SHOCK EFFECTS IN NWA 8159: A MARTIAN PLAGIOCLASE-AUGITE BASALT. T. G. Sharp[1], E. L. Walton[2,3] and J. Hu[1]. [1]Arizona State University, School of Earth and Space Exploration, (tom.sharp@asu.edu) [2]MacEwan University, Department of Physical Sciences, [3]University of Alberta, Department of Earth & Atmospheric Sciences.

Introduction: NWA 8159 is an augite-plagioclase basalt that is distinct from other SNCs [1]. The sample consists of augite, plagioclase (An_{50-65}), olivine (Fa_{61-76}), magnetite and minor orthopyroxene [1]. This meteorite represents a distinct sample of the Martian crust [1]. NWA 8159 has several mm-thick shock-melt veins that contain a fine-grained granular mixture of silicate and sulfide with a texture unlike that seen in other shocked meteorites [2-3]. The purpose of this study is to determine the high-pressure phases in and associated with the shock veins.

Methods: Samples were characterized using optical petrography, scanning electron microscopy (SEM), electron probe micro-analysis (EPMA) and Raman spectroscopy at UA. Regions of interest in SEM images were selected for focused-ion-beam (FIB) sectioning for TEM analysis using a FEI CM200-FEG with EDX.

Results: Our sample thin sections have several shock veins that range up to 1-mm in width. The plagioclase is predominantly anisotropic (crystalline) throughout much of the sample, but is isotropic in the vicinity of shock veins. Tissintite, after plagioclase, occurs in contact with shock melt. In contact with shock melt, fayalitic olivine is partially transformed to ahrensite (Fe_2SiO_4-rich ringwoodite [4]). Olivine is also transformed into a nanometer-scale mixture of magnetite and silicate. Minor silica grains have been transformed to stishovite and coesite.

BSE images of the shock veins show increasing crystal size toward the vein centers. The predominant phase is a poikiolitic garnet that appears bright in BSE images. TEM analyses of a fine-grained vein-edge assemblage indicate a mixture of majorite-grossular garnets and stishovite. The central region of a 1-mm thick shock vein has a different assemblage that consists of majorite-grossular garnet, sodic-calcic clinopyroxene, stishovite and glass, along with Fe-sulfide. TEM analysis of the oxide plus silicate mixtures in transformed olivines confirms the presence of magnetite and identifies the silicate as clinoenstatite. This is the same assemblage as the larger-scale magnetite plus pyroxene rims on olivine outside of shock veins.

Interpretation: The transformation of fayalitic olivine (Fa_{75}) to ahrensite constrains the minimum shock pressure to be 8 GPa [5]. The shock-vein margins have an assemblage of majoritic-garnet plus stishovite whereas the vein centers have an assemblage of majoritic-garnet plus clinopyroxene plus stishovite. Based on the high-pressure phase relations for MORB [6], these two assemblages are consistent with crystallization at approximately 16 GPa and 2300 K. It is likely that crystallization occurred during pressure release with the more rapidly quenched shock-vein edge crystallized above 16 GPa and the more slowly quenched central-vein assemblage crystallized below about 16 GPa. The presence of majoritic garnet throughout a 1-mm wide shock veins suggest a relatively long shock-pulse duration.

References: [1] Agee C. B. et al. (2014) Abstract P54B-02, AGU Fall Meeting. [2] Sharp T.G. et al. (2015) Abstract 1939 Lunar and Planetary Science Conference. [3] Walton E., et al. (2015) Abstract P12A-05, AGU Joint Assembly. [4] Ma C. et al. (2014) Abstract 1222, Lunar and Planetary Science Conference. [5] Fei Y. and Bertka C. M. (1999) *Geochemical Society Special Paper 6,* 189-207. [6] Hirosi et al, (1999) *Nature 377*, 53-56.