

Attachment A

FY 2018 NGGDPP Proposal Information Summary

Name of the State Geological Survey: Michigan Geological Survey

Project Title: Michigan Geological Survey 2018 Data Preservation program:
Preserving unique historical collection of drill cuttings and generating inventories together with metadata for them

Principal Investigator: William B. Harrison, III
Michigan Geological Survey
Department of Geosciences
Western Michigan University
1903 W. Michigan Avenue
Kalamazoo, MI 49008-5241
Telephone: (269) 387-8691 Email: harrison@wmich.edu

Authorized Institutional Representative: Western Michigan University
Michigan Geological Survey
Attn: Sherine Obare
1903 W. Michigan Avenue
Kalamazoo, MI 49008-5456

Amount Requested:	FY 2018 FEDERAL BUDGET	FY 2018 STATE BUDGET
	Salaries - \$24,970	Salaries - \$24,971
	Fringe Benefits - \$7,591	Fringe Benefits - \$7,594
	Other Direct Costs - \$150	Other Direct Costs - \$150
	Indirect Costs - \$16,683	Indirect Costs - \$16,685
	Grand Total - \$49,394	Grand Total - \$49,400

Proposed Start Date: September 1, 2018

Proposed Duration: Twelve months from proposed start date

Has this proposal been submitted to any other agency for funding: No

Active NGGDPP-related grant: Michigan Geological Survey 2018 Data Preservation program:
Preserving unique collections of shallow cores, cuttings and associated paper well logs and thin sections, scanning the well logs and thin sections, and generating inventories with metadata for all records

PROJECT SUMMARY

The Michigan Geologic Survey (MGS), through its repository, the Michigan Geological Repository for Research and Education (MGRRE), part of the Department of Geosciences at Western Michigan University (WMU), preserves geological samples and data, making them readily accessible. For this project, the Survey will preserve, inventory and generate metadata for a large collection of historical drill cuttings recently given to the MGS by another university. The MGS will also submit that information in required format to the National Digital Catalog (NDC). This project meets FY 2018 NGGDPP priorities of preserving geological material and submitting inventories and metadata to the NDC.

These drill cuttings are small rock samples from the great majority sedimentary formations throughout Michigan's Lower Peninsula. They were acquired through early oil and gas exploration from the late 1920's-1950's, carried out by one primary company in partnership with several smaller operators. Based on our initial examination of the collection, we expect these are likely the only remaining physical samples for most of these early bore holes.

All the samples are contained in fragile glass vials placed loosely on cardboard trays stacked in large paper boxes. The boxes have sustained water damage and deterioration from poor storage conditions. Initially vials were organized on trays from shallower to deeper samples. Because the boxes have been moved several times, many of the vials have rolled out of the trays and there is little remaining order. Often the paper labels on vials, identifying the well and sample footage, have come loose but are still wrapped around the vials. Some of the vials are cracked and a few have broken. Even so, most of the sample material remains in the vials.

We will correctly identify each well by state permit number based on information from the vial labels, company information and data from current State databases. If further well identification is needed, we will examine the cuttings and compare them to written lithologic descriptions and well logs. Complete inventories with detailed sample footages will be prepared and metadata will be created. To preserve these fragile samples, we will repair or replace damaged glass vials and storage materials, and tape loose paper labels to vials, taking care to retain original written information. Vials will be cleaned, organized by depth within each well and taped to trays which will be held in place by Styrofoam to maintain that order and facilitate examination. We will make these samples accessible and known to stakeholders by uploading inventories to the NDC and to our Survey Web pages.

By preserving these samples we will safeguard an enormous amount of raw data about the geological natural resources the wells penetrated. Making that data accessible will lay the foundation for scientific research about the geologic history of the Michigan Basin, for resource exploration by industry, and for use in educating the next generation of geoscientists.

These drill cuttings are particularly valuable because they hold data essential to providing societal benefits. They represent some of Michigan's critically needed geological resources: aggregate materials such as sand and gravel that are used in road and bridge construction; mineral deposits including salt, used for road de-icing, and potash, an essential ingredient in fertilizer; and building materials such as limestone and gypsum, needed for private and public works. These rock samples from the earliest gas and oil wells are also a significant source of reservoir data essential to efficiently guiding future hydrocarbon exploration using newer technologies. Some of these old well fields may produce additional domestic energy through secondary and tertiary production. These geological resources are essential to supporting economic growth.

