A Terrestrial Analogs Database for Mars and Europa Mission Operations Support I. J. Doloboff[1], E. J. Eshelman[1], G. Wanger[1], E. Hara[2], V. M. Paez[3], V. J. Orphan[4], J. P. Amend[2], L. W. Beegle[1], and R. Bhartia[1]. [1]NASA Jet Propulsion Laboratory, California Institute of Technology, 4800 Oak Grove Drive, Pasadena, CA 91109 (Ivria.Doloboff@jpl.nasa.gov). [2]University of Southern California, Department of Earth Sciences, 3651 Trousdale Pkwy., Los Angeles, CA 90089. [3]Georgia Institute of Technology, North Avenue, Atlanta, GA, 30332. [4]California Institute of Technology, 1200 E California Blvd, Pasadena, CA 91125.

Introduction: The Multi-INstrument Database (MIND) is a cloud-based research data management repository that hosts and integrates diverse datasets generated by instruments across multiple institutions and astrobiology research endeavors. The NASA Astrobiology Institute (NAI) and Mars 2020 rover mission share the goal of searching for locations where life could have existed or could exist today; however, the methods of data organization across the astrobiological efforts are non-uniform [1], [2]. The growing data deluge has produced problems with organization of data, and concern from the astrobiology community about the sharing and reuse of datasets [3]. MIND establishes a distinct data ontology for the preservation of vetted data using well-documented standards. The singular goal of this database is to be a permanent, reliable, and ever-growing resource for astrobiology research.

On Earth, analytical methods including deep UV Raman and fluorescence spectroscopy, electron microscopy, and molecular biological techniques, operate over multiple spatial and spectral scales. In the case of Raman and fluorescence, macro- and micro-mapping of spatial distribution of aromatics, aliphatics, and minerals offer the possibility to correlate organics and minerals with morphology [4]. Investigation of near- and sub-surface environments on Earth will augment future analysis of Mars and Europa mission data. The sample-centric organization and breadth of well-vetted datasets of terrestrial data analogs and standards in MIND will support Mars and Europa surface operations. Surface instruments investigate potential evidence for life by examining persistent morphology, chemical signatures, and spatial distribution of compounds in rock and ice. SHERLOC (Scanning Habitable Environments with Raman and Luminescence for Organics and Chemicals) on Mars 2020 is a robotic arm-mounted deep UV fluorescence and Raman spectrometer that will identify potential biosignatures and characterize mineralogy both on and near- surface [2].

Investigation of key astrobiological questions often pairs *in situ* data with Earth-based laboratory analogs; correlative comparisons can characterize Mars habitability and the possibility for "life as we know it". For terrestrial analogs, astrobiologists assess how biosignatures and evidence of habitable environments persist across epochs on Earth. The Life Underground program funded by NAI performs these assessments as a research theme that investigates near and sub-surface intraterrestrials.

The first sequence of the spectral pipeline begins a recurring down-selection of sample spot analysis; including each scale within the same database permits interplanetary correlative data analysis. Terrestrial data native to one database rather than many could better support research efforts that compare morphological features on Mars with like features on Earth. Data belonging to a single ontology could prevent comparisons across terrestrial datasets collected without translatable data standards. Defining data standards across myriad analytical techniques is necessary, albeit difficult, in a robust research data management system. Within MIND's "sample-centric" relational database is a defined taxonomy of instruments and data sources. The purpose for this organization is two-fold: 1) Data from multiple analytical techniques can be associated to a given sample; 2) custom PHP scripts can perform server-side searching and ordering actions to enable innumerable processing functions. Analysis of raw data involves a top-down interrogation of data, whereas the collection and curation of data involves a bottom-up, forward-looking approach. Keeping in mind these two necessities, MIND was conceptualized and then modified. Continued adjustments to the original database have grown a barebones architecture into a comprehensive data management system for terrestrial rock and ice sample storage and analysis.

A database like MIND, using a unifying data ontology, can support a cross-disciplinary search for "life as we know it", by 1) storing well-documented datasets; 2) facilitating access to, and analysis of, these large data sets using cloud-computing capabilities, and; 3) enabling correlative analysis of raw and derived data aross analytical techniques.

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