

ART. VIII.—*On the Occurrence of a Peat bed beneath Deposits of Drift in Southwestern Ohio.*

A BED of peat has lately been found one mile east of Germantown, Montgomery county, Ohio, and twelve miles west of south from Dayton—in the occurrence and connections of which there are several facts of unusual interest.

It lies in, and directly above, the channel of Twin creek, a tributary of the Miami river. The general course of the creek is southeasterly, but just above the point where the peat bed is exposed, it has made a sudden change in direction from east to west of south. Its northern and eastern banks for $\frac{1}{4}$ of a mile in each direction from the point of deflection, are precipitous walls of stratified clay and gravel, from 50 to 100 feet in thick-

ness; kept nearly vertical by the constant undermining action of the stream.

Beneath these heavy deposits and occupying 40 rods of the east bank of the creek, the peat bed is found, varying in thickness, in different portions of its extent, from 12 to 20 feet. The amount of the bed that is exposed depends upon the stage of water in the stream. The stream is bedded for 10 or 15 rods upon the peat, but in deeper portions of the channel, upon the eastern bank, an underlying formation of gravel can be detected. The uppermost layers of the peat contain undecomposed sphagnum mosses, grasses and sedges, but in other portions of the bed, the vegetable structure is generally indistinct, with the exception of abundant fragments of coniferous wood, which in many instances can be identified as Red Cedar (*Juniperus virginianus*). At the southern extremity of the bed in particular, there is a great accumulation of wood, in trunks, roots, branches and twigs, much of which has been flattened by the pressure of the 80 feet of clay and gravel that overlie it. Branches that were originally two inches in diameter now afford lenticular sections with no more than a $\frac{1}{4}$ inch for the shorter axis, while many of the smaller stems have been compressed into ribbons. The berries of the cedar are abundant in the upper layers of the peat. At a point $\frac{1}{2}$ mile higher up the stream, trunks of cedar nearly two feet in diameter, have been taken from beneath these same drift beds and turned to account for fencing posts.

There are indications that the peat bed has a considerable extent to the northward and eastward. A bed of "black earth" was found underlying clay and gravel in digging a well $1\frac{1}{2}$ miles east of this locality. The bed occurred at a depth of 30 feet and was itself from 10 to 15 feet in thickness. The waters of springs in the same neighborhood are discolored, as if by contact with such deposits.

It may be added in this connection that there is a large amount of wood buried beneath the drift throughout this region generally. It is not a circumstance of infrequent occurrence to meet with it in the digging of wells. There is scarcely a square mile in the thickly settled portions of the adjacent country in which instances of this kind can not be found, and three instances are on record within the limits of a single village.

The wood is in great part coniferous, but not exclusively so; for according to the testimony of intelligent and observing, practical men who deem themselves entirely competent to give a judgment in the case, ash, hickory and sycamore, together with grape-vines and beech leaves, have been found covered with drift deposits.

A stratum of soil, one or two feet in thickness is often associated with these vegetable remains. The soil and the wood

occur at various depths, but in the cases already noted, between the limits of 10 feet and 90 feet. A large proportion, however, of the instances on record, have been found at about 30 feet in depth, immediately beneath the yellow clays that constitute the last of the drift series in this region.

Through all portions of the peat above mentioned, sand and pebbles are scattered. The pebbles are mostly of small size, seldom larger than a pea, but occasionally three or four inches in diameter. They agree in general character with the gravel of the country.

At the lower extremity of the peat bed, the formation thins out and the bottom layers are found above the water, resting upon a surface of gravel that slopes downward at an angle of about 30 degrees. All the limestone pebbles which the peat overlies at this point, appear to have been "burned." They are white and soft, as much so as they would have been if they had been converted into hydrates of lime by the ordinary processes. Analysis, however, shows them to be in the state of carbonates.

In the inclined strata, heavy beds of ochreous gravel occur. The ochre is easily separated from the gravel by washing and furnishes a marketable paint of fair quality. The nature and arrangement of the materials of these inclined beds indicate that they were brought from the eastward by a torrent-like stream and deposited over a precipitous bank.

In pockets of the gravel and also in the clay that immediately covers the peat, small quantities of vivianite, "blue earth," or phosphate of iron, are found. From one of the largest accumulations of this substance, a tusk or tooth was taken. It was described as resembling a hog's tusk, except that it was much larger. It may also be added that two mastodon tusks, each measuring eight feet in length, were taken in the spring of 1870, from the northern part of the same drift bed to which the peat belongs and at about the same level.

The reference of the phosphoric acid of the vivianite to vertebrate bones will, therefore, hardly be questioned.

From the above named facts, we seem warranted in concluding that the coniferous wood in question grew in the region where we find it buried. The amount of the wood renders this probable and the nature of the remains forbids any other supposition. In this connection, it is only needful to recall the facts, that cedar berries in notable quantity, and that branching twigs, the veriest spray of the cedar, sometimes still covered with bark, are well preserved in the peat.

We learn furthermore that the date, at which this vegetation grew, was in the closing or Champlain epoch of the Drift period, for it is underlain by stratified drift deposits. A subsidence of the continent below its present level had already occurred, dur-

ing which these underlying beds were formed, but there would seem to have been a restoration of this southern border of the drift-swept region at least, to dry land once more, and this restoration must have continued through a period of considerable length. It was followed by another movement of depression, during which the highest of the yellow clays, the latest formation of the drift, were deposited. There seem materials in this line of facts for a more orderly division of the later formed deposits of the post-tertiary than has heretofore been recognized.

We also learn that mammalian life was associated with this intercalated period of vegetable growth. The mammoth and the mastodon subsisted on the coniferous wood which is represented so largely here. The series of changes in level already referred to, must have exterminated these earlier representatives of elephantine life, but we find the same species returning to their old dwelling places when the waters of the drift seas had finally abated.