

DINOSAUR TRACKS FROM THE UPPER CRETACEOUS MENEFEE FORMATION, WEST-CENTRAL NEW MEXICO

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Abstract—Dinosaur tracks from the upper Santonian-lower Campanian Cleary Coal Member of the Menefee Formation northeast of Grants in Cibola County are tridactyl and mesaxonic pes tracks with thick and relatively short digits and a bilobed heel impression, and small, oval-to-round depressions that represent the manus imprint. These are the tracks of ornithopods, presumably hadrosaurs, and are best assigned to *Caririchnium leonardii*. They are the first footprint record from the Menefee Formation and part of a hadrosaur ichnocoenosis found in coal-bearing strata of the Mesaverde Group in Colorado, New Mexico and Utah.

INTRODUCTION

Most of the Cretaceous dinosaur footprints known from New Mexico are of Early Cretaceous (late Albian) age and are found in strata of the Dakota Group (Mesa Rica and Pajarito formations) in the eastern part of the state (Hunt and Lucas, 1998; Lockley et al., 2000). Only a few Late Cretaceous footprint records have been documented from New Mexico: (1) ornithopod tracks from Cenomanian strata of the Dakota Sandstone at Jaralosa Creek in Socorro County (Heckert and Lucas, 1998); (2) very large ornithopod tracks from the Campanian Fruitland Formation near Bisti in San Juan County (Wolberg et al., 1988; Hunt and Lucas, 2003); and (3) the track of *Tyrannosaurus*, named *Tyrannosauripus pillmorei* by Lockley and Hunt (1994), and associated theropod and ornithopod tracks from the Maastrichtian interval of the Raton Formation near Cimarron in Colfax County (Lockley and Hunt, 1995). Here, we add to this sparse Late Cretaceous record some ornithopod footprints from the Campanian Menefee Formation near Grants in Cibola County. In this article, NMMNH refers to the New Mexico Museum of Natural History and Science.

LOCALITY

In 2003, coal-mining operations at the Lee Ranch Mine northeast of Grants (Fig. 1) uncovered a large sandstone surface with numerous dinosaur tracks (Fig. 2). A worker at the mine brought the tracks to the attention of NMMNH staff, but the tracks were destroyed by mining operations before they could be studied. Photographs of the footprints provided by Sammy Lynn are the only documentation of the footprints and are the basis of this report.

The tracksite is NMMNH locality 6678 in the SE1/4 NE1/4 sec. 26, T15N, R8W. The track-bearing horizon is stratigraphically low in the Menefee Formation (Chapman et al., 1979, sheet 2) (Fig. 1). These are strata of the Cleary Coal Member (or its equivalent) of late Santonian-early Campanian age (Molenaar, 1983).

DESCRIPTION

More than 25 individual footprints that make up four trackways are (were) preserved on a large sandstone slab (Fig. 2). The trackways are relatively narrow and display no tail drags. All of the footprints are of approximately the same size and shape. They are about 35-40 cm long and about 30-35 cm wide. The footprints are tridactyl and mesaxonic with three stout, relatively short and broad-spreading digits that end in blunt, hoof-like claws. Total divarication angle of the digits is about 60°. They have a bilobate heel impression. The middle digit (digit III) is slightly longer than the lateral digits (digits II and IV), all the digits are of the same shape, and in front of the middle digit there is a round or oval depression that represents the manus.

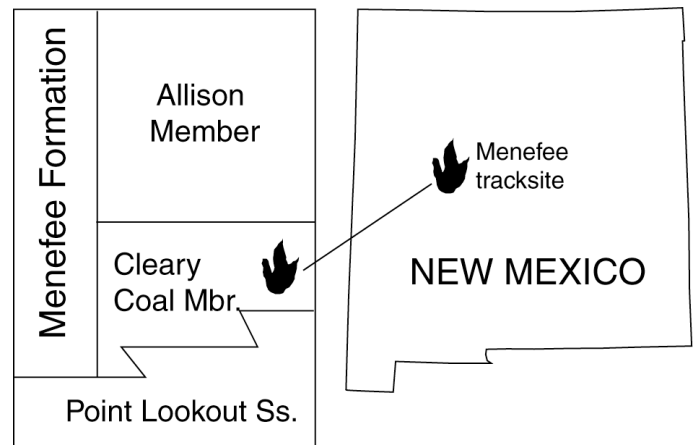


FIGURE 1. Index map and generalized stratigraphic succession at NMMNH locality 6678, Menefee dinosaur tracksite.

