to a depth of fifteen feet, below which they are still present, and the matrix in this lower part is also unleached. This was the only pit examined west of the Delaware in which the depth of leaching is clearly shown. In most exposures the matrix is not sufficiently calcareous to give ready response to tests with acid. Limestone pebbles also are very scarce in some of the exposures so that thorough search is necessary to find one.

There is an extensive exposure of reddish-brown till along the railroad tracks at “Iron Hill,” in the east part of Bethlehem, with a depth of thirty to forty feet. It is mainly a rather stony till, and includes rocks of various kinds, brought in from distant points to the northeast.

Was There a Lake Packer?

Williams has interpreted the upper or surface part of the Illinoian drift in the limestone lowland, and within the Lehigh drainage basin, to be a lake deposit, and he has given the name “Lake Packer” to the body of water which he thought occupied the lowland. He inferred that ponding occurred before the ice sheet had reached its culmination, and that it occurred as the ice border melted back across the lowland. He based the presence of such a body of water in some degree on hypothetical grounds, and gave it the altitude of the lowest part of the divide between the Lehigh and Schuykill drainage basins in the limestone lowland, about 500 feet above sea level. But he also cited places where clay deposits rest on undisturbed gravel, and drew the inference that the clay was not deposited by the ice sheet, for if it had been, the gravel beds under it would show disturbance. Any lake deposits made during the advance of the ice were covered by glacial material to the extent that the ponded area was invaded and occupied by the ice sheet. The deposits as now exposed are thus restricted by him mainly to material laid down during retreat of the ice border. This material termed “Packer clay” is described as follows in the paper above cited. From this description it will be seen that the “Packer clay” is of complex and varied character, much like till, and with little resemblance to the ordinary lake deposit.

“The clay is generally a reddish-brown, unstratified, sandy deposit, with a burden of glaciomarine, singular, and river-rolled material scattered irregularly through it. Very few stratified layers have been found in the sections studied, and the bulk of the burden consists of river cobbles and pebbles, with a considerable proportion of perfectly angular fragments, derived from the rocks in the north of the locality where they occur in the clay. In the case of syenitic fragments, they occur near the South Mountain, where they could have been picked up by shore ice and carried a short distance. The general proportion of the burden, however, are sandstones and shales, with a small amount of limestone and slate. One specimen of syenitic rock exhibited is from the clay, and shows the general freshness of the burden. The clay here is generally fresh within, if oxidized externally, and workable clay can be found feet from the surface, whereas the average depth of decomposed soil over an unglaciated area, or one exposed to long atmospheric action, is from sixty to seventy-five feet.

“The clay deposit varies from a perfectly clean clay to clayey sand and as we go from the deep water of the south to the northern valleys. It is generally unstratified, but shows local areas of stratification. Its thickness varies from a few inches to twelve feet at West Bethlehem, but the general average is three feet.

“The “Packer clay” was thought by Williams to be absent from the part of Saucon Valley west and south of Hellertown. He interpreted this absence to denote that there was no outflow from the Saucon Valley past Leitheville to Durham Valley, and thence to Delaware River. He said that if a flow over that divide would have distributed the clays over the Saucon Valley in great bulk. Concerning the state of oxidation of the clay (and this seems to include the till), Williams remarked:

“The high state of oxidation of the clay has been adduced as evidence of its great age, but the argument is worthless in view of the manner in which it was accumulated and the condition of the burden it carries. This glacial, rolled and angular stones are generally fresh and unoxidized, as just described. We have, therefore, a highly oxidized clay throughout, bearing at all levels fresh material. The mixture is no older than the fresh part, and the oxidation of the clay is either preglacial, from its having been part of the soil of the region (as glacial, limetmo, and clays prior to such a clay), or due to oxidation while it was being deposited. Judging from the state of certain portions of the till, the chances are in favor of the former supposition. These fresh fragments antedate the great moraine and show that it also is of recent date. It may be argued that the clay (Packer) is the ordinary boulder clay of subglacial origin.