

**PROCESSING APOLLO CORE SAMPLES 73001/2 – INSIGHTS FROM ANGSA TO PREPARE FOR FUTURE SAMPLE RETURN MISSIONS TO THE MOON AND BEYOND.** J. Gross<sup>1,2,3,4</sup>, A. Mosie<sup>5</sup>, C. Krysher<sup>5</sup>, S.A. Eckley<sup>5</sup>, R.A. Zeigler<sup>1</sup>, F.M. McCubbin<sup>1</sup>, C. Shearer<sup>4,6</sup>, and the ANGSA Science Team<sup>7</sup> (jgross@eps.rutgers.edu). <sup>1</sup>ARES, NASA Johnson Space Center (JSC), Houston, TX 77058; <sup>2</sup>Dept. of Earth & Planetary Sciences, Rutgers University, Piscataway, NJ 08854; <sup>3</sup>Dept. of Earth & Planetary Sciences, American Museum of Natural History, New York, NY 10024; <sup>4</sup>Lunar and Planetary Institute, Houston TX 77058; <sup>5</sup>Jacobs JETS, NASA JSC, Houston, TX 77058; <sup>6</sup>Institute of Meteoritics, University of New Mexico, Albuquerque, NM 87131; <sup>8</sup>www.lpi.usra.edu/ANGSA/teams/

**Introduction:** Apollo Sample 73001/2 is a ~71cm long double drive tube consisting of an upper part (73002) and a lower part (73001) that contains regolith collected near Lara Crater at the Apollo 17 site, Station 3. The double drive tube is believed to have penetrated a lunar landslide deposit that was transported from the slope of the South Massif into the Taurus-Littrow Valley [1]. As part of the ANGSA (Apollo Next Generation Sample Analyses) initiative, preparing a preliminary examination (PE) catalog of 73001/2 is a crucial first step for the early identification of material types such as rock fragments and potential stratigraphy within the core. Many new curation and scientific tools such as X-ray computed tomography (XCT) [3], multi-spectral imaging [4], and gas extraction manifold with piercing tool [5-7], have been applied to the ANGSA core to benefit curation strategy, PE efforts, sample allocation to the planetary science community, and ultimately help to prepare for future sample return missions like Artemis.

**73001/2 Preliminary Examination (PE) and Processing:** Prior to opening either sample (73001 and 73002), the entire core was scanned using XCT to 1) facilitate non-destructive, rapid detection of minerals, lithic clasts, and void spaces within the drive tube (73002), as well as any contamination potentials due to piercing of the CSVC during gas extraction (73001) [7]; and 2) to aid in the Artemis sample tool development and provide data on the knife edge seal of the CSVC. This knowledge will help us connect the mechanics of the implemented design (i.e., XCT data) to the performance of the seal (i.e., data on the gas samples will tell us how well the seal preserved the volatile record of lunar samples). Both type of information will feed forward into Artemis tool and storage strategies for future samples. Further, the data was used during the dissection process to anticipate when and where void spaces could be encountered, and thus identify regions where the core would be particularly friable, as well as where and when larger rock fragments and clasts would be encountered. Knowing ahead of time what to expect helped circumvent problems and allowed us to take counter measures (e.g., video recording of loose intervals) to maximize sample integrity, and thus, minimize science loss. Sample 73002 was successfully opened and

extruded in Nov. 2019 and fully dissected by the end of 2021. Sample 73001 was successfully opened and extruded in March 2022 and fully dissected by the end of June 2022.

**Results and Lessons learned:** The XCT data of the CSVC and core tube of 73001 within showed that the bottom Teflon cap was not pierced during gas extraction (Fig. 1c) and thus, the sample integrity remained guaranteed. However, the XCT scan of the top of the core (Fig. 1b) revealed that the drive tube was overfilled with lunar soil and the tool that keeps the soil constrained within the drive tube was not fully deployed. These preliminary data allowed us to implement the necessary steps to prevent loss of sample integrity, including any potential stratigraphy shifts during extrusion. An informative PE catalogue is currently being created that, in its current state, represents a living document and includes: 1) an image database; 2) an interval inventory database with information pertaining to each interval including the weights of all size fractions present in each interval per pass, depth of each interval, parent numbers, etc.; 3) a particle database of all  $\geq 4$ mm XCT images and movies; and 4) digitized dissection notes and sketches for each interval that capture the characteristics of the core such as color, texture, grain size, compactness, locations of clast and rock fragment, and other noteworthy information.

**Conclusion:** Processing Apollo core 73001/2, creating an informative PE catalog, and applying new and refined tools and technologies for sample analyses are invaluable activities that will assist in circumventing any potential pitfalls, aid in the characterization of samples, and help in the assessment of how well any lunar material has been collected and preserved in the past. This will aid in designing future sample collections and curation procedures, help to prepare for future human exploration and sampling missions such as Artemis, and ultimately, will enable new scientific discoveries about the Moon and our solar system.

**References:** [1] Schmitt H. (2017) *Icarus* 298, 2-33. [3] Zeigler et al. (2021) *LPSC* 52nd, #2632; [4] Sun et al. (2021), *LPSC* 52nd, #1789; [5] Parai et al. (2021), *LPSC* 52nd #2665; [6] Schild et al. (2021) *LPSC* 52nd #1888; [7] McDonald (2022) *ESL* 2022.