FY 2009 FINAL TECHNICAL REPORT

NATIONAL GEOLOGICAL AND GEOPHYSICAL DATA PRESERVATION PROGRAM

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Virginia Geologic Information Catalog

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ABSTRACT

As part of the Virginia Department of Mines, Minerals and Energy, the Division of Geology and Mineral Resources (DGMR) serves as Virginia's geological survey. The Division is responsible for gathering and disseminating geologic and mineral resources information, and encouraging the wise use and sustainable development of resources to support a more productive economy. Since the early 1900's, DGMR (and its predecessors in name) has maintained and added to collections of geologic materials including reference rock specimens and associated thin sections, core samples, well cuttings, and fossils that are presently stored in warehouse facilities in Charlottesville. The Division also maintains collections of geologic maps, historical photographs, aerial photographs, geophysical and geochemical datasets, manuscripts and publications, and mineral locality information.

Recognizing the need to both preserve these valuable collections and improve the ability of staff and customers to search for, cross-reference, and access key information, DGMR implemented a long range data preservation plan. With support from the U.S. Geological Survey (USGS) National Geological and Geophysical Data Preservation Program (NGGDPP), the Division is standardizing and consolidating key data collections into the Virginia Geologic Information Catalog (VGIC). The VGIC SQL-database platform utilizes a map-based web browser interface to serve internal and external customers alike. Continued programming support for the VGIC also provides the optimal means for creating feature-specific metadata in the format that serves the priority needs of the National Digital Catalog.

In FY 2009, DGMR added five high priority data collections with the associated metadata to the VGIC. A map-based interface to the Catalog was launched in early 2010, which enables DGMR staff and customers to conduct searches based on keywords and geographic coordinates. As a key deliverable, DGMR uploaded 25,491 metadata records for these five priority data collections to the National Digital Catalog using the USGS web site *http://datapreservation.usgs.gov/*.

INTRODUCTION

The Department of Mines, Minerals and Energy's (DMME's) Division of Geology and Mineral Resources (DGMR) collects, maintains, and distributes information related to the geology, mineral and energy resources, and geologic hazards of Virginia. The Division's customers include the general public, schools and educational programs, mineral and energy production industries, construction industries, land use planning authorities, and local, state, and federal government agencies.

DGMR seeks to improve our customers' ability to locate and wisely develop or conserve rock, mineral, water, and energy resources. A key strategy to achieve this objective is to enhance the organization and accessibility of the geologic information contained in the DGMR archives. The archives comprise a variety of collections of geologic materials and data that vary in format, size, and complexity. The format of our published and unpublished map products that depict geologic, geophysical, geochemical, mineral and energy resources data includes hard copy media (paper, mylar, sepia, etc) and digital data. The collections also include historic photographs, rock thin sections, results of petrographic and microscopic analyses, geochemical laboratory results, reports on groundwater and mineral spring characteristics, historic and out-of-print publications, well logs, well cuttings, drill cores, and extensive collections of rock, mineral, and fossil specimens. These collections continue to grow as DGMR gathers new data.

Supported by a FY 2007 Phase 1 grant from the U.S. Geological Survey (USGS) National Geological and Geophysical Data Preservation Program (NGGDPP), DGMR identified and characterized existing inventories of physical materials, maps and other key data sets. In FY 2008, and again supported by NGGDPP grant funds, DGMR began standardizing and consolidating its data collections into a centralized system called the Virginia Geologic Information Catalog (VGIC). This catalog significantly improves the ability to search for and access geologic information, and will also provide feature-specific metadata through a web-based search tool. In FY 2009, DGMR staff added five prioritized data collections to the VGIC. In addition, a preliminary on-line portal to the VGIC was launched from the DGMR web site. Feature-specific metadata records describing these five data collections were uploaded to the National Digital Catalog in late June, 2010.

PURPOSE AND JUSTIFICATION

DGMR customers with an interest in geologic information currently browse the *DMME Web Store*, an on-line electronic commerce site at the url: *https://www.dmme.virginia.gov/commerce/*, or browse the *Catalog of Publications and Maps*, a document that is available in hard copy and digital PDF format. The *Web Store* and *Catalog* provide a full listing of the titles of reports and maps that have been published as part of DGMR's publication series, and includes a comprehensive index and list of keywords. An extensive amount of unpublished information is also part of the DGMR archives, but is not readily available. Access to this unpublished data is typically accomplished by contacting a DGMR staff member. Starting in 2009, State budget and staff reductions have made it especially challenging for remaining DGMR staff to effectively serve it's customers, highlighting the substantial need to advance the development of the digital Virginia Geologic Information Catalog.

