Montana Bureau of Mines and Geology
Montana Tech of The University of Montana

INVENTORY OF GEOLOGICAL AND GEOPHYSICAL DATA AND SAMPLES AT THE MONTANA BUREAU OF MINES AND GEOLOGY

U.S. Geological Survey (USGS) Award No. G12AP20158

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FINAL TECHNICAL REPORT

Phase VI

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Department of the Interior
U.S. Geological Survey
National Geological and Geophysical Data Preservation Program (NGGDPP)

Abstract

The Montana Bureau of Mines and Geology (MBMG or Bureau), established in 1919, was purposely located in Butte, Montana, site of the world-class Butte mining district. A major part of the legislature's directive to the MBMG was to collect mining industry drawings, maps, reports, minerals, and models (reports), not only for Butte but across the State. As a result, the MBMG now possesses an expansive collection of mining-related data on properties throughout Montana. The reports contain irreplaceable information about Montana's resources; particularly those located in Butte, as all of the Butte underground mines and the Berkeley Pit are now flooded and inaccessible, underscoring the importance preserving information for the largest remaining copper deposit in the US.[1]

The MBMG's collections include historical mines and minerals data such as mine maps, drilling records and assays, geochemical and geophysical maps, and production records; water-well logs; oil and gas well logs; coal records; seismic data; a one-of-a-kind collection of thin sections, polished sections, and samples from the Butte underground mines (the Anaconda Collection); nearly a quarter-million aerial photographs spanning multiple decades that provide information on land use change; and about 15,000 mineral specimens that are the foundation of Montana's only true mineral museum. MBMG collections are routinely used by local, state, and federal agencies, lawyers, small miners, mining companies, researchers, mining/engineering students, realtors, and teachers as well as the general public.

To date, MBMG's participation in the NGGDDP included:

Phase I: Assessments of the estimated volume, quality, and accessibility of seven MBMG collections: Anaconda thin sections; mineral museum specimens; water well logs; seismic records; aerial photos, historic mining property files; and mining maps.

Phase II: Data Preservation Plan development, inventorying of selected MBMG data collections, creation of USGS-appropriate inventory metadata, and uploading the metadata to the USGS National Digital Catalog.

Phase III: The MBMG did not participate in Phase III.

Phase IV: The MBMG assessed information holdings at its branch office in Billings, Montana, continued metadata creation for the mining property and map collections, and began digitizing these collections with scanning equipment purchased with NGGDPP grant funds.

Phase V: MBMG continued metadata creation for the historic property files, mining maps, and water well logs; continued digitization (data migration) of historical mining property files and maps; created metadata for a portion of oil, gas, and coal records; uploaded metadata to the National Digital Catalog; continued implementation of the data preservation plan, created a Data Preservation Committee and

[1] Long, K.R., DeYoung, J.H., Ludington, S.D., Database of significant deposits of gold, silver, copper, lead, and zinc in the United States, Part A: Database Description and Analysis; USGS Open-File Report 98-206A, 1998, 60 pp.

conducted the first committee meeting. Data residing on obsolete floppy and Bernoulli disks were rescued and converted to current electronic data formats.

Phase VI Report

This technical report is submitted in fulfillment of the Phase VI grant award requirements. Quarterly SF 272 financial reports have been submitted as required; the Final Financial and the SF 269 Final Financial Status reports have been submitted.

Project Goals

1. Continued metadata creation for mining maps, water well logs, oil, gas and coal records;
2. Continued data migration (digitization) of mining property files and maps;
3. Periodic uploading of metadata to the National Digital Catalog;
4. Continued implementation of the MBMG data preservation plan; and
5. Conduct an annual meeting of the MBMG data preservation committee

Project Objectives

Metadata creation

Methodology

MBMG derived record descriptions for its collections from the actual hardcopy documents. Location information (latitude and longitude) was taken (in order of information availability) from file information, MBMG Abandoned Mine database (where onsite latitudes and longitudes were identified), the USGS Geographical Names Information System, or calculated (when township, range and section were available) using the Montana Natural Resource Information System (NRIS) Topographic Map Finder search tool (NAD83) (http://maps2.nris.mt.gov/scripts/esrimap) or EarthExplorer (WGS84). Water well log metadata were derived from the actual hardcopy drill logs.

