A NEW DINOSAUR TRACK LOCALITY FROM THE DAKOTA SANDSTONE (UPPER CRETACEOUS: CENOMANIAN) IN WEST-CENTRAL NEW MEXICO

ANDREW B. HECKERT[1] and SPENCER G. LUCAS[2]

[1]Department of Earth & Planetary Sciences, University of New Mexico, Albuquerque, NM 87131;
[2]New Mexico Museum of Natural History and Science, 1801 Mountain Road NW, Albuquerque, NM, 87104

ABSTRACT: We assign two incomplete dinosaur tracks from the Dakota Sandstone in Socorro County, west-central New Mexico to the ichnogenus *Caririchnium* sp., widely believed to represent the tracks of an iguanodontid ornithopod dinosaur. This is the first record of Cretaceous dinosaur tracks from west of the Rio Grande rift in New Mexico. Previous work suggests that the Dakota Sandstone in west-central New Mexico is of middle Cenomanian age, which makes these tracks younger than those of the so-called "dinosaur freeway" in the Dakota Group of northeastern New Mexico and eastern Colorado.

INTRODUCTION

Recently, we learned of the occurrence of dinosaur tracks on private land in the Jaralosa Creek drainage system in Socorro County, west-central New Mexico (Fig. 1A). We have cast the tracks, preserved as two incomplete pedal impressions in convex hyporelief on a single large slab, and studied the stratigraphy of the locality to determine that these are the first Cretaceous dinosaur tracks reported from New Mexico outside of the northeastern portion of the state (Fig. 1A; also see Hunt and Lucas, this volume). In this paper, NMMNH = New Mexico Museum of Natural History and Science, Albuquerque.

GEOLOGIC SETTING

The locality, NMMNH L-3758, is in a yellowish gray (5Y7/2) to light olive gray (5Y6/1) sandstone that crops out in an arroyo on the eastern edge of a low hogback on the east flank of Jaralosa Creek in section 13, T1N, R6W, Socorro County, New Mexico (Fig. 1B). The beds here strike nearly due north–south and dip 33–38° to the east. The tracks are preserved in convex hyporelief on the undersurface of a bed of fine- to medium-grained, moderately well sorted, subangular to subrounded quartzarenite that is typically 15–30 cm thick. This sandstone is sheety to weakly ripple-laminated and well-indurated. A thin (< 5 cm) layer of medium gray (N5), very fissile calcareous shale underlies the track-bearing sandstone and appears to be the actual substrate into which the tracks were impressed. However, this layer is almost completely weathered away, and the only remaining tracks at the locality consist of other fragmentary, convex hyporelief tracks. Other bedforms preserved in the track-bearing sandstone include mudcracks, preserved in much the same manner as the tracks, and some isolated flute casts and tool marks.

The track-bearing layers are in the stratigraphically highest layers of a ledge-forming sandstone approximately 10 m thick that rests disconformably on the bentonitic mudstone and sublitharenite of the upper part (Painted Desert Member, Petrified Forest Formation) of the nonmarine Upper Triassic Chinle Group (Fig. 1B). The dominant lithology in this ledge-forming sandstone is a yellowish gray (5Y7/2) fine- to medium-grained, subangular, moderately poorly sorted, quartz-rich sublitharenite to quartzarenite. Locally there are some greenish black (5GY2/1) spots, and these sandstones may weather to moderate orange pink (5YR8/4) and grayish orange pink (5YR7/2). There are some thin interbeds of similar lithology to the track-bearing shale. Overlying this low hogback is a slope-forming interval dominated by light olive gray (5Y5/2) to greenish gray (5GY6/1) mudstone that locally weathers to moderate orange pink (5YR8/4) and grayish orange pink (5YR7/2). Interbedded in this mud-dominated interval are thin (< 1 m thick) sandstones that are grayish olive (10Y4/2) fresh, weathering to dark yellowish orange (10YR6/6) and pale red purple (5RP6/2). These sandstones are typically very fine- to fine-grained, moderately sorted, subangular quartzarenites.

