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GRATINGS OF THE MOON NATIONAL MONUMENT

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Introduction

The lava flows which built up the vast area of the Snake River plains vary in age from Pliocene to within a very few centuries of the present time. The earlier of the outpourings consist of the acid lavas, rhyolite and trachyte, but all recent ones have been of the darker basalt. The acid lavas are evident today in only a few isolated peaks which protrude through the basaltic surface rock.

Among the more recent of these flows are those found within the area of the Craters of the Moon, so named because of the seeming resemblance of its craters to those of the moon. The region contains both cones and flows and well drillings indicate that successions of flows and cinders from cones have been built up to a thickness of many hundreds or possibly a thousand or more feet. The last eruption is believed to have taken place between four hundred and a thousand years ago. The almost complete lack of weathering of the lavas has been used as the basis for the maximum age and the age of trees on the lava determines the minimum age. Up to the present time there has not been found a definite criterion for determining the exact age.

In addition to furnishing some of the finest examples of volcanic phenomena to be found on this continent the Craters area offers a possible solution to the long-standing controversy over the nature and source of the Snake River flows. It was long believed, and still is by some geologists, that they were the results of eruptions from great fissures where lava welled out in sheets from cracks in the earth. But Lindgren (1898) and

Russell (1902) pointed out that they were the product of many local eruptions from distinct vents and that inconspicuous craters probably supplied most of the lava. A compromise between these two extreme ideas is found in the Craters region where the eruption can best be described as a "localized fissure" type. The lava reached the surface through distinct vents, comes now marking most of the sites. Their near perfect alignment gives unmistakable evidence that they are on a line of weakness, which in the monument has been called "The Great Rift". This line runs diagonally southeast across the monument, a distance of about thirteen and a half miles, and continues for several miles beyond.

Volcanic Phenomena

Fissures- The Great Rift is marked by a line of fissures which can be traced almost continuously from Hupkes Top cone to the southern limit of the monument. In most cases the fissures merely represent crustal fracturing since the time of the eruption of the cone or flow on which they occur. In a few cases some activity in the form of broken/^{ejection}rock has also taken place, and as will be pointed out in connection with lava domes there may have been actual fissure flows for short distances. The fissure openings range up to thirty feet across and forty feet deep, how much deeper the cracks may go it is not possible to determine. The fissures appear to be of varying ages and there is a possibility that there has been fracturing up to very recent years.

Cinder Cones- Within the monument there are about thirty-five cones, most of them cinder cones. The "cinders" of

which these are largely composed are solidified lava spray which was forced out of the vent due to the pressure of the contained gases. They accumulated around the vents and were partly cemented together by the seepage of lava out into the mass, forming crater walls. The vent being thus extended more cinders were blown out.

Big Cinder Butte is the largest of the cones; its summit rises seven hundred and fifty feet above the surrounding flows and its basal diameter is about a mile. This cone is the product of several eruptions and does not have a well-defined crater. The largest craters are found in the Big Craters. This cone is two hundred and twenty feet high and has a double crater.

Spatter Cones- What Stearns (1920) described as, "one of the most perfect spatter-cone chains in the world" is located just south-east of the Big Craters. This series contains seven cones, varying in height from thirty to sixty feet, and all containing craters. The spatter which built up these cones consisted of slots of partially cooled lava which were ejected into the air a short distance. Being only partially cooled when they fell back they are more-or-less fused together.

Lava Domes- A lava dome is a low-angled cone of lava which issued usually from a fissure. Due to its low gas content it was not built into a cone of great height but issued out slowly and much of it was free to flow away. These domes have no visible craters. The elevated areas at Indian-tunnel and Great Owl cavern appear to be of this origin.

Flows- Covering the surface between the cinder cones and extending east and west of the Great Rift for about five

miles are lava flows. Most of these poured out of the bases of the cones but some flow-lava probably was supplied by the lava domes.

Emerging from the vent and spreading out as would a freely moving liquid a flow may travel for miles before becoming too cold to move. It is during the cooling process that the surface types, pahoehoe and aa are formed. These are about equally abundant in the monument. The pahoehoe or rope type is produced while the lava surface is still plastic enough to bend and it becomes rope or wrinkled as it is pulled or compressed during the flowing process. Part of a flow may be pahoehoe and another part aa. The latter type forms when the surface becomes too brittle to bend and it breaks and jams up like ice on a river.

Many of the flows have been traced to their sources but accurate mapping of the fields with the determination of the relative ages has not been done.

Lava Tubes- There are numerous subtities or lava tubes at various places in the flows. All formed in essentially the same manner, by the draining away of lava from under a roofed-over flow area. The Indian-tunnel tube is over a mile long although only about one-eighth mile is open, the remainder having caved in. The Great Owl cavern is the most perfectly formed and preserved lava tube which has been found in the monument. It is about seven hundred feet long and is nearly tubular in cross-section with a diameter of thirty five feet. It may be of some significance that the biggest lava tubes are

in the areas described as lava domes. Stearns (1928) has suggested that the tubes were the channels through which the lava flowed from the vents, but this is a possibility which is far from being accepted at the present time.

Bombs- Many bombs were destroyed or carried away before the area was put under the protection of the Park Service. However, there are many left and the interested observer can see spindle, ribbon, broad-crust, and tear-drop bombs on the sides and around the bases of most of the cinder cones. The largest of the ribbon bombs found is about eight feet, possibly sixteen when entirely uncovered, feet long, and the largest spindle bomb is about two feet in length.

Monoliths- Inbedded in the North Crater flow and in greater abundance in the Devil's Orchard are numerous monoliths which stand out prominently above the surrounding flows and cinders. These are walls of old craters. It is possible that in some cases fragments may have been moved from their original position by later flows. Small quantities of obsidian have been found in these monoliths.

Tree Molds- The only positive evidence of life at the time of the eruptions lies in the tree molds which are to be found in several places but in greatest abundance on Trench Mortar Flat. Here there are ninety eight, and in an area one half mile south of the Great Owl cavern there fifteen. Although the general laws of geology state that fossil formation seldom takes place in igneous rock the tree molds show unmistakably that they were formed by the enveloping of the bases of trees by

moving flows. The molds are confined to the edges of the individual flows, the lava being nearly cold at that stage of advancement. Even so the molds show that the trees were charred and may have been destroyed as soon as the molds were made. Most of the molds are vertical but a few are horizontal, showing that the trees fell into the advancing flow. They range in depth from three to nine feet and in diameter from two inches to thirty inches.

Lost River- The lost rivers which die on the Snake River plains are rather well-known. The water of several rivers sinks into the lava and again appears at the Snake river, fifty miles to the south. The important lost rivers, Big and Little Lost, are about thirty miles to the east of the monument but there is a small lost stream entirely within the monument. Little Cottonwood creek flows to the foot of the White Knob mountains and then sinks into the lavas.

Mountain Building

Idaho Batholith- The monument extends one and a half miles into the White Knob mountains which are underlain by a batholith which is probably an outlier of the Idaho batholith of late Cretaceous time. In other regions the White Knob batholith is of granite porphyry and while no exact work has been done in the immediate vicinity it is probable that it is of similar composition.

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