

Funded PhD position in isotope geochemistry:

Tracking the composition of the Archean atmosphere and oceans using fractionated stable isotopes in chert

Project: The abundance of chert deposits in Archean terrains constitutes one of the most unusual features of early Earth. The question of how the composition of the atmosphere and oceans changed during the first 3 billion years (Ga) of Earth history has been hotly debated by geologists. Diverse arguments are used to defend opposing points of view but interpretation of mass-independent fractionation of stable isotopes holds the key to resolving ongoing debates. Specifically the proposed project will:

(1) Build on recent work performed at SUERC to constrain Devonian palaeo-atmospheric signals to elucidate the temporal evolution of Archean atmospheric chemistry using the isotopic compositions of Ar and Xe preserved in cherts. For example, models predict the $^{40}\text{Ar}/^{36}\text{Ar}$ ratio (where ^{40}Ar is produced by the decay of ^{40}K in the crust and mantle) evolved during the Archean. If atmospheric Ar was trapped in cherts or in fluid inclusions containing seawater that had equilibrated with the Archean atmosphere, the Ar isotope composition should constrain the kinetics of atmospheric evolution and discriminate between models that propose early catastrophic degassing of the Earth, and those that argue for more protracted degassing. Data will be modelled using Earth outgassing models to reconstruct atmospheric evolution over the past 4.5 billion years.

(2) Proposed explanations for the origin of Archean cherts has relied primarily on field observations, trace element patterns, or O isotope signatures, with such data failing to yield an encompassing model. We will investigate Si isotope systematics in cherts from the Pilbara Craton (Western Australia) as evidence of their formation by several distinct processes in Early Archean near-surface environments (hydrothermal vents). O and H isotopes will complement the Si isotopes and together provide novel insights on both the composition and temperature of Archean seawater through time.

Supervisors: Dr. Darren Mark, Dr. Finlay Stuart & Prof. Martin Lee (Uni. Glasgow)

Requirements: Graduating with a strong background in geology and/or chemistry, as a PhD student in the SUERC noble gas group, you will be trained in isotope geochemistry and expected to make cutting-edge isotope measurements.

Details: The Oxford University Pilbara chert collection will be accessed through Prof. Martin Brasier. Time will also be spent at the University of Glasgow petrographically characterising samples (electron microscopy and Raman spectroscopy). Si isotope analyses will be conducted at the NERC Isotope Geosciences Laboratories (Keyworth). Fieldwork will be undertaken in Archean greenstone belts, e.g., Pilbara (Australia) or Barberton (South Africa). You will also attend national and international geochemistry conferences to present project data (e.g., Goldschmidt, AGU).

Your application: Applicants should submit 1) a curriculum vitae, 2) a statement of research interests and 3) contact details of two people who will provide a reference.

For questions on the project please contact: Dr. Darren Mark (d.mark@suerc.gla.ac.uk)

Deadline for applications: March 2nd 2012.

The position is funded by the Natural Environment Research Council, SUERC and the University of Glasgow (3.5 years). UK applicants are eligible. We will fill the position as soon as possible.