NATIONAL REGISTER BULLETIN

Technical information on the the National Register of Historic Places:
survey, evaluation, registration, and preservation of cultural resources

U.S. Department of the Interior
National Park Service
Cultural Resources
National Register, History and Education

Guidelines for Identifying, Evaluating, and Registering Historic Mining Properties

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to tribes.

The National Park Service preserves unimpaired the natural and cultural resources and values of the National Park System for the enjoyment, education, and inspiration of this and future generations. The Park Service cooperates with partners to extend the benefits of natural and cultural resource conservation and outdoor recreation throughout this country and the world.

This material is partially based upon work conducted under a cooperative agreement with the National Conference of State Historic Preservation Officers and the U.S. Department of the Interior.

Cover Photo: This photograph of Lead Historic District in South Dakota illustrates the complex array of mineral extraction facilities, mills, worker housing, and tailings piles which typify the industrial nature of many historic mining properties. (Scott Gerloff)

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GUIDELINES FOR IDENTIFYING, EVALUATING, AND REGISTERING HISTORIC MINING PROPERTIES

BY
BRUCE J. NOBLE, JR.
AND
ROBERT SPUDE

U.S. DEPARTMENT OF THE INTERIOR
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NATIONAL REGISTER OF HISTORIC PLACES

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PREFACE

Mining activity comprises an important component of our nation's heritage. Native Americans engaged in the extraction and processing of precious metals long before initial contact with Europeans. Stories of abundant mineral wealth ranked high on the list of factors that first attracted Europeans to the North American continent. The quest for mineral wealth continues in contemporary America. Many centuries of mining activity have left a legacy of historic mining sites that now exist throughout the entire United States.

The opulent Victorian architecture characteristic of some successful nineteenth-century mining towns has galvanized interest in preserving and restoring these communities. The decaying industrial sites where the actual mining occurred have received considerably less attention. However, the industrial mining sites often face the greatest threats today. Massive earth moving efforts associated with modern mining, along with programs to reclaim abandoned mine lands, can harm the remnants of historic mining activity. In addition, many mining sites have fallen victim to the combined effects of neglect, abandonment, vandalism, and severe weather.

The threats faced by these properties, along with the complex task of understanding the significance of deteriorated sites associated with our industrial heritage, suggest the timeliness of a bulletin on evaluating and nominating historic mining properties to the National Register of Historic Places. The National Register evaluation process offers a framework for assessing the significance of mining sites, while listing in the National Register will help assure that significant mining sites are recognized and protected when possible. The ultimate goal of this bulletin is to provide a body of information to support Federal, State, and local efforts to manage historic mining properties with a sense of stewardship predicated upon recognition of the importance of these properties in our nation's history.

Lawrence E. Aten
Chief, Interagency Resources Division
National Park Service
Department of the Interior

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This publication has been prepared pursuant to the National Historic Preservation Act of 1966, as amended, which directs the Secretary of the Interior to develop and make available information concerning historic properties. *Guidelines for Identifying, Evaluating, and Registering Historic Mining Properties* was developed under the general editorship of Carol D. Shull, Chief of Registration, National Register of Historic Places. Antoinette J. Lee, historian, is responsible for publications coordination and Patty Sackett Chrisman, historian, provides technical support. Comments on this publication may be directed to Keeper, National Register of Historic Places, National Park Service, 1849 C Street, N.W., Washington, D.C. 20240.

I. INTRODUCTION

The United States has ranked among the world's leading nations in the production of gold, silver, copper, iron, lead, coal, oil, zinc, molybdenum, uranium, and other metals. These treasures from the earth have also made major impacts on the settlement and development of many regions, from Appalachia to Alaska. Precious metals have created unimaginable fortunes, while unwise investment has caused the loss of millions of dollars. Large segments of the population have been influenced by the work of prying ore, rock, or coal from the bowels of the earth. The purpose of this bulletin is to assist in the recognition of significant mining properties worthy of listing in the National Register of Historic Places.[1]

Some of this country's spectacularly successful mining operations have already been documented and recognized. For example, Virginia City, Nevada; the Sloss blast furnaces at Birmingham, Alabama; Butte, Montana; the Elkins coke works at Bretz, West Virginia; Kennecott, Alaska; and the Calumet and Hecla Mine in Calumet, Michigan, are designated National Historic Landmarks. Many additional mining properties are listed in the National Register of Historic Places. However, throughout the nation, many significant mining properties have yet to be documented, evaluated, and listed in the National Register. Many of these remaining resources are small, but important, elements of historic mining activity such as a ditch, a shaft opening, a road, or a collection of prospect pits. As a result, this bulletin will not focus on mining camps and their architecture, but instead will emphasize the identification, evaluation, and registration of the frequently overlooked mining properties and industrial tracts.

Mines and industrial tracts encompass a range of types of historical and cultural properties. They vary from iron works, to precious metal mills, to dredges and their associated outbuildings. They include mercury furnaces from the Mexican-era in the West; an early twentieth century nickel refinery in Perth Amboy, New Jersey; Russian coal mines in Alaska; the expansive open pits of the Iron Range of Minnesota; coal tipples in Appalachia; and copper mines of the Southwest. Although the various metals require different technologies to extract economically valuable metal from ore, there are many similarities in extraction, beneficiation (the initial process of upgrading ore), and refining. Oil and gas fields, however, require unique technologies developed for the extraction of fossil fuels. This difference means that the extractive industries of oil and gas are not examined in detail, although this bulletin will give general direction for their evaluation.

The transient nature of mining activity has left a legacy of historic properties that pose challenges to our traditional rules for evaluating significance and integrity. Many mining structures were built for temporary use and quickly abandoned once the minerals had been exhausted. The resources have subsequently experienced decades of neglect, aggravated by vandalism and severe weather. In other cases, mining activities were short-lived. Hamilton, Nevada, for example, witnessed a whirlwind of silver rush activity in 1869, but the mines failed and the town faded to a ghost town within a decade (Jackson, 1963). The significance of such properties will have to be based on their archeological potential and not on their present lack of standing structures.

The need for guidance in evaluating mining resources is pressing because of a marked increase in activities that threaten historic mining resources. These activities include the recent upswing in coal mining and precious metal mining which can impact historic mining areas. In addition, mine reclamation and clean-up efforts often threaten historically significant mines. Although well-intended, these clean-up activities can contribute to the loss of significant resources.

The National Register of Historic Places provides an important tool for evaluating and protecting mining properties. Utilizing uniform criteria to evaluate significance and employing established integrity standards, the National Register process provides a valuable yardstick for measuring the historical significance of mining properties. Thus, the National Register is the best means for determining the significance of historic mining properties in the United States. In addition to providing an incentive for preservation by recognizing resources that warrant preservation, listing affords a measure of protection from Federal undertakings and can help to identify properties worthy of Historic Preservation Fund grant assistance, tax incentives, and other forms of assistance. The bulletin will also provide an approach for complying with Federal laws such as the Surface Mining Control and Reclamation Act of 1977 that help protect properties listed in the National Register.

National Register listing also gives credibility to State and local efforts to preserve mining resources based on their continuing contribution to a community's identity. The documentation contained in surveys and nominations of these historic mining properties — especially those that are neglected or threatened — is the key to their better protection and management. This information has a variety of uses, including public education; planning by local, State, or Federal agencies; or publication. The purpose of this bulletin is to guide Federal agencies, State historic preservation offices, Certified Local Governments, preservation professionals, and interested groups and individuals through the process of identifying, evaluating, and registering historic mining properties to the National Register.

This bulletin outlines a general approach to the identification, evaluation, and registration of historic mining properties throughout the United States. A broad range of mining activities were conducted in different regions of the country. Although this bulletin may not provide specific details about every form of mining and every type of mining property, the general process discussed in this bulletin will assist with the nomination of a great diversity of mining properties.

The focus of this bulletin is historic mines or associated properties constructed specifically for the extraction of minerals or to support the extraction, benefication, and refining of minerals. In addition, this bulletin may also assist with the identification, evaluation, and registration of properties associated with non-metallic mining. Examples include clay mining (associated with brick making), salt mining, salt petre mining, and rock and gravel quarrying. For the purposes of this bulletin, the word "mineral," when used in the context of extracted matter, includes coal.

General instructions for preparing National Register nominations are available in two National Register bulletins: *How to Complete the National Register Registration Form*, and *How to Complete the National Register Multiple Property Documentation Form.*

This photo of Virginia City, Nevada illustrates characteristic features of mining towns such as headframes, tailings piles, and exploration pits. Representing one of the United States' most successful mining operations, the Virginia City Historic District was designated a National Historic Landmark in 1966. (Jim Reinheiler)

II. HISTORIC CONTEXTS FOR MINING

Mining camps have been the focus of many mining-related National Register nominations. Too often, however, mining areas are evaluated for their architectural resources without fully considering the role once played by industrial features like mines and mills. In many cases, the industrial features associated with mining receive scant attention because they lack any remaining buildings, structures, or objects. The transient nature of mining properties and the frequency with which mines have been abandoned means that many mining resources occur either as simple earthen protuberances or as subsurface voids. Historic machinery is scavenged from isolated mining locations, often to be displayed in distant museums. Present-day mining can obliterate historic mining features.

A single mining district may contain features dating to several distinct mining periods. Understanding the cultural resources in a former mining area can be complicated by the repeating boom and bust periods within a single mining district. Each boom period occurred with the rise of metal market prices or by the introduction of new technologies. These booms brought new equipment and machinery which is either superimposed over or placed alongside the remains of previous mining activity.

Along with changes caused by market price fluctuations or evolving technologies, the metals sought by nineteenth-century prospectors tended to change over time as local conditions improved, caused usually by a drop in transportation, labor, or fuel costs. Most Western prospectors initially sought gold, then moved to silver, and finally to base metals. For example, the Butte mines were first located during the great Montana gold rush of the 1860s. After the decline of the readily accessible placer gold, the local economy slumped until a fresh discovery made Butte a huge silver producer in the late 1870s. Silver mining collapsed in 1893, but by then the copper mines on Butte Hill had come into production (Malone, 1981). Other early Western mining towns witnessed similar, though less phenomenal, histories as silver mines became tungsten mines and gold mines began by yielding gold before later moving or to produce zinc and lead. The mining of iron, coal, and other base metals also relied on favorable economic conditions, all tied to cheap labor, fuel, and transportation.

The preceding discussion demonstrates that the initial evaluation of mining properties can pose challenges. These challenges result partly from the fact that the industrial features associated with mining have not always been fully appreciated. In addition, many of the industrial features which typify mining properties have either been demolished or seriously damaged through neglect. Finally, evolving technologies and changes in the types of minerals being mined can create situations where resources dating to a variety of periods may be contained within a single mining district.

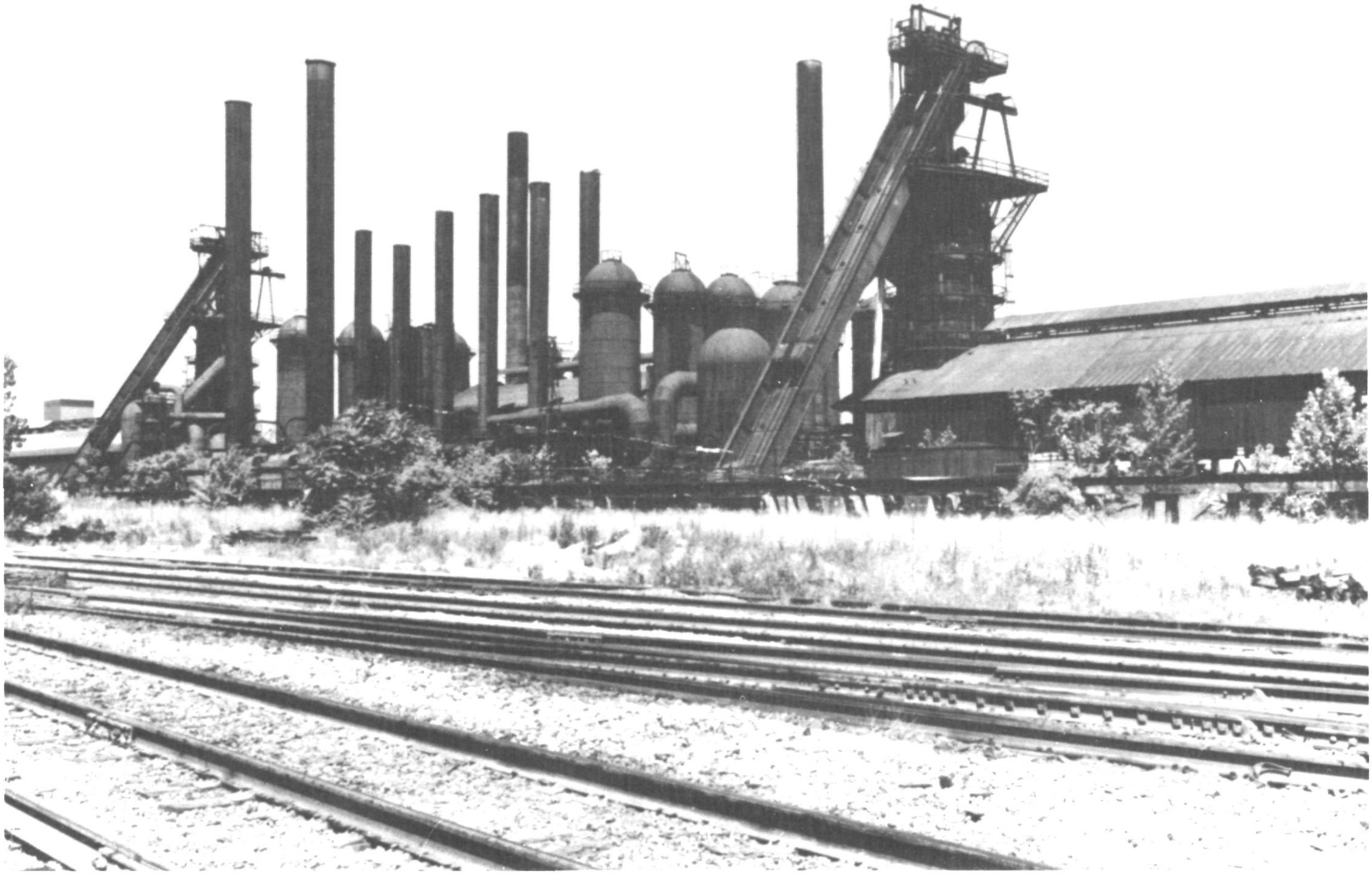
The potential complexities of evaluating diverse and enigmatic mining properties can be addressed by identifying historic contexts. The identification of historic contexts should emphasize those contexts associated with extant historic properties likely to be encountered during field surveys. By following this practice, historic contexts will help to unravel the separate threads of mining history which may exist within a single geographic area.

