Mine Inventory

By E. Paul Martin

Chapter D3 of

Integrated Investigations of Environmental Effects of Historical Mining in the Basin and Boulder Mining Districts, Boulder River Watershed, Jefferson County, Montana

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Abstract

An inventory of inactive and historical mines and mine-related sites in the Boulder River watershed study area was compiled from existing State and Federal sources. Site locations were spatially verified using digital orthophoto quadrangles to ensure an accurate geographically referenced inventory. The inventory also provides, where available, descriptive information, compiled from published sources, that supports the environmental evaluation of the effect of historical mining in the study area. This information includes the presence and the pH of flowing water from an adit, the presence and estimated volume of mine waste and mill tailings, and estimates of past production. These data provide site-specific information about potential anthropogenic contributions of deposit-related trace elements observed within the watershed.

Introduction

This chapter describes the mine inventory compiled for the Boulder River watershed study area. One of the most important facets of characterizing watersheds affected by historical mines is determining the location of as well as information about the mines, mills, and other mine-related sites. Every site in the watershed represents a potential source of deposit-related trace elements that could affect water quality and ecosystem health through direct drainage, seepage, erosion, or runoff. Within the Boulder River watershed, abundant and comprehensive data are available from several previous investigations. However, these data had not previously been compiled into one database, and many of the inventoried sites had only approximate locations.

The objective of this inventory is to create a database of mine-related sites that are accurately positioned and attributed in order to provide information to answer important questions about mine-site and stream remediation. The inventory combines geographically referenced locations and descriptive information in a format that lays the foundation for answering environmental and remediation questions using geographic information system (GIS) technology. The inventory comprises significant mines and mine-related sites in the Basin Creek, Cataract Creek, and High Ore Creek basins (major tributaries of the Boulder River), and in the areas drained by the portion of the Boulder River from the mouth of Basin Creek to High Ore Creek. (See Church, Nimick, and others, this volume, Chapter B, fig. 2.)

Methodology

The process used to determine the representative location for a mine-related site included the following steps. Data from the State of Montana, United States Department of Agriculture (USDA) Forest Service, Bureau of Land Management (BLM), and U.S. Geological Survey (USGS) databases provided an initial site data and localities list. These data were combined into one digital layer, and each site location was resolved to one representative point based on 1993 and 1998 digital orthophoto quadrangles (DOQs). Some mine-related sites contained multiple adits, shafts, and prospects, yet only one point location was captured to "best" represent the inventory site. Also, in some cases, the site location had to be determined strictly from a written description because not all of the historical data were georeferenced. Using digital orthophoto quadrangle (DOQ) image plots containing the resolved mine locations, USDA Forest Service and USGS personnel in Montana verified and revised the localities of the mine-related sites based on limited site visits, survey plats, and local knowledge of the area. Field inventories conducted by the Montana Bureau of Mines and Geology (Metesh and others, 1994, 1995, 1996; Marvin and others, 1997; Roby and others, 1960), the Montana Department of State Lands (1995), the Montana Department of Environmental Quality (1997), and the U.S. Geological Survey (Elliott and others, 1992) represent the sources for the descriptive data.

Data

Figure 1 shows 143 mine-related sites included in the inventory. Factors for inclusion or exclusion in the inventory focused on a site's contribution to environmental degradation, the physical hazard risk, past production volumes, and simply whether a site had a known name. The number for each site in figure 1 references a unique identifier for the study. Within the

Figure 1. Mine inventory for Boulder River watershed study area.

mines database, this identifier is an item called Amli_mine_id and allows mine-related sites to be associated with scientific data and selected field sample sites. (See Rich and others, this volume, Chapter G, for a complete explanation of this relationship and how to access the mine inventory and project databases.)

Table 1 presents the descriptive information for each site in the inventory. The name field is self-explanatory. The next fields are the unique identifier just referenced and the geographic coordinates. The location status field provides a relative measure of how accurately the site has been positioned. The shafts and adits fields give an indication of the extent of

Table 1. Site-specific data for mines and prospects in the Boulder River watershed study area.

[Amli_mine_id in the database is Site No. (fig. 1); verif., verified; apprx., approximated; gpm, gallons per minute; undeterm., value not known; quantities expressed in units used in original data; tons, 2,000 pounds; yd^3, cubic yard; --, no data. Blank spaces for flow rate and pH reflect the logical extension of a value of zero for the number of flowing adits or "no data" for the number of flowing adits. Production: very large, greater than $5,000,000 or greater than 250,000 tons of ore; large, $500,000 to $5,000,000 or 25,000 to 250,000 tons of ore; medium, $50,000 to $499,000 or 2,500 to 24,000 tons of ore; small, less than $50,000 or less than 2,500 tons of ore. Production data from Elliott and others (1992)]

Table 1. Site-specific data for mines and prospects in the Boulder River watershed study area.—Continued

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the workings at that site. The number of flowing adits, the flow rate, and the pH of the discharge represent important point-source information. In numerous cases, either the site did not have a flowing adit or data were not available for the flow rate and pH. The mill existence field indicates the historical presence or absence of a mill at the site. The dump quantity and tailings quantity fields provide a measure of the amount of waste rock or mill tailings at each site (again, the sources did not necessarily document this descriptor for every site). The past production field shows each site's output in relative terms. The following provides a measure of the value or magnitude of production based either upon the value of the ore shipped (expressed in units of $1,000) or tonnage produced (expressed in units of 1,000 tons): very large, greater than $5,000,000 or greater than 250,000 tons of ore; large, $500,000–$5,000,000 or 25,000–250,000 tons of ore; medium, $50,000–$499,000 or 2,500–24,000 tons of ore; small, less than $50,000 or less than 2,500 tons of ore; no or undetermined production. Monetary figures represent value at time of production (Elliott and others, 1992).

Discussion

The Boulder River watershed study area contains numerous prospects and smaller mine-related localities not inventoried for this study. Whereas the potential exists for any one of these sites to adversely affect ecosystem health, the data sources and field investigations suggest that this inventory is comprehensive in terms of identifying the significant historical mines and mine-related sites.

Some historical mine sites contain large underground workings or have multiple shafts and adits over an area. Regardless of complexity, the inventory represents each site with a single location.

The decision to encode the location status field in table 1 with "verified" or "approximate" was determined by a comparison of the source description and field diagrams with the DOQs and locations symbolized on existing maps. A verified value means that USDA Forest Service and USGS personnel in Montana checked the mine-related location and agreed on its position with a high degree of confidence.

The values in table 1 represent a choice of values from multiple sources. Discounting the unique identifier, the geographic coordinates, and the location status, the values for any particular column do not necessarily originate from the same source. For example, the number of adits for the Ada mine originates from source A, and the number of adits for the Bullion mine originates from source B. Likewise for any particular mine, the values for each of the columns may derive from different sources. All data sources are referenced herein.

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