

FROM APOLLO TO ARTEMIS: HOW PROCESSING ANGSA CORE SAMPLES 73001/2 CAN HELP TO PREPARE FOR FUTURE SAMPLE RETURN MISSIONS TO THE MOON AND BEYOND.

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Introduction: Apollo Sample 73001/2 is a ~71 cm 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 and Processing: Sample 73002 was successfully opened and extruded in Nov. 2019 and fully dissected at the end of 2021. Sample 73001 (Fig. 1) was successfully extruded in March 2022 after careful planning before opening the Core Sample Vacuum Container (CSVC) that was holding the drive tube of 73001. XCT, as part of PE, was used to scan the bottom and top part of the 73001 core tube within the CSVC prior to opening it to 1) facilitate non-destructive, rapid detection of any contamination potentials due to piercing of the CSVC during gas extraction [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.

Results and Lessons learned: The XCT data of the CSVC and core tube within showed that the bottom Teflon cap was not pierced during gas extraction (Fig. 1c) and thus, the sample integrity remained guaranteed during piercing and subsequent gas extraction. 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. 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 and help to prepare for future human exploration and sampling missions such as Artemis.

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.

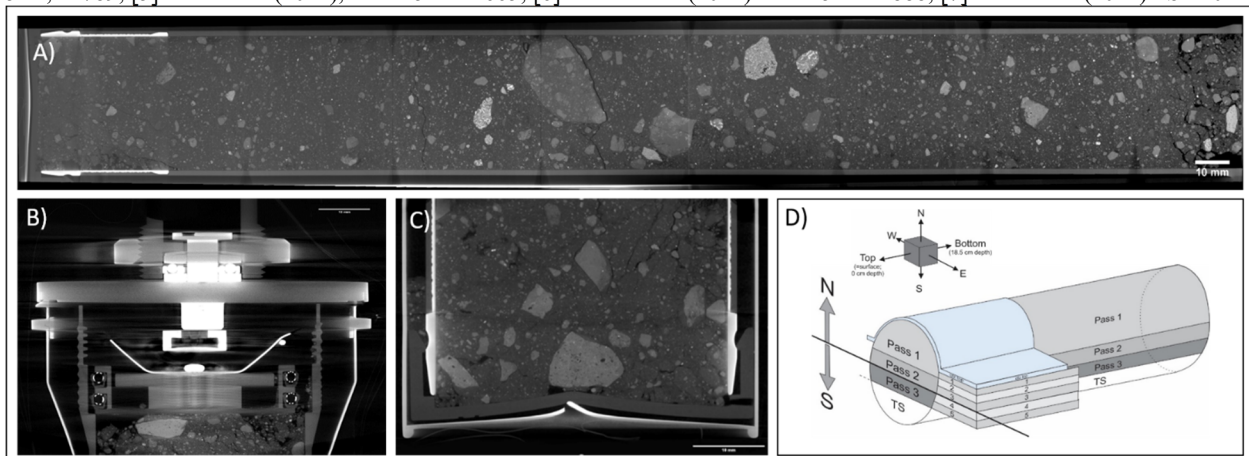


Figure 1: A) Stitched whole core XCT scan of 73001; B) XCT scan of the top of 73001 within the CSVC; C) XCT scan of the bottom of 73001 within the pierced CSVC; D) Sketch of 73002 core with locations of each dissection pass.