Water-Rock Reactions in the Solar System

- **Electron microscope investigations of water species**
- **Understanding the effects of water on asteroidal and Mars rocks**

Level	PhD
First Supervisor	John Bridges
Second Supervisor	Adrian Martindale
Application Closing Date	19 January 2022
PhD Start date:	26 September 2022

Project Details:

Samples of different Solar System bodies arrive on Earth through the natural flux of meteorites and sample return space missions. By using a variety of experimental techniques on such samples we can constrain the origin of mineral assemblages associated with the reaction of water on Mars and asteroids in order to better understand the evolution of the Solar System.

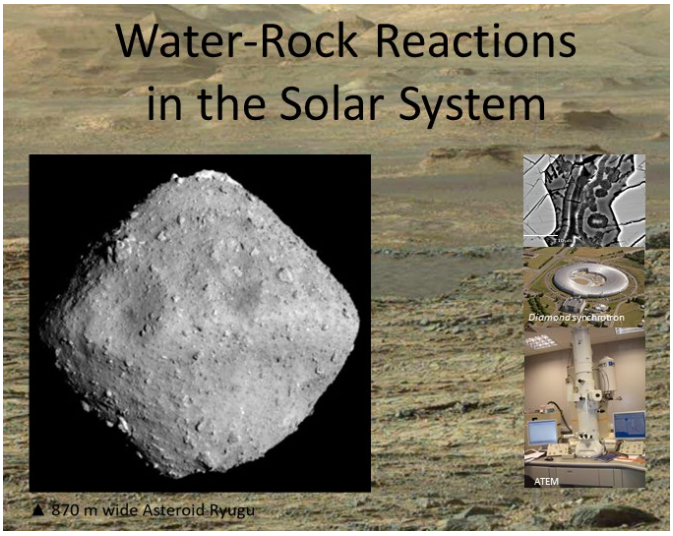
The Hayabusa2 mission successfully sampled asteroid Ryugu in mid 2019 and returned samples to Earth a year later. Leicester is part of the Hayabusa2 mineralogy team and we are making some of the first analyses of the samples. Using a variety of electron microscopy techniques and recently commissioned beamlines at the Diamond synchrotron we have a unique opportunity to determine asteroidal processes. We will also analyse close analogues to the Ryugu material from carbonaceous chondrites including the recently discovered Winchcombe meteorite find.

The same analytical techniques can be applied to recently discovered martian meteorites. We have made some of the most detailed analyses of the nakhlite meteorites and this studentship will study a recently discovered new nakhlite. By determining the mineral assemblages resulting from water-rock reactions in the parent rocks we will be able to constrain the environment of sub surface hydrous processes in that part of the martian crust.

The School of Physics and Astronomy and Space Park Leicester have a wide range of space science activities including the study of Mars through mission involvement (e.g. Mars Science Laboratory, ExoMars, HiRISE, CaSSIS) and the study of martian meteorites. Our Advanced Microscopy Facility holds state of the art electron microscopes and we have long standing expertise in the use of synchrotron beamlines to analyse planetary materials.

The PhD student will not only work with the supervision team at Leicester but also as external supervisor Dr Susanne Schwenzer, a leading expert on Mars fluid studies.

We welcome applications from a range of disciplines – Physics, Geology in particular, and a desire to working in a multidisciplinary research environment is important. Fellow PhD students and researchers work on related topics including Mars Sample Return instrumental techniques, Mars Science Laboratory and ExoMars. The student will learn state of the microscopy and synchrotron techniques at Leicester and ePSIC, Diamond.



Water-Rock Reactions in the Solar System

Further information on how to apply and funding can be found HERE

References:

1 Bridges, J. C., Schwenzer, S. P., Leveille, R., Westall, F., Wiens, R. C., Mangold, N., Bristow, T., Edwards, P., and Berger, G. (2015), Diagenesis and clay mineral formation at Gale Crater, Mars, J. Geophys. Res. Planets, 120, 1– 19, doi:10.1002/2014JE004757.

2 Piercy, J. D., Bridges, J. C., Hicks, L. J., MacArthur, J. L., Greenwood, R. C., & Franchi, I. A. (2020), Terrestrial alteration mineral assemblages in the NWA 10416 olivine phyric shergottite. Geochimica et Cosmochimica Acta, 280, 26. doi: 10.1016/j.gca.2020.03.026