

CURATING NASA'S FUTURE EXTRATERRESTRIAL SAMPLE COLLECTIONS: THE ROLE OF ADVANCED CURATION

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Introduction: The Astromaterials Acquisition and Curation Office at NASA Johnson Space Center (JSC) (henceforth referred to herein as NASA Curation Office) is responsible for curating all of NASA's extraterrestrial samples. Under the governing document, NASA Policy Directive (NPD) 7100.10F "Curation of Extraterrestrial Materials," JSC is charged with "The curation of all extraterrestrial material under NASA control, including future NASA missions." The Directive goes on to define Curation as including "...documentation, preservation, preparation, and distribution of samples for research, education, and public outreach." Here we describe some of the ongoing efforts to ensure that the future activities of the NASA Curation Office are working towards a state of maximum proficiency.

Founding Principle: Curatorial activities began at JSC (Manned Spacecraft Center before 1973) as soon as design and construction planning for the Lunar Receiving Laboratory (LRL) began in 1964 [1], not with the return of the Apollo samples in 1969, nor with the completion of the LRL in 1967. This practice has since proven that curation begins as soon as a sample return mission is conceived, and this founding principle continues to return dividends today [e.g., 2].

Advanced Curation: Part of the curation process is planning for the future, and we refer to these planning efforts as "advanced curation" [3]. Advanced Curation at NASA is founded as a cross-disciplinary field of advanced research and development under the auspices of the NASA Curation Office. Advanced Curation conducts research, explores and invents new innovative technologies and techniques for collection, handling, characterization, analysis, and curation of astromaterials that could be used for both next-generation human and robotic space exploration missions and current collections. Advanced Curation has a primary goal of expanding the sample processing and storage capabilities of NASA's astromaterials curation facilities, preparing the Curation Office for future sample return missions as well as maximizing the science returns of our existing sample collections. In addition, the program integrates, tests, and evaluates new technologies and operational procedures for future sample return missions through human and robotic analog studies. These goals are aimed at improving our core curation functions of protecting the scientific integrity of NASA's astromaterials collections and serving as responsible distributors of astromaterials to the global community of sample scientists and educators in a fair, timely, and professional

manner. The Advanced Curation initiatives described will allow for the reduction of contamination to astromaterials and the unprecedented preservation of the scientific integrity of all samples from mission inception through ATLO, sample collection, preliminary examination on Earth, curation, and secure delivery of the samples to Earth-based laboratories for in-depth scientific analyses.

Looking Forward: We are fully committed to pushing the boundaries of curation protocol as humans continue to push the boundaries of space exploration and sample return through both human and robotic exploration efforts. However, to improve our ability to curate astromaterials collections of the future and to provide maximum protection to any returned samples, it is imperative that curation involvement commences at the time of mission inception. Specifically, when curation involvement is at the ground floor of mission planning, it provides a mechanism by which the samples can be protected against project-level decisions that could undermine the scientific value of the returned samples.

Concluding Remarks: The return of every extraterrestrial sample is a scientific investment. The curation facilities and personnel are the primary managers of that investment, and the scientific community, at large, is the beneficiary. The NASA Curation Office has the primary goal of maintaining the integrity of all of NASA's astromaterials and ensuring that the samples are distributed for scientific study in a fair, timely, and responsible manner. It is only through this openness and global collaboration in the study of astromaterials that the return on our scientific investments can be maximized. For information on requesting samples and becoming part of the global study of astromaterials, please visit curator.jsc.nasa.gov

References: [1] Mangus, S. & Larsen, W. (2004). Lunar Receiving Laboratory Project History. NASA/CR-2004-208938. NASA, Washington, DC. [2] Allen, C. et al., (2011) Curating NASA's extraterrestrial samples-past, present, and future. *Chemie Der Erde-Geochemistry*, 71, 1-20. [3] McCubbin, F.M. et al., (2016) Curating NASA's Past, Present, and Future Extraterrestrial Sample Collections. 47th LPSC #2668.