Thermal metamorphism in the ordinary chondrites

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Most published petrographic classification schemes lump the homogenization of olivine and pyroxene as a single event used to separate petrographic grades (e.g. Van Schmus and Wood, 1967; Brearly and Jones, 1998). However, observations from many authors have noted that pyroxene takes longer to equilibrate than olivine (e.g. Dodd et al.,1967; Freer, 1981), and recent studies of pyroxene in ordinary chondrites have found compositionally defined lamellae in petrologic types 3.8-4 (Tsuchiyama et al, 1988; McCoy et al., 1991). This indicates that there is much more to be learned about the heating history of chondrite parent bodies by examining pyroxene equilibration.

A suite of L chondrites spanning the range of petrographic types has been examined in order to closely observe the compositional distribution of pyroxene in response to increasing thermal metamorphism. Initially homogeneity was measured by selecting a large number of points to analyze with a Cameca electron microprobe SX50. Now, we are testing the reliability of two techniques. With one, element abundance maps of 11 major elements are collected for each meteorite in an area of 5000 by 5000 microns, using a 10-micron beam. With over 250,000 "pixels" of data, this produces a much more robust histogram of compositions, although calibration of raw x-ray counts to known abundance is imprecise. The second method has the same footprint as a point analyses beam. This improves calibration, but takes longer to produce the same quantity of measurements. The analysis of this data, using the IDL programming environment, has the potential to provide modal mineralogy as well as compositional trends in olivine, pyroxene and other phases.

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