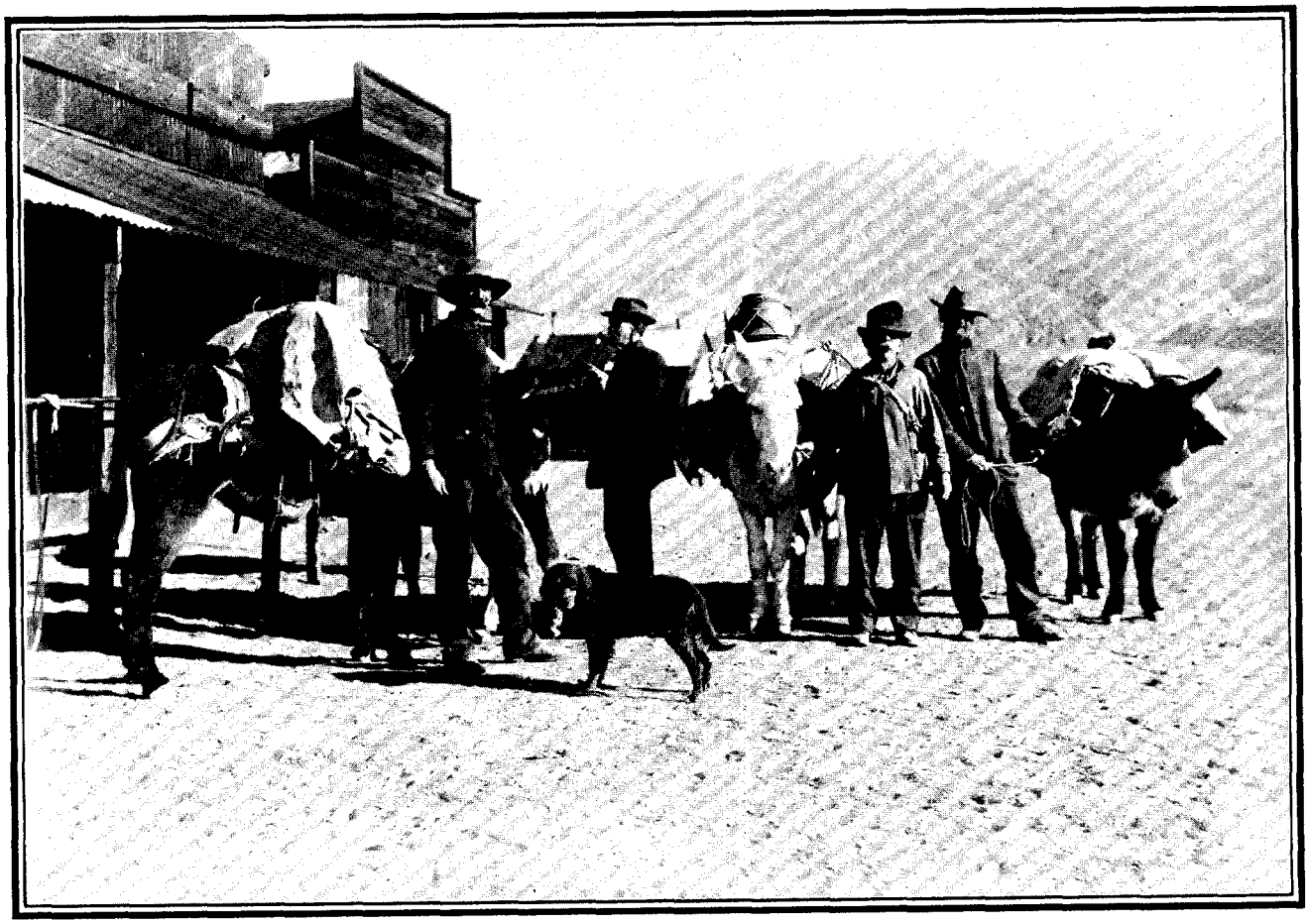
DEATH VALLEY TO DEADWOOD; KENNECOTT TO CRIPPLE CREEK



PROCEEDINGS OF THE
1989 HISTORIC MINING CONFERENCE
DEATH VALLEY NATIONAL MONUMENT

Division of National Register Programs
Western Regional Office • National Park Service

Cover: Shorty Harris and assorted Death Valley prospectors preparing to leave Ballarat (1910s). Photograph courtesy of the Dane Coolidge Collection, Arizona Historical Foundation, Tempe, Arizona.

Funding for this publication was made possible by support from the Minerals Management Division, Alaska Regional Office, National Park Service, and the Office of Surface Mining, Washington, D.C..

Copies of this report may be obtained after April 1, 1991, while supplies last, from the Division of National Register Programs, National Park Service, Western Regional Office, 600 Harrison Street, Suite 600, San Francisco, California 94107.

DEATH VALLEY TO DEADWOOD;

KENNECOTT TO CRIPPLE CREEK

Proceedings of the Historic Mining Conference
January 23-27, 1989
Death Valley National Monument

Edited by
Leo R. Barker and Ann E. Huston

Division of National Register Programs
National Park Service
San Francisco, California

September 1990

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ACKNOWLEDGEMENTS

Many individuals and groups assisted in making this conference possible. To all of them, thank you.

Robert Spude, Chief, National Preservation Programs, Rocky Mountain Regional Office, and Eric DeLony, Chief of the Historic American Engineering Record, Washington, D.C., served as coordinators of the conference and worked diligently to organize its various components. Bob's familiarity with both the history of mining in the Far West, and with the scholars and managers involved in the preservation of that history, ensured a broad spectrum of speakers with diverse disciplinary perspectives and experiences. Eric's commitment to the workshop in the planning stage helped its supporters through discouraging moments, while at Death Valley he facilitated its successful conclusion.

In the National Park Service's Rocky Mountain Regional Office, Regional Director Lorraine Mintzmyer and Chief of Cultural Resources Rodd Wheaton allowed staff time to assist in organizing this workshop.

In the Western Regional Office, Regional Director Stanley Albright, Chief of National Register Programs, Margaret Pepin-Donat and Chief of Park Historic Preservation Thomas Mulhern also provided considerable staff time.

Without the support of Death Valley National Monument Superintendent Edwin Rothfuss and his staff, especially Mel Essington, the workshop would have faltered. Mel worked long hours to ensure its success.

Thanks to Gordon Chappell, Western Regional Historian, and Linda Greene of the Denver Service Center, who both shared their exceptional knowledge of Death Valley, helped coordinate field trips, and contributed articles for this volume.

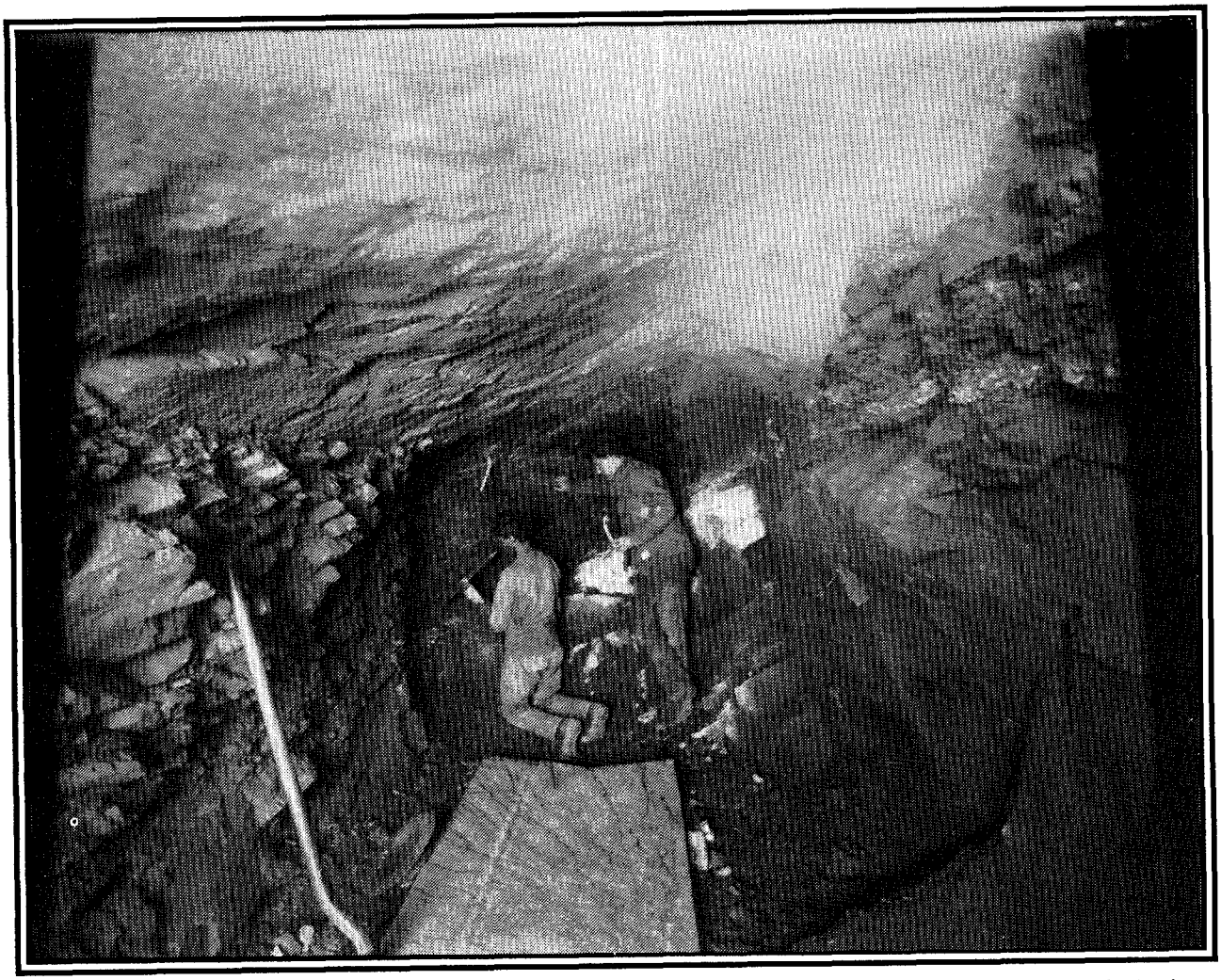
Thanks too to Woody Harrell of the Albright Training Center and Dave Sharrow of the Mines and Minerals Branch for their assistance. Also thanks to Katherine Boonin and Bruce Noble of the National Register of Historic Places for their assistance in creating a current list of National Register properties associated with western mining.

It goes without saying that the editors are in perhaps greatest debt to the enthusiastic scholars that presented formal and informal papers at the workshop, most of which are presented in this volume. Also we are grateful to Duane Smith and Richard Lingenfelter, whose keynote lectures invoked the spirit of the Mining West. Also, a special note of gratitude to Jeff Moore of the U.S. Borax and Chemical Corporation for his informative tour of the mining town of Ryan.

Special thanks to Annetta Cheek and the Office of Surface Mining, which provided funding for part of the conference costs. Also, we extend our gratitude to Floyd Sharrock, Chief of the Minerals Management Division, Alaska Regional Office of the National Park Service, for generously supporting the production cost of this volume.

And finally, a note of appreciation to the Death Valley Day Care group for the excellent snacks. They nourished and refreshed us as much as the discussions and the January sun of Death Valley.

INTRODUCTION



Underground in the Yarnell Mine, Arizona (1890s). Photo Courtesy of the Arizona Historical Foundation, Spude Collection, Tempe.

INTRODUCTION

Robert Spude, Historian
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The decade of the eighties brought much activity, both in mining and preservation compliance, to formerly tranquil mining camps. The rise of gold prices in the 1970s and the reopening of old mines in the West, coupled with the government initiative to clean up abandoned mine lands, has created a compliance nightmare for anyone managing lands with mining-related historic resources. The requirements of the National Historic Preservation Act have been interpreted and reinterpreted without conclusive guidance. A conference on historic mining issues was deemed beneficial for the public, the National Park Service, other state and federal agencies, and historical and archeological consultants dealing with these issues. Thus, in January 1989 a week-long conference was held at Death Valley National Monument. The following serves as an introduction to the discussions and papers presented there.

PRESERVATION OF MINING SITES AND RELICS

Preservation of mining-related sites and objects has a long history. Shortly after the days of the '49ers pioneers began to build monuments to their participation in the "Grand Event." Collection and preservation of mementos followed each gold or silver rush or copper boom; by 1900 the pioneers were erecting monuments to James Marshall at Coloma, California, establishing historical societies in Arizona, and setting aside the founder's cabin at Skagway, Alaska, a recent Klondike Gold Rush boom town. Commemoration of the pioneers continued, with statues placed and cabins enshrined (more often than not distant from their original sites), hastened in the 1930s by the declining numbers of '49ers. Shops were opened to sell curios or relics of those times to an increasing number of "excursionists," who were more eager to gape at the site of legendary Main Street shoot-outs among desperados than look at the mines or milling relics nearby. The beginning of Deadwood, South Dakota's, annual "Days of '76" celebration in 1924 illustrated the public's fascination with mining lore and legends of the "wild West." The miners in the gulch and hills were ignored in favor of shoot-outs, the death of Wild Bill Hickok and the antics of legendary Deadwood Dick (in reality, the total figment of a dime novelist's imagination). Mining site preservation and interpretation had not caught on, except for the occasional gold panning booth or the old prospector and his burro in the parade.

