

**RAMAN MICROSCOPY OF SHOCKED AND UNSHOCKED BASALTS FROM LONAR CRATER, INDIA.** T. D. Glotch<sup>1</sup> and M. J. Ferrari<sup>1</sup>, <sup>1</sup>Stony Brook University, Stony Brook, NY 11794-2100, tglotch@notes.cc.sunysb.edu

**Introduction:** Mars, the Moon, and other planetary bodies have been subjected to intense bombardment by meteorites throughout their histories. Understanding the effects of this bombardment on the crystal structures of target materials is a first-order problem in planetary science that has important implications for planetary remote sensing and *in situ* mineralogical studies.

Within the the ejecta of Lonar Crater are basaltic rocks shocked at intermediate pressures of 20-80 GPa [1]. Other terrestrial impact craters primarily occur in typical continental crust or sedimentary settings. The basaltic composition of the Lonar impact crater makes it the only terrestrial impact analog suitable for understanding the effects of impact on the composition of the Martian basaltic crust and lunar mare.

Several studies have detailed the mid-IR spectroscopic properties of synthetically shocked plagioclase feldspar and pyroxene-rich samples and basalts [2-4]. Recent studies have also detailed the macroscopic mid-IR spectral properties of naturally shocked basalts from Lonar Crater [1,5]. Here, we provide micro-Raman data for both shocked and unshocked basalts from Lonar Crater. These data provide a detailed view of the petrography of Lonar samples and indicate that the effects of shock are not homogenous throughout the material undergoing shock compression.

**Samples and Methods:** We analyzed several samples of shocked and unshocked basalt from Lonar Crater collected by S. P. Wright and described further in [6]. Three samples, LC09-206, LC09-207, and LC09-284 were selected for analysis. LC09-206 and LC09-284 are shock class 2 samples (20-40 GPa shock pressure) [7], while LC09-207 is an unshocked basalt collected in the same suevite breccia outcrop as the other two shocked basalts that displays a minor amount of weathering. Samples were cut and polished into thick sections with a roughness of 0.25  $\mu\text{m}$ .

Each sample was examined using the Stony Brook University Vibrational Spectroscopy Laboratory (VSL) WiTEC alpha300R confocal Raman microscope system equipped with a 50 mW frequency doubled 532 nm Nd:YAG excitation laser. This Raman imaging spectrometer is capable of acquiring spectra from  $\sim 8000$ -150  $\Delta\text{cm}^{-1}$  and is equipped with multiple objective lenses enabling spatial resolutions between several microns and 260 nm/pixel.

**Results and Discussion:** Both LC09-206 and LC09-284 contain abundant maskelynite (feldspathic glass) formed as a result of the shock process. These samples also contain unshocked clinopyroxene and

melt glass, either in veins or pockets. Figure 1 shows background-removed labradorite and augite spectra (705 nm spot size) from the unshocked LC09-207 sample and maskelynite and melt glass spectra from the shocked LC09-206 sample. The maskelynite and melt glass Raman spectra differ, with maskelynite displaying broad peaks between 500 and 600  $\Delta\text{cm}^{-1}$  and  $\sim 900$ -1100  $\Delta\text{cm}^{-1}$ . The melt glass spectrum displays a comparatively sharp peak centered at 590  $\Delta\text{cm}^{-1}$  and a weaker, broader peak centered at 1090  $\Delta\text{cm}^{-1}$ . Both spectra differ markedly from the crystalline spectra from the unshocked sample. Future work will concentrate on creating Raman maps with sub- $\mu\text{m}$  spatial resolution in an effort to determine the effects of shock on potential accessory minerals and to study the effects of aqueous weathering on these samples and correlating results with micro-FTIR studies of the same samples [8].

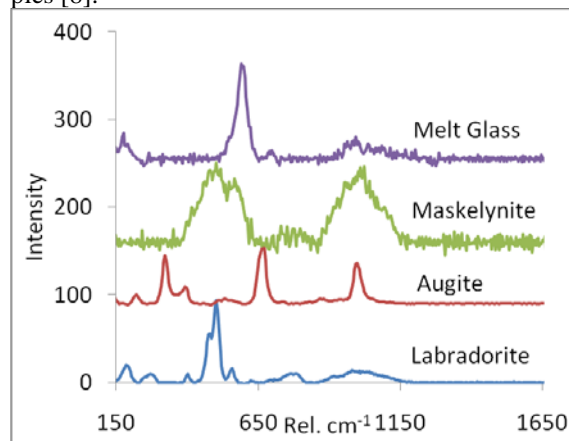


Figure 1. Micro-Raman spectra acquired from samples LC09-284 (labradorite and augite) and LC09-206 (maskelynite and melt glass). Spectra were acquired using a 532 nm excitation laser and a 20 X, 0.46 N.A. objective, leading to a 705 nm spot size.

**References:** [1] Wright S. P. et al. (2008) *LPS XXXIX*, Abstract 2330. [2] Johnson J. R. et al. (2002) *JGR*, 107(E10), 5073. [3] Johnson J. R. et al. (2003) *Am. Miner.*, 88, 1575-1582. [4] Johnson J. R. et al. (2007) *Am. Miner*, 92, 1148-1157. [5] Wright S. P. et al. (2011) *JGR*, in review. [6] Wright S. P. and H. E. Newsom (2011) *LPS XLII*, Abstract 1619. [7] Kieffer S. W. (1976) *LPS VII*, 1391-1412. [8] Glotch, T. D. et al. (2011) *LPS XLII*, Abstract 1566.