GAMMA IRRADIATION EFFECTS ON MARTIAN ANALOGUES

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Introduction: The search for life on Mars is a primary focus of sample return missions planned for the coming decades. The chance of finding extant life in returned samples is small, but non-zero. Mars sample return missions will be designated COSPAR category $IV_{b\text{-}c}$. Sterilisation of Martian material is essential prior to removing samples from biocontainment. Gamma irradiation with doses exceeding 30Mrad may provide a suitable method of biological sterilisation due to the limited alteration it produces in the host sample [1]. The present study aims to quantify the potential irradiation-induced alteration of petrological, chemical and isotopic properties in a range of Martian analogue material.

Methods: A ^{60}Co radiation source will be used to expose the samples to ≥30Mrad. Sections of irradiated and unirradiated samples will be analysed by a broad range of techniques, including: field emission SEM, XRD, optical and IR microscopy, Raman spectroscopy, ICP-MS, light stable isotope analyses (C, N, O), and analyses of organic compounds and bacteria will also be undertaken.

Samples: Previous studies have demonstrated several effects of gamma irradiation [1]. Various rocks and minerals were demonstrated to respond differently to intense gamma irradiation. To further our knowledge of irradiation effects it is therefore important to study a diverse range of physical and chemical properties across a range of Mars-like lithologies. Such investigations are essential and should form a major part of planning for future Mars sample return missions.

Data from recent Mars missions suggest the presence of evaporite and sulphate minerals such as jarosite [2,3], as well as the typical weathered basaltic soils. Samples of basalt, Mars soil simulant, jarosite, halite, and illite will be analysed. Additional samples will also be analysed in order to quantify the irradiation effects in organic compounds. These samples will include both synthetically-doped and naturally organic rich samples, such as Kimmeridge clay and CM2 Murchison.

References: [1] C.C.Allen et al., Journal of geophysical research, vol. 104 (1999). [2] A. Gendrin et al., Science 307, 1587 (2005). [3] G. Klingelhöfer et al., Science 306, 1740 (2004)