THE OLDEST NORTH AMERICAN PROSAUROPOD, FROM THE UPPER TRIASSIC TECOVAS FORMATION OF THE CHINLE GROUP (ADAMANIAN; LATEST CARNIAN), WEST TEXAS

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Abstract—An isolated tooth from the Tecovas Formation of the Chinle Group, Crosby County, West Texas, represents the oldest definitive record of a prosauropod dinosaur from North America. Its age is Adamanian (latest Carnian, approximately 225 Ma) based on vertebrate biostratigraphy, palynostratigraphy and other data. It is clearly distinguished from isolated ornithischian teeth by a combination of prosauropod dental synapomorphies. The addition of this tooth to other recent discoveries of late Carnian prosauropod material from Brazil and Madagascar, as well as the Moroccan Azendohsaurus, indicates a Pangea-wide distribution for prosauropods near their oldest occurrences.

Keywords: Carnian, prosauropod, Tecovas Formation, tooth

INTRODUCTION

The Prosauropoda are poorly represented in the Upper Triassic of North America. Among the oldest known prosauropod body fossil specimens from the continent is a single dorsal centrum from the Revueltilian (early-middle Norian) Bull Canyon Formation of New Mexico (Hunt et al., 1998) and part of the holotype of the putative ornithischian Technosaurus smalli Chatterjee, 1984 (Sereno, 1991). All other Triassic prosauropod records in North America are restricted to tracks. These include tracks assigned to the ichnotaxon Agrestipus hottoni from the Rhetaian Balls Bluff Siltstone (Newark Supergroup) of Virginia (Weishampel and Young, 1996), many other occurrences of Tetrasauroptus and Pseudotetrasauroptus from the Newark Supergroup (Olsen, 1988), and numerous tracks in the uppermost Chinle Group in Oklahoma, New Mexico, and Utah, also assigned to Tetrasauroptus and Pseudotetrasauroptus (Lockley and Hunt, 1995; Lockley et al., 2000). Hunt (1988) claimed the oldest prosauropod dinosaur from the Upper Triassic of North America was based on teeth from the Bull Canyon Formation of the Chinle Group in New Mexico. However, Hunt (1989) later reassigned these teeth to the ornithischian dinosaur Renellosaurus.

Recently, we recovered a single prosauropod tooth from a microvertebrate locality in the lower part of the Tecovas Formation of the Chinle Group near Kalgary in Crosby County, Texas. This tooth represents the only body fossil evidence for pre-Norian prosauropods in North America. Here, we establish the Adamanian (latest Carnian) age of this tooth, describe and compare it to that of other basal prosauropods, and discuss briefly early prosauropod distribution and evolution. In this paper, NMMNH refers to the New Mexico Museum of Natural History and Science, Albuquerque.

STRATIGRAPHY AND AGE

The prosauropod tooth described here, NMMNH P-26400, was collected near Kalgary, Crosby County, Texas at NMMNH locality 1430, UTM 3701500 N, 298850 E, zone 14, NAD 27 (Lucas and Luo, 1993) (Fig. 1). We screenwashed more than three metric tons of sediment from the lower part of the Tecovas Formation of the Chinle Group at this locality and recovered only one prosauropod tooth. However, an extensive assemblage of microvertebrates collected from this locality includes many isolated ornithischian teeth, as well as the holotype of Adelobasileus cromptoni, the oldest known mammal (Lucas and Luo, 1993).

The fossiliferous deposit is approximately 14 m above the base of the Chinle Group in the Tecovas Formation (Fig. 1). The dominant lithology at NMMNH locality L-1430 is a dark reddish-brown, clay- and siltstone-pebble conglomerate overlain by a very fine-grained, light greenish-gray to pale yellowish-brown micaceous sublitharenite. Clearly, these are channel- to point-bar deposits.

Tetrapod fossils from the Tecovas Formation near Kalgary establish an Adamanian (latest Carnian) age for the upper part of the unit. Specifically, the co-occurrence of the phytosaur Rutisodon and the aetosaur Stagonolepis, both index taxa of the Adamanian land-vertebrate faunachron, indicate an Adamanian age for the upper part of the Tecovas Formation in West Texas (Lucas and Hunt, 1993; Lucas, 1998).
DESCRIPTION

NMMNH P-26400 is a laterally compressed and spatulate tooth (Fig. 2). It is 6 mm tall, with a basal labio-lingual crown width of 1 mm. Mesiodistally, the labial surface of the crown is slightly more convex than the lingual surface (Fig. 2E-J). In lingual or labial view, the tooth is symmetrical, with the maximum width of the crown (3 mm) apical to the crown-root junction (Fig. 2A-D). The crown base has an antero-posterior length of 3 mm and shows slight constriction. The apex of the crown is straight and slightly tapered.

