CLASSIFICATION OF METEORITES BY OLIVINE UNIT CELL USING MICRO X-RAY DIFFRACTION. S. Round, R.L. Flemming, Y. Beausoleil, P.J.A. McCausland. Dept. of Earth Sciences, U. of Western Ontario, London, ON, Canada N6A 5B7 (rflemmin@uwo.ca).

Introduction: There is a well known positive correlation between unit cell and composition for terrestrial olivine (Mg, $Fe)_2SiO_4$, where size of the unit cell increases as a function of increasing fayalite (Fa) content [1]. This has recently been exploited to study olivine in chondrites, using powder X-ray diffraction (XRD) methods [2,3]. In this study we have extended XRD examination to a variety of meteorites, by micro X-ray diffraction (μXRD). This recently-developed technique enables rapid *in situ* analysis of intact meteorite samples with no damage caused to the sample, allowing meteorites to remain pristine [4]. The relationship between unit cell parameters and Fa content of olivine obtained by μXRD can be used as a preliminary reconnaissance tool in the classification of unknown meteorites.

Methods: Olivines from ordinary chondrites, pallasites, an olivine shergottite, olivine diogenite, and dunite, were analyzed by μXRD. *In situ* analyses were performed on rock slabs and thin sections, as well as on powders, using the Bruker D8 Discover μXRD at the University of Western Ontario, with theta-theta geometry and a General Area Detector (GADDS). The diffractometer was operated with CuKα radiation generated at 40 kV and 40 mA; the Kα beam diameter was set to 500 μm. Data were collected using omega scan mode (synchronously rotating optics) to maximize the diffraction data from stationary samples. The *d*-spacings were measured using Bruker DiffracPlus^{TM} EVA software. Unit cell refinements were performed using Celref [5].

Results: Comparison between unit cell parameters (a_o, b_o, c_o, and V_o) and olivine composition (% Fa) was made graphically. Data have also been compared to a compilation of available literature data for natural terrestrial olivines.

Discussion: The relationship between unit cell and substituting cation composition was demonstrated to be a sensitive discriminator between sources of extraterrestrial olivine; different meteorite types plotted in distinct clusters along the natural terrestrial olivine line. Unit cell volume was the parameter most sensitive to Fe-Mg compositional changes and is recommended for use in the preliminary classification of meteorites. Olivine unit cell refinement was demonstrated to be more successful for data from powdered samples than data from randomly-oriented single crystals *in situ*, for which fewer lattice planes satisfy Bragg's law. μXRD is advantageous for powdered samples as it only requires a small amount of powder, obtained from one to three individual grains. μXRD data collection is rapid and useful for preliminary analysis and classification of meteorites prior to further, more destructive analysis. Further μXRD analysis of other meteorite types will aid in the investigation of planetary parentage beyond meteorite classification.

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