MARS SIMULATED EXPOSURE AND THE CHARACTERISTIC RAMAN BIOSIGNATURES OF AMINO ACIDS AND HALOPHILIC MICROBES

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Though Raman bands of α-amino acids (AA) are well documented, often only the strongest intensity bands are quoted as identifiers (*e.g.* Jenkins *et al.*, 2005; De Gelder *et al.*, 2007; Zhu *et al.*, 2011). Unknown regolith mixtures on Mars-sampling missions could obscure these bands. Here the case is made for determining, via a statistical method, sets of characteristic bands to be used as identifiers, independent of band intensity or number of bands (Rolfe *et al.*, 2016). AA have upwards of 25 potentially identifying bands and this method defines sets of 10–19 bands per AA. Examination of AA-doped Mars-like basalt resulted in a maximum of eight bands being identified, as some characteristic bands were obscured by mineral bands, including the strongest intensity band in some cases. This proved the need for characteristic bands to be defined, enabling successful identification of AA. The ESA *ExoMars* Rover mission will crush and then pass the sample to the Raman Laser Spectrometer. We crushed a Mars-like basalt to a similar grain size expected to be created by the rover. Our samples were doped with 1 % (by weight) AA samples, resulting in no detection of AA, because of loss of original spatial context and spaces between the grains. We recommend that Raman spectroscopy on future missions should be conducted before the sample is crushed.
Halite-entombed halophilic microbes, known to survive being entombed, were exposed to Mars-like surface (including temperature, pressure, atmospheric composition and UV) and freeze-thaw cycle (plus pressure and atmospheric composition) conditions. This test on the survival of the microbes showed that survival rates quickly deteriorated in surface conditions, but freeze-thaw cycle samples had well preserved Raman biosignatures, indicating that similar signatures could be detectable on Mars if similar life persists in evaporitic material or brines today.

References

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