Wes Moore, Governor

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Final Technical Report

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Project Title: Preservation of Drill Cuttings and Core, Inventory of Geophysical Logs, and Preservation of Data Relevant to Critical Minerals in Maryland (2021-2022, extended 2023)

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ABSTRACT: In its fourteenth year as a recipient of a U.S. Geological Survey (USGS) National Geological and Geophysical Data Preservation Program (NGGDPP) grant, the Maryland Geological Survey (MGS) conducted work on several projects aligned with FY2021 NGGDPP Program Priorities – *Priority1*: preserve geoscience data and materials and *Priority 2*: identify critical minerals resources. The MGS received a no-cost extension for this grant due to restrictions to collection access related to COVID-19 and approval for a change in one co-principal investigator.

Under Priority 1, the MGS conducted two projects. *For Project 1A*, MGS remediated 635 boxes of drill cuttings; completed a detailed inventory and database entries for these cuttings; determined related borehole identifiers and coordinates to the extent feasible; submitted updated NGGDPP-compliant item-level metadata to the Registry of Scientific Collections (ReSciColl); and is updating its online collection information. The MGS is working with the USGS to get general collection-level information updated in ReSciColl.

For Project 1B, the MGS conducted a detailed inventory of 3,257 paper geophysical logs. The inventory data was recorded in internal spreadsheets designed to include information for compilation into the USGS borehole template format. Efforts were made to correlate logs with borehole identifiers/location data to the extent feasible, however this work is on-going; as a result, item-level metadata is still in progress; once locations can be confirmed, the MGS will submit NGGDPP-compliant metadata to the ReSciColl. The MGS is working with the USGS to get collection-level data posted into ReSciColl (new collection).

For Priority 2 the MGS participated in a critical mineral regional workshop in the fall of 2021; developed an initial long-range strategy for the preservation of data relevant to critical minerals; and worked to reformat a compilation map and tabulated data that identify areas with potential critical mineral resources in Maryland to new standardized digital files/templates. These data included geospatial representations of areas (*Project 2A*) and select borehole data (*Project 2B*). Compiled data and metadata for *Project 2A* have been uploaded to ReSciColl; MGS is working to get data for *Project 2B* uploaded to ReSciColl. The MGS will work with the USGS to get collection-level data updated as appropriate.

INTRODUCTION

In 2008, in response to financial incentives offered by the USGS NGGDPP, the Maryland Geological Survey (MGS) began to address the long-term preservation of its data and collections in a formalized, systematic way. With successive NGGDPP funding, the MGS has made strides in preserving its geoscience collections. The MGS FY2021 NGGDPP grant activities focused on the preservation of geologic materials, the inventory of paper geophysical logs, and the compilation and preservation of critical minerals data.

GRANT GOALS AND RESULTS

The goals and results for each FY2021 NGGDPP grant project are described below. Results include a summary of accomplishments, challenges, and impediments.

Project 1A – Preservation of MGS Drill Cuttings and Core (from 2018 Guilford facility salvage)

Project 1A built upon activities to preserve drill cuttings collection that were conducted during the FY2017 - FY2020 NGGDPP grant cycles.

Goals: 1) Remediate ~600 boxes of drill cuttings and ~ 100 boxes of core; 2) perform a detailed inventory and database entries for these materials; 3) identify/confirm borehole identifiers (IDs) and coordinates; 4) create and submit updated NGGDPP-compliant metadata to the ReSciColl (former National Digital Catalog, NDC); and 5) update MGS collection webpages.

Results:

Storage Container Remediation: The MGS remediated 635 boxes of drill cuttings in varying degrees of deterioration; more than 185 boxes of cuttings were severely deteriorated and fragile. Originally, boxes of differing quality contained cutting samples in a variety of container types, most commonly ~15-70 paper envelopes/box. Many cuttings needed to be transferred to new cuttings paper envelopes. Where original envelopes could be retained, they were placed in plastic bags (protective sleeves). Envelopes were organized by depth, and put into new heavy, corrugated cardboard boxes, as appropriate. All information from the original containers was transferred manually onto the replacement storage boxes and/or envelopes. Due to the effort involved in cuttings preservation, no core preservation was undertaken.

Detailed Inventory and Borehole Location Identification: The MGS staff completed a detailed inventory of the 635 boxes of drill cuttings being re-packaged. Efforts to identify borehole locations for the cuttings were coincident with the inventory process and built upon some of the preliminary inventory work of the previous grant. While many boxes had limited site location information on them, making it difficult to cross reference the cuttings to a borehole location and determine coordinates, approximately 78 percent of the boxes were matched to boreholes. Thanks to successive NGGDPP grants, MGS has inventoried and remediated ~ 3,231 boxes of drill cuttings containing over 69,700 envelopes to date. Despite the challenges in identifying and locating the source boreholes, the MGS successfully correlated ~2,516 boxes of drill cuttings to 912 boreholes unique borehole locations. Work is on-going to determine borehole locations for the remaining boxes.

