MOONDB: UPDATE ON THE RESTORATION AND SYNTHESIS OF LUNAR GEOCHEMICAL AND PETROLOGICAL SAMPLE DATA. K.A. Lehnert[1], C. Evans[2], N. Todd[2], R. Zeigler[2] [1]Lamont-Doherty Earth Obseravtory, Columbia University, 61 Rt 9W, Palisades, NY, 10964, USA; lehnert@ldeo.columbia.edu, [2]Johnson Space Center, full mailing address and e-mail address).

Introduction: Nearly 2,200 rocks, soils, and core samples were collected during the Apollo missions from six geologically diverse locations on the Moon. These samples have been curated with utmost care and expertise and made available to the global research community for studies that have helped expand our understanding of the history and evolution of the Moon and our solar system. Over 3,000 different studies have been conducted in the nearly 50 years since the samples were collected, but the study of the lunar samples continues as new scientific approaches and vastly improved analytical technologies generate new data and insights. An average of >55 requests and >600 distinct subsamples are still been allocated annually.

While new studies are encouraged, it is important to recognize that the Apollo samples are a finite resource and new studies should not duplicate previous studies, but rather leverage previous results, helping to preserve the samples and scientific funding.

We created the MoonDB project to develop a data system that not only rescues and restores analytical data from the Apollo samples generated over the past, especially unpublished analytical data, but that provides a home for all future data generated on these samples, integrating them with the older data and making them accessible in a way that maximizes their utility for new science.

Developement of MoonDB: Over the past two years, the MoonDB project has focused on the following tasks: 1. compiling data and relevant metadata from published scientific articles, from the Apollo Sample Compendium, and from datasets contributed by researchers, and preparing them for ingestion into the MoonDB relational database (formatting, harmonizing terminology); 2. encouraging and supporting lunar scientists to prepare their unpublished geochemical data for ingestion into MoonDB; 3. developing the MoonDB Reference Catalog that integrates references from all relevant databases; and 4. developing the MoonDB database and user interface.

Data Restoration: Since the beginning of the project in 2015, we have identified about 850 priority papers and compiled the data and metadata from approximately 700 of these papers for ingestion into MoonDB. Based on input from investigators, we have digitized 6 of the 16 NASA technical reports that had been published by the Department of Geology and the Institute of Meteoriticis of the University of New Mexico in the 70's and 80's. We have and permanently preserved these digitized datasets in the EarthChem Library (http://www.earthchem.org/library), where they have been published and registered with DOIs so they can be properly cited. Additional reports will be made available shortly.

We have reached out to authors for unpublished datasets that were intended to be included with abstracts and papers. However, despite the investigators' initial enthusiasm for the project and our offers for resources to assist the data compilation, few researchers have contributed their datasets and we have received only a handful of responses. We anticipate that we will be more successful once we can demonstrate the utility of MoonDB when a fully functional user interface is available. We also expect that tangible results that have already come out from the MoonDB data rescue effort will further increase willingness to contribute. A pilot project involving the rescue of geochemical data of John Delano on Apollo pyroclastic glasses (for example [1]) has already been referenced in multiple Apollo sample requests, and Delano's compiled data were used as part of one of the new studies.

MoonDB Database: We have developed and implemented the MoonDB database using the Observation Data Model [2], which provides the necessary capabilities of describing samples, hierarchical sample relationships, and analytical procedure and data quality. Scripts have been developed to read compiled data from our data templates and ingest them into the relational database. The ingestion of all compiled data will be completed by the end of May 2017.

MoonDB Search Interface: The MoonDB search interface provides tools for users to query the database for samples by Apollo mission or based on their lithology and composition. It allows users to create customized datasets containing a set of chemical variables for a specific sample or group of samples as selected by the user. The new MoonDB user interface uses Ealsticsearch to provide users with structured as well as free-text keyword searches and enhance performance.

References:

[1] Delano, J. (2016) Electron microprobe analyses of Apollo 14 low-Ti green glasses from Lunar Samples 14047, 14049, 14301, 14307, and 14313; doi:10.1594/IEDA/100584

[2] Horsburgh J. et al. (2016) *Environmental Modelling & Software*, 79, 55–74.