GABBROIC SHERGOTTITE NORTHWEST AFRICA 6963.

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Introduction: Eight kg NWA 6963 was found in Guelmim-Es-Semara, Morocco and based on its bulk chemistry and oxygen isotopes, it was classified as a martian meteorite [1, 2]. While originally classified as a basaltic shergottite [1], additional investigations of the textures and crystal sizes of the rock have reclassified it as a gabbroic shergottite because of the similarity with terrestrial and lunar gabbros [3]. However, a full investigation of the petrology and geochemistry of NWA 6963 has not been reported. Here, we investigate the mineralogy, petrology, geochemistry (major and trace elements, and Li isotopes), shape preferred orientation of pyroxene, and spectral properties of gabbroic shergottite NWA 6963 to constrain its petrogenetic history including the depth of emplacement (base of a flow vs. crustal intrusion).

Methods: For major elements, electron microprobe analyses were conducted on a fused bead for bulk chemistry at WUSTL and on a doubly polished thick section for mineral chemistry at AMNH. Micro-XRF at WUSTL and solution ICPMS at Maryland were used to analyze for bulk trace elements. For Li isotopes, solution MC-ICPMS was conducted at Maryland. For shape preferred orientation, the Intercept method [4] was used on a BSE image of the same thick section used for mineral chemistry. Reflectance spectra of a powdered bulk rock of NWA 6963 were obtained at the NASA/Keck Reflectance Experiment Laboratory (RELAB). The same powdered sample was used for solution ICPMS at Maryland.

Results: Similar to many basaltic shergottites [5], two populations of pyroxenes exist in NWA 6963: augite and pigeonite. The pyroxenes are in equilibrium and give a high T crystallization of ~1250°C and low T of ~1000°C from [6]. The pyroxene crystals shape ratio indicated by image analysis and apparent lack of plastic deformation microstructures in pyroxenes suggests that magmatic deformation occurred on Mars. NWA 6963 is a coarse grained rock which rules out eruption and surficial flow as the cause of the orientation (as has been suggested to explain the textures in other shergottites [5]). The coarse-grained texture and strong shape-preferred orientation of the sample indicate three probable fabric-forming processes: 1) subsurficial magmatic flow, 2) crystal-settling/compaction or 3) a combination of both. The mineralogy and textures of NWA 6963 suggests that it may represent a piece of a layered gabbroic intrusion into the Martian crust.

References: [1] Meteoritical Bulletin. 2011 *Meteoritics & Planetary Science*. [2] Wilson N., Agee C. and Sharp Z. 2012. 43rd Lunar and Planetary Institute Science Conference. Abstract# 1696. [3] Filiberto J. et al. 2014. *American Mineralogist* 99: 601-606. [4] Launeau P. and Robin P.Y.F. 1996 *Tectonophysics* 267: 91-119.[5] McSween H.Y. 1994. *Meteoritics* 29: 757-779. [6] Andersen D.J. et al. 1993. *Computers and Geosciences* 19: 1333-1350.