

TRACKWAY OF A GIANT *ARTHROPLEURA* FROM THE UPPER PENNSYLVANIAN OF EL COBRE CANYON, NEW MEXICO

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Abstract.—We document a giant terrestrial arthropod trackway assigned to *Diplichnites cuithensis* Briggs, Rolfe and Brannan, 1979 from the nonmarine redbeds of the Cutler Group (Late Pennsylvanian, Missourian?) in El Cobre Canyon, New Mexico, a classic Pennsylvanian-Permian vertebrate fossil locality. The El Cobre trackway is the first occurrence of *D. cuithensis* in the American Southwest, and, with a width of 38 cm, the largest known trackway of *D. cuithensis*. The tracks are attributable to *Arthropleura*, a gigantic terrestrial myriapod-like arthropod. The Late Pennsylvanian age and paleoenvironmental setting of the El Cobre trackway is consistent with most other records of *D. cuithensis*.

INTRODUCTION

El Cobre Canyon in northern New Mexico (Fig. 1) has been known to paleontologists since 1858 when J. S. Newberry visited the copper mines developed in Upper Triassic strata along the canyon walls (Newberry, 1876). Most of the paleontological fame of the canyon rests on the fossil vertebrates from strata of the Pennsylvanian-Permian Cutler Group exposed in the canyon floor (e.g., Vaughn, 1963; Fracasso, 1980; Berman, 1993). These Cutler Group strata also yield a paleoflora (Hunt and Lucas, 1992) and a little studied trace-fossil assemblage. Here, we document an unusual element of this trace fossil assemblage, a locomotion trace of the giant terrestrial myriapod-like arthropod *Arthropleura*. In this paper, NMMNH refers to the New Mexico Museum of Natural History and Science, Albuquerque.

PROVENANCE

The trackway reported here was collected at NMMNH locality 6037 near the fossil plant locality first reported by Fracasso (1980) and documented by Hunt and Lucas (1992). The trackway (now catalogued as NMMNH P-45287) is on the top surface of a bed of fine- to medium-grained, small-scale cross bedded to ripple-laminated, micaceous arkosic channel sandstone in the lower part of the El Cobre Canyon Formation of the Cutler Group (see Lucas and Krainer, this volume). This bed is between grayish-red, fossil-plant-bearing muddy siltstone beds (Hunt and Lucas, 1992). A few meters away, a smaller, less well-preserved trackway of similar morphology is on the same bedding plane as the trackway described here. Both trackways are heading nearly due west. Fossil pollen, plants and vertebrates suggest a Late Pennsylvanian (Missourian?) age (see Lucas and Krainer, this volume).

DESCRIPTION AND IDENTIFICATION

The trackway at NMMNH locality 6037 (Fig. 2) is preserved in concave epirelief and consists of two track rows of mostly

crenate imprints that are oriented perpendicular to the midline and extend over a distance of about 210 cm. Each track row is missing a mid-length section ~ 50 cm long due to erosion. External trackway width is 32-38 cm. Imprints are 5-7 cm wide and up to 2 cm deep. Spacing between imprints varies between 2.5 and 4 cm. The trackway is heading N80°W, and there are about 18-20 imprints per 100 cm.

The individual imprints are mostly crescent shaped, but include hemispherical impressions, complex lobate shapes and simple, rounded impressions. We regard most of these shape differences as being due to erosion, the fact that the trackway clearly is an undertrack and the variability of imprints made by repetitive, overlapping footprints of more than one appendage.

We assign the trackway to *Diplichnites cuithensis* Briggs, Rolfe and Brannan. Briggs et al. (1979) diagnosed that taxon as a very large *Diplichnites* with rare trifold tracks shallowing toward the trail axis. Their emended diagnosis of *Diplichnites* reads: "morphologically simple trail, up to 36 cm wide, consisting of two parallel series of tracks (each up to 9 cm wide); individual tracks elongate roughly normal to trail axis, spaced closely and

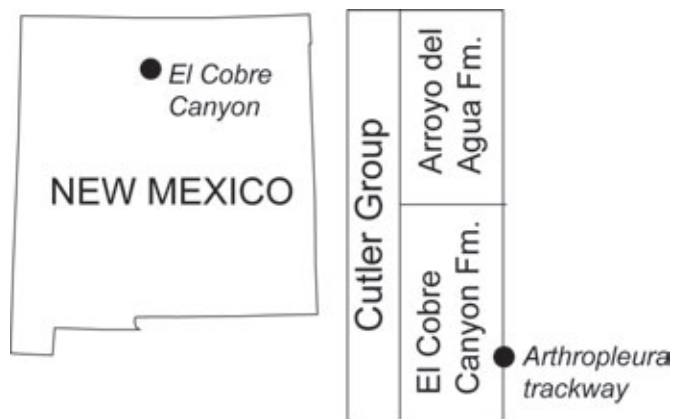


FIGURE 1. Index map and generalized lithostratigraphy showing the location of El Cobre Canyon and the *Arthropleura* trackway locality, NMMNH 6037.