The following table summarizes the MBMG's metadata creation activities through 2013:

			Phase VI
Collection	**Status**	**Record Metadata Committed**	**Record Metadata Completed**
Water well logs (230,584 records)	230,584 records[1] *Completed*	345,000	230,584
Anaconda collection-thin and polished sections	6,182 records *Completed* 2009	0	0
Mineral Museum mineral specimens;	*Withdrawn*[2]	0	0
Historic mining property files; (4,636 total files)	4,371 records[3] *Completed*	1,270	885[2]
Mining maps; (31,068 records)	4,400 of total completed	1,478	1,478

Collection	Status	Phase VI Record Metadata Committed	Phase VI Record Metadata Completed
Aerial photo collection (233,000 records)	*Withdrawn*[4]	—	—
Seismograms (252,032 records)	*Completed*[5]	0	252,032

1 The projected number of water well records was more than the number generated. Metadata for the entire collection has been created.
2 MBMG withdrew the Mineral Museum collection from National Digital Catalog participation due to security concerns.
3 This total represents the remaining files in the collection for which metadata could be created.
4 Aerial photos in the MBMG collection are duplicated on the USGS Earth Explorer site. Collection withdrawn per NGGDPP policy.
5 The paper inventory for the hard copy seismogram collection was misplaced when the MBMG moved to its new building. The lost inventory was found and an electronic inventory and accompanying metadata completed.

Property file metadata:

The MBMG property file collection contains 4,636 files or records. Each file contains a variety of information about a single mining claim, a group of mining claims, a reconnaissance area, or a specific exploration project. The files range in size from a single page to multiple files containing hundreds of pages of information. In FY 2013, 110 new files were added to the collection. Upon inspection of their contents during the scanning process, some files were combined with others to correct filing errors and eliminate duplication, reducing the total number of files.

Of the total number of files recorded in the collection, 258 files were categorized as "General" information by county. They include miscellaneous mining information not attached to a particular property or insufficient data was available to create discrete metadata (i.e., latitude and longitude). These file were excluded from upload to the National Digital Catalog. As the files are examined for digitization in the future, the MBMG will attempt to re-catalogue each document to an existing property file or create a new file for the information. For the purpose of the NGGDPP grant, metadata creation for all property files is complete.

Metadata fields: Property Files

- Pf_id: Unique, MBMG-generated, property file identification number
- Mils_id: U.S. Bureau of Mines Mineral Industry Location System property identification number
- State: State of Montana
- County: Name of county in which property is located
- Mining_district: The mining district (either organized or unorganized) in which the property is located. If a district name was not available, the field was described as "unspecified".
- Mining_claim: Name of the mining claim at the time the information in the file was generated. Mine names may have changed over time. Alternate mine names are cross referenced in the Associated Names field.

- Associated_name: Names of nearby mines; and/or alternate names for a specific mine.
- Township: Township in which the property is located.
- Range: The range in which the property is located.
- Section: The section in which the property is located.
- Latitude: The latitude at which the property is located.
- Longitude: The longitude at which the property is located.

Mining map metadata

The mining map collection now consists of 31,068 records. Newly donated maps awaiting review, acceptance and inventorying are not included in these totals.

For purposes of record entry, maps are catalogued first by county, then by mining district (if known) and then by the claim, group of claims or project that the map information represents. Metadata for 2,881 maps were created during the previous grant period. To date, metadata has been created for 4,400 maps, an increase of 1,519 maps.

Metadata fields: Mining Maps

- MF_id: Unique, MBMG-generated, map file identification number
- State: State of Montana
- County: Name of county in which property is located
- District: The mining district (either organized or unorganized) in which the property described on the map is located. If a district name was not available, the field was described as "unspecified".
- Claim_Name: Name of the mining claim that is described on the map
- Latitude: The latitude for the center point of the map or the mining information contained on the map. If the map pertains to a property for which a file exists in the property file collection, the assigned latitude of the property file is used.
- Longitude: The longitude for the center point of the map or the mining information contained on the map. If the map pertains to a property for which a file exists in the property file collection, the assigned longitude of the property file is used.
- Map_date: Map production date. If the map was a revision of an earlier version, the later date is used. The map date is not available for all maps.
- Company: Name of the company, engineer or cartographer noted on the map. This information may not be available for all maps.
- Comments: Miscellaneous information, such as map media, map scale, map characteristics, number of copies, and reference numbers indicated on the maps. Miscellaneous information is not available for all maps.