A historic context can be described as a particular theme that is further deliniated by a time period and a geographic area. (For example, "Silver Production in Butte, Montana, 1879-1893.") Identifying historic contexts will serve a variety of purposes. They can provide locational information that will assist with the identification of mining properties in the field. Furthermore, an individual property associated with a given historic context can be compared with other properties related to that context to reach decisions about the relative significance of related properties. In addition, initial historic context documentation identified at this early point will expedite the nomination process by allowing for eventual incorporation of this documentation into the narrative of a nomination.

With regard to historic contexts for mining areas, the *theme* component of the context will revolve around some aspect of mining history. These themes should not be defined too narrowly. In addition to considering mining technology, research done to develop themes should consider transportation, water systems, habitation, labor, the role of ethnic groups, and the role played by prominent figures in the mining industry. In some cases, themes may involve mining as one component of a more general overview of a community's industrial and economic development.

In defining an appropriate *time* frame, a historic context (or series of contexts) should attempt to span the period from the time of a mining region's initial discovery to the point of its abandonment or decline. Although each mining district will have its own unique history, districts will experience a series of similar phases during the course of their development. Generally speaking, each district will have: 1) a discovery phase, 2) a development or boom phase, 3) a mature phase or phases emphasizing production, and then 4) a bust or decline phase. These phases may recur if a new technology is discovered to work the lower-grade ore or if other developments occur, such as the advent of uses for discarded ores or the new availability of cheaper transportation, fuel, or labor. Awareness of these common phases may help to determine the appropriate time periods for mining district historic contexts.

The *geographic* component of a historic context can relate to political boundaries which define the extent of a



The Sloss Blast Furnaces, dating from 1881, are among the oldest extant blast furnaces in the Birmingham, Alabama iron and steel district. The complex is representative of Alabama's preeminence in pig-iron production in the early twentieth century, and was designated a National Historic Landmark in 1972. (Historic American Engineering Record).

town, county, State, or Federal land management unit (i.e., a national park or national forest). The geographic definition may simply be the mining district boundaries established during a miners' meeting and duly recorded in the county courthouse. The US Geological Survey (USGS) has also drawn boundaries for mining districts that may clearly define the geographic extent of historic mining activity. In addition, for over a century USGS has published bulletins which include maps of mining regions. In the East, State geological survey reports and maps serve the same purpose. These maps may also assist with the development of historic contexts.

In conclusion, historic contexts must be identied to allow for confident evaluations of a historic mining property's significance. Because most mining properties are either in ruins or mere imprints on the landscape, they can pose difficult integrity questions. Significance must be determined based on an understanding of an area's history before making decisions about National Register eligibility. In some cases, significant historic properties may be entirely overlooked without a proper historic context. Even ruinous properties can be significant if they yield information valuable in historical archeology, especially if the property contains remains of engineering works that help to illustrate the broader historic context of technological innovation and diffusion. For example, the nomination of the Dubuque, Iowa, lead mines was based on a written historic context and on archeological evidence that revealed a great deal about mining and smelting technology in the early 1800s. The nomination of these lead mines occurred in spite of the fact that no standing structures remained at the location of this previously active mining district.

SOURCES OF HISTORIC CONTEXT INFORMATION

Identifying historic contexts related to mining activity should begin with an investigation of existing contexts. State Historic Preservation Officers (SHPO) represent one possible source of existing historic context documentation. In particular, statewide historic preservation plans, previously completed multiple property submissions, and other information maintained by SHPOs may contain material concerning historic mining properties. Other possible sources of existing information include Federal agencies (particularly Federal land-managing agencies) and academic institutions. Background investigations may reveal that a number of mining-related historic contexts have already been developed for a given area. If so, these existing contexts may provide valuable assistance to the researcher.

A number of other sources may assist with the development of historic contexts. The USGS has published mining-district maps showing geologic formations and minerals throughout the United States. In addition, descriptions of mining districts are contained in a series of USGS bulletins, monographs, professional papers, and other publications. These sources supply information on ore deposits. Some mining districts, especially in the West and Alaska, received thorough evaluation and mapping by the USGS. These evaluations led to the publication of reports that describe mines, prospects, and company activities, as well as geographic and cultural information.

In the East and the Midwest, where the USGS was less active, State geological bureaus provided similar publications and maps on mining regions. Coal mining areas in Pennsylvania, West Virginia, and Kentucky, for example, were extensively mapped by the State. Early information on lead mining can be found in the reports of the State geological offices of Missouri, Wisconsin, and Iowa. Information on the early copper industry can be found in Michigan geological reports.

Information in these geological reports, which often included economic histories, can be crosschecked with corporate descriptions in the *Mines Handbook* (after 1905) and *The Mineral Industry* (after 1892). Other useful government reports include the annual reports of the U.S. Mining Commissioner, 1866-1876, the reports of the Director of the Mint, and the Bureau of Mines annual report (later called the *Minerals Yearbook*). These reports, particularly the bulletins and information circulars of the USGS and Bureau of Mines, frequently include specific data on lode and placer mining techniques and equipment as well as discussions of individual mines and mining districts. The Bureau of Mines also published technical reports on mine safety and technology.

Other records of the Federal government will have potential research value. With regard to mining in the West, specific information about mine ownership can be found in the mineral patent records of the Bureau of Land Management (BLM). Created through a merger of the Grazing Service and the General Land Office in 1946, BLM offices will also contain records of mineral patents issued by the General Land Office. Deed records housed in the local county courthouse may provide an additional source of mine ownership information. If litigation occurred, extensive files may be found in the Department of Justice records in the National Archives in Washington, DC. If minerals were produced for military purposes, the records of the Secretary of War should be consulted.

State and local histories may contain information on mines and mining in a particular locality. In addition, some States published annual reports issued by State geological surveys, mine inspectors, mining commissioners, or department of mines. Records of State corporation commissions, which may contain articles of incorporation and annual reports, can help to explain corporate involvement in mining enterprises.

Period journals and newspapers provide a panoply of promotional information about a mine. Both successful and unsuccessful mining camps and towns frequently had newspapers that touted each mine or prospect. Individual mines and mining companies produced annual reports and distributed other forms of literature. The productive ones published annual reports which might include photographs and diagrams that typically described the extent of both works and machinery. Although mining town newspapers and company literature can provide fascinating local color, these sources must be used with caution based on their inclination to accentuate the positive and downplay the negative.

In some cases, mining activity was well documented by early photographers. Archives, museums, and other sources should be contacted for historical photographs to assist with historic context research. Photographs of mine equipment and mill machinery for a specific mine may not exist, but contemporary photographs of nearby mines and mills document the material culture and industrial facilities of a particular mining region.

In the West, early mining district record books can serve as an important source of historic context material. In some cases, these record books document the formation of miners' committees that established district laws and recorded the tenuous ownership of mineral deposits. (After the passage of the 1872 Mining Law, only a patent issued by the Federal government would legally secure ownership.) A hypothetical example of the value of these early records might involve a prospect pit discovered in an 1860s gold district, but abandoned after the first rush. Lacking these records to provide historic context information that links the property with the early gold rush era, the evaluation may be based solely on the marginal integrity that the property exhibits today. Such an evaluation would overlook the prospect pit's critical association with a significant period in mining history.

Oral histories can also serve as an important source of historic context information. Individuals living near historic mining areas may offer valuable information about resources in a given locale. In some cases, previous oral history studies will already have documented these stories either on tape or in print. In other cases, researchers may have to seek out individuals capable of providing valuable perspectives concerning local mining properties.

There are many books and other sources of information on the history of mining. (See Section VI for a listing of mining history references.) These studies help provide a general understanding of mining history. The difficult task is to combine the historic context information in these sources with the guidance provided in other National Register publications and use these materials to conduct successful field evaluations and prepare nominations for actual mining properties.

III. IDENTIFICATION

SURVEY AND DOCUMENTATION

The National Register bulletin entitled *Guidelines For Local Surveys: A Basis for Preservation Planning*, provides advice regarding appropriate fieldwork practices. Although this bulletin addresses questions about where and how to survey, specific questions about mining-related resources are not defined. Therefore, the following comments offer guidance specifically focused on surveying historic mining properties.

Perhaps most importantly, surveys of historic mining areas should be conducted with caution. Because mining properties are often located in remote areas, such as rugged mountain slopes or in steeply banked canyons, hiking trails may provide the only access. Given this situation, those involved with mining area surveys should be prepared to encounter rigorous conditions when conducting fieldwork.

Mines present special hazards with potentially lethal consequences. Field personnel should be trained in, familiar with, and able to recognize mining-related dangers prior to conducting field work. All explosives encountered should be considered extremely dangerous. Blasting caps are just as dangerous as "stick" powder. Explosives can be found in any part of a mining area, not just in the vicinity of the powder magazine. The ground around mine openings is frequently unstable; unguarded and obscured shafts, raises, and stope openings are hazards to avoid. Covered mine openings should not be considered safe. Unless proper training has been completed, one should not enter the underground portion of a mine. The hazards associated with surveying historic mines are real and should not be ignored.

In the West, many historic mines are located on public lands. The opposite situation prevails in the East where most historic mines will be on privately owned lands. Regardless of the geographic locale, owner consent should always be obtained before venturing onto privately-owned mine lands.

After ascertaining that conditions are safe and contacting the owners, begin the survey by defining the limits of the area to be investigated. This could be the entire mining district or just one mining claim whose boundaries are recorded in the mining deed records in the county courthouse or in the mineral patent records of BLM. If a mine operation extended over several claims, patented or unpatented, the survey area should encompass the full extent of claims associated with the mine. In the case of large mining corporations, ownership could extend over hundreds of claims. Other sources that will assist in defining the limits of a survey area include oral histories, company records, industrial directories, and USGS and State geologic maps and surveys.

The relationship between the claims and the topography can differ dramatically between hard rock and placer mining districts. Placer claims will usually be oriented to the drainage patterns while lode claims will follow the geologic structure as it was understood at the time the claims were located. Claims may also overlap and homestead, townsite, and other land claims may cover the same ground as placer and lode mineral claims. Knowledge of the historic development of an area should be acquired before conducting field work. This will ensure appropriate boundaries for the field survey.

Because many mining properties contain few standing buildings or structures and disconnected parts of machinery scattered throughout the area, the field surveyor should use the previously gathered historic context information to determine the type of mine at hand. This step is important because, for example, a placer mine will have different features than a hard rock mine or mill. Hard rock mines tend to have more fixed structures than placer mines. More important, placer mine surface equipment does not necessarily stay in one place. Over time, placer mine excavation and processing plants are moved along a creek as the stream bed is dug up and the auriferous material

The California State Parks Department has placed warning signs around the industrial buildings and mine openings at Bodie State Park, California. Researchers should be aware of dangers associated with surveying mining properties. (Robert Spude)

washed through the sluice box. On some creeks, the equipment associated with a placer mine may be found abandoned in place miles from where it was first used.

Furthermore, the fieldwork should result in thorough mapping of any evidence of earth-moving activity. This would include the mapping of waste rock and tailings piles. Dumps and tailing piles will often indicate the locations of removed or obscured features and will provide clues about the type of activity that created them. Coal mine waste gobpiles on the Illinois prairie or placer mine dredge tailings in California may be the only indications that major mining industries once operated in these areas.

Outlying support features should be mapped as well. For example, if a headframe stands over a shaft, not only should the headframe be described, but also the hoist house. The dams, flumes, and penstock supplying water to placer mines are as important as the camps erected to house the miners. Machinery should be described, especially its function and manufacturer (if these can be readily determined). Sanborn fire insurance maps and patent maps from BLM may provide descriptions and details on mines and structures that date to the time when the mine was in operation, as would any map prepared by companies owning the property. If available, these maps should be compared to the resources evident today.

Mill drawings may be available from company records. If not, examples of mills are in standard plan books, mine machinery catalogs, contemporary mine engineering books, or advertisements in such journals as *Coal Age, Mining and Scientific Press, The Colliery Engineer* and *Engineering and Mining Journal.* Regional journals are also helpful, but are rare until the 1890s. Field analysis of mills, especially outlines of foundations and tailings, will help describe the adaptations of general plans for the specific location.

A process flow chart is essential in understanding the metallurgy in use at mills. Flow charts were prepared for all mills, but few are extant. Thus, thorough mapping and noting of machinery in place is needed in order to reconstruct the flow chart diagram. Similarly, mapping of landscape features and remaining equipment can be used to reconstruct operations at placer, hard rock, and coal mines. While usually less complex, flow charts at coal and placer mines are equally useful to the understanding of mining operations.

Mining property surveys should include **preliminary research** related to the mine, the actual **field survey** of physical remains, and **property analysis** designed to reanimate the operational system which once functioned at a mine. This three step process is especially important in cases where the contemporary mining property lacks historic buildings and structures.

