SUMMARY OF APOLLO NEXT GENERATION SAMPLE ANALYSIS (ANGSA) AND INSIGHTS FOR ARTEMIS PRELIMINARY EXAMINATION ACTIVITIES. F.M. McCubbin[1], C.K. Shearer[2,3], J.J. Barnes[4], K. Burgess[5], B.A. Cohen[6], N. Curran[6], M.D. Dyar[7], J.E. Elsila[6], J.J. Gillis-Davis[8], J. Gross[1], A. Sehlke[9], K.C. Welten[10], R.A. Zeigler[1], and The ANGSA Science Team[12]. [1]ARES, NASA Johnson Space Center, Houston (JSC) TX 77058 (francis.m.mccubbin@nasa.gov), [2]Dept. of Earth and Planetary Science, Institute of Meteoritics, University of New Mexico, Albuquerque, New Mexico 87131; [3]Lunar and Planetary Institute, Houston TX 77058; [4]Lunar and Planetary Laboratory, University of Arizona, Tucson, AZ 85721; [5]United States Naval Research Laboratory, Washington DC 20375; [6]NASA Goddard Space Flight Center, Greenbelt, MD 20771; [7]Department of Astronomy, Mount Holyoke College, South Hadley MA 01075; [8]Department of Physics, Washington University in St. Louis, St. Louis MO 63130; [9]NASA Ames Research Center, Moffett, CA 94035; [10]Space Sciences Laboratory, University of California, Berkeley, CA 94720; [11]the list of co-authors includes all members of the ANGSA Science Team (https://www.lpi.usra.edu/ANGSA /teams/), which includes members of the JSC curation team that participated in ANGSA (https://www.lpi.usra.edu/ANGSA/teams/JSC/).

Introduction: Analyses of Apollo samples have provided fundamental insights into the origin and history of the Earth-Moon system and the solar system broadly. With great foresight, a subset of samples from Apollo were left unprocessed so that they could be studied by future generations with their modern technology. To prepare for the return of samples from the Moon by the Artemis Program, NASA initiated the Apollo Next Generation Sample Analysis Program (ANGSA) to analyze a subset of the previously unprocessed Apollo samples. The ANGSA consortium consisted of 9 original teams funded by NASA that combined into a single science team referred to as the ANGSA Science Team. ANGSA was designed to function like the sample analysis phase of a sample return mission with a goal to investigate the lower portion of a double drive tube previously sealed on the lunar surface (73001), the upper portion of that drive tube that had remained unopened (73002), and a variety of Apollo 17 samples that had remained stored at -20 ºC for approximately 50 years.

The preliminary examination (PE) and project science phase of ANGSA served to prepare curators and researchers alike for samples returned from Artemis missions. In particular, ANGSA included in its design to place samples within the context of local and regional geology through new orbital observations collected over the last decade and new "boots-on-the-ground" observations and interpretations provided by Apollo 17 astronaut Harrison Schmitt. Additionally, ANGSA used new analytical techniques like X-ray computed tomography that were established in the curation office over the last decade to prepare, document, and allocate the ANGSA samples. ANGSA also included the development of new tools to open and extract gases from the vacuum-sealed CSVC containers, and it included the application of new analytical instrumentation previously unavailable during the Apollo Program to reveal new information about these samples. Most of the 90 scientists, engineers, and curators involved in this mission were not alive during the Apollo Program, and it had been 30 years since the last Apollo core sample was processed in the Apollo curation facility at NASA JSC.

The results of ANGSA have been published in several manuscripts already [1-5], including an overview manuscript by Shearer et al., [6] that is in press at *Space Science Reviews*. There is also a special collection of manuscripts that are coming out in the *Journal of Geophysical Research – Planets* [e.g., 3-5]. Here, we highlight some of the most important insights that have been gained from ANGSA to help prepare for Artemis, particularly as it pertains to PE.

Insights for Artemis PE: (1) The PE and dissection of core samples are time consuming and typically takes 6-8 months. For Artemis, the examination of collected core will far exceed the typical 6 months allotted for releasing an initial sample catalog. Therefore, core-dissection should not be part of PE for the initial catalog. **(2)** A variety of imaging techniques (XCT, multi-spectral) applied during PE would produce a richer sample catalog. **(3)** Some sample measurements may be time-sensitive and will need to be released early to the science community or utilize new technologies that prevent terrestrial effects (atmosphere, temperature). These measurements must be identified early and included in the Artemis PE plan. **(4)** More than 4 hours per person in the lab each day doing PE is not sustainable and will introduce mistakes that could lead to science loss due to the increased mental and cognitive workload in a cleanroom environment. Furthermore, meticulous documentation is part of PE and curation, including documenting the environment that each sample will see at any given point (e.g., during transfer). Efficient time needs to be calculated to update the data packs for each sample, enter information into internal databases, annotate images, transcribe notes and sketches, etc. The amount of time needed for documentation and database upkeep outside the cleanroom is about equal to the amount of time needed inside the cleanroom for a given sample-processing task.

References: [1] Sun et al. (2021) *MAPS*, 1574-1584. [2] Wilbur et al (2023) *MAPS*, 1600-1628. [3] Elsila et al. (2024) *JGR-Planets*, 129, e2023JE008133. [4] Sehlke et al. (2024) *JGR-Planets*, 129, e2023JE008083. [5] Simon et al. (2024) *JGR-Planets*, 129, e2023JE007991. [6] Shearer et al. (In Press) *Space Science Reviews*.