

water courses, like those of the Vahtse river and Fountain stream described by Russell as flowing out from beneath the Malaspina glacier. In these subglacial channels the streams must be building up eskers, while gently sloping gravel and sand plains are being deposited by the silt-laden waters in their course from the ice front to the sea (1).

Professor E. W. Claypole drew a section of the marginal portion of the ice-sheet, showing how, in his opinion, the Pinnacle hills were formed by a stream which gathered drift from the melting ice surface, and then fell through a crevasse and deposited the sand, gravel, and boulders in a tunnel under the ice.

Following these speakers, I remarked that the absence of any covering of till upon the top and slopes of this esker, such as must have fallen upon it from the englacial and superglacial drift of its roof of ice if it were formed in a subglacial tunnel, leads me to believe that its stream was wholly superglacial, and that the esker was deposited in a deep ice-walled gorge, open above to the sky, eroded in the border of the ice-sheet by the melting action of the running water.

The purpose of the present essay will be completed by more fully considering the probable manner of transportation of the many boulders found in some portions of the gravel and sand of the Pinnacle hills, the relationship of this esker to the lower morainic ridge continuous from it westward, the abrupt eastward ending of the Pinnacle hills range, and similar features of the Pittsford esker series, with the inquiry constantly in mind whether these features support the view that these eskers were derived from previously englacial drift and accumulated in superglacial channels. It will be needful at the same time to consider the drainage from the ice-border in its relations to the glacial Lake Warren and to the beginnings of Lake Iroquois. Beyond this we ought to learn, if possible, whether the same explanation is generally applicable to eskers in other regions.

The leading reason for our special interest in the Pinnacle hills is the demonstrably near sources of their Niagara limestone boulders, which have been transported only a few miles and yet were uplifted at least 100 to 200 feet into the ice-sheet from an approximately plain country. Here we have a demonstration of the competency of the glacial currents to gather drift into the lower part of the ice-sheet from a nearly flat area, and we may understand how this takes place by the differential movements of the upper, middle and lower portions of the ice. Upon a belt of the ice-sheet extending many miles

(1). For description of the present process of formation of eskers and sand plains by rivers of the Malaspina glacier, see Russell's paper on "Mt. St. Elias and its Glaciers," *Am. Jour. Sci.*, III, Vol. XLIII, pp. 169-182, with map, March, 1892.