

or transportation. Along portions of the line in western Pennsylvania, Ohio, and Indiana, the amount of drift material is small, so that it is sometimes called the attenuated margin of the drift. But at some places in Ohio the terminal till is stated by Wright to be 100 feet thick or more. In southern Illinois, Williamson County, the thickness at the limit averages, according to Chamberlin and Leverett, 20 feet, and in some places is 50 feet thick; and striation is deep in the vicinity, proving the action of a *land* ice-mass. In Kansas and Missouri, the most southern portion of the drift, there are boulders of considerable size. To the eastward, in eastern Pennsylvania, near South Bethlehem, the Durham and Reading Hills, 665 to 900 feet high, have boulders and scratches at all altitudes.

Far eastward, south of New England, in the region of greatest precipitation, the terminal moraine extends along the islands from Nantucket, Martha's Vineyard, by Block Island, to the south part of Long Island. On this island, west of the Shinecock Hills, there is a long interval of stratified sands; and then at the western extremity of the island the drift is again at the surface, and continues to Staten Island and New Jersey. The deposits are coarse, 100 to 200 feet or more in thickness, partly stratified in places, and carry large boulders.

Ten to twenty miles north of the line just described, from Cape Cod along the Elizabeth Islands and the shores of Rhode Island and Connecticut, between Narragansett Bay and Watch Hill, and then along Fishers Island and the north side of Long Island, there is a second range of terminal moraine, as first announced by Upham. The islands are not drift made; for they had an earlier existence, as subjacent Cretaceous and other terranes show; and they may, therefore, have determined the twofold subdivisions of the drift. Yet it is more probable that there are two lines of moraines, and that only the more southern is to be taken as the terminal moraine, or that at the limit of maximum extension. Nothing is known to exist over the sea bottom south of Long Island to indicate a still more southern line, although the surface for 25 miles or more seaward was part of the dry land.

This epoch of the advance in the Glacial period was probably of great length. The vastness of the area covered with ice, the thickness of the ice-mass, and its accumulation even over the dry Continental Interior, lead to this conclusion; and, as has been shown, the attenuation of the drift along much of the front is not evidence against it; for, notwithstanding this, there was slow transportation to the limit.

The terminal moraine, or southernmost limit of the ice, was located along the islands south of New England first by Upham and Clarence King; and along the coast east of Watch Hill (which is a continuation of Fishers Island) by C. King. Its location over New Jersey was made out by G. H. Cook and F. Smock.

## 2. Epoch of the First Retreat.

1. *Distance of the Retreat.* — The evidence of a retreat of the ice-front is afforded by the condition of the till and other glacial deposits over the region of the retreat, and by the record of a long halt at the close in the