Revisiting the elemental composition of Enstatite chondrites

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The enstatite chondrites are a group of metal- and sulphide-rich meteorites with a highly reduced composition. They have an oxygen isotope composition that is indistinguishable from that of the Earth-Moon system [1], and partly on this basis have been cited as model precursors for the Earth [2]. However, it has proven difficult to reconcile the bulk elemental abundances of enstatite chondrites with those of the Earth. In order to explore any compositional link that enstatite meteorites may have with other planetary bodies, a good understanding of the range of their compositions is required. Previous work has used a variety of methods to determine the minor and trace element composition of these materials, with individual work often focusing upon either a restricted range of elements and/or a restricted number of meteorite samples. The highly reduced nature of the meteorites and the chemical reactivity of some of the meteorite components implies that only samples from falls should be considered for analysis. This, inevitably, makes drawing any conclusions from their bulk compositions somewhat difficult.

Here we present compositional data from a comprehensive range of EH and EL meteorite falls, using a quadrupole ICP-MS technique for trace element analysis, together with ICP–OES for the major elements. The aim is to provide an internally consistent data set for a large elemental range, such that better constraints may be placed both upon the models of enstatite chondrite formation, and their genetic relationship with other planetary bodies.

References

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Experimental growth of biofilms for studies on the impact of microbes on transport processes in groundwater systems

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Introduction

The effect of biofilm growth on the physical and chemical properties of rocks and sediments, and in particular how this might influence hazardous and radioactive waste transport, is poorly understood. A review of existing work on microbial transport has shown that the impact of rapid change of pH or ionic strength and valency on established biofilms are least well understood. This work builds upon a previous project (Redox Experiment in Detailed Scale – REX), investigating rock-water and microbial interaction using diorite and groundwater from the Äspö Hard Rock Laboratory, Sweden.

Experimental test work

Initial aims were to develop methodologies for biofilm cultivation and to observe their growth. A flow-through cell was built, which was packed with crushed and milled diorite from Äspö. Artificial groundwater adjusted to pH 7.5, prepared to simulate the geochemical conditions at Äspö, was continuously circulated through the cell, and the system was inoculated with a bacterium *Pseudomonas aeruginosa*. After 4 days, the flow cell showed visible signs of a developed biofilm, the presence of which was confirmed by staining using Acridine orange, fluorescent stain.

Conclusions

Initial experiments have shown that it is possible to grow a biofilm within a few days on a diorite substrate over which artificial groundwater containing minimal nutritients was circulated. Future investigations will focus on physical effects of rapid changes in pH, nutritient levels, and ionic strength on established biofilms as well as the effect of phage on biofilm development. Therefore, an experimental set-up of two columns, one with and one without biofilm would seem to be the most suitable method to trace physical and chemical property changes.

References

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