$^{53}\text{Mn} - ^{53}\text{Cr}$ systematics of chondrules and the chronology of the early solar system

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**Image Caption:** Back-scattered electron image of an individual chondrule from Lance. The chondrule contains olivine, pyroxene and mesostasis.

**Image Caption:** A $^{53}\text{Mn} - ^{53}\text{Cr}$ isochron diagram produced from individual phases from the Paris meteorite (*Göpel* et al., 2015).

**Project Background**

Building a chronology for processes that occurred during the first few millions years of the solar system can be approached from two standpoints; absolute dating using techniques such as the long-lived U-Pb chronometer and the utilisation of short-lived isotope systems (*Amelin and Ireland*, 2013). Of the short-lived isotope systems, $^{53}\text{Mn} - ^{53}\text{Cr}$ (half-life of 3.7 Ma) has huge potential because Mn and Cr are abundant in meteoritic materials and are readily fractionated due to differences in volatility, thus providing insights into the timing of a range of processes from condensation to the differentiation of planetesimals.

**Project Aims and Methods**

The project will be based around obtaining high-precision Cr isotope data on chondrules and other components in meteorites. While the $^{53}\text{Mn} - ^{53}\text{Cr}$ system has been used a chronometer for several decades (*Birck and Allègre*, 1988; *Trinquier* et al., 2008) the utility of the $^{53}\text{Mn} - ^{53}\text{Cr}$ system for dating requires homogeneity in the initial $^{53}\text{Mn}/^{55}\text{Mn}$ ratio, which is hotly debated (*Qin* et al., 2010). Interpretation of $^{53}\text{Mn} - ^{53}\text{Cr}$ dates for chondritic meteorites has proved complicated and there is growing evidence that different chondrule groups may have distinct $^{53}\text{Cr}$ compositions (*Göpel* et al., 2015). This project will provide the first comprehensive study of $^{53}\text{Mn} - ^{53}\text{Cr}$ systematics in individual chondrules, with the aim of dating chondrule formation and their relationship to other meteoritic components. Critical to the project’s success will be petrographic characterisation of the chondrules and integrating $^{26}\text{Al} - ^{26}\text{Mg}$ data to provide a self-consistent chronology of the early solar system.
Candidate

The successful applicant should have a background in either Earth Sciences or a related physical science, preferably to MSc/MSci level. A strong interest in Earth or planetary sciences is essential.

Training

The project will be based around obtaining high-precision isotope data on meteorites and their constituent components. Therefore, we will provide training in clean laboratory techniques and mass spectrometry. The project will entail petrographic and mineral chemical analyses of meteorites and so additional training will be given in microbeam techniques. The student will be expected to present results at national and international conferences and to publish findings in international journals. This will require excellent communication and written skills.

References / Reading List


Links

http://www.bristol.ac.uk/earthsciences/courses/postgraduate/

Application deadline: 23.59 GMT, Monday 2nd April 2018

How to apply to the University of Bristol: http://www.bristol.ac.uk/study/postgraduate/apply/.

Please select PhD in Geology as the programme in the online application system.