To better manage the archival of geologic materials and information in the VGIC, and ensure that these resources are readily accessible to customers, DGMR developed a long range data preservation plan. This plan includes best management practices for archival methods, converting key information from non-digital format to digital, developing metadata, enabling web-based access, and participating in the effort to build the National Digital Catalog. Since most geologic information is tied to a geographic location on the earth, DGMR has established the goal of delivering and enabling searches using the VGIC based on key spatial information. A web-based mapping interface enables searches using geographic coordinates, allowing direct access to the information by clicking on points, polygons, and polylines that represent available data. The VGIC will also deliver site-specific metadata for each data set. For many commonly requested data sets, DGMR will be able to provide scanned digital versions. Examples include core logs, seismic lines, sample descriptions, and results of chemical analyses.

The VGIC will serve as a database management system for the organization, management, preservation, and distribution of data. Among the many benefits of this system, the following are expected for the specified customer groups:

General Public, Education, and Business:

- Direct and timely (24hr x 7d) access to a wide range of geologic information in a downloadable format;
- Eliminates costs of travel to DMME offices, data copying, shipping, etc;
- Ability to search for geologic information based on specified geographic locations;
- Access to unpublished and out-of-print data.

Land Use Planners:

- Direct and timely (24hr x 7d) access to GIS data for incorporating into comprehensive land use and transportation infrastructure plans.

State and Federal Government:

- Enables internal DMME staff and other government agencies to quickly search for available geologic information to serve their needs;
- Reduces the response times to customer requests;
- Reduces the costs of data handling, copying, and shipping.

STRATEGY FOR LONG-TERM DATA PRESERVATION

The work accomplished to date has effectively advanced DGMR's long range data preservation goals, which are:

1. Data collections will be preserved for future generations;
2. Data collections will be organized and stored in a secure and accessible manner;
3. Data collections will be incorporated into the Virginia Geologic Information Catalog;
4. Data collections will be standardized, consolidated, and normalized;
5. The Virginia Geologic Information Catalog will be accessible on-line.

This project will ensure that all of DGMR's geologic information is preserved, standardized, and accessible to all of its customers in a secure, robust relational database that is readily queried using keywords and geographic coordinates.

FY 2009 GOALS

For FY 2009, DGMR proposed to expand the VGIC by adding five prioritized data collections. The five collections are among those most frequently requested, and most include digital data. The five collections, with the native digital format shown in parenthesis include:

1. Carbonate rock geochemical database (MS Access database) – contains over 6,100 geochemical analyses of carbonate rocks in Virginia including major, minor, and trace element analyses, reflectance and chlorine content.
2. Coal quality data collection (Excel spreadsheet) – includes laboratory analyses for 375 coal samples from the Southwest Virginia Coalfield. The data set includes proximate and ultimate analyses, heat content, key physical properties, sulfur content and forms of sulfur, ash fusion temperatures, major and minor oxides, major and minor elements, and trace elements.
3. Mineral Resources of Virginia collection (SQL-Server database) - inventory of over 8,100 specific mineral occurrences, prospects, mines, quarries, and other mining and processing sites of base and precious metals, industrial minerals, and energy resources in the Commonwealth.
4. Geophysical data collection (Excel spreadsheet and paper documents) seismic lines, base maps, and processed seismic data.
5. Borehole data collection (MS Access database) - includes location information, lithologic logs, and interpreted formation contacts from boreholes drilled in Virginia's Coastal Plain.

The five prioritized data collections were to be integrated into a comprehensive Microsoft SQL-Server relational database, which serves as the VGIC platform. Site-specific metadata were to be developed for each data collection. All metadata developed as part of this project will comply with the National Catalog Metadata Products requirements.