Approximately 15–20 meters above the track-bearing sandstone is another prominent sandstone bench of similar lithology, approximately 5 m thick. This sandstone has prominent

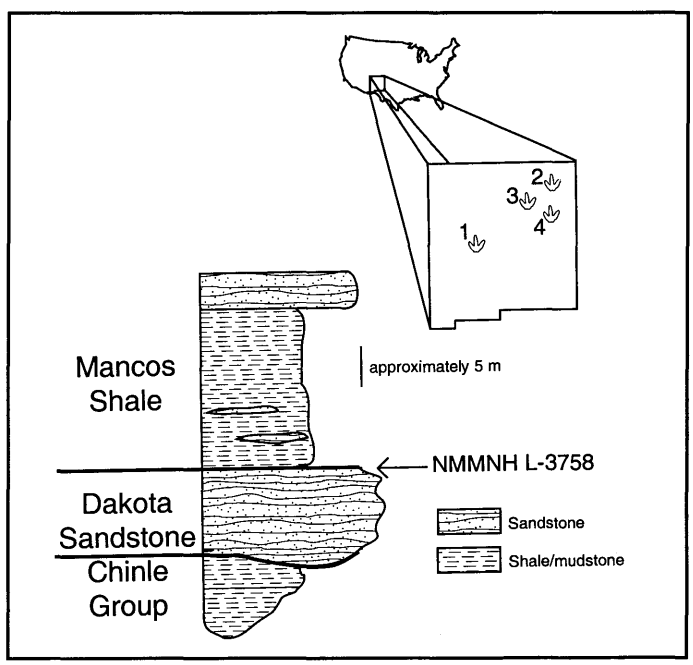


FIGURE 1. **A**, Index map showing the geographic distribution of known Dakota Group dinosaur tracks in New Mexico. **B**, Generalized stratigraphic section showing the geographic and stratigraphic position of the ornithopod tracks at NMMNH locality L-3758. **1** = Jaralosa Creek, Socorro County; **2** = Clayton Lake, Union County; **3** = Mills Canyon, Harding County; **4** = Mosquero Creek, Harding County.

interference ripples and other sedimentary structures associated with tidal channel deposits.

Most workers in the region have reported difficulty in correlating the Cretaceous System in west-central New Mexico to the better-exposed, more continuous outcrops in the San Juan Basin to the north (e.g., Pike, 1947; Tonking, 1957; Foster, 1964; Hook, 1983a; Hook et al., 1983). The generalized stratigraphic section we report here, however, closely matches the basal Cretaceous System in the region to the north and east (Tonking, 1957; Hook, 1983a; Hook et al., 1983) and the south and west (Foster, 1964). In particular, we note that all of these authors report that the Dakota Sandstone rests disconformably on the Chinle Group in this region, also reported by Lucas and Heckert (1994) in their study of the Chinle to the north and east of L-3758. Thus, the track-bearing horizon closely matches the stratigraphic position, thickness, and lithologies reported from the Dakota Sandstone in the region. The overlying mudstone-dominated interval almost certainly pertains to the lower shaly interval of the Mancos Shale (Foster, 1964; Hook, 1983a; Hook et al., 1983), and the sandstone above the track-bearing horizon may pertain to the Twowells Tongue of the Dakota Sandstone (Hook et al., 1983).

Therefore, L-3758 occurs at the top of the Dakota Sandstone. Throughout west-central New Mexico, the Dakota Sandstone is stratigraphically equivalent to the Romeroville Sandstone in the northeastern part of the state but is somewhat younger due to time-transgressive deposition of the Dakota Sandstone. This is an important correlation, as this indicates that the tracksite we report here is at a different stratigraphic level, and therefore considerably younger, than those from the eastern part of the state, all of which occur at the top of the Mesa Rica Sandstone or the Pajarito Formation, of late Albian age (Hunt and Lucas, this volume). Hook (1983a) and Hook et al. (1983) reported an invertebrate fauna consisting of the inoceramid *Inoceramus rutherfordi*, the oyster *Ostrea beloiti*, and the ammonite *Turrilites acutus americanus* from very low in the Mancos Shale and the ammonites *Neostlingoceras kottlowskii*, *Metoicoceras mosbyense*, and *Metoicoceras* sp. from higher in the section near Puertocito, 14 km north-northeast of L-3758. *Inoceramus rutherfordi* indicates a latest middle Cenomanian age and *Metoicoceras mosbyense* indicates an early late Cenomanian age for the lower Mancos shale (Hook, 1983a, 1983b). Thus, the underlying Dakota Sandstone is probably of middle Cenomanian age (Hook, 1983a, 1983b).

