ON THE GLACIAL POTHOLE IN THE NATIONAL MUSEUM

By GEORGE P. MERRILL

For several years the department of geology of the National Museum was on the lookout for a desirable object of the nature indicated by the above title and of such dimensions and so situated as to allow its removal and installation in the National Museum. In the summer of 1884 the one finally obtained was "located," but it was not until 1892 that conditions favored the attempt to remove it. The supervision of the work was entrusted to Dr. O. C. Farrington, to whom I am indebted for the account of its extraction given below. The rock in which the pothole occurs is a gray, white-banded, strongly foliated, micaceous gneiss, standing nearly on edge, with the hole eroded parallel with the foliation. These features are shown in the accompanying illustration (plate XXXI). It is scarcely necessary to state that the parallel flutings on the outside of the block were caused by the drills during the process of extraction. Although somewhat shattered by the jar of blasting, as stated by Dr. Farrington, the injury was easily remedied by a little cement, and the specimen as it stands to-day is one of the most striking in the department. The total weight of the specimen is about 4000 pounds.

Following is a transcript of the label:

GLACIAL POTHOLE

Riggsville Landing, Georgetown, Maine. 60,880. Collected for the Museum under the direction of O. C. Farrington. 1893.

"Besides its proper and characteristic rock erosion, a glacier is aided in a singular way by the coöperation of running water. Among the Alps, during the day in summer, much ice is melted, and the water courses over the glaciers in brooks which, as they reach the crevasses, tumble down in rushing waterfalls, and are lost in the depths of the ice. Directed, however, by the form of the ice passage against the rocky floor of the valley, the water descends at a particular spot, carrying with it the sand, mud, and stones, which it may have swept away, from the surface of the glacier. By means of these materials it erodes deep potholes (moulins), in which the

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rounded detritus is left as the crevasse is closed or moves up the valley."—Geikie, p. 400.

The pothole here exhibited is assumed to have been formed by a glacial ice stream in the manner described, during the melting of the ice sheet of the Glacial epoch. Similar holes are formed by running streams, but in this case there is now no stream in the near vicinity, nor traces of others than those temporarily formed by the melting ice. This hole was one of several situated on the rocky shore of a cove a few feet above tidewater action. The largest one is described as some 14 feet in depth. It is stated that a smaller hole is always to be found at a distance of a few feet to the southward of each of the large ones.

The inequalities of the interior of the hole are due to the unequal hardness of the material, and perhaps in part to the direction of the current of water. The rock is gneiss, and it will be observed that the hole is cut parallel with the foliation, the gneiss at this point standing nearly vertical.

Holes of this kind are variously called potholes, moulins, giants' kettles, and caldrons, and sometimes Indian ovens, or kettles, from the popular belief that they were excavated by the Indians and used in grinding corn or cooking food.

The following description regarding the work of extraction is taken from Dr. Farrington's notes:

"This pot-hole was one of a score or more found in the vicinity of Riggsville Landing, Georgetown, Maine. They are variously situated, in different degrees of preservation, and vary in depth from a few inches to fourteen feet. Nearly all were visited with a view to ascertaining which were best adapted for removal, but only one was found which seemed to be at all favorably situated for the purpose. This had a depth of 40 inches, a diameter of 20 inches, and was situated on the edge of a sea-wall which furnished one face of the block which it would be necessary to cut out, and giving room for horizontal drilling without the excavation of a large amount of rock from the front. The bed-rock here also appeared on careful examination to be nearly free from seams or joints, and though a gneiss of contorted structure, quite tough and homogeneous.

"To 'dig up a well,' however, is proverbially an impossible task, and even with so many favoring circumstances the work presented difficulties which made success seem very doubtful.

"So evident were these, especially when the small amount of money available for the work was taken into consideration, that it was some time before a contractor could be found willing to undertake it.

"Finally, however, a Bath firm, Messrs. Liberty and Lake, consented to make the attempt, on condition of being freed from responsibility if the work was a failure.

"The task in hand was to drill a solid row of vertical holes four feet deep around three sides of the pothole, then having excavated on the sea-wall side sufficiently to give room for the use of tools, to drill a horizontal row meeting these some inches below the bottom of the pothole and thus cut out a block containing it.

"The first plan was to do the drilling by hand, but as seventy-five holes must be made, each four feet in depth, it was found that this would require the labor of as many men as could be employed for several months and an expense quite beyond the means available. Accordingly a steam drill and scow were procured and work begun with these on April 12. Some large masses of overhanging rock were soon found to interfere with the working of the drill, and as the removal of these by hand would have been very tedious and expensive, it was though best to employ powder. The result, however, was disastrous to the perfection of the pothole, since the concussion from the explosion shattered the ledge and opened several seams, showing that the rock was by no means the tough, homogeneous mass which it had appeared to be.

"As the work proceeded this weakness became more apparent, as even the jar from the pounding of the drill caused pieces of the interior of the "well" to loosen and fall away and the seams to open still wider. All devices resorted to for overcoming this, such as keeping the stone wet and lining the interior with plaster and cement, were of little avail. Before the drilling could be completed other masses of rock had to be removed, and as our financial resources would not allow doing this by hand, powder was necessarily employed, to the further injury of the pothole as a specimen. After two weeks of this work the drilling was finished and the cutting by hand of the cores between the drill-holes commenced, a task which occupied about a week. To free the block from its bed, pairs of long, iron wedges were inserted in the horizontal holes at the bottom and driven in till the mass was raised a few inches, when it was brought forward and grappled with a chain. It was then hoisted by means of a derrick, transferred to a scow (great care being necessary in this operation lest the block should break apart), and, on May 2d, towed to Bath, where it remained for some days before being shipped to Washington.

"For the guidance of those who would undertake similar work it should be noted that sufficient means ought to be provided to per-

form the task without the use of explosives, since these are certain to shatter the rock to a greater or less extent. The damage might be less to a rock of different structure, such as granite, but in the present instance the disintegrating action of ice and water upon the interior of the pothole for ages has necessarily left it in a brittle condition.

"Acknowledgments are due Mr. G. C. Campbell, owner of the land on which the pothole was situated, for the gift of the stone and for assistance rendered in every way possible to facilitate the work. To Messrs. Liberty and Lake credit is given for their enterprise in undertaking the work and for the ingenuity and skill displayed in overcoming its difficulties."