Water well metadata

The Ground-Water Information Center (GWIC) at the Montana Bureau of Mines and Geology (MBMG) is the central repository for information on the ground-water resources of Montana. The data include well-completion reports from drillers, measurements of well performance and water quality based on site visits, water-level measurements at various wells for periods of up to 60 years, and water-quality reports for thousands of samples. The databases at GWIC are continually updated with new data

from driller's logs, MBMG research projects, and research projects from other agencies. Electronic copies of the data are stored on an SQL server and are available over the internet at http://mbmggwic.mtech.edu.

Metadata fields: Water well logs

- GWIC_Id: Unique, MBMG-generated, site record identification number;
- Site_Name: Most recent owner/site/business name listed on the well log form;
- Site_Identifier: Individual identifier for a site that is part of a group of sites;
- Latitude: Latitude of site in decimal degrees;
- Longitude: Longitude of site in decimal degrees;
- GeoMethod: Method used to determine the latitude and longitude;
- Datum: Horizontal reference datum for latitude and longitude values.
- LLScale: Map scale if a map was used to determine latitude and longitude;
- LLDate: Date that the currently reported latitude and longitude values were calculated;
- Altitude: Altitude of the ground surface at the drill site in feet above mean sea level;
- Method: Method used to determine altitude;
- Datum: Vertical reference datum for altitude values;
- AltDate: Date that the currently reported altitude values were calculated or determined;
- Site_Type: Type of site (borehole, mine, pit, drainage ditch, etc.). Values for this field are controlled by a validation list.
- Township: Montana township in which the site is located;
- Range: Montana range in which the site is located;
- Section: Section in the reported township in which the site is located;
- County: Montana county in which the site is located;
- Basin: Drainage basin I which the site is located (validation list controlled);
- Addition: Addition or subdivision name, if provided, in which the site is located;
- Block: Block name or number if provided;
- Lot: Lot name or number if provided;
- Assessor Tract: Assessor's tract if provided;
- Certificate of Survey: Certificate of survey identifier if provided;
- Parcel: Parcel name or number if provided;
- GeoCode: 17 digit identifier that links the Montana property tax database with the specific property on which the well was drilled;
- USGS Quad: Name of the USGS 7.5-minute Quadrangle map that the site is located on;
- Notes: Miscellaneous information about the site location.

Seismogram metadata

The Earthquake Studies Office (ESO) of the Montana Bureau of Mines and Geology opened in June, 1980 to operate the Montana Regional Seismograph Network. The office collects and analyzes seismic data and reports earthquake information from MBMG's network of 37 seismometers as well as data from 7 USGS stations located in Montana and operated cooperatively with the MBMG, including the U.S. Forest Service Earthquake Visitors' Center. Prior to 1989, the only method used to collect earthquake

data was paper seismograms recorded on drum recorders using pen and ink, or heat pen and heat-sensitive paper. Thus, paper seismograms recorded before 1989 are original (and irreplaceable) records. Beginning August 1989, a triggered digital recording system was implemented that captured data for larger events but did not provide continuous digital recording. From August 1999 through July 2000, paper seismograms were the only source of continuous seismic data for Montana's Regional Seismic Network.

Metadata fields: Seismograms

- Seismic station: 3 or 4 digit alpha code for specific seismic recording station;
- Station Description: Full name of specific seismic recording station;
- Latitude: Latitude of specific seismic recording station;
- Longitude: Longitude of specific seismic recording station;
- Record date:The date each daily seismic was recorded.
- Comments: Comments regarding station performance; change in status or location and miscellaneous information pertaining to the specific record. Comments may not be available for each record.

Data Migration

The MBMG continued the conversion of mining property files and mining maps to digital formats.

Methodology

Part time student workers assisted with document scanning. Originally, property file contents were scanned, modified to eliminate irregularities (crease lines, water stains, etc.) and saved as a single .pdf. Discussions with MBMG's database administrator prompted a process change to facilitate customized online user searches and to eliminate possible redundancy or omissions created by merely adding new pages to previously scanned files. Instead, each page of every mining property file is being scanned and categorized as a specific document type so that database searches can be customized by the user (e.g., searching only for assay or mine production information). Historic mining property files are scanned to .tif files at a 400 dpi resolution. Documents are stored in grayscale format unless color information is important to the document contents. The original scans are saved as separate .tif files, reviewed for presentability, and creases, stains and blemishes removed, as necessary. The modified scans are saved by document type (i.e., correspondence, reports, sketches, forms, etc.) or map type (geologic, assay, topographic, location, survey, cross section, long section, vertical section, etc.), first as .jpegs and finally as pdfs. The pdf files will be publicly served by the MBMG Mining Archives webpage upon its completion and implementation.

