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**Principal investigator:**            **Margaret (Peggy) Delaney**  
Montana Bureau of Mines and Geology  
1300 West Park Street  
Butte, MT 59701  
406-496-4381  
mdelaney@mtech.edu

**FINAL TECHNICAL REPORT**

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## ***Abstract***

The Montana Bureau of Mines and Geology's (MBMG or Bureau) FY 2015 National Geological and Geophysical Data Preservation Program (NGGDPP) proposed to accept ownership of selected information related to the 1995 Crown Butte Mining development of the New World Mine from Gallatin/Beaverhead National Forest office. Based on photographs of the collection and discussions with the Forest Service, the Bureau proposed to inventory, organize, digitize, and create metadata for mine-related hardcopy documents and maps selected by the Forest Service for transfer. Initially, the MBMG was approved to take approximately 100-150 lineal feet of documents (including assay data, borehole lithology, sampling logs, geochemistry data, water data, mine and mill design reports, environmental assessments) and 150-200 maps. During the Bureau's acquisition site visit, the Forest Service significantly increased the number of documents to transfer to the Bureau. As a result, the MBMG acquired substantially more information than was originally proposed in the FY 2015 NGGDPP application. The MBMG organized, inventoried and eliminated duplicate documents, resulting in a total of 27,029 document processed pages. Of these, 14,537 were optimized, reviewed for completeness and document integrity, georeferenced, and prepared for online publication as archival .pdfs. The Bureau received over 1,300 project-related maps. Once duplicate maps were identified and eliminated, the remaining 1,058 were stabilized, scanned, optimized, georeferenced, and prepared for online publication.

## ***Introduction***

The Montana Bureau of Mines and Geology (MBMG or Bureau) was established in 1919 and directed to collect mining industry drawings, maps, reports, minerals, and models from throughout the state of Montana. As a result, the MBMG now possesses an expansive collection of mining-related data on properties throughout Montana. The repositories contain irreplaceable information about Montana's resources.

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 over 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, teachers, and the general public.

The Bureau's data preservation efforts fit well with the introduction of the U.S. Geological Survey's Geological and Geophysical Data Preservation Program (NGGDPP) in 2006. The Bureau submitted successful proposals in FY 2007, FY 2008, FY 2009, FY 2011, FY 2012, FY 2013 and FY 2014. In 2007, the MBMG initiated its data preservation program. Successive NGGDPP funding provided support for the MBMG to inventory and create metadata for water well logs; thin and polished sections from the Anaconda Copper Mining Company's properties in the Butte mining district; historical reports and files for mining properties located throughout Montana, historical mining maps; aerial photos; seismograms, oil and gas well logs, and coal-related maps and reports. NGGDPP awards and MBMG funds were used to acquire scanning technology to transfer hard copy data into a digital format, rescue data from obsolete storage media, and develop a long-term data preservation plan.

Preservation of Montana geologic and mining-related data remained a priority for the MBMG and it collaborated with other governmental agencies in its preservation efforts. In 2013, the MBMG received a collection of aerial photos from the Missoula Montana Forest Service office and obtained Butte mining district core samples from the Butte-Silver Bow, Montana government. A short time later, the MBMG was approached by the Gallatin/Beaverhead National Forest Service Office in Bozeman, Montana regarding its planned disposal of information about Crown Butte Mining's 1995 proposed New World mine development in Park County, Montana. The nearly 800-acre property is located adjacent to the northeast corner of Yellowstone National Park. The park's close proximity of the proposed New World development created much public concern and, subsequently, a private land trust elected to purchase the property and withdraw it from development in the late 1990s. The project's information was stored by the Gallatin/Beaverhead-Deerlodge National Forest office in Bozeman, Montana.

Discussions with the Forest Service led to an ownership-transfer offer of select portions of the information to the Bureau. The information included geologic and mining engineering reports compiled in 1995 by the USDA-US Forest Service during the environmental analysis phase of the New World mine development in Park County, Montana. Photographs of the storage unit contents showed about 100-150 lineal feet of filed documents and approximately 150-200 maps identified for transfer by the Forest Service. The geologic, hydrogeologic, and geophysical data represent the most comprehensive extant data set related to this world class Eocene epithermal gold deposit. Because of the New World site's protected status, the data will not likely be updated.

The MBMG concluded that the acquisition was an appropriate project to submit as an NRGDPP project. The MBMG proposed to take possession, stabilize and preserve, and inventory the physical documents selected by the Forest Service for transfer. Additionally metadata for the information would be created and the physical information converted to a digital format and made publically available online. During the acquisition site visit, the Forest Service significantly increased the number of documents it identified for transfer to the Bureau. As a result, the MBMG acquired substantially more information that was originally proposed in the FY 2015 NRGDPP application.

The information was described, organized, and entered into the MBMG Mining Archive database. The physical documents were added to the MBMG Mining Property Files and Mining Maps inventories and metadata created in an .xml format for submission to the National Digital Catalog. Electronic images of documents and maps were scanned, optimized and converted to archival .pdf images for publication on the MBMG's Mining Archive website. By preserving the data in a publicly accessible venue, basic geologic data potentially applicable to other epithermal gold deposits in Montana or the west will remain accessible.

