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Astrobiological studies with extremely halophilic Archaea

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Extremely halophilic Archaea were isolated and characterized by both classical and modern molecular biological methods from hypersaline and haloalkaline lakes, salted soils, solar salterns and rock salt deposits (1). The survival of these micro-organisms after embedding in laboratory-made halite was investigated. Their presence in fluid inclusions was demonstrated by staining with the BacLight LIVE/DEAD kit and observation of their fluorescence by microscopy. Following resuspension of cells from halite crystals, a survival of about 0.5 - 4% according to colony forming units was obtained.

In previous studies which focussed on the resistance of halophilic archaea to UV radiation or the space environment, survival of a dose of 110 J/m^2 (using liquid cultures) and up to 10 000 J/m^2 at a range of 200 - 400 nm was reported, when dried Haloarcula sp. in a single layer were exposed on the Biopan facility (2). We exposed a few haloarchaeal strains to a Martian UV simulator lamp with a range of 200 - 400 nm and an intensity of 41.2 W/m^2, obtaining a viability of about 51- 67% of cells following different exposure times.

Other studies focus on the detection of haloarchaea in halite by Raman microspectroscopy and by NIR-FT-Raman spectroscopy, which are considered to be important future tools for Mars exploration (3). Using the Dilor XY Raman spectrometer with laser excitation at 514.5 nm, equipped with a confocal microscope BX40 (Olympus Corp., Japan) and a Bruker IFS 66 + FRA106 with laser excitation at 1064 nm (Bruker, Germany), instruments, we obtained characteristic carotenoid peaks contained by these microorganisms.

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