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A GEOLOGICAL SITUATION IN THE LAVA FLOW, WITH REFERENCE TO THE VEGETATION.

BY HARRIET M. CLEARMAN.

This great lava flow extends over a great part of Idaho, Washington, and Oregon. The area covered is extensive, some 200,000 square miles. That this flow has considerable depth may be seen at Shoshone Falls, and at various places where the river has cut a gorge. That there were successive flows with intervals of rest between may also be seen by a river gorge, for in the walls are fossil roots and stumps. Further than this but little has been written concerning this wonderful field.

To those who know the character of this region I shall need to offer no apology for the inadequateness of my investigations. The chief obstacles to the work were, first, the lava, which was utterly impassable in many places; second, the lack of water; and third, that the region had not been surveyed. The distances consequently are only approximate, and the whole investigation which was made in 1899 and 1900 is merely offered as a suggestion.

In Idaho the Snake river flows entirely in the lava region; and from near the source to beyond Shoshone Falls, more than one-half the distance across the State, about 450 miles, there is no tributary from the north. Here are a number of volcanic buttes but they could hardly be the source of so vast a quantity of lava, so the theory of earth fissures should hold good here.

In the eastern part of the Snake river desert is a portion designated on the map, Rolling Plains, Sand and Lava. The sand is a very great obstruction. The plains are more or less sandy until the sand-hills or dunes are reached. These form the most conspicuous feature of this region. At a distance of about 60 miles they have the appearance of a low mountain range, peculiar in the fact that their color is strikingly white against the darkness of the farther mountains. On closer inspection they are somewhat darker, the sand being composed of quartz crystals mixed with particles of lava. The range is estimated to be 30 miles long and from 3 to 8 miles wide. Some of the dunes reach a height of 300 feet; on the windward side they are gently sloping and ripple-marked by the wind, while the other side is perpendicular. These large dunes stand entirely alone and travel independently—the rate of travel varying with the velocity of the wind. They have been known to advance one foot per day. They are approaching the Snake river, and whether they are strong enough to cross the stream or if their sand shall be washed away by the swift current will be known by the future. I have given these only a brief mention because of their conspicuousness, and because of their obstruction to other investigations.

Starting from Saint Anthony and traveling in a northerly direction, after the first mile or so the lava plains are exceedingly rough and bare except for the sand and the sagebrush which is more or less scanty. In this course for about 12 miles it seems to be apparent that there were several lava flows, for one flow seems to overlap another, the successive margins marked by an abrupt cliff or shelf; each succeeding terrace being marked by less weathering and hence by less vegetation.

In this distance five of these shelves were counted, then suddenly appearing in the midst of this lava waste, in a slight depression or basin, is a fertile tract very springy and marshy, covering probably 2 or 3 sections, which is entirely surrounded by the lava desert with no sign of

water for at least 12 miles. In contrast with the sagebrush growth of the desert here is a luxuriant vegetation. The trees are mainly *Juniper* and *Populus angustifolia* and *P. tremuloides*. Sedges are many, and among the flowering plants were two species unlike anything found along the desert streams, for all of these streams on the south side of the river have a similar vegetation: but here is a species of orchid growing abundantly,—*Spiranthes romanzoffiana*; the nearest locality in which we found it was Stanley Lake in the Sawtooth mountains about 500 miles away. The other was a species of gentian, a low, one-flowered plant, unlike any other species found and unlike anything described in the northwest flora.

Beyond this basin is what seems to be the latest of these flows; it is but little weathered, hard and sharp, just as the writhing, twisting, swirling mass cooled, apparently unchanged since the eruption.

Following up the grade of this flow we found a breaking in of the surface lava. We descended about 20 feet and discovered a series of chambers or caves. They were about 100 feet long more or less, with a width of 20 feet and an arched roof 10 feet in its greatest height, and about 2 feet where one communicated with another.

These caves were doubtless formed in the cooling of the lava; as the surface cools first the flowing continues below, thus forming these cavities.

As the surface crust was broken down in several places we were able to follow one series for about a quarter of a mile. In one chamber which had direct communication with the outside, was a floor of ice, which by the light of lanterns afforded a unique skating pond. The temperature must have been at the freezing point, although it was the middle of July and outside the thermometer stood at 110°, in the sun, for there was no shade. Our course in these caverns was finally obstructed by a flowing stream which utilized these cavities for a bed.

Beyond this plain, coming down from mountains, are a number of lost rivers, so called because they disappear in

sinks in the desert. Now these lost rivers are directly in the slope down to the fertile basin and between lie the lava caves; so the inference is drawn that the water of these lost rivers is conducted by such subterranean channels to places like the fertile basin described, and probably to the Snake river itself.