REPRINT FROM *PALEONTOLOGY AND GEOLOGY OF THE DINOSAUR TRIANGLE*
Edited by WALTER R. AVERETT
The Museum of Western Colorado, 1987

DINOSAUR TRACKSITES OF WESTERN COLORADO AND EASTERN UTAH

LATE CRETACEOUS COAL MINE TRACKS

MARTIN G. LOCKLEY AND CHET JENNINGS

Abstract

A large number of dinosaur tracksites, some yielding other interesting trace fossils, are known in the Dinosaur Triangle region of western Colorado and eastern Utah. However, few of the Triassic and Jurassic sites are documented to any extent, and the Late Cretaceous tracksites in coal mines, although historically famous, also lack proper documentation. A brief historical overview of the Late Cretaceous coal mine tracks is presented.

Introduction

On the Colorado Plateau, dinosaur footprints and other fossil tracks and traces occur in rocks representing all three periods of the Mesozoic Era. The northern part of the plateau, the Dinosaur Triangle area, is no exception, and we report herein on dinosaur tracksites of Cretaceous age (fig. 1). The tracksites from each time period are entirely different in terms of the animals and ancient environments represented and the history of scientific study. We report on the tracksites by first outlining the type of trace fossils observed, and discussing the implications of the evidence for interpretation of ancient biotas and their habitats.

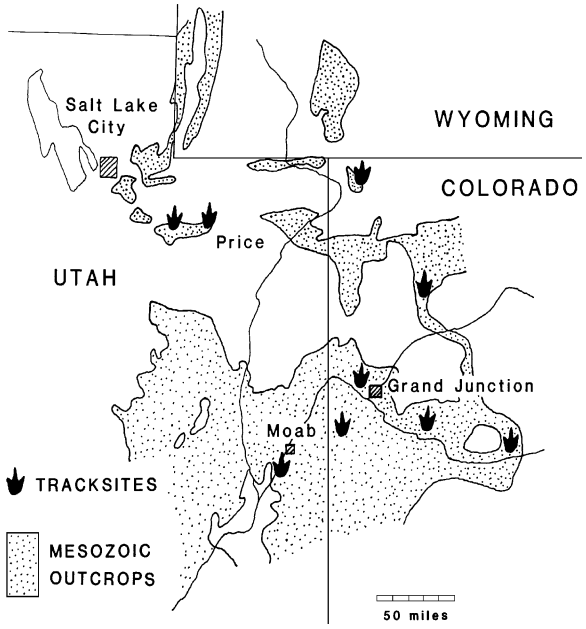

Figure 1. Simplified geologic map of the Dinosaur Triangle region, showing generalized locations of tracksites referred to in text.

The study of trace fossils is known as ichnology, and a species or genus name given to a particular track or trail is known as an ichnospecies or ichnogenus. If a specific designation cannot be given, a broader grouping, such as ichnofamily, may be appropriate. All such categories are referred to as ichnotaxa (singular ichnotaxon).

Late Cretaceous Footprints

The story of Late Cretaceous dinosaur footprint research is centered around material discovered in the coal mines of Colorado and Utah. The story is historically fascinating, but a nightmare from the scientific viewpoint. The cast of characters includes a mystery dinosaur called “Xosaurus”, contenders for the world’s largest and smallest tracks, and several famous paleontologists, including Earl Douglass, discoverer of Dinosaur National Monument; Barnum Brown, from the American

