

A NEW TYPE OF EVOLVED LUNAR LITHOLOGY: BASALTIC-ANDESITE GLASS. R. A. Zeigler, R. L. Korotev, B. L. Jolliff, and C. Floss. Washington University, Campus Box 1169, St. Louis, MO, 63130. zeigler@levee.wustl.edu.

Introduction: We have identified a unique type of impact glass in the Apollo 16 regolith that we designate basaltic-andesite (BA) glass because the composition falls in the field of basaltic andesite according to the total alkali-silica classification [1]. Glasses with similar compositions have been previously reported at the Apollo 16 site and designated “HKFM,” i.e., high-K Fra Mauro [2,3]. In detail, however, these glasses have a composition that is distinct from “Fra Mauro” glasses and other evolved lunar materials [4,5].

Methods: The 24 BA glass fragments in this study were found among the <1 mm fraction of six different Apollo 16 regolith samples. We determined major-element concentrations by electron microprobe analysis and trace-element concentrations by secondary-ion mass spectrometry on polished thick sections.

Results: The BA glasses are silica-rich (52.5 wt%), ferroan (Mg' : 39), moderately FeO and TiO_2 rich (13.3 and 3.6 wt% respectively), with elevated concentrations of Na_2O (1 wt%), K_2O (0.6 wt%), and incompatible trace elements (ITE; Sm: 59 ppm; Th: 17 ppm). The REE pattern and interelement ITE ratios (except for the alkalis) are similar to KREEP. Morphologically the BA glasses are angular fragments, never spherical (or even partially spherical). Some contain small blebs of meteoritic metal and minor amounts of mineral clasts.

Discussion: The BA glasses represent an evolved lithology that must have been exposed on a large enough scale to produce impact melt of this composition. In detail, it is distinct from other evolved lunar lithologies. The various “flavors” of KREEP (basalt and impact-melt breccias) are much more magnesian (Mg' : 50–70) and have lower FeO, TiO_2 , and ITE concentrations. Granites and felsites have different REE patterns, higher concentrations of large-ion lithophile elements (LILE), and are less mafic. Quartz monzodiorites/gabbros have less Ti, higher concentrations of ITEs, and tend to be deficient in the LILEs. Whereas it is easy to identify what the BAGs are not, it is not immediately apparent what they are, or more to the point, what they were prior to becoming glass. The presence of meteoritic metal and mineral clasts indicate that these are impact products. Given their extreme composition, they are unlikely to be a mixture in which more than one lithology is volumetrically important. Despite differences in Mg' and TiO_2 concentration, BA glasses share many compositional similarities with KREEP. In fact, this composition is more like what one would expect from a magma-ocean residuum, but without having mixed with magnesian components [4,6]. Given their ITE-rich composition, the provenance of these glasses is likely to have been in the Procellarum KREEP Terrane. Their young age of (3.75 Ga [3]) and absence from the Apollo 16 ancient regolith breccias preclude their having been Imbrium ejecta. Their point of origin and the mechanism by which their abundance came to be moderately high among impact glasses at the Apollo 16 site remain obscure.

References: [1] Zeigler R.A. et al. 2004. #2082. *LPS* 34. [2] Meyer H.O.A. and Tsai H.-M. 1975. *EPSL* 28: 234–240. [3] Zellner N.E.B. et al. 2005. #1199. *LPS* 35. [4] Jolliff B. L. 1998. *International Geology Review* 40: 609–610. [5] Papike J.J. et al. 1998. in *Planetary Materials*, Revs. in Min., Vol. 36:5. [6] Warren P.H. 1988. *PLPSC* 18, 233–241.