

In Mexico, Lance (1950) tentatively assigned two upper and one lower carnassials from Yepómera, Chihuahua, to *Osteoborus*. Later, Dalquest and Mooser (1980) assigned an upper and lower carnassial, collected from Rancho El Ocote in Guanajuato, to *O. cf. O. cyonoides*, but suggested that it be an undescribed species. Lindsay (1984), in the faunal list of the late Cenozoic localities of northwestern Mexico, mentioned the presence of this borophaginae in Basuchil, Chihuahua.

Recently, Guzmán-Gutiérrez and Rodríguez-Huerta (1991) reported the presence of *Osteoborus* in the area of Belén del Refugio, Jalisco, at a distance of 20 km from the present locality. Their material consists of a partial skull with the upper dentition almost complete: left and right I1/ and the right P1/ are missing. The skull was associated with a right dentary with I/2-M/3 and a fragment of the left lower jaw with I/3-P/3. This apparently is the most complete and best preserved specimen of *Osteoborus* collected in Mexico.

Carranza-Castañeda (1992) confirmed the presence of this genus and species in the late Hemphillian of Guanajuato and reported a partial right lower jaw with M/3-P/4 (IGM 6412). P/4 is broken, and M/1 and M/3 are partially preserved.

The present author was able to compare the material collected from Guanajuato and Jalisco and MWSU 5434, UCMP 30660, 30492 and 30663, lower jaws from Coffee Ranch local fauna. Comparing the measurements of the Mexican specimens with those reported by Dalquest (1969) and Richey (1979) from Coffee Ranch local fauna, Texas, and those of Harrison (1983) from the Edson local fauna, Kansas, (and those directly obtained), it is observed that the teeth are practically the same size (see Table 1). In Richey's work, the measurements for all teeth are not given and the present author uses those from Dalquest (1969), but the ratios and graphs are Richey's. Based on Richey (1979) and including the Mexican specimens in his graphs (Richey, 1979, figs. 3, 4, 7, 8), the specimens (Guzmán-Gutiérrez and Rodríguez-Huerta's and IGM 6677) fall within the morphological limits and range of size of *Osteoborus cyonoides*. Subtle differences were observed: the ratio  $wP4/wM1$  of the specimens from Jalisco is almost 1, which means that the widths of premolar and molar are almost the same size. In the specimens from the Coffee Ranch fauna, the difference in these measurements is greater. This agrees with the tendency to the enlargement or broadening of the fourth lower premolar suggested by Richey (1979). Also, in the specimen from Belén del Refugio, the ratio  $wP3-wP4$  is 0.52, in contrast to 0.47 and 0.48 of the Coffee Ranch and Teocaltiche specimens.

Order Perissodactyla Owen, 1848

Family Equidae Gray, 1821

Genus *Astrohippus* Matthew and Stirton, 1930

### *Astrohippus? stockii* Lance, 1950

**Age and distribution**—Late Hemphillian of Yepómera and central Mexico, Texas Panhandle, and Florida.

**Referred material**—IGM 6678 is a right M1/, and IGM 6679 is a right P4/ and teeth fragments.

**Horizon**—The basal and the overlying units A and B.

**Description**—The upper molars are slightly curved, the protocone is elongated, and there is a well developed anterior projection. The protocone connects to the protoloph. The fossettes are crescent-shaped, and the enamel borders are very simple. The pli-caballin and the hypoconal groove are absent. In IGM 6679 the mesostyle is wide and flattened, suggesting that it is a P/4.

**Measurements**—IGM 6678, length 19.0 mm, width 17.5 mm; IGM 6679 length 22.1 mm, width 20.3 mm.

**Discussion**—The *Astrohippus? stockii* is common in the Mexican late Hemphillian faunas, such as those from Yepómera in Chihuahua (Lance, 1950), and Rancho El Ocote and Rinconada in Guanajuato (Carranza-Castañeda, 1992). No significant differences were found with specimens from Yepómera and Guanajuato.

Genus *Dinohippus* Quinn, 1955

### *Dinohippus? mexicanus* Lance, 1950

**Age and distribution**—Late Hemphillian of Yepómera and central Mexico, Texas Panhandle, and Florida.

**Referred material**—IGM 6680 is a left lower jaw with milk DP2, DP3, DP4. The M1 is erupting. Part of the ascending ramus is preserved.

**Horizon**—The green-yellowish sandy clay, unit C.

**Description**—The valley between metaconid and metastylid is

Table 1. The measurements of the lower dentition of *Osteoborus cyonoides* from Coffee Ranch and the Mexican specimens.

	Coffee Ranch		Teocaltiche		Belén		Guanajuato	
	Length	Width	Length	Width	Length	Width	Length	Width
P/3	8.63 ± 0.19	5.74 ± 0.11	9	5.6	9.4	5.7		
P/4	16.66 ± 0.21	10.69 ± 0.13	15.7	11.0	17.0	10.5		10.5
M/1	27.58 ± 0.29	11.77 ± 0.13	27.4	11.5	26.0	11.1	24.6	11.8
M/2	12.63 ± 0.21	8.65 ± 0.16	13.2	8.6	10.7	7.9	9.7	7.2
P/4-M/1	42.5 ± 0.34		42.5		45.0			

wide and the former is larger than the latter. A parastylid is present.

**Measurements**—Lengths DP2 33.3 mm, DP3 26 mm, (DP4 is broken  $\approx$  24 mm).

**Discussion**—Similar in size and shape to those described by Lance (1950) from Yepómera. This equid had a wide distribution in southern North America and Mexico during the late Hemphillian (MacFadden, 1992). This species is important because it is considered to be close to the origin of the extant genus *Equus* (MacFadden, 1986).

