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Mapping Buried Lava Flows using Synthetic Aperture and Ground Penetrating Radars in Craters of the Moon Lava Field, Idaho, USA

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Craters of the Moon (COM) lava field developed in a multiple eruptive history. Burial of older flows has resulted in a complex subsurface stratigraphy. For the older eruptive periods, the locations of source vents are either speculative or unknown. Surface and subsurface backscatter characteristics of the L-Band polarimetric Airborne Synthetic Aperture Radar (AIRSAR) data and Ground Penetrating Radar (GPR) soundings are used to resolve different Lava flows. Our primary objective is to define the most effective polarization and frequency for mapping, resolving and characterizing different lava types on extended volcanic field areas. Polarimetric analysis of AIRSAR images from COM allows clear recognition of the different lava types as results of the variability in their roughness and dielectric properties. HV polarized, AIRSAR L-band was utilized to produce a detailed map delineating surface lava with different backscattering properties. An accuracy assessment, onsite field survey and published geological maps were used to quantify the reliability of mapping lava flows and lava types using AIRSAR data. Mapping of pahoehoe flows was 98% accurate whereas Devil's Orchard aa' lava flow obtained accuracy of 87.7%. Accuracy values of only 46%-62% were obtained in ash and cinder deposits. Our data analysis suggests that the L-band frequency have an observable penetration depth up to 3 meters constrained mainly by the surface roughness and the subsurface dielectric properties. This penetration ability revealed buried fissures, outcrops and lava flows that were validated with ground-truthing GPR surveys.