## ***Methodology***

### Inventory

The MBMG acquired 115 lineal feet of boxed documents and over 1,300 maps. The documents were organized by date and then by report or map type. Duplicate documents were identified and purged, retaining the best copy of each document for preservation processing.

### Metadata creation

MBMG derived record descriptions from the actual hardcopy documents. Location information (latitude and longitude) was obtained (in order of information availability) from file information, the

MBMG Abandoned Mine database (where onsite latitudes and longitudes were identified); the Montana Cadastral System, the USGS Geographical Names Information System, the USGS Mineral Resource Data System (MRDS), or EarthExplorer (WGS84).

### Scanning

Each document page and all maps were scanned by student employees under staff supervision. Scans were categorized by document type to enable online users to customize database searches (e.g., by assay, engineering report, map type, etc.). Property file documents were scanned on a Kyocera TaskAlpha 4551 ci scanner at a minimum 600 dpi resolution in full color. The physical documents were added to the existing New World Mine property file. Maps were scanned in full color at a minimum of 400 dpi resolution, using a ColorTrac Paradigm ImagePro GxT 42 HD Plus scanner. Hardcopy maps were added to the existing New World Mine map file.

Electronic documents were converted grayscale format unless color information was deemed important to document integrity. Original scans were saved as permanent .tiff files. Creases, stains, and blemishes were removed from the electronic images using Photoshop and the resulting optimized scans reviewed for content integrity. The modified scans were 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.), as .jpps and also converted to archival .pdfs. Original scans of all documents as well as their optimized versions will be retained by the MBMG. Archival .pdf versions of the optimized scans are maintained on the MBMG Mining Archives webpage.

### Quality Assurance

Mining Archives supervisors reviewed each document to ensure that all report pages were completely scanned, correct page size and orientation used; satisfactory restoration quality maintained; and that department file naming protocol met. Supervisory staff then created archival .pdfs, transferred all digital images (original scans, .jpps and .pdfs) from a temporary working directory to a permanent archival directory, and publicized the archival .pdfs on the MBMG Mining Archives website. The images are retained on a dedicated mining archives server and mirrored on a second server. The server is backed up daily.

## **Results**

### Property file documents

The MBMG's Historic Mining Property File collection (NDC ID P1411<sup>\*1</sup>) contains documents related to specific mining properties located throughout Montana. The hard copy collection is organized alphabetically by Montana county and individual property name. Each electronic record contains the following metadata:

- Pf\_id: Unique, MBMG-generated, property file identification number
- Mills\_id: U.S. Bureau of Mines Mineral Industry Location System property identification number, if available
- State: State of Montana

<sup>\*1</sup> Pre-USGS ScienceBase National Digital Catalog identification number

- County: Name of county in which property is located
- Mining\_district: Name of 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 “N/A”
- 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: The 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
- GeoMethod: Method used to determine the latitude and longitude;
- Datum: Horizontal reference datum for latitude and longitude values.

A property file record for the New World Mine in Park County, Montana already existed in the MBMG Property File collection. The MBMG organized, inventoried, and eliminated duplicates from the newly acquired documents. A total of 27,029 document pages were added to the original New World property file. Of these, 14,537 pages were scanned, optimized, reviewed for completeness and accuracy, georeferenced, and prepared for online publication as archival .pdfs.

### Maps

The MBMG Mining Maps collection (NDC P1620<sup>\*1</sup>) contains mining-related geologic and geophysical maps pertaining to Montana properties. The physical maps are organized by Montana county, mining district and related property name. Each electronic record contains the following metadata:

- 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
- GeoMethod: Method used to determine the latitude and longitude
- Datum: Horizontal reference datum for latitude and longitude values.

<sup>\*1</sup> Pre-USGS ScienceBase National Digital Catalog identification number

- Comments: Miscellaneous information, such as map media, map characteristics, number of copies retained, and significant map annotations. Miscellaneous information is not available for all maps.
- Map width: Map width measured in inches
- Map length: Map length measured in inches
- Map scale: Scale size noted on map, if available

Based on initial conversations with the Forest Service, the MBMG estimated that 150-200 maps would be acquired from the U.S. Forest Service. Subsequent discussions led to the transfer of over 1,300 maps. The maps were organized and duplicates identified and eliminated, leaving 1,190 maps to process. The remaining maps were stabilized and their metadata entered into the Mining Archives relational database using the above-described fields. All maps were scanned, optimized and underwent quality assurance review. To date, 1,058 map images received quality assurance review and archival .pdfs were created for them.

### ***Summary***

MBMG continues to recognize the tremendous value of historical mining, geology, hydrology, mineralogy, seismic information and, in particular, irreplaceable information and physical specimens from mines and areas that are no longer physically accessible. New data are becoming increasingly available for rescue and archiving as 'boomer-age' mineral resource professionals retire. In the past year, the MBMG received three new collections from retired geologists. The MBMG will continue to expand its collections and collaborate with the USGS by contributing metadata about those collections to the National Digital Catalog. The MBGM will continue to make the information available electronically to its customers via its website and educate the public about the information's availability. Our past preservation achievements would not have been possible to pursue in a timely fashion without the financial support of the USGS NCGDPP program.