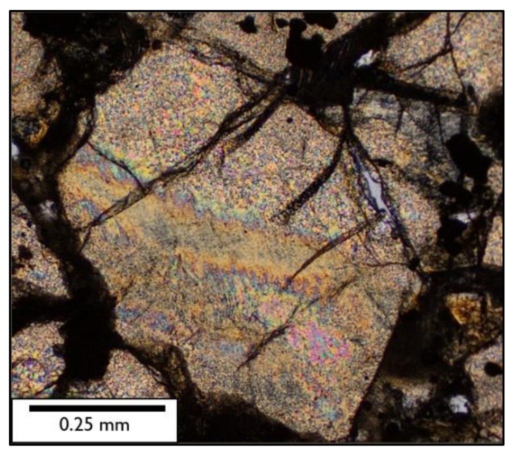
DETAILED MINERALOGY AND PETROLOGY OF INTERMEDIATE MARTIAN LHERZOLITIC SHERGOTTITE NORTHWEST AFRICA 6342

T.V. Kizovski[1,2] and K.T. Tait[1,2], [1]Department of Earth Sciences, University of Toronto, Toronto M5S 3B1, Canada, t.kizovski@mail.utoronto.ca [2]Royal Ontario Museum, Toronto M5S 2C6, Canada, ktait@rom.on.ca.

Introduction: NWA 6342 is a 35.5 g intermediate ultramafic lherzolitic shergottite that was found in Algeria in 2010 [1]. Due to the lherzolitic shergottites' similar petrology, mineralogy, and identical crystallization and exposure ages, they are thought to have originated from the same igneous block on Mars [2,3]. It has been proposed that small differences in the mineralogy and chemistry within the lherzolitic shergottites are probably due to variable cooling rates and re-equilibration during crystallization [3-6]. As such, understanding the petrogenesis of newly discovered lherzolitic shergottites like NWA 6342 is imperative to better characterizing the igneous body from which they originated. At this time, studies on NWA 6342 are currently limited to a few abstracts (e.g. [1,7,8]). The purpose of this work is to complete a detailed mineralogical, petrological, and geochemical analysis of NWA 6342 in order to better characterize its petrogenesis, and its original stratigraphic position within the igneous block.

Petrography and Mineralogy: One polished thin section (30 μm thickness) of NWA 6342 was investigated in this study using optical petrography, the scanning electron microscope (SEM), the electron microprobe, and Raman spectroscopy. Two distinct petrographic zones are observed including: poikilitic zones primarily consisting of rounded olivine chadacrysts (0.12 – 0.6 mm) enclosed by large low-Ca pyroxene oikocrysts (up to 12 mm in length), and a non-poikilitic area mainly comprised of olivine (0.15 – 2.66 mm), with pockets and veins of vesicular plagioclase glass (approximately 9% vol; average composition of $An_{81.5}Or_{0.6}$). Accessory minerals were mainly observed within the non-poikilitic area and include: chromite, ilmenite, merrillite, and pyrrhotite. Olivine compositions are more varied in the poikilitic area (Fa_{24-32}) and more iron-rich in the non-poikilitic area (Fa_{30-34}). Pyroxene compositions in NWA 6342 are similar to the other lherzolitic shergottites. Augite ($Fs_{14.8-32.0}Wo_{20.6-38.8}$) is observed around the rims of the low-Ca pyroxene oikocrysts and within the non-poikilitic area. The large oikocrysts are mainly comprised of low-Ca pigeonite ($Fs_{22.2-27.6}Wo_{5.1-13.0}$), and clinoenstatite ($Fs_{18.9-23.5}Wo_{2.6-4.9}$). Preliminary study of NWA 6342's petrology, mineralogy, and geochemistry, indicate that it is similar to lherzolitic shergottite NWA 1950 [4,6] and slightly more evolved than the most equilibrated lherzolitic shergottites (GRV 99027 and ALH 77005) based on the model by Mikouchi et. al [5].

Shock Features Analysis: The conversion of plagioclase to a vesicular glass, and the re-crystallization texture in the olivine grains indicate that NWA 6342 experienced shock pressures between 60 – 70 GPa [9], likely in the impact event that ejected it from Mars. Of particular interest are the distortion features observed around the melt pockets (see figure). SEM and electron microprobe analysis show no chemical differences across these boundaries. Future studies will include high resolution Raman spectroscopy, and electron backscatter diffraction (EBSD) analysis across these distortion features with a focus on determining minimum shock pressures.



Example of a distortion feature observed near a melt pocket in NWA 6342 (XPL).

References: [1] Irving A. et al. (2011) *LPSC XLII*, Abstract #1612. [2] McSween H. (1994) *Meteoritics* 29:6. [3] Mikouchi T. and Miyamoto M. (2000) *Antarctic Meteorite Research* 13:256–269. [4] Mikouchi, T. (2005) *Meteoritics & Planetary Science*, 40:1. [5] Mikouchi, T. and Kurihara, T. (2008) *Polar Science*, 2:3. [6] Walton, E. and Herd, C. (2007) *Meteoritics & Planetary Science*, 42:1. [7] Huber L. et al. (2012) *LPSC XLIII*, Abstract #1408. [8] Yang S. et al. (2013) *LPSC XLIV*, Abstract #1719. [9] Stöffler D. et al. (1986) *Geochimica and Cosmochimica Acta* 55:12.