By the 1920s and 1930s similar "preservation" and "interpretation" of the mining frontier had spread, from Tombstone's "Helldorado Days" to Skagway's "Days of '98," presenting what promoters imagined visitors might want to see...and pay for. Fueled by pulp Western novels and lured by the expanding road network, automobiles filled with families toured these creations in ever-increasing numbers after World War II. Historic preservation on the mining frontier had come to be misrepresented by a bias toward the thrilling, the vigilantes or the urban amenities. Extremely isolated areas and such places as Georgetown and Central City, Colorado, and the California Mother Lode towns along Highway 49 did preserve exceptional examples of architecture, but this architectural bias left the mining-related resources--the mine shaft houses, the stamp mills and smelters, the campsites and ruins--as derelict backdrops. Any interpretation of the mining industry was omitted or given token attention in museum exhibits, in "artifact gardens"--where machinery was dragged in and displayed like so many *objets d'art*--or in a quick underground tour of a short adit. Desires to see the fantasy West led to the creation of theme parks such as the Ghost Town at Knott's Berry Farm, California; Old Tucson, Arizona; Buckskin Joe, Colorado, and a host of other buckaroo recreations far removed from the original events and any of the mines.

LEGISLATION

A more scholarly approach to the study of Western history evolved by the 1960s, which led to a changed view of the Western frontier and of mining sites and resources considered worthy of preserving. The federal government had established a system to inventory significant cultural resources in the 1930s. The 1935 "Historic Sites Act" authorized "a survey of historic sites, buildings, and objects for the purpose of determining which possess exceptional value as commemorating or illustrating the history of the United

States" (P.L. 292, August 21, 1935; Section 2[b]). The National Survey of Historical Sites and Buildings, carried out by the National Park Service on behalf of the Secretary of the Interior, resulted in the evaluation of hundreds of historic properties which fit into defined historical themes. The Historic Sites and Buildings inventory looked at over 100 mining sites and selected 17 as potential National Historic Landmarks. The results of the study were published as *Prospector, Cowhand and Sodbuster* (National Park Service, 1967). The National Park Service evaluation system reflected to a large degree the popular view of looking only at the towns rather than mines or mills. With a few exceptions, industrial sites were not included unless adjacent to the camp. Thus, significant mine structures or mills standing at the time were rarely recognized.

Unfortunately too, the "Historic Sites Act" lacked a mechanism to preserve the resources. Although the intent behind surveying properties was to consider each site for possible inclusion in the National Park System, the survey resulted in few properties being acquired as park units, none of them related to mining until the 1976 establishment of Klondike Gold Rush National Historical Park at Skagway, Alaska, a boom-town on the trail to the gold fields. Thus, there was a need to recognize and assist significant properties not in National Park Service ownership. In 1960 the National Historical Landmark program was established to commemorate sites of exceptional national significance. Passage of the "National Historic Preservation Act" of 1966 provided additional protection for landmarks. Since then the National Park Service has given priority to National Historic Landmarks for recording, revising documentation, and providing technical assistance. When grant monies have been available grants have been provided. A few commercial properties have received rehabilitation tax credits. "The Mining in the National Parks Act" (P.L. 94-429), passed in 1976, established a process to report on threats or damage to National Historic Landmarks from surface mining projects. In addition, the National Park Service monitors the condition of all National Historic Landmarks and information about endangered landmarks is reported annually to Congress, as required by Section 8 of the "General Authorities Act" (P.L. 94-458, October 7, 1976). The majority of mining sites also receive some protection through the review process established by Section 106 of the National Historic Preservation Act.

During the 1960s and 1970s, private and state initiatives provided additional protection. Virginia City, Nevada, had long been a tourist destination when Lucius Beebe arrived in the 1940s and made preservation fashionable; he revived the romance of the Queen of the Comstock through his books, the *Territorial Enterprise*, and his flamboyant lifestyle. At Virginia City, Montana, the Bovey family acquired half the near-ghost town and preserved buildings otherwise bound for demolition; similarly, the Cain family patched and braced the buildings of Bodie, California, until the State of California could acquire the property. California had undertaken several important preservation projects throughout the Mother Lode, most outstandingly at Coloma, Columbia, Sutter's Fort, and Grass Valley, in the 1940s-1950s, during the centennial of the gold rush. Nearly every other far western state followed suit with at least one state park dedicated to the mining theme--at Tombstone and Jerome, Arizona, at Bannack, Montana, and at South Pass City, Wyoming. Again, the focus of these parks was often the towns, not the mines. Finally, in the 1970s a few parks were created to interpret the industrial West--hydraulic mining at North Bloomfield, California, a silver mill at Berlin, Nevada, the gold works at Independence Mine, Alaska, and the railroad and mines at Georgetown, Colorado. The National Park Service too began preserving sites within its large natural parks which represented mining history--Harmony Borax works and the Keane Wonder tramway at Death Valley National Monument, the Terlingua quicksilver mines at Big Bend National Park, and the Coal Creek dredge in Yukon-Charley Rivers National Preserve.

Outside parklands, the story was different. In 1974 Congress lifted the ban on private ownership of gold; market prices jumped from the regulated $32 per ounce to over $600, then settled down to the $300 to $400 range during the 1980s. Abandoned gold mines immediately became profitable. Large-scale mining resumed at Virginia City, Nevada; Cripple Creek, Colorado; and other areas using new technologies of open cut mining and heap leach processing. Contemporary technology has created massive, large scale threats to the historic scene.

In 1977, Congress passed the "Surface Mining Control and Reclamation Act" (SMCRA, P.L. 95-87), which provided grants to states through the Office of Surface Mining to close dangerous mine openings and clean up life-threatening hazards. Western states established abandoned mine land programs and initiated clean-ups, often within historic mining districts. The Environmental Protection Agency also received new mandates, especially through the "Comprehensive Environmental Responsibility, Compensation and Liability Act" of 1980, as amended (CERCLA, 42 USC Section 9601-9657), which will greatly impact such

landmarks as Butte, Montana; Leadville, Colorado, and a host of lesser sites. These acts of Congress created a mechanism for destruction of historic mining resources before federal agencies could react or put in place systems to evaluate and protect or mitigate the loss of significant resources. The acts forced preservationists interested in mining heritage to shift their attention from the architecture of the mining camps to the mines, many of which had reverted back to public ownership. In addition to the issue of mining on public lands, the new extensive mining operations, with their large open cuts and pits, created massive stockpiles of overburden and acres of tailings requiring processing, most of which ended up on public land. Thus, compliance with federal preservation laws came into play. Federal agencies and their contractors began to ask questions about how best to inventory and document mines, how to mitigate impacts, and how to interpret or display objects or industrial sites. Job opportunities for cultural resource management specialists were greatly enhanced.

CULTURAL RESOURCE MANAGEMENT ISSUES

The State Historic Preservation Office of South Dakota was the first to apply a holistic approach to grappling with the compliance issues. In 1982 the Homestake Mining Company reopened the Open Cut at Lead, an act that would raze part of the National Register towns of Lead and Terraville. The South Dakota State Historic Preservation Office worked with the U.S. Forest Service, the Homestake company and other agencies to ensure compliance with historic preservation law. They also hosted a workshop in 1987, the results of which were published as the *Proceedings of the Workshop on Historic Mining Resources, Defining the Research Questions for Evaluation and Preservation* (available from the State Historical Preservation Center, Box 417, Vermillion, South Dakota, 57069). It brought up questions about definition of terms, inventory, historical archeology, and documentation.

While new mine operations, EPA clean-ups, and Office of Surface Mining initiatives continue, additional threats loom. The Forest Service must deal with increased visitor use on its lands. For example, the ski industry of Colorado, operating on Forest Service lands, has changed the ambience of Aspen, Crested Butte, Breckenridge, Telluride and other former mining camps. Where Breckenridge began the 1980s with 195,718 skiers, it ended the decade with over 1,000,000. Similarly, Off-Road Vehicle use on Bureau of Land Management desert lands has increased in number and destructiveness. Increased tourism at historic mining sites threatens fragile resources. Vandalism and relic-collecting are prevalent.

The weight of these threats to mining resources prompted the National Park Service to coordinate a workshop on historic mining resources. During January 23-27, 1989, a group of concerned individuals, consultants, and state and federal agency representatives met at Death Valley National Monument to discuss and share information about the preservation of historic mining sites. Holding the conference at Furnace Creek allowed the participants to enjoy the mineralized setting, the local Borax Museum, and the preserved Harmony Borax Works site. Workshop participants discussed many areas of mutual concern: how to survey and evaluate sites, how to inventory and document them, how to restore and rehabilitate sites and how to interpret and manage those significant remnants of America's mining past. The group also took part in field trips to various mining properties within the monument.

PAPERS PRESENTED AT THE WORKSHOP

The multiplicity of concerns is reflected in the following papers. Because of new mining activities in historic mining areas, contractors and agencies were interested in how to survey and nominate properties to the National Register of Historic Places as well as how best to mitigate adverse actions on significant resources. Other participants addressed management concerns related to historic mining sites--old mills or campsites, mine adits or waste piles--on public lands. Representatives from private, state and federal agencies and museums were interested in the interpretation and display of mining sites and materials.

Duane Smith, long-time resident of the mining regions of Southwestern Colorado and history professor at Fort Lewis College in Durango, presented a brief overview of the impact of mining on the West. His paper sets the stage for understanding the widespread appearance of mining, and the consequent abundance of sites, in varying states of repair and ruin, across the landscape.

A critical question about mining resources is determining which ones are significant and which are not. Land managers and cultural resource professionals are challenged by the abundance of remains and must make decisions about how best to identify and evaluate them. Section 2 addresses these issues. The

papers outline the preservation planning process, methods of inventory, and the National Register of Historic Places guidelines. Special topics presented included cultural landscapes, engineering works, and underground resources. A particularly important aspect of mining sites is their historical archeology. Because mining sites were often ephemeral and easily removable, often all that remain are the debris and ruins of former activity. Section 2 also describes the approaches to and state of mining site historical archeology.

Section 106 of the National Historic Preservation Act requires Federal agencies to take into consideration actions that may have an impact on historic properties within their jurisdiction. Compliance with Section 106 usually requires mitigation of adverse effects on cultural resources. The 106 process is explored in Section 3 as it relates to mining properties. Examples of mitigation measures used for historic mining sites are given, such as videos, films and other interpretive devices, archeological and structural recovery or salvage, documentation, publications, signs and markers, and stabilizing of historic structures. The Abandoned Mine Reclamation program has posed numerous problems for managers of public lands. The program is discussed from the National Park Service perspective and a method of mine closures using heavy metal nets that have been used at Death Valley and other National Park properties is presented in this section.

Levels of documentation of sites vary, from simple sketches and thirty-five millimeter photography accompanying a state or other survey form, to Historic American Buildings Survey/Historic American Engineering Record (HABS/HAER) documents, which include large-format photography, well-researched histories, and ink-on-mylar drawings. HAER recording is often used as a mitigation measure for the adverse effect of removing a historic structure. Section 4 describes the HAER program and provides examples of projects from Alaska to Michigan.

Resource management and interpretation work hand-in-hand at many historic mining sites. Land managers must decide how best to protect and interpret historic mining properties while providing for multiple demands from visitors, mining companies, and other groups. Often historic mining sites are located within parks set aside for their natural resources. Park managers must take into consideration cultural resources in their parks and occasionally take actions to preserve and interpret them. Several of the papers in Section 5 discuss options for such management on state and federal lands. Examples of successful preservation of mining sites are also discussed in a paper about the first steps in researching a potential heritage tourism site and other papers about the management of parks established to commemorate mining events. The final paper in this section discusses the Western Mining Museum in Colorado Springs, Colorado, a unique mining museum in that the goal of its founders was to provide visitors with the opportunity to see operating machinery, including a complete ten-stamp mill, steam drills, and a Corliss engine.

A variety of papers comprises the last section, including two case studies of survey, evaluation and documentation, an example of how computer-generated mapping was used to assess impacts of a proposed mining project within the Comstock Historic District, information about state mining associations and the view of today's mining companies toward historic mining areas, and the history of Ryan, a major borate mining camp visited by many of the attendees of the conference.

The appendix contains a general bibliographies related to the history and historical archeology of western mining and inventories of historic mining sites culled from the HABS/HAER and National Register databases that will be useful when researching historic contexts for mining properties.

AGENDA FOR THE 1990S

During the conference several resolutions were passed in support of further work.

First, we must continue to look at the remains of the mining industry, not just the legends and architecture of the mining frontier. The mines are no longer a backdrop to the history of mining and must be attributed their full measure of significance.

Federal agencies must recognize and continue to responsibly manage the historic mining sites which are in their jurisdictions or affected by their undertakings. Those out of line need to be brought to account and corrected. There should be no more overzealous clean-ups.

Mining operations can continue and still be responsive to public concerns and federal requirements. Current operations engaged in moving massive quantities of earth to extract invisible gold must be made aware of their ability to quickly erase the remnants of a century before, and be encouraged to preserve significant historic mining sites.

In addition, resolutions were passed in support of a National Historic Mining Initiative to identify and protect mining resources. This action would include Congressional directives to agencies responsible for management of mining sites; the completion of National Register guidelines for mining sites; the continuation of Advisory Council and SHPO guidance to agencies on appropriate mitigation or avoidance; the development of historic contexts and other management tools for effective preservation planning on mining sites; and the establishment of HAER guidelines for mining sites.

NATIONAL HISTORIC MINING INITIATIVE

Eric DeLony
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The call for a National Historic Mining Initiative registers the concern of historians, archeologists and preservationists for historic mining resources. The Death Valley Historic Mining Workshop revealed that while archeological remains are extensive, little is left of the extant, surface structures of Western mining operations--the head-frames, mills, cyanide plants and smelters that processed the ore extracted from the ground. Historic mining structures are threatened with government-wide reclamation programs that close abandoned mine openings and remove potential liabilities like the old mill buildings and head-frames. New mining activities are another threat to historic mining sites. With the price of gold as high as $570 an ounce, and a leap in technology that makes it profitable to rework the tailings of the last gold rush, dozens of mining companies have descended on the gold fields of the West in the 20th century equivalent of the California Gold Rush.