Remember too that technology changed as did the terms used to describe mining. Use technical publications contemporaneous with the period of mine operation: a 1930s technical description of a gold mill will differ greatly from a description in an 1880s publication.

Other sources to consult include the following: census records, tax assessment records, company books, personal diaries, community plats, cartographic sources, iconographic and pictorial materials, professional and technical journals, governmental publications, newspaper accounts, city directories, oral histories, and local informants. Information recorded during field work should use mining nomenclature from the period of operation and for the region. A West Virginia coal tipple and a Nevada mine headframe and ore bin might do essentially the same thing — store coal or ore pulled from the mine — but mining glossaries will help field crews get their descriptions correct. Use the appropriate glossaries and technical publications for the area and era. (See Section VII for a partial glossary of mining terms.) Initial historic contexts developed at this point should remain flexible enough to allow for the incorporation of new materials that may result from visiting the property or completing additional research.

Hardrock Mines used shafts to tap ore bodies; headframes supported the rope or wire cable that hauled workers and ore. Wooden headframes, like this one at the Bullion-Beck mine in Eureka, Utah, were replaced by steel at the turn of the century. (Robert Spude)

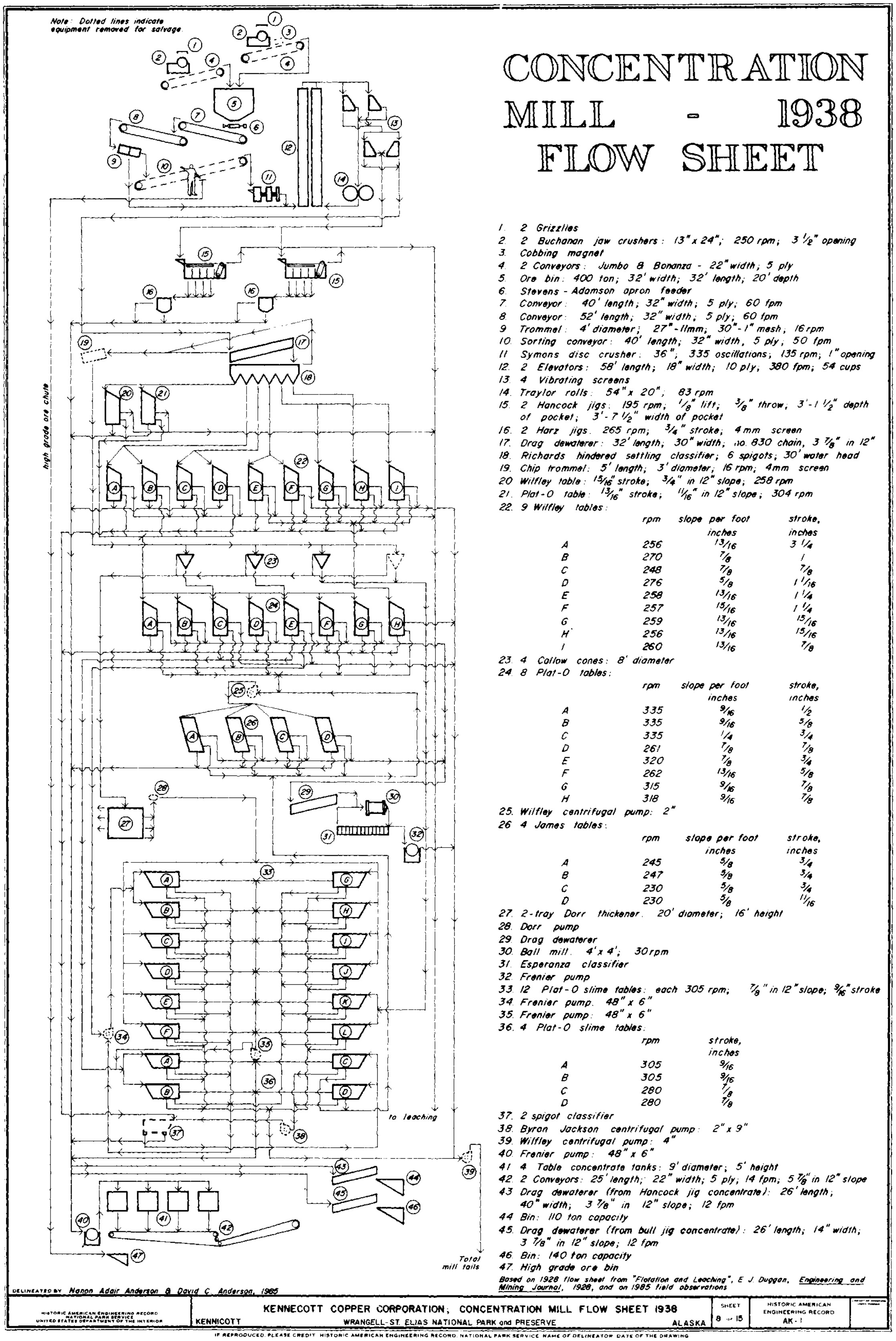
PRELIMINARY RESEARCH

As discussed previously, preliminary research is begun during the initial process of preparing historic contexts. However, in most cases, new information will be produced to refine historic contexts both immediately before and during the field survey. Thus, the ongoing nature of preliminary research will help to flesh out the historic contexts, develop new contexts, and provide further input to the field survey process. In turn, information derived from the survey will lead to further refinements in the historic contexts.

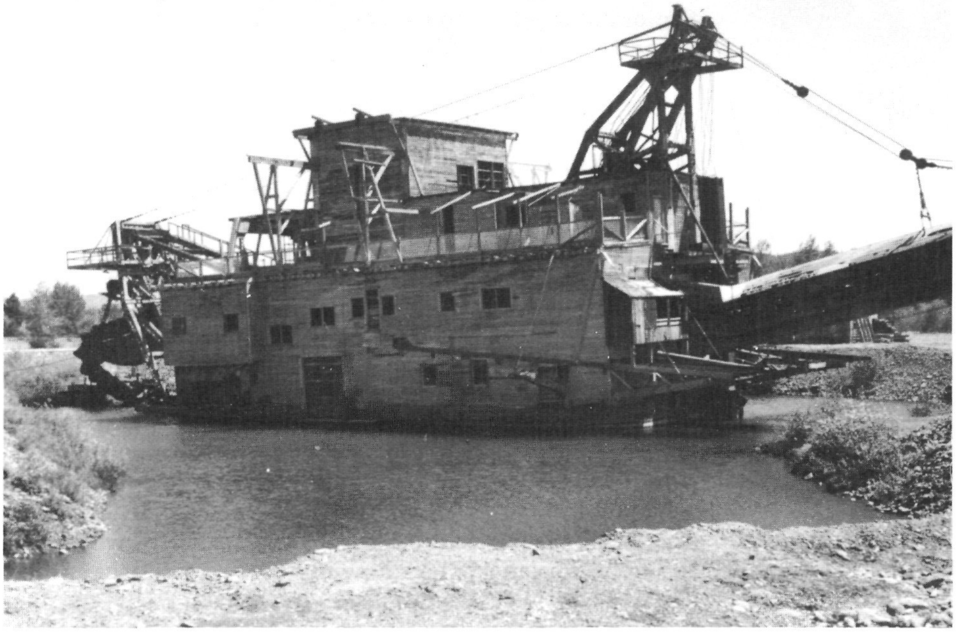
When conducting preliminary research, it is critical to engage in a literature search that yields information about the type of extraction, beneficiation, or refining process that took place in a given area. Preliminary research into the history of resources associated with mining activity plays an important role in preventing erroneous field interpretations: bituminous coal is processed differently than anthracite; a gold mill is different than a silver mill. At minimum, read the USGS or State geological bureau report on the mining area prior to beginning field work.

FIELD SURVEY

With the preliminary research documentation in hand, the field inventory of physical remains can begin.



The flow sheet for the Kennecott Concentrator in Kennecott, Alaska is one of the few extant process flow charts which were once prepared for all mill sites. These diagrams are essential to understanding the technology employed in the mills. (Nanan and David Anderson, Delineators, Historic American Engineering Record)



Placer gold mines were once numerous in the West. Some employed floating dredges, such as the Sumpter Valley Gold Dredge in Baker County, Oregon, to dredge up gravel and wash gold dust and nuggets from the waste. Dredges typically deposited large tailings piles along stream beds. (Oregon State Historic Preservation Office)

The physical remains of mines may include standing buildings, structures, and other architectural remains; machinery; archeological remains; and landscape features such as mine waste rock dumps, mill tailings, water delivery systems, open pits, and roads. Archeological remains, which may be the most abundant, typically include prospects, privy pits, wells, cellar holes, building foundations and platforms, dugouts, domestic and industrial trash dumps, isolated artifacts, collapsed headframes, machine pads and platforms, depressions, roads, ditches, pathways, and bulldozer cuts.

The methods used to locate the physical remains of mines may include aerial photography, pedestrian survey, remote sensing (such as radar profiling or proton magnetometry), and simple probes. For preliminary mapping and assessment purposes, low-level aerial photography is an excellent way to document the physical remains of mining properties. A systematic program of pedestrian survey, however, is essential. Planning for scale is critical since the physical remains of mining properties may cover a large geographical area. Historic placers, which can extend for miles, call for inventive approaches to field mapping and documentation. For example, using small-scale aerial photography and transparent overlays to record linear features and apparently isolated elements as well as the location of larger concentrations of features can often make sense out of apparent chaos. Superimposed historic maps on contemporary maps can help identify features and further detail the chronological and industrial development of an area. Recording methods should include photography, the preparation of architectural plans and elevations, sketches of machinery and other objects, narrative description, and the preparation of scaled maps.

Field surveys also should include methods for assessing the integrity and significance of the physical remains. Determining whether archeological deposits have a buried component may, for example, require probing or remote sensing. The suitability of the physical remains for conveying a sense of time, place, and historical patterns or themes should be considered. The surveyor should also record observations about the extent to which the physical remains are repositories of information, including the presence or absence of artifacts that carry information needed to answer important research questions about mining technology or community. Mining resource surveys will often require multi-disciplinary approaches to survey, using the talents of archeologists, historians of technology, landscape architects, architects, and mining engineers as well as assistance from geologists or practicing miners or individuals with first hand knowledge of the area.

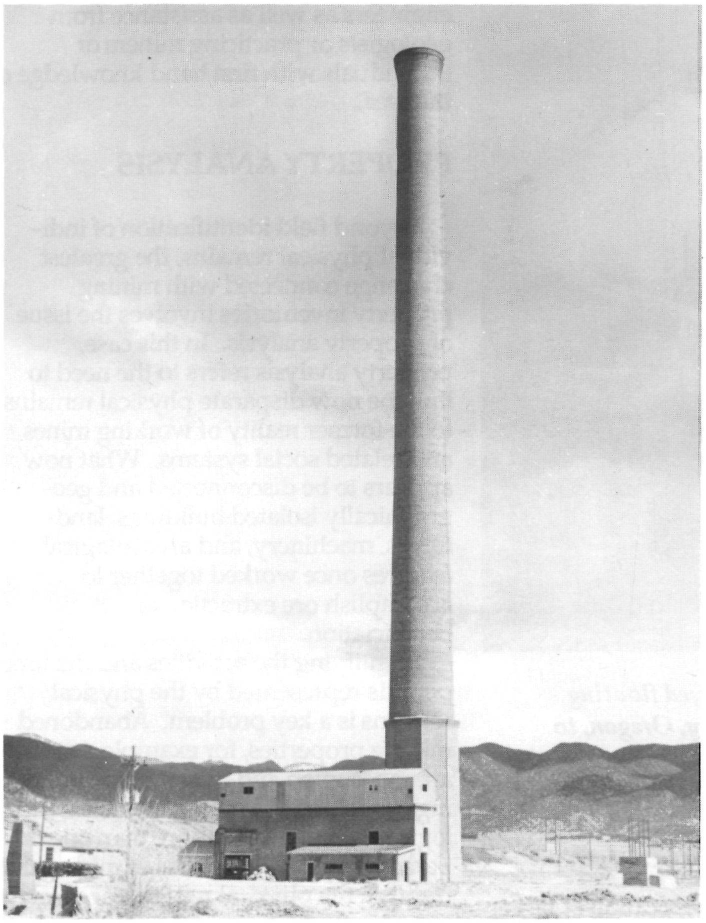
PROPERTY ANALYSIS

Beyond field identification of individual physical remains, the greatest challenge connected with mining property inventories involves the issue of property analysis. In this case, property analysis refers to the need to link the now disparate physical remains to the former reality of working mines and related social systems. What now appears to be disconnected and geographically isolated buildings, landforms, machinery, and archeological features once worked together to accomplish ore extraction or beneficiation.

Identifying the activities and the time periods represented by the physical remains is a key problem. Abandoned mining properties, for example, typically are reoccupied and may include buildings, machinery, landforms, and archeological remains from more than one time period. The new episodes of mining cut through the physical remains of older mining activities, making it difficult to interpret the engineering and other technological systems from earlier time periods. Sorting the physical remains by time period and activity into separate technological or social systems may be helpful. The location of the Tenabo Mill in central Nevada, for example, which was built in 1886 to process gold and silver ore, includes the mostly archeological remains of two separate beneficiation technologies: the Russell process in the original mill and the cyanide process installed in 1908. Evidence of both technological systems can be seen when viewing the extant physical remains today, but the earlier Russell process technology has been largely destroyed by the later cyanide operation (Hardesty, 1988).

IDENTIFYING PROPERTY TYPES

Mining properties may contain a great variety of resources representing the mineral-extraction process. Evaluation of these complex properties can be organized by noting that the processing of ore into metal includes the following three basic functions: **extraction** of the ore from the earth; **beneficiation**, which



Smelters, such as this one at the Ohio-Colorado Smelting and Refining Company in Salida, Colorado, represent one type of beneficiation plant.

upgrades the ore's value; and **refining**, which enhances the value of the ore/metal even further until it achieves a nearly pure state.

