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Spencer G. Lucas, Adrian P. Hunt, and Phillip Huber

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JURASSIC DINOSAUR FOOTPRINTS FROM NEW MEXICO

SPENCER G. LUCAS,[1] ADRIAN P. HUNT[1,2] and PHILLIP HUBER[2]
[1]New Mexico Museum of Natural History, P.O. Box 7010, Albuquerque, New Mexico 87194-7010;
[2]Department of Geology, University of New Mexico, Albuquerque, New Mexico 87131

Abstract—This is the first report of Jurassic dinosaur footprints from New Mexico. Two footprints of a large theropod dinosaur, identified as *Grallator* sp., were collected from the lower part of the Morrison Formation near Las Vegas, New Mexico. These footprints add to a scattered dinosaur-footprint record from the Jurassic-Cretaceous Morrison Formation

INTRODUCTION

Dinosaur footprints are well known in New Mexico from rocks of Late Triassic and Early Cretaceous age (Conrad et al., 1987; Hunt et al., 1989; Lucas et al., 1989). They are also known from Late Jurassic strata of the Morrison Formation in southeastern Colorado (Lockley et al., 1986). Here, we report the first Jurassic (Morrison Formation) dinosaur footprints discovered in New Mexico.

STRATIGRAPHIC CONTEXT

One of us (PH) discovered a slab of sandstone with two dinosaur footprints in the east-facing cut of I-25 at Romeroville Gap (sec. 16, T15N, R16E: Fig. 1) about 7 km south of Las Vegas, San Miguel County. The stratigraphic section at Romeroville Gap has been described numerous times, most recently by Lucas et al. (1985a, b) and Lucas and Kietzke (1986). The Jurassic strata here begin with the Entrada Sandstone overlain by 5.9 m of kerogenic limestone of the Todilto Formation of Callovian age (Lucas and Kietzke, 1986). The overlying 8.7 m of shale and siltstone were incorrectly identified by Kietzke (in Lucas et al., 1985b) as "Bell Ranch Formation?" However, these strata clearly pertain to the lower part of the Morrison Formation (cf. Mankin, 1958). The Bell Ranch Formation, from its type area near Tucumcari, pinches out (or is beveled off by the J-5 unconformity of Pipiringos and O'Sullivan, 1978) to the west before Trujillo Hill (sec. 15, T15N, R21E) about 50 km east of Romeroville. These lower Morrison strata include the "agate bed," a marker interval of nodular chalcedony present in the lower Morrison across northeastern New Mexico (Neuhauser et al., 1987).

The dinosaur footprints are preserved as impressions near the base of a sandstone 1.8 m above the "agate bed" (Fig. 1; Appendix 1). The parting of the track surface is a ripple-laminated diastem above an underlying surface with two track impressions. Although the Morrison Formation is now known to include strata of Late Jurassic and Early Cretaceous age (Lucas, 1989), the footprint-bearing sandstone is low enough in the Morrison (more than 100 m of Morrison strata are above it) to be of probable Jurassic age. The footprint-bearing slab was found as a piece of rubble after apparent work on the highway cut. Although the stratigraphic position of the slab was located unambiguously, steepness of the outcrop prevented further excavation.

THEROPOD FOOTPRINTS

The dinosaur footprints are preserved as impressions in a slab of sandstone 48 cm long, 33 cm wide and 7.5 cm thick catalogued as NMMNH (New Mexico Museum of Natural History) P-14159 (Fig. 2). Exfoliation of the trackbearing surface has obscured the ripple marks that cover the upper surface of the slab.

Two footprints are present on the slab. The better-preserved print is of a three-toed left pes. The other print includes the tips of digits 2 and 3 along the end of the slab. The left pes has a maximum length of 27 cm, a maximum width of 18.5 cm and digit divarication of 47°. Individual digit pads can be discriminated weakly for about 20 cm from the anterior end of the footprint before they coalesce into a single heel impression. Digit 2 is 17 cm long (length from back of heel), has an acute tip and is curved slightly outward. Digit 3 is 27 cm long and has an indistinct tip. Digit 4 is 20.5 cm long with a sharp tip. Measurement between the anterior tips of the second digits of both footprints gives a pace of 44.5 cm. Depth of the footprint impressions ranges from 1 to 2 cm.