DISCUSSION

These tracks are clearly those of a relatively large ornithopod dinosaur (see Thulborn, 1990; Lockley and Hunt, 1995). This identification is based upon: (1) tridactyl pes; (2) broad digits; (3) lack of claw impressions; (4) relatively wide digit divarication; and (5) presence of manus imprints. Because of their age (late Santonian-early Campanian), it is tempting to identify the trackmaker as a hadrosaur. Indeed, hadrosaurs are known from body fossils in the Menefee Formation (Hunt and Lucas, 1993). Furthermore, the Menefee tracks generally resemble tracks attributed to hadrosaurs by various workers, including Langston (1960), Alonso (1980), Lockley et al. (1983), Parker and Rowley (1989) and Thulborn (1990), and are about the same shape and size as the hadrosaur tracks from the Mesaverde Formation near Gunnison, Colorado, documented by Lockley et al. (1983).

However, for ichnotaxonomic purposes it is not clear that the tracks of large iguanodonts and of hadrosaurs can be differentiated (Thulborn, 1990). Indeed, the Menefee tracks most closely resemble tracks assigned to *Caririchnium leonardii* (cf. Lockley and Hunt, 1995), which are mostly of Early Cretaceous age and therefore attributed to non-hadrosaurian ornithopods. Indeed, we assign the Menefee tracks to *C. leonardii* based on wide tridactyl morphology with wide, blunt toe impressions, a bilobed heel and a small manus imprint (Lockley, 1987; Hunt and Lucas, 1998).

It is significant that coal-bearing Mesaverde Group tracksites in Utah (Parker and Rowley, 1989), Colorado (Lockley et al., 1983) and in New Mexico (this report) are dominated by hadrosaur tracks. Lockley et al. (1994) named a *Caririchnium* ichnocoenose (originally defined as an ichnofacies: see Hunt and Lucas, 2006) for ichnofaunas dominated by the ornithopod track *Caririchnium*. The *Caririchnium* ichnocoenose occurs in the late Albian of the Western Interior, and the Menefee ichnofauna