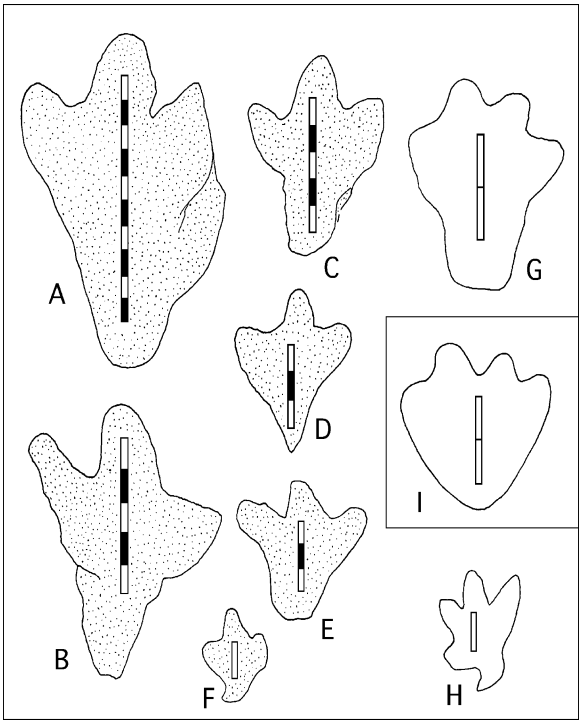

Figure 2. Outline drawings of Late Cretaceous "Dinosauropodes" from the area of Price, Utah, illustrated by Strevell (1932, 1940) and named by Lull. A through H, respectively, were assigned the trivial ichnospecies names Magrawii, Wilsonii, Bransfordii, Sweeti, Sternbergii, Nettletoni, Osbornii, and Crawfordii (Strevell, 1940, p. 14-15). This order has some significance, and follows the direction of R.S. Lull; A-F are 3-toed (tridactyl) forms (stippled), G is a 4-toed ?ceratopsian, and H is a problematic track. I is a ceratopsian track from the Price area (after Lockley, 1986).

Museum of Natural History; Richard Swann Lull, from the Peabody Museum; and Charles Gilmore, from the Smithsonian.

In 1924 William Peterson, of the Utah Agricultural College at Logan, published the first illustrated account, entitled "Dinosaur tracks in the roofs of coal mines", and quoted Dr. W.D. Mathew, of the American Museum of Natural History, who inferred that the large three-toed tracks (length 76 cm; width 79 cm) could be attributed to *Tyrannosaurus*.

In 1932, Charles Strevell, of Salt Lake City, published an article entitled "Dinosauropodes", in which eight new species names were proposed, based on casts removed from mines in the vicinity of Price, Utah. He indicated that the name "Dinosauropodes" (literally "terrible lizard foot") had been coined by Earl Douglass. Although no thorough account appeared in the paleontological literature, Strevell wrote to leading paleontologists and published excerpts from their correspondence. Charles Gilmore wrote that the tracks "were made by one of the larger members of the duckbilled dinosaurs", whereas Barnum Brown expressed interest in the "largest" specimen "Dinosauropodes Magrawii"), which measured 136 cm long by 91 cm wide. However, Strevell was mainly influenced by Richards Swann Lull, a leading footprint expert, who visited Salt Lake City to examine the specimens "personally", and concluded that "it might be worth while to publish the photographs and a description of these tracks". Lull's encouragement prompted Strevell to illustrate eight different footprints, all with different species names (fig. 2).

Unfortunately, Strevell's descriptions do not conform to accepted systematic procedure, and his inexperience shows in a number of ways. He used the same ichnogenus ("Dinosauropodes") to encompass both three-toed and four-toed tracks, he capitalized the species names, and he published in the Deseret News, not in a recognized scientific journal. These considerations conspire to make his names invalid and in need of proper revision. Whereas the three-toed tracks are almost certainly hadrosaurian, the four-toed track ("Dinosauropodes Osborni") is probably ceratopsian (Lockley, 1986). These latter are relatively uncommon, probably suggesting that they were rare visitors to the coal swamp environments.

The coal mine tracks of Colorado and Utah developed quite a reputation in the 1930s. Barnum Brown had already expressed an interest in the largest specimens because they would make spectacular exhibits. With this objective in mind he coordinated his 1937 expeditions to include track excavation at a coal mine near Cedaredge, Colorado, and promptly published a paper entitled "The Mystery Dinosaur" (Brown, 1938), with a subtitle referring to "footprints of a giant with a 15-ft stride". The term "mystery dinosaur" had appeared in the New York Times, and was adopted by Brown and his assistants in 1937 while searching the Mesaverde of Wyoming for the giant's skeletal remains (Bird, 1985, p. 102). There is also evidence that the idea of the 15-ft step originated from the message sent to Brown by the mine owner. Nevertheless, despite the precedents set in 1937, it was Brown's rather sensationalistic approach and lack of supporting scientific publications that ultimately shrouded the evidence in exaggerated and anecdotal interpretation. Gilmore and Lull had already made some matter-of-fact statements about the tracks, but Brown was the only eminent paleontologist to actually put pen to paper. In doing so he perpetuated several myths that were still being debated in the 1980s.

Although Brown's approach was understandable in the context of his role as collector and public relations spokesman for the American Museum of Natural History, his preoccupation with large tracks and trackway segments that showed monstrous steps glossed over the fact that other paleon-

tologists had already begun making reasonable interpretations of the evidence. Instead, he played up the lack of skeletal evidence for any dinosaur large enough to make the tracks, and actually steered the interpretation away from hadrosaurs by claiming that the pad impressions suggested a more *Iguanodon*-like animal, and that hadrosaur bones from the same mine could not be referred to the mystery dinosaur (Bird, 1985, p. 105). So the field of track interpretation veered into the realm of myth and mystery. By the time popular writers like Look (1955) had embellished Brown's interpretations, the animals were taking even more monstrous steps and throwing their weight around by stepping on animals resembling crocodiles.