Business leaders and governmental agencies can make better decisions about development and regulation only if they have comprehensive data about these critical resources. The physical samples provided by these historic drill cuttings are some the most prolific sources from which that data can be acquired.

PROJECT DESCRIPTION

Introduction

Project Overview, Compliance to NGGDPP and to Secretarial Priorities—By preserving and archiving this collection of historical drill cuttings, inventorying them and creating metadata, and submitting that information in required format to the National Digital Catalog (NDC), this Michigan Geological Survey (MGS) project meets the FY 2018 NGGDPP priorities of preserving geoscience material and data to benefit access by researchers and investigators.

This project also addresses U. S. Department of the Interior Secretarial priorities by providing data essential to (1) sustainably develop our energy and natural resources, and to (2) modernizing our infrastructure. The data provided by these samples when used by the oil and gas industry can produce greater efficiency in future exploration and development resulting in production of more domestic energy. The geological data about near-surface and bedrock materials is essential to locating, mapping and assessing qualities of aggregates and building materials (e.g., sand, gravel and crushed stone) needed for public and private structures, including roads and bridges, resulting in risk reduction through use of appropriate materials and greater subsurface stability for those structures that are key components to modernizing our infrastructure.

Background information about the collection, scope of project methods and goals—These cuttings were recently donated to the MGS by another university. They are now the property of the MGS. Although a few note cards listing information about a few of the wells had been made, there was no complete listing of the wells.

These samples are fragile. Each sample, usually representing 5'-10' feet of the bore hole material, is contained in a glass vial. Those vials were placed in multiple layers of shallow cardboard trays stacked in 634 large cardboard boxes, which show damage from water and poor storage conditions. We estimate there are 600,000-700,000 glass vials, in total. Each vial must be carefully handled, labels taped down if they are loose, corks and screw tops tightened, organized by well, organized in trays by depth, and taped to the trays taking care to keep all original data.



Fig. 1 Damaged boxes

To complete the inventory, we will secure information from vial labels, company information, and current State databases. Because this is a time-consuming project, requiring attention to detail, we plan to complete the work over a two-year time frame. The project for this year reflects our goal to preserve, inventory and create metadata for half of the collection; the budget reflects that goal.

Primary users and frequency of use—Primary users are (1) university faculty and students (2) industry members, (3) governmental agencies, and (4) K-12 students and teachers. Non-affiliated researchers and industry members visit the facility 2-3 times per month. Industry members affiliated through a yearly partnership work at the facility 2-3 days a week; those industry workers are our alumni and they also mentor our current students. About 150 people from academia, industry and government attend our yearly workshops, which we present in our role as the Michigan Center for the Petroleum Technology Transfer Council (PTTC). There we share our research results, industry members present their recent activities, and government members address regulatory issues. We host about 6-8 on-site groups of K-12 students and teachers per year and our CoreKids K-12 outreach program reaches hundreds of students at off-campus educational events and mineral shows. MGS Web pages receive about 9,500 visitors each month.

Drill cuttings in particular have increasingly been used in recent years. The Survey provided several hundred cuttings samples to a national laboratory that studied Michigan shale and other fine-grained formations. Recently Michigan company geologists have examined cuttings extensively as exploration increases with higher oil prices. They examine cuttings with a microscope to determine rock types, potential porosity, and formation history. Please see accompanying support letter.

Project Narrative

Project Activities and Methods—To fully understand the scope, detail, and quality control measures needed for this huge project, we randomly selected and completed the work for 20 boxes. Based on the time and personnel required for this initial project, we determined that completing the work for the entire collection of 634 boxes will require two years. During this project year, we propose to carry out the work for half the collection; the budget reflects that effort.

Because these cuttings were not identified by permit numbers, our first priority was to secure all well identifying parameters. The paper label on each vial showed the company’s alpha-numeric identifier—a 3-4 letter county abbreviation followed by a 1-4 digit number. Fortunately, the donor university had retained the company’s old hand-typed lists of wells for each county and gave those to the Survey. Those lists, comprised of 20,000 wells, proved essential to identifying the wells. They include “farm and well number”, location information, well depth and elevation, and often the permit number itself. Where the permit number was not shown, there was sufficient information when used with State databases and sample examination to confidently identify the well by permit number and subsequently by API number that will be entered in the database. The next priority was coordinating work by staff to identify permit numbers and student work to preserve the samples and complete initial inventory forms.

