KAUHAKO CRATER AND CHANNEL, KALAUPAPA, MOLOKAI:
A PRELIMINARY LOOK AT A POSSIBLE ANALOG TO LUNAR SINUOUS RILLES;
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Despite recent advances, the origin of lunar sinuous rilles remains controversial. Hypotheses still believed feasible for their origin include: 1) thermal erosion by lava, 2) structural control of the lava flows, 3) formation as constructional features, 4) the result of lava lake drainage, or, 5) some combination of the above. Due to the current inaccessibility of the Moon for field work, we are studying possible terrestrial analogs as part of a larger study of the nature and origin of lunar sinuous rilles. The lava tubes and channels associated with both recent and historic Hawaiian basalt flows have been shown to be very similar to the rilles found on the lunar surface. These previous studies have been helpful in outlining the basic similarities between the lunar rilles and terrestrial lava channels and their associated tubes. In this current study, we are searching for clues to the basic processes responsible for the formation of lunar rilles as well as the factors which control their development. As such, we have located a volcanic complex on the peninsula of Kalaupapa, Molokai, that appears to be a viable analog to lunar sinuous rilles. The preliminary results of our geologic study of this relatively recent volcanic feature are presented in this abstract.

Due to its isolated location and the fact that access is restricted, very little research has been done on Kauhako Crater and its lava channel/tube. Located on the Kalaupapa Peninsula of Molokai, access to the lava channel has been limited due to the presence of the Kalaupapa Settlement for those with Hansen's Disease. However, a series of petrologic analyses were made on a section of Kalaupapa's lavas at the turn of the century, and a slightly more complete geologic analysis of the peninsula was made in 1947 by Stearns and McDonald.

Photo- and map-reconnaissance of the crater and channel has shown that morphologically, Kauhako Crater/channel is very similar to many lunar sinuous rilles (fig. 1). These morphologic similarities include: a deep source crater at the head of the channel/rille, a sinuous lava channel that may or may not have formed a tube, basaltic composition, evidence of thermal erosion and some pyroclastic activity about the source areas.

At the summit of Pu'u 'Uao (Peacemaker Hill), in the center of Kalaupapa, is Kauhako Crater, a deep volcanic crater, and its associated sinuous channel and partly-collapsed lava tube. Pu'u 'Uao shield rises to an elevation of 122 m and is approximately 3 km across. Kauhako Crater, centered atop the shield, is 400 m across, more than 135 m deep, has a depth/diameter ratio of 0.37, and extends well below sea-level. Brackish water currently fills the bottom of this crater, making access to its depths difficult. Kauhako channel is 1.9 kilometers long and varies in width from 24 m to 110 m, with an average width of 58 m. The channel varies in depth from < 15 m to slightly more than 30 m nearer to the source crater. The channel gradient is just less than 4°.

Kauhako Crater erupted late in Molokai's history (late Pleistocene) to form Pu'u 'Uao and the Kalaupapa peninsula. The erupted basalts formed layers of alkalic olivine basalt pahoehoe with phenocrysts of feldspar, olivine and augite scattered throughout. It is believed that during the final building stages of Kalaupapa, molten lava almost filled the crater, then flowed northward through a large lava channel/tube created by the
draining lava. The tube has since partially collapsed and is marked by a long sinuous channel that runs down the north slope of the shield.

During the upcoming field season more detailed measurements will be made along the rille in order to more fully understand the dynamic history of the channel. Measurements to be made include: radii of curvature, height of lava “bath-tub” rings, changes in width and depth along the channel, as well as tube dimensions such as diameter, roof thickness, height of benches, and changes in floor gradient. The extent of lava erosion will also be measured and the factors which control it investigated. Models developed by Hulme\textsuperscript{3} and Wilson and Head\textsuperscript{14} will be applied. Results from this quantitative analysis will enable us to more closely compare Kauhako channel/tube to similar data that we have acquired for lunar sinuous rilles, and lead to a more complete understanding of the relationship between lunar and terrestrial rille formation.

Preliminary conclusions in this study are:

(a) Kauhako Crater and its adjoing channel were the final additions to the Kalaupapa volcanic complex and were formed during the late Pleistocene Era by multi-phase eruptions. (b) Lava tube formation occurred over significant portions of the length of the channel, segments of which have since collapsed. (c) Lava erosion appears to have been a factor in the formation of Kauhako channel. (d) The results of our preliminary analysis indicate that this feature may be a good analog for lunar sinuous rilles.

REFERENCES:

Figure 1: Oblique photograph of Kalaupapa Peninsula, Molokai, Hawaii. Kauhako Crater is centered atop Pu‘u ‘Uao. The channel is 1.5 mi long. (HIG photo)