A vitrophyric clast in the Martian NWA 7034 breccia: An analog to Humphrey

A. UDRY[1*], N. G. LUNNING[2], H. Y. MCSWEEN[2] AND R. J. BODNAR[3]

[1]University of Nevada Las Vegas, Las Vegas, NV 89154
[2]University of Tennessee, Knoxville, TN 37996
[3]Virginia Polytechnic Institute, Blacksburg, VA 24061
*correspondence: arya.udry@unlv.edu

The martian meteorite Northwest Africa (NWA) 7034 and paired meteorites are polymict breccias, which likely represent the Noachian martian regolith [1-3]. NWA 7034 consists of various igneous clasts with basaltic, basaltic andesite, trachyandesite and Fe-, P-, Ti-rich compositions. These breccias also contains sedimentary and impact-derived components [1].

Here we describe a large impact melt clast (5 x 4.5 mm) that displays a unique vitrophyric texture [4]. It contains acicular elongated skeletal orthopyroxene and olivine crystals. Olivines are rare in NWA 7034 and were only found in melt clasts [1]. The pyroxenes show compositional zoning from $En_{69}Fs_{28}Wo_3$ cores to $En_{60}Fs_{35}Wo_5$ rims. The olivine grains have compositions of $Fo_{55\text{-}63}$. The mesostasis is generally homogeneous with a basaltic composition. The disequilibrium composition and texture of the vitrophyre clast suggest very fast cooling. Its high Ni content (1020 ppm) indicates potential contamination by a chondritic impactor. The nickel content of the vitrophyre suggests a possible addition of 5.3-7.7% chondritic component.

The bulk composition and the boundary between this vitrophyric clast and the host breccia suggest that NWA 7034 was not the protolith of the vitrophyre. In addition, low concentrations of Zn and S imply that martian soil was not incorporated into the vitrophyre. We compared the bulk composition of this vitrophyric clast to igneous rocks analyzed on the martian surface and martian meteorites in order to understand if a known martian composition could have been the protolith. This vitrophyric clast has a bulk composition that is very similar to Humphrey, a primary basalt analyzed by the Spirit rover in the Gusev Crater.

This vitrophyric clast demonstrates that the regolith breccia NWA 7034 and paired meteorites likely sample igneous compositions not previously identified in martian meteorites.

[1] Santos et al. (2015), *GCA* **157**, 56-85 [2] Cannon et al. (2015) *Icarus* **252**, 150-153 [3] Humayun et al. (2013), *Nature* **503**, 513-516 [4] Udry et al. (2014) *GCA* **141**,281-293