Building upon the work accomplished as part of Task I, which was supported by NGGDPP grant funds in FY 2007 and FY 2008, the activities and timeline for work proposed for FY 2009 included the tasks listed below:

Task II. VGIC database design to accommodate DGMR's data collections
(July 1, 2009 – January 1, 2010)

a. Participate in the AASG/USGS Data Preservation Techniques Workshop in Bloomington, IN, July 14-15;
b. Define database fields, table structure, relationships, indices, queries, etc;
c. Develop user interfaces entry, querying, and viewing;
d. Establish data quality standards;
e. Develop site-specific metadata (meeting National Digital Catalog Metadata standards) for each collection.

Task III. Populate and deploy VGIC
(January 1, 2010 – June 30, 2010)

a. Populate the SQL-Server database with data collections;
b. Test the database for proper data migration;
c. Enter descriptive attributes for collections without existing digital data;
d. Conduct quality assurance and quality control for the databases and sample collection site-specific metadata;
e. Provide final summary report and site-specific metadata to USGS as grant year-end deliverable.

FY 2009 RESULTS

In July 2009, DGMR staff participated in the AASG/USGS Geoscience Data Preservation Techniques Workshop held in Bloomington, IN. This informative workshop provided a timely review of best management practices for the preservation of data and physical samples and other geologic materials.

DMME staff made substantial progress in the development of the VGIC. This catalog was designed as a customized Microsoft SQL-Server database application by DMME programming support staff. Table structure, relationships, and other design criteria were established, together with user interface screens to allow data entry, querying, and reporting. The database is hosted on a DMME server currently located in the Big Stone Gap office. In early 2010, a preliminary map-based version of the VGIC was launched on the DGMR web site, allowing on-line access to many of the key data collections. The site may be accessed at the following URL: http://www.dmme.virginia.gov/DgmrGoogleMap/frmMain.aspx

Five high-priority data collections were targeted for metadata creation in FY 2009. Following an extensive quality control review, the feature-specific metadata records were formatted using the guidelines provided in the USGS document *Metadata Profile for the National Digital Catalog*. The metadata records were submitted to the USGS in the extensible markup language file format (.xml) at the close of the FY 2009 grant year. A total of 25,491 records were uploaded to the National Digital Catalog using the USGS web site portal http://datapreservation.usgs.gov/. The five collections included the following:

The **Carbonate Rock Geochemical Database** contains over 6,100 geochemical analyses of carbonate rocks in Virginia including major, minor, and trace element analyses, reflectance and chlorine content.

The **Coal Quality Data Collection** includes laboratory analyses for 375 coal samples from the Southwest Virginia Coalfield. The data set includes proximate and ultimate analyses, heat content, key physical properties, sulfur content and forms of sulfur, ash fusion temperatures, major and minor oxides, major and minor elements, and trace elements.

The **Mineral Resources of Virginia collection** consists of over 8,100 specific mineral occurrences, prospects, mines, quarries, and other mining and processing sites of base and precious metals, industrial minerals, and energy resources in the Commonwealth.

The **Geophysical Data Collection** includes seismic lines, base maps, processed seismic data, radiometric, gravity, magnetic and other geophysical data sets.

The **Borehole Database** includes location information, lithologic logs, and interpreted formation contacts from boreholes drilled primarily in the Coastal Plain of the Commonwealth.

Table 1 shows the current status of Virginia's NGGDPP collections in the USGS National Digital Catalog and indicates the number of uploaded records for each of the prioritized collections from FY 2008 and FY 2009. The table also shows the number of estimated records for collections that are targeted for FY 2010.

TABLE 1. Summary of key data collections held by the Virginia Division of Geology and Mineral Resources

Collection Name	Type	Number of Records / Units	USGS Inventory Status	Metadata Completion Status
Fossil repository	Physical	742	FY 2007	*FY 2010*
Well cuttings	Physical	7,376	FY 2007	*FY 2010*
Uranium information/files	Digital and analog	1,404	FY 2007	*FY 2010*
Rock cores	Physical	**447**	FY 2007	**FY 2008**
Rock (specimen) repository	Physical	**7,712**	FY 2007	**FY 2008**
Historic topographic maps	Maps	640	FY 2007	
Historic photographs	Photographs	1,500	FY 2007	
DGMR Publications Index	Maps, reports	**5,237**	FY 2007	**FY 2008**
Thin sections	Physical	11,320	FY 2007	
Carbonate geochem database	Digital	**6,193**	FY 2007	**FY 2009**
Aerial photographs	Photographs	8,000	FY 2007	
Silica geochemical database	Paper files	399	FY 2007	
Clay materials analyses	Paper files	850	FY 2007	
Geophysical data	Digital, mixed	**1,734**	FY 2007	**FY 2009**
Borehole database	Digital	**6,721**	FY 2007	**FY 2009**
Sinkhole maps	Paper maps	180	FY 2007	*FY 2010*
Mineral resources inventory	Digital	**10,442**	FY 2007	**FY 2009**
Unpublished geologic maps	Paper maps	**670**	FY 2007	**FY 2008**
Coal quality database	Digital	**401**	FY 2007	**FY 2009**
UVA Rock/Mineral/Fossils	Physical	9,000+	*FY 2010*	
TOTAL		>66,500		

