Soluble Sulfate in the Martian Soil at the Phoenix Landing Site

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Sulfur has been detected by X-ray spectroscopy in martian soils at the Viking, Pathfinder, Opportunity and Spirit landing sites. Sulfates have been identified by OMEGA and CRISM in Valles Marineris and by the spectrometers on the MER rovers at Meridiani and Gusev. The ubiquitous presence of sulfur has been interpreted as a widely distributed sulfate mineralogy. One goal of the Wet Chemistry Laboratory (WCL) on NASA's Phoenix Mars Lander was to determine soluble sulfate in the martian soil. We report here the first in-situ measurement of soluble sulfate equivalent to ~1.3(±0.5) wt% as SO_4 in the soil. The results and models reveal SO_4^{2-} predominately as $MgSO_4$ with some $CaSO_4$. If the soil had been wet in the past, epsomite and gypsum would be formed from evaporation. The WCL-derived salt composition indicates that if the soil at the Phoenix site were to form an aqueous solution by natural means, the water activity for a dilution of greater than ~ 0.015 g H_2O/g soil would be in the habitable range of known terrestrial halophilic microbes.

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