Detailed Internal Database Records: The MGS internal drill cuttings database is in Access Microsoft 365 (MSO Version 2110), (*Cuttings_Inventory_Database_120519*). This database is split into front end (FE) and back end (BE) components to allow multiple users to perform inventory and data entry on different boreholes concurrently. In the inventory table, *CuttingsInv_SIMPLE_Table_120519,* each cuttings box was entered as a separate record. Each record captures extensive information about the box and contents including, but not limited to, information on sample IDs/aliases, container(s), sample depths, storage location at the MGS and related data sources. When cuttings from multiple drilling sites were found together in one box, a unique record was created for each using the Bx_SiteIDNum field.

Geographic location information is stored primarily in the *BoreholeCoordinates* table, which was updated as part of this project. This table contains geospatial coordinates for NGGDPP metadata as well as the original coordinates; their source, projection, and accuracy; and the method of coordinate conversion. The *BoreholeCoordinates* table links to the cuttings inventory table via the db_BholeID field in a one-to-many relationship.

***Updated Metadata Submission to the ReSciColl*:** With the newly revised format for NGGDPP item-level metadata, the MGS needed to convert the previous cuttings metadata into the new format so that metadata for work completed during this project period could be integrated. Updated NGGDPP-compliant item-level metadata for the Drill Cuttings Collection was validated and submitted to the ReSciColl. MGS is working with USGS (Dan Arthur) to set up MdEditor to edit/update the collection-level information.

Drill Cuttings Collection Webpage and Drill Cuttings Mapper Update: The MGS is in the process of updating the webpages for the drill cuttings collection and the interactive mapper with information for the newly inventoried cuttings boxes. The collection webpage provides general collection information along with links to the interactive mapper, an Excel table of cuttings metadata, the collection webpage on the ReSciColl, and instructions on how to make an appointment to access the collection (http://www.mgs.md.gov/publications/mgs_data_preservation/drill_cuttings.html). The interactive mapper allows users to click on a borehole location and a summary of cuttings available and links to relevant online publications or data. These webpages help increase the collection's visibility and promote public awareness of and access to the collection.

Project 1B: Inventory of Paper Geophysical Logs

Project 1B proposed to initiate the inventory and consolidation of paper geophysical logs at the MGS.

Goals: 1) design internal data inventory tables; 2) initiate a detailed inventory of geophysical logs, limited in this proposal to those in paper format only; 3) identify/confirm borehole IDs and coordinates; 4) consolidate paper collection components; 5) create and submit metadata to NDC; 6) create an MGS collection webpage and interactive geophysical log mapper.

Results:

Inventory Table Design: An inventory table was designed in Excel to capture detailed inventory of paper geophysical logs. Fields take into account relevant aspects of the USGS borehole template so that data tabulated for the internal inventory may be extracted later for other purposes. In the inventory table, each paper log (which may contain >1 log) was entered as a separate record. Each record captures extensive information about the log including, but not limited to, the log IDs/aliases, type(s) of logs, top depth(s), bottom depth(s), well owner, driller, paper log condition, the storage location at the MGS. This table include fields for borehole IDs that can link to the *BoreholeCoordinates* table.

Detailed Inventory & Data Table Entry:

A detailed inventory of 3,257 paper logs was completed, however, this represents only about two thirds of the collection. Work on the inventory phase was paused late in the project period to focus on cross-referencing inventoried logs to boreholes and determining borehole locations.

Borehole ID/Location Research: Although significant effort was made to cross-reference the inventoried logs to boreholes and coordinates, additional work will be needed to complete the borehole identification and location process and related QA/QC. Geographic location information is stored primarily in the *BoreholeCoordinates* table (Microsoft Access), which is also used with the core and cuttings inventories. The *BoreholeCoordinates* table can be linked to the log inventory table via the db_BholeID field in a one-to-many relationship.

Log Consolidation: Once the inventory is completed, the paper logs will be reorganized; currently logs are stored in metal filing cabinets. Digital files associated with the inventory in-progress are stored on individual computers and backed up on a network drive which in turn is backed up off site.

Metadata Submission to NDC (now ReSciColl): A new collection needs to be created in ReSciColl for the collection of paper geophysical logs. MGS is working with the USGS (Dan Arthur) to get a MdEditor set up properly for this process.

Collection Webpage and Online Mapper: The MGS is in the process of setting up a webpage for the geophysical log collections. It is anticipated that once item-level metadata is complete, a layer will be added to an online interactive mapper tool with the paper geophysical log collection.

