

## **Project EARTH-16-STFC-CHB1: Tracing the accretionary origin and processing of planetary volatiles using noble gas isotopes**

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The noble gas relative abundances and isotopic composition in primitive materials such as carbonaceous chondrites are very different to those observed in inner planetary atmospheres (Venus, Earth, Mars). Where information is available, the inner planetary interiors have yet different compositions. Although significant advances have been made in understanding the noble gas composition of solar nebula gases, cometary material and components within carbonaceous chondrites there are many outstanding and major science questions still to be addressed by developing an understanding of the processes that must link the accretionary precursors to planetary volatile inventories.

There are several areas in which development of improved observational constraints will help bridge this gap. For example, the concept of 'average carbonaceous chondrite' provides a reference point for many cosmochemical models but the data set defining such for noble gases is remarkably small. Most recent work has focussed on distinct noble gas components within chondritic materials rather than the bulk composition that would be delivered to a forming planet. Similarly, the effect on noble gas composition by the processes which form planetesimals, and likely lose a significant portion of their volatile inventory, is little explored. In addition, the interaction or buffering between planetary interiors and atmosphere during planet formation is often overlooked in planetary scale models of volatile acquisition.

This project will have an experimental component to acquire and analyse materials likely to be representative of accretionary material. This will be used to gain a better view of key compositional and isotopic variability in the 'average carbonaceous chondrite' that forms the inner planets. The modelling strand of the project will utilise this data to develop models that investigate planetesimal growth and volatile loss and the interaction between planetary interiors and the development of planetary atmospheres.

### [Models for the distribution of terrestrial noble gases and evolution of the atmosphere](#)

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NOBLE GASES IN GEOCHEMISTRY AND COSMOCHEMISTRY Book Series: REVIEWS IN MINERALOGY & GEOCHEMISTRY Volume: 47 Pages: 411-480 Published: 2002

### [Meteorite Kr in Earth's Mantle Suggests a Late Accretionary Source for the Atmosphere](#)

By: Holland, Greg; Cassidy, Martin; Ballentine, Chris J.

SCIENCE Volume: 326 Issue: 5959 Pages: 1522-1525 Published: DEC 11 2009

### [Evolution of volatile species in the earth's mantle: A view from xenology](#)

By: Tolstikhin, I.; Marty, B.; Porcelli, D.; et al.

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