All three functions may occur within one mining property, such as at some Western or southern Appalachian gold mines, or may be miles apart, such as iron, copper, or lead smelters located great distances from mines. Although a universal description of mineral properties will not address all individual cases, the following provides a general guide to defining historic mining property types based on these three fundamental stages of mineral processing:

EXTRACTION

The property types associated with mine extraction sites can be generally classified into two categories reflecting the evolution of a mine: prospecting/mine exploration property types and mine development or exploitation property types. The distinction can be applied to hard rock, placer, and coal mines.

Prospecting/Mine Exploration Property Types

These property types are associated with the search for ore bodies. Hand-dug prospect pits, power-shovel trenches, bulldozer cuts, and drill holes, for example, are the physical remains associated with four different patterns of mine exploration technology. Some additional explanation will help to understand the origin of typical exploration activity.

Mining is a speculative industry. To discover metal, many test pits or prospects must be dug. According to the 1872 Mining Law, holding an unpatented claim requires a miner to do annual assessment work that might include digging another prospect hole in order to retain possessory title by demonstrating that a claim is still active. If a mining district has a producing mine, speculators employ a process sometimes known as grubstaking that involves paying prospectors to seek outcrops of ore and to excavate exploratory shafts or adits. In return, the prospector promises the speculator a percentage of any profits earned. In big speculative ventures in coal, iron, or copper areas, investors might pay crews to test lands they have optioned for purchase. In placer mines, pits as well as trenches may be found across streambeds or on benches where placer miners sought gold at bedrock, often without luck.

Given this sort of activity, holes abound in mining areas. These holes are not truly mines, but prospects. Individually, these prospects may appear to lack significance. However, prospects are often associated with the phase of a region's mining history that witnessed rampant speculation or boom and bust. Entire mining camps have arisen based not on actual metal production, but on the speculative investment in prospects. Thus, isolated holes — shafts or adits — may qualify as separate property types. In addition, a combination of research and field work may reveal a pattern of prospect holes on the land that offers physical evidence of the speculative phase of mining development in a given region.

These prospect holes may acquire additional significance if historical archeological evidence associated with an adjacent camp or equipment is found. If the material culture possesses sufficient integrity, it will help the archeologist in reconstructing the unwritten history of the mining property. Additionally, the prospect hole may have significance if it is associated with any of the following: the first settler of an area, a prominent miner with whom no other properties are associated, or to prehistoric or aboriginal mining.

Mine Development and Exploitation Property Types

These property types are associated with the definition and extraction of an ore body. Typically found at such locations are the physical remains of hoisting works such as headframes and hoist engines; excavations such as open pits or shafts or adits; ventilation systems such as air shafts or blowers; power systems such as steam boilers or electric generator houses; drainage systems such as Cornish pumps; water delivery systems; ore bins or tipples; transportation systems such as shortline railroads or ore cart runways; and maintenance and administrative facilities such as blacksmith shops, assay laboratories, offices, and worker's housing. These structures and systems are described in the nine-volume *Mining Library* published by McGraw-Hill in the 1910s. Their eight-volume *Library on Coal Mining* series does the same for that industry.

Hard rock mines were opened with shafts or adits (tunnels). The ore was removed from large openings called stopes. Creation of these large openings required the use of new support technologies such as square-set timbering and, later, concrete supports. A hoist and head frame over a shaft used a cable and bucket or cage to hoist ore; a horizontal adit had a level or slightly inclined rail system to tap the vein. An open pit or surface pit used earth-moving machinery to remove overburden and to extract ore. At the mine

Open mines may be found from coast to coast, wherever rock outcrops exist. A survey of existing literature and a file search should be conducted prior to field evaluation. This mine adit is located on the Tantiusques Reservation in Sturbridge, Massachusetts. (Wolfgang Lowy)

surface, waste rock was dumped and ore was stored in bins to await shipment to processing plants.

Coal mines were different from hard rock mines in that coal was usually ready for market after minimally separating it from waste rock by water or gravity (or both) and dumping it into bins for shipment. This all occurred in a tipple, located at or near the mine entrance. The development of the district around St. Clair, Pennsylvania, was characteristic of the anthracite regions of Appalachia in the nineteenth century. At the mine, coal was extracted by pit, shaft, or other standard methods, and then broken, cleaned, and sized at a surface plant called a breaker (used to crush the hard anthracite coal). Mine owners then loaded coal into railroad cars bound for the markets of Philadelphia or nearby industries (Wallace, 1988). There was no further beneficiation or refining. Some bituminous coal was converted to coke by a baking process in beehive shaped ovens, which removed impurities. Coke ovens were beneficiation plants, in the strictest sense, used to improve coal to meet the heat requirements of industry.

Placer gold mines, abundant in the West, required a different technology than either hard rock or coal mines. For example, a placer gold mine system might include dams, penstocks, flumes, ditches and holding ponds for water; moved gravels and rock piles; sluice boxes or long toms; hydraulic nozzles; camp buildings; support structures; and, if used, dredges and their support facilities. Placer mines can extend for miles along a streambed.

As technology changed, placer mining operations might also cover earlier operations, new tailing piles covering old workings. In the placer mines of Virginia City, Montana, gold miners in the 1860s first used simple sluice boxes and then hydraulic plants to extract gold nuggets and dust. After 1890, the Conrey Placer Mining Company used floating gold dredges on Alder Gulch to dredge gravel and wash the gold dust and nuggets from the waste, while also covering earlier mine debris. The gold was purified and melted into bars at an assay lab on site and shipped to the U.S. Assay Office in Helena. There was no further processing needed to sell the mine product to the purchaser, the Federal government (Spence, 1989).

The technical literature on placer mining is vast; see, for example, August J. Bowie, *Hydraulic Mining*, 1878; Robert Peele, *Mines Handbook*, 1918 ed.; Charles Janin, *Gold Dredging in the United States*, 1918; and the bibliography in Rodman Paul, *California Gold*.

BENEFICIATION

Except for coal, placer gold, or the rare cases involving placer silver, platinum, or copper, most minerals are extracted from the ground in an impure and excessively bulky state and need to be upgraded before shipment to a refinery. Beneficiation—the upgrading of ore to increase its value—is accomplished in a processing plant.[2] Beneficiation is a broad category, which includes many metallurgical processes.

The history of metallurgy is complex and rapid changes occurred during the nineteenth and twentieth centuries. Thus, one must be aware of changing processes used for metal beneficiation as well as the machinery developed to crush, concentrate, and separate metal from waste rock. Fortunately, the various processes used in connection with beneficiation property types are detailed in published textbooks. For example, Charles R. Hayward's *An Outline of Metallurgical Practice* (1929, revised 1940) describes over fifty different processes for extracting metals.

The complexity of beneficiation property types results, in part, from the way that the technology of milling systems responded to the increasing sophistication of mining practices. At the Oro Belle mine in the Bradshaw Mountains of central Arizona, to cite an example involving gold, the first prospectors of the 1860s used the donkey-powered arrastra to crush the ore and then used mercury to amalgamate the gold. In the early 1870s, a group of miners built a steam-powered arrastra. In 1888, the new owners built a standard ten-stamp mill to crush the ore. The sand-like ore then washed across copper plates where mercury captured or amalgamated with the gold. This mill was eventually expanded to include concentration tables, which produced a concentrate of lead, zinc, and gold, which was shipped to Colorado smelters. By the early 1890s, the cyanide process was introduced at the plant. This evolution was typical. Thus, a property might have an overlay of several technologies. Similar changes occurred in silver mills, lead and zinc

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[1] Beneficiation, in its strictest definition, includes every phase of upgrading mineral value, from the mine face to the refinery product. However, in its common use, the meaning of beneficiation is restricted to the processing of ore in a mill or concentrator, or otherwise preparing the ore for refining. In the Iron Range of Minnesota, concentrators were called "benificiation plants".

A coal tipple consists of the tracks, trestles, and screens where coal is processed and loaded. Coal tipples are good examples of Mine Development and Exploitation property types. Pictured is the Kay Moor tipple located along the New River in Kay Moor, West Virginia. (National Park Service)

Cyanide leaching tanks at the Hirshey Mine in the Chugach National Forest in central Alaska represent beneficiation processes employed widely in the United States in the early twentieth century. (U.S. Forest Service)

concentrators, and copper concentrators during the nineteenth and twentieth century.

In general, the development of concentration mills changed through time to reduce the amount of skilled labor required for each ton of ore processed. In the book *Cradle to Grave,* Larry Lankton discusses the evolution of technology and its impact on Lake Superior copper mining labor and strife. It is important to link the evolution of mining technology to the impact it had on management, labor, business, politics, and communities, besides the obvious role it had in the history of science and technology.

Iron, copper, lead, zinc, and other base metal ores commonly were crushed and received initial beneficiation in concentrators that were first based upon gravity and then upon flotation processes. Understanding which process was used will help the field team determine what type of crushers and/or separation machines were used. This will also help with architectural description since mills were designed around the interior machinery metallurgy not the reverse.

Smelters represent another type of beneficiation plant. A smelter may accept high-grade ore directly from a mine or receive the concentrate from a mill for further reduction by heat. The heat and fluxes of the smelting process removed further impurities and upgraded the ore into a form known as a matte. Early smelters were small scale and operated either adjacent to, or in proximity to, the actual mines. As transportation networks evolved and fuel, space, water, labor and other factors came into play, smelters were relocated away from mines. The early plants used simple log-, charcoal-, or coal-fueled fires to melt ores into a matte that was still not pure, but rich enough in content to ship to refineries and manufacturers.

Given the evolution of the smelting process, an early nineteenth- century Pennsylvania iron "plantation," a mid-century Midwest lead smelter, and an 1860s - 1880s Colorado silver-lead smelter would all be located near the mines. By the end of the century, new economies of scale and fuel demands were removing the plants from the mines to distant locales. In the process, the industry became identified with the large conglomerates created at the turn of the century such as Anaconda in copper, the American Smelting and Refining Company (ASARCO) in silver-lead (Marcosson, 1949; Marcosson, 1957), and U.S. Steel. Smelters either operated as independent corporations that bought ores from a number of producers or as part of an integrated system linking mine, mill, and smelter. Large smelters were built at rail centers and near fuel—at Pittsburgh; Pueblo, Colorado; El Paso; and the Salt Lake Valley—to serve many mining districts.

Certain smelting companies, like the Cambria Iron Co. at Johnstown, Pennsylvania, and the United Verde Copper Company at Jerome, Arizona, provide examples of the evolution in the direction of high-capacity smelters. Each mining company began with small furnaces with a capacity of a few tons per day; within three decades of initial operations, the firms had mammoth plants reducing thousands of tons of iron or copper ore. Cambria included coking ovens to prepare coal, iron furnaces, roller mills that produced railroad rails and iron wire all in a one mile long complex (Brown, 1989).

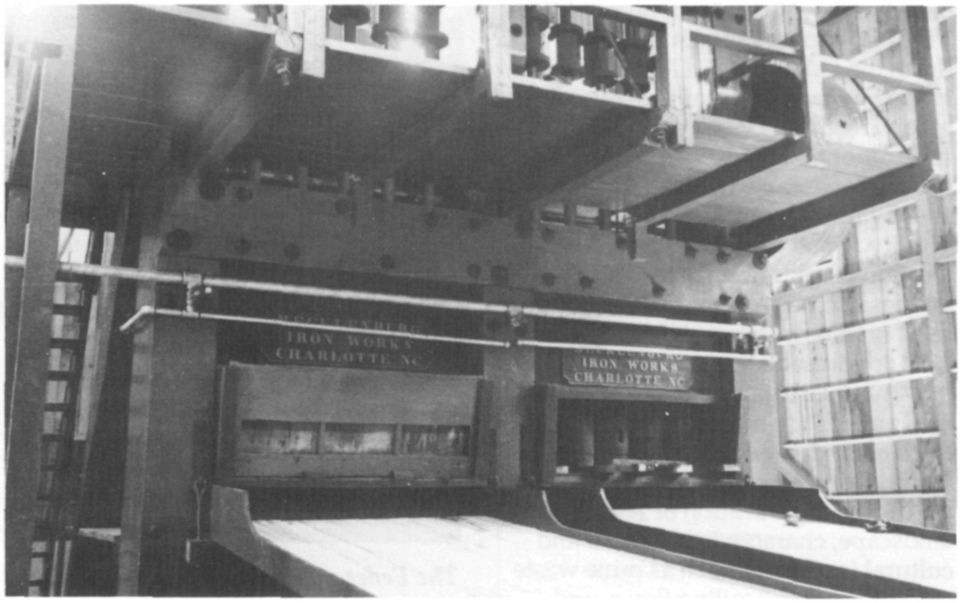
The above discussion reflects the complex nature of beneficiation as the process evolved over time. The broad overview provided is intended as a general introduction to the subject that will assist with the identification of property types associated with beneficiation.

REFINING

Refineries convert metal into a state of purity suitable for industrial use, manufacturing, or for commercial exchange. U.S. mints and U.S. assay offices refined the gold and silver amalgamated from mills. Although private banks, express offices, and assay offices might also contain the necessary furnaces to refine the metal, after 1866 Congress required them to sell their product to the U.S. mints. (Prior to 1866, several private assay offices minted gold coins for regional use as specie.) By the assay offices were operated by the Bureau of the Mint. These offices served the local mines by buying gold and helped the local economy by providing gold coins for the specie-short frontier economy, from the southern Appalachian gold fields to Alaska.