The legacy of frontier-era legislation aimed at encouraging the settlement of the West, the General Mining Law, signed by President Ulysses S. Grant in 1872, has played a vital role in the development of minerals essential to a modern industrial nation. Under the 118-year old law that governs the mining of hard rock minerals--gold, silver, copper and many other ores--anyone who finds a valuable deposit on federal lands is generally allowed to take it.

This legacy of "free access" is under increased scrutiny on Capitol Hill, where reformers and their congressional allies have revived a decades-old struggle with the mining industry to scrap the law. Conceived in an era of pick-and-shovel prospecting, the mining law now governs massive industrial enterprises capable of remaking thousands of acres.

The Maritime Initiative might be the model for an Historic Mining Initiative. To focus the public's attention and target resources on America's deteriorating maritime heritage, Congress launched the Maritime Initiative in cooperation with the National Park Service, National Trust for Historic Preservation and the maritime community in 1985. A similar initiative is needed to save historically significant mining structures which are threatened with extinction over the next few years if something is not done.

Several participants at the workshop pointed out that the mining industry itself is proud of its tradition and would cooperate and support efforts to save historic mining sites. It was suggested that the next workshop, possibly called "Contemporary Mining in Historic Areas," be cosponsored by the mining industry or at least should incur its substantial involvement. Though invited, only one industry representative was present at Death Valley.

Documentation was another subject discussed extensively at the workshop as it is the basis for sound decision-making on what merits preservation. If a site cannot be saved, documentation insures that a permanent record is available.

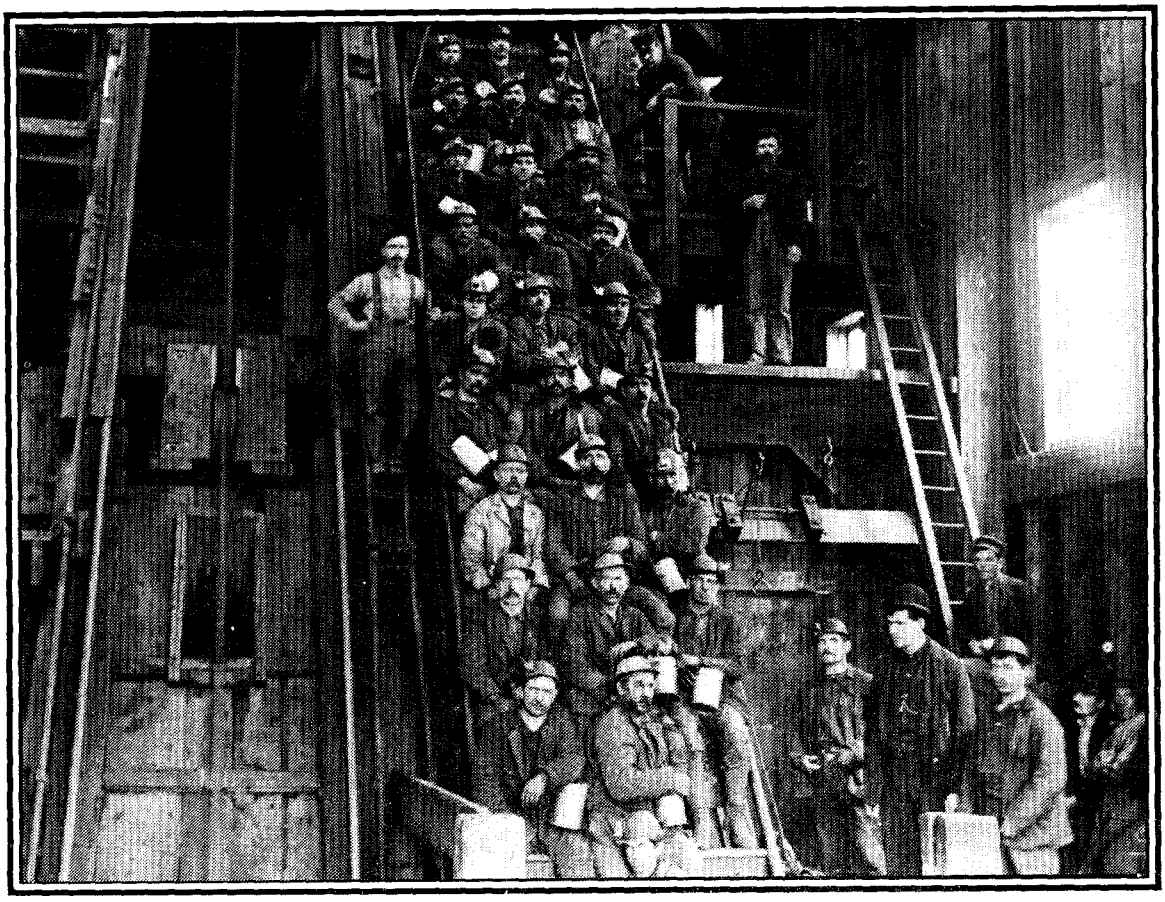
A pilot HAER historic mine recording project that demonstrates the process of documenting a mine site was recommended at the workshop. Several National Park Service sites were selected for recording--Skidoo Mine and the Keane-Wonder in Death Valley, Lost Horse Mill and the Wall Street Mill in Joshua Tree National Monument, and the Mariscal Quick Silver Mine in Big Bend National Park in Texas. None of these projects have been accomplished. On the private side, efforts will continue to develop co-sponsors to support HAER documentation of non-Park Service sites such as the National Historic Landmark Anselmo Copper Mine in Butte, Montana, and portions of the Homestake mine and smelter in Lead, South Dakota. Discussions were initiated with California State Park personnel to record state owned historic mining resources in the Mother Lode region such as Bodie or the Empire Mines.

A mine, mill and smelter context needs to be addressed by most of the western mining states followed by thematic studies that evaluate the extant sites. Other than South Dakota, few of the western states

have completed baseline surveys of these sites. The State Historical Preservation Center and South Dakota State Historical Society sponsored a workshop on historic mining resources in April 1987, following its intensive survey of selected mining sites in the Black Hills gold fields.

These are the highlights of the Death Valley Workshop. The Workshop demonstrated the broad range of expertise, the depth to which people are investigating mining resources, and the level of commitment people showed for preserving, understanding, interpreting, and managing historic mining sites. Most of the nearly one hundred participants of the Workshop left Death Valley with a better understanding of the issues confronting hard-rock mining sites in the West. These proceedings reveal the issues and the tools available to address them. Hopefully, this publication will stimulate debate on the need for a Historic Mining Initiative and the strategies to save the physical remains of one of the most dramatic themes in American history--hard-rock mining in the West.

Historical Overview



Miners waiting, lunch buckets in hand, to be lowered underground along an inclined shaft. (ca. 1900) Photo courtesy of Michigan Technological University Archives and Copper Country Historical Collections.

"NO RISK, NO GAIN": THE HERITAGE OF THE MINING WEST

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In January 1848, a visitor to the land that stretched from the Rocky Mountains westward found few settlements. Those that existed were scattered haphazardly over the landscape. Fifty years later, the entire region had been divided into states and territories, with towns and cities dotting the landscape, a regional economy providing the basis for further growth, and a network of railroads tying everything together. Many of these startlingly rapid changes came because of mining, which opened, promoted, and developed this vast territory in less than a generation.

The chain of events began innocently on a January day in 1848 on the South Fork of the American River, when James Marshall discovered gold. The news spread across land and sea almost overnight; the next year, 100,000 or so argonauts raced to California from throughout the world. With their washbowls and shovels, they dug out the mother lode country of California and, in the process, impacted the world's economy. They did not stop there; in 1859 it was off to Washoe, where silver had been found on the Comstock, and to Pike's Peak or Bust for gold.

Both rushes came just in time to help the North win the Civil War. Before all was said and done, the early-day miners had placered up thousands of nameless creeks and burrowed into hundreds of granite mountains, from Canada to Mexico and from the Pacific coast to the Black Hills of Dakota--with an offshoot to Alaska's tundra. The change from "poor man's diggings" to industrial mining came in a twinkling, along with corporation dominance.

One exciting rush followed another, until they all came to an end in Goldfield and Tonopah, Nevada, in the new century's first decade. By then, a legend had been born; the legend of the mining West. In the span of history, the western mining phenomenon had occupied only a flicker of time, but it changed the American West forever.

What is the heritage of western mining? Is it the mined-out districts with present or potential environmental problems? Or the scores of abandoned camps and towns, "epitaphs for places that have died?" Was this scramble for wealth simply the "world's largest underground lunatic asylum"? Or may it all be summarized simply by saying, "get in, get rich, get out"?

Cynics could say (and have said) all of these things, but the significance of the mining frontier overrides the aspersions cast on it. Nothing else had so great an impact on the settlement of the American West or, for that matter, on the history of the United States. A woman writing from Caribou, Colorado, in the 1880s gave a clear perspective: "We miners are always looking for something big whether we get it or not. No risk, no gain is our motto. We have enough to live on and that is more than a good many have. So we ought to be thankful."

The ore-seekers were always looking for something big, the attainment of the ultimate American dream; failing that, however, they usually found enough to live on and keep their dreams alive. Several generations of Americans caught the mining fever; their lives would never be the same again.

For them, the mining frontier was home, and they provide the vital substance of the story. They tried to carve settlements out of the wilderness and recreate the life they left behind. They had little appreciation for the wildness of the West and did their best to curb the excesses that fiction writers like to emphasize in their "gunsmoke and gallop" stories. That they did not totally succeed in accomplishing this goal is not an indication of failure, but of the difficulties involved. They believed in a grow-or-die philosophy and would move on if a district looked less than promising. They left behind the foundation of much of today's West. If they could return, they would probably be proud of their handiwork.

Theirs was an urban frontier, unique in pace and magnitude in American history. In the rush to get rich, miners did not have the time or the inclination to tend to many of life's necessities. For this reason,

others came to "mine the miners," who had the gold and silver to purchase goods and services, a rare opportunity not found in most of the earlier frontiers. Hundreds of camps, scores of towns, and a few cities evolved from these circumstances. Given the transitory nature of mining, some of them boomed and busted within a season or two, but the strongest are alive and well. A few still thrive on mining's activities; others live off the past.

Two of the region's great metropolises, San Francisco and Denver, owe their growth and prosperity to mining. San Francisco benefited mightily as the gateway to California's mother lode country, and when that excitement weakened, the Comstock discovery gave the city twenty years of prosperity. When it was over, San Francisco had emerged as the Pacific coast's heart and soul. Denver's birth came because of mining. Its fortunate location as the entryway to the Colorado Rockies kept it alive until the Leadville silver bonanza turned it into the region's major city. Denverites delighted in calling their community "Queen of the Mountains and Plains."

Only a few steps behind these two came Helena, Boise, Tucson, and Colorado Springs, all of which flourished because of mining's prosperity. Some of the great mining towns--Butte, Leadville, Virginia City, Cripple Creek, Tonopah, and Jerome--are mere shadows of their former selves, but, in their day, they pumped millions into the American and world economies and promoted the region in which they prospered. Most camps did not have that much of an impact, serving simply as a home and work place for a generation of Americans. A few others, such as Tombstone and Deadwood, left behind more legend than mining reality; they all contributed in their way, however, toward settlement and development.

In these communities, the pioneers built their homes, schools, churches, and libraries and organized their businesses, clubs, lodges, and baseball teams. Each settlement wrestled in its own way with sanitation, water, and road problems, and a fair number of them organized town governments to do the worrying for the rest of the busy residents. In the end, the majority of the communities did not prove to be permanent, but that is not the issue. Each one helped to transmit Victorian society--its attitudes, politics, and culture--to the frontier, instantaneously. In some of the larger towns, such as Virginia City, Leadville, Butte, and Goldfield, it was a dazzling life at its peak, providing ideal grist for the print mills of out-of-town journalists and writers.

With mines and towns blossoming all over the West, it was only natural that a transportation network would develop to tap the mushrooming trade. First came the trails for the burros, mules, and horses, followed by major wagon roads to transshipment points, such as Denver. From there, Austin, Sacramento, Helena, and a score of other business centers pushed roads into the mining districts. They proved adequate to begin with, but something even better was needed, and that something was the railroad. Americans had become enamored with that ultimate in nineteenth-century transportation, and the miners found it a necessity.

Because of the potential profit to be gained, railroads raced west, then into the mining districts. Both sides benefited. Mining needed the best transportation to ship supplies, equipment, ore, and people in as comfortable, safe, economic, and reliable a manner as possible. The railroad owners could see profits rolling in if they could only be first on the scene.

Men like William Jackson Palmer and his Denver and Rio Grande made the expansion of mining and the region possible. In addition to miners, the farmers, businessmen, tourists, investors, and immigrants all used these lines to come for a visit or to settle. Mining might decline and the railroads retrench, but the transportation network would stay to build and promote.

The same could be said about the farmer. The more traditional pattern of slow development went by the board as a nearby market exploded for all the products that the farmer had to sell. Indeed, some of the early would-be miners found that their trade was not the way to "get rich without working;" realizing the potential of farming the land, they returned to the occupation they had followed before coming west. The earlier concept of the "Great American Desert" vanished before the prospects of profit. Farmers and ranchers settled in the valleys of Montana, Idaho, Colorado, and California to tap the market at their doorstep. They came because of mining, put down roots, and decided to stay when mining declined and agriculture became one of the region's economic pillars.
If mining encouraged transportation and farming, it also stimulated the growth of industry. Throughout the West, mills and smelters met the needs of hard-rock mining, as did industrial plants that turned out

everything from tramways to jackhammers. San Francisco, Denver, Salt Lake City, Pueblo, and other communities reaped the benefits of industrial growth. Lumbering flourished as well, being needed to timber the mines, construct the homes, and furnish ties to the railroads.

