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Pyroclastic and Volcaniclastic Deposits Near Bishop, California: Geologic Controls on Near- Surface Electrical Resistivity and Radar Data

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Volcanic deposits near Bishop, California were recommended for study as potential Mars analogs (National Research Council Decadal Study report on Terrestrial Analogues to Mars, 2001). We report here on three geophysically distinct analog sites in the Bishop area; the nonwelded Bishop Tuff, the moderately welded Bishop Tuff, and a fluvially reworked volcaniclastic unit. We performed geological mapping and sampling, multielectrode resistivity profiling, and ground-penetrating radar (GPR) profiling to identify and interpret radar signatures obtained from these three analogs of near-surface lithologies. Specific gravity and electromagnetic properties will be determined from core and hand samples to assess the electrical response of these geologic units. Multielectrode resistivity survey results indicate the moderately welded Bishop Tuff has relatively high resistivities (average ρa= 964 ohm-m) and contains near-vertical, alluvium-filled joints. The nonwelded Bishop Tuff is relatively resistive (average ρa= 364 ohm-m), massive, and highly fractured near large- displacement faults. The reworked volcaniclastic unit is less resistive (average ρa= 207 ohm-m), contains primary ashfall deposits interbedded with layered fluvially reworked tuffaceous sediments, and is cut by horst- bounding, meter-scale displacement normal faults. This study provides a basis for correlating physical attributes (i.e., lithology and deformation features) with measured data (i.e., resistivity and GPR data). Survey results indicate that multielectrode resistivity is a particularly instructive method to use with GPR surveys for constraining interpretations and for estimating signal loss from attenuation (e.g., Grimm et al., this meeting). This integrated approach provides a deeper understanding of the electrical and radar properties within terrestrial analogs of Mars.

McGinnis, R. N. et al. (2006), Moderately to Poorly Welded Tuff, Bishop, California: Geophysical and Geological Characterization to Determine the Source of Radar Scattering, Eos Trans. AGU, 87(52), Fall Meet. Suppl., Abstract P31B-0132.