Mapping Volcanic Fissures at Kilauea

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Abstract

Volcanic fissure vents are a narrow, sub-vertical ground cracks that erupt magma. They are difficult to quantify due to their inherent danger and their extremely narrow size. Additionally, lava flows, lava drain back, or collapsed rampart blocks typically conceal a fissure's surface expression. When a fissure remains exposed, documenting the non-uniform distribution of wall irregularities, drain back textures, and the larger scale sinuosity of the whole fissure system can be done with our developed robotic mapping device: VolcanoBot. VolcanoBot maps the fissures from the **inside** after an eruption ends and the fissure cools off to <50 C. The robot uses a near-IR structured light sensor that can reproduce the 3d structure to cm-scale accuracy. Here we present a portion of our 3D model within the Mauna Ulu fissure system. We see a self-similar pattern of irregularities on the fissure walls throughout the entire shallow subsurface, implying a fracture mechanical origin similar to faults. These irregularities are typically 1 m across, protrude 30 cm into the drained fissure, and have a vertical spacing of 2 m. A horizontal spacing has yet to be determined. Irregularities are larger than the maximum 10% wall roughness used in engineering fluid dynamic studies, indicating that magma fluid dynamics during fissure eruptions are probably not as passive nor as simple as previously thought. Where piercing points are present, we infer the dike broke the wall rock in order to propagate upwards; where they are not, we infer that syn-eruptive mechanical erosion has taken place.

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