**FROM APOLLO TO ARTEMIS: HOW ANGSA HELPS PREPARING FOR FUTURE SAMPLE MISSIONS TO THE MOON AND BEYOND.** J. Gross[1,2,3] R.A. Zeigler[1], F.M. McCubbin[1], C. Shearer[3,4], and the ANGSA Science Team. [1]ARES, NASA Johnson Space Center, Houston (JSC) TX 77058, (juliane.gross@nasa.gov); [2]Depart. of Earth and Planetary Sciences, Rutgers University, Piscataway NJ 08854; [3]Lunar and Planetary Institute, Houston TX 77058; [4]Dept. of Earth and Planetary Science, Institute of Meteoritics, University of New Mexico, Albuquerque, New Mexico 87131.

**Introduction:** The Apollo Program returned 381 kg of samples. Analyses of these samples have provided fundamental insights into the origin and history of the Earth-Moon system and our solar system. During Apollo some samples were collected or preserved in unique containers or environments and have remained unexamined by standard or advanced analytical approaches [1]. The Apollo Next Generation Sample Analysis (ANGSA) Program was designed to examine a subset of these special samples and to function as a sample return mission with site characterization, processing, basic characterization, preliminary examination (PE), and analyses utilizing new and improved technologies and recent mission observations [2]. Nine selected ANGSA teams are examining two distinct types of samples: (1) Apollo 17 double drive tube, 73001/2 consisting of an unopened vacuum sealed core sample (Core Sample Vacuum Container; CSVC 73001) and its unsealed but unstudied companion core 73002; and (2) Apollo samples that were placed in cold storage approximately 1 month after their return in the early 1970s [1]. Studying these unopened and specially curated samples could allow scientists to gain insight into the origin of the lunar polar ice deposits, as well as other potential resources for future exploration such as Artemis.

Many new curation and scientific tools such as X-ray computed tomography (XCT) [3], multi-spectral imaging [4], and gas extraction manifold with a piercing tool [5,6], that will be used to extract gas from 73001, are currently being developed and/or applied to the ANGSA core to benefit curation strategy, PE efforts, and ultimately sample allocation to the planetary science community [1,2]. Analyses of these samples with these new tools and technologies will maximize the science return from Apollo, as well as enable a new generation of scientists and curators to refine their techniques and help prepare future explorers for lunar missions within the next five years and beyond. As such the ANGSA Program links the first generation of lunar explorers (Apollo) with future explorers of the Moon (Artemis).

**ANGSA 73001/2 samples:** ANGSA has numerous science goals that fulfill Apollo mission goals and address new science concepts developed over the last 50 years [7]. A specific goal is to understand how effective the double-vacuum sealed containment of 73001 was at preserving the volatile record of lunar samples, which is paramount for preserving the core's integrity and the meaningfulness of any subsequent analysis [7]. With future lunar missions likely to target the polar regions, and the international Mars Sample Return program in preparation, newly developed instruments such as the gas manifold and piercing tool, as well as protocols for extracting the volatiles that might still be present in 73001, will provide essential information for developing future sampling containers for Artemis and beyond.

**ANGSA cold curated samples:** Four science teams were selected to study cold and/or volatile-bearing samples collected during the Apollo program. The ANGSA samples that are stored cold have special storage and handling requirements that necessitate their processing in a -20°C environment [8]. Sample processing under cold conditions and meeting the Apollo materials and cleanliness requirements revealed some unique challenges in materials performance and PPE [9-11]. ANGSA provides excellent preparation for Artemis' future cold sample processing efforts because lessons learned here will aid in the development and implementation of a cold sample processing facility, including curation procedures, needed to process the cold and volatile-bearing samples planned to be returned by Artemis missions [8].

**Conclusion:** Processing Apollo core 73001/2 and other future ANGSA samples, creating an informative PE catalog, and applying new and refined tool and technologies for sample analyses are invaluable activities that (1) will assist in the characterization of samples and (2) help us assess how well the lunar material has been collected and preserved. This will help us design future collection and curation procedures and will help to prepare for future human exploration and sampling missions such as Artemis.

**References:** [1] McCubbin et al. (2021) LPSC 52$^{nd}$, #1541; [2] Gross et al. (2021) LPSC 52$^{nd}$, #2684; [3] Zeigler et al. (2021) *LPSC 52$^{nd}$, #2632;* [4] Sun et al. (2021), LPSC 52$^{nd}$, #1789; [5] Parai et al. (2021), LPSC 52$^{nd}$ #2665; [6] Schild et al. (2021) LPSC 52$^{nd}$ #1888; [7] Shearer et al., (2021) LPSC 52$^{nd}$ #1566; [8] Mitchell et al (2020) AGU, V017-08; [9] McCubbin et al. (2019) *Space.Sci.Rev.* 215:48; [10] Herd et al. (2016) Meteoritics & Planetary Science; [11] Amick et al. (2021) LPSC 52$^{nd}$, #2506.