

**AN  $^{57}\text{Fe}$  MÖSSBAUER STUDY OF THE METAMORPHIC SEQUENCE IN UNEQUILIBRATED ORDINARY CHONDRITES.** O. N. Menzies<sup>1</sup>, P. A. Bland<sup>1</sup> and F. J. Berry<sup>2</sup>. <sup>1</sup>Planetary and Space Sciences Research Institute, The Open University, Milton Keynes MK7 6AA, UK, <sup>2</sup>Department of Chemistry, The Open University, Milton Keynes MK7 6AA, UK.

**Introduction:** Unequilibrated ordinary chondrites (UOCs), along with carbonaceous chondrites, are some of the most primitive materials in the solar system [1]. However, heterogeneous silicate compositions and fine-grained matrix make analysis difficult by conventional means.

Previous work [2] has shown that  $^{57}\text{Fe}$  Mössbauer spectroscopy can be used to identify chemical compositional differences in equilibrated ordinary chondrites, particularly by looking at Mössbauer parameters ascribed to olivine. The technique also provides information on the abundance of Fe-bearing phases in chondrites. Therefore we chose to use Mössbauer spectroscopy to study mineral abundance, olivine chemistry and equilibration in UOCs.

**Methods:** A series of 18 UOCs collected in the Antarctic, and also several falls were examined by Mössbauer spectroscopy. Approximately 100mg of powdered meteorite was placed in a lead sample holder. The spectra were recorded at 298K with an  $^{57}\text{Fe}$  Mössbauer spectrometer using a  $^{57}\text{Co}/\text{Rh}$  source. Spectra were fitted with a constrained non-linear least squares fitting programme of Lorentzian functions.

#### Results and Discussion:

**Mössbauer parameters.** Three parameters reflecting the chemical environment of electrons at the nucleus are observed by Mössbauer analysis. One, quadrupole splitting (QS), gives an indication of the symmetry of the Fe site [3] and we have shown it to be correlated with silicate chemistry in chondrites [2].

The QS value for each chondrite was plotted against the degree of equilibration, or class. QS values increase with metamorphism. Figure 1. shows this relationship strengthened by the addition of equilibrated ordinary chondrites and UOC falls.

The widths of olivine doublets in Mössbauer spectra can be correlated with degree of homogeneity [4]. We would expect a large line width for more unequilibrated samples. This observation is observed when line width is plotted against degree of equilibration, i.e. the graph is inverse to Figure 1.

**Mineralogy trends.** Mössbauer spectroscopy gives information about the proportion of total Fe found in each Fe-bearing mineral component. These figures can be roughly correlated to wt% values although the major trends can still be observed from the Mössbauer values [5].

