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The first Late Eocene continental faunal assemblage from tropical North America

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ABSTRACT

To date, the terrestrial faunal record of the North American late Eocene has been recovered from its subtropical and temperate regions. We report the first late Eocene continental faunal assemblage from tropical North America, in southern Mexico. Fossil specimens were collected from mudstones that crop out in the Municipality of Santiago Yolomécatl, in northwestern Oaxaca. Previously published K–Ar ages of 32.9 ± 0.9 and 35.7 ± 1.0 Ma in overlain nearby volcanic rocks and biostratigraphy of these new localities suggests a Chadronian mammal age for this new local fauna. The assemblage is composed by two turtle taxa, *Rhineura*, two caniform taxa, a sciurid, a jimomyid rodent, a geomyine rodent, *Gregorymys*, *Leptochoerus*, *Perchoerus probus*, *Merycoidodon*, a protoceratid, *Poebrotherium*, *Nanotragulus*, *Miohippus assinoboiensis*, a chalicotherid, a tapiroid, cf. *Amynodontopsis*, *Trigonias* and the hymenopteran ichnofossils *Celliforma curvata* and *Fictovichnus sciuttoi*. The records of these taxa in northwestern Oaxaca greatly expand southerly their former geographic distribution in North America. The records of the geomorph rodents and *Nanotragulus* extend their former known biochronological range to the late Eocene. The hymenopteran ichnofossils in the localities suggest the presence of a bare soil after periodic waterlogging, under a sub-humid to sub-arid climate. This new local fauna represents the first glimpse of Eocene vertebrate and invertebrate terrestrial life from tropical North America.

1. Introduction

The Eocene is bracketed by some of the most dramatic climatic changes of the last 66 million years, beginning around 56 million years ago (Ma) with the Paleocene–Eocene Thermal Maximum and concluding around 33.9 million years ago with global cooling that heralded the modern icehouse world (Woodburne, 2004). From the late Eocene (37.8–33.9 Ma) to the earliest Oligocene (33.9–33 Ma) this cooling averaged ~4.8 °C at high latitudes and ~3 °C in tropical latitudes (Liu et al., 2009). This climatic change had a significant impact on the North American terrestrial biotas (Woodburne, 2004).

The continental faunal record of the North American late Eocene — the Chadronian North American Land Mammal Age — mainly comes from the northern and central Great Plains and the southern Great Basin in Texas (Prothero and Emry, 2004), all of them in subtropical and temperate North America (Fig. 1). In Mexico, the only Chadronian vertebrate local fauna is Rancho Gaitán of Chihuahua in northern Mexico (Ferrusquía-Villafranca et al., 1997).

Recent paleontological and geological work carried out in what was once considered the only Paleogene mammal locality in tropical North America, Simojovel in Chiapas, southern Mexico, revealed that the fossil-bearing sediments are early Miocene in age (23 Ma) (Vega et al., 2009; Calvillo-Canadell et al., 2010; Perrillat et al., 2010), and not Oligocene (26–28 Ma) as was initially assumed (Ferrusquia-Villafranca, 2006); additionally, the reported artiodactyl is a tayassuid and not a helohyid (Prothero et al., 2013).

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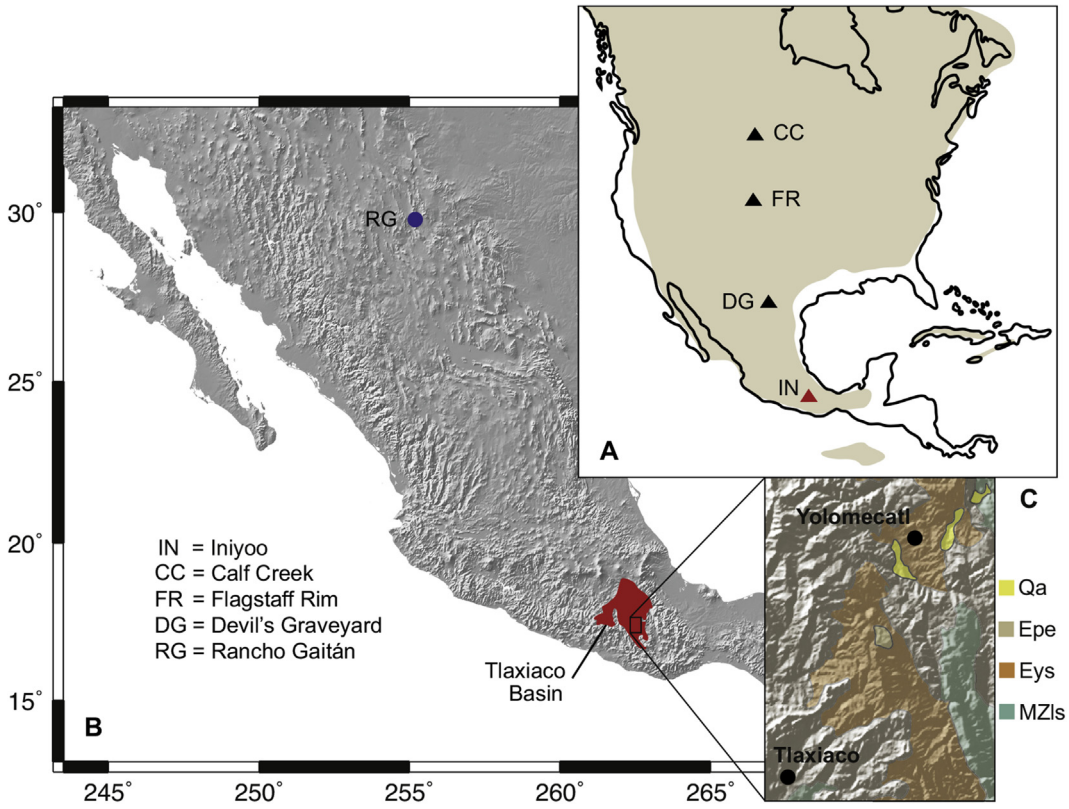