During this initial work, we saw three different size cuttings vials and two tray sizes. Each box contained 24-36 trays with 600-1200 vials each, averaging 1050/box, depending on vial and tray size. More than half the boxes contained the smallest size vials, arranged in two rows per tray, with 25 cuttings per row. Based on this initial work, we estimate the entire collection comprises 3,000 to 4,000 wells.

The Project Coordinator identified the permit number for each well with some assistance from the Project Manager. Both the Project Coordinator and the Data Manager trained and supervised student work. Through this initial work, we prepared written student instructions to assure quality control. After training, students worked an average of 4 hours per box to complete the work:

- Carefully remove all cuttings in trays or loose in the box, repair or replace cracked vials, keeping original labels, gently remove dirt and dust with dry cloth, tape loose labels to vials, tighten corks and screw tops, repair or replace cardboard trays as needed.
- Organize vials in trays by well identifier number shown on label; place vials with labels facing up in order by depth (shallower to deeper), tape vials to trays, label trays with permit numbers provided by supervisor
- Complete inventory form for each box, record well identifier number, sample depths (e.g., 250-
- Repair or replace the cardboard box if needed, retain original writing, place trays in, secure trays with Styrofoam, submit completed inventory to supervisor and discuss any remaining issues.



Fig. 2 Cuttings vials and Student working with cuttings

The Data Manager then checked initial inventories against State databases for completeness and consistency, entered data into Excel spreadsheets and created additional metadata as described in the Metadata section below. She assigned Pallet ID and location, updated databases and rack location signs, strapped pallets to secure them and placed them in their rack locations.

During the 2018 project year, we will follow the procedures developed in the initial work, revising if necessary if we encounter additional issues, to complete work for 310 of the remaining 614 boxes.

Metadata Creation and Maintenance—The Data Manager will check identification parameters for each well and create metadata: Box Number, Pallet ID, Pallet Location, Well Name, Operator Name, Permit Number, API Number, County, Township, Range, Section, Total Depth, Sample footages, Latitude and Longitude. She will submit metadata to National Digital Catalog describing 1) inventoried collection using supported methods documented in web page titled “Data Provider Dashboard” (http://datapreservation.usgs.gov/page/submit_data/), and 2) individual samples using one of the supported methods documented at “Prepare Metadata Files for Upload to National Digital Catalog” (http://datapreservation.usgs.gov/page/prepare_metadata_for_NDC) for collections already entered in the National Digital Catalog. Further details are described in the Data Management Plan (DMP).

Societal and Scientific Benefits and the Importance of the Proposed Project—The MGS proposes this project to preserve data about natural resources including sand and gravel, building materials, and hydrocarbon reservoirs as well as data about structural characteristics of shallow geologic formations which is essential for scientific research, economic development and infrastructure improvements.

Shedding light on the depth, lateral extent, and characteristics of aggregate materials alone can save money in construction. Schools, churches, public water treatment facilities, sewers, roads and bridges all require aggregate materials. Because costs double for every thirty miles these heavy materials are moved, local sourcing is important. Know their geologic properties and quality is also essential.

Using drill cuttings to acquire subsurface geological data about all our natural resources is both time-efficient and cost effective. These small pieces of rock are produced through drilling all bore holes, are collected throughout the entire depth, and are far more available than logs and cores, especially for older wells.

Cuttings are used to evaluate hydrocarbon reservoir qualities including porosity, pore structure, mineralogy, total organic carbon (TOC), and thermal maturity. Porosity is essential for a formation to hold gas and fluid such as hydrocarbons. When evaluating shale formations for prospective oil production, determining porosity is very important because it varies so much both laterally and vertically. Several large laboratories and service companies have recently developed tests specifically to evaluate shales and other fine-grained rocks: Scanning electron microscope imaging and analysis provides data about mineralogy, rock structure, and porosity; X-Ray fluorescence analysis shows TOC and elemental chemistry; Pyrolysis yields data about producible hydrocarbons and TOC.