DESCRIPTION

Casts of the two well-preserved tracks from L-3758 are catalogued at the NMMNH as specimen P-8000 and clearly pertain to a three-toed, medium-sized dinosaur (Fig. 2). The anterior track only preserves two digits (II and III), the third (IV) apparently did not impress into the muddy substrate. The heel is partially preserved, primarily on the medial side of the track. This track is clearly of the right pes of an ornithopod dinosaur. The more posterior track, which does preserve all three toes but is truncated posteriorly at the edge of the slab, is obviously the left pes of the same animal. The partial heel imprint from the anterior track preserves a single lobe offset to the left of the midline. Thus, it appears that the pes prints were bilobed, allowing us to assign this print to the ichnogenus *Caririchnium*, as opposed to the ichnogenus *Amblydactylus*, which has a single lobe along the midline (Leonardi, 1984; Lockley, 1987).

The two valid ichnospecies assigned to *Caririchnium* are *C. magnificum* Leonardi (1984) and *C. leonardii* Lockley (1987) (see Hunt and Lucas, this volume). The two ichnogenera are distinguished by differences in the morphology of the manus prints (Lockley, 1987), so we are unable to assign the Socorro County tracks to either ichnospecies, and instead identify them as *Caririchnium* sp., but note that all *Caririchnium* tracks in New Mexico and throughout the American west that are diagnostic to the species level have been assigned to *C. leonardi* (Lockley, 1987; Lockley et al., 1992; Hunt and Lucas, this volume).

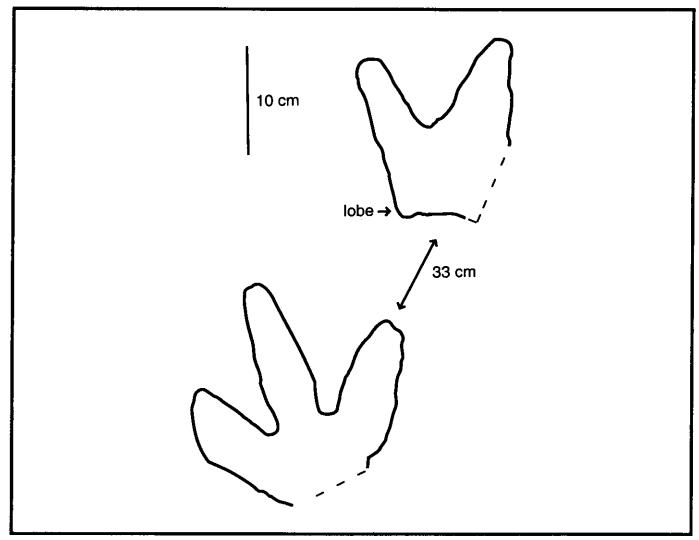


FIGURE 2. Outline drawings of NMMNH P-8000, two partial tracks assigned to *Caririchnium* sp., from the Dakota Sandstone at NMMNH locality L-3758.

SIGNIFICANCE

This track locality is significant for two reasons: (1) it extends the known record of Cretaceous tracks in New Mexico west-southwest by over 350 km; (2) it is the stratigraphically highest (youngest) tracksite associated with the Dakota Sandstone in New Mexico, and thus is of Cenomanian, not late Albian, age.

