Alaska Geologic Materials Center Inventory Database

A web-accessible geologic sample catalog

Seitz, Susan ⏩ Alaska Division of Geological & Geophysical Surveys ⏩ susan.seitz@alaska.gov
Freeman, Lawrence K. ⏩ Alaska Division of Geological & Geophysical Surveys ⏩ lawrence.freeman@alaska.gov

Introduction

The Alaska Geologic Materials Center (GMC) is the central repository in which geologic materials collected from Alaska are cataloged, stored, and studied (Figure 1). With specimens dating from the present day back to the early 1900s, the Alaska Geologic Materials Center contains non-proprietary rock core and cuttings that represent nearly 12 million feet of energy resource exploration and production drilling; nearly a quarter million feet of diamond-drilled core samples from hard-rock mineral holes; over 5,000 boxes of surface samples; and various processed samples including petrographic thin sections, and micropaleo glass slides.

As part of the federally funded Minerals Data and Information Rescue in Alaska (MDIRA) project, the Alaska Division of Geologic and Geophysical Surveys (DGGS) is developing a mobile, web-based inventory system for GMC's surface samples and hard rock drill core. The ultimate goals are to provide a secure, reliable catalog for all the geologic materials held by the GMC and to provide public users with tools for searching for samples of interest. These tools will enable users to assess sample availability and condition prior to traveling to the GMC.

Figure 1. Alaska Geologic Materials Center

Challenges Facing the GMC database

The GMC inventory database is currently housed in a Microsoft Access 2003 database. While the system is functional for internal staff and on-site visitors, it does not allow remote users to easily query the GMC holdings, nor does it allow for a geographic based search of these materials.

Figure 2. External Storage Units

Decentralized Data

Site-specific data for the oil and gas samples and processed sample collection are housed in separate schemas within the existing database. The DGGS surface sample and mineral drill core collections have various levels of geo-referenced information and are being tracked by a series of Excel spreadsheets. This decentralized data structure makes it difficult to manage and to query the entire GMC inventory as a whole.

External Storage

In addition to data decentralization, the GMC facility faces overflow storage issues. External, unheated storage units without internet access (Figure 2) are used to store the majority the minerals-related samples, making it difficult to perform an inventory of the sample materials.

Solutions

DGGS is working to overcome these challenges by migrating from Microsoft Access to DGGS's centralized Oracle 10g database, enabling secure, multi-user access to the geological materials inventory. The various GMC collections will be streamlined and loaded into an existing normalized data structure populated with DGGS sample locations, geochemical analyses and geochronologic age dates. The schema is based on a location for each sample and/or container, which allows integration with the existing site-specific data. If an exact sample location is unavailable, samples will be matched to a known project area, place name, or quadrangle.

A Mobile Inventory

In order to conduct a basic inventory in the external storage units, GMC staff will use a Motion F5, a rugged, mobile PC tablet (Figure 3). The Motion F5 is integrated with a 2.0 Megapixel digital camera for photographing samples and boxes, a barcode/RFID reader, along with Wi-Fi and Bluetooth® wireless connectivity allowing locally stored inventory data to be uploaded to the centralized Oracle database.

For performing a detailed inventory of the geologic materials, an online data entry tool and uploading utility are in development. These Java Servlet and JSP-based applications will interface directly with the DGGS Oracle database.

Figure 3. Motion F5 PC Tablet

GMC Search Engine

As the inventory data are catalogued, the next major objective is to create an online, geographic search engine of the GMC materials, which will provide public users with tools to assess the availability and condition of geologic samples prior to traveling to the GMC. The search engine will be available through DNR's Business Reporting System (DBRS), an "umbrella" web application that allows users to query data from various DNR databases.

Text Based Queries

The GMC Basic Search (Figure 4) allows users to create precise text-based queries, and to customize the result fields using the "Select Field Names" button. In addition, the GMC Advanced Search provides a similar interface with extended search parameters.

Spatial Queries

Both interfaces allow users to perform spatial queries on the GMC sample library through Alaska Mapper, DNR's interactive map application (Figure 5). After navigating to an area of interest, users can flexibly navigate and sort the resulting sample locations on almost any of the available fields (Figure 6). Each record has a link to a detailed dynamic JSP page generated directly from the DGGS Oracle database (Figure 7). This detailed report provides URLs to published GMC Data Reports and geochemical analyses, and summary age data (if available) for the sample location. The results can then be exported to a Microsoft Excel spreadsheet for further manipulation or saved as an Adobe PDF document. Future releases may include the ability to download the spatial query results from Alaska Mapper as an ERSI shape file.

System Architecture

DBRS and Alaska Mapper are both Java-based, with the mapping application using MapInfo's MapXtreme for Java (4.8.1) at its rendering core. These web applications are served via Apache (2.0.52) and Tomcat (5.5.23). The cluster is powered by multiple Dell PowerEdge 2950 servers running Red Hat ES4 Linux, all within a VMWare virtual server environment. This architecture is essential to achieving the system's current optimal performance. While the GMC inventory data are ultimately stored in DGGS's Oracle 10g database, the data will be refreshed daily via a data link into a materialized view within DNR's Oracle database that serves up the summarized data from the search and map interfaces.