Mining companies, confronting power and fuel problems because of isolated mine sites, had the desire and the money to try innovative solutions. "No risk, no gain is our motto." As a result, electricity came into general use very quickly in mine and camp shortly after its potential was realized. The first use of alternating current for industrial purposes occurred in 1891 at Ames, Colorado, and at the nearby Gold King Mine. The telephone, too, earned early acceptance, along with other inventions; the money was available and the need was great--and there were few entrenched franchises or vested interests to object. Mining provided the impetus, but the entire region gained immeasurably from the innovations.

Mining also promoted the West. Nowhere else could such stories of sudden bonanza and fame attract so much newspaper coverage. The millionaires of Virginia City, Butte, or Leadville supplied the staff of life in their districts. That the mining West paved the road to instant wealth could hardly be doubted when men like John Mackay, George Hearst, Horace Tabor, and William Clark testified to the wonders that mining could achieve for the individual. There were also the stories of smaller investments, which also turned a giddy profit in real estate, business, or mining-stimulated agriculture. All the stories publicized a glamorous West that stood in sharp contrast to the mundane life that most people endured.

Tourism also came early. The prospect of "seeing the elephant" in a mining district spurred travelers to come west. Most of them imagined that life in that "fast track" was quite different from that of a midwestern farming town or a New England village. People came west once the railroad made travel easier, and they went on to the mining communities to see and perhaps sample the pleasures. Some bemused locals could not resist poking fun at some of these church deacons and respected individuals who would not think of doing such things back home. By the 1890s, people journeyed west just to see the frontier before it passed into history.

Mining also encouraged the development of hot springs, Ouray and Idaho Springs in Colorado being examples. Miners enjoyed a dip in the pools for their therapeutic and pleasurable aspects; so did tourists, who soon responded to the siren songs, which claimed that these springs could cure a wide variety of aches and pains. Mining districts usually put the tourist somewhere in the mountains, within easy reach of some of nature's grandest vistas. All in all, mining stimulated, promoted, and helped cement tourism as a viable economic force.

Mining required investment that few local mine owners and fewer prospectors could supply to open and exploit their property. Hence, they turned to the outside, tapping investment markets from San Francisco to London and beyond. Easterners, such as Robert G. Dun and Marshall Field, and hundreds of parlor plungers, sent their funds west and a few received some dividends in return. Home-grown millionaires like Tabor, Clark, and Mackay also reinvested, encouraging others to try their luck. In the end, they not only boosted mining, but they also created jobs inside and outside the industry and stimulated the local and regional economy in ever-widening circles.

Investors built mills and smelters, railroads to reach the districts, roads to the mines, and a wide variety of buildings. They purchased supplies and hired workers to do the work. Some underwrote company towns, especially in the coal and copper districts. They also dabbled in local politics and were not above "investing" to secure special business or political favors. Many of their activities attracted newspaper coverage, thereby keeping the West in the public's eye.

There was a negative side to all the mining activity, as well. The wishes of the people who already lived there were usually ignored. When mining confronted the Indian, the latter gave way--quite quickly, more often than not. Custer died at the Little Big Horn because miners rushed into the Black Hills, and the Utes left western Colorado because the miners stampeded into the San Juan Mountains. Other states provide similar examples. Taxpaying miners believed that they could make better use of the land than the hunters and gatherers who first called it home.

The physical cost, too, was great and is underscored by the many cemeteries that testify to the prevalence of accidents and epidemics. Men, women, and children aged rapidly on this frontier and in the

industrialized mining West; dangers lurked in camp and mine. It was not the glamorous life that readers and visitors often imagined. Investments could disappear almost overnight in the faulting of a vein or in the sudden borrasca of a bonanza. Graft and corruption were not unknown, from Main Street politics to stock speculation.

And there was an environmental cost, one that continues today and will extend into many tomorrows. One needs only to look at the photographs of the era to see how cavalier these earlier Americans were about the environment entrusted to them. They would have defined it as land, water, and air. But their hands were tied, since their livelihood depended on mining and smelting. Closing down those industries would have killed local business and the town itself.

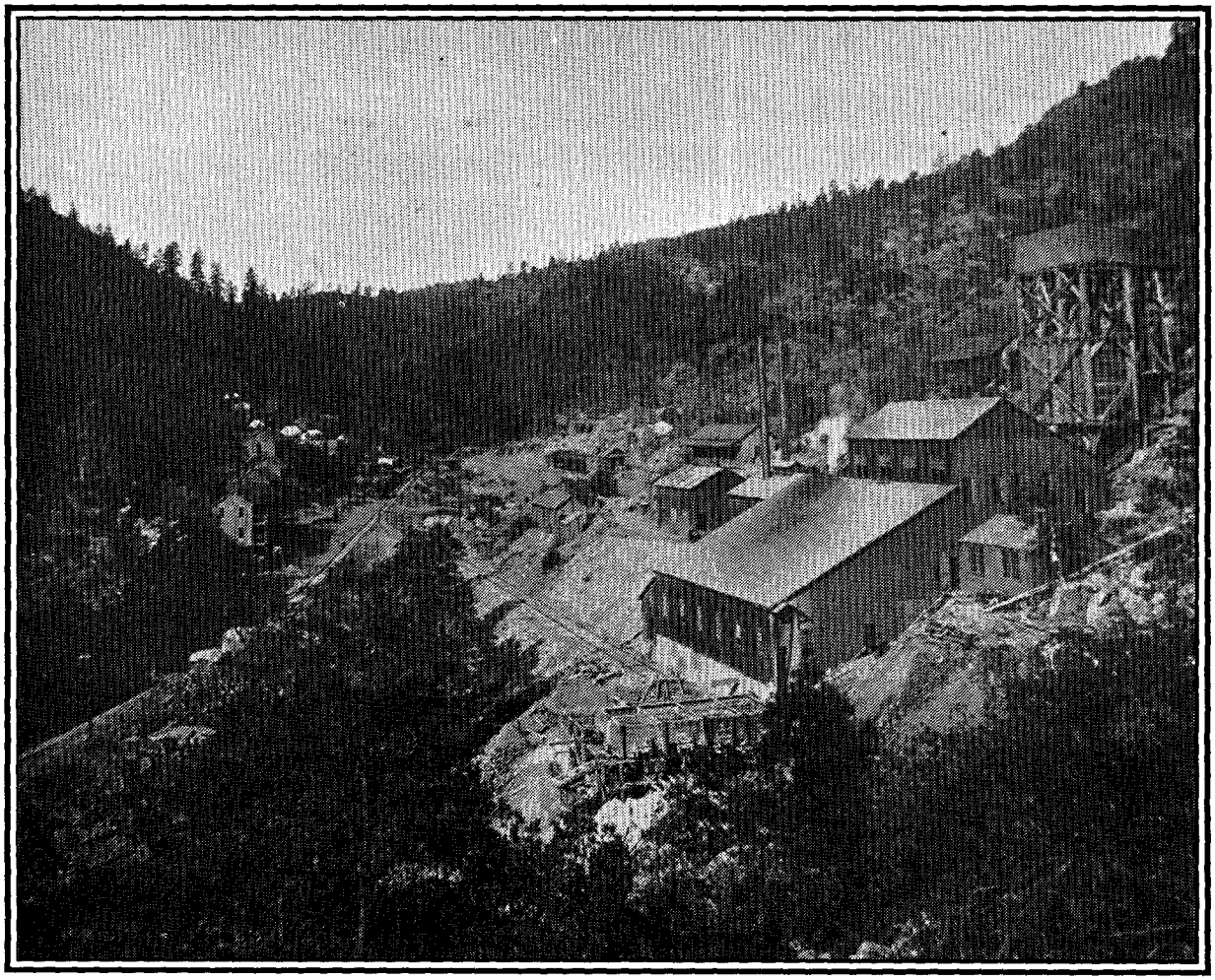
There were some protests from concerned California farmers and from Butte and Anaconda residents, who initiated discussions and classic lawsuits over mining pollution. Some industry employees showed a commendable awareness of the environmental damage that was occurring around them. But investors in the east and in Europe wanted profits, and they wanted them now. They dismissed any issues that might threaten those dollars. In the final analysis, the blame had to be shared among the miners, the owners, and the investors, as well as by local businessmen. For all of them, profits overrode all else. It would be several generations before the general public arose in protest, and mining would be forced reluctantly to fall into step.

The good and the bad, the high points and the low, were all part of the heritage of western mining. Legends arose from it: the Big Four on the Comstock, the fight of the copper kings in Butte, Horace Tabor's Colorado saga, and the story of the prospector and his burro. The mining communities are also elements of that legend. But these are only part of the larger significance to the region and nation. Mining made it possible to open the West with a speed and ease that would not otherwise have been possible. It left behind a regional transportation network, urbanization, and a broad-based economy that has withstood the buffetings of the decades since the turn of the century.

What the history of mining can offer today's West is a sense of time and a sense of place. Both are tremendously important to understanding how we got here and why. Perhaps the mining West never was "a spot for one brief shining moment that was known as Camelot." It was, however, people, a time, and an industry that impacted American and world history and changed the course of western development. Today's West was built on the bedrock of gold, silver, copper, and coal. The remnants that are still visible today do not begin to describe the saga of those who passed this way as part of the epic chronicle of western mining.

Editor's Note: For expansion on the themes presented here see books listed in the appended bibliography and especially Dr. Smith's *Rocky Mountain Mining Camps*, which portrays the mining frontier as an urban one; his *Mining America*, an analysis of environmental concerns and the changing place of mining in the Western American mind; his exemplary biography of bonanza king Horace Tabor of Leadville (*Horace Tabor, His Life and the Legend*); and his examination of two mining regions: the silver boom town of Caribou, Colorado, as described in *Silver Saga*, and the mining history of Southwestern Colorado in *Song of the Hammer and Drill, the Colorado San Juans, 1860-1914* and *Rocky Mountain Boom Town, A History of Durango*. In *Colorado Mining, A Photographic History*, Dr. Smith presents an overview of Colorado mining.

PLANNING, SURVEY, & EVALUATION



A typical gold camp with mill, railroad and haulage tunnel tapping several mines. Poland, Arizona (1905). Photo courtesy of the Sharlot Hall Museum, Prescott, Arizona.

THE SURVEY AND INVENTORY OF MINING PROPERTIES

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This paper will discuss survey and inventory activities as they fit into the larger framework of planning. By approaching survey through the planning process we can use preservation goals and management needs to help define the areas to survey, the resources to look for, the professional disciplines needed, and the techniques to be used. This approach should lead to a better use of available survey funds and more consistent and better informed decision-making.

The National Park Service published standards and guidelines for historic preservation programs, including planning and survey, in 1983 ("Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines"). These standards are intended to create a consistent national approach to preservation activities and to promote a framework for consistent decision-making at any level. These are the standards that the National Park Service, other federal agencies, State Historic Preservation Offices, and local governments use; the survey and planning approaches that will be described should be general enough to apply to any situation, not just to National Park Service projects.

For detailed information about the procedural aspects of survey, please refer to National Register Bulletin 24, entitled "Guidelines for Local Surveys: a Basis for Preservation Planning," which is a good step-by-step guide for conducting a survey and discusses integration of survey activities into overall preservation planning.

The goal of planning is to identify, evaluate, and establish treatment priorities for the full range of properties representing the historic context. Identification, evaluation, and protection are the preservation goals encompassed in the 1966 National Historic Preservation Act, and they form the basis of the planning process. Identification is the important first step toward reaching the ultimate goal of making well-informed and consistent management decisions about cultural resources. The purpose of a survey is to identify resources that contribute to the character of an area or illustrate its development and importance and deserve consideration in planning. A survey provides planners with a database of information on historic resources, it increases public awareness of the cultural environment and the need for preservation efforts, and it assists in establishing priorities for preservation.

HISTORIC CONTEXTS

When beginning a survey, the amount of data available can be overwhelming. The National Park Service planning standards recommend breaking down this mass of data into manageable units by developing historic contexts. The definition of historic context is "an organizational framework that groups information about related historic properties based on a theme, geographic area, and time period." The historic context focusses the identification, evaluation, and protection efforts and forms the basis for decision-making about what to survey, what is likely to be found, how to evaluate what is found, and how to manage the significant resources.

The process of developing a historic context before starting field survey activities is a way of stepping back and taking a survey of the <u>situation</u> in order to formulate an efficient approach to undertaking the <u>field</u> survey. The historic context should first identify the concept, time period, and geographical limits for the study. Contexts can be developed at any level: an example of a local historic context might be "Boom Period Land-Use on the Comstock in the 1860s and '70s;" a state-level context could be "California Gold Rush Placer Camps from 1848 to 1860;" and a national context might be "Nineteenth Century Precious Metal Rushes in the U.S."

Next it is necessary to assemble existing information about the context, which might consist of a historical overview, existing survey data, land-use plans, environmental impact reports, and so on. This data must be assessed to note the biases and gaps in the information base. The historic context should synthesize

all of the information into a useable form that identifies important patterns, events, persons, and cultural values. Keep in mind that this "situational" survey is all oriented toward eventual identification, evaluation, and management of the physical resources associated with the context.