Until this study, all Cretaceous dinosaur tracks from New Mexico were known only from localities in the northeastern portion of the state (Fig 1A; Hunt and Lucas, this volume). In spite of the long history of study of Cretaceous stratigraphy in the San Juan Basin and elsewhere in New Mexico, the tracks we report here are the first that are not associated with the Mesa Rica Sandstone and the Pajarito Formation in the Great Plains and along the front ranges of the Rocky Mountains, over 350 km to the north and east of L-3758. Thus, these tracks are by far the southwesternmost record of *Caririchnium* in New Mexico.

Secondly, these tracks are from a stratigraphic interval equivalent to the Dakota Sandstone *sensu stricto* (or Romeroville Sandstone of the Dakota Group), which overlies the more eastern tracksites associated with the "dinosaur freeway" of Lockley et al. (1992). Thus, these trackways are stratigraphically higher, and substantially younger, than the "dinosaur freeway" trackways. The abundant lines of evidence documented previously, and based primarily on invertebrate fossils, indicate that the Dakota Sandstone at L-3758 is of middle Cenomanian age (Hook, 1983a,b), making these tracks by far the youngest Cretaceous dinosaur tracks associated with the Dakota Sandstone in New Mexico.

ACKNOWLEDGMENTS

Steve Cather at the New Mexico Bureau of Mines and Mineral Resources alerted us to the dinosaur tracks. Mr. Lee Henderson graciously allowed us access to his land and to cast the tracks, and showed us the locality. The New Mexico Museum of Natural History and Science supported this research.

REFERENCES

Foster, R.W., 1964, Stratigraphy and petroleum possibilities of Catron County, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 85, 55 pp.

Hook, S.C., 1983a, Stratigraphy, paleontology, depositional framework, and nomenclature of marine Upper Cretaceous rocks, Socorro County, New Mexico: New Mexico Geological Society Guidebook 34, p. 165-172.

Hook, S.C., 1983b, Mid-Cretaceous molluscan sequence at Gold Hill, Jeff Davis County, Texas, with comparison to New Mexico: New Mexico Bureau of Mines and Mineral Resources, Circular 185, p. 48-54.

Hook, S.C., Molenaar, C.M. and Cobban, W.A., 1983, Stratigraphy and revision of nomenclature of Upper Cenomanian to Turonian (Upper Cretaceous) rocks of west-central New Mexico: New Mexico Bureau of Mines and Mineral Resources, Circular 185, p. 7-28.

Hunt, A.P. and Lucas, S.G., 1998, Tetrapod ichnofaunas from the Lower Cretaceous of northeastern New Mexico, USA, this volume.

Leonardi, G., 1984, Le impronte fossili di dinosauri; *in* Bonaparte, J.F. et al., eds., Sulle orme di dinosauri, Venezia Erizzo, p. 161-186.