Base metals used by industry were refined at the larger smelters of the West or in Eastern refineries that offered access to international metal markets. Refineries were like smelters and operated in concert with them. The Eureka, Nevada, refinery, one of the earliest in the West, is discernable from the adjacent smelter by location and by archeological evidence. Refineries might also be associated with manufacturing works in Eastern cities, where the refinery might also be used to create blended metals called alloys. The great works of the New York City area and Chicago provided an array of metals and alloys to manufacturers. In general, field survey will be easier for refinery property types because of the amount of technical literature published about these large-scale, capital-intensive properties.

In addition to defining property types based on the three mineral processing stages, other historic mining property types exist. These property types include engineer-designed complexes, mining landscapes, and related properties.



Stamp Mills such as this one, located at the Reed Gold Mine in North Carolina, crushed gold ore into a sand-like consistency which was then washed across copper plates where mercury was amalgamated with the ore. The amalgamation process was widely employed in the United States until the early twentieth century, when it was replaced by the cyanide process. (Virgil Smithers)

ENGINEER-DESIGNED COMPLEXES

The ideal mining situation was the bonanza mine that had its own concentration mill on site; a smelter to reduce the product into nearly pure metal; a tramway or railroad haulage system connecting the entire works; and an infrastructure of power house and lines, company housing, store, and office. This situation most often existed in iron and copper camps. For example, by the end of the 1890s the Arizona Copper Company had an integrated complex designed by mining engineers. This complex included shaft houses with hoists that lifted the ore to ore bins, narrow gauge trains that collected and hauled the ore to concentration mills, and railroads that hauled the ore from the concentration mills to the company's smelter at Clifton, Arizona.

Most larger mines were part of an engineer-designed system. They were intricate industrial operations with every component ideally working in harmony to reduce costs, increase production, and maximize profits. Especially after the 1890s, mining engineers developed standard systems for mine operation. *The Mines Handbook* by Peele et al. describes in detail most of the components of the mine engineers' system. This system, which integrated massive operations to produce economies of scale, corresponded with the rise of big business in America. Massive operations created phenomenal profits, which often went into bigger plants. These engineer-designed complexes help define the twentieth-century operations at Minnesota's iron ranges, the copper mines of the Far West, the lead and zinc of the tri-state region of the Mississippi Valley (Illinois, Wisconsin, and Iowa), and the big gold mines of Cripple Creek, Colorado, and the Homestake of Lead, South Dakota.

On the other hand, smaller mine operations may have been designed by a skilled craftsman during the nineteenth century or before, or by an engineer, especially after the turn of the century. Yet, these are rarities. The lead district in the tri-state region of the upper Mississippi Valley, for example, is dotted with small mine pits where miners extracted abundant lead deposits during the antebellum period. These pits reflect a lack of system in mining as well as a lack of common knowledge about geology, ore deposits, and mining. Engineer-designed complexes reflect the development in the professional skills of mine engineering and allowed for the development of massive industrial corporations.

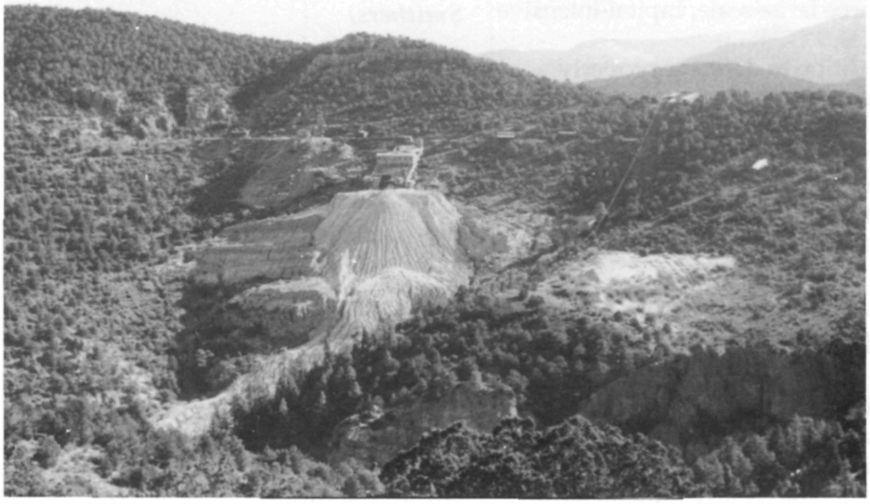
MINING LANDSCAPES

The National Register bulletin on *Guidelines for Evaluating and Documenting Rural Historic Landscapes* defines a rural historic landscape as "a geographical area that historically has been used by people, or shaped or modified by human activity, occupancy, or intervention, and that possesses a significant concentration, linkage, or continuity of areas of land use, vegetation, buildings and structures, roads and waterways, characteristic of open-pit mining landscapes found in places such as Bingham Canyon in Utah and the Mesabi Range in Minnesota, and and natural features." Given the extent to which mining activity represents a human activity that modifies the natural features of the earth, many mining properties will qualify as historic landscapes.

Landscapes may represent the most dramatic visual images of mining. Mining landscapes evoke images of time, place, and historical patterns associated with past mining epochs. Mining landscapes might include ravaged landscapes denuded by nineteenth-century hydraulic mining in the Mother Lode region of California, barren strip-mining landscapes of West Virginia, gaping holes in the earth dredging landscapes in Alaska characterized by mounded tailings piles lining great stretches of creek and river beds. In addition to the visual impact of the mining landscape, the land forms created by mining provide clues to past activity. Spoil piles often indicate the location of adits and shafts, and placer tailings can help define the methods used to mine a stream even if few artifacts are present.

Mining landscapes can be characterized and distinguished by historic patterns of land use such as strip-mining, hydraulic mining, or open-pit mining; the spatial organization or layout of the landscape; characteristic natural and cultural landforms such as mine waste rock dumps, mill tailing flows, and canyons; roads and pathways; vegetation patterns related to land use such as secondary growth of plants on mine waste rock dumps; distinctive buildings and structures such as headframes or cyanide mills or coal tipples; clusters of buildings and structures such as those at mines or urban settlements; and small-scale features such as mine claim markers or fences. Landscapes can be described and evaluated by utilizing the methodology applied to rural historic landscapes (see *Guidelines for Evaluating and Documenting Rural Historic Landscapes.)* In most cases, mining landscapes will be defined as historic districts for the purposes of National Register nomination.

The Federal Lead Company's mill in Missouri Mines State Park near Bonne Terre, Missouri is an example of a large scale concentration plant. This facility upgraded ore into a concentrate for shipment to the smelter at Herculaneum on the Mississippi River. (Robert Spude)



Tailings piles, such as the ones at the Socorro Mines in Catron County, New Mexico, can be important landscape features that contribute to the significance of a mining property. (Chris Wilson)

RELATED PROPERTY TYPES

Mining properties may include buildings, structures, or systems that support mine operations such as entire communities complete with stores, schools, and other properties. For example, housing and support facilities such as employee homes, machine shops/blacksmith shops, and power houses may be located on mining property. Rail haulage and road systems may also appear. McGill, Nevada; Madrid, New Mexico; and Calumet, Michigan are examples of one-time major mining towns that include housing and support facilities, along with the usual commercial and service industries. These related property types should be recorded as components of the overall mining operation.

In remote placer districts, such as in parts of Alaska, isolated mining camps — tent frames and small cabins — that once provided shelter frequently remain as monuments to the tenacity of early prospectors and miners. Water pipelines and ditches (like the Fairhaven Ditch across Bering Land Bridge National Preserve) snake around the contours of hills for miles, often far from any other evidence of mining activity. Small mining camps may contain a limited number of buildings and structures: one or two cabins or tent frames and a few outbuildings such as a shed, several dog houses, and a cache. These small camps, while important as mining property types, are often associated with a number of other activities including hunting, trapping, and woodcutting.

Potentially significant mining-related properties can also be located in places distant from the actual mine locations. These properties include mine union halls, hydro-electric plants, school of mines laboratories, courthouses, and mine promoters' homes. Although important to the history of mining, these properties require little discussion in this bulletin. They can be evaluated and nominated according to standard practices outlined in *How to Complete the National Register Registration Form* and *How to Complete the National Register Multiple Property Documentation Form.*

IV. EVALUATION

APPLYING NATIONAL REGISTER CRITERIA TO MINING PROPERTIES

To be eligible for listing in the National Register of Historic Places, a mining property must be significant in American history, architecture, engineering, or culture and possess integrity of location, design, materials, workmanship, feeling, and association. In addition, the mining property must meet one or more of the four National Register criteria:

A. be associated with events that have made a significant contribution to the broad patterns of our history; or

B. be associated with the lives of persons significant in our past; or

C. embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that posses high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. have yielded, or may be likely to yield, information important in prehistory or history.

CRITERION A

Under Criterion A (association with "events that have made a significant contribution to the broad patterns of history") a mining property may qualify for listing in the National Register through its connection with historic themes. Applicable areas of significance (listed in *National Register Bulletin 16A)* include the following:

Agriculture: Some early mining properties were operated as part of plantations or haciendas which included the production of food stuffs for workers and wood for furnaces. Hopewell Furnace National Historic Site, a restored iron plantation in Pennsylvania, exemplifies this type of early mining operation, as do presently unevaluated Mexican-era mines of the Southwest around Tubac, Arizona.

Business: The development of big business has been associated with extractive industries generally, and oil and the iron and steel industries specifically. The captain of industry or robber baron, depending on the view of the writer, is exemplified by such families as the Rockefellers, the Douglases of Arizona, and the Guggenheims.

Commerce: Mining properties such as the Julien Dubuque lead mines of Iowa produced minerals for exchange and barter. Other commerce-related mining activities may include those properties associated with attempts to corner certain metals markets, such as Jay Goulds' effort to corner gold in the 1860s and the Secretan syndicates attempt on copper in the 1880s. Virtually all successful mines helped to increase commerce and trade.

The Ross Furnace in Westmoreland County, Pennsylvania is one of several hundred charcoal iron furnaces which remained in use in Western Pennsylvania long after they had been phased out in the eastern part of the State. This furnace was abandoned in the 1850s. (Diane B. Reed)

Community Planning and Development: Company towns often were found adjacent to mines, especially in the base metal and coal industries. Some town planning was unique such as Phelps-Dodge's mission-style company towns at Ajo, Arizona, and at Tyrone, New Mexico.

Conservation: Mining has often been viewed as the antithesis of conservation. Major disputes over resource conservation have been caused by the attempts of corporations to exploit ore bodies. An example would include the Ballinger-Pinchot feud which involved efforts to develop an Alaskan coal field intended to provide fuel for a proposed smelter for working Kennecott copper ores. This plan violated the conservation philosophy espoused by U.S. Forest Service Chief Gifford Pinchot and led to a controversy that eventually caused serious fractures both in President William H. Taft's cabinet and in the Republican party.

Economics: The accumulation of phenomenal wealth from a few mines caused massive speculation in the industry as well as in the stock markets of the world. The brief economic panic of 1907, for example, is associated with the financial machinations of Butte's copper kings and the collapse of rampant speculation in the mines of Nevada. The history of monetary processes is closely tied to the precious metal industry. The Panic of 1893 was caused by the demonetization of silver; its impact was the near total collapse of the Western silver mining industry.

Education: Schools of mines played a significant part in the development of public education, especially in the West where training was needed to operate mines and mills. These colleges often had laboratories or educational mines in mining districts. A number were located in mining districts, such as at Fairbanks, Alaska; Houghton, Michigan; and Butte, Montana. In certain instances, schools even owned and operated mines. Examples include Harvard University's ownership of the Conrey Placer Company of Montana.

Engineering: After 1890, many mining complexes featured components designed by mining engineers. This would include water and transportation systems built to serve mining operations. Noteworthy examples of mining engineering would fall under this area of significance. The ascendance of the mining engineer over the skilled craftsperson was a gradual process. Many mining properties can demonstrate the nature of the change and provide evidence of the intermediate steps in the process of change.

Ethnic Heritage: Alibates Flint Quarries National Monument in Texas and Pipestone National Monument in Minnesota offer examples of extractive technology and resource use by American Indians. American Indians worked in the California gold fields, Arizona copper mines, and Alaskan mines. Spanish and Mexican mining predates American mining in the Southwest; Mexican-Americans played an important role in the early development of mining in the former Spanish provinces. Immigration of ethnic groups from the mining regions of Europe and Latin America may be evident at mining properties. The gold mining districts of the West attracted numerous Chinese laborers as well.

Exploration/Settlement: This area of significance applies to mining properties that represent exploration or early settlement. This includes properties associated with the prospecting, discovery, and development of a region. The gold rushes in California, the Rocky Mountains, and in Alaska a half century later are strongly associated with early settlement of their respective regions.

Invention: Mining properties may be related to the discovery of a new metallurgical process, the introduction of new machinery, or to the development of new methods of transport and power transmission. An example would be the long-distance power transmission plant at Telluride, Colorado.

Industry: Mining properties may be related to the technology and process of managing materials, labor, and equipment to produce goods and services, such as refineries that converted metal into a state suitable for industrial use, manufacturing, or commercial exchange. Iron and copper plants, engineer-designed complexes that often had concentration mills, smelters, railroad haulage systems, and infrastructures of power houses and lines, company housing, stores, and offices, are other types of mining properties with associations to the industry area.

Labor: Mining properties may be related to mine accidents, miners strikes, unions, and other aspects of labor history. The tragedy at Ludlow, Colorado, or the bloody mine wars of West Virginia are two examples of labor controversies.

Law: Mining properties may be related to the development of mineral law or to localities connected with significant litigation which caused the reinterpretation of mineral law. For example, Nevada's history is closely associated

Mining properties such as the Mariscal Mine in Big Bend National Park in Texas may be eligible for listing in the National Register under Criterion D. The processing plant and the waste rock piles at the Mariscal Mine may yield significant information about mining technology. (David G. Battle)

with mining law, especially the evolving legal perspectives related to the Mining Law of 1872.

