CHARACTERISING THE ROLE OF MINERAL ORIENTATION ON IR MICROSPECTRSCOPY

G.K. Benedix[1,2], V.E. Hamilton[3] and S.M. Reddy[1]. [1]Dept. of Applied Geology, Curtin University, Perth, Western Australia, 6845, Australia. E-mail: g.benedix@curtin.edu.au. [2]Western Australia Museum, Locked Bag 49, Welshpool, WA, 6986, Australia, [3]Southwest Research Institute, 1050 Walnut St. #300, Boulder, CO, 80302, USA.

Introduction: To interpret surface mineralogy of Mars, orbital spectral data are deconvolved using a database of terrestrial minerals [e.g. 1]. However, minerals on Mars have compositions that differ from the minerals in the database, sometimes significantly and those compositional differences can affect spectral properties. Thus, measuring the spectra of Martian-specific minerals would provide better fits to the deconvolution routines. This in turn will lead to a more precise analysis of the surface mineralogy of Mars.

Because Martian meteorites are quite rare (79 out of ~52000), it is difficult to obtain powdered samples on which to measure the spectra to add to the database. Thin sections, however, are abundant. Advances in microspectroscopy mean that minerals in thin section can provide spectra (over many wavelengths) of any composition. In a powdered sample, spectra vary with composition. In thin section, they vary with both composition and mineral orientation.

Electron backscattered diffraction (EBSD) is a powerful technique that is used to measure and analyse mineral orientation in thin section. Previous studies on Martian meteorites have focussed primarily on determining specfically the orientation of pyroxenes [2, 3]. In this study we combine IR microspectral mapping with EBSD to assess the affect of orientation on spectral features of the minerals in the thin section (olivine, pyroxene, opaque minerals).

Samples and Analytical Techniques: We spectrally mapped RBT 04262, an enriched lherzolitic shergottite[4] with a ThermoElectron iN10 FTIR reflectance microscope. The area mapped was a single, large (9.5x4mm), twinned, subhedral pigeonite with an augite rim. This grain poikilitically encloses several olivine grains. EBSD measurements were obtained in subsets of the same area and these data were processed to constrain grain orientation.

Results and future work: There is a significant difference in the spectra of the pigeonite on either side of the twin boundary. Because this is a twinned pigeonite grain, we can decouple the effect of orientation from composition. Composition across the grain is remarkably consistent with the pigeonite having an average composition of $Fs_{26\pm1}Wo_{6\pm1}$,so any variation in the spectral features can be ascribed solely to orientation. We can also see distinct spectra for different olivines enclosed in the pigeonite grain. Using EBSD we can determine the orientation of the twins to each other, as well as any variation in orientation of the olivines. This approach will allow us to quantify these effects.

References: [1] Bandfield J. L. et al. 2000. *Science* 287: 1626. [2] Kaczmarek M. A., et al. 2013. s. *Mineralogical Magazine* 77: 1414. [3] Stephen N. R., et al.. 2013. *44th Lunar and Planetary Science Conference* 44: 2131. [4] Usui T., et al. 2010. *Geochimica et Cosmochimica Acta* 74: 7283–7306.