Partly because of Brown's claims, inference and speculation on the step and stride length of the mystery trackmaker has developed into a convoluted debate. Because of the inaccessibility of mine trackways, the debate has focussed on the large 17-ft-long, 8000-lb American Museum slab purported to exhibit the two consecutive steps of the giant trackmaker. Although the slab clearly shows evidence of another footprint at the midpoint, Brown (1938, p. 196) overlooked the probable significance of this, and claimed that his prize exhibit showed a step of 15 ft 2 in. Look (1955, p. 71) perpetuated the belief in giant steps by suggesting that in the same mine "new tracks have a stride of sixteen feet four inches . . . the largest in the world". Again, the concept of the world's largest track can be traced back at least to the New York Times of 1957 (Bird, 1985, p. 98). Look also latched onto Brown's concept of the "mystery dinosaur" by christening it "Xosaurus", and in an inadvertently prophetic statement wrote that "Xosaurus little realized how many paleontological headaches he was going to cause".

Not content with the world's "largest" tracks, the region was soon to boast "one of the smallest tracks known". These were described by Wilson (1969, p. 25) from the Royal Mine near Castle Gate, Utah as "measuring 1 3/4 inches long by 3/4 of an inch wide". It is interesting that these small three-toed tracks resemble the larger specimens in overall shape (Lockley, 1986).

Although temporarily forgotten, the debate about the giant steps was revived when Russell and Beland (1976) disputed this interpretation by drawing attention to the midpoint footprint. Although this did not deter Russell (1981) from adhering to Brown's original interpretation, Lockley and others (1983) showed that in general, steps average between 7 and 8 ft (range 5-11). This is consistent with observations by other workers, including Peterson (1924), Strevell (1932), Wilson (1969), Balsby (1980) and Brown's own measurements of other trackways (Brown, 1938, p. 192). Although Lockley and others (1983) did not entirely dismiss the possibility of giant 15-16-ft steps, they did show that tracing trackways in the confines of coal mines is difficult. Given what is known of these and other similar large ornithopod trackmakers, it seems highly unlikely that these animals ever covered such large distances in single steps. Lockley and others (1983) also pointed out that giant hadrosaurs are now known (Morris, 1973). This would suggest that the origin of the tracks is much less mysterious than Brown suggested, and that Gilmore was on the right track from the beginning.

As a footnote, it is worth noting that access to footprint sites in mines is difficult and dangerous, and never recommended without proper authorization. A few late Cretacious tracksites exist at surface exposures, as at the De Beque landslide site. This particular site was vandalized before road widening operations cut into the track-bearing rocks. The vandalism problem is a perennial difficulty that can only be counteracted through education. All tracksites provide valuable information about our natural heritage, and tracks must always be properly studied in the context of their natural occurrence before any steps are taken to collect, preserve, or otherwise handle the material.

References

Balsley, J.K., 1980, *Cretaceous wave-dominated delta systems: Book Cliffs, east-central Utah: Tulsa, American Association of Petroleum Geologists Guidebook*, Continuing Education Department, 162 p.

Bird, R.T., 1985, *Bones for Barnum Brown*: Fort Worth, Texas, Texas Christian University Press, 225 p.

Brown, Barnum, 1938, The mystery dinosaur: *Natural History*, v. 41, p. 190-202, 235.

Lockley, M.G., 1986, Dinosaur tracksites: *University of Colorado at Denver, Geology Department Magazine*, Special Issue no. 1, 56 p.

Lockley, M.G., Young, B.H., and Carpenter, K., 1983, Hadrosaur locomotion and herding behavior: Evidence from the Mesaverde Formation, Grand Mesa Coalfield, *Colorado: Mountain Geologist*, v. 20, p. 5-13.

Look, Al, 1955, *1000 Million years on the Colorado Plateau*: Denver, Golden Bell Publishers, 354 p.

Peterson, W., 1924, Dinosaur tracks in the roofs of coalmines: *Natural History*, v. 24, p. 388-91.

Russell, D.A., 1981, Estimated speed of a giant bipedal dinosaur: Reply: *Nature* 292, p. 274.

Russell, D.A., and Beland, P., 1976, Running dinosaurs: *Nature* 264, p. 486.

Strevell, C.N., 1932, *Dinosauropodes*: Salt Lake City, Deseret News.

———— , 1940, *The Story of the Strevell Museum*: Salt Lake City Public Schools Publication, 96 p.

Wilson, W.D., 1969, Footprints in the sands of time: *Gems and Minerals*, p. 25.