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Survival of amino acids on the surface of Mars

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Several space missions are planned that will particularly search for organics and biosignatures on Mars. It is therefore important to investigate what processes may affect organic molecules on and below the planetary surface. In order to determine the stability of impacting organic compounds, laboratory simulation data on the survival of organics are a crucial step to understand chemical reaction pathways on the Martian surface. We have designed and built several small Mars simulations chambers for specific purposes in order to create a database on the degradation of organics and microorganisms on the Martian surface. Simple amino acids have been shown to be destroyed rapidly as a result of martian UV lighting. The photolytic degradation rate varies directly with the sample temperature, allowing us to predict that colder, near-polar, regions of Mars will offer better degrees of preservation for postulated relics of complex organic chemistries. Furthermore we have investigated the native amino acid composition of two analogs of martian soil, JSC Mars-1 and Salten Skov. The effects of the simulated conditions have been examined using high performance liquid chromatography (HPLC). Exposure to energetic ultraviolet light in vacuum appears to cause a modest increase in the concentration of certain amino acids within the materials, which is interpreted as resulting from the degradation of microorganisms. The influence of low temperatures shows that the accretion of condensed water on the soils leads to the destruction of amino acids, supporting the idea that reactive chemical processes involving H_2O are at work within the martian soil. We discuss the influence of UV radiation, low temperatures and gaseous CO_2 on amino acids thin films and the intrinsic amino acid composition of martian soil analogs. The studies completed within

this project have demonstrated that the martian environment is hostile to the prolonged presence of amino acids at the Martian surface. We describe with the help of a simple model, how these studies fit within the framework of life detection on Mars and the practical tasks of choosing and using martian regolith analogs in planetary research.

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