The conical denticles of NMMNH P-26400 are apically inclined approximately 45° to the crown edges. As many as 33 denticles extend along the entire length of the anterior edge of the crown, but denticulation is not preserved along the lower third of the posterior crown margin. Apically, the size of the denticles decreases gradually. Near the base there are approximately 8 denticles per mm. Higher on the crown this number increases, approaching 10 denticles per mm. On both the lingual and labial surfaces, a median ridge gradually widens from the apex to the base of the crown, where it is four times its apical width. The basal half of the ridge is flat to gently concave, which may represent abrasion of both the lingual and labial ridge surfaces. However, the crown surfaces show no wear facets. The tooth thus displays the following features, which in combination are dental synapomorphies of the Prosauropoda sensu Galton (1990) and Hunt and Lucas (1994): (1) spatulate shape; (2) symmetrical crown; (3) numerous, obliquely-angled marginal serrations; (4) poorly
developed “neck”; and (5) straight and narrow shape in mesiodistal views.

The tall, narrowly spatulate crown of NMMNH P-26400 is more similar to the crown shape of the Middle Norian Sellosaurus from the Middle Stubensandstein than to the proportionally broader spatulate crowns of Plateosaurus, from the Upper Stubensandstein and the overlying Knollenmergel of Germany (Galton, 1985). NMMNH P-26400 also resembles Sellosaurus in the slender, conical shape of the denticles, in contrast to the fuller, wider denticles of Plateosaurus. Specifically, NMMNH P-26400 is most comparable to teeth from the posterior portions of the dentition of Sellosaurus, which are characterized by symmetrical (absence of recurvature), spatulate crowns and subequal denticulation on the mesial and distal crown edges (Galton, 1985). Its size is also comparable to that of Sellosaurus teeth illustrated by Galton (1985) and much smaller than teeth assigned to Plateosaurus.

EARLY PROSAUROPOD TEETH AND EVOLUTION

Gauffre (1993a) assigned a Carnian age to Azendohsaurus laaroussii from the Argana Formation of Morocco, thereby making it not only one of the earliest dinosaurs, but the oldest known prosauropod. Lucas (1998) further resolved the age of these strata as Otischalkian (early late Carnian) based on the presence of the aetosaur Longosuchus.

More recently, other early prosauropod material was recovered from upper Carnian strata in Madagascar and Brazil. Flynn et al. (1999) reported two new prosauropods from the base of the Isalo II Beds in Madagascar that display contrasting dental morphologies. One form is based on several maxillae and dentaries that share characters with Azendohsaurus. These include a neck between the crown and root of the teeth and anteroposterior expansion of the crowns beginning at their bases. The dental morphology of the second Malagasy prosauropod is characterized by the dental apomorphies of the Prosauropoda. However, like NMMNH P-26400 and teeth of Sellosaurus, the crowns are elongate with slender denticles.

Flynn et al. (1999) assigned a probable early Carnian age to the base of the Isalo II, based largely on the inferred stage of evolution of the rhynchosaur “Isalorynchus” genovae (Whatley et al., 1999). However, we concur with Langer and Schultz (2000) and Langer et al. (2000) and consider Isalorynchus to represent a Hyperodapedon-grade rhynchosaur. Hyperodapedon is otherwise known from late Carnian units in Argentina, Brazil, Scotland and India (Langer and Schultz, 2000).

Other Late Triassic prosauropods from South Africa include Euskosaurus browni, Blikanasaurus cromptoni, Galton and Heerden, 1985, and Melanosaurus readi, Haughton, 1924, all from the lower Elliot Formation. These taxa, as well as an undescribed prosauropod from the same unit in Lesotho (Gauffre, 1993b) are of probable Revueltian (early-mid Norian) age. Previous reports placing the lower Elliot Formation in the Carnian, as well as early dinosaurs: Science, v. 286, p. 763-765.


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