Literature: Mining properties may be related to literary figures such as Mark Twain, Jack London, Bret Harte, Rex Beach, Mary Halleck Foote, and other writers who lived in Western mining camps and used their experiences as a basis for their writing. Many of the Muckrakers or mining critics wrote about frauds in the extractive industries or published accounts of mining safety problems. One such critical examination of mining appears in Upton Sinclair's *King Coal*.

Military: Mining properties may be related to military intervention during miners strikes, military efforts to protect miners working in dangerous frontier conditions, and military expeditions which acted to stimulate interest in a particular area's mineral resources.

Politics/Government: Mining properties may be related to the development of mining districts or miners' meetings held to formulate laws for a district. Other properties with associations to the politics/government area may be related either to political debates over federal regulations, like the silver issue of the 1870s-1890s, or to the political aspirations of such individuals as the Western bonanza kings. These bonanza kings include California's George Hearst, Colorado's Simon Guggenheim, Montana's William A. Clark, Nevada's James G. Fair, and others who used their mining wealth for political ends.

Science: Mining properties may be related to important developments in geology, metallurgy, and other aspects of mining engineering. For example, early geologist Douglass Houghton and scientist Charles T. Jackson aided in the description and development of Midwest mineral deposits.

Social History: Mining properties may be related to corporate efforts to protect the well-being of workers through the construction of company hospitals and libraries, sponsorship of humanitarian endeavors, and other aspects of social history.

CRITERION B

Under Criterion B (association with "persons significant in our past") a mining property will possess significance if directly related to a historically significant person. Examples would include properties linked to the following aspects of a person's historical significance: Herbert Hoover's mine engineering career before he entered politics, financier Bernard Baruch's rise to power through mine speculation dealings, General Sherman's early years as a California gold dealer, or bonanza king Horace Tabor's association with the Matchless mine in Leadville, Colorado. Applicable themes under Criterion B may include exploration/settlement, invention, law, literature, politics/government, and labor. (For additional information about Criterion B, see the National Register bulletin on *Guidelines for Evaluating and Documenting Properties Associated with Significant Persons.)*

CRITERION C

Under Criterion C, a mining property possesses significance if it embodies "the distinctive characteristics of a type, period, or method of construction, or represents the work of a master, possesses high artistic values, or represents a significant and distinguishable entity whose components may lack individual distinction." Mining properties are often eligible for National Register listing within the following categories:

Architecture: Mining properties have an architecture of their own, especially the industrial complexes of mills, hoist houses, and smelters. Innovations in the use of metal and concrete have received broad application in the realm of mining. The multitude of gables and roof slopes has inspired other architectural developments. Noteworthy vernacular architecture is sometimes evident in mine buildings constructed by particular ethnic groups, such as the Cornish influence seen in Central City, Colorado.

Engineering: The field of mining engineering and its derivatives, such as metallurgical engineering, witnessed tremendous progress in the last century and a half. Mining properties often provide excellent illustrations of the changes in methods of mining technology over time. The work of master engineers, such as Daniel Jackling's design for the open pit at Bingham Canyon, Utah, have significance based on their design and engineering innovation.

CRITERION D

Under Criterion D, a mining property is significant if it contains information important in prehistory or history. Eligible resources which may provide such information include standing buildings or structures; surviving machinery; landforms such as mill tailings or mine waste rock dumps; or less visible physical remains such as privy pits, trash dumps, prospect pits, collapsed headframes, building foundations, roads, and machine pads or anchor piers. **Application** of Criterion D to mining **properties** requires the development of a good research design that not only identifies the research questions that are important to mining-related scholarship or science but also the information that is needed to answer the research questions. The information value of what remains can be evaluated within a systematic framework based on the following: developing research questions, identifying data requirements, and assessing the property's information content.

Research Questions

The research questions used under Criterion D should be important and derived from a scholarly field, or combination of scholarly fields, such as history of technology, historical archeology, archeology, anthropology, geography, architectural history, or landscape architecture. Among others, questions about variability and change in mining technology, mining society and culture, and mining landscapes should be considered. The conditions under which innovations in mining technology take place and are accepted or rejected (e.g., Basalla 1988), for example, or the impact of changes in mining technology upon the workplace (e.g., Dix 1988, Lankton 1991) are likely to be important. Similarly, questions about community formation (e.g., Hogan 1990), the miner's domestic household, the spatial organization of mining settlements, the production and consumption of commodities in the mining frontier marketplace, ethnicity and ethnic relations, gender, and social structure are likely to be important to scholarship on mining society and culture. And yet another group of questions that may be important to the application of Criterion D have to do with the characteristics and evolution of mining landscapes (Francaviglia 1992).

Identifying Data Requirements

"Critical information" assessment is the next step in Criterion D evaluation. The type of information needed to answer each of the questions identified in the research design must be stipulated. Questions about mining technology, for example, might require information about variability and change in architectural arrangements, the spatial arrangement of work-related activities, the arrangement and type of machinery, and landforms. Similarly, the information needed to answer questions about the mining frontier marketplace may include the consumer behavior of a miner's domestic household, retail and wholesale store inventories, transportation costs, and factory production.

Field Assessment of Information Content

The last step in evaluating the significance of a mine under Criterion D is field assessment. How does one know that a property contains critical information? First of all, it is necessary to make an inventory of what remains at the property that can provide information. The remains containing information may be buried or visible on the surface and may take the form of isolated artifacts, archeological features such as trash dumps or privy pits or wells, standing buildings and structures, machinery, or landforms such as mill tailings or mine waste rock dumps. Next, assess the quantity and quality of information contained in the remains at the property. Domestic trash dumps, for example, often contain artifacts carrying information about the consumer behavior of domestic households, household organization, gender, ethnicity, and social structure.

CRITERIA CONSIDERATIONS

Ordinarily cemeteries, birthplaces, or graves of historical figures; properties owned by religious institutions or used for religious purposes; structures that have been moved from their original locations; reconstructed historic buildings; properties primarily commemorative in nature; and properties that have achieved significance within the past 50 years *shall not be considered eligible* for the National Register. However, such properties *will qualify* if they are integral parts of districts that meet the criteria or if they fall within the following categories:

A. a religious property deriving primary significance from architectural or artistic distinction or historical importance; or

B. a building or structure removed from its original location but which is significant primarily for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or

C. a birthplace or grave of a historical figure of outstanding importance if there is no other appropriate site or building directly associated with his or her productive life; or

D. a cemetery which derives its primary significance from graves of persons of transcendent importance, from distinctive design features, or from association with historic events; or

E. a reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or

F. a property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own historical significance; or

G. a property achieving significance within the past 50 years if it is of exceptional importance.

Examples of historic mining properties that generally will not qualify for listing in the National Register include mining resources that are less than fifty years old, reconstructed mining towns that provide a contemporary portrayal of the frontier mining era, and collections of mining artifacts removed from their original locations and placed in museum collections. However, some of these properties may qualify for the National Register when they fall within categories A through G listed above. Examples include the following:

Moved Properties—Relocated properties generally do not qualify for the National Register. Under ordinary circumstances, this requirement places few constraints on the nomination of mining resources since they are not inherently moveable. However, certain components of mining properties are subject to relocation. For example, a shack used to store blasting powder may be small enough to have been moved from an inactive mining property to an active one. In addition, all manner of mining equipment is portable. Such equipment, classified as objects for National Register nomination purposes, would include ore carts, stamp mill batteries, drilling implements, tram cars, steam engines, water wheels, flotation tanks, and many other possibilities.

In general, if buildings, structures, or objects associated with mining activity are moved to other mining locations, these resources can be eligible as contributing features of a mining property provided that the most recent relocation occurred over fifty years ago. In addition, the moved resource must contribute to the significance of, and fall within the period of significance of, the mining property to which it was moved. If buildings, structures, and objects are more than fifty years old, but were moved less than fifty years ago, these resources will not contribute to the significance of the property. Although recently moved resources may not contribute to a property's significance, the mining property may still be eligible if it is predominately greater than fifty years old and retains integrity. Buildings, structures, and objects removed from their original locations and placed in museums for public display will not be eligible.

Resources Less than 50 Years Old—A historic mining resource achieving significance within the past 50 years can be listed in the National Register if it is exceptionally important. To qualify, a mining resource must be associated with important recent themes or developments (such as World War II) that scholarly or professional research has recognized as having a significant impact on the history of mining activity.

For example, certain less-than-50 year-old uranium mines may be eligible for the National Register. Congress created the Atomic Energy Commission (AEC) following the conclusion of World War II. Shortly afterwards, the AEC acted to stimulate uranium production by offering discovery and development bonuses. This practice fostered a uranium mining boom that continued until the bonus program experienced severe cutbacks in 1958. If sufficient scholarly documentation has been produced to demonstrate that particular uranium mines played exceptionally important roles in the development of the nation's nuclear capabilities, these mines may be eligible for listing in the National Register even though they are less than 50 years old. Establishing exceptional importance will require that such mines be compared with other uranium mines having similar associations and qualities in order to identify the strongest candidates for National Register listing.

INTEGRITY

Integrity is the ability of a property to convey its significance. To be listed in the National Register, a property must not only be shown to be significant under the criteria, but it also must have integrity. The National Register recognizes seven aspects or qualities that, in various combinations, define integrity. The seven aspects of integrity consist of the following: location, design, setting, materials, workmanship, feeling, and association. To retain historic integrity, a property will always possess several, and usually most, of the aspects.

When assessing the integrity of a mining property, it is important to remember that the National Register will accept significant and distinguishable entities whose components may lack individual distinction. As discussed elsewhere in this bulletin, the passage of time, exposure to a harsh environment, abandonment, vandalism, and neglect often combine to cause the deterioration of individual mining property components. For example, buildings may have collapsed, machinery may have been removed, and railroad tracks may have been salvaged. However, the property may still exhibit a labyrinth of paths, roads, shaft openings, trash heaps, and fragments of industrial activity like standing headframes and large tailings piles. Although these individual components may appear to lack distinction, the combined impact of these separate components may enable the property to convey the collective image of a historically significant mining operation. In essence, the whole of this property will be greater than the sum of its parts. In such cases, a mining property may be judged to have integrity as a **system** even though individual components of the system have deteriorated over time.

Because most historic mining properties will be abandoned and in poor repair, special care must be taken when evaluating integrity. The integrity of a mining property cannot be judged in the same fashion as the integrity of a building. In some cases, buildings and objects related to mining will have been relocated and many original construction materials will be gone. The following sections explain how the seven aspects of integrity relate to historic mining properties.

Numerous small mining camps sprang up during the boom years in the Mining West. Independence was founded during Colorado's silver rush, but was abandoned by 1900. Towns like Independence once dotted the West, but most have deriorated because of neglect. In spite of its deterioration, Independence, and other mining properties like it, may retain integrity as a significant and distinguishable entity whose components lack individual distinction. (William E.

LOCATION

Integrity of location means that a mine or mill remains in its original location. A place where mining once occurred is not inherently moveable, but components used to conduct mining or milling can be moved. Because machinery was often moved to several different mining properties during its lifespan, relocated historic mining equipment (i.e., equipment over fifty years old) can retain integrity under certain conditions. For example, 100-year-old mining equipment may have been moved to a newer mine that first went into operation seventy years ago. Although this equipment is not in its original location, it can contribute to the significance of the property since it has been in place for over fifty years.

In other cases, a mine may be historic (i.e., over fifty years old) and equipment at the mining location may be historic (i.e., over fifty years old), but the equipment may have been moved to the location less than fifty years ago. Historic equipment which has been at a mining property for less than fifty years will not contribute to a property's significance. However, this equipment will not necessarily detract from the property's integrity provided that the equipment generally serves to complement the setting.

Machinery moved explicitly for the purposes of display in a museum, park, or other interpretive site completely divorced from the place of historic mining activity has lost integrity of location. Machinery moved to "artifact gardens" also lacks integrity.

DESIGN

As mentioned earlier, mines and mills evolve through time with the introduction of new machinery or technology or the expansion of the mining operation. This evolution means that plants found in an unaltered state are rare. Thus, contemporary evaluation of a mill's integrity should not only be based on its conformance with an original construction plan, but also on its ability to illustrate the property's evolution through time. However, in cases where the property has undergone significant alterations during the past fifty years, the evolutionary process may result in a loss of integrity.

Mining operations were designed to follow established mine engineering practices that involved the flow of ore from the mine to the mill to the refinery. The engineering flow chart is essential in understanding the integrity of design. The lack of a minor feature in a system should not detract from its integrity, much in the same way that a missing cornice detail should not result in a loss of integrity for an entire house. However, the cumulative number of missing components must be taken into consideration.

When considering the cumulative loss of features, the evaluator must be sure to include buildings and machinery as well as the designed landscape, the moved earth, and piled stones or debris. For example, when evaluating a placer mine which has a historic hydraulic nozzle found in place but lacking any of the connecting system or evidence of canvas or metal pipes, take into consideration any earth works used to support the system. The pipe may be piled nearby to avoid being split by winter freeze or washed out by early spring flood. In this case, the hydraulic system may still have integrity of design because the machinery and earth works were found as they were meant to be in mid-winter.

Underground works were designed as part of the mine system and, under some conditions, may receive consideration when establishing integrity of design. However, the underground works may be inaccessible and need not be inspected for National Register integrity if the mine is unsafe. The majority of underground mines are extremely unstable and should never be entered unless a State mining inspection has certified their safety. Thus, design integrity will generally be limited to the ability to reconstruct the flow chart from the mine opening and beyond.

