

ART. LIV.— *Three-toed Dinosaur tracks in the Newark Group at Avondale, N. J.*; by J. B. WOODWORTH.

A "track stratum" appears first to have been recognized in the quarries along the west bank of the Passaic River, in New Jersey, in the Newark rocks, by Mr. Frank L. Nason, of the N. J. Geol. Survey, in 1888. In his description, the general stratigraphic relations of these quarries are set forth, but nothing more is said regarding the tracks other than that they are referred to "reptiles, birds and insects." *

The object of this notice is to confirm Mr. Nason's observations as to the existence of tracks, and to describe a track-covered slab seen in the quarry at Avondale in September of this year. Having come fresh from the collection of dinosaur tracks at Amherst, the writer began a search in the now little-worked Newark quarries. Ill-defined impressions were here seen, but nothing that was satisfactory. At Avondale, markings, due neither to current-mark nor to ripple-mark, were at once seen on the brownish-red shale-covered surfaces of several blocks of freestone. In addition to these equivocal impressions, the following described foot-prints are essentially identical with those found in the Connecticut valley area:

On a triangular block about 7 feet on a side, 15 tracks were seen. These were of two kinds, with the exception of one isolated print, in three lines as follows:

* Annual Report of the State Geologist for 1888, Camden, 1889, pp. 22, 28.

1. Three foot-prints about 8 inches long; stride from toe to toe of 1 and 2 about 19 inches; from toe to toe of 2 and 3, about 31 inches. The tracks resemble the form named *Anomæpus major* by Edw. Hitchcock, the print embracing the impression of the foot together with that of the lower part of the tarso-metatarsus, which latter would make the prolonged, indefinitely-ending, heel-like projection wherever the animal crouched upon the beach.* If this explanation be applicable in this case, the foot proper has a length of about 5 inches.

2. Three-toed prints from 2.5 to 3 inches long, digital impressions jointed; one line of these prints contained five distinct tracks, with a stride of about one foot. The second line of tracks was similar, with six prints.

A heart-shaped impression about four inches on a side and sharply defined was seen on another slab. A similar impression, in the Amherst collection, is in a relation to foot-prints to indicate that it was made by an animal crouching on the beach. Other vague impressions, due to the moulding of the bottom as if by the rolling contact of a flexible, wrinkled body, are probably to be explained as made by dinosaurs in a recumbent position. Long straight and curved furrows also exist both at Avondale and on the track layers in the Newark quarries.

So far as one can judge from tracks, these impressions afford nothing not already known in the Connecticut area. Their existence in the section which has been taken for the type of the Jura-Trias basins along the Atlantic coast, is of importance as serving to remove the criticism which has been made against the revival of Redfield's term,—the Newark group,—that the characteristic fossil tracks of the better known Connecticut area do not occur in it.

I am indebted to my friend, Prof. Geo. C. Sonn, of Newark, N. J., for essaying to have the large slab with fourteen tracks preserved in the High School of that city.

Harvard University, September 18th, 1895.

* I am indebted to Professor Emerson for this explanation of the similar tracks in the collection at Amherst.