NEAR-SURFACE AGE DISTRIBUTION OF LUNAR IMPACT-MELT ROCKS. N. M. Curran[1,2] D. M. Bower[1] and B. A. Cohen[1], [1]NASA Goddard Space Flight Center, 8800 Greenbelt Rd, Greenbelt, MD 20771; [2]NASA Postdoctoral Program

Introduction: The ages and compositions of impact melt rocks, both in lunar meteorites and in the Apollo and Luna sample collections, have been used to address questions related to the impact history in the Earth-Moon system and to investigate regional geology. However, the role of gardening as a possible bias affecting the preservation of impact-melt samples in the near-surface regolith needs further clarification. One way to understand the changes in impact-melt sample populations is to choose samples from depth in the regolith. The Apollo 16 double-drive tube 68001/68002 provides the opportunity to evaluate variations in age and composition of impact materials with depth. Based on composition and the soil maturity parameter I_s/FeO, there are five compositionally distinct units in the core [1]. The fact that each of these horizons can be distinguished from one another implies that each contains a potentially distinct population of impact materials. Additionally, a small inflection in the I_s/FeO profile at 3 cm depth may be related to the nearby South Ray impact, making this horizon similar to the Apollo 12 and 15 soils containing dated spherules, also located near small, young craters. Our intent is to secularly sample particles from each interval, group them according to parent lithology, and then conduct ^{40}Ar-^{39}Ar dating on representatives from each lithology to build a complete picture of the materials contributed to that horizon. While not a perfect analogy for a surface collection mission, it is meant to be illustrative of how we could use a combination of major-element chemistry, mineralogy, and age to understand impact history of a lunar site.

Samples: We received six 0.5-g bulk soil samples from each of the five intervals in 68001/2, plus one near surface sample. We sieved each soil sample into aliquots of size fraction greater than 250 μm, greater than 106 μm, and fines. The approximate mass of each fraction is shown in Fig 1; all aliquots had 50-70 individual particles in the 250+ size fraction that were used for continued analysis. We grouped particles visually using the petrographic microscope, but wanted a more robust method for determining parent lithologies for the groups of particles, and ideally one with the least sample preparation or destruction. First, we mounted each particle on double-sided tape and used micro-XRF to analyze the major-element chemistry, along with several terrestrial K-feldspar grains for calibration. We used Principal component analysis (Fig 2) and hierarchical clustering methods to analyze the dataset, but found that there is not enough variation in major-element chemistry among the particles to form robust groups, though in both methods, the terrestrial K-feldspar readily stood out from the lunar samples.

We tried additional analyses of the unprepared samples using low-vacuum secondary electron microscopy (SEM) and Raman spectroscopy. Unfortunately, the extreme topography and rough surfaces of the particles prevented us from getting robust results with either method. Penetrating analyses such as laser-induced breakdown spectroscopy (LIBS) would be ideal for these samples, but they are too small for reliable LIBS analyses in our laboratory.

Ongoing work: To achieve a more robust association or grouping of particles, we are turning to a mount-and-polish technique. Each particle will be mounted individually using superglue, hand-polished with SiC grinding paper, and analyzed by SEM and Raman spectroscopy to provide texture, major-element composition and mineralogy, to distinguish volcanic, plutonic, and impact-melt samples [2-4]. We will report on these results at the meeting.

References: [1] Korotev *et al.* (1997) *Geochim Cosmochim Acta* 61, 2989-3002. [2] Cohen *et al.* (2005) *Met Planet Sci* 40, 755-777. [3] Delano (1986) *J Geophys Res* 91, 201-213. [4] Zeigler *et al.* (2006) *Geochim Cosmochim Acta* 70, 6050-6067.
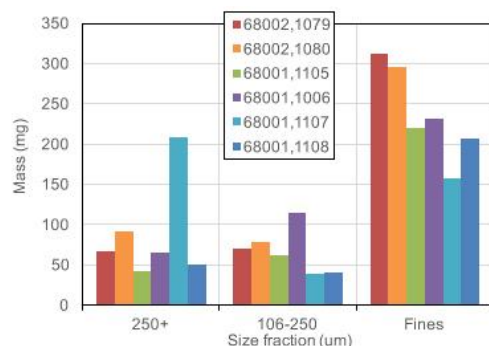

Fig. 1 (left) Mass per size fraction, sorted by depth.

Fig. 2 (right) PCA analysis of all samples shows the primary variability among samples is mafic-felsic (F1) and incompatible-elements (F2).