PDS GEOSCIENCES NODE DATA ARCHIVING AND DISCOVERY SUPPORT FOR ASTROMATERIALS AND MARS SAMPLE RETURN. T. C. Stein, E. A. Guinness, S. J. V. VanBommel, McDonnell Center for Space Sciences, Dept. of Earth and Planetary Sciences, Washington University in St. Louis, 1 Brookings Drive, CB 1169, St. Louis, MO 63130, tstein@wustl.edu.

Introduction: The Planetary Data System (PDS) Geosciences Node [1] actively supports astromaterials and Mars Sample Return (MSR) Program archiving and data discovery tasks. We have developed an astromaterials-specific extension to PDS4 data dictionary as part of our work with providers archiving related datasets. The Spectral Library [2] has data from meteorite and lunar samples. The Analyst's Notebook (AN) [3] for Perseverance Rover (an.rsl.wustl.edu) includes initial reports and dossiers of collected samples. The Analyst's Notebook architecture is positioned to support sample return data from Artemis III and other lunar missions. We are also actively supporting the Mars Sample Return Program archive planning efforts.

Astromaterials Data Archiving: The Geosciences Node of the NASA Planetary Data System (pds-geosciences.wustl.edu) archives planetary science data from missions to Mercury, Venus, Mars, and the Earth's Moon, and from individual investigators funded by NASA data analysis programs.

We help data providers put data into PDS by working with missions to design, receive, and validate data deliveries, and by working with individual scientists to archive data from their research, e.g., from PDART-funded projects. We help the planetary science community get data out of PDS by providing services for searching and downloading data as well as providing expert help in understanding and using the data.

The Astromaterials Local Data Dictionary (LDD) is an extension to the PDS4 information model, tailored specifically to enable comprehensive descriptions of astromaterials data and accompanying documents for long term archival. This data dictionary, created by the Geosciences Node, is designed with the needs of future missions and studies in mind, specifically enabling data relations and descriptions pertaining to astromaterials sample metadata such as collection/recovery year, origin, and relation to other relevant materials.

In addition, we are working with the Astromaterials 3D team at JSC to archive their collection of high-resolution photographs, X-ray computed tomography (XCT) slices, and 3D models of Apollo samples [4] (ares.jsc.nasa.gov/astromaterials3d).

The AstroMaterials PDS Archive contains data from the AstroMaterials Data System geochemistry database of laboratory data acquired from samples curated in the Astromaterials Collection at the Johnson Space Center (JSC) [5]. The database is accessible at www.astromat.org.

The Node archive also contains bidirectional reflectance distribution function data for six Apollo soil samples measured at the Bloomsbury University Goniometer laboratory [6] (pds-geosciences.wustl.edu/missions/labdata/apollobug.htm).

Data Discovery with the Spectral Library: The Spectral Library (pds-speclib.rsl.wustl.edu) contains measurements of Earth, lunar, and meteorite materials for comparison to flight measurements. It includes visible and infrared spectra for nearly 12,000 meteorite and lunar specimens from Reflectance Experiment LABoratory (RELAB) and 25 synthesized glass samples. The analysis data are archived at the Geosciences Node.

Mars 2020 Sample Initial Reports and Dossiers in the Analyst's Notebook: Perseverance Rover has cached to date some two dozen of the 43 available sample tubes for return to Earth, with 10 samples dropped at the backup Three Forks Depot and the rest remaining on the rover. As part of each sample collection, the mission science team prepares an initial report and a dossier containing a rich collection of key information needed to understand the rationale and immediate scientific context for that sample. Details and initial reports for the first 21 samples are captured in the PDS archive and, along with pre-release dossier files, incorporated in the Perseverance Rover Analyst's Notebook (an.rsl.wustl.edu) (Figure 1).

The Notebook for Perseverance also contains daily documentarian and mission lead reports that provide a view into science operations—insight into why and how particular observations were acquired. Reports are edited only for grammar and spelling, and removal of spacecraft and instrument sensitive content. Additional Notebook components include the peer-reviewed, publicly available data delivered by the instrument teams; documentation describing context for the observations, processing methodology, and data formats; a surface operations historical overview; and an interactive rover traverse map.

