Simulation experiments to identify potential martian bio-signatures

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Crucial to determining whether life could have endured on Mars is the identification of when and where liquid water may have existed. Observations of secondary alteration minerals [1,2] and Recurring Slope Lineae [3,4], suggests liquid water may have once been present on the martian surface, or in the present sub-surface, indicating habitable environments could have existed in Mars' history, or could potentially exist today. This warrants further investigation as to whether martian environments could support microbial life, and if so, what geochemical signatures could be produced and used as a key indicator for life.

Abiotic and biotic experiments have been conducted to determine if potentiall aqueous environments could support microbial growth, and, if so, identify any geochemical changes they induce, which could be used as bio-signatures. To accomplish this, we have used regolith simulants representative of a global martian composition [5] and a haematite-rich composition [6], and derived their associated fluid chemistries using thermochemical modelling [7]. The simulants and fluids have then been used to mimic the specific chemical environments found on Mars in the laboratory. A microbial community from Pyefleet mudflats in the Colne estuary (Essex, UK) was used as an analogue community. A flow through reaction vessel was used to simulate the physical conditions found in the martian subsurface [8]. Fluid evolution has been monitored using ICP-OES and the formation of secondary alteration minerals were determined using SEM and Raman spectroscopy.

We will present initial results from these experiments, which will contribute to understanding whether martian environments could support microbial life, and identify microbially-induced geochemical changes that could be used as bio-signatures.

References: [1] F. Poulet, et al., Nature 438 (2005), pp. 623–627. [2] J. Carter, et al., J. Geophys. Res. E Planets 118 (2013), pp. 831–858. [3] V.F. Chevrier & E.G. Rivera-Valentin, Geophys. Res. Lett. 39 (2012), pp. 1–5. [4] F.J. Martín-Torres, Nat. Geosci. 8 (2015), pp. 357–361. [5] R. Gellert, et al., in LPSC, 2013, Abstract# 1432. [6] N.K. Ramkissoon, et al., in review. [7] N.K. Ramkissoon, et al., in LPSC, 2018, Abstract# 1934. [8] Olsson-Francis *et al.,* in prep.