Contribution ID : **95** Type : **Oral**

Water dynamics in minerals on the surface of Mars

Thursday, 12 November 2020 13:30 (30)

Water was discovered 1.5 km below the surface of Mars in 2018 and some liquid water may occur transiently on the Martian surface in the spectrally dominant phyllosilicate group, smectite. In the same year, NASA confirmed that water ice is present in silicates on the surface of the Moon in the polar regions. This discovery has prompted the return of people to the Moon, whereby the Artemis program planned for 2024 will see the next man and the first woman land at the South Pole. The extraction of trapped and frozen water from minerals on other planetary bodies such as the Moon and Mars is a technical challenge if humanity is to implement an innovative and sustainable program of exploration enabling human expansion across the solar system.
We have investigated the hydration properties of clays and minerals found on Mars using time-of-flight neutron spectroscopy. [1] From Quasi-Elastic Neutron Scattering data we determined water diffusion coefficients for input into our model to identify possible sites where the water resides in Na-smectites. Additional characterisation of montmorillonite has been conducted at the Australian Synchrotron facility using far-infrared radiation to obtain proportions of bound and unbound water in Na- and Ca-smectite. We observed the cation rattle at low energy (~45 cm-1) as a distinct signal from that of the bulk-like water and cationic bound water, where the latter is 'trapped' within the clay layers. [2,3]
Understanding of water hydration processes in these abundant soils and minerals will be of use not just on other planetary bodies but also in extreme environments such as Antarctica. On Earth, knowledge of water dynamics at clay mineral surfaces can be utilised to improve performance and durability of lining materials for barriers used in environmental protection. [4]

[1] W.P. Gates, L.P. Aldridge, G.G. Carnero-Guzman, R.A.Mole, D.Yu, G.N. Iles, A. Klapproth, H.N. Bordallo. (2017) App. Clay Sci. 147 (2017) 97–104
[2] G.N. Iles, W.P.Gates, G.G. Carnero Guzman. "Quantifying bound water in smectites using Far-IR". Australian Synchrotron Proposal M13427 (2018)
[3] G. N. Iles, D. Appadoo, A. Fehervari, A. Mentor, W. P. Gates. Cation rattle in Martian minerals holds key to water mobility. (In preparation)
[4] W.P. Gates, H.N. Bordallo, A. Bouazza, G.G. Carnero-Guzman, L.P. Aldridge, A. Klapproth, G.N. Iles, N. Booth, R.A.Mole. "Unfrozen water in frozen mud". Nature (Submitted 2020)

Speakers Gender

Female

Level of Expertise

Experienced Research

Do you wish to take part in the poster slam

No

Primary author(s) : Dr ILES, Gail (RMIT)

Co-author(s) : GATES, Will (Deakin University); MOLE, Richard (ANSTO); Dr FEHERVARI, Andras (Institute for Frontier Materials, Deakin University)

Presenter(s) : Dr ILES, Gail (RMIT)

Session Classification : Earth & Environment

Track Classification : Earth & Environment