

LAVA ERUPTION AND EMPLACEMENT: USING CLUES FROM HAWAII AND ICELAND TO PROBE THE LUNAR PAST. D. H. Needham¹, C. W. Hamilton², J. E. Bleacher³, P. L. Whelley^{3,4}, K. E. Young^{3,5}, S. P. Scheidt², J. A. Richardson^{3,4}, S. S. Sutton². ¹NASA MSFC, 320 Sparkman Dr., Huntsville, AL 35805, debra.m.hurwitz@nasa.gov, ²LPL University of Arizona, ³NASA GSFC, ⁴USRA, ⁵Jacobs Engineering Group.

Introduction: Investigating recent eruptions on Earth is crucial to improving understanding of relationships between eruption dynamics and final lava flow morphology. In this study, we investigated the 2014/15 Holuhraun, Iceland, and December, 1974 Kilauea, HI eruptions to gain insight into the dynamics in the source vent, the initiation of lava channels, and the origin of down-channel features. Insights are applied to Rima Bode on the lunar nearside to deduce the sequence of events that formed this sinuous rille system.

Geology of Rima Bode: Rima Bode is located on the Moon in SE Sinus Aestuum and is characterized by an elongate source vent (Fig. 1a) and two channel segments separated by a smooth plain 266 km² in area (Fig. 2a). The channel segments are 109 and 139 km long, 870 and 670 m wide, and 100 and 75 m deep, respectively, measured using Kaguya Terrain Camera (TC) imagery and Lunar Orbiter Laser Altimeter (LOLA) topography tracks. Vent depth varies from 160 to 500 m and has a volume of ~6 km³, and the upper channel initiates at the NW rim of the vent (Fig. 1a). The down-channel smooth plain has a marginal ledge that encircles the entire feature (Fig. 2a, arrow). By studying recent terrestrial eruptions, we gain in-

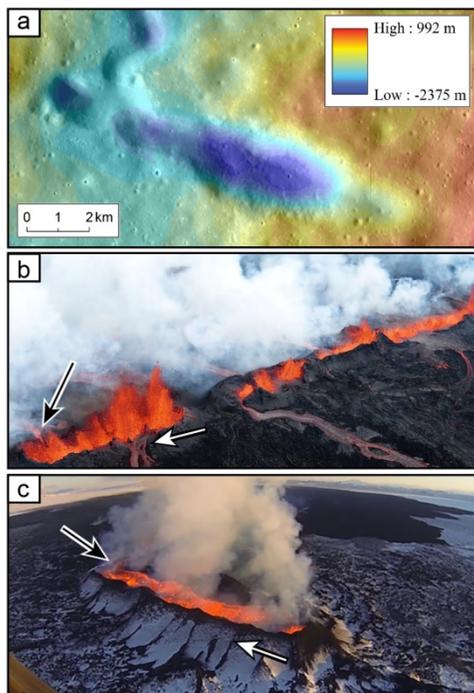


Fig. 1: (a) Rima Bode source vent (LOLA on Kaguya TC) and Holuhraun vent, (b) late 2014 and (c) February, 2015.

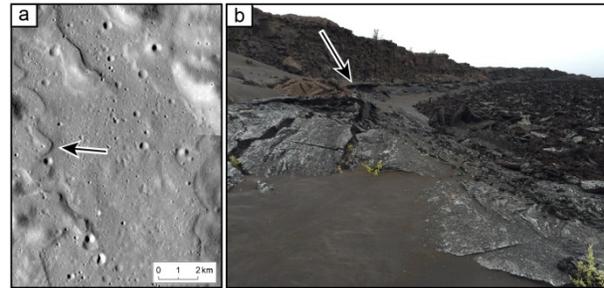


Fig. 2: (a) Rima Bode feature with marginal ledge, and (b) Kilauea, HI December, 1974 lava pond with marginal ledge.

sight into (1) the origin of vent morphology and its variable depths, (2) the timing of initial channel formation, and (3) the origin of the down-channel plain.

Origin of the Vent and Channel: The 2014/15 eruption at Holuhraun, Iceland provides an analog for the vent/channel system of Rima Bode. This widely documented fissure eruption initiated August 29, 2014, and over the ensuing 183 days deposited 1.5 km³ of lava over an area of 83.5 km², with a mean eruption flux of 161 m³/s [1]. The fissure developed spatter cones around distinct centers of explosive eruptions, with the largest encircling the longest-lived, 0.5 km-long NE cluster of eruption centers (Fig. 1b,c). Lava channels formed throughout the eruption — some were cut off by spatter deposition while others widened (Fig. 1b,c, arrows), possibly through small-scale local erosion as lava carried portions of the vent down channel.

Origin of the Down-Channel Plain: The December, 1974 eruption at the West Rift of Kilauea, HI has a similar mid-channel feature to that observed at Rima Bode. The eruption occurred December 31, 1974 and lasted 6 hours, depositing 0.014 km³ over 7.5 km², with a mean eruption flux of 662 m³/s. The relatively smooth plain is characterized by crusted lava in the interior exhibiting three episodes of separation, and a marginal ledge of lava that denotes high lava stands (Fig. 2b). These observations are consistent with the formation of a lava pond that subsequently drained [2].

Applications to Rima Bode: Rima Bode likely developed analogously to these terrestrial cases. The lunar vent's morphology is consistent with varied eruption rates observed in Iceland, and the smooth plains ledges are consistent with the high lava marks of the drained lava pond seen in Hawaii. Additional analyses will yield insight into dynamics of the lunar eruption.

References: [1] Gudmundsson et al. (2016) *Science*, 353. [2] Hamilton et al. (2015) *LPSC 46*, #1072.