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A PRE-KANSAN PEAT BED.

BY T. H. MACBRIDE.

In making an excavation through a low ridge just east of Oelwein, in Fayette county, the workmen of the Chicago Great Western railway have recently brought to light some very interesting superficial or quaternary deposits. As to the nature, age and significance of these deposits taken as a whole, our geologists are no doubt ready to give early and accurate account. It is for me in this brief paper to discuss, from the standpoint of the botanist, a single member of the series of strata thus fortunately brought to light.

By way of description it is sufficient to say that the railway cutting mentioned displays on the face of an almost vertical wall a succession of well-defined deposits in which have been recognized the two principal drift sheets with which Iowa is known to be more or less covered, the Iowan and the Kansan, and at least one more, prior to the Kansan and, of course, underlying it. These drift sheets or deposits are separated from one another in the Oelwein exposure, as elsewhere, by thin carbonaceous strata, the evidence of the vegetation which at one time covered the surface of the older deposit. At Oelwein one of these carbonaceous division sheets, and that the lowermost, is of remarkable prominence and thickness, and to this particular layer your attention is now invited.

Those who have had experience in such studies, and who have attempted to trace the limits of superficial deposits, know that contact lines are often exceedingly obscure; the strata are recognized by more or less abrupt change of color, or, at best, by simply a darkened trace; but here we have a stratum in some places nearly a foot in thickness, so purely organic as to form almost a brown coal, an unusually pure quality of peat, and so striking in appearance as to have won the attention of even the men of pick and shovel. The deposit is actually more dense than the clay or drift layers above and below, so that weathering brings it out as a distinct ledge to-day on the face

of the exposure. The stratum from the point of best exposure dips to the west, and, so far as I could observe, can be followed in that direction no more than twenty or thirty rods when it dips below the present level of the excavation. Eastwardly it thins out, and at length becomes only a trace, obscure, or vanishes entirely. For the greater part of the entire distance the structure and composition of the bed varies from rod to rod, but everywhere where the exposure is thickest the purity of the seam is greatest below. Indeed, in the most favorable case examined the purity of vegetable accumulation near the bottom of the formation is remarkable in the extreme, there being no admixture, so far as can be discovered, of any other substance whatsoever.

Upwards the materials are less pure, the amount of inorganic matter increasing until the seam blends above with the overlying blue clay or drift. It is a little surprising to find the lowest, that is, the oldest part of the bed, exhibiting organic objects in most perfect condition. The bottom of the seam is a compact mass of moss, compacted and pressed together no doubt, but absolutely untouched by putrefaction or decay, perfect in every leaf and fibre as any herbarium specimen in the world. Specimens you may examine show this perfectly. You may see the stem, the attachment of the leaves, the innovations, the form of each leaf, nay, the very areolation of leaf apex and base, quite as absolutely defined as in the case of any freshest specimen one may bring in now from any living turf or forest bed. For this reason we are able with much confidence to identify the species concerned although, so far, we have seen no smallest sign of capsule or fruit. So far, also, all the material seems to represent but a single species, a *Hypnum*, probably *Hypnum fluitans* Linn., a common moss which creeps out from shore or clings to floating objects, itself immersed or semi-floating in ponds, marshes or peat-bogs around the whole northern world.

Above the compacted moss which altogether makes up an inch or two of solid matter, lies a still more solid mass of vegetable detritus several inches thick. In this case the vegetation, whatever it was, appears to have undergone pretty thorough decomposition and disintegration before it was compacted. The microscope reveals simply cells and fragments of cells with considerable admixture of sharp, white sand, but nothing identifiable. This pulpy layer blends rather abruptly above

with a crude admixture of sand, mud and fragmentary vegetable detritus which, as said, becomes at length indistinguishable from the overlying drift.

In the very lowest portion of the (upper) drift, and often resting directly on the peat seam proper, are quantities of half-decomposed wood, not rotten wood at all, rather wood which has lost its lignin and of which only the cellulose basis remains, but showing all the original structure elements and features with perfection absolute. The wood seems identical with that of *Larix americana* Mx.

The facts before us would seem to warrant the following conclusions in reference to the state of affairs or conditions under which the peat bed was laid down: The *Hypnum fluitans*, free from all foreign matter of every kind, bespeaks a wide, clear, open marsh or peat-bog to which anything like muddy drainage from the surrounding regions never came. Here for a long period, probably centuries, the moss must have flourished undisturbed, but was at length completely submerged and drowned, probably by the closing of the drainage outlets. In the deeper water that succeeded flourished a different flora, probably a surface aquatic flora such as the *Lemnas*, filamentous algæ, *Anacharis*, possibly, whose dying fronds and filaments settled through other centuries to form at last the second layer of our peat bed seam. Over this, as has been stated, lies a mixture of organic and inorganic matter. Whether this was deposited *in situ* by another change in the depth of the water and local surface conditions or whether this represents the lowest part of the drift sheet as it came is difficult to say. In this particular layer there are evidences not a few of the presence of higher plants, monocotyledons chiefly. These may have been pushed in from other shallower parts of the same marsh. However this may be, the final catastrophe is not a matter of doubt. The whole region was slowly frozen up and at length whelmed by an icy deluge of frozen mud, fragments of swamp-loving trees wrenched and broken as they came, sand boulders, detritus of all the surrounding surface soils, whatever their variety, their flora or formation. Once this process complete, our peat bed remained hermetically sealed, unaffected, doubtless, by subsequent surface changes of any sort until stirred by the plowshare of the railway engineer. Considering the assumed great age of the deposit the state of preservation in which the plant remains occur is truly noteworthy. But then

we recall the notorious fact that peat-bogs and marshes, whether by the abundance of humic acid or from other causes, are pronouncedly aseptic. If moss, developed under such conditions, was finally buried at a low temperature and sealed up, its preservation is explained. But again, the wood fragments referred to are saturated with a solution of ferrous sulphate. The occurrence of this salt in this condition is a problem to which the attention of the chemist, rather than of the botanist, may be invited.

In closing, one other fact may be mentioned. Some years since well diggers of Washington county, in the town of Washington, brought up from great depth, some hundreds of feet, a perfectly preserved and uninjured cone. This I identified at the time as the fruit of *Larix americana*. If our determinations are therefore to be trusted, the Oelwein peat bed and the Washington cone represent the same horizon. As the only drift in Washington county is Kansan, the position of the Oelwein peat as pre-Kansan is to this extent rendered more certain.

SUMMARY OF DISCUSSION*.

BY PROF. S. CALVIN.

The discussion following the preceding papers on the Oelwein section was participated in by Calvin, Fink, Bain, Shimek, Beyer, Finch and others. The facts developed during the discussion may be summarized as follows:

A few years ago geologists were content to look upon the glacial period as a unit, and the drift mantle of Iowa was regarded as the effect of a single invasion and retreat of glacial ice. Some time ago, however, McGee demonstrated that in northeastern Iowa there are two distinct drift sheets separated by a soil horizon and forest bed which represent an interglacial period of considerable length. The two sheets of drift were then named respectively the lower and the upper till. Later two distinct drift sheets were recognized in Union county, near Afton Junction. They are separated by a soil bed and by

*A motion that Professor Calvin be requested to summarize this discussion was carried unanimously.