Fig. 1. A. The North American continent and Caribbean islands in the late Eocene. Beige areas were exposed subaerially. Southern Mexico was at the southern tip of the continent at the time and separated from South America by remnants of the Tethys Sea. Triangles indicate important Chadronian (late Eocene) faunas of the United States and Canada, together with the new Iniyoo Local Fauna. B. Topographic map of southern North America. The Tlaxiaco Basin, where the Iniyoo Local Fauna is situated, is shown in red. C. Geologic map of the areas between Santiago Yolomécatl and Heroica Ciudad de Tlaxiaco. MZls, Mesozoic limestone; Eys, Paleogene Yanhuitlán Formation; Epe, Paleogene volcanics and epiclastics; Qa, Quaternary alluvium. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)

Thus, what it is known about the vertebrate life of North America just before the great Oligocene climatic deterioration comes from extratropical assemblages. At present it is not known if there was a significant climate change on land in tropical North America and, if so, how the taxa responded to this climate change that began in the late Eocene.

Ongoing paleontological research within the Tlaxiaco basin in northwestern Oaxaca, southern Mexico, led us to the discovery of several Paleogene vertebrate fossil localities in the surroundings of Santiago Yolomécatl (Fig. 1). Previously published K–Ar ages of 32.9 ± 0.9 and 35.7 ± 1.0 Ma in overlain nearby volcanic rocks and biostratigraphy of these new localities suggests a Chadronian (late Eocene) age for this new local fauna. Thus, it can be correlated with Chadronian assemblages from temperate North America.

The aim of this paper is to briefly describe the vertebrates and ichnofossils of this new local fauna, which we dubbed the Iniyoo Local Fauna (the Mixteca name of Yolomécatl), and to make some comments about the paleobiological significance of several taxa collected from these new Mexican localities.

2. Geographical and geological contexts

The study area is in the outskirts of the municipality of Santiago Yolomécatl, Oaxaca state, southern Mexico (Fig. 1); this region is within the Sierra Madre del Sur physiographic province and the Tierras Altas de Oaxaca subprovince (Ortíz-Pérez et al., 2004). Pre-Cenozoic units include Jurassic marls and the Cretaceous (Albian–early Coniacian) Teposcolula Limestone (Santamaría-Díaz et al., 2008). Cenozoic units include the Eocene Yanhuitlán Formation and the late Eocene–early Oligocene Cañada María Andesite (Fig. 2). The first comprises a fluviolacustrine succession of red to cream-colored clay, siltstone and some fine-grained sandstone beds, that grades transitionally to a series of ash flow tuffs, ash fall sand and volcanic sandstone (Cerca et al., 2007). Within the mapped area of the Yanhuitlán Formation there is a fossiliferous unit, fluviolacustrine in origin, which fills the basin of Yolomécatl and that conformably underlies the Cañada María Andesite.

This unit consists in its lower part of around 40 m of thickly-bedded, partially silicified limestone, which upwardly changes to a sequence of about 200 m in thickness of thinly to thickly bedded mudstones with occasional coarse lenses and some beds of volcanic and limestone pebble, cobble and some boulder clasts, and unlike the Yanhuitlán Formation in all other areas, paleosols horizons are abundant. Some thinly bedded chert layers are also intercalated with the fine-grained strata. The beds of the Yolomécatl unit are much thicker (around 1 m or more) than those of the typical Yanhuitlán, showing a bimodal grain-size distribution, with minor pebble content.

Two radiometric ages (K–Ar) of 35.7 ± 1.0 and 32.9 ± 0.9 Ma, from the Cañada María Andesite nearby the study area are available (Martini et al., 2000; Santamaría-Díaz et al., 2008). The rock sample of 35.7 ± 1.0 Ma was collected close to the base of this unit, around 20 km north of Yolomécatl, but given that there are some faults in between, this radiometric date is accepted with some reserve. The other sample (with an age of 32.9 ± 0.9 Ma) was collected around 13 km to the south of Yolomécatl, up in the volcanic sequence (Fig. 2) and there are no major faults in between. Additionally, the available radiometric dates of the volcanic rocks from the study