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Martian regolith simulation: testing the properties of organic molecules and microorganism in martian soil analogues

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Over the past few decades, Mars has seen a myriad of visitors from Earth in the form of orbiters and landers. Many of these missions were involved, directly or indirectly, in finding evidence for past or present life on Mars. Laboratory simulations are an invaluable tool for the verification of data from past and ongoing missions, or to direct future missions. We have investigated the intrinsic amino acid composition of martian soil analogues including JSC Mars-1, Salten Skov, and soil samples from Chilean and Peruvian deserts. The martian soil analogues were compared to ground samples of the Murchison and Orgueil meteorites. A Mars simulation chamber has been built to accomodate the temperature, pressure, and lighting conditions similar to those found at low latitudes on the martian surface. The effects of the environmental conditions were examined using high performance liquid chromatography (HPLC). We discuss the influence of UV radiation, low temperatures and gaseous CO_2 on the intrinsic amino acid composition of martian soil analogues and meteoritic samples.

While the current martian conditions are degradative to organic molecules, Mars is widely thought to have had a milder climate with liquid water on it's surface in the past. The progressive desiccation of the surface after a geologically long wet period, may have led to an increase in the salt content in 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 martian organisms. We have exposed samples of the halophilic archaean Natronorubrum sp. strain HG-1 to UV radiation, similar to the levels currently prevalent on Mars. Furthermore, the effects of high and low temperature and dessication on Nr. strain HG-1 have been investigated. We describe how these laboratory studies fit within the framework of life detection on Mars and the practical tasks of choosing and using martian regolith analogues in planetary research.