MINERALOGICAL AND GEOCHEMICAL INVESTIGATIONS OF MARE BASALTS FROM THE APOLLO COLLECTION.

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Introduction: The Apollo mare-basalts represent the largest and most pristine collection of lunar basaltic material on Earth. A thorough assessment of their petrological and geochemical characteristics provides key information on the evolutionary history of the Earth-Moon system. The aim of our research is to carry out systematic studies involving mineralogy, petrology and geochemistry of a suite of mare basalts from the Apollo 11, 12, 14, 15 and 17 sites. With the aid of *in situ* U-Pb dating of phosphates in the Apollo basalts, the samples are being grouped within the existing lunar classification scheme(s)[1] with the aim of gaining a more precise chronology of basalt extrusions at these locations.

Methodology: Our analytical protocol includes the collection of backscatter and x-ray maps for a polished section of each sample followed by electron microprobe spot and transect analysis of individual mineral phases. LA-ICP-MS data reveals the trace element signature of minerals in each sample, while the solution ICP-MS technique is utilised for the bulk chemistry. U-Pb age dating of phosphates is currently being carried out using the SHRIMP facility at Hiroshima University[2,3].

Results & Conclusions: Our preliminary data are consistent with previous observations that lunar basalts vary widely in terms of texture and mineralogy, which are products of complex crystallisation processes. Initial LA-ICP-MS data not only confirm the heterogeneity of REE signatures between the Apollo sites but also between individual samples from the same site. Focusing on clinopyroxene for example, the variation in La/Yb ratio throughout the sample suite ranges from 0.5 to 0.008 while Eu anomalies (Eu*= Eu/√(Sm*Gd)) range from 0.09 to 0.36. These variations were most likely produced by a combination of fractional crystallization of mare magma and their source heterogeneities. We also plan to carry out oxygen isotope measurements on these samples to further constrain the processes involved in mare-basalt petrogenesis.

[1] Neal A. B. and Taylor L.A. 1992. *Geochim. Cosmochim. Acta* 56: 2177-2211. **[2]** Terada et al., 2007. *Nature* 450: 849-852. **[3]** Anand et al., 2003. *Geochimica et Cosmochimica Acta* 67: 3499-3518.