Michigan petroleum geologists examine the Survey’s cuttings by microscope. Experienced geologists can see indicators of reservoir properties like porosity, mineralogy and reservoir development. For example, corals and algal development can show reef development and potential porosity. For a hydrothermal play, seeing white dolomite with very good crystalline structure can indicate porosity.

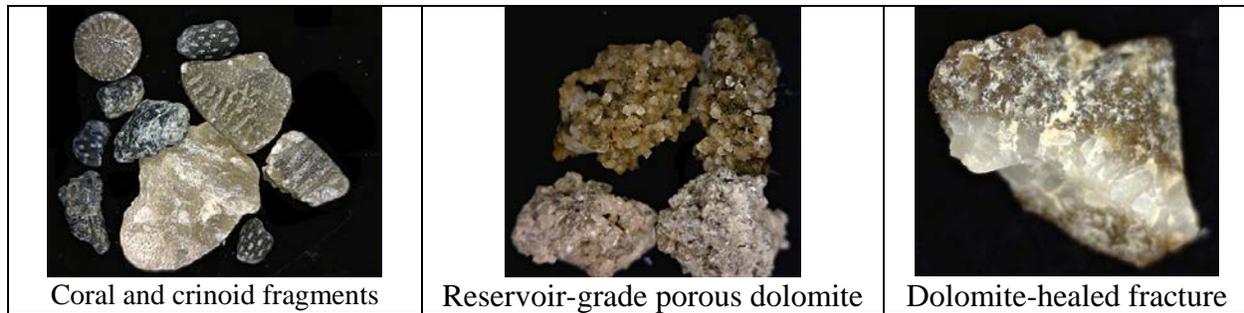


Fig. 3 Cuttings components indicating reservoir properties

Faculty and students at this university will also use the cuttings in their research, thereby training the next generation of geoscientists. Current MGS faculty and staff research projects include:

- Reservoir analysis to address implementation of a real-world CO₂ storage complex in the Northern Michigan Basin
- Characterizing reservoir properties for Niagaran reefs to facilitate additional natural gas storage
- Using carbon isotope analysis to look for time excursions for use in time correlation
- Using XRF analysis to yield elemental composition of sediments to help reconstruct the paleogeographic character of formations and their facies
- Mapping bedrock surface lithology and topography and determining glacial drift thickness in Wayne County, Michigan

Products and Results—Preservation and archiving of these drill cuttings which will be accurately labeled and securely contained, and readily accessible for examination; complete inventories prepared showing detailed sample depths for each well; metadata creation for the collection and for each sample described in conformance with NCGDPP metadata schema, and submitted to the NDC.

Project personnel names, roles, responsibilities and expertise related to project budget—All personnel work at the Survey. The budget shows appropriate supervisory hours reflecting the limited number of Survey employees. In addition to the director, employees consist of 3 part-time staff members and 3 part-time students.

(1) William B. Harrison, III, Project Manager and subject matter expert. He will manage project priorities, resolve cuttings well identification discrepancies by examining cuttings and written lithologic descriptions, well records and logs, and prepare the Final Technical Report. He has conducted research about Michigan geology for 42 years, has published extensively and has decades of experience in sample/data examination and identification.

(2) Jennifer L. Trout, Geoscientist and Data Manager. She will train and supervise student workers, checking inventories for consistency and completeness, prepare final inventories, enter further metadata, and upload all datasets following protocol to the National Digital Catalog. She has a Master's degree in geology and seven years' experience curating samples and managing data, controlling inventories, creating metadata, maintaining spreadsheets, and training and supervising student employees.

(3) Linda K. Harrison, Project Coordinator. She will train and supervise students; secure well identifications from sample labels, the company well list and public records; coordinate staff and student work with project priorities assuming timely task completion; report progress to the Project Manager; and assist in preparing the Final Technical Report. She has 24 years' related experience and a Master's degree in geology.

(4) Project Assistants, hourly student employees. They will preserve samples by repairing and/or replacing damaged material, retain original data; tape loose paper labels to vials, organize vials by well and then by depth within each well, prepare initial inventories, and repackage all the samples to secure them in place. These science and engineering students understand the importance of attention to detail.

Data Management Plan

For this project, the Michigan Geological Survey will preserve, inventory and generate metadata for a collection of cuttings, both of which consists 614 cardboard boxes, each containing an average of 1050 glass cuttings vials. Metadata will be generated for each well represented in the collection that we will inventory. We cannot know with certainty exactly how many wells are represented until the inventory is completed.