Project 2 – Compilation and Preservation of Maryland Critical Mineral Resource Data

Goals: 1) Provide geospatial representations and descriptions of areas with potential to host critical mineral resources in shapefile and excel format (Project 2A); 2) provide summary descriptions of borehole data in a borehole template format (Project 2B); 3) develop a long-range strategy for critical minerals relevant data preservation; 4) participate in a critical minerals workshop

Results:

Project 2A: Geospatial Representations of Mineral Districts and Associated Data: The MGS prepared geospatial representations along with associated data and references of mineral districts in Maryland in the prescribed digital formats. Map data was compiled as a set that included a shapefile and associated Excel file following "Districts_EarthMRI" templates. Compiled data files and metadata were uploaded to the NDC (now ReSciColl). The MGS will need to work with USGS to edit and restructure files properly for ReSciColl.

Project 2 B: Summary descriptions of borehole data in a borehole template format

MGS prepared borehole data from select MGS publications in a prescribed "Borehole template". Data provided for each borehole included location (in decimal degrees) and total depth. If available, data provided may include identification of stratigraphic tops, lithology, driller's logs, construction information, geophysical data, analytical results, depth to Precambrian basement, and depth to consolidated rock beneath Quaternary and/or Coastal Plain deposits. MGS is working to get compiled data files and accompanying metadata uploaded to the NDC.

Development of a long-range strategy for critical minerals-relevant data preservation

An initial long-range strategy for the preservation of critical minerals data for Maryland was developed. It is anticipated that the strategy will evolve over time as the collection and preservation methods grow and change.

***Critical Minerals Workshop*:** MGS staff participated in a virtual critical minerals workshop in the fall of 2021.

CHALLENGES AND IMPEDIMENTS

The MGS experienced some significant challenges as a result of the COVID-19 pandemic. Access to collections was restricted for part of the project period and work on previous extended grants overlapped. In addition, there were some major changes in the MGS staff which affected the staff working on NGGDPP projects. The MGS appreciates the accommodation that the USGS provided by approving a no-cost extension so that we could strive to complete work on materials and data preservation and the change in one of the co-principal investigators.

Severe deterioration of some of the cuttings inventoried in this grant period required extra care to repackage, relabel and, with the poor legibility or limited original labeling, to cross-reference to boreholes. Similarly the effort to inventory and catalog paper geophysical logs required more effort than anticipated, particularly given the variety of logs encountered and difficulties in cross-referencing. Additional work is needed to complete the inventory and borehole identification and location process.

USER SUCCESS STORIES/SOCIETAL BENEFITS

Online and digital data are increasingly valuable and were particularly important when COVID-19 precautions impeded physical access to geologic collections, challenging scientists and public alike, in the early portion of this grant period. Due to adaptations by the public and researchers as a result of the pandemic, there is a greater interest in digital records and remote access. As part of this grant, digital information about the MGS collections and digital compilations of geologic data increased. Potential for discovery, accessibility and use are enhanced by the collection information and metadata records prepared for and uploaded to the ReSciColl and the MGS collection webpages and online tools.

Use of cuttings, core, and geophysical log collections by geologists continued. These collections are of particular interest to MGS geologists working on quadrangle geologic maps and stratigraphy, including work on a project to identify and resolve conflicts in Mid-Atlantic Coastal Plain stratigraphy and the Cecilton quadrangle geologic map which spans the Maryland-Delaware state line. Because the MGS has inventoried cuttings and core from many of the counties along the Maryland-Delaware line, they can be easily located and used for comparison with geologic material and data from the Delaware Geological Survey. Preservation of the collections helps leverage the time- and cost-savings of using existing materials to more fully these investigate geologic issues.

CONCLUSIONS

The MGS FY2021 NGGDPP grant activities focused on: the inventory and preservation of drill cuttings, the inventory of paper geophysical logs; the compilation of critical minerals data into tables and a GIS map with associated geodatabases; and the development of an initial long-range-strategy for the preservation of critical minerals-relevant data.

For its Drill Cuttings Collection, the MGS continued its detailed inventory and re-packaging– completing the fifth cycle of a multi-year effort to properly document, organize, and store the collection. In this grant cycle the MGS was able to fully inventory and preserve 635 boxes of cuttings. To date, the MGS has inventoried over ~ 3,231 boxes of cuttings. Approximately 78 percent of the boxes of cuttings inventoried have been geospatially tied to borehole locations. Related NGGDPP metadata (item-level) for the entire subset of 2,516 boxes that have been matched to 912 boreholes to date was updated in the ReSciColl following the current metadata format.

As part of the current grant, the MGS started an inventory of its paper geophysical log collection. A detailed internal inventory of 3,257 logs was completed which represents only a portion of the entire collection. Some initial cross-references to boreholes and locations were made but work is needed to verify these matches.

The MGS participated in the Critical Minerals workshop during 2021. Previously compiled information on critical minerals in Maryland was reformatted into standardized geospatial files and templates; map-related data has been uploaded to ReSciColl; the preparation and upload of borehole data is in progress. An initial long-range strategy for the preservation of data relevant to critical minerals occurrence potential in Maryland was developed, providing a foundation to build upon. Like the overall long-range data preservation plan for the MGS, the strategy for preserving critical minerals data will need to be revisited periodically and revised/updated as appropriate.