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The behaviour of halophilic archaea under martian conditions

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Mars is thought to have had liquid water at its surface for geologically long periods. The progressive desiccation of the surface would have led to an increase in the salt content of remaining bodies of water. If life had developed on Mars, then some of the mechanisms evolved in terrestrial halophilic bacteria to cope with high salt content may have been similar to those existing in martian organisms. We have exposed samples of the halophilic Natronorubrum sp. strain HG-1 (Nr. strain HG-1) to conditions of ultraviolet radiation (UV) similar to those of the present-day martian environment. Furthermore, the effects of low temperature and low pressure on Nr. strain HG-1 have been investigated. The results, obtained by monitoring growth curves, indicate that the present UV radiation at the surface of Mars is a significant hazard for this organism. Exposure of the cells to high vacuum inactivates ˜50 % of the cells. Freezing to -20 °C and -80 °C kills ˜80 % of the cells. When desiccated and embedded in a salt crust, cells are somewhat more resistant to UV radiation than when suspended in an aqueous solution. The cell inactivation by UV is wavelength dependent. Exposure to UV-A (> 300 nm) has no measurable effect on the cell viability. Comparing the inactivating effects of UV-B (250-300 nm) to UV-C (195-250 nm) indicates that UV-C is the most lethal to Nr. strain HG-1. Exposure to UV-B for a duration equivalent to ˜80 hours of noontime equatorial illumination on the surface of Mars, inactivated the capability to proliferate of more than 95 % of the cells. It cannot be excluded that they can survive when embedded in the soil or buried underneath rocks.