The Origin of Chondrule Rims – a unique window into the protoplanetary disk?

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**Description:**
Primitive meteorites contain a multitude of components recording various details of the earliest stages of solar system formation. A large portion of these rocks are composed of chondrules, mm sized spheres of once molten silicates, and while they have been studied extensively considerable debate persists as to their origin, in part driven by limited knowledge about the precursors. However, many of these chondrules are rimmed by various materials that were acquired after the chondrules formed, but before accretion on the parent body, and therefore uniquely offer the opportunity to investigate materials that may have been precursors for the chondrule, and experienced on-going processing in the protoplanetary disk post chondrule formation. Pre-solar grain abundances of chondrule rim material is similar to that in the more abundant inter-chondrule matrix [1,2], suggesting broad similarity, but little is known about the bulk isotopic signatures, that can constrain generic relationships and track the evolution gas-dust exchange in the protoplanetary disk. This project builds upon our extensive experience using our NanoSIMS 50L at the Open University to investigate the isotopic reservoirs sampled by the most primitive solar system materials available [3,4] and seeks to:

a) **Compare the O-isotope variation of chondrule rim material, host chondrule and co-existing fine-grained matrix material in the host chondrite to understand the relationship between these distinct reservoirs.**

b) **Investigate the O-isotope variation in complex fine-grained rims, providing unique insight into the evolution of the dust reservoir post chondrule formation**

c) **Investigate the isotopic variation recorded in igneous (or melted) rims [5], and compare with our recent studies of Wark-Lovering rims round refractory CAI inclusions [6]**

d) **Characterise the isotopic and structural nature of any organic material present in order to help constrain the protoplanetary disk environment at the time of rim formation.**

We have access to a wide range of primitive meteorites, which will be studied using advanced analytical scanning electron microscope(s) to identify and characterise the most representative and interesting chondrule rims. Isotopic information will be acquired with the NanoSIMS 50L at the Open University, using the instrument in high precision spot mode and high-resolution isotope ratio mapping mode. Raman spectroscopy mapping at comparable scale to NanoSIMS will be performed using our Raman microscope [e.g. 7]

Further advanced analytical tools may be deployed to further characterise the fine-grained rim material depending on initial findings in partnership with some of our established collaborators, including synchrotron XANES, transmission electron microscopy, ICPMS and micro-XRD.
References:


Qualifications required: This project is well suited to candidates with a good first degree in Earth/planetary sciences, particularly with experience in geochemistry. Graduates with Physics/Chemistry degrees with experience of analytical instrumentation and/or interest in solar system formation are also encouraged to apply.