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Halophilic microbial life on Mars?

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The search for extraterrestrial life has been declared as a goal for the 21th century by several space agencies. Plans for the exploration of Mars involve joint missions by ESA and NASA (ExoMars), with launches expected for 2018. Potential microbial candidates include extremely halophilic archaea (haloarchaea), since viable strains of these species have been isolated from million years old salt deposits (1) and halite has been found in Martian meteorites and in surface pools on Mars. Other recent discoveries on Mars of astrobiological interest are liquid saline water on the Phoenix lander (2), occurrence of perchlorate in Martian soil, and fluctuating amounts of methane in the Martian atmosphere.
This presentation will focus on the connection of these phenomena to possible activities of halophilic microorganisms on Mars, including survival of extreme environmental conditions. Low water activity, as in saturated salt solutions, is tolerated by halophilic microorganisms. Due to depression of the freezing point, brines will remain liquid at low temperatures and thus conducive to potential growth. The endurance of viable haloarchaea in ancient halite may be related to the preferential localisation of cells in small fluid inclusions, as was shown with bore cores and could also be demonstrated in laboratory experiments with the species Halobacterium salinarum and Halococcus dombrowskii. Investigations of haloarchaeal responses to simulated Martian UV irradiation and real space conditions indicated shielding against cellular damage by thin layers of salt (3), as well as the presence of mechanisms for DNA repair in some species. Methane production could possibly be caused by halophilic methanogens, and methane consumption by halophilic methanotrophs. Thus, salt deposits and subsurface samples from evaporitic sites should receive high consideration in future Mars missions.

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