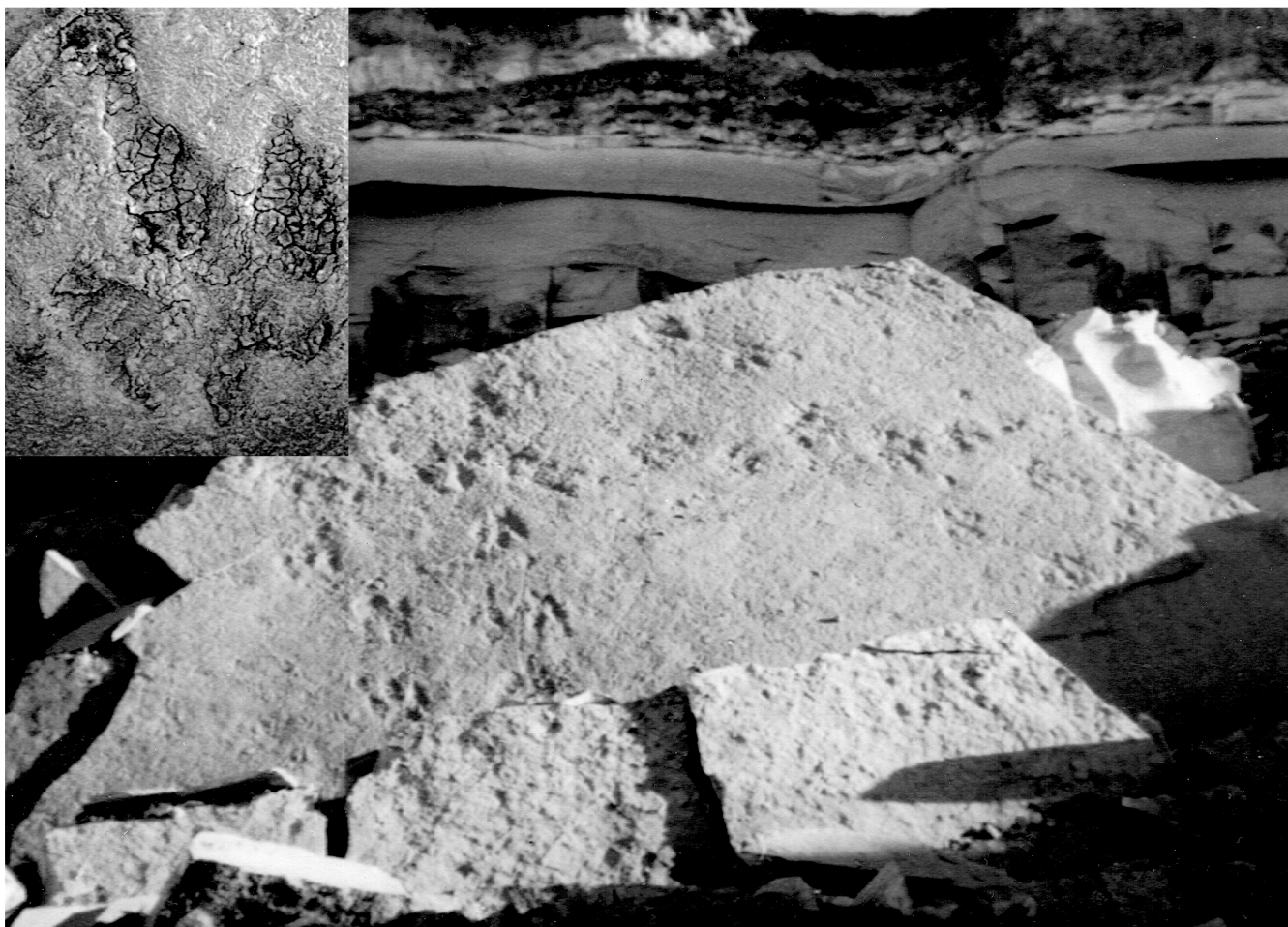


FIGURE 2. Overview of sandstone slab with ornithomimid tracks and detail (inset photograph) of particularly well-preserved footprint. The footprint in the inset photograph is 30 cm long.

represents an age extension into the Santonian or Campanian.

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REFERENCES

- Alonso, R., 1980, Ichnites de dinosaurios (Ornithopoda, Hadrosauridae) en el Cretácico Superior del norte de Argentina: *Acta Geologica Lilloana*, 15: 55-63.
- Chapman, Wood and Griswold, Inc., 1979, Geology of Grants uranium region: New Mexico Bureau of Mines and Mineral Resources, Geologic Map 31, 3 sheets, scale 1:125,000.
- Heckert, A. B. and Lucas, S. G., 1998, A new dinosaur track locality from the Dakota Sandstone (Upper Cretaceous: Cenomanian) in west-central New Mexico: *New Mexico Museum of Natural History and Science, Bulletin* 14, p. 169-171.
- Hunt, A. P. and Lucas, S. G., 1993, Cretaceous vertebrates of New Mexico: *New Mexico Museum of Natural History and Science, Bulletin* 2, p. 77-91.
- Hunt, A. P. and Lucas, S. G., 1998, Tetrapod ichnofaunas from the Lower Cretaceous of northeastern New Mexico, USA: *New Mexico Museum of Natural History and Science, Bulletin* 14, p. 163-167.
- Hunt, A. P. and Lucas, S. G., 2003, A new hadrosaur track from the Upper Cretaceous Fruitland Formation of northwestern New Mexico; *New Mexico Geological Society, Guidebook* 54, p. 379-381.
- Hunt, A. P. and Lucas, S. G., 2006, Tetrapod ichnofacies: a new paradigm: *Ichnos*, in press.
- Langston, W., Jr., 1960, A hadrosaurian ichnite: *Natural History Papers of the National Museum of Canada*, no. 4, 9 pp.
- Lockley, M. G., 1987, Dinosaur footprints from the Dakota Group of eastern Colorado: *Mountain Geologist*, v. 24, p. 161-186.
- Lockley, M. G. and Hunt, A. P., 1994, A track of the giant theropod dinosaur *Tyrannosaurus* from close to the Cretaceous/Tertiary boundary, northern New Mexico: *Ichnos*, v. 3, p. 213-218.
- Lockley, M. G. and Hunt, A. P., 1995, Dinosaur tracks and other fossil footprints of the western United States. New York, Columbia University Press, 338 pp.
- Lockley, M. G., Hunt, A. P. and Meyer, C., 1994, Vertebrate tracks and the ichnofacies concept: implications for paleoecology and palichnostratigraphy; in Donovan, S., ed., *The paleobiology of trace fossils*: London, John Wiley, p. 241-268.
- Lockley, M. G., Lucas, S. G. and Hunt, A. P., 2000, Dinosaur tracksites in New Mexico: A review: *New Mexico Museum of Natural History and Science, Bulletin* 17, p. 9-16.
- Lockley, M. G., Young, B. H. and Carpenter, K., 1983, Hadrosaur locomotion and herding behavior: Evidence from footprints in the Mesaverde Formation, Grand Mesa Coal Field, Colorado: *The Mountain Geologist*, v. 20, p. 5-14.
- Molenaar, C. M., 1983, Major depositional cycles and regional correlations of Upper Cretaceous rocks, southern Colorado Plateau and adjacent areas; in Reynolds, M. W. and Dolly, E. D., eds., *Mesozoic paleogeography of the west-central United States*: Denver, RMS-SEPM, p. 201-224.

Parker, L. R. and Rowley, R. L., Jr., 1989, Dinosaur footprints from a coal mine in east-central Utah; in Gillette, D. D. and Lockley, M. G., eds., *Dinosaur tracks and traces*: Cambridge, Cambridge University Press, p. 361-366.

Thulborn, T., 1990, *Dinosaur tracks*. London, Chapman and Hall, 410 pp.

Wolberg, D. L., Hall, J. P. and Bellis, D., 1988, First record of dinosaur footprints from the Fruitland Formation, San Juan Basin, San Juan County, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 122, p. 33-34.

