Rapid cooling is easier near the cold of interstellar space. Con: It is hard to achieve major dust/gas fractionations (one possibility is that dust is spun out of turbulent eddies and accumulates in stagnant zones between them).

Gooding, J.L. and K. Keil, 1981. *Meteoritics* **16**, 17.

Grossman, J.N., E.R.D. Scott, and E.H. Levy, 1987. In *Meteorites and the Early Solar System (MESS)*, in press.

Hashimoto, A., 1983. *Geochim. J.* **17**, 111.

Hewins, R.H., 1983. *CATO*, 122.

Rubin, A.E., B. Fegley, and R. Brett, 1987. In *Meteorites and the Early Solar System (MESS)*, in press.

Taylor, G.J., E.R.D. Scott, and K. Keil, 1983. *Chondrules and Their Origins (CATO)*, 262.

Wood, J.A., 1986. *LPS XVII*, 956.

Wood, J.A. and G.E. Morfill, 1987. In *Meteorites and the Early Solar System (MESS)*, in press.

MELILITE CRYSTAL/LIQUID PARTITIONING OF REFRACTORY LITHOPHILES

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The trace element chemistry of CAI's is complicated because of their multistage histories (e.g., Grossman, 1980; Murrell and Burnett, 1987). There is more to CAI origin than just igneous processes, even for Type B inclusions. We have initiated *in-situ* trace element microdistribution studies of synthetic and natural samples, to determine which aspects of CAI trace element microdistributions are due to igneous processes. Our ultimate goal is to assess those aspects that are not explicable in terms of igneous processes, so as to place constraints on the additional processes involved.

Based on the crystallization sequences for CAI compositions (Stolper, 1982), we prepared a spinel-deficient synthetic CAI Type B composition [CAI-2 glass composition in Table 3 (Stolper, 1982)], which, after minor spinel crystallization, has melilite as the crystallizing phase. The starting material was spiked with trace levels ($\leq$ 500 ppm) of Sr, Y, Zr, Sm, and Yb [targeted for PIXE (proton microprobe) and SXRF (synchrotron microprobe) analyses], and Th and U (for nuclear particle track radiography). It was held at 1369°C for 2½ hours, cooled at 2.7°C/hr, and held at 1258°C for 2½ hours. Large regions (up to 300 microns across) of spinel-free melilite and glass were obtained.

We have preliminary SXRF analyses of melilite and glass for Sr, Y, Zr, Sm and Yb. These were obtained at the National Sychrotron Light Source (NSLS). The samples were irradiated in air at 45° with respect to both the incident white light (continuum, 3-30 KeV) beam and the EDS [Si(Li)] X-ray detector. An 18 mil Kapton filter was used to attenuate the major element X-rays, so as to minimize deadtime and pulse pileup effects. Live acquisition times were typically 10-20 minutes. The incident beam was collimated to 20-40 micron beam spot sizes. The X-ray production cross sections decrease slowly with depth in the sample, so the depth response is determined almost entirely by absorption of the emerging induced X-rays. For ~ 15 KeV X-rays (Sr, Y, Zr K-alphas), the absorption half thickness is roughly 400 microns in silicates, so for microanalysis of our (typically smaller) phases, we prepared free-standing doubly-

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polished sections of accurately-known thicknesses, circa 80 microns. Estimates of X-ray peak areas were obtained from the Nuclear Data PKSEACH routine, and an interactive peak fitting routine, STRIP, was used to deconvolute overlapping peaks. Elemental concentrations were obtained with the NRLXRF analysis package which corrects for absorption in the filters and specimens. Trace element concentrations were determined relative to Ca, which served as the internal standard for each spectrum.

Electron probe analyses of analyzed grains are necessary to verify the compositions assumed here [based on Stolper (1982)], to determine accurately the percent crystallization, and to assess the extent of possible zoning. However, based on qualitative assessment of PKSEARCH output for all spectra, intergrain and intragrain chemical variability appears relatively small, and this is also indicated by the NRLXRF quantitative analyses completed to date. Uncertainties due to counting statistics are small ($\sim 1\%$); however, we conservatively estimate up to $\sim 35\%$ uncertainties with the present spectral deconvolution and background fits. Analysis of an AN75 standard suggests systematically high Sr values of about 33%. This is not inconsistent with an estimate based on Sr mass balance. Zr is undetectable in melilite. Thus, Zr analyses of glass can be used to assess the percent melilite crystallization and 30% is indicated, consistent with Stolper (1982). Roughly half that value is obtained if our Zr values are systematically high, as for Sr. Mass balance considerations indicate underestimates of both Sm and Yb (both analyzed using their L lines) by about 55% with the present analysis routines. Partition coefficients should be insensitive to any such systematic errors. Based on our preliminary Sm, Y, Yb analyses, REE crystal/liquid partition coefficients show a gentle decrease from just over 0.2 down to almost 0.1. These are similar to, but may be somewhat low compared to, rough estimates available from INAA analyses of mineral (heavy liquid) separates (Nagasawa et al., 1980). Comparison is difficult due to a variety of factors, including differences in synthesis (e.g., thermal history, chemistry). For Sr we obtain a partition coefficient of unity and for Zr, we estimate an upper limit of 0.002.

Grossman, L., 1980. *Ann. Rev. Earth Planet. Sci.* **8**, 559.
Murrell, M. and D. Burnett, 1987. *GCA* **51**, 985.
Nagasawa, H. *et al.*, 1980. *EPSL* **46**, 431.
Stolper, E., 1982. *GCA* **46**, 2159.

CARBON AND NITROGEN IN NAKHLA AND EETA79001,239

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It has been demonstrated that Nakhla contains carbonate minerals which are distinguishable from terrestrial or other meteoritic carbonates on the basis of $\delta^{13}C$ and $\delta^{18}O$ values (Carr *et al.*, 1985). Furthermore, in light of the similarity in $\delta^{13}C$ between the carbonates in Nakhla and trapped CO_2 in the shergottite EETA 79001, believed to be martian atmospheric gas, a genetic association (e.g. gas-solid weathering) for these two components has been suggested (Carr *et al.*, 1985). Notwithstanding the similar characteristics of shergottites and nakhlites, some recent results have raised doubts about the consanguinity of these meteorites (Ott and Begemann, 1985; Chen and Wasserburg, 1986) and therefore the relationship of carbon components could be fortuitous. However, a rather serendipitous new saw-cut of EETA 79001 has revealed the presence of calcium carbonate (Gooding *et al.*, 1987) providing a further link

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