PLANNED WORK

Activities related to the FY 2010 grant period are currently in progress. For FY 2010, the total number of anticipated database records is estimated to be about 9,700. These records will be derived from information contained in the fossil repository, the sinkhole map collection, the uranium information files, and the collection of well cuttings from oil, gas, and water wells drilled in Virginia. All records will be checked for quality assurance to eliminate duplicates, ensure geographic accuracy, and maintain data standardization for all required data attributes.

The work accomplished as part of the FY 2010 grant year will be summarized in the Final Technical Report that will be submitted to USGS during the 3rd quarter FY 2010 (April-June 2011). The report will describe the metadata records for the four prioritized data collections identified above, which will be formatted to meet the National Catalog Metadata Products standards. The metadata records will be submitted to the USGS in the extensible markup language file format (.xml) at the close of the grant year, and it is anticipated that these records will be added to the National Digital Catalog at that time.

PROJECT PERSONNEL

Principal Investigator – William L. Lassetter, Jr.
William L. Lassetter, Jr. (*M.S., Hydrogeology, 1996, University of Nevada, Reno; B.S., Geology, 1980, Virginia Tech*) serves as the Principal Investigator and has coordinated the project work since FY 2008, providing in-kind services as part of the State cost share. William has worked with the Department of Mines, Minerals, and Energy since April 2000, and has managed the DGMR Economic Geology program since November 2005. As an economic geologist, he has worked with many DGMR's data collections, having supervised staff activities that included data gathering, data entry, quality control, and metadata creation and maintenance. William will be closely involved with the quality control review of data records contained in all of the collections, supporting the development of data entry/reporting capabilities in the Virginia Geologic Information Catalog, and reviewing metadata deliverables.

Information Systems Specialist – Christina M .Wood-Smith
Christina Wood-Smith (*M.S., Management Information Systems, 1994, University of Virginia; M.E., Systems Engineering, 1994, University of Virginia; B.S., Management Information Systems, 1989, University of Virginia*) provided IT project management and technical expertise on data entry, storage, security, quality assurance and metadata development. She has 20 years of experience in digital data management and applications development. Her most recent accomplishments include implementation and providing technical support for the DMME web-based forms management system that supports over 2,000 mineral mining customers. Christina's expertise in best management practices in regards to digital data accessibility and data archival methods will be an asset to the preservation of key DGMR data collections.

Senior Programming Analyst – Matthew Stanley
Matthew Stanley (*B.S. Computer Information Systems, 2004, University of Virginia College at Wise*) coordinated the development of the VGIC user input screens, system database tables, and programs to export the metadata deliverables. Matthew started his career with DMME as a

student intern in 2001, working part time until college gradation in 2004. After working two years as the Assistant Computer Systems Manager for Wise County Public Schools, Matthew returned to DMME in 2006.

Geologic Data Specialist – Michael R. Enomoto

Michael Enomoto (*B.S. Geology, 1978, California State University at Long Beach*) provided technical support for the collections inventory and characterization activities, data entry, quality control and assurance, and development of metadata. Michael has been a key member of DGMR's NGGDPP team since September 2008. Supported by NGGDPP grant funds in FY 2008 and FY 2009, he completed the inventory and assessments of the extensive DGMR rock sample and core collections, the historic geologic map collection, and the geophysical data collection. He is presently compiling metadata for other high priority collections contained in DGMR's archives. Michael has an extensive background working with seismic data on various media and will be a valuable asset in coordinating the digital conversion of DGMR data and creating the feature-specific metadata records.