Red Hot: Determining the Physical Properties of Lava Lake Skin

Camera Ford[1] and Einat Lev[2]

[1]Department of Earth, Environmental, and Planetary Sciences, Brown University, Providence, RI
[2]Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY

Lava lakes are the surface expression of conduits that bring magma to the mouth of a volcano from deep within the earth. Time-lapse data from a thermal imaging camera and a model of lava flow temperature variations were used to calculate the cooling rate and constrain the porosity of lava lake skin. Thermal footage taken at the Halema‘uma‘u Crater at the Kilauea Volcano in Hawai’i was analyzed to determine the cooling of two separate features of the lake’s surface. First, we calculated the cooling rate of the skin immediately after large gas bubbles burst at the lake’s surface. Second, the temperature of the skin was calculated as a function of distance from molten spreading centers on the surface, which provides evidence for cooling as a function of the skin’s age. These two cooling rates were compared against cooling curves produced by a model that simulates lava flow cooling based on a myriad of physical factors. The comparisons revealed that the calculated cooling rates most closely corresponded to the cooling curves that were produced with a lava porosity value of at least 80%.