

had its times of slight advance, it is but natural to expect slight frontal deposits built against the northern slope of the Palisade ridge where its course turned so as to lie athwart the path of ice motion. Such deposits actually occur.

The morainal deposits of this stage are well shown at the Haverstraw station on the West Shore Railroad. The material is a reddish till in a thick deposit lying approximately between 100 and 200 feet above the sea from the vicinity of the railroad station to and beyond the limits of the Tarrytown atlas sheet. The conditions of the ice front at this time are indicated in the accompanying cross-section drawn across the front between High and Little Tor [fig. 8]. South of High Tor this morainal coating fails to appear as a flanking deposit on the iceward side of the trap ridge. As will be described in some detail presently,

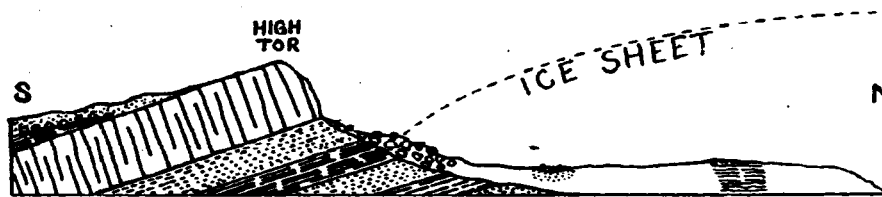


Fig. 8 Diagrammatic cross-section showing relation of ice sheet to frontal moraine at Haverstraw: below cliff, the moraine; to the right, clays, sands and gravels

morainal deposits reappear in the northern part of Croton point and it is therefore reasonable to suppose that the ice front left the west bank of the river in the vicinity of Short or Long Clove and crossed the Hudson gorge to the east bank, curving or projecting southward in mid-channel.

While the ice lay in the Hudson gorge south of Short and Long Clove, these two passes across the Palisade ridge would have afforded an outlet for the lateral drainage flowing between the ice on one side and the trap wall on the other. The long straight course of the Hackensack from the Cloves down to West Nyack is so well developed as to suggest that the stream may have been enlarged in the glacial period by water pouring through these passes, which lie at about 200 and 220 feet above the sea.

About $\frac{1}{4}$ of a mile south of the West Shore bridge over Minisceongo creek and east of the railroad there was a sand knoll exposed in 1900 in which stratified sands from 40 to 60