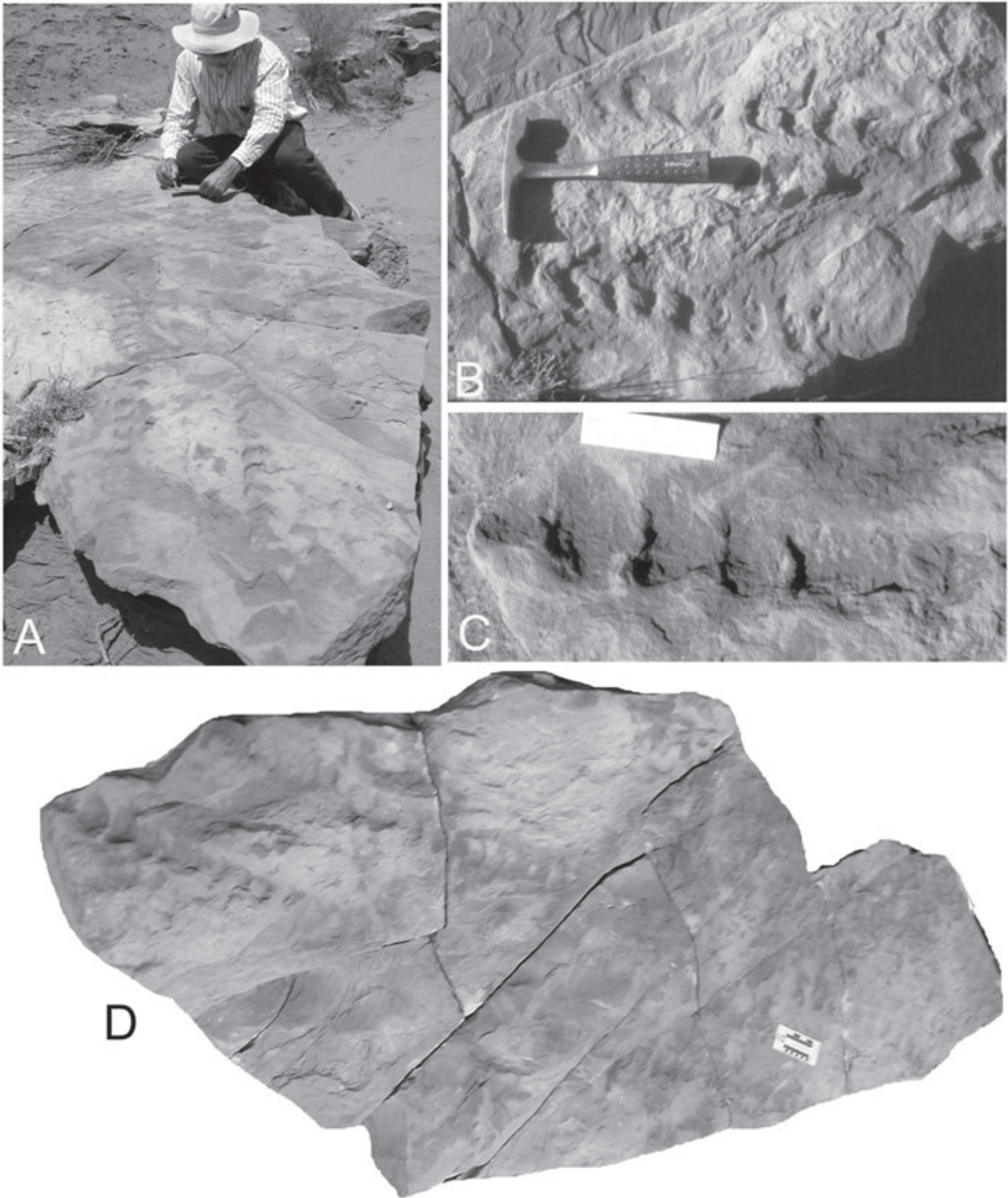


FIGURE 2. Selected photographs of the trackway of a giant *Arthropleura*, *Diplichnites cuihensis*, at NMMNH locality 6037. A, Overview of trackway. B-C, Details of trackway. D, View of trackway in the Museum (NMMNH P-45287).

regularly, at up to about one per cm" (Briggs et al., 1979, p. 289). The trackway from El Cobre Canyon fits well with this diagnosis except that the trifold tracks toward the rail axis are not preserved. The El Cobre trackway resembles illustrated specimens of giant *Diplichnites* (e.g., Briggs et al., 1979, 1984; Briggs and Rolfe, 1983; Almond, 1985; Wright et al., 1995).