The next task is to identify the known or expected property types that relate to the context. Development of historic contexts and identification of property types should involve an interdisciplinary approach, to ensure consideration of the full range of historic (and prehistoric) properties and the perspectives that impart historic or scientific value to them. The property types link the theoretical material in the historic context with the actual historic resources that illustrate those ideas. As an example, property types associated with hydraulic mining during the California Gold Rush might include informal camp sites with ethnic associations, as opposed to organized company towns; evidence of geographical alterations such as eroded hillsides or damaged streamcourses; and remains of various hydraulic engineering technologies, such as monitors, sluices, flumes, etc.

Explain where these resources, or property types, are likely to be found and what their current condition is expected to be. Then identify the information needs. What data gaps exist that can be filled by additional archival research or field survey? Perhaps all of the existing surveys have concentrated on archeological remains of campsites and the like, but have ignored engineering-related resources.

A fully developed historic context or contexts--with the theme, time period, and geographical area identified, assessment and synthesis of existing information completed, and property types and their probable locations and condition identified--will provide the basis for developing goals and priorities for the identification, evaluation, and treatment or management of historic resources (in other words, for creating a historic preservation plan).

In real life, planning doesn't proceed in a step-by-step, logical fashion, and everyday we're faced with making decisions lacking comparative information on property types, lacking the historical context to evaluate the significance of a property, even lacking basic historical data about a property we might be dealing with. The planning process described above recognizes that there may be a lot of available data or there may be only a little. It calls for continual refinement of historic contexts, goals, and priorities, as the information base is expanded by inventories, or as issues arise and are dealt with.

What it is important to keep in mind is that this planning approach is intended to provide a consistent and interdisciplinary approach to survey, evaluation, and treatment activities, to provide a larger framework for looking at things, and to create a larger pool of available data from which to make decisions.

INTERDISCIPLINARY APPROACH

An interdisciplinary approach is almost essential when dealing with mining sites. Too often, surveys of mining areas have concentrated solely on the architecture, particularly in commercial areas, and have ignored the residential areas, archeological remains, or the mining resources. An interdisciplinary team might include a historian, architectural historian, historical archeologist, oral historian, geographer, geologist, engineer, miner, and a few other possibilities. Involving an interdisciplinary team early in the planning process should help reduce survey costs by focussing on the management needs and preventing wasted time and energy during the survey. An interdisciplinary approach will ensure that all resources are identified and evaluated within the historic contexts.

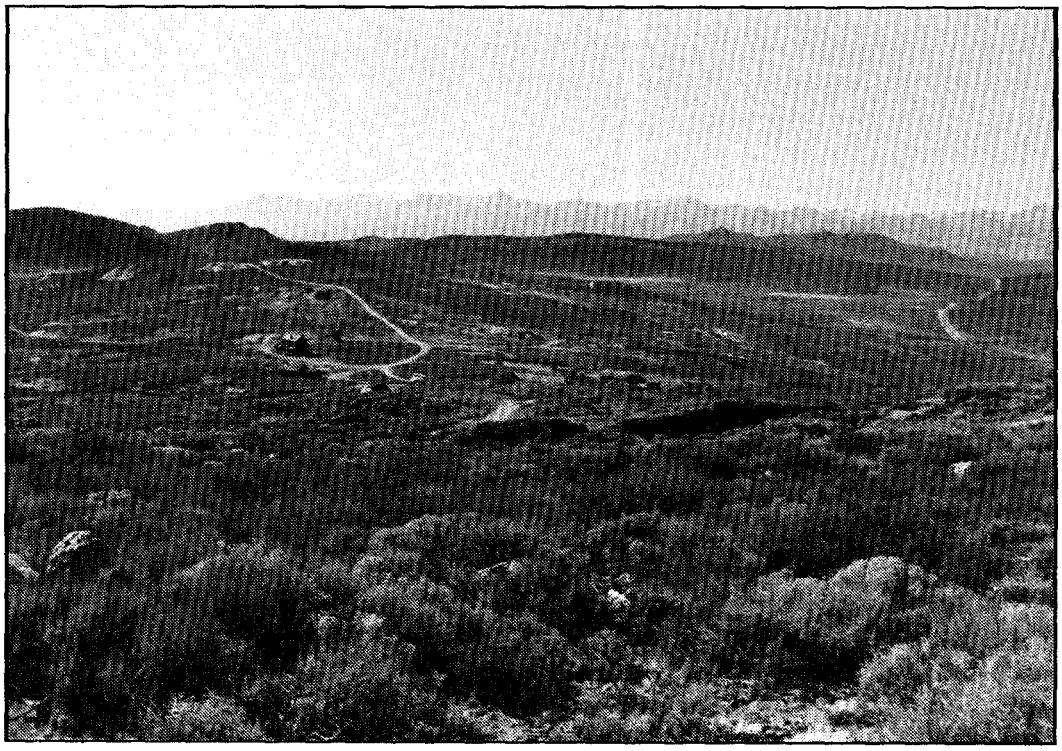
Survey will be an important step toward filling some of the gaps identified in the preservation plan and ensuring that the full range of historic values is considered. Development of the historic context will help gear the scope of the survey to the goals identified in the planning process and current management needs. These goals will determine whether reconnaissance or intensive survey or a combination of both are undertaken and what professional disciplines should be involved in the survey. Whatever methods are used, and whatever limitations are placed on the survey by time, money, or other factors, always keep in mind that the survey must provide enough information to carry out evaluation and make informed judgments as to treatment or management of historic properties.

RESEARCH DESIGN

The survey should be guided by a research design. To the extent that a preservation plan or historic contexts do not exist before starting the survey, they should be developed enough to create the research design. The research design integrates the various survey activities and links them directly with the goals of the preservation plan and the historic contexts developed within the plan. The research design sets out the objectives of the survey, the methods to be used, and the expected results.

ARCHIVAL RESEARCH

The importance of archival research in both the survey and planning processes should be emphasized. Archival research is essential to both development of historic contexts and to guiding the field survey. Interdisciplinary involvement is also necessary in archival research. Each discipline will view the data differently. Whether the research is accomplished as part of the planning process and development of the historic contexts, or as part of the survey process, it is crucial to defining what areas to look at, what resources to look for, what techniques to use, and how the resources will be evaluated. In the course of the research, the historic contexts and the research design will probably be changed and refined.



The mining landscape of Bodie Bluff, Bodie Historic District National Historic Landmark, California. Photo courtesy of Ann Huston, National Park Service.

Bodie, California, can be used as an example. The commercial and residential areas of the town, which was occupied from the boom period of the 1870s and '80s until its abandonment in the 1940s, are located within a bowl adjacent to a ridge containing the mineral-rich quartz veins. The Bodie townsite is part of Bodie State Park, which has been well-inventoried. Surrounding the townsite are thousands of acres of mining remains and occupation sites which are in BLM and private ownership and which have not been well identified or studied. Bodie also poses the interesting issue of outliers: associated sites located miles from the mining center, such as the deforested areas and Mono Lumber Mill at the southern edge of Mono Lake, which furnished the building materials for the town and the mines. Toll roads and

railroads were essential transportation links carrying lumber, produce, and other goods to the isolated town. The Green Creek hydroelectric plant produced power that was carried thirteen miles to the town. Without first examining existing documents and doing archival research, it would be impossible to decide where to focus one's efforts to most effectively make use of available survey funds and time. Faced with a resource base as vast as Bodie, by going immediately into the field without doing preliminary research, surveyors could easily miss important contributing resources or simply identify sites for acres in all directions without understanding how they fit into the overall development of the area.

A good list of archival sources of information on mining sites can be found in Don Hardesty's newly published book on the archeology of mining in Nevada, which can be ordered from the Society for Historical Archeology.

FIELD SURVEY

Once the archival research has been completed or is well underway, the field survey can begin. A breakdown of the historic resources that can be expected in a mining area would include:

- residences
- commercial areas
- mining sites (of different types and eras)
- industrial sites for processing ores
- service centers (sawmills, power plants, quarries)
- supply routes (toll roads, railroads, etc.)
- landscape features

This breakdown could in fact be a list of the property types for a given historic context. Significant properties will be revealed archeologically, in architectural and engineering resources, and also in the cultural topography or landscape. Each professional discipline will view these resources with its own theoretical perspective.

The architecture and engineering features of mining sites have probably received the most attention in studies of mining areas. There has been a tendency to focus on large mining artifacts, usually out of their systemic context. Mining landscapes or topography have not received a great deal of attention in the past, perhaps because "landscape," even though an integral part of a mining area, is hard to define or quantify. Examples of mining landscape features would include tailings piles, prospect holes, tailings ponds, or hydraulicked hillsides. Two good sources of information on mining landscapes are a paper presented at the 1988 Society for Historical Archeology meeting by Richard Francaviglia on interpreting and evaluating the man-made topography of historic mining districts, and National Register Bulletin No. 30 on rural historic landscapes.

HISTORIC LANDSCAPES

Viewing a mining area as a historic landscape allows us to look at the components (whether they are archeological remains, buildings, engineering structures, or topographic features) in terms of the systems and patterns they represent. The historic landscape evidences human responses to natural features, illustrates patterns of spatial organization and land use, and shows the influence of cultural traditions. For mining areas, the geographical location of the ore body is the primary determinant of the land use pattern. Secondary determinants will be sources of water, the location of existing towns and roads, and supporting resources such as timber stands. Cultural factors will influence the settlement patterns of the residents, architectural styles, and mining technology. Economic factors condition proximity of mills to mines, locations of roads and railroads, and so on.

Studying mining areas from the historic landscape perspective leads to a more holistic view of the resources which allows interpretation of the resource patterns as well as the individual components of the landscape and encourages an interdisciplinary approach.

THE NEED AND PROCEDURES FOR INVENTORYING ABANDONED HISTORIC MINING SITES

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The National Park System contains a large number of western parks that were originally established to preserve outstanding scenic and natural wonders. Those places also, however, contain a variety of cultural resources connected with early exploration and settlement, transportation networks, ranching and stockraising activities, and lumber and mining operations. The Park Service's mining resources are not confined to the west, but are found in many parks in the east, south, and northern portions of the country as well as in Alaska. Historic hardrock mines operated on boom and bust cycles based on fluctuating economic conditions. They were alternately developed, abandoned, and reworked in later years when rising metal prices and new technological advances made such work economically productive.
Abandoned hardrock mining sites in the west have left the National Park Service with a variety of remains in various stages of decay, including habitations, adits, tunnels, shafts, ore bins, mill ruins, and assorted debris associated with daily life and mineral processing. The discovery of nonmetallics, such as borax and talc in Death Valley, initiated a new era of mining activity, as did the years during World War II, which spurred prospecting for strategic minerals such as tungsten, lead, and uranium. These later activities, in addition to coal mining and oil and gas exploration, have had different impacts on the environment and created different types of historical remains. Often fewer structures remain on these sites, but there has been bulldozing of roads, the removal of entire hillsides in the quest for wealth, and environmental degradation involving erosion, leaching of heavy metals, and acid mine drainage.

Abandoned mining sites pose a variety of problems for Park Service management. Chief among these is visitor safety, which is associated with mine site exploration by park visitors. Potential threats to life and limb include unstable structures, open shafts, and dangerous explosive materials. The mitigation of these hazards and related questions of Park Service responsibilities and liability at abandoned mining sites should be one of the major thrusts behind formulation of a comprehensive Abandoned Mineral Lands policy. Resource protection is another problem posed by abandoned mineral lands and has two aspects. One deals with the damage to the environment posed by erosion and chemical drainage, although this usually pertains to more recent operations such as uranium, coal, gas, and oil extraction activities. In terms of hardrock mining, threats exist to the resource itself because it is difficult to patrol and protect from vandalism many of those sites due to their isolated locations.

Specific federal laws exist that establish broad policies for cultural resource preservation and give the National Park Service authority for specific planning and management activities geared toward protection of mining sites, controlled visitor use of those resources, and the mitigation of adverse effects on them. The planning and management activities of the Park Service in regard to historic mining sites are undertaken with the recognition that tangible resources such as mine structures and associated machinery and artifacts are nonrenewable. Park Service policies also stress the preservation of existing authentic resources, realizing that their loss means a decrease in park values and a less satisfactory visitor experience. Management policies of the Park Service require park managers to locate, identify, evaluate, preserve, manage, and interpret qualified cultural resources in every park in such a way that their integrity will be preserved and that they will continue to provide information and enjoyment to future generations.

CULTURAL RESOURCE INVENTORIES

The initial step in determining management policies for abandoned mining sites should involve an inventory of those resources, a process that identifies sites and the extent of their remains. Combined with documentary research that establishes a contextual framework within which sites can be evaluated for significance, this process will enable managers to formulate appropriate management decisions concerning treatment and use of abandoned historical mining sites.

Inventories fulfill a variety of management needs. First, they accomplish basic information retrieval. Every park superintendent needs to know what resources his park contains and what his visitors might

encounter in terms of safety hazards, such as explosives, flimsy structural ruins, dropoffs, and the like. The record of having noted and tried to mitigate those hazards could be extremely important in future liability questions. Second, inventories establish a resource data base. In addition to providing information on the condition of a mining property at the time of inventory, they initiate a record-keeping process to monitor the condition of the site over the years. Third, inventories facilitate the identification of significant cultural properties. They help the Park Service fulfill its compliance responsibilities by providing a basis for evaluations of significance based on comparative data and the integrity of individual sites. Fourth, the identification of significant resources will enhance park interpretive programs. The National Park Service has identified mining in America as an important historical theme within its areas. Properties with integrity that are associated with that theme should become an integral part of the park visitor experience. The educational implications are even broader in terms of the contributions that study of these sites can make to the general pool of scholarly knowledge on mining processes, lifestyles, social interactions, use of material, and communication and transportation networks. Fifth, inventories can be helpful in expansion of museum collections by identifying objects of exceptional interpretive value that might be lost if left on site. Sixth, inventories can provide data useful for other aspects of park operation, such as natural resource management. Inventories can identify patterns of human occupation and land use, record the impact of man on the environment over the years, and assess the effects of that occupation on vegetation and landforms. They can also note how animals use abandoned mine sites and how water sources have been impacted historically. Finally, of particular interest to managers should be the fact that inventories can aid in the prioritization of park expenditures. Inventory and evaluation do not "write off" certain mining sites, but do help in the determination that some sites are not significant enough to merit planning attention or money for interpretation, although because of safety hazards they might deserve stabilization or mine safety measures.