Order Artiodactyla Owen, 1748  
Family Antilocapridae Gray, 1866

**cf. *Hexobelomeryx fricki* Furlong, 1941**

**Age and distribution**—Hemphillian of Mexico.

**Referred material**—IGM 6681, 6682 two left M/3's, IGM 6683 one M/2.

**Horizon**—Lowest unit of the section, unit A.

**Description**—Cheek teeth are hypsodont.

**Measurements**—IGM 6681, length 18.4 mm, width 6.6 mm. Two other teeth (IGM 6682 left M/3 and IGM 6683 M/2) are broken and poorly preserved. The teeth are indistinguishable from LACM (CIT) 281/289, from Yepómera, Chihuahua.

**Discussion**—A great variety of antilocaprids from the late Cenozoic deposits of North America has been noted by several authors. *Hexobelomeryx fricki* is the only antilocaprid reported from the Mexican Hemphillian faunas, it had been only described from Yepómera (Lance, 1950) and Matachic, in Chihuahua (Lindsay, 1984); Rancho El Ocote, La Presa and Coecillo, in Guanajuato (Miller and Carranza-Castañeda, 1984; Carranza-Castañeda, 1994); and Zietla, in Hidalgo (Carranza-Castañeda, 1994). The horn core constitutes the diagnostic character for antilocaprid identification, but unfortunately it is not commonly found. Isolated teeth are not diagnostic by themselves, but because this is the only antilocaprid reported from Mexico, the material is questionably referred to this taxon.

Order Proboscidea Illiger, 1811  
Family Gomphotheriidae Hay, 1922 or Cabrera, 1929

**Genus indeterminate**

**Age and distribution**—The age and distribution of the family is early Miocene-late Pleistocene in North America, Europe, Africa, Asia and South America.

**Referred material**—IGM 6684 is a left upper first molar.

**Horizon**—Green-yellowish sandy clay with calcite concretions, unit C.

**Description**—This tooth is very worn, but the outline of the enamel is distinguishable. The triloph is narrower than the protoloph and metaloph. Having only this tooth, a firm identification is apparently not possible.

**Measurements**—Length 89 mm, width 70 mm.

**Discussion**—The nomenclatural and taxonomic history of the gomphotheriids is complex and confuse. This is partly due to the fragmentary nature of the material. Few complete skulls associated with lower jaws have been recovered (Miller, 1980).

Madden (1981) included in this family the genera *Stegomastodon*, *Gomphotherium*, and *Teleobunomastodon*, and considered *Teleobunomastodon*, *Cuvieronius*, *Rhynchotherium*, and *Cordillerium* to be synonyms, but Miller (1990) considered *Gomphotherium*, *Rhynchotherium*, and *Cuvieronius* to be valid genera. The gomphotheres recorded for Mexico are *Gomphotherium*, known from the Miocene sediments in southern Mexico and *Rhynchotherium* with three species (*R. falconeri*, *R. tlascalae* and *R. browni*) reported from Hemphillian and Blancan local faunas (Osborn, 1921, 1936; Frick, 1933; Carranza-Castañeda, 1976; Miller, 1980, among others). *Cuvieronius* has been recorded in Pleistocene local faunas (Downs, 1958; Pichardo-del Barrio, 1960; Torres-Martínez, 1981). *Teleobunomastodon* with two species (*T. edensis* and *T. tropicus*) has been recorded from Pleistocene localities (Cope, 1884; Freudenberg, 1922; Pichardo-del Barrio, 1960; Silva-Bárceñas, 1969; Ochoterena-F. and Silva-Bárceñas, 1970). *Stegomastodon* has been collected in Yepómera, Chihuahua (Lance, 1950) and Rancho El Ocote, Guanajuato (Miller and Carranza-Castañeda, 1984) local faunas, and *Rhynchotherium* from Rancho El Ocote and Rinconada in Guanajuato (Dalquest and Mooser, 1980; Carranza-Castañeda, 1992), and skull and jaws from La Goleta in Michoacán (Carranza-Castañeda 1976), the tooth from Jalisco might belong to one of these genera.

**DISCUSSION**

MacFadden (1984) suggested that the occurrence of the equids *Dinohippus mexicanus* and/or *Astrohippus stockii* is biochronologically very useful. They are considered to be indices of post-Coffee Ranch local fauna time, that means late Hemphillian. In the last review of the North American land mammals ages, Tedford and coworkers (1987) proposed that the late Hemphillian mark the last occurrence of *Dinohippus mexicanus*, *Astrohippus stockii* and *Osteoborus cyonoides*.

In Mexico, the early reports of Pliocene vertebrates are dubious as already pointed out by Miller and Carranza-Castañeda

(1984). Most of them lack geological information, and the collecting was made without stratigraphic control. As a consequence, misleading age assignments were proposed, such as in La Goleta (Michoacán) and Tehuichila (Hidalgo). The only well studied Hemphillian localities are Yepómera in Chihuahua, Rancho El Ocote and Rinconada in Guanajuato, and Zietla in Hidalgo, which represents the early late Hemphillian.

Lindsay and others (1984), based on magnetic polarity sequence, placed the Yepómera fauna in the Sidujall subchron of the Gilbert magnetic chron about 4.4 to 4.5 Ma (but see May and Repenning, 1982). Kowallis and coworkers (1986) dated a tuffaceous sandstone from the Rancho El Ocote site by fission-track at 4.6 Ma. The presence of the equids and canid suggests that the age of this small fauna is late Hemphillian, and the Teocaltiche fossils correlate with Yepómera and Rancho El Ocote local faunas.

Earlier authors suggested that late Hemphillian faunas be traced with little change into northern Mexico (Yepómera fauna) (Tedford *et al.*, 1987). The information reported here confirms the hypothesis and extends the geographic distribution at least until central Mexico.

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