To date, MBMG has scanned 1,032 property files (containing over 23,300 pages of information) and 2,412 mining maps.

Metadata Uploaded to the National Digital Catalog.

Metadata for the collections noted above have been uploaded to the National Digital Catalog using .xml file transfers. Only records containing latitude and longitude locations were uploaded.

Data Preservation Plan Implementation

MBMG Data Preservation Committee

In Phase II, the MBMG developed its Data Preservation Plan which prescribed creation of an advisory committee to provide general data preservation and collection use policy for MBMG. The committee was created in July, 2012 and met in August, 2012 as well as May 2013. Committee members included: Ann St. Clair, Montana Tech Library Director; Robin McCulloch, International Silver; Mitzi Rossillion, Butte Archives; Dave Frank, USGS Facility Manager/Outreach Coordinator, Spokane Office and Ted Antonioli, geologic consultant. The Abandoned Mines section of the Montana Department of Environmental Quality has accepted an invitation to participate on the committee as well.

The Montana Bureau of Mines and Geology was represented by: John Metesh, Director; Tom Patton, Chief, Research Division; Luke Buckley, Database Administrator; Nancy Favero, Information Systems Technician; Jeff Johnson, Computer Support Specialist; Peggy Delaney, NGGDPP Grant Principal Investigator. The meeting agenda and notes from the most recent meeting are attached (see Appendix A).

Mining Archive webpage development is proceeding with an anticipated early spring 2014 launch date.

Summary

MBMG continues to recognize the immense value of historical mining, geology, hydrology, mineralogy, and seismic information and, in particular, the irreplaceable information and physical specimens from mines and areas that are no longer physically accessible. Current mineral commodity prices are high causing high demand for electronically delivered archived data; at the same time new data are becoming increasingly available for rescue and archiving as 'boomer-age' mineral resource professionals retire. The MBMG will continue to expand its collections, collaborate with the USGS by contributing metadata about those collections to the National Digital Catalog, make the information available electronically to its customers via the MBMG website and educate the public about the availability of the information. These goals would not have been possible to pursue in a timely fashion without the financial support of the USGS NGGDPP program.

Appendix A. MBMG Data Preservation Meeting Documents

MBMG Data Preservation Committee Meeting
May 29, 2013
10:00 a.m. – 2:00 p.m.
(Lunch will be served)

Present status (space, employees, funding level, collections & size, digitization status, and website progress)

New funding (review of MT HB2 funding and priority on coal related information; USGS NGGDPP grant; deliverables)

Funding impact – Program expansion

1. Digitization of all existing mining property files and mining maps – priority;
2. AIM information integration; ensure information consistency between databases;
3. Improve accuracy, completeness, consistency and relational efficiency of existing Mining Archives databases;
4. Network with other mining-related information repositories (NRIS, DEQ, Butte Archives, Montana Historical Society, etc.);
5. Identify new sources of information to add to digital collection (and hardcopy collections if materials are donated or requested);
6. Departmental operations review by an archival consultant – review current processes; recommend process revision/streamlining and operational policies (e.g., handling proprietary information, acquisition and disposition policies; copyright policies, etc.);
7. Development of information dissemination policies (hard copy and online; address proprietary vs. nonproprietary definitions and issues);
8. Program "marketing"/education – informing public; agencies; schools, mining/geology industry of information availability, access, donation opportunities, other

Data Preservation Committee
Montana Bureau of Mines and Geology
Meeting Notes
Wednesday, May 29, 2013
10:00 a.m.

Present: Connor Cote, Montana Tech Library (for Anne St. Claire)
Mitzi Rossillion, Butte Archives
Dave Frank, USGS, Facility Manager/Outreach Coordinator, Spokane Office
Ted Antonioli, Geologic consultant
Montana Bureau of Mines and Geology:
John Metesh, Assistant Director
Tom Patton, Chief, Research Division
Luke Buckley, Database Administrator
Nancy Favero, Information Systems Technician
Jeff Johnson, Computer Support Specialist
Phyllis Hargrave, Assistant Research Geologist
Peggy Delaney, Research Assistant

Absent: Brian Shovers, Montana Historical Society
Robin McCulloch, International Silver, Inc.

