

## Volcanic Phenomena in the Craters of the Moon, Idaho

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This paper reports field observations made in the summer of 1935 in the Craters of the Moon area in Central Idaho, part of which is included in the National Monument of the same name. It is located at the north edge of the Snake River plain midway between the towns of Arco and Carey. A complete traverse across the desert to Minidoka and an airplane trip over a large portion of the lava fields furnished additional information reported here.

The surface features of this area are the results of the most recent volcanic activity of the Snake River lava plateau. As far as has been determined in other regions, where lava flows overlie till deposits, this activity took place in Pleistocene and Recent time and at three distinct periods of eruption, the last of which dates from 500 to 1000 years ago.

Many phases of volcanic activity are represented here. Most of the eruptions were of Hawaiian type, producing basic aa and pahoehoe flows in abundance. Numerous lava tubes are found in the latter flows. Cinder and spatter cones of Vesuvian type have been formed and there are indications that some of the eruptions may have been accompanied by *nuées ardentes* such as characterize eruptions of Mont Pelée altho its lavas are generally acidic.

The surface flows are extremely fresh and exposed in much the same condition as left on first cooling. A view from any elevation at once reveals the source and direction of flow of many of these lavas. Having this positive information as a check, I was interested in other criteria for determining the direction of flow, but found only one reliable criterion. No bent amygdule pipes were found such as have been described from the Keweenaw flows of northern Michigan. The bending of pahoehoe curls which form rough semi-circles with the convex side pointing in the direction of movement was the one type of index that could be used with at least local certainty.

One large irregular dike-like mass was observed at the edge of a flow where the lava had been forced from beneath the flow at a late stage in its eruption, oozing out between the edge of the flow and the older retaining wall beyond. It was traced for more than a half a mile and was from twenty to sixty feet high. The width could not be determined, but was at least thirty feet in places. Dikes of this character have been found along the crater rim of Mont Pelée and elsewhere.

The striking features of this region and the one furnishing the chief unsolved problem is the Great Rift and associated phenomena. As already mentioned, there have been three distinct periods of eruption

and the forces responsible for the Rift Zone were active thru all of them. The most obvious manifestation of this force is the alignment of the vents in a northwest-southeast direction forming a belt nearly three miles wide clearly shown on the topographic map of the Craters of the Moon, N. M.

If this line is projected north of the plain into the White Knob mountains a group of volcanoes known as the Lava Creek Vents is found at a distance of less than five miles. Not only is the group in line with the Rift Zone, but the vents themselves are similarly oriented. Their age is comparable to those on the plain and the Lava Creek Vents are several thousand feet higher in elevation.

This complete alignment of the cones in the Craters of the Moon led early investigators to call this an illustrious example of a fissure eruption and the National Monument was set aside as such. Of the true Icelandic type of fissure eruption, however, there was almost no evidence found in this entire region. Two questionable areas may be referred to other processes. The lavas have not been extruded along a great fissure, spreading out in large lake-like sheets, but have come from individual, widely separated vents.

The second feature of the Rift Zone is the parallelism of the numerous open fissures, predominantly oriented in the direction of the cones. These fissures are open fractures in the flows and cinder cones and are not sources of lava flows. The cracks range from a few feet to over a quarter of a mile in length, a few inches to over fifty feet in width, and some have a depth of nearly a hundred feet. No vertical or horizontal displacements could be found or other indications of faulting.

Exceptions to the linear arrangement of the rifts are found, usually at a considerable distance from the Rift Zone where there is a definite lack of orientation. In the Rift Zone itself there are a few areas where the fissures have been formed at an angle of  $60^\circ$  from the average trend.

The problem raised by these phenomena is to explain the force or forces which could determine the orientation of the vents and produce these fractures of similar alignment. The fissures are all tensional in character and have narrow U cross-sections. It is not impossible that the cinder cones were formed along similar rifts beneath the present surface flows, but this does not explain the open fractures in the latest of the lava flows. Also, if this were the case, one would expect to find feeder dikes along the Snake River canyon, but none have been reported. It does not seem probable, therefore, that the fissures determined the position of the vents, but that the rifts were produced by forces accompanying or associated with the eruptions.

Whatever may be the explanation, the force was tectonic and was undoubtedly connected with the major diastrophic disturbances of central Idaho. A regional investigation of the problem may throw some light on it considering the tectonic history of this region and the extrusion of the Snake and Columbia river lavas from every standpoint.