Indeed, the El Cobre Canyon trackway of *D. cuithensis* is the largest known trackway of that ichnospecies. With a width of about 38 cm, it is larger than the famous Arran, Scotland record, which is 36 cm wide (Briggs et al., 1979) and those found at Gardner Creek, New Brunswick, which are also about 36 cm wide (Briggs et al., 1984). Note that Pearson (1992, p. 129) claimed a possible occurrence with a width of 46 cm, but his certain trackways are only 21-24 cm wide. Schneider and Werneburg (1998) reconstructed a 2 m long *Arthropleura* based on a leg from the Lower Permian Manebach Formation, Thuringia, Germany, as well as on well-preserved ventral body remains from the Döhlen Formation in Saxony, Germany. The trackway made by an individual of this size should have been about 40-50 cm wide.

DISCUSSION

Diplichnites cuithensis is generally considered to be the trackway of the giant myriapod-like arthropod *Arthropleura* (Fig. 3). Arthropleurids are the largest terrestrial invertebrates known (Schneider and Werneburg, 1998). Using the criteria of Wilson (2003), the crescentic nature of the imprints of the El Cobre trackway indicates that the arthropleurid making the trackway was moving rapidly.

The El Cobre Canyon record of *D. cuithensis* is its first published record from New Mexico and its first documentation in the American Southwest (Hunt et al., 2004). *Arthropleura* trackways, sometimes assigned to the ichnospecies *D. cuithensis* or *D. aenigma* Dawson, 1873, are well known from the Carboniferous of eastern Canada (New Brunswick and Nova Scotia: Ferguson, 1966, 1975; Rolfe, 1979; Briggs et al., 1984; Archer et al., 1995), and in the USA *D. cuithensis* has been reported from Kansas (Mángano et al., 2000). A large (15 cm wide by 3 m long) trackway from the Casselman Formation (Conemaugh; Stephanian equivalent), in Cambria County, Pennsylvania described by Marks et al. (1998) may well also have been made by *Arthropleura*. Mass occurrences of 2-5 cm wide trackways of juvenile arthropleurids were reported as *Diplichnites minimus* by Walter and Gaitzsch (1988) from Permocarboniferous tuffites of the Flechtingen high in central Germany.

Trackways assigned to eoarthropleurids range back in age to at least the Late Silurian (Wright et al., 1995) and the Early Devonian (Gevers et al., 1971; Braddy and Milner, 1988; Smith et al., 2003). Trackways made by *Arthropleura* are Viséan to Stephanian (Late Pennsylvanian) in age (e.g., Pearson, 1992; Briggs, 1986; Walter and Gaitzsch 1988; Archer et al., 1995). The age of the El Cobre Canyon occurrence of *Diplichnites cuithensis* thus is consistent with the other occurrences.

Body fossils of *Arthropleura* are Viséan to Early Permian in age (Briggs and Almond, 1984; Schneider and Barthel 1997, Rößler and Schneider 1997, Schneider and Werneburg, 1998)

and in North America have been reported from Nova Scotia, Illinois, Ohio and western Pennsylvania (Richardson, 1956, 1959; Copeland, 1957; Rolfe, 1979; McComas and Mapes, 1985; Hannibal, 1997a, b). There are additional, undescribed specimens of *Arthropleura* from east-central Pennsylvania in the collections of the United States National Museum of Natural History.

Sedimentological studies indicate that the depositional environment of the El Cobre Canyon Formation was that of a low sinuosity river system with locally vegetated interfluvial and floodplain surfaces (Fracasso, 1987; Eberth and Miall, 1991; Krainer and Lucas, 2001). This environment belongs to the so-called "wet red bed" facies characterized by common *Scoyenia* burrows, ferric soils with hematitic concretions as well as immature calcisols and calcareous rhizoconcretions. Other records of *Diplichnites cuithensis* and of *Arthropleura* suggest that these giant myriapod-like animals preferred river floodplain environments with an open, mesophilic vegetation (Walter and Gaitzsch, 1988; Schneider and Barthel, 1997). The El Cobre Canyon occurrence of *D. cuithensis* is in rocks representative of such an environment, and thus paleoecologically consistent with earlier records.

The preservation of the trail as relatively deep undertracks at the surface of a fluvial channel sandstone contradicts the latest interpretation of Kraus and Brauckmann (2003) of *Arthropleura* as a thin-skinned caterpillar-like animal, stabilized only by means of antagonistic hydraulics of body fluids. This interpretation is obviously based on an incorrect over-interpretation of resorbed and therefore thin molting remains of *Arthropleura*. Instead, the exoskeleton of this giant must have been strongly sclerotized in order to make deeply impressed trackways such as those from El Cobre Canyon.



FIGURE 3. Reconstruction of *Arthropleura* and its trackway (from Rolfe, 1979).

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