Understanding the earliest stages of planetary evolution

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The southern giant impact basin on Asteroid Vesta from which the Vestoid asteroid family [1] was likely ejected (images: NASA).

Project highlights:
• This study will provide important insights into the early stages of planet formation.
• The project will provide training in a range of cutting-edge analytical techniques.
• The work will be undertaken in collaboration with partners in the US, Japan, Sweden and France.

Project Description: Understanding the initial formation conditions of the terrestrial planets remains an outstanding issue in planetary science. Modelling and theoretical studies suggest that during their early stages, planets grow by incorporation of minor bodies, termed planetesimals [2]. Some achondritic meteorites are potential representatives of this early planetesimal population and preserve evidence of impact mixing during planetary growth [3]. This project will seek to understand the processes involved in early-planet formation through geochemical and isotopic analysis of key basaltic achondrite samples.

This project will focus on a suite of anomalous basaltic achondrites, which display evidence for heterogeneous oxygen isotope composition (e.g., Dhofar 007, Bunburra Rockhole) [4]. This heterogeneity may be the result of impact processes [3]. Work undertaken as part of this project will involve detailed petrographic and mineralogical investigations of selected samples with the aim of understanding the diversity of components present in each. Subsequently, mineral separates will be prepared for three oxygen isotope analysis. Other
aspects of the project involve in-situ age dating of key components and nanoSIMS analysis for volatile elements such as H and Cl.

The successful candidate will receive training in the analysis of extra-terrestrial samples in modern, state-of-the-art, laboratories, gaining valuable transferrable skills. Techniques to be used will include electron microscopy (SEM, EBSD, EPMA), laser-fluorination (O isotopes), ion probe (for age dating and volatiles). There may be an opportunity to undertake visits to our international collaborators’ labs for data collection.

References:

   https://doi.org/10.3847/PSJ/accb98
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