THE GEOLOGY OF PINE AND CRATER BUTTES: TWO BASALTIC CONSTRUCTS ON THE FAR EASTERN SNAKE RIVER PLAIN

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Pine and Crater Buttes are two basaltic volcanic centers of the Mud Lake volcanic area which lie approximately 9 km west of the Island Park caldera complex on the Eastern Snake River Plain (ESRP). The Mud Lake volcanic area consists of extensive pahoehoe lava flows derived from a variety of local vents which vary both in structure and chemical composition. The types of vents in this region include low relief basaltic shields, spatter and cinder cones, as well as more silicic rich tuff cones (Stearns, 1938, 1926). No detailed investigations of this area have ever been conducted so the purpose of this study was to develop and describe the emplacement history and petrochemical evolution of the volcanics associated with Pine Butte, Crater Butte and other nearby vents.

The area around Pine and Crater Buttes exhibits features characteristic of basaltic "plains" type volcanism (Greeley, 1976) in which flows have been erupted from numerous local vents associated with a northwest trending rift zone. All the observed vents are small coalescing shields produced by accumulation of tube and channel-fed flows of relatively high volumes. East of the area the rift zone is a tensional crack while within the vent area where it is visible it is marked by abundant elongate spatter ramparts and spatter cones. The spatter ramparts are typically less than a meter high while the spatter cones often attain heights of over 4 meters. The spatter cones have developed around small vents where local concentration of activity along the rift set has occurred. Spatter composing the ramparts and cones consists of welded blebs of magma, ejected in a semi-fluid state.

Four major vents were identified in the study area (Figure 1) and their associated eruptive products were mapped. All of the vents show a marked physical elongation or linear orientation coincident with the observed rift set. Flows from these vents moved predominantly southwest illustrating the generally southern slope of the Snake River Plain (Greeley, 1977).

Pine Butte is an elongated low shield with two collapse pits, Pine Butte East and Pine Butte West, at its summit. Pine Butte East is approximately .28 km wide and the base of its summit crater is at an elevation of 6435 m. A distance of only 259 m separates the two craters implying that the two vents are genetically related and, for the most part, contemporaneous in age although activity did not cease at both centers simultaneously. A lack of any significant in situ exposures in the crater wall and the highly degraded character of the lava tubes and channels from the summit indicate that Pine Butte East is the older of the two craters. Pine Butte West is an elongate collapse pit approximately .26 km in width and .43 km in length with its summit crater at an elevation of 6298 m. The final eruptive activity occurred at Pine Butte West with tube

emplacement of flows to the west and southwest, away from the topographically higher Pine Butte East.

Crater Butte consists of several coalescing smaller vents including Little and Big Craters. Little Crater is an oval shaped depression which lies just east of Pine Butte along the rift set. Several major lava tube/channel systems emanate from Little Crater and can be traced for many kilometers from the source area. Exposures in the walls of collapsed tubes and channels reveal the presence of at least four eruptive episodes. Each flow exhibits a similar stratigraphy which, from top to bottom, consists of 1) a sequence of thin, gas-rich layers with abundant pahoehoe toes and small distributary tubes, 2) a fine grained massive section with vesicular flow banding, 3) a nonvesicular massive section with accumulation of olivine and plagioclase phenocrysts, and 4) a thin, undulating vesicular section at the base. Distributary tubes from the main systems, varying in size from a few tens of centimeters to a few meters in diameter, are extremely numerous and therefore played an important role in flow emplacement. The youngest eruptive episode from Little Crater represents the most recent activity of any of the major vents in this area. Big Crater is about 1 km farther east along the rift from Little Crater. Big Crater is a deep collapse/explosion pit which has a single major tube/channel system which extends over 13 km to the southeast. The 55 m deep summit pit is a result of explosive activity late in the vent's history and post-eruption collapse following withdrawal of magma from beneath the vent. Big Crater's explosive nature is manifested by the presence of a tephra ring on the southwest rim of the crater.