Mars Sample Return: The Geosciences Node is assisting with archive planning for MSR Program elements Sample Retrieval Lander and Capture, Containment, and Return System. We will incorporate MSR archives and support documents into the Analyst's Notebook with connections to JSC sample curation

team who will maintain samples after return. In addition, we plan to develop interoperability support with the European Space Agency Planetary Science Archive who will be archiving Earth Return Orbiter project data. We do not expect to archive data from analyses of return samples conducted in laboratories, except for any spectral data that become part of the Spectral Library.

Lunar Samples in the Apollo AN: Images of samples collected from Apollo missions 11, 12, 14, 15, 16, and 17 are available in the Apollo Notebook, along with annotated images, location maps, reference documents, and searchable traverse maps.

Conclusion: With a growing number of missions poised to perform in situ measurements and return samples for further analysis, the PDS Geosciences Node is committed to supporting astromaterials community data archive and discovery requirements. Future Notebooks are planned for the VIPER and Dragonfly missions, and the collection of spectral data will continue to grow with new archive submissions.

References: [1] Ward, J. et al. (2023), LPSC LIII, Abstract #1533. [2] Scholes, D. et al. (2021), 5th Planetary Data and PSIDA 2021, Abstract #7006. [3] Stein, T.C. et al. (2010), LPS XLI, Abstract #1414. [4] Blumenfeld, E. H. et al. (2019), LPS L, Abstract #3056. [5] Lehnert, K. et al. (2022), LPS LIII, Abstract #2845. [6] Shepard, M.K. (2001), LPS XXXII, Abstract #1015.

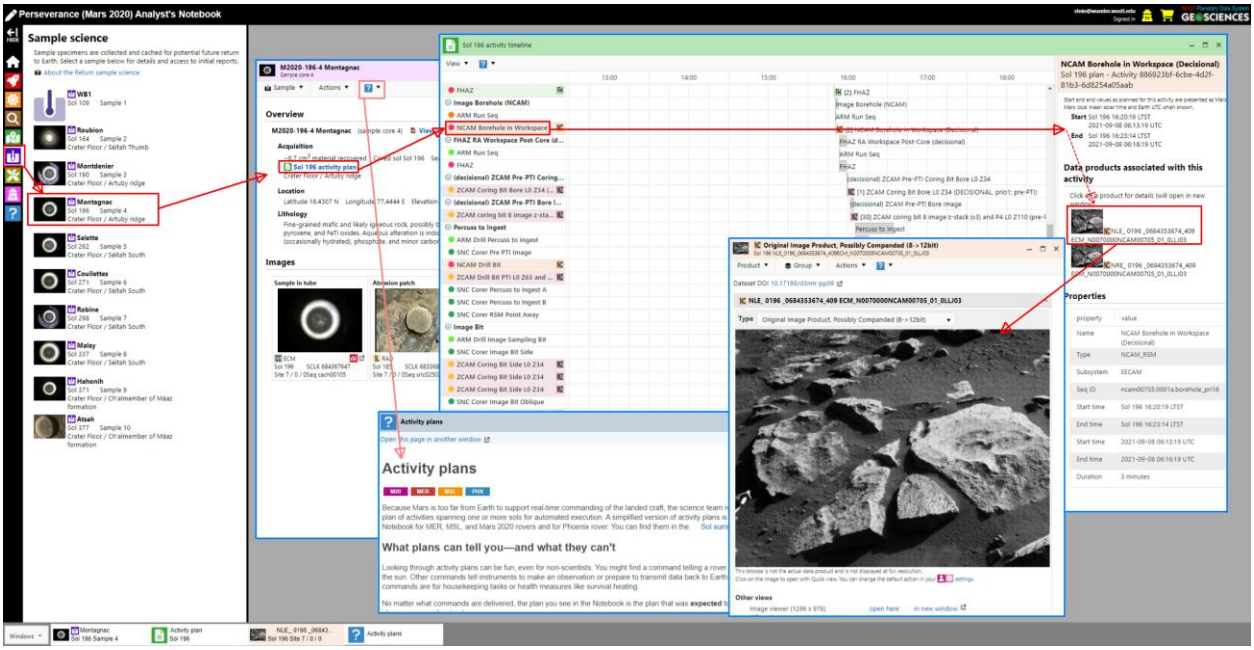

Figure 1. Screen shot from the Mars 2020 Analyst's Notebook for Perseverance Rover. The example shows a listing of cached samples and links between windows containing sample details, an activity plan timeline, acquired data, and related user help.