The process of inventorying abandoned mining lands within the National Park System has not yet been perfected. Most data bases developed to date are for purposes of mine closure or reclamation or are conducted in the course of completing a Historic Resource Study, which is the major cultural resource vehicle for the inventory of abandoned mining sites. There needs to be further coordination of this effort between the Park Service's mining and minerals branches and the agency's cultural and natural resource sectors in order to ensure acquisition of all the data needed for planning considerations.

RECORDS SEARCH

The basic procedure for inventory of abandoned mining sites should include a records search at the earliest stage. This can prove to be a very complex process because the researcher is dealing with diverse resources, many types of minerals, hundreds of locations, and a wide range of technology. Initial aids in the inventory process at this point include existing park data bases and surveys that might have been carried out by park rangers, VIPs, or other interested persons. Both primary and secondary sources are important for gaining a knowledge of state, regional, and national contexts within which a mining property can be evaluated. By becoming familiar with the prehistory and history of a region, it is possible to define important patterns in the development of an area and identify types of mining sites and communities that might be associated with them.

Another important potential source of information in the research phase are graphic materials, such as photographs, maps, and architectural drawings. Photos, a vital form of evidence, can provide views of mining operations at their peak and indicate what to look for and where to look for it. They are instrumental in showing the style and fabric of buildings, the extent of historical development, the organization of communities, the layout of milling plants, and changes in the landscape resulting from historical activity. Because original design drawings of mills and plants, if they exist, do not always reflect building and machinery placement as built or as expanded, photos can show the alterations and additions to original plans based on changing operational needs. Of importance, too, is that photographs focus one's consideration of a mining site on a process rather than on individual objects or structures and aid in analyzing relationships between individual objects, working and living areas, transport systems, and milling plants. Early survey maps and mining plats show activity areas and the location of structures and name companies and people involved at specific sites at specific times. Maps produced by the U.S. Geological Survey show precise locations of mines, types of minerals excavated, and also water sources, roads, and general development in the area of the site. Architectural drawings are sometimes available for larger sites or mining operations, but seldom for small desert operations.

Some parks have corporate records, especially if mining activity has been ongoing. These are invaluable in providing property descriptions, legal data, discussion of types of minerals mined, production levels, shipping routes, and the type of equipment used. Government and state publications can provide detailed information on the condition and status of mining properties at specific times. County documents, including deeds, tax records, and plats help trace ownership, dates of transfer of properties, and the extent of development. Professional and technical journals such as the *Mining and Scientific Press* and *Engineering and Mining Journal* provide detailed illustrations of mining and milling processes and good specific technical data as well as accounts of activities in the mining districts across the country. Newspapers and oral history are sources to utilize with discretion. Newspapers, especially from the early days when they were used to promote mining in an area, maintain morale, and attract new investors, are useful for pictures, the introduction of names associated with investment and operations, and for some sense of the production rates at mine operations in a specific locality, although these are often exaggerated. Former mine owners or workers can fill in informational gaps, but their observations should always be supplemented by documentary research and field observation.

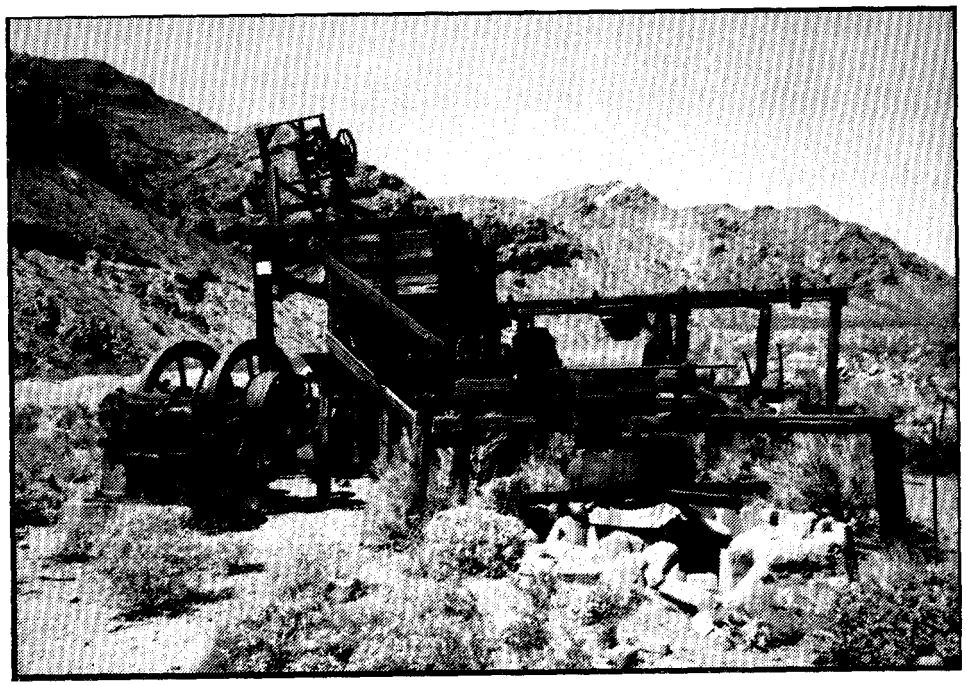
FIELD SURVEY

The second important phase of inventory work is on-site reconnaissance, whose purpose is to record sites and their associated historical, architectural and archeological components. Such fieldwork involves recording and documenting extant structures and objects and "reading" the landscape in an attempt to identify nonextant or subsurface features of a mining area that were noted in an earlier records search. This phase should follow preliminary archival, photo, and map research so that the inventory team has an idea of what to look for and should precede implementation of any plans adversely affecting the mining site. A standardized inventory form should be used for documenting features of a site. The Park Service needs to institute a form for this procedure that insures the acquisition of adequate data related to safety hazards and natural and cultural values. At the very least the form should include the site name and location; rough boundaries, including significant structures, roads, and objects; a statement of the type of resource, whether it is a site with above-ground features, whether there are possible subsurface remains, whether it is an individual structure, or whether it is a district with a significant concentration of remains. The site description and map should include identification of above-ground and subsurface features; the relationships of structures to each other; general characteristics of the site; building materials; specific features, such as roads and walls; artifacts; and the general condition of the site. Taking photographs and accurately locating the site on Geological Survey maps are also essential. Additional information on safety hazards, the types of minerals mined, soil samples, an assessment of the property's effects on the environment, and its use by wildlife should be present. All this information is needed to implement a responsible Park Service abandoned mineral lands management policy.

Several considerations should be kept in mind in carrying out field inventories. One of them is the identification of more than just the primary structures that are easily recognizable. An effort should be made to find clues to secondary features such as supply routes, patterns of settlement, and types of land use. Items of industrial/engineering significance may be present in mines or in the ruins of milling plants, such as specialized machinery that characterized the early mining industry. One site may illustrate several different extraction and milling processes, and one needs to try and recognize relationships between individual isolated objects on site and broader technological processes. It is best to view independent pieces as interconnected units of a complex mine operation.

OTHER CONSIDERATIONS

One rule of thumb is that "the biggest is not always the best." We should not always be looking for the biggest producers or the largest number of ruins. Sites are often important simply because they illustrate a particular lifestyle, arrangement of structures, or mining process, or because they contain an example of something becoming very scarce, such as a stamp mill. Because even the most inconsequential-looking artifact can provide information to the trained eye on any one of a number of social, engineering, and technological questions, input from a variety of disciplines, such as mining engineers, geographers, geologists, archeologists, and anthropologists is useful in assessing interrelationships at mining sites. One should also look for groups of sites showing similarities in historical land use and modifications over time that indicate a geographically definable cultural landscape. It also will pay to remember the archeological component that may affect later assessments, such as trash dumps, privies, foundations, and the like.



A unique small scale gold mill from the 1930s. Gold Hill Mill, Death Valley National Monument. Photo courtesy of Linda Greene, National Park Service.

Assessed independently of written accounts, they can often act as a check on documentary research. Most importantly, perhaps, we in the National Park Service must look to the future in inventory work. Recent mining operations may seem less important and less appealing aesthetically, but they are an important part of the continuing development of the mining industry in America. If we do not preserve and interpret examples of all types of early mining operations, as well as significant examples of those less than fifty years old, we will have lost part of the national mining record and the resources needed to illustrate this aspect of America's industrial and social heritage. Hardrock mining sites appeal to a wide variety of people and have therefore undergone at least some consideration for preservation and interpretive use. Other resources, such as coal mines and gas and oil wells, are as much a part of the American industrial story and deserve the same treatment in terms of inventory, evaluation, and planning procedures.

The presence of many historical mining sites within the National Park System and of thousands of more recently abandoned mineral lands, plus the seriousness of a variety of problems related to visitor safety, interpretation, recreational use, and resource protection, demand a comprehensive National Park Service policy concerning the management of abandoned mineral lands. This program must begin with a consistent nationwide inventory procedure. The National Park Service cannot deal responsibly with its mining resources until it knows exactly how many and what types are included within the system. Only then can the agency place these resources into a larger context and attempt to balance its concerns for visitor use and safety, historic preservation, and the interpretation of significant cultural resources.

HISTORIC MINE LANDS AS CULTURAL LANDSCAPES

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One way to look at mine lands is from a cultural landscape perspective. This is to say that mining areas are not just a collection of isolated features, significant in and of themselves as industrial objects; rather, abandoned mine lands are distinct landscape districts, inclusive of all relevant cultural and natural features. The built features, the planning, the technology, and the natural resources are all significant, contributing elements in a mining area. The resources cannot be separated one from the other, for they operate as a single entity, with the landscape as the staging area. As the landscape is an integral part of any mining activity, an understanding of the complete picture is difficult without its inclusion.

As defined by the National Park Service's Cultural Resources Management Guideline (NPS 28), a cultural landscape is a "geographic area, including both cultural and natural resources, that has been influenced by, or reflects human activity, or was the background for an event or person significant in human history." There are five types of cultural landscapes: 1) historic scenes; 2) historic sites; 3) historic designed landscapes; 4) historic vernacular landscapes; and 5) ethnographic landscapes. Historic mine lands, in general, fall into the category of historic vernacular landscapes.

The definition of a **historic vernacular landscape** is a geographical area that has been used, shaped, or modified over time by human activity, occupancy, or intervention, and that possesses a significant concentration, linkage or continuity of historic landscape features, including areas of land use, buildings, vegetation, roads and waterways, and natural features. In addition to mining sites, agricultural and lumbering areas, maritime activities, and transportation systems fall into this landscape category. In general, the spatial organization, the concentration of historic features, and the historical period of development distinguish a rural historic landscape from its immediate surroundings.

The National Register has established specific criteria for determining historical significance and integrity for rural historic landscapes. Draft Bulletin #30 of the National Register presents a step-by-step process for identifying, evaluating and nominating these properties. This paper will present an overview of identification and evaluation approaches for historic mining sites as cultural landscapes.

IDENTIFICATION

Similar to other nomination procedures, one must first go through an identification process for a particular site. First, establish a **historic context.** This is a framework for organizing information about related historic properties based on a specific theme, period of time, and geographical area. How does a particular landscape fit into the historical development of the larger geographical area where it is located?

Next, conduct **historical research.** Develop a chronology for the area and particular landscape. Be sure to identify the historical eras and evolution of the site. From this research, a period or periods of significance should be determined. The period of significance is the time in which a landscape was either associated with notable events, activities, cultural groups and land uses, or a period during which the landscape attained important physical qualities and characteristics. There may be more than one period of significance. With mining districts, the period of significance is typically the boom, though there may be additional developmental eras to evaluate--the discovery episode, the rush, the bust, redevelopment and/or continued use. In any event, keep in mind that it is the most significant period(s) against which integrity is used to measure Register eligibility.

The next step is to establish **overall boundaries** for the district. An understanding of the historical context and physical extent of the site for each of the periods of significance is needed to properly establish a current boundary. When defining the edges of a rural historic landscape, some elements to consider are historic and current legal boundaries, fixed demarcations, rights-of-way, natural features, changes in spatial organization, edges of new development, and regional perspectives. "Mining landscapes

may encompass not only the most prominent mining structures, but also the communities shaped as a result of the mining activity and the surrounding landscape where the mining claims were located and where shafts, tunnels, and pits were dug to extract the minerals" (p.31, draft Bulletin 30). Once this information is collected, the site must be evaluated.

EVALUATION

Evaluation consists of the identification and documentation of the historic components, establishment of significance, and the assessment of integrity. In general, the overall goal is to identify the significant, character-defining elements of the mining site, from both historic and current perspectives. Following the historic research, a current condition assessment is needed. What remains today? Can the story be interpreted from what remains? Is there the potential for important information to be yielded to history or prehistory from the remains? These kinds of questions must constantly be asked when evaluating a cultural landscape. It is important to realize that a landscape is not static; it is always evolving through natural and/or man-made actions and often includes recent changes in land use. For example, an abandoned historic mine may reopen decades after its closing; new extraction processes may be introduced that dramatically alter the historic setting, such as the re-milling of historic tailings. Hence, a careful process of identification, analysis and evaluation of the site's significant elements is critical for assessing integrity.

