

Title:

Transitional lava flows as potential analogues for lunar impact melts

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Abstract

Lunar impact melt deposits are among the roughest surface materials on the Moon at the decimeter scale, even though they appear smooth at the meter scale. These characteristics distinguish them from well-studied terrestrial analogues, such as Hawaiian pāhoehoe and ‘a’ā lava flows. The morphology of impact melt deposits can be related to their emplacement conditions, so understanding the origin of these unique surface properties will inform us as to the circumstances under which they were formed. Although there is no perfect archetype for lunar impact melts on Earth, certain terrestrial environments lend themselves as functional analogues. Specifically, a variety of transitional lava flow types develop if the surface of a pāhoehoe-like flow is disrupted, producing ‘slabby’ or ‘rubbly’ flows that are extremely rough at the decimeter scale. We investigated the surface roughness of transitional lava flows at Craters of the Moon (COTM) National Monument, comparing radar imagery and high-resolution topographic profiles to similar data sets acquired by the Lunar Reconnaissance Orbiter for impact melt deposits on the Moon. Results suggest that the lava flows at COTM have similar radar properties to lunar impact melt deposits, but the terrestrial flows are considerably rougher at the meter scale. It may be that lunar

impact melts represent a unique lava type not observed on Earth, whose surface texture is influenced by their high emplacement temperatures and/or cooling in a vacuum. Information about the surface properties of lunar impact melt deposits will be critical for future landed missions that wish to sample these materials.