THE ORIGIN OF BROWN OLIVINE IN MARTIAN DUNITE NWA 2737.

C. M. Pieters[1], R. L. Klima[1], T. Hiroi[1], M. D. Dyar[2], M. D. Lane[3], A. H. Treiman[4], S. K. Noble[5], J. M. Sunshine[6] and J. L. Bishop[7]. [1]Brown University. Carle_Pieters@brown.edu [2]Mt. Holyoke College, [3]PSI, [4]LPI, [5]JSC, [6]Univ. Md., [7]SETI.

The Northwest Africa (NWA) 2737 meteorite is the second Martian meteorite has been identified that is composed primarily of heavily shocked dunite. This meteorite has several similarities to the Chassigny dunite cumulate, but the olivine is more Mg-rich and, most notably, is very dark and visually brown [1, 2]. Carefully coordinated analyses of NWA 2737 whole rock and olivine separates were undertaken using visible and near-infrared reflectance, mid-infrared emission and reflectance, and Mössbauer spectroscopic studies of the same samples along with detailed petrography, chemistry, SEM and TEM analyses [3]. Mid-infrared spectra of this sample indicate that the olivine is fully crystalline and that its molecular structure remains intact. Near-infrared spectra of NWA 2737 olivine are compared with those of Chassigny and San Carlos in the figure below. The unusual color and spectral properties that extend from the visible through the near-infrared part of the spectrum are shown to be due to nanophase metallic iron particles ($npFe^0$) dispersed throughout the olivine during a major shock event on Mars. Although a minor amount of Fe^{3+} is present, it cannot account for the well-documented unusual optical properties of Martian meteorite NWA 2737. Apparently unique to the Martian environment, this "brown" olivine exhibits spectral properties that can potentially be used to remotely explore the P-T history of surface geology in addition to surface composition.

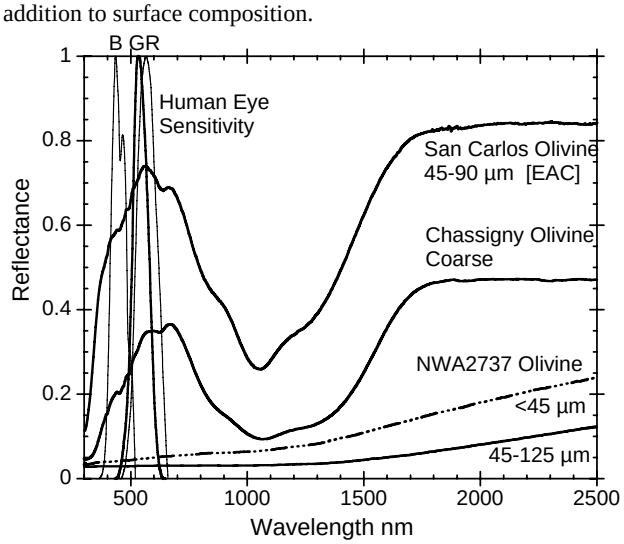

Figure 1. Reflectance spectra of two size fractions of NWA 2737 olivine compared to coarse grained Chassigny and San Carlos olivine. The low albedo and distinct "red" sloped continuum of NWA 2737 is due to a small amount of $npFe^0$ that is pervasive throughout the olivine.

References: 1. Beck et al., 2006, *Geochim. Cosmochim. Acta*, 70, 2127-2139. 2. Treiman et al., 2007, *Journal of Geophysical Research* 112, E04002, doi:10.1029/2006JE002777. 3. Pieters et al., 2007, *Journal of Geophysical Research* submitted.

Acknowledgement. Support from the Mars Fundamental Research Program is greatly appreciated.