Geophysical Research Abstracts, Vol. 9, 11355, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-11355

Comprehensive Imaging and Raman spectroscopy of Carbonate Globules from Martian Meteorite ALH 84001 and a Terrestrial Analogue from Svalbard.

Steele, A1., Fries, M.D1., Amundsen, H.E.F2., Mysen, B.O.1, Fogel, M.L.1, Schweizer, M.1, Boctor, N. Z1.

1 - Geophysical Laboratory, Carnegie Institution of Washington, 5251 Broad Branch Road, Washington DC 20015. 2 - Physics of Geological Processes (PGP), University of Oslo, PO Box 1048 Blindern, N-0316 Oslo, Norway.

We report a comprehensive imaging study, including confocal micro-Raman spectroscopy, Scanning Electron Microscopy (SEM) and 3-D extended focal imaging light microscopy, of carbonate globules throughout a depth profile of the Martian meteorite ALH 84001 and similar objects in mantle peridotite xenoliths from the Bockfjorden volcanic complex (BVC), Svalbard. Carbonate and iron oxide zoning in ALH 84001 is similar to that seen in BVC globules. Hematite appears to be present in all ALH 84001 carbonate-bearing assemblages except within a magnesite outer rim found in some globules. Macromolecular carbon (MMC) was found in intimate association with magnetite in both ALH 84001 and BVC carbonates. The MMC synthesis mechanism appears similar to established reactions within the Fe-C-O system. By inference to a terrestrial analogue of mantle origin (BVC), these results appear to represent the first measurements of the products of an abiotic macromolecular carbon synthesis mechanism in Martian samples. Furthermore, the ubiquitous but heterogeneous distribution of hematite throughout carbonate globules in ALH 84001, may be partly responsible for some of the wide range in measured oxygen isotopes reported in previous studies. Using BVC carbonates as a suitable analogue, we postulate that a low temperature hydrothermal model of ALH 84001 globule formation is most likely, although alteration (decarbonation) of a subset of globules possibly occurred during a later impact event.