Peggy Delaney welcomed the committee. She gave a brief recap of the present status and progress of the Mining Archives' activities. Activities included hiring more student workers for the summer term, identifying additional workspace for the Archives, continued document and map scanning/optimizing, preparing digital copies for webpage publication, and continued work on accessioning the Orvana collection. Peggy shared that she submitted another application to the USGS for ongoing participation in the National Geological and Geophysical Data Preservation Program (NGGDPP). Award notification by the program will likely be made in late August.

John Metesh informed the committee that the Montana State Legislature, largely due to the efforts of Sen. James Keene and Sen. Duane Ankney, has allocated monies to the MBMG for its Mining Archives program. Approximately $300,000 per year for two years has been appropriated on a one-time-only basis. John also informed the committee that he was recently appointed to the NGGDPP grant review committee by the USGS.

The committee discussed the impact of the new state funding on the program and identified opportunities for significant program expansion.

- Make digitization of existing property files and mining maps a priority,
- Ensure information consistency and accuracy of mine locations between records within the Mining Archives program and the MBMG Abandoned and Inactive Mines program,

- Conduct a review of existing department policies and procedures by an outside expert to ensue archival best practices,
- Develop a long term equipment upgrade and replacement plan, including electronic data storage and redundancy capacity, scanning and computer equipment upgrades and software upgrades,
- Identify new sources of information to add to digital inventory and/or to hard copy inventory, if materials are donated to the Bureau,
- Develop and implement a marketing and education program – inform public, agencies, schools, mining/geology industry of information availability, access, donation opportunities,
- Identify archival short and long term storage space

Phyllis Hargrave provided an overview of the Abandoned and Inactive Mines program and discussed some of the challenges in "meshing" that information with the Mining Archives information. The goal will be to continually update information in both programs to provide the most accurate data possible.

❖ Committee Suggestions: **Abandoned and Inactive Mines/Mining Archives Integration**

- put abandoned sites and names online;
- create map overlays of AIM and Mining Archives mining locales in a .kml format;
- develop interagency cooperative agreement with Forest Service to document geology and structure of newly abandoned mine sites prior to FS closure and reclamation

❖ Committee Suggestions: **Identify new sources of information; information at high risk for destruction or disposal.**

The Committee suggested a targeted approach in identifying and approaching possible sources of new information.

<u>Possible donations:</u>

- USGS – Spokane office is facing significant storage space reductions and may be willing to give Montana-related information to the Mining Archives;

<u>Possible cooperative agreements:</u>

- Offer to digitize mining-related information and return both hard copy original and digital copies to owner. MBMG would be allowed to publish the information on its website. Suggestions for organizations approach included Montana Historical Society, Copper Village (Anaconda), Forest Service, BLM, National Archives (Denver; for US Bureau of Mines property files for Montana), corporate archives (ASARCO, Pathfinder Gold, Cogema), Office of Surface Mining, Foster Huett Collection at USGS

<u>Core Samples:</u>

- Identifying the location of existing cores and samples was discussed. The USGS has 12 pallets of core from the Stillwater operations; Dan Winston holds a core repository from the Cominco project; the current locations of many core repositories are unknown. Lack of adequate core and sample storage space was discussed.

- Committee Suggestions: **Department policy and procedure review**
  - Jill Schneider, Alaska DataTech, was suggested as a contact to perform this work.

- Committee Suggestions: **Storage**
  - To promote donations of mining information, maps, photos, cores and samples, the committee felt it was important to have adequate storage space (short and long term) to readily accommodate all acceptable donations. It was suggested to begin looking at storage options in Butte. Two suggestions were the Kelly Mine Building and the Kenwood Building, both located in uptown Butte.

- Committee Suggestions: **Marketing and Outreach**
  - News releases in local newspapers about Mining Archives website
  - Brochure development to use when targeting repositories, museum, libraries, local government agencies, and professional associations
  - Poster presentation and booth sponsorships at AASG, NW Mining Association meeting, Montana Mining Association meeting

The meeting adjourned at 2:15 p.m.