Searching for martian samples in asteroidal regolith

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Description: A major goal of future exploration of the martian system includes a better understanding of the origin and nature of its moons, Phobos and Deimos [1], and the possibility of the existence of martian material in Phobos regolith – a key consideration driving JAXA's MMX mission [2]. The surface regolith on Phobos appears to resemble a complex heterogeneous breccia and it has been suggested previously that Phobos' upper regolith may contain appreciable amounts of martian material on account of Phobos' vicinity to Mars and its low escape velocity [3].

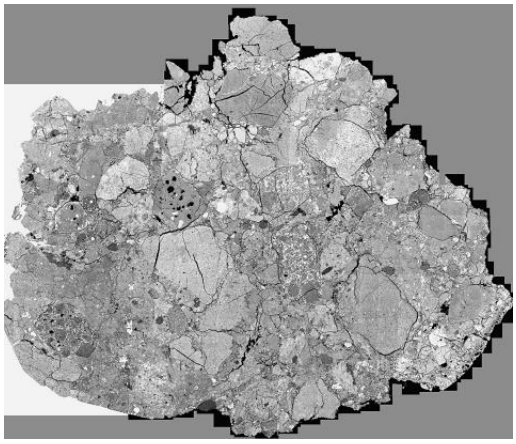

Fig. 1. BSE image of a Kaidun polished section showing lithological clast diversity. Image is 4 cm across.

Although no candidates have yet been unequivocally identified as being from Phobos, the meteorite Kaidun (Fig. 1) has many of the necessary characteristics and has been postulated as a possible Phobos candidate [4]. Previous research on Kaidun highlighted the diversity of clast types including some that would have originated on a large differentiated body [4].

A recent triple O isotope study performed on some Kaidun differentiated clasts (n=4) confirmed their diversity. However, recent improvements in sample size and precision offer the opportunity to explore a much wider range of samples, that will allow a far more complete understanding of origin of these clasts that will permit a far better evaluation of their potential links with Mars. The friable mixed regolith nature of Kaidun with the presence of igneous, possibly martian, clasts makes this material excellent for the preparation and demonstration of high-precision measurements of martian regolith samples that will likely be amongst those to be returned by MSR.

In this project the PhD student will carry out (1) detailed petrographic characterisation of Kaidun meteorite to identify clasts of differentiated types; (2) refine micro sampling strategy for carrying out high-precision triple O isotope study on differentiated clasts in Kaidun to evaluate their potential martian origin.

Results from this study will provide important insights into the origin of the martian moon, Phobos, while training the next generation of planetary scientists for maximal scientific exploitation of samples returned by MSR and MMX missions.

Continued

References:

[1] Murchie et al (2014) Planetary and Space Science, 102, 176-182. **[2]** Usui T. et al. (2020) Space Science Reviews 216, 49. **[3]** Ramsley and Head (2013) Planetary and Space Science 87 115–129. **[4]** Zolensky and Ivanov (2003) Chemie Der Erde 63, 185–246.

Qualifications required:

BSc (hons) in Geosciences, 2:1 or higher (a first class Master's degree in Geosciences or equivalent with some independent research experience would be preferred)