

### RAMAN, FTIR, AND MÖSSBAUER SPECTROSCOPY OF OLIVINES FROM THE D'ORBIGNY METEORITE.

Y. A. Abdu<sup>1</sup>, M. E. Varela<sup>2</sup>, and F. C. Hawthorne<sup>1</sup>. <sup>1</sup>Department of Geological Sciences, University of Manitoba, Winnipeg, Manitoba R3T 2N2, Canada. E-mail: abdu@cc.umanitoba.ca. <sup>2</sup>ICATE- CONICET, Av. España 1512 Sur, CP J5402DSP, San Juan, Argentina.

**Introduction:** Olivine is a major basaltic mineral in high-temperature volcanic rocks and in stony meteorites. The D'Orbigny angrite contains large olivine crystals (up to ~ 1 cm in size) that are present throughout the rock, mimicking xenocrysts or forming olivinite (polycrystalline olivine) [1-3]. The olivinites are of particular interest, as very little is known about them. Here, we study three types of D'Orbigny olivines: honey olivine (HOI), green olivine (GOI), and olivinite (POI), by Raman, Fourier-transform infrared (FTIR), and Mössbauer spectroscopy, and compare their structural and spectral features.

**Experimental:** Raman spectroscopy measurements were done using a LabRAM ARAMIS confocal microscope (Horiba Jobin Yvon). A x100 objective microscope was used to focus the laser beam (532 nm excitation line) on the sample to a size of ~ 1  $\mu\text{m}$ . FTIR spectra over the range (4000–400  $\text{cm}^{-1}$ ) were collected on KBr sample pellets using a Bruker Tensor 27 FTIR spectrometer. Transmission Mössbauer spectra were acquired at room temperature (RT) using a <sup>57</sup>Co(Rh) point source.

**Results and Discussion:** The chemical compositions of the three olivines were determined by electron microprobe analysis (EMPA). The Mg# [=Mg/(Mg+Fe)] is 0.64 for HOI, 0.85 for GOI, and 0.90 for POI.

**-Raman and FTIR spectroscopy.** The main feature of Raman spectra of olivines is a doublet with peaks located at ~ 850  $\text{cm}^{-1}$  ( $\kappa_1$ ) and 820  $\text{cm}^{-1}$  ( $\kappa_2$ ) due to the asymmetric and symmetric vibrations, respectively, of the SiO<sub>4</sub> group [4]. For D'Orbigny olivines, the  $\kappa_1$  and  $\kappa_2$  peaks occur at 850, 820  $\text{cm}^{-1}$  for HOI; 854, 823  $\text{cm}^{-1}$  for GOI; 856, 824  $\text{cm}^{-1}$  for POI, reflecting variability in composition. Using the  $\omega$  ( $= \kappa_1 - \kappa_2$ ) – Mg# relation [3], the estimated Mg# for HOI, GOI, and POI are 0.70(4), 0.82(4), and 0.93(4), respectively, in close agreement with EMPA results. Similarly, the FTIR spectra of the three olivines do not show any differences except the composition dependence of the bands positions. Furthermore, no structural OH bands are observed in the OH-stretching region (3800-3000  $\text{cm}^{-1}$ ) for all samples.

**Mössbauer spectroscopy.** The RT Mössbauer spectra of the HOI and GOI consist of two asymmetric absorption peaks, resulted from the overlap of two quadrupole doublets due to the presence of Fe<sup>2+</sup> at the M1 and M2 octahedral sites. On the other hand, the spectrum of POI shows an additional weak doublet (CS = 0.35 mm/s, QS = 0.30 mm/s, relative area = 2%) which is attributed to Fe<sup>3+</sup>. Because Fe<sup>3+</sup> could indicate a laihunite-like material similar to that observed in partially oxidized metasomatized mantle olivines [5], olivinites may record the increasing oxidizing conditions prevailing during the late metasomatic event that affect angrite formation.

**References:** [1] Kurat G. et al. 2001. Abstract #1753. 32th Lunar & Planetary Science Conference. [2] Kurat G. et al. 2004. *Geochimica et Cosmochimica Acta* 68: 1901–1921. [3] Varela M.E. et al. 2005. *Meteoritics and Planetary Science* 40: 409–430. [4] Mouri T. and Enami M. 2008. *Journal of Mineralogical and Petrological Sciences* 103: 100–104. [5] Banfield J. F. et al. 1992. *American mineralogist* 77: 977–986.