The tridactyl morphology of the footprints, together with their sharp digit tips, indicating the presence of claws, indicate that these footprints represent theropod dinosaurs (cf. Haubold, 1971, fig. 47, 1–2; Olsen and Galton, 1984, fig. 4A–B). Indeed, NMMNH is very similar to footprints attributed to "carnosaurs" by Lockley et al. (1986, figs. 8D–E, 9C). The large size of the footprints suggests they do represent a large theropod ("carnosaur"). The morphology of the prints is typical of the Theropoda, and they are very similar to footprints from the Upper

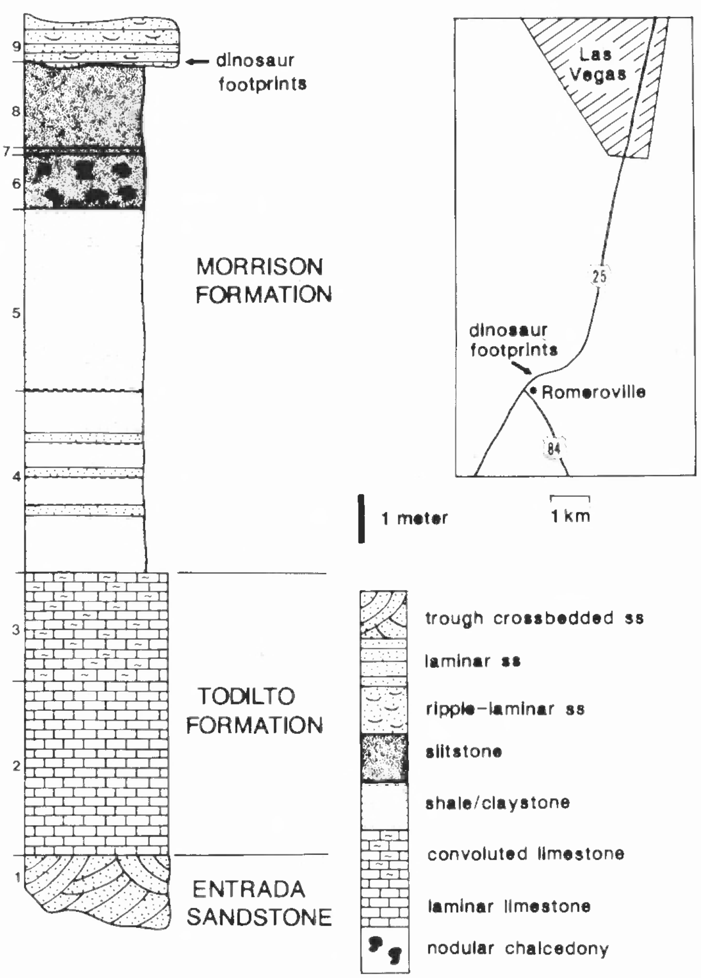

FIGURE 1. Location map and stratigraphic section of dinosaur-footprint locality in lower Morrison Formation at Romeroville, San Miguel County, New Mexico. See Appendix 1 for description of lithologic units in measured section.

