

Rare calcium chloride-rich soil and implications for the existence of liquid water in a hyperarid environment

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We discovered permanently hydrated CaCl_2 -rich soils in Earth's driest region, the Atacama Desert. The soils contain up to ~15% CaCl_2 . X-ray diffraction indicates the rare minerals sinjarite, schoenite, and tachyhydrite. When water is added, the CaCl_2 crust immediately turns white due to an apparent mineralogical phase change from sinjarite to a brine. The surfaces are nearly continuously wet due to the salt's hygroscopicity. The Ca-enriched soils occur in rare exposures, possibly from shallow groundwater. Unlike the surface of adjacent abundant halite crusts, the CaCl_2 outcrops remain continuously wet, with up to 12% water under modern, and essentially rainless, climatic conditions. The wet surface stabilizes the land surface and acts as a dust trap. The sediment began accumulating at ca. 14 ka, contains trace quantities of organic carbon, and has total nitrogen that isotopically reflects significant biologically mediated gaseous losses. These deliquescent salts are unique habitats for life within the climatic limits of life on Earth, and are a potential analog for transient liquidwater sources for microorganisms in Martian soils.