Planetary exploration has revealed the importance of volcanic processes in the genesis and modification of extraterrestrial surfaces. Interpretation of surface features has identified plains-type basaltic volcanism in various mare regions of the Moon and the volcanic provinces of Mars (Greeley and Schultz, 1977). Plains-type basaltic terrains are differentiated from flood basalts and shield basalts by the presence of lava tubes and channels (sinuous rilles), rift zones, and low-profile shields. Portions of the Orientale Basin including Lacus Veris and Lacus Autumni, the upper parts of Mare Imbrium, Oceanus Procellarum and many of the smaller lunar maria have been proposed as areas of plains basaltic activity (Greeley, 1976) by the presence of small, low relief constructs and a marked abundance of sinuous rilles relative to other mare regions. Small shields, often associated with rilles, have also been identified in the southeastern part of Chryse Planitia of Mars (Greeley et al, 1977) and the Marius Hills of the Moon (Greeley, 1971). Identification of these areas with features that appear analogous to those observed in the Pine Butte area suggests similar styles of eruption and mode of emplacement. Such terrestrial analogies serve as a method to interpret the evolution of volcanic planetary surfaces on the inner planets.

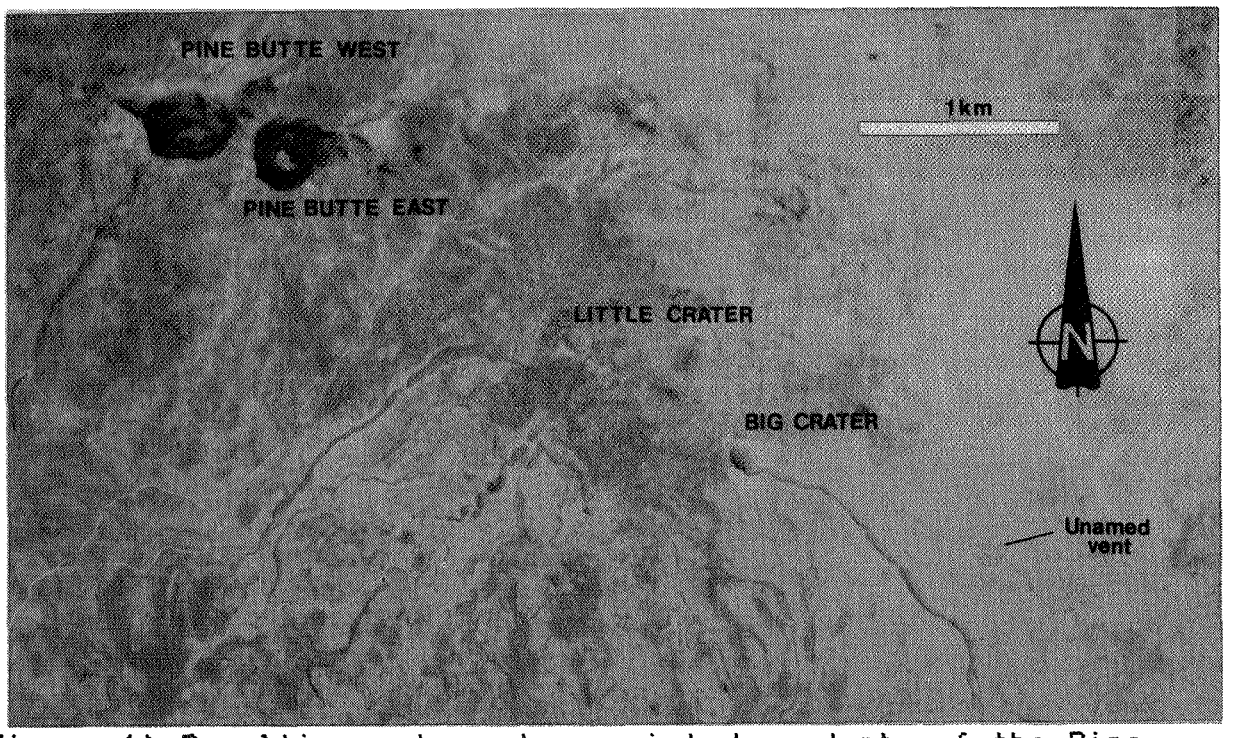

Figure 1) Basaltic vents and associated products of the Pine Butte and Crater Butte area.

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