LUNAR RESOURCES CATALOG (LRC) K. Ennico-Smith[1], L. Keszthelyi[2], R.A. Beyer[3,1], A. Colaprete[1], J.A. Coyan[4], C.I. Fassett[5], J.L. Heldmann[1], J. Kleinhenz[6], [1]NASA Ames Research Center (kimberly.ennico@nasa.gov), [2]USGS Astrogeology Science Center (laz@usgs.gov), [3]SETI, [4]USGS Minerals, Energy, Geophysics Science Center, [5]NASA Marshall Space Flight Center, [6]NASA Glenn Research Center

Opportunity: Multiple assets are being deployed to explore the Moon at a rapid cadence. There will be a huge expansion in lunar surface exploration with mobility (e.g., rovers). Several missions are focused on collecting data for assessing lunar resources for potential In-Situ Resource Utilization (ISRU). Work has begun on establishing an ISRU measurement plan (i.e., what data is needed) [1] and the identification of Lunar Critical Data Products applicable to general lunar science [2]. How to *integrate* these data into the broader Planetary Data Ecosystem (PDE) following FAIR (i.e., Findability, Accessibility, Interoperability, and Reuse) data practices has not been addressed.

The Volatiles Investigation Polar Exploration Rover (VIPER) team desires to provide the definition for and a pathfinder dataset to establish a Lunar Resources Catalog (LRC). A precedent for a catalog focused on resources exists for the Mars Community: the Subsurface Water Ice Mapping (SWIM) project. This multi-year effort delivered an integrated set of mapping products (e.g., ice consistency, thermal, WEH, geomorphology maps) created by ingesting data from multiple spacecraft plus modeling. This database and products are used by mission planners and the scientific community to identify the location and nature of potential water resources on Mars [3].

Requirements: For a LRC to be usable, it will be essential to embrace FAIR data practices. This requires clearly defined organization of inputs (e.g., data type, format, units, quality factor, etc.). A LRC also must accept several data types (e.g., spectra, images, derived parameters) from both surface and orbital assets. A relatively new challenge is to include depth information (e.g., from a drill, ground penetrating radar, etc.).

For resource assessments to be trustworthy, it is important that the *full process* from raw data to derived products (e.g., calibrated data, maps) to knowledge be stored, cataloged, and efficiently searchable. At all levels it should follow existing standards when possible, and always include documentation of methods used. The data structure must also be reactive to community needs (e.g., ISRU mission planners, lunar science and geostatistical researchers, commercial).

VIPER Pathfinder Set: VIPER is scheduled to land in the lunar south pole Nobile region in late 2023. Equipped with spectrometers, cameras, and a drill for sub-surface access, the VIPER mission will provide an unprecedented dataset for exploring lunar resources (especially ice) at the human/rover scale [4]. VIPER will generate raw and calibrated data from each instrument, plus derived products such as surface maps of temperature and spectral parameters and vertical profiles of volatile species and concentration. Equally important is that the data is collected with a geo-statistically robust approach (e.g., sampling different ice stability regions, length and density of sampling profiles, and number of drilling sites) [5].

The VIPER dataset consisting of separate measurements plus correlated comparisons is positioned to replace the semi-arbitrary weights used in today's qualitative resource favorability assessments with *data-driven weights*. This is a key and needed step in *quantitative* assessment of lunar resources.

Community Resource: The LRC will be an information and knowledge management construct *for the community*. Inputs come from both original data sources (e.g., data from orbital and landed missions), and the knowledge transfer from people analyzing the data in the generation of reports, papers, maps, etc.. The catalog should grow and be reinforced as knowledge changes. The LRC would be friendly to "your favorite analysis and processing tools." As the LRC's backbone will be based on community standards, the data flow to/from tools and the LRC should be transparent or easily adaptable. The ultimate goal is to create a *community resource* that continues to grow even after the VIPER mission is complete. Because the PDE is in a period of rapid evolution, we remain flexible in the specifics of where and how a LRC will be implemented and housed. In constructing a catalog focused on lunar resources, we will leverage experience from USGS mineral resource assessments [6,7].

Impact: The LRC can be a critical first step in integrating lunar resource related data into the broader PDE. The end goal will be to maximize reuse and interoperability with the existing and evolving PDE for lunar data products particularly relevant to ISRU. If you have an interest in shaping the development of the LRC, please contact one of the authors.

References: [1] J. Kleinhenz, et al. (2020) NASA/TM-20205008626. [2] A. Stickle, et al. (2021) LCDP-SAT-REPORT-20211110.pdf. [3] G.A. Morgan et al. (2021) *Nature Astron.*, 5, 230–236. [4] A. Colaprete (2019) AGU P34B-0. [5] A. Colaprete et al. (2021) LPI No. 2548, Abs #1523. [6] Keszthelyi, L. et al. (2021) 11th JTMSS&SRR. [7] Coyan, J.A. (2021) 11th JTMSS&SSR.