To do this, a framework established by the National Register for examining rural historic landscapes should be utilized. Again, this is outlined in detail in draft National Register Bulletin #30. There are several landscape components that should be documented for each significant historic period, as well as for existing conditions and potential threats. The integrity of these components today, compared to the historically significant period, is the primary means to evaluate integrity, and subsequently, National Register eligibility.

Careful and thorough research is needed, and the findings should be graphically illustrated whenever possible. Historical research should reveal some information about the evolution of the landscape. Journals and/or old USGS records often describe the landscape when a claim was first made. A river mouth in Alaska was described as being a narrow, canyon-walled corridor. Today this spot is a 1/4-mile-wide gravel bed, thanks to past hydraulic mining operations. This type of information is invaluable for assessing integrity.

It may also be helpful to conduct a visual assessment of an area. Overlay drawings and maps are extremely useful for analyzing changes over a period of time. Also, the components of a mining landscape often overlap in information value and are not exclusive of one another.

COMPONENTS OF HISTORIC LANDSCAPES

With mining sites in mind, the landscape components used for evaluation are:

1. Patterns of spatial organization: this is an analysis of the overall, broad landscape organization, based upon landforms, site boundaries, circulation systems, and areas of land use. The overall landscape organization analysis will depict who is where. How have the natural features affected the distribution of activities? For instance, water sources are typically critical influences on settlement siting and organization. With some mining landscapes, this may be extensive, such as in Virginia City, Nevada.

2. Land use and activities: offers an understanding of the human forces and processes that form and shape the landscape. How have people interacted with the landscape? Diagram land use zones for the significant historic period as well as for existing conditions. Areas to include are residential/community, mineral extraction, processing and waste zones, recreation, cemetery, and relevant outlying operation areas. Be sure to describe the types and dates of land use, locate them, and identify past and present exploitation of these areas.

3. Response to natural features: overlaps with land use to a certain extent, but allows for additional information concerning natural resource availability, unique construction, orientation and cluster arrangements resulting from adaptations to the environment. Describe the micro-climate and local ecology. Where are the resources? How have their locations effected settlement patterns?

4. Cultural traditions: how did the landscape affect cultural traditions, and how are cultural traditions reflected in the site? These traditions may include technological innovations, political and social customs, ethnic identification, and land grant policies, as manifested in the built environment through vernacular characteristics and patterns of land division. How have cultural traditions affected community organization? Often with mining sites, there was a company hierarchy reflected in the area's planning. Other examples may be social stratification based upon ethnic groups or even gender, manifested in the physical layout. Cultural traditions may also be reflected at the small scale, such as construction techniques particular to a certain culture. Identify the source of these cultural traditions and describe the kinds of features resulting from these traditions.

5. Circulation networks: describe routes that facilitate travel within the landscape and connect a particular site to the larger region. Document, at various scales, the regional to local patterns of circulation--railroads; roads; tramways; paths from the residential to work areas; and connections between individual structures, such as boardwalks. Trace the evolution of these routes, as population growth and technological advances directly affected circulation. Identify circulation systems that were initiated but never completed, for these may be significant to an understanding of the area's development.

6. Boundaries: as the larger, contextual boundaries should be determined in the identification process, divisions of land at a smaller scale should be determined. Establish physical boundaries created by vegetation, topography, circulation and water supply systems, structures, legal claim demarcations, and other delineations, both historic and current. Tie these local boundaries back to overall patterns of spatial organization and regional patterns of land division.

7. Vegetation related to land use: is typically associated with the residential and community areas of a mining district, rather than the work zones. Vegetative features are the result of human activities or intentional planting. Typical elements include fields, treelines along circulation systems, gardens and planting beds. The distinct lack of vegetation may be a noteworthy characteristic. A vegetative element typically found in mining landscapes is the natural or man-made reclamation of a site following abandonment. Old leaching ponds may now be eutrophic; once denuded slopes may have new timber growth. These characteristics should be noted.

8. Structural types: describe the built features, past and present. Identify the varying types of buildings such as mills, power stations, offices, stores, housing, and outbuildings, as well as structures, which include adits, shafts, tramways, and engineered water features. Relate these features' characteristics to their functions and the overall land use patterns, for these may be important in understanding the history of the landscape and the community. Identify the date, and describe the condition, materials, construction types, location, and nature of additions and alterations. Descriptions of qualities such as mass, materials, scale, and texture should be included. It is important to trace the evolution of these structures as related to technological advances. Discuss the impacts of nonhistoric construction and identify contributing and non-contributing features.

9. Cluster arrangements: identify clusters of buildings, structures, and other features, and the residual spaces between them. Note patterns of arrangement. How is one cluster organized? How do various clusters relate to one another? Are there repeated patterns? Describe the function, scale, spatial arrangement, condition and composition of the arrangements. These may reveal information about the historical use, cultural traditions, response to natural features, technology, and broad, regional patterns of siting and spatial organization.

10. Archaeological sites: these include prehistoric and historic abandoned sites and ruins that are likely to provide valuable information about the ways in which the landscape has been shaped, patterns of social history, or the methods, practices, and extent of such activities as mining. Identify the types of sites, their setting, distribution, surface and subsurface features, disturbances, and threats. Examples include road beds, foundations and building ruins, trash piles, tailings, and pre-historic resource extraction sites.

11. Small-scale elements: these are features that collectively add to a landscape's setting. They may include ruins which are not necessarily archaeological sites but add to the historic scene; fences; retaining walls; tailings; hand-stacked rock piles; water diversions; social foot paths; curbing; signs; and abandoned equipment.

12. Technology: although not identified as a separate component by the National Register, technology should be evaluated as an integral influence on the landscape. How did changes and advances in technology affect the interaction with the landscape? Particularly with mining sites, a technological revolution occurred during the western mining boom, which significantly altered extraction and milling processes. Man and the machine quickly and dramatically began to shape the landscape. For instance, with gold placer mines, the technological evolution started with hand-held pans; then grew to water manipulation for sluices; then to extensive ditches and diversions for hydraulic monitors; and eventually evolved to dredging operations. Each one of these techniques left a particular mark on the landscape; from a simple, small-scale operation, to extensive landscraping. Similar changes in the technology of hard rock mining also dramatically altered the landscape. Technological advances also impacted the landscape with the development of new communication and circulation systems, and construction techniques.

SIGNIFICANCE AND INTEGRITY

Once these components are documented, the next step is to define significance for the site, following from the National Register's criteria. An area of significance is that aspect of history in which the rural landscape through use, occupation, physical character, or association, influenced the development or identity of its community or region. Mining sites will likely fall into the topical areas of "community development and planning," "engineering," "exploration/settlement," and/or "industry."

With an understanding of significance, integrity must be assessed. Historic integrity is the composite effect of the described components, and requires that those elements which influenced the landscape during the historic period be present today in as much the same way as they were historically. The period of significance is the benchmark for measuring whether changes contribute to the landscape's historic evolution or alter the integrity of the historic scene. Often there has been a continuum of use which must be addressed.

Threats to integrity must also be recognized. Recent mining activities may have altered the significant characteristics beyond the point of integrity. For instance, current mining practices, such as large open pits, may be uncharacteristic of the historic extraction process. Integrity may also be lost due to the cumulative effects of incremental changes; relocation or loss of historic structures; loss of small-scale features; and other significant characteristics which defined historic land use patterns. Recent changes must be identified and assessed for their effects on the overall character-defining elements of the historic scene.

Last, identify contributing and non-contributing resources to the area. The final decision on integrity relies on many factors: significance, historic landscape characteristics, balance of contributing and non-contributing resources and the existing and potential threats. In any rural historic landscape, changes may occur without loss of integrity, but there is often a fine line in deciding when enough is enough and not too much. Management of these mining areas is obviously of great concern, particularly in a situation of continuous use.

In general, a lot of progress has been made by the National Register in dealing with cultural landscapes, including mining areas. A vocabulary for a variety of sites has been established, and this should continue to be utilized and enhanced with the inclusion of abandoned mine lands. The cultural landscape viewpoint provides a useful framework for identifying, evaluating and determining significance and Register eligibility from an overall perspective, assessing integral relationships between natural and cultural resources. This framework may provide pertinent information otherwise overlooked when analyzing mining districts.

EVALUATING HISTORIC MINING RESOURCES: A NATIONAL REGISTER PERSPECTIVE

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Several years ago, while studying history in graduate school at the University of Wyoming, I had the good fortune to be hired as a summer interpreter at South Pass City State Historical Site. South Pass City is a small historic gold mining town located at the southern terminus of Wyoming's Wind River mountain range. Along with many pleasant job assignments I received that summer, I was asked to participate in a cultural resource survey conducted throughout the several-hundred-acre mining district.

Although the survey presented an excellent opportunity to visit the many mining sites scattered across that scenic area, I still recall the sense of frustration that accompanied our attempts to evaluate the deteriorated mining properties we encountered. We stumbled across numerous isolated prospect pits, deep shafts with tumbled down headframes, mountainous trash piles consisting primarily of discarded bottles and cans, and mostly-collapsed cabins held precariously together by a mixture of square and round nails.

We often felt like explorers "discovering" these remote resources for the first time, but we clearly faced some evaluation obstacles. While these sites clearly illustrated historically significant mining activity, it was equally clear that most of the sites had lost "integrity" in the traditional way that historic preservationists understand the term. By the same token, these sites had not yet deteriorated to the point where they had become the stuff of archeology. Because historical archeology had not then gained the measure of acceptance which it has achieved today, we lacked a coherent framework for understanding what we had surveyed. We certainly had plenty of documentation to allow us to understand the history of the mining district, but interpreting the extant resources was quite another matter.

In many respects, these evaluation problems remain very prominent today. Historical archeology has helped to fill the void, but grey areas persist. Mining resources obviously pose certain inherent evaluation problems. They are generally located in regions which experience extreme climates, they are usually built for temporary use, and they are quickly abandoned once the minerals play out. Consequently, a marked level of deterioration typifies the scene.

This inherent problem is compounded by the fact that we have already identified and documented many of the spectacularly successful mining operations. We have all heard of Virginia City, Nevada, or Butte, Montana, or Kennecott, Alaska, and, not surprisingly, all of these mining areas have been listed in the National Register. Today we more frequently find ourselves puzzling over the remnants of the more typical historic mining sites. These are the areas which have attracted enough attention to imprint the land with the discernible marks of mining activity, yet the financial return was too insignificant to warrant the construction of substantial buildings or structures. Thus we find ourselves in the difficult position of attempting to evaluate little more than a ditch, a shaft opening, a road, or a collection of prospect pits.

CONTEXT AND LEVEL OF SIGNIFICANCE

A case recently evaluated by the National Register helps to illustrate these difficulties. The mining district in question is located on federal land in an isolated mountainous region of Oregon far removed from the state's best known historic mining operations. At the heart of the district is a small mining camp consisting of dormitories, a few small stores, and several miners' cabins. This small area, which contains the only intact buildings and structures to be found in the mining district, was determined eligible for listing in the National Register several years ago.

In the meantime, attention shifted to the larger land area surrounding the parcel of land determined eligible for listing. Although this surrounding area includes no extant buildings, the area does include a labyrinth of paths and roads, numerous shaft openings, a collapsed flume system, and scattered mining

equipment. This area clearly includes remnants of mining activity functionally and historically associated with the mining camp. However, our building-oriented approach to assessing integrity provides no framework for evaluating these resources. In addition, because historic context documentation verifies that this is not amongst the state's more significant mining districts, the district evaluation will have to be based on consideration of its local significance.

In this case, an analysis of local significance should not prove terribly difficult. This analysis will involve historic context documentation which considers such factors as the influx of miners, the development of transportation systems to serve the mines, and the profitability and productivity of the mining activity. However, our ability to judge the potential significance of this district breaks down when we attempt to use traditional integrity standards to evaluate an area largely devoid of standing structures. Fortunately, two forthcoming National Register bulletins provide a much needed framework for evaluating this type of resource.

NATIONAL REGISTER BULLETINS

National Register Bulletin #30 is entitled "How to Identify, Evaluate, and Register Rural Historic Landscapes." This bulletin defines a rural historic landscape as "a geographical area that has been used, shaped, or modified over time by human activity, occupancy, or intervention, and that possesses a significant concentration, linkage, or continuity of historic buildings, vegetation, roads and waterways, and natural features." A rural historic landscape may or may not contain historic buildings, but a historic landscape will always include tangible imprints upon the land left as result of historic land use activities. While the bulletin offers a more detailed approach to recognizing and evaluating rural historic landscapes, it is enough to mention here that this bulletin provides a methodology for evaluating mining districts containing a few buildings of questionable integrity and a large area which clearly exhibits landscape impressions left by historic mining activity.

The second forthcoming publication of interest, National Register Bulletin #36, is entitled "Historic Archeological Properties: Guidelines for their Evaluation." This bulletin borrows from archeologist James Deetz the concepts of visibility and focus. **Visibility** refers to the actual above-ground physical resources, while **focus** refers to a pattern of impressions in the earth which remain evident even in the absence of visible above-ground resources.

