

CONSTRAINING VOLATILE ABUNDANCE IN CHONDRITIC COMPONENTS.

S. H. Gordon^{1,2}, P. A. Bland^{1,2}, S. J. Hammond^{1,3}, N. W. Rogers³.

¹Impact & Astromaterials Research Centre (IARC), Imperial College London, South Kensington Campus, London SW7 2AZ, UK. E-mail: s.h.gordon@imperial.ac.uk. ²Department of Mineralogy, The Natural History Museum, Cromwell Road, London, SW7 5BD, UK. ³Department of Earth Sciences, The Open University, Walton Hall, Milton Keynes MK7 6AA, UK.

Introduction: Volatile depletion was the fundamental chemical process occurring in the early Solar System, but has yet to be fully explained. Proposed models include the two-component model (e.g.[1,2]), incomplete condensation (e.g.[3,4]), evaporative fractionation prior to chondrule formation [5] and inheritance of a depletion from the interstellar medium [6]. These hypotheses are largely based on bulk compositional data from chondrites. A knowledge of the variation in composition of chondritic components (e.g. matrix and chondrules) may provide some useful constraints on the mechanism for volatile depletion.

In addition, an improved knowledge of their trace and minor element composition may help to clarify chondrule:matrix complementarity. Some models (e.g. [2]) call for chondrule formation close to the young Sun, with chondrules being added to chemically unrelated matrix at asteroidal distances. Complementarity between chondrules and matrix in siderophile and chalcophile elements (e.g.[7,8]) casts doubt on this scenario.

The relatively sparse data for many elements in chondrules and matrix is related to the difficulty in acquiring precise separates. The current study is intended to overcome this obstacle.

Method: Modal recombination analysis (MRA) [9] and electron probe microanalysis (EPMA) are used to determine the bulk composition of individual chondrules. A micromill is then used to drill precise volumes of material from a pre-specified area. Solution and LA-ICP-MS is subsequently employed to determine the chemistry of these separates. The ICP-MS data are then combined with major element data determined by MRA and EMPA.

Results: CV3 chondrites Allende and Vigarano were investigated initially, as chondrules are large and easily defined. In addition, Allende is one of the few meteorites for which chondrule minor and trace element data are available [10]. Data gained via MRA and EPMA fall within the compositional parameters defined in the literature. Solution ICP-MS will allow for the determination of a wider range of minor and trace elements than in previous INAA studies.

Conclusions: Matrix and chondrules have been analysed to investigate the extent of chemical complementarity between these two components, and to constrain mechanisms for volatile depletion. Results will be presented at the meeting.

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