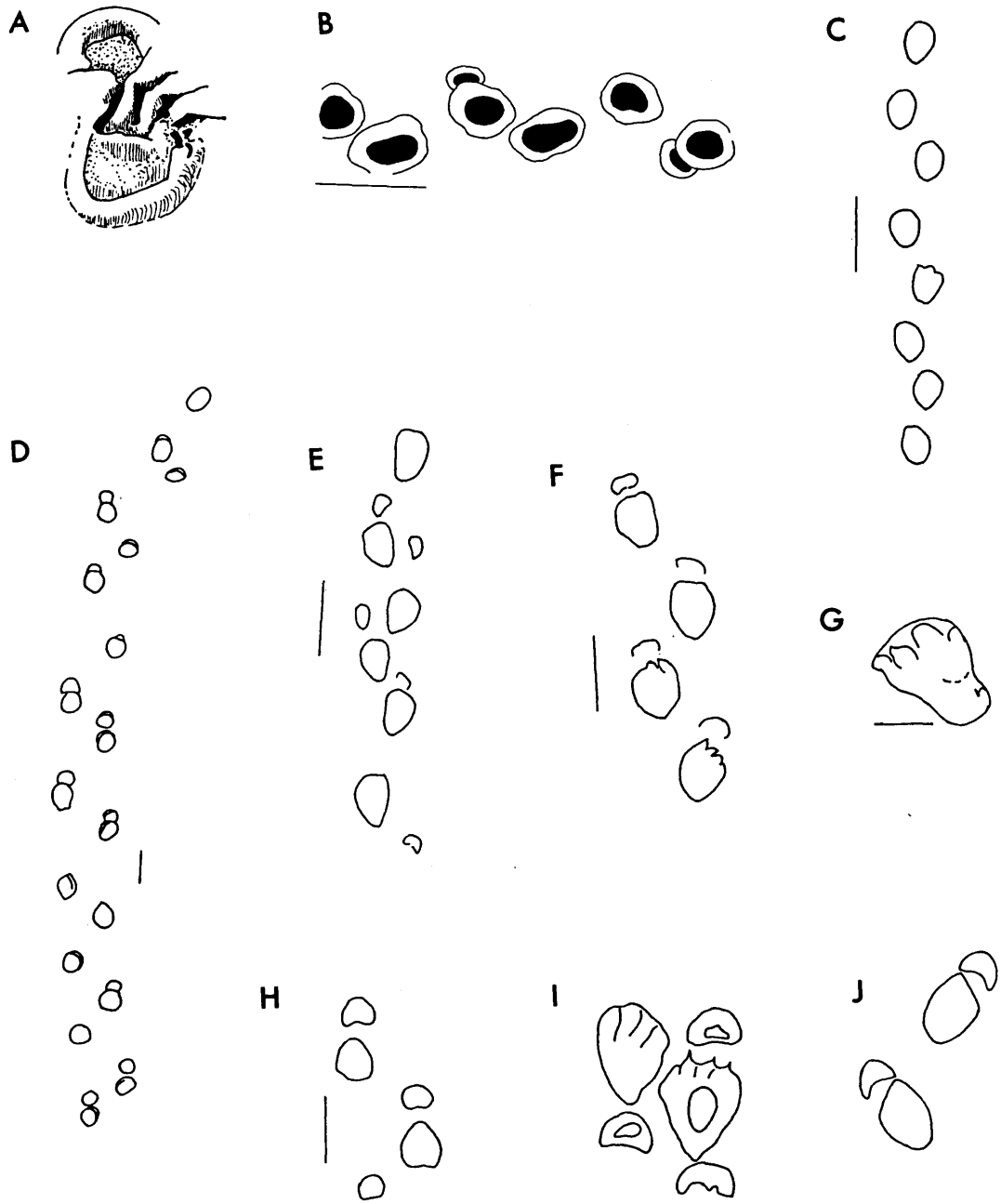
Lockley, M.G., 1987, Dinosaur footprints from the Dakota Group of Eastern Colorado: The Mountain Geologist, 24, p. 161-186.

Lockley, M.G., Holbrook, J., Hunt, A.P., Matsukawa, M. and Meyer, C., 1992, The dinosaur freeway: a preliminary report on the Cretaceous megatracksite, Dakota Group, Rocky Mountain Front Range, and High Plains, Colorado, Oklahoma and New Mexico; *in* Flores, R., ed., Mesozoic of the Western Interior field trip guidebook, SEPM Midyear Meeting Fieldtrip Guidebook, p. 39-54.

Lucas, S.G. and Heckert, A.B., 1994, Triassic stratigraphy in the Lucero uplift, Cibola, Valencia and Socorro counties, New Mexico: New Mexico Geological Society Guidebook 45, p. 241-254.

Pike, W.S. Jr., 1947, Intertonguing marine and nonmarine Upper Cretaceous deposits of New Mexico, Arizona, and southwestern Colorado: Geological Society of America, Memoir 24, 103 pp.

Tonking, W.H., 1957, Geology of Puertocito quadrangle, Socorro County, New Mexico: New Mexico Bureau of Mines and Mineral Resources, Bulletin 41, 67 pp.



Various footprints attributed to sauropod dinosaurs (from Farlow, J. O., 1987, Lower Cretaceous dinosaur tracks, Paluxy River valley, Texas: Baylor University).