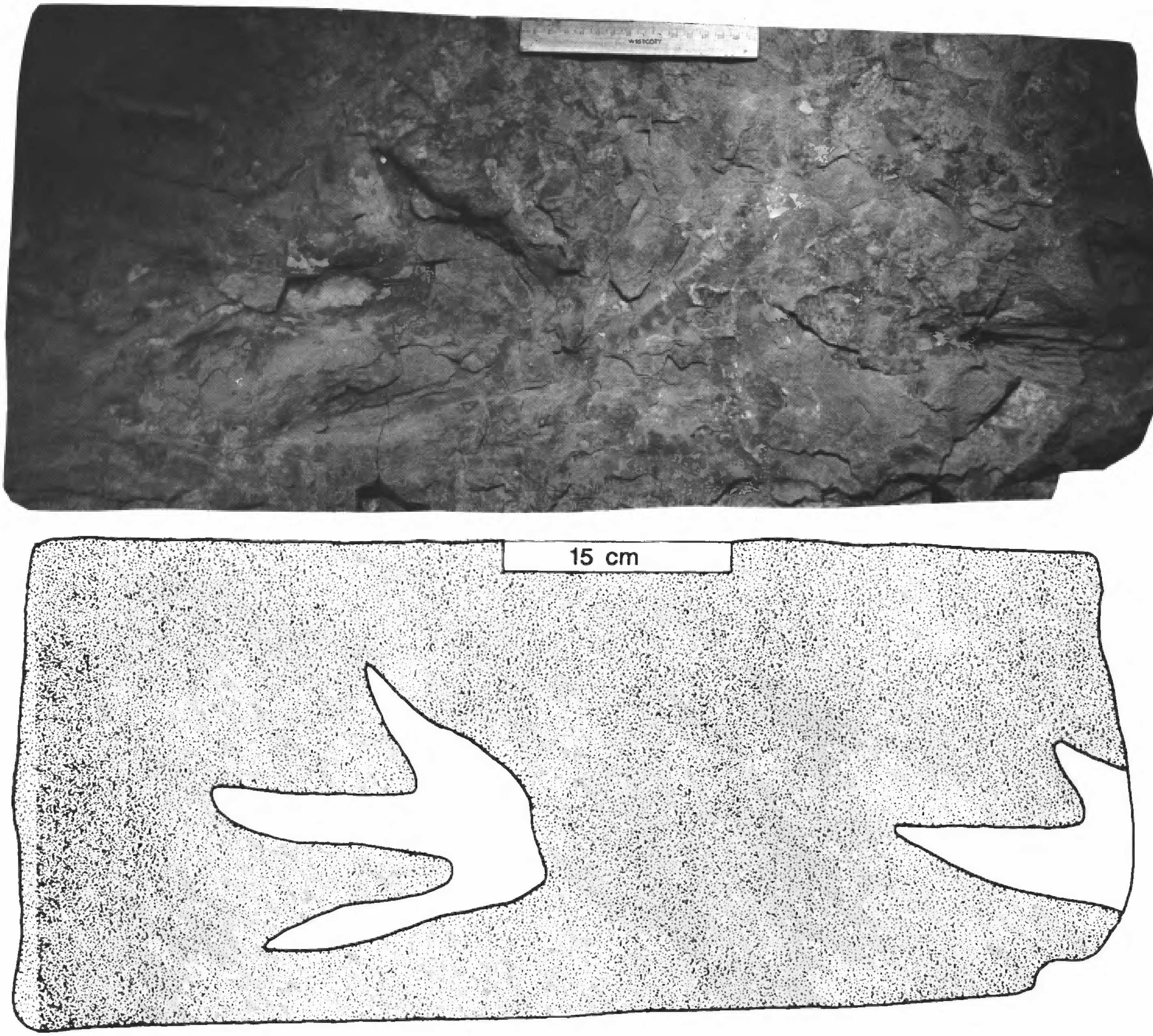

FIGURE 2. NMMNH P-14159, footprints of a large theropod dinosuar, *Grallator* sp., from the lower part of the Morrison Formation at Romeroville, San Miguel County, New Mexico.

Triassic-Lower Jurassic of eastern North America named *Grallator* or *Eubrontes* (Haubold, 1971, fig. 47, 1–6; Olsen and Galton, 1984, fig. 4A–B). Given the relatively indistinct morphology of the Romeroville footprints, we follow the philosophy of Olsen and Galton (1984) and identify NMMNH P-14159 as *Grallator* sp.

These are the first Jurassic dinosaur footprints reported from New Mexico. They also add to a relatively scattered record of dinosaur footprints across the broad geographic extent of the Morrison Formation (Lockley et al., 1986) and thus bring to 23 the number of known Morrison footprint occurrences (M. Lockley, written commun., 1990).

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APPENDIX—STRATIGRAPHIC SECTION

The stratigraphic section in Figure 1 is described below. Strata dip 25° to N60°E. Rock colors are those of Goddard et al. (1984).

unit	lithology	thickness (m)
Morrison Formation:		
9	Sandstone; yellowish gray (5 Y 7/2); very fine grained to fine grained; subrounded; poorly sorted; quartzose; very slightly calcareous; laminar and ripple laminar; dinosaur footprints at base.	0.9+
8	Sandy siltstone; greenish gray (5 GY 6/1); sand is very fine grained, subangular-subrounded quartz; very slightly calcareous; bioturbated.	1.7
7	Siltstone; bluish white (5 B 9/1); highly calcareous; forms a prominent white band (altered bentonite?).	0.1
6	Interbedded sandy siltstone and nodular chalcedony ("agate bed"); sandy siltstone is brownish gray (5 YR 4/1) and noncalcareous with sand that is fine grained, subangular quartz; nodular chert is medium dark gray (N 4) and light gray (N 7) with moderate red (5 R 4/6) streaks.	1.2
Disconformity (J5 unconformity of Pipiringos and O'Sullivan, 1978)		
Todilto Formation:		
3	Limestone; medium dark gray (N 4); kerogenic micrite; convoluted bedding; vuggy at top.	2.3
2	Limestone; same color and lithology as unit 3; finely laminar to "crinkly."	3.6
Entrada Sandstone:		
1	Sandstone; pale yellowish orange (10 YR 8/6); fine to medium grained; subrounded; quartzose; trough crossbedded.	not measured

The Buffalo mine, which derived its name from parent Buffalo–New Mexico Mining Company, was located on the west fork of Placer Creek near Red River. Long on dreams and short on luck, the Buffalo, like many other mining ventures in the district, developed abundant water and hardship but too little pay grade ore. Although well equipped to handle the bonanza that never materialized, the mine died during the great depression. Harry Moberg and Jack Munden (mine foreman) pose beside the mine car with the company mascots. Could that be Dick Hahman's grandfather at the far right? Photo courtesy of Winifred Hamilton.