The original setting of the Crystal Plant near Marble, Colorado is an integral part of the significance of the property. (J. Heywood)

SETTING

Historic mines were industrial complexes that contained a multitude of functions. In many cases, the industrial features typical of a mining property are not pleasing to the eyes of contemporary viewers. For example, use of dredges may have left unsightly tailings piles that stretch for miles along stream beds. In other cases, a historic mining are may be littered with abandoned machinery and dilapidated buildings and structures. The appearance createdby these vestiges of bygone industrial activity represent important aspects of setting that can actually contribute to the integrity of a mining property.

Modern day instrusions can compromise the setting. Attempts to artificially empellish a mining property's setting can detract from the property's integrity. For example, the introduction of false-fronted boom-town structures can create an inappropriate setting that lacks historic authenticity. Other modern intrusions include recent mining activity activity that can compromise integrity of setting through the introduction of newer mass mining systems that destroy the historic mining property or leave it isolated. Also, recent settlement or development associated with gambling initiatives in a historic mining location can have a negative impact on integrity of setting.

MATERIALS

Retaining integrity of materials requires evidence that sympathetic materials have been used during the course of previous repair or restoration of mining properties. Thus, a mine tramway with wooden supports should have been repaired with in-kind wooden materials. Because mine structures were often unpainted and expected to deteriorate, previous restoration efforts should have used untreated wood with the expectation that it would eventually need to be replaced too. However, inappropriate painting of mining properties will not automatically amount to a loss of integrity.

WORKMANSHIP

To the largest extent possible, mining properties should retain evidence of original workmanship. For example, the integrity of workmanship should be maintained in cases where an underground mine is open to the public. This would include preservation of such features as square-set timbering systems, the protection of pipe lines and track, and retaining the feel of the confined working space.

FEELING

As abandoned industrial properties generally located in isolated areas, the sites of historic mining activity often evoke a strong sense of feeling when viewed by contemporary observers. Since mineral resources are non-renewable, mines close when ore reserves are depleted. Structures and equipment are simply abandoned. The image of abandonment has attracted more popular attention than active industrial operations. The feeling of a deserted historic mine can help reflect the character of the boom and bust cycles of mining regions. The loss of this feeling of isolation and abandonment due to encroaching modern development can diminish the integrity of a mining property.

ASSOCIATION

Integrity of association will exist in cases where mine structures, machinery, and other visible features remain to convey a strong sense of connectedness between mining properties and a contemporary observer's ability to discern the historical activity which occurred at the location.

Three brief examples may help to summarize the process of applying integrity standards to mining properties. The first example involves those rare cases where a mining property consists of a complete mining system including shafts, transportation facilities, extant mill buildings, worker housing, and other aspects of the overall system. In such cases, the property would have integrity.

In the second, more typical, example, a mining property would lack visible buildings or contain only buildings that had been altered extensively. However, the property would have associated features like mine shafts, headframes, tramways, house and mill foundations, tailings piles, trash dumps, cemeteries, privies, and other isolated objects. Although buildings may be lacking or in a deteriorated state, this property would have integrity as long as key aspects of the mining system remain visible.

In a third case, visible buildings might remain extant, but the buildings may have been totally altered and the fundamental components of the mining system may have been destroyed by modern development. This property would have lost integrity.

The important principle inherent in each of these three examples is that the integrity of mining properties will frequently hinge not so much on the condition of the extent buildings, but rather on the degree to which the overall mining system remains intact and visible. This method of evaluating integrity requires a holistic outlook that comprehensively considers all the component parts of a **mining system**. If clear physical evidence of a complete system remains intact, deterioration of individual aspects of the system may not eliminate the overall integrity of the resource.

V. DOCUMENTATION AND REGISTRATION

How to Complete the National Register Registration Form and *How to Complete the National Register Multiple Property Documentation Form* contain specific instructions for completing individual and multiple property nominations. The following discussion will focus on special considerations related to the nomination of mining properties. This discussion begins with a brief overview of the different nomination formats and the circumstances under which one format may be employed instead of another.

The National Register lists individual properties, including districts, sites, buildings, structures, and objects. Multiple property submissions contain groups of properties, which are related by common historical associations or physical characteristics and which are nominated under a single "cover document."

The National Register Registration Form (NPS Form 10-900) should be used for the nomination of individual districts, sites, buildings, structures, and objects related to mining. This format is used in situations involving the nomination of an individual standing structure or building such as a single powder shack, mill, or headframe. However, individual mining resources generally do not exist in isolation. Based on the premise that individual mining resources will usually serve as single elements of larger mining systems, only a relatively small percentage of mining resources will be nominated as individual buildings or structures.

Given the prevalence of mining systems, the historic district is a common framework for nominating a concentrated assemblage of related mining resources to the National Register. The National Register defines a district as follows: "A district possesses a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united historically or aesthetically by plan or physical development." This definition aptly describes many mining properties. Most potentially eligible mining properties do not consist only of a single resource, but rather will include a discrete historical area containing a grouping of functionally related resources that all played a part in the extraction, refinement, and production of minerals. Historic districts are nominated on the National Register Registration Form.

A discontiguous district may be relevant to the nomination of mining properties. A discontiguous district is composed of two or more definable significant areas separated by nonsignificant areas. According to the National Register Bulletin on *How to Apply the National Register Criteria for Evaluation* A discontiguous district is most appropriate where

- elements are spatially discrete;

- space between the elements is not related to the significance of the district; and

- visual continuity is not a factor in the significance."

These three factors could apply to many mining properties. Given the large-scale nature of certain mining activities, elements of many mining systems will be separated by spaces unrelated to the significance of the district. Among many possibilities, discontiguous districts may be most appropriate for the nomination of mining properties involving linear systems like tramways, ditches, and flumes. Ditch and flume systems, for example, may have periodically terminated by dumping water into streams. Water may then be diverted back into the same system several miles downstream. In this case, the stream itself may not be included in the district, but the ditches and flumes would be elements of a discontiguous system.

In another example, an aerial tramway originally built to transport copper ore to a smelter several miles away might be nominated as a discontiguous district containing both the tramway and the smelter. Although first built as a linear system, many elements of the system may have lost integrity today. All the tram towers may have been removed and the entire tram route may be covered with forest growth not present during the period of historic significance. However, the copper mine, the smelter, and several tram tower pads may remain clearly visible today. These elements of the original tram system could be nominated as a discontiguous district. A discontiguous district is nominated on a National Register Registration Form.

The Multiple Property Documentation Form (NPS Form 10-900-b) is used to document a group of significant properties linked by a common historic context. The Multiple Property Documentation Form is not used to nominate properties, but provides a historical overview, defines property types related to the overview, and outlines the significance and registration requirements for the property types. Individual properties associated with the historic context are nominated on a National Register Registration Form. An example might involve several gold mines dispersed across a given county, all of which produced ore for refinement at a mill located some distance away from each of the mines. The historic significance of the mines and the mill could be outlined in a historic context titled "Gold Production in Grand County, 1874-1893." In terms of property types, all the mines can be classified as an extraction property type and the mill could be categorized as a beneficiation property type. The registration requirements for property types establish a benchmark for defining eligibility for listing.

The historic context documentation pertaining to "Gold Production in Grand County" and related property type information is included on the Multiple Property Documentation Form. Within the multiple property framework, separate nominations for each of the individual mines, the mill, and any historic districts must be prepared using registration forms (NPS Form 10-900). The advantage of this approach is that one "cover document" can be used to expedite the documentation and nomination of a number of separate properties.

Because mining properties are often large and complex resource types, several historic contexts may be required to convey the overall significance of a mining property. However, nominations can be submitted before all associated historic contexts have been documented. Once a single historic context has been documented on a Multiple Property Documentation Form, related property nominations can be prepared and are submitted to the National Register. When other historic contexts are documented and property nominations completed, these can be submitted to the National Register at a later date as amendments to the original Multiple Property Documentation Form. Thus, the multiple property format offers a flexible mechanism for nominating groups of mining properties over a period of time.

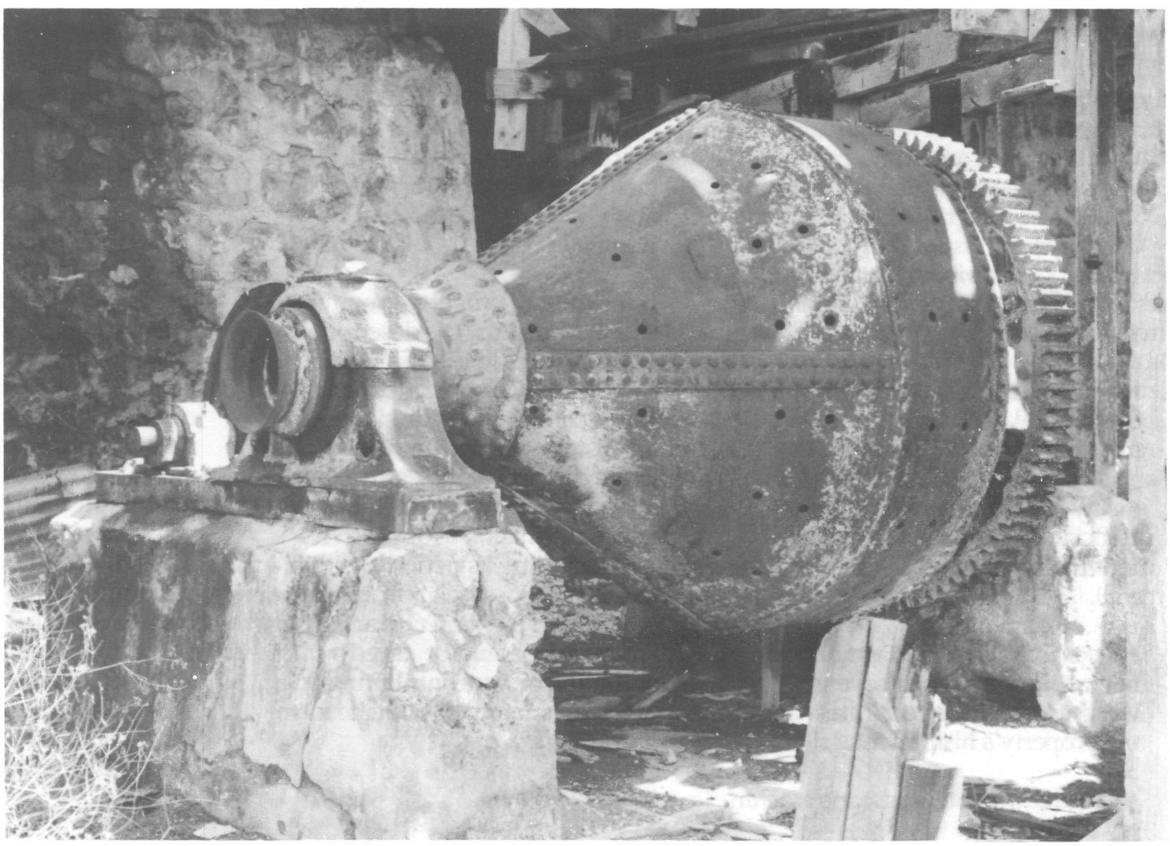
Situations will arise where individuals involved in the preparation of nominations will ask whether a historic district nomination is most appropriate for a given mining property or whether a multiple property nomination ought to be undertaken. A multiple property submission will usually be appropriate in cases where separate mining resources are related by a common historic context or theme, but are spatially separate. An example would involve several mine properties associated with a mill where all the ore within a mining region was brought for refinement. In spite of the obvious historic association between the mines and the mill, it may be that the transportation systems leading from the mines to the mill have lost their historic identity over the years. Another possible scenario would involve a case where the same hypothetical mill is located so far away from the mining property that creating a historic district is not justified. In these situations, nominators should adopt the multiple property format.

A district nomination generally will be appropriate in cases where all of the elements of an intact mining system are located within a contiguous geographic area. The size of such an area might vary from a small parcel of less than one acre, which includes a few buildings and a mine shaft opening, to a broad expanse extending over a thousand acres and including mines, mills, tramways, flumes, roads and other related pieces of machinery and equipment. In addition, all the elements of the district must retain their historic associations with one another.

Whether preparing individual property nominations or multiple property nominations, the National Register Registration Form plays a role. Several sections of the registration form are of particular importance when nominating mining properties. These sections include #7 (description), #8 (significance), and #10 (boundaries). Each of these elements of the individual form will now be examined in greater detail.

SECTION 7: DESCRIPTION

The description section of an individual registration form should begin with an introductory paragraph that briefly describes the property, notes its major physical characteristics, and assesses its physical integrity. Additional paragraphs should support the introductory paragraph and provide a more detailed description of the property. This additional material should



As a potential source of information about technological innovation, mining machinery should be discussed in the description section of a National Register nomination. This ball mill at the Socorro Mines in Catron County, New Mexico was used in the cyanide processing of ore. (Chris Wilson)

During the nineteenth century immigrants from mining regions throughout the world arrived in the new mining fields of America. Among these immigrant groups were the Cornish, who used their homeland building techniques to establish communities such as the upper Mississippi River lead district town of Mineral Point, Wisconsin, shown here. Ethnic group contributions to the development of a mining area should be described in the significance section of a nomination. (State Historical Society of Wisconsin)

also discuss the property's historic and current condition, and identify and date of any alterations, additions, or other changes that have affected the historic evolution and integrity of the property.

Other specific issues that should be addressed in describing mining properties will include discussion of the following:

- Natural features that contributed to the original decision to conduct mining activity in the area.

- Any landscape modifications associated with historic mining activity (i.e., tailings piles, gob piles, etc.).

- Deterioration due to vandalism, neglect, lack of use, or severe weather, and the effect it has had on the property's historic integrity.

- Original and other historic machinery still in place.

- Linear systems within the property such as canals, ditches, railroads, railroad beds, roads, and tramways including their approximate length and width and the location of terminal points.

If the mining property is nominated as a historic district, the description section also should discuss whether or not all the individual components of the resource contribute to the significance of the historic district. In determining whether district resources are contributing or noncontributing, consider specific information about each resource including its period of significance, function, association, information potential, and physical characteristics. All resources should be keyed as contributing or noncontributing on a sketch map submitted with the form.

