

as these and to such distances. The only agency we can look to is that of ice, and this we find actually producing such results in various parts of the world at the present day. One has only to go to Switzerland, to the Himalayas, to Alaska or to Greenland, to witness precisely similar effects, and it is a great geological principle that like effects must be referred to like causes. Ice, therefore, in the form of glaciers, must once have been active wherever the results of that action are clearly recognizable, and Acadia must, at some time in its history, have been submitted to glacial conditions. Almost tropical warmth must have been followed by a lengthy period of arctic cold.

It has been supposed by some that the transportation of boulders was due to the action of icebergs rather than of glaciers. But the Province of New Brunswick affords some striking facts which favour the latter rather than the former as the real agents concerned in these results. It is true that icebergs have great transporting power and annually drop large quantities of material along the bed of Baffins Bay and the Straits of Belleisle, but, apart from the fact that icebergs pre-suppose glaciers, being, in all instances the broken-off feet of the latter, there are occurrences observed which are hardly to be explained upon any other supposition than that they are due to the operation of land ice. One of these is the occurrence of large boulders of bituminous shale picked up from the valley of the Coverdale River in Albert county and dropped on the top of Caledonia Mountain at an elevation nearly one thousand feet higher. This could hardly be accomplished by a floating iceberg. Again, on the western side of Chamcook Mountain, near St. Andrews, N. B., of which the face is nearly vertical, the volcanic rocks which form the upper portion of the eminence may at one point be seen to project horizontally for fifteen or twenty feet beyond the comparatively soft red sandstones which form its lower half, and yet the *under* side of this projecting ledge is completely covered with glacial markings which could only have been produced by a mass of land ice crowded against the face of the bluff and not by a freely floating berg.

But this leads us to another class of facts. What are the glacial "markings" thus referred to? Well, they are lines or scratches crossing the face of the rock in parallel directions as though they had been produced by some gigantic rasp. Such lines or striae are common all over Acadia. Wherever

the overlying soils have been freshly removed and the rocks have been hard enough to preserve them, we find these similarly scored, sometimes very beautifully. Fine examples may be seen upon some of the islands of Miramichi Bay, and still better ones at many points along the Atlantic coast of Nova Scotia. Here indeed they are, in some instances, much more than mere scratchings or groovings of the surface. They are deep furrows, and at one point, near Lockeport, they are great troughs, varying from three or four to ten feet in depth. Such troughs, smoothed and rounded like the body of a canoe, yet striated from end to end, could never have been produced by floating ice. They are the work of an uncommonly heavy moving mass. They mark the course and the action of the great glaciers which then covered the whole of Acadia as they were slowly sliding southward on their way to the sea.

The course of the striae is always southward, generally a little east of south, and as the transportation of boulders was generally in the same direction, it is evident that both owe their origin to a common cause. Striated surfaces, similar in every way to those here described, are a common feature in glacial regions such as have been referred to, and as they are found upon the summits of our highest hills it is evident that the whole surface of the land was covered with what may well be regarded as a continental glacier. And as in Alpine regions, the sides of glaciers are usually marked by what are known as moraines, *i. e.*, by confused masses of rock which have descended as avalanches from the bordering hills or have been piled up at the glacier's foot when the ice melts away; so in both New Brunswick and Nova Scotia the boulders are often arranged in trains or are placed so as to show that they represent lateral or terminal moraines. Both the moraines and the striae show little correspondence with the present inequalities of the surface, crossing valleys like that of the St. John transversely to their course, and, as we shall see later, sometimes serving to change the course of smaller streams into totally different channels. In other instances they probably both deepened and widened pre-existing channels, and such north and south gorges as those of Digby Gut and the Petite Passage, as well as the fiord-like indentations of the southern coasts of both Provinces, including such harbours as those of Halifax and Shelburne, may owe their origin in part to this cause. Many of