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IN-SITU MEASUREMENTS OF IONIC MOTION DIRECTLY IN PLANETARY SOILS

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The search for extant life is one of NASA's most important goals. The existence of life, even in the most inhospitable terrestrial environments suggests that biosignatures of life may be ubiquitous provided we know what to look for.[1] Empirical evidence suggests that life, as we know it, requires an adequate supply of water. Recent Microscopic Imager and mineralogical data from Mars Opportunity and Spirit indicates a watery past. Mars Odyssey neutron and γ-ray orbital data are also being interpreted as indicative of the continued presence of near-surface water at mid-latitudes, albeit in relatively small amounts compared to most terrestrial environments.[2] Measuring ionic motion of these water-bearing soils will provide important information on the state of the soil and its capacity as a medium for harboring life. Moreover, terrestrial studies have demonstrated a close relationship between the depositional environment and the physical and chemical properties of the soils.[3,4] Such measurements would, therefore, also be important in determining the importance of chemical weathering and cementation phenomena.

Analytical laboratories in development for planetary exploration while, in principle, capable of such measurements, disturb the soils in gathering and processing the samples, thereby altering the chemical state of the native soil. The required consumables of these laboratories further limit the number of such measurements that could be made, handicapping their ability to perform large area surveys. We report here some results on the viability of an analytical instrument that eliminates the "laboratory" by performing measurements directly in the native planetary soils (see Figure 1). The data indicate that an appropriately configured instrument is capable of measuring ionic motion under the < 3 % water reserve identified by GRS. While further studies are needed to confirm the robustness of this approach under other environmental conditions, these initial measurements are extremely encouraging on its viability.

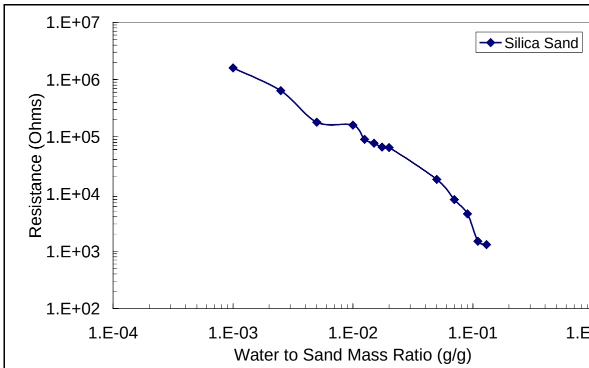

Figure 1: Electrical conductivity of fine silica sand mixed with varying amounts of water containing 100mM KCl solution.

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