Geophysical Research Abstracts
Vol. 20, EGU2018-1112, 2018
EGU General Assembly 2018

Detection of Polycyclic Aromatic Hydrocarbons on the Martian South Polar Residual Cap

Jacqueline Campbell, Panagiotis Sidiropoulos, and Jan-Peter Muller

University College London, Mullard Space Science Laboratory, Imaging Group, Surrey, United Kingdom (jacqueline.campbell.16@ucl.ac.uk)

The Martian South Polar Residual Cap (SPRC) is a permanent region of CO_2 ice exhibiting unique, dynamic, flat floored, circular sublimation features known colloquially as Swiss Cheese Terrain (SCT) [1]. Sublimation processes can expose dust particles trapped within the ice during winter, which can then be analysed using data from the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM) on board NASA's Mars Reconnaissance Orbiter (MRO) [2].

Polycyclic Aromatic Hydrocarbons (PAHs) are a type of organic molecule, and are considered to be important in astrobiology; they potentially play a role in abiogenesis, can be a biomarker for extant life, and have yet to be detected on Mars. PAHs have been shown to be rapidly destroyed by ultraviolet radiation at the Martian surface [3], and in this work we analyse the composition of SCT dust rims, with a particular focus on the detection of PAHs that might have been preserved within the SPRC.

A series of laboratory experiments has been carried out at the Cold Surfaces Spectroscopy (CSS) facility at the Institut de Planetologie et d'Astrophysique de Grenoble (IPAG) to establish diagnostic features of PAHs, and their detectability limit within SPRC ice analogues.

CRISM spectra of regions of interest have been compared with known Martian mineralogy and laboratory data, with results suggesting Magnesium Carbonate dust content in depression rims, and rims have been found to have a higher water content than regions of featureless ice. CO_2 frost and ice has been found to be the most limiting factor in looking for PAH diagnostic signatures on the SPRC. Further work is being undertaken to understand the contaminating effects of Martian atmosphere, surface CO_2 frost and ice on PAH signatures.

Part of the research leading to these results has received partial funding from the European Union's Seventh Framework Programme (FP7/2007-2013) under iMars grant agreement n° 607379; MSSL STFC Consolidated grant no. ST/K000977/1 and the first author is supported by STFC under PhD studentship no. 526933.
Europlanet 2020 RI has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 654208.

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Preferred session: Remote Sensing of Solar System Bodies or Astrobiology