MANAGING ANALYTICAL DATA FROM PRISTINE RETURNED SAMPLES IN COMPLIANCE WITH NASA'S DATA STRATEGY: THE ASTROMATERIALS DATA SYSTEM. K. A. Lehnert[1] and L. Profeta[1], [1]Affiliation (include full mailing address and e-mail address if desired) for first author, [2]Affiliation for second author (full mailing address and e-mail address).

Introduction: Analytical studies of astromaterials samples returned by NASA space missions generate unique and highly valuable data that contribute fundamentally to our knowledge and understanding of the origin and evolution of Earth, our solar system, and the universe. These data need to be openly accessible and curated in a manner that maximizes their reuse in and utility for future science and that ensures their quality and long-term preservation. In several recent strategic documents and reports, NASA recognizes this need [1] and is adjusting its science information policies [2]. In 2020, NASA charged the Planetary Data Ecosystem Independent Review Board (PDE-IRB) to conduct a review of the planetary data landscape and make recommendations for improving access to and use of planetary science data by the science community [3]. This presentation will highlight features and services of the Astromaterials Data System that align the IRB's recommendations.

The Astromaterials Data System (Astromat) is a data infrastructure that has been funded by NASA since 2018 to curate, archive, and publish analytical data that are generated from astromaterials samples collected by NASA missions and curated at the Johnson Space Center in the Astromaterials Research & Exploration Science Division. Astromat's mission is to: preserve astromaterials data and ensure their long-term access and reusability for new science endeavors; restore legacy data of astromaterials samples acquired in the past; synthesize historic and new data into a comprehensive, analysis-ready data store that allows scientists to use new technologies such as Machine Learning and Artificial Intelligence to explore and mine these data in previously impossible ways.

Astromat operates a data repository where researchers can deposit their data for archiving and publications, specifically to comply with new journal policies and guidelines for Open and FAIR data and Data Management Plans required by funders. The repository follows international best practices. Astromat also maintains the Astromat Synthesis, a relational database that integrates legacy and new data into a harmonized data collection that allows users to find and extract data at the granularity of individual analytical measurements and combine these into customized new compilations for advanced data analysis.

PDE-IRB Recommendations: The IRB report presents a total of 67 findings and 65 recommendations pertaining to the strategic development of the data ecosystem; barriers to data preservation; and barriers to access, usability, and development. Recommendations address many different aspects of the Planetary Data Ecosystem, from technical requirements to governance and oversight to the need for a culture change in the research community. The Astromaterials Data System reviewed these recommendations in light of its own operational principles and policies, technology and architecture, collaborations, and user services. We here explain how Astromat already fulfills a number of the IRB recommendations that will be critical for the envisioned improvements to the overall Planetary Data Ecosystem.

Astromat's Compliance with Principles and Best Practices: Astromat's systems, services, policies, procedures, and management have been designed to comply with the FAIR principles for Findable, Accessible, Interoperable, and Reusable data [4], and TRUST principles for Transparent, Responsible, User Focused, Sustainable, and Technologically stable repositories [5]. Astromat also follows best practices for laboratory analytical data established in the geochemistry community [6] and FAIR physical samples [7] that are emerging through various initiatives.

AstroMat is compliant with many of the PDE-IRB recommendations. Examples of recommendations that Astromat already addresses include:

- *R9: NASA should seek CoreTrustSeal certification, and thereby WDS membership, for the PDS data nodes. NASA should encourage CoreTrustSeal certification for other PDE elements that serve as data repositories.* – Astromat has already completed its application for CoreTrustSeal Certification.
- *R33: NASA should establish a requirement for the preservation of mission-supported laboratory analyses of returned sample material that makes the information accessible to the planetary science community.* – Astromat provides the infrastructure and services that support the preservation and access of laboratory analyses of returned sample material.
- *R47: NASA should support and encourage expanded use of DOI-like identifiers for data, thereby connecting data at various levels of processing to assist users in locating the best version of a data set for their needs.* – The AstroMat Repository registers data with DataCite to assign DOI. Astromat also is

working to assign persistent, globally unique identifiers (IGSN) to the samples.

- *R49: NASA should fund the development of more analysis-ready data (ARD) products derived from the lower-level products created by NASA missions.* – Astromat's Synthesis Database delivers astromaterials data analysis-ready via machine-actionable interfaces.

References: {1] SMD's Strategy for Data Management and Computing for Groundbreaking Science 2019-2024. [2] Scientific Information policy for the Science Mission Directorate, SMD Policy Document SPD-41 (August 2021). [3] Besse, S., et al. (2021). *LPI Contributions 2549, 7070.* [4] Wilkensen, M. D., et al. (2016). *Scient. Data 3,* [5] Lin, D., et al. (2020) *Scient. Data 7.* [6] Goldstein, S. L., et al. (2014) *IEDA https://doi.org/10.1594/IEDA/100426.* [7] Maicher, D., et al. (2019) *Geophys. Res. Abstr. 21.*