Standards that will be used for the data and metadata formats are those described in Part I, C. NCGDPP Reports and Products, conforming to the NCGDPP metadata schema (https://datapreservation.usgs.gov/page/submit_data/). Specific to this project, these procedures will be followed for metadata generation and maintenance:

Metadata will be generated from data as written on the original cuttings vials and trays, the hand-typed cuttings list accompanying the collection, and from available public records. Microsoft Office Suite is the primary software package used for document, spreadsheet, and database production. Data are summarized into a single CSV file whose fields are compatible with NCGDPP formatting schematics. At a minimum, the following fields will be incorporated:

- TITLE: consists of a unique identifier such as Permit Number and Well Name
- ABSTRACT: County, Section, Township, Range, and API (American Petroleum Institute) number. The API number serves as a unique identifier for each line entry for data from oil and gas wells, and is assigned by the State of Michigan. Water well cuttings have a unique “W” number assigned by the State.
- DATATYPE: (core, cutting, well log, thin section)
- SUPPLEMENTALINFORMATION: web address for specific information on how to access the physical data represented by the metadata record.
- COORDINATES: longitude/latitude as referenced by Michigan Department of Environmental Quality (MDEQ) databases
- DATASETREFERENCEDATE: date of metadata submission

The CSV file will then be uploaded into the National Digital Catalog as per protocol.

When company-generated identifiers written on cuttings vials and well information provided on the accompanying company list is not complete or poses a question as to the API number, the determination of well identification will be ascertained by visually examining each sample and comparing the lithology to the written lithologic description and characteristics as recorded in drillers’ reports well logs, and other records. We will check the identification parameters for each well by verifying information such as section, township, range, permit issue and drill dates, sample depth verification through lithologic descriptions, drillers’ reports and well logs. Two tiers of data management are practiced—one at the local level and the other at the national level. If the identification of core or cuttings cannot be confidently confirmed, then that record remains at the local tier and is omitted from the National Digital Catalog pending further research.

Digital data lists are maintained at the Repository and made available to the public via Web pages. For short-term maintenance, full digital data back-ups are performed weekly with incremental back-ups daily. For long-term maintenance, back-ups are housed off-site at the main University campus. Updates at the local tier occur as new or revised data become available. Updates to the National Digital Catalog are provided upon project completion, or at minimum, annually at the end of the fiscal year (June 30). All line items will carry a unique identifier for that particular record to assist in the management of version control and history. The NCGDPP file upload user interface will be used.

All data lists are public accessible at no cost. We offer industry members an 8-month period of confidentiality for samples and data which they donate to the Survey. Donated materials become the property of the Survey.

The metadata and inventory sample descriptions submitted to the National Digital Catalog, funded by the USGS, and all MGS inventories on our Website are freely and publicly accessible. The public may view all documents, research results (except where copyrighted), and most collections at no charge. However, when our labor is necessary, for example to facilitate or provide for sample examination and/or to take portions of samples to give to visitors for analysis (usually to industry members), we do charge nominal fees. Paper copies of all well records are freely available for use at the facility. If photocopies of the records or digital copies are requested by the user, we charge nominal fees. Thin sections are available for free examination but cannot be taken offsite. The Survey was transferred from the Michigan Department of Environmental Quality to Western Michigan University in 2011. No funding accompanied that transfer. The MGS/MGRRE gratefully acknowledges that the MGRRE facility and utilities for the facility are provided by Western Michigan University. However, because the MGS/MGRRE receives no continuing financial support from any source, our overhead for operational costs and salaries must be met by research activities, workshop fees, industry fees, interest on endowments, and donations. Because we would like to be able to offer all our services at no cost to all users, we are working toward obtaining on-going legislated financial support. Toward that goal, we are seeking support from community groups, industry organizations, and local governmental agencies.

When samples from our collections are analyzed by researchers and industry members, we require that all data or analytical results generated from testing these samples be returned to the MGS/MGRRE within one month of their receipt by the researcher or industry member. We will keep this information in confidence for eight months after receipt if we receive a written request along with the information. After that period of time, the data is freely available. We also require that reference to any publications for which this data was used be provided to us and that the publication acknowledges that we provided those samples.