SECTION 8: SIGNIFICANCE

The statement of significance should begin with a paragraph summarizing the significance of the mining property. This paragraph should explicitly discuss how the property meets the National Register criteria, including the criteria considerations, and how it represents all periods and areas of significance indicated on the form. The opening paragraph should be followed by a discussion of the property's historic context. Additional facts directly pertaining to the property's eligibility may be included to establish a property's significance, integrity, or ability to meet one or more criteria considerations.

Questions tend to arise about the required length of the historic context documentation. In general, the National Register does not mandate that a particular amount of documentation should accompany each nomination. Sufficient information should be provided to justify the significance and eligibility of the nominated properties. However, the length of the context statement will vary depending upon the nomination format.

The multiple property format requires that historic context material be included in the multiple property documentation form. This means that individual nominations submitted as part of a multiple property package need only include a description, a brief historic context statement pertinent to that property, and an indication of how the nominated resource meets the registration requirements established for measuring the significance of the property type. However, properties nominated without a multiple property cover form will have to contain sufficient context information within the nomination to support registration.

When explaining the significance of mining properties, the following types of questions should be addressed:

- How do the extant vestiges of mining functions or processes relate to the broader mining or technological development of the locality, region, State, or nation?

- How important were the entrepreneurs, engineers, laborers, ethnic groups, and others who contributed to the development of the mining operation?

- How do the remaining buildings, structures, sites, objects, and historic districts reflect significant mining production processes?

- How did the mining operation(s) impact or influence other activities within a region or locale, such as exploration, settlement, and/or other commercial development-related activities?

- How is evidence of historic mining activity reflected in the archeological record?

SECTION 10: BOUNDARIES

All mining property boundaries should be plotted on USGS topographic maps. These maps will be included with the nomination documentation. Because of the complexity of many mining properties, a separate sketch map (preferably drawn to a scale of 1 inch equals 200 feet) may help to clearly identify both the boundaries and the resources within those boundaries. Resources within sketch map boundaries should be labeled as contributing or non-contributing. These resources should also be cross-referenced to the description section (Section 7) of the nomination.

Mining property boundaries should be selected to encompass, but not exceed, the full extent of the resources making up the property. Boundaries for a single parcel of land should encompass the significant concentration of buildings, sites, structures, or objects which comprise the mining property. Byproducts of mining activity, such as tailings piles, should be included within property boundaries.

In nominations involving discontiguous historic districts, a separate boundary should encompass each discontiguous element of the district. Each discontiguous element should be plotted on a USGS map, even though several maps may sometimes have to accompany the nomination. If necessary, separate sketch maps may be submitted for each discontiguous element.

In some instances, legally recorded mineral patent applications will help to determine the appropriate boundaries for a mining property. Such material can help to develop verbal boundary descriptions and to accurately plot the location of mining properties on the USGS maps that must accompany each National Register nomination. If available, these patent applications may be found in county courthouses, state geological offices, or in Bureau of Land Management offices.

The above-ground portion of a mining property will often be considerably smaller than portions of the property located beneath the surface of the earth. Because of the potential dangers involved, field investigators should not attempt to verify this fact by exploring underground mines. Underground investigation should only be attempted in those very rare cases when a State mining inspector has certified that a mine is safe to enter. As a general rule, however, exploration of underground mines should be avoided.

In some cases, written records may contain information about the extent of an underground mine. If so, this knowledge should be utilized when determining the above-ground boundaries of the property. Such information should be used to define above-ground boundaries that encompass the extent of the underground reaches of the mine. This will help to protect the full extent of the mining property by assuring that development projects only occur outside the property boundaries. In addition, such measures will help to ensure that new development does not take place in areas where ground subsidence is likely to occur. In many cases, however, boundaries will relate only to the mining resources visible on the surface of the ground.

VI. SELECTED BIBLIOGRAPHY

SAMPLE PERIODICALS AND JOURNALS

The following are examples of periodicals and journals that were in print during the ninteenth and early twentieth centuries that discuss events, technology, and personalities involved with mining during that era. This list is by no means exhaustive, but will provide general guidance to researchers. The periodical and journal titles are commonly used but may have changed over time.

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VII. GLOSSARY

This glossary provides a quick overview of terms used in the text. For a comprehensive glossary of mining terms see Albert H. Fay, *A Glossary of the Mining and Mineral Industry*, U.S. Bureau of Mines Bulletin 95, Washington, D.C.: Government Printing Office, 1920 edition and Paul W. Thrush, comp., *A Dictionary of Mining, Minerals and Related Terms*, US Bureau of Mines, Special Publication, Washington, D.C.: Government Printing Office, 1968.

Adit: A horizontal passage driven from the surface for working or unwatering a mine.

Amalgamation: The process of bringing particles of free gold or silver in contact with mercury. The most common practice was to pass a slurry of crushed gold ore over large copper plates that had been coated with mercury or, in the case of silver, mix a slurry of crushed silver ore in metal pans containing mercury.

Arrastra: A primitive mill using a circular path of cobblestones with retaining walls on either side. Heavy drag stones were drug over the mixture of ore and mercury using a horse, water wheel, or steam for power. As the ore was crushed the free gold was amalgamated. The amalgam was dug from between the cobblestones.

Assay: The content, type, or quality of metal in an ore was tested or "assayed" by an experienced assayer using various methods including fire assay or acid tests. Assay offices often purified precious metals prior to shipment to the mint.

Base Metal: Copper, lead, zinc, and other common industrial metals.

Beneficiation: The initial process of upgrading ore.

Blast Furnace: An upright shaft furnace in which solid fuel was burned with an air blast to melt the ore and fluxes, and obtain a separation between the metal and the slag.

Bucket: In mining, an enlarged metal or wooden bucket used to haul matter out of a mine shaft. Sometimes used to carry miners.

Breaker: A machine used to break coal, particularly anthracite, prior to shipment. In time, the entire surface crushing and separating plant at an anthracite coal mine was called a breaker.

Cage: A vehicle riding on guides in the shaft, that was moved up and down by the hoisting engine, and was used for hauling men, supplies, and ore.

Coke: The product obtained from fixed carbon and incombustible material after strongly heating bituminous coal out of contact with air, and driving off the volatile constituents.

Concentrator/Concentration: A device or process for reducing the values in an ore into a smaller bulk in order to diminish the expense of shipping and further treatment. Sluicing of placer ground was the earliest form. Hand-sorting of ore to obtain a higher grade was probably the most commonly used. In concentrating mills the ore was crushed, screened to the proper size, and then passed over vibrating tables to separate the heavier metals from the gangue. Concentrator was the name given to the surface plants which concentrated ore into a concentrate prior to shipment to smelters.

Cornish Steam Pump: A very early mine pump that was invented by Watt for the Cornish tin mines in England. The pump consisted of a steam engine that operated a walking beam. The other end of the beam was connected to a wooden timber that extended to the bottom of the shaft. The end of the timber was connected to a piston with check valves so the water was lifted on top of the piston. If the shaft was greater than 300 feet deep, an additional pump had to be installed, and the water in the lower section was pumped up into a sump. The top section then pumped the water from the sump to the surface. Additional walking beams were installed to act as counterweights to overcome the weight of the timber and the water column.

Cyanide Process/Cyanidation: The dissolving of gold and silver by the use of a solution of alkaline cyanide. The process was invented in Scotland in 1887, first successfully used in South Africa and New Zealand in 1890, and in the United States at Mercur, Utah in 1892. The practice consisted of fine grinding of the entire tonnage in a roller, tube, rod, or ball mill. The crushed ore passed to leaching tanks. A solution of sodium or potassium cyanide was placed in the tank with the ore. The ore then gave up the silver or gold mineral into the solution. The gold was retrieved in zinc boxes (or other methods of precipitation) where the precious metals were precipitated. The precipitate was smelted and refined into gold and silver bullion.

Dredge: A floating placer mine operation where buckets scooped up gravels that were then screened, sorted, and sluiced. Gold stayed onboard in the sluice boxes while waste gravels and sand were washed back into the creek or sent by conveyer to stacks in the creekbed behind. The dredge was developed in New Zealand in the 1880s and first successfully worked in the United States at the Bannack District, Montana in 1895.

Flotation: The separation of minerals from each other and from waste matter by inducing (through the use of reagents) relative differences in their abilities to float in a liquid medium. The process will separate all metallic sulphides or elemental metals. If necessary, differential flotation can be used on complex ores. In such an ore, each sulphide mineral, such as copper, lead, and zinc, can be separated from the others. First patented by Carrie Jane Everson of Denver on August 4, 1886, the process was ignored until perfected in Australia at the turn of the century. The first successful plants in the United States were at Butte where in 1911 the process was introduced at the Butte & Superior zinc-lead mine and at the Inspiration Copper Mine at Miami, Arizona in 1915.

Flume: An inclined channel, usually made of wood, for conveying water.

Grubstake: An agreement between the miner and a business owner whereby food, clothing, ammunition, and mining supplies would be furnished in exchange for a negotiated percent of return on the miner's earnings.

Headframe: A timber or steel structure over the shaft that supports the sheave and hoisting rope and is braced to withstand the pull of the hoisting engine.

Hoist: Any engine with a drum on which the hoisting rope is wound.

Hydraulic mining: The excavating of a bank of gold-bearing gravel by a jet of water that was discharged through a nozzle under great pressure. The nozzle was known as a "monitor" or a "giant." The gravel was carried away by the water and transported through sluices with riffles to catch the gold. Hydraulic mining was perfected in California by 1853.

Long Tom: An open box 12 feet long that is 15 inches wide at the upper end and 30 inches wide at the lower, or discharge, end. The lower end is closed, but has a screen in the bottom of the last two feet. The holes in the screen are one-half inch wide. Under the screen is another inclined box at least 36 inches wide and 6 feet long with riffles in the bottom. Both boxes are usually 12 inches deep. Water enters at the upper end and washes the gravel through the screen. The slurry drops into the lower box and the heavy metal is collected in the riffles.

Matte: The metallic mixture that results from smelting sulphide ores.

Mill tailing: See tailing.

Mine Face: The end of a tunnel, drift or exposed ore body.

Open cut; open pit: A method of mining the ore in which the workings are open to the surface.

Ore: The portion of a deposit containing valuable minerals that can be mined at a profit.

Ore bin: A metal or wooden structure used to store ore prior to shipment.

Placer mining: The extraction of heavy minerals from alluvial gravel by removing the detrital material with running water and trapping the values in riffles.

Precious metals: Usually designated as gold, silver, and platinum.

Prospect: A mineral property, the value of which has not been proven.

Raise: A vertical or inclined opening or passageway connecting one mine working area with another at a higher level.

Russell Process: A metallurgical process perfected in the mid-1880s at Park City, Utah for the extraction of silver via lixiviation.

Shaft: A vertical or steeply inclined access passage from the surface into a mine. It is usually sunk from the surface by mining in a downward direction. The interior is timbered so that each entity has its own passageway or compartment—cage, skip, manway, or pipe.

Sluice: A series of inclined troughs, each of which are about 12 feet long and 12 inches square, called sluice boxes. These were coupled together to form a continuous trough 24 to 72 feet long. Devices known as riffles were placed in the bottom of the sluice. As the gravel was washed through the trough, the heavier metals were retained by the riffles.

Smelting: The chemical reduction of a metal from its ore and certain fluxes by melting at high temperatures. The non-metallic material floated on top of the heavier metallic constituents in the molten state and remained in that position when it cooled and hardened.

Stamp Mill: The ore to be treated by amalgamation is usually ground in a stamp mill. A stamp consists of a vertical steel stem with an iron foot or shoe that is lifted by a cam and dropped onto previously crushed ore. Five stamps in a row are usually included in one battery.

In the case of gold ore, the discharge from the battery flows over amalgamating plates. These are copper plates usually about the width of the battery (approximately 5 feet) and 10 to 12 feet long. The copper sheets have a silver plating and are coated with a thin film of mercury which adheres to the silver. This allows them to catch the particles of gold. Silver ore passes from stamps to pans for amalgamation.

Stamp milling was developed in Europe during the Middle Ages and improved in California in the 1850s. The process was used throughout the precious metal mining regions of the United States until amalgamation was replaced by the cyanide process in the early twentieth century.

Stope: An opening in the underground workings of a mine from which ore is mined. The width and height of the stope are determined by the size of the ore body.

Strip Mine: See open cut; open pit.

Tailing: The gangue and other refuse material resulting from washing, concentrating, or treating ground ore that is discharged from a mill.

Timbering: The operation of setting timber supports in a mine.

Tipple: The tracks, trestles, and screens at a coal mine where the coal is processed and loaded.

Tramway: An established system of roads, rails, or cables over which ore is moved from the mine to the mill.

Waste Rock Dump: The uneconomical rock that was mined and disposed of in the vicinity of a mining operation.

VIII. LIST OF NATIONAL REGISTER BULLETINS

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Part B: How to Complete the National Register Multiple Property Documentation Form

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Guidelines for Evaluating and Documenting Historic Aids to Navigation *

Guidelines for Identifying, Evaluating and Registering America's Historic Battlefields

Guidelines for Evaluating and Registering Historical Archeological Sites

Guidelines for Evaluating and Registering Cemeteries and Burial Places

How to Evaluate and Nominate Designed Historic Landscapes *

Guidelines for Identifying, Evaluating and Registering Historic Mining Sites

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The above publications may be obtained by writing to the National Register of Historic Places, National Park Service, 1849 C Street, NW, Washington, D.C. 20240. Publications marked with an asterisk (*) are also available in electronic form on the World Wide Web at www.cr.nps.gov/nr, or send your request by e-mail to nr_reference@nps.gov.