X-RAY MICRO-COMPUTED TOMOGRAPHY OF APOLLO SAMPLES AS A CURATION TECHNIQUE ENABLING BETTER RESEARCH

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Introduction: X-ray micro-computed tomography (micro-CT) is a technique that has been used to research meteorites for some time [e.g., 1, 2 and many others], and recently it is becoming a more common tool for the curation of meteorites [3] and Apollo samples [4]. Micro-CT is ideally suited to the characterization of astromaterials in the curation process as it can provide textural and compositional information at a small spatial resolution rapidly, nondestructively, and without compromising the cleanliness of the samples (e.g., samples can be scanned sealed in Teflon bags). This data can then inform scientists and curators when making and processing future sample requests for meteorites and Apollo samples. Here we present some preliminary results on micro-CT scans of four Apollo regolith breccias.

Methods: Portions of four Apollo samples were used in this study: 14321, 15205, 15405, and 60639. All samples were 8-10 cm in their longest dimension and approximately equant. These samples were micro-CT scanned on the Nikon HMXST 225 System at the Natural History Museum in London. Scans were made at 205-220 kV, 135-160 μA beam current, with an effective voxel size of 21-44 microns.

Results: Initial examination of the data identify a variety of mineral clasts (including sub-voxel FeNi metal grains) and lithic clasts within the regolith breccias. Textural information within some of the lithic clasts was also discernable. Of particular interest was a large basalt clast (~1.3 cm^3) found within sample 60639, which appears to have a sub-ophitic texture. Additionally, internal void space, e.g., fractures and voids, is readily identifiable.

Discussion: It is clear from the preliminary data that micro-CT analyses are able to identify important "new" clasts within the Apollo breccias, and better characterize previously described clasts or igneous samples. For example, the 60639 basalt clast was previously believed to be quite small based on its ~0.5 cm^2 exposure on the surface of the main mass. These scans show the clast to be ~4.5 g, however (assuming a density of ~3.5 g/cm^3). This is large enough for detailed studies including multiple geochronometers. This basalt clast is of particular interest as it is the largest Apollo 16 basalt, and it is the only mid-TiO_2 basalt in the Apollo sample suite.

By identifying the location of interesting clasts or grains within a sample, we will be able to make more informed decisions about where to cut a sample in order to best expose clasts of interest for future study. Moreover, knowing the location of internal defects (e.g., fractures) will allow more precise chipping and extraction of clasts or grains. By combining micro-CT scans with compositional techniques like micro x-ray fluorescence (particularly on sawn slabs), we will be able to provide even more comprehensive information to scientists trying to best select samples that fit their scientific needs.

References: [1] Kuebler K. E. et al. 1999. *Icarus* **141**:96-106. [2] Almeida N. V. et al. 2014. *MAPS*, abstract # 5033, this volume. [3] Smith, C. L. 2013. *MAPS* **76**, Abstract #5323. [4] Zeigler, R. A. 2014. 45th LPSC, abstract 2665.