

ART. V.—*Glacial Action on Mount Katahdin*; by JOHN DE LASKI, Carver's Harbor, Maine.

ON the twenty-first of September last, in company with Mr. George E. Bird of Portland, a graduate of Harvard College, and a guide from Sherman, the next town south of Pattern, I ascended Mount Katahdin, the highest land in Maine, on the south side by way of one of the "slides." The weather was fine, with few clouds in the sky till late in the afternoon. This slide I take to be the same by which Prof. Charles H. Hitchcock and party ascended to the top of Katahdin ten years ago.* On this route, after crossing Avalanche Brook at the base of the mountain—the stream of which is fed by springs up toward the top of Katahdin—we found fossiliferous rocks at various heights in our path. Boulders of this character were met with well up toward the "Horseback" ride, and I judged the highest place of their occurrence to be seven hundred feet below the "Chimney" top. This is the highest peak in the region except Pomola, the apex of Katahdin, which according to Dr. Young, with whom I visited the mountain twenty-four years ago, is five thousand three hundred feet above the sea, and according to Prof. Hitchcock, eighty-five feet higher.† I do not think the "Chimney" top is more than three hundred feet below the top of Pomola, and probably two hundred would be nearer the truth; and if this is added to the seven hundred feet, and the amount taken from the height, we have four thousand three hundred and eighty-five feet for the height of the fossils above the sea; and if we call the foot of the slide three thousand feet above the ocean, we have nearly fourteen hundred feet above the foot of the slide for the locality of the upper fossils.

In connection with these Devonian fossils—all of them impressions of shells of Oriskany beds—we found small boulders of micaceous sandstone and arenaceous schist, and a specimen of epidote; and Mr. Bird found a specimen of flint, undistinguishable from chalk flint, higher than the localities of the foreign boulders found by me. I should judge his specimen to have lain five or six hundred feet higher than the boulders containing fossils. The mass of flint would weigh a pound or more, and was water-worn.

Now the question presents itself, how came these erratic boulders—fossiliferous and non-fossiliferous—on the south side of Katahdin? The entire mountain so far as I saw it—and I have also been up it by the way of the north side to the top, and down that of its eastern side—is syenite, like that of the "granite" of Vinalhaven, but generally of a coarser texture.

* Report of Scientific Survey of Maine for 1861, p. 397 † *Ib.*, p. 308.

I am not able to agree with Prof. Hitchcock in regard to the manner of the deposit of these fossiliferous boulders. He suggested that "they came round the west side of the mountain."* If we admit the iceberg theory—for the last few years considered nearly extinct, and which Mr. Hitchcock advocated at the time of writing the sentence above, ten years ago—there is the smallest possibility that those Devonian fossils could have been transported by icebergs—or floe-ice—from their native beds just north of Katahdin from fifteen to thirty five miles, and dropped on the south side of the mountain. The Oriskany beds are three thousand feet lower than the locality where the fossils were found on the shoulders of Katahdin.

The southwestern and southeastern sides of Katahdin bear evidence of glacial erosion—that is, these slopes have the uniform cut-off appearance, that all our northern hills have, even down to the ledges of our fields. At the base of the slide by which we ascended, we took the direction and found that all the higher parts of the mountain bore northwest, north, and northeast; and it is therefore evident that a glacial sheet slowly moving over this part of Maine, and not investing the higher parts of Katahdin, could not have had a portion of its mass so deflected—from the west, or east—as to crowd its boulders into this southern locality; for the sheering of the glacier must have been at right angles to its normal path. The glacial stream would have poured its boulders into this quiet and depressed basin of ice on the southern side of Katahdin, at an angle probably never more than forty-five degrees. And theory would give a much greater height to the crests of the deflecting ice-ridges or waves of the glacier, than the height of the locality of those fossils found by Prof. Hitchcock and myself. Furthermore, could these fossils, originally *in situ* not far distant from Katahdin, on low-lying lands, have worked themselves, during their short journey, from the bottom of a glacier to a position fourteen hundred feet higher into the body of the ice-cap? Though large boulders do sometimes appear on the surface of a valley-glacier (having obtained this position from some inferior locality owing to the complex pressure of the moving ice-mass), we may safely doubt, I think, whether small boulders weighing from half a pound to two or three pounds, would be likely to be materially displaced as regards their original position in the great glacier, during a progress of not many miles, and that up an inclined plain.

Nor is there much probability that those fossils were originally deposited in the localities where we find them. The "slide" is everywhere a plain of yielding sand and gravel, whose material has a constant tendency to descend.

* Report of Scientific Survey for 1861, p. 395.