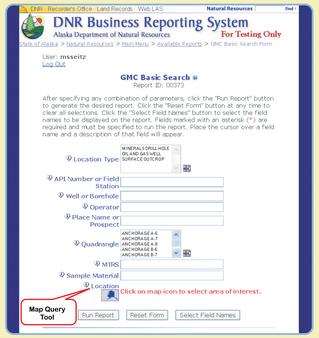

Figure 4. GMC Search Interface

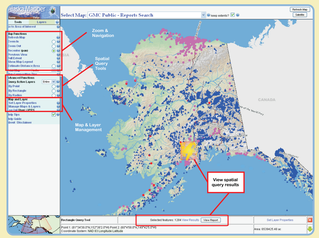

Figure 5. GMC Map Interface (Alaska Mapper)

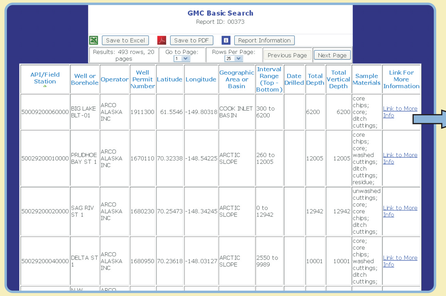

Figure 6. GMC Search Results

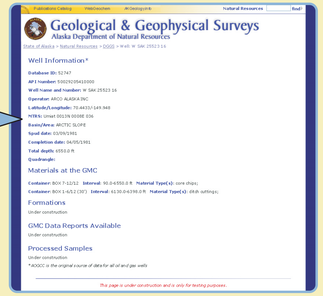

Figure 7. DGGS Detailed Sample Information

National Digital Catalog

The GMC inventory database is the source of several DGGS site-specific data collections selected for submission to the National Digital Catalog as part of the National Geological and Geophysical Data Preservation Program (NGGDPP). DGGS is developing a dynamic Java/XML solution to provide the necessary site-specific digital metadata for each collection.

XML Output

DGGS is designing a Java Servlet to receive an HTTP request from a url query string that will pass a specific collection identifier value. The servlet generates a customized query of site specific data against the Oracle database based on the collection id. Oracle's JDBC Thin Driver allows the servlet to communicate to the database. The results are then output in a formatted XML document based on the ISO 19115 Geospatial Information – Metadata standard profile specified by the National Catalog Committee (Figure 8). This implementation uses Java 1.5 and will be served via Apache Tomcat 5.5.25 hosted on a Dell PowerEdge 2950 server running Red Hat ES4 Linux.

Within each sample record of the xml document is a direct url pointer to the DGGS Field Station and Sample Information page. This dynamic Java Server Page will provide any additional information about the specific archived sample, such as the sample material type and condition of its physical storage at the GMC, available processed slides, geochemical analyses, and summary geochronology age dates.

Web Feature Service (WFS)

DGGS is also working on another means of distributing the GMC inventory data to the National Digital Catalog through the open protocol of a Web Feature Service (WFS), implemented by OpenGIS Consortium (Figure 9). DGGS will install GeoServer (http://www.geoserver.org), an open source software server written in Java that allows users to share and edit geospatial data. GeoServer will utilize DGGS' Oracle Spatial database as its data source in order to distribute GMC sample location data. This solution will allow efficient distribution of the data for the public and enable users to the view the data with their preferred client (Google Earth, Alaska Mapper, ESRI Desktop etc.).

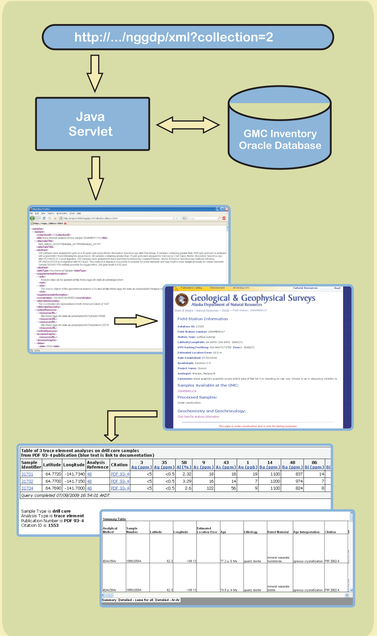

Figure 8. GMC database XML output to National Catalog

Acknowlegements

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Programming solutions to distribute GMC inventory data to the National Digital Catalog are funded by the National Geological and Geophysical Data Preservation Program (NGGDPP), authorized by Section 351 of the Energy Policy Act of 2005.

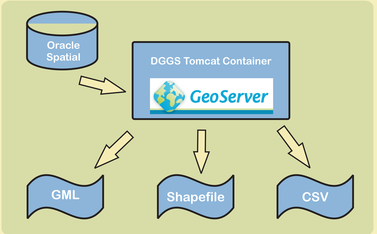

Figure 9. DGGS proposed WFS implementation