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From Source to Surface: Tracing the Volatile Record of High-Titanium Mare Basalts

JESSICA J BARNES[1], ZOE E WILBUR[1], MARYJO BROUNCE[2], CAROLYN A. CROW[3], SEAN POMEROY[3], LUNN J ONG[4], TIMOTHY HAHN[5], JED MOSENFELDER[6], JEREMY W BOYCE[7] AND TIMMONS ERICKSON[8]

[1]University of Arizona
[2]900 University Drive
[3]University of Colorado Boulder
[4]university of arizona
[5]NASA JSC
[6]University of Minnesota
[7]NASA
[8]Jacobs - JETS, NASA JSC

Presenting Author: jjbarnes@lpl.arizona.edu

Over the last two decades, missions led by NASA have discovered water ice on the lunar surface [1-3]. These findings have revolutionized our view of the abundance, distribution, and potential sources of H_2O and other volatiles to the Moon [4]. However, within the developing field of lunar volatiles there are debates regarding: the abundances of volatiles in the bulk silicate Moon, the timing of volatile accretion to the Moon, the sources of lunar volatiles, and the modes and timing of volatile loss, exchange, and or mixing. To address some of these outstanding questions, we are studying a group of high-titanium lunar mare basalts that were co-collected during the Apollo 17 mission. The sample-set includes cold curated basalt 71036 which is available as part of NASA's Apollo Next Generation Sample Analysis (ANGSA) program. Using coordinated in-situ microanalysis and bulk-rock techniques, we are studying the texture, mineralogy, volatile content (H, F, Cl, S), isotopic composition (D/H), oxidation state (via S speciation), formation age (via U-Pb, Pb-Pb dating), and exposure histories (via the Ar system) of the samples. Combined these data will elucidate the inventory, magmatic processing, and post-magmatic history of volatiles for a group of Apollo 17 basalts in unprecedented detail. At the meeting, we present our latest results on this project.

[1] Clark (2009) *Science,* 326, 562-564. [2] Pieters et al. (2009) *Science*, 326 (5952), 568-572. [3] Sunshine et al. (2009) *Science*, 326 (5952), 565-568. [4] McCubbin et al. (2015) *Am. Min*., 100 (8-9), 1668-1707.