Along the "Horseback" lie boulders so perched upon one another that we are sure they were not piled up by any frosts to which the mountain has been exposed in modern times; in fact, no frost agency could have put them in their present position. The ridge is narrow, and drops at an angle not differing much from forty-five degrees. We can safely presume that snow never accumulates on this ridge to any considerable depth. This locality is the very focus of winds at all seasons of the year, and especially during the winter months. What snow falls there is probably transformed into ice, and would not have much downward movement over the narrow ridge as avalanches. These boulders I consider to have been loosened by the glacier, which invested and overtopped them, though some of them may be erratic. The evidences in regard to the boulders all the way to the "Chimney," is of like character; and the same may be said about those lying at the base of Pomola, on the north and northwest sides of the high ridge of which it is the pinnacle. This ridge runs for two or three miles toward the southwest, and is three hundred feet above the table-land. The entire side of this hill is obstructed with granite boulders, generally angular, and some of them from ten to twenty feet square. The great blocks are heaped upon each other without order and to such a height that it is exceedingly difficult to climb over them.

I believe the top of Katahdin to have been overridden by the glacier, and that the ice-cap has everywhere degraded its summit, though, like Hitchcock, I saw nothing of the glacier polish and scratches there; nor should we expect to find them on so high an eminence composed of coarse granite, where no soil can accumulate to protect them from the eroding action of winter frosts. Prof. Hitchcock thinks that the northern sides of Katahdin at any considerable height have not been stossed by the drift agent.* I can say with great confidence, that the northern side of the mountain just below the "Monument," which is three thousand five hundred feet above the Wassatacook, washing the base of the hill, really "appears like one great stoss side," and is a glacially degraded wall, just as all our hills in Maine are, at all heights below that of Katahdin. We see boulders with rounded corners lying in place there, and wonder why they have not been toppled down the mountain by the winter frosts.

Furthermore, we have the fact of the disruption of the top of Katahdin into "strata," as Mr. Hitchcock designates them. On the south side of the mountain, just under the "Chimney," this disruption is very marked, apparently horizontal, though the sheets probably dip toward the south. Now

* Report of Scientific Survey for 1861, p. 396.

the case is that the strata everywhere slope from the shoulders of the mountain downward. On the north side, the dip is toward the north; on the east, toward the east; on the west, toward the west; and on the south, generally toward the south. This is the case with all the "granite" hills of Maine, and is referable to the action of the great glacier over them. This structure has *not* been superinduced by superficial changes of temperature," as Dr. Hunt conjectures, in *Silliman's Journal*, July, 1870, p. 88. Among all the quarries of Vinalhaven, the surface is broken into sheets or "platforms," and at all depths penetrated by the workmen. The deeper the quarry is worked, the thicker are the sheets. They are generally regular in their lines of fracture, running sometimes almost across the quarry, without much variation as to horizontality; and again we see the lines somewhat waved and distorted. The depths of these sheets in the quarries wholly exclude the idea of their origin being referable to variation of atmospheric temperature, or to any other cause, I think, than that of glacial action.* The first suspicion I had years ago of the enormous thickness of the great glacier, was suggested by these remarkable fractures. In the locality under the "Chimney," which I have just mentioned, where the formation is in sheets, and which is more than four thousand five hundred feet above the sea, quite a stream of water runs out of the fracture and falls into the "Avalanche Brook," which also, probably, has a similar origin. Wherever, therefore, the bare front of Katahdin is open to view, I think it will be found to be shattered as I have described; and in my judgment these effects must be referred to glacial action. Now the glacier could not have broken up the top of Katahdin, unless the ice-cap had been several hundred feet in thickness above the summit, to insure the pressure necessary to fracture the rock, in connection with the general progressive motion of the mass. It was the slow grinding motion of this ice-sheet which broke up all the surface of New England to great depths. I am therefore not disposed to estimate the thickness of the glacier at *less* than eight thousand feet, as I have done in my article on the "Motion of Glaciers," in Vol. I, Part II, of the *Proceedings of the Portland Society of Natural History*.

I add a word on the route to Katahdin.

Of the different routes to Katahdin taken by tourists, one is by way of the West Branch of the Penobscot, either down it by the way of Moosehead Lake, or up it from its junction with the East Branch; and by the way of Sherman to the Hunt Farm, and the Wassatacook Stream. On this route, the

* May not the origin of this structure antedate both the ice and the action of superficial temperature?—EDS.

path is generally taken to Katahdin Pond, and south to the mountain, though I should prefer the route up the Wassatacook to the place where Katahdin comes down to this stream, and so up the mountain from the north, where it is easier of ascent. Before the summit is reached in this direction, there is a chance to camp in the mixed growth of trees; and starting early, you can get over the top of the mountain without that exhausting labor which attends ascent by the other routes. The magnificence of this mountain is not appreciated without a visit to it. Its base above the surrounding country running north and south must be nearly ten miles long, and its top in this direction not far from six miles. The summit is in general flat, though having several peaks.