These two concepts can be linked together in four ways which help to evaluate the National Register eligibility of mining sites. First, a site which has both visibility and focus will be eligible. Such a site would consist of a complete mining system including shafts, transportation facilities, extant mill buildings, commercial buildings, worker housing, etc. and all of these resources would be intact and interpretable. Second, a mining site with focus, but no visibility would possibly be eligible. This type of site would lack visible buildings, but, in order to be eligible, would have to contain features such as mines, headframes, tramways, mill sites, tailings piles, house sites, trash dumps, cemeteries, privies and isolated objects which reflect interpretable changes in mining and milling technology and cycles of occupation and abandonment. Third, a site which had visibility, but no focus would not be eligible. This site would include visible resources altered to the point where their historic appearance had been totally lost and what remained could not be interpreted through historical or archeological methods. Finally, a site which had neither visibility nor focus would obviously not be eligible.

While neither bulletin focuses exclusively on mining issues, both provide guidance in evaluating mining areas where building integrity is lacking. Most importantly, these bulletins advocate a more holistic evaluation process which looks not only at buildings, but also comprehensively considers all the component parts of a complete mining system. Until the National Register issues a mining bulletin currently in the planning stages, both bulletins 30 and 36 provide much-needed insight into the evaluation of complex mining resources.

NATIONAL REGISTER DOCUMENTATION

Having considered some evaluation approaches, we should now consider the mechanics of employing the new National Register forms to document significant mining sites. Many mining sites will occur as components of multiple property groups which will allow them to be nominated on the Multiple Property Documentation Forms. A completed Multiple Property form consists of three elements: a context

statement, an analysis of property types associated with the context, and an individual property form to nominate eligible resources. A completed Multiple Property form consisting of a historic context statement and a property type analysis will not actually nominate any properties. Rather, the Multiple Property form will simply provide a framework for evaluating resource significance, while eligible examples of significant property types will be nominated on individual property forms.

Leaving the jargon behind for a moment, let's consider a concrete example. One possible historic context relevant to the immediate area might be Borax Mining in Death Valley during the 1880s. This establishes the three fundamental contextual elements: theme (borax mining), time (1880s), and place (Death Valley). The survey process will identify a variety of extant property types associated with this context. These property types might include mill sites, underground borate mines, mining camps, tramways, and so on. If all these resources exist in close proximity to one another, then the property type will qualify as a historic district. If property types occur in relative isolation (a remote underground mine site, for example), the property type will focus on the characteristics of that individual resource. The Multiple Property Documentation form would include a written historic narrative discussing Borax Mining in Death Valley during the 1880s and a description of the property types related to that context. Whether a property type defines a district or an individual resource, an individual National Register form would be used to nominate eligible examples of that property type.

The National Register advocates comprehensive surveys oriented around a theme which will identify eligible resources within a given geographic area and ultimately result in the completion of a multiple property nomination. However, in some cases, limitations on time and money will prevent us from engaging in such comprehensive projects. In these cases, individual National Register forms can be used to nominate a single mining resource or district to the National Register. It is important to remember that even though a mining district may consist of a multitude of features, these districts will still be documented on an individual National Register form.

In conclusion, I would like to return to an earlier point and stress once again that mining resources be evaluated as complete systems. Frequently at the National Register we are asked to determine the eligibility of, for example, a sluice ditch or an individual tailings pile because of pending actions which may impact these resources. However, when removed to a larger interpretive context, it becomes difficult, if not impossible, to assess the significance of an individual ditch or tailings pile. Fortunately, National Register Bulletins 30 and 36 and the new multiple property nomination format act to provide a framework for evaluating mining resources on a holistic and understandable basis.

ADDITIONAL READING

Deetz, James, *In Small Things Forgotten: The Archeology of Early American Life* (Garden City, NY: Anchor Books, 1977), pp. 93-95.

Little North Santiam Mining District, Marion County, Oregon, National Register Determination of Eligibility files

Mark Gob Piles, Putnam County, Illinois, National Register Determination of Eligibility files

National Register Bulletin 16--Guidelines for Completing National Register of Historic Places Forms

National Register Bulletin 30--How to Identify, Evaluate, and Register Rural Historic Landscapes (draft version available)

National Register Bulletin 36--Historic Archeological Properties: Guidelines for their Evaluation (draft version available)

Proceedings of the Workshop on Historic Mining Resources: Defining the Research Questions for Evaluation and Preservation, Sponsored by the State Historical Preservation Center, South Dakota State Historical Society, April 6-8, 1987.

MINING TECHNOLOGY AND THE NATIONAL REGISTER

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I have been wrestling with mining resource nominations since failing to nominate to the National Register the former copper camp of Swansea, Arizona, in 1976. My questions about why the abandoned mining camp was determined ineligible went unanswered, other than the explanation that the ghost town was just that, a derelict with cast-off machinery, rusting embarrassments to be ignored or removed, if not despised. Since then mining site nominations have become more accepted and receive more consideration (Swansea has since been determined eligible). The following relates some of my own experiences in Alaska and now Denver, and some of the projects I have encountered.

The National Register of Historic Places nomination process is well described in Bulletin 16. What makes the process complex is the professional judgment required to differentiate between a significant or contributing structure, site, district, or object and another property which lacks significance. I will focus on some examples of mining properties that help illustrate National Register eligibility for mining properties in general and those that are associated specifically with technology and ways in which the National Register criteria can be applied.

INTEGRITY OF INDUSTRIAL RESOURCES

The history of mining technology is complex, making the evaluation of significance difficult. Between 1848 and 1930, mining practices experienced a revolution. So many processes were experimented with, used, then discarded as a new process was developed that it is difficult to differentiate the important from the ephemeral. Because mines have a specific life span in relation to the value of the ore deposit (or belief in the value of an ore deposit yet to be found), engineering works in the American West were built mostly for the short term. Thus, most mining operations consisted of physical plants which could be relocated to another prospect when the vein pinched out. Woodframe mills, gravity stamp batteries, and steam boilers were often moved several times before being discarded or scrapped.

Adding to the complexity is the fact that the scrap drives of two world wars hastened the removal of derelict machinery. These activities were thorough. Look at historic photographs of a Tonopah, Nevada; Oatman, Arizona; or Creede, Colorado, and compare the number of industrial complexes with their absence today. Because of this scarcity of extant resources, any mining site with standing structures and machinery is worthy of serious evaluation.

NATIONAL REGISTER CRITERIA

National Register evaluation is based on four criteria. Until recently, most mining sites have been determined eligible under criteria A and B; for association with the broad patterns of history or for associations with significant individuals. This tendency is the result of the bias toward resources related to Western expansion and settlement. Such obvious sites ranging from James Marshall's gold discovery site at Coloma, California, to the Nome gold discovery site in Alaska, were nominated because of their association with the broad patterns of history, that is the Western mining frontier. Sites related to the gold and silver rushes have been listed in every western state under criterion A. Criterion B also has been more easily used because of the flamboyant Bonanza Kings or the reforming women of the West. Leadville merchant-turned-millionaire Horace Tabor adds to the significance of that camp as does Esther Hobart Morris, the co-author of Wyoming's woman's suffrage act of 1869 and justice of the peace for the gold camp of South Pass City.

Criterion C, identified with the works of an architect or master craftsman, is more difficult to justify. In the mining world, the world of the mining engineer and the rule-of-thumb mining man, National Register nominations have focused on the architecture of the mining camp or the few well-known mineral discoveries. Surrounding these camps and at these discoveries there developed complete systems of

extraction, benefaction, and refining--i.e., mining technological systems--to convert dirt into gold...or silver, copper, and lead. It is time to focus on these systems as "structures." Unfortunately there is no readily available "What Style Is It?" handbook to assist the evaluator of a mining system. Also, no complete synthesis of mineral processes has been written, though Otis Young's popular *Western Mining* is a start. Nor has a biographical text on prominent mining men and women been prepared, though, too, Clark Spence's *The Mining Engineer* is helpful. The student must do much research in order to define the engineering technology (style), or which "master craftsman" (mining engineer), created the works at these potential National Register properties.

MINING TECHNOLOGY

The Young and Spence monographs can help with the beginning of an understanding of mining technology to 1890 and of mining engineers. But the evaluation of mining sites must take into consideration later periods, especially after the metallurgical revolutions caused by the discovery of the cyanide process, flotation, and large-scale smelting. Gold placer mining also went through its transformation, with the development of the dredge and dragline scraper. Underground work changed rapidly as well. The replacement of timber with concrete in some mines, then the system of block caving and other massive mining systems, and finally the open-pit method of extraction all occurred within a relatively short period of time. Thus, although prospectors arriving in the American West at mid-nineteenth century would have used methods not unknown to the ancients, between 1850 and 1925, only seventy-five years, a host of new machines and chemical processes rapidly changed the mining world. The legacy of that era of technological change is abundantly evident in the mining districts of the West, if in nothing more than the omnipresent waste rock dumps and tailings piles.

The mining engineer in the American mining West would take the practices of Europe, reshape and refine them and then spread them throughout the world. Like the profession of architecture, that of mining engineer became more specialized and complex, as did the plants they designed. For example, the small woodframe, wood and iron stamp mills brought to California from England in the 1850s were transformed by the turn of the century into all steel and concrete concentrators or cyanide mills. The early mills were mere toys working a few tons of ore per day, compared with the later mills working thousands of tons per day. Some sites have significance under criterion C because of their association with these masters, such as the open-pit at Bingham, Utah, which was the brainchild of mining engineer Daniel C. Jackling.

Other mine engineering sites may be significant under Criterion C even if their components lack individual distinction. This observation is especially true of placer mining. The hydraulic mines of Bonanza Creek in the Chisana District, Alaska, contain splash dams, flumes, hoses, nozzles, and tent frames, which in and of themselves may not meet National Register requirements, but as definable components in the mining system are eligible under Criterion C. Similarly, the dredge tailings in Coal Creek, Alaska, are considered eligible as a component of the complete gold dredging system, which includes a flume and hydraulic system, the dredge, two camps of woodframe structures, and the Yukon River landing.

MILLS

Because of the rapid change in technology and scale some mills might be built over older works, erasing the previous plant. At Oro Belle, Arizona, a site owned by the Arizona Historical Society, the collapsed ruin of an early twentieth-century concentrator has erased any trace of the 1880s gold stamp mill, which in turn had eliminated the steam powered arrastra set-up of the 1870s, which in turn replaced the single burro arrastra of the pioneer miner of the 1860s. Thus, in many cases, the best examples of early engineering works are not found at the bonanza mines or big producers, but at the derelict operations which had meager, if any, production. The more isolated the mine, the more machinery might remain. An isolated piece of equipment was too costly to move out. Thus, for example, the remote districts of Alaska are treasure lands for historic mining equipment.

In the Alaska case, we are fortunate that standing structures remain as well. Many are significant under Criterion C as embodying a significant mining process, such as the copper concentrator at Kennicott, Alaska. Discovered in 1900, the Kennecott copper claims came under the control of the Guggenheims, who built a twenty million dollar railway from the Pacific coast to the mine and a twelve-story

concentrator. Several tramways connected the mill with the mines, 4000 feet above the mill. The mill was a classic concentrator; designed in 1910-12 it contained the standard engineering works of jigs and concentration tables. The development of new processes--flotation and ammonia leaching--led to the construction of additions to the mill. As the skin of the mill was drawn to cover the new machinery, the mill gained many gables and roof lines in its stair-stepping down a slope on the edge of the Kennicott glacier. The mill is much photographed because of its appearance. For us, however, the mill has a special significance because its machinery is nearly intact over fifty years after the plant closed. The flow of the ore through the engineering works can be retraced and a flow diagram devised. Thus, at Kennecott we have a unique reminder of this significant mining technology. Not surprisingly the mill is part of a National Historic Landmark which highlights this engineering work, the best example of a type as described in National Register criterion C.

A smaller example of a mill is the North Midas mill at Kuskalana district, Alaska. The plant was built as a copper concentrator and then greatly altered with new machinery to become a gold mill using the cyanide process. A Pelton waterwheel power system was replaced by a diesel engine for power to drive machinery. To complicate matters, the copper concentrator machinery was left in place and the new machinery dropped in beside it or in new wings. Again, the mill is significant under criterion C as an intact example of a technological process.

But there is only one Kennecott and there are few North Midas mills. Most sites have only foundations or a few remnants of machinery. These resources require additional care in understanding the engineering process that occurred there. Though contemporary journals and newspapers may have described the mills and their operation, the actual on-the-ground, day-to-day operation may have been greatly different. The quality of ore, the contaminants in the mineral, the hardness of rock all may have forced the miller to change operations, even remove or replace machinery, especially if a new system was put in place. Historic contexts must be developed to understand the significance of a site. This brings us to Criterion D.

HISTORICAL ARCHEOLOGY

The most troublesome National Register criterion is D, significance based on the ability to yield information important in prehistory or history. Historical archeologist Don Hardesty will speak about the social and economic aspects and concerns of his profession. In the history of technology, many questions still remain about the application of theory to practice, especially prior to 1900. Mining complexes which may have used a certain process can enlighten history through industrial archeology. For example, sites associated with the development of the cyanide process may be inadvertently lost before an understanding of the nascent process can be concluded. Only foundations remain at Crestone and Denver, Colorado, and Mercur, Utah, where the process was first successfully tested in 1890-92. Does a complete turn-of-the-century cyanide plant exist? Probably not. We must rely on the industrial archeology to shed light on this question.

To evaluate these ruinous sites without a thorough history is to the detriment of the resource. Much literature exists. Before undertaking fieldwork, we must assess the significance of sites in the context of social, business, and technological history. Thus, a site overlain by a century's covering of leaves was found after thorough research and field work. Its association with the early development of lead mining in the upper Mississippi River valley was significant as was its importance in the history of lead mining technology. The simple remnants of an 1830s smelter and its associated mine pits have been identified and listed. The Mines of Spain State Recreation Area, Iowa, is now under consideration for landmark status.

Like the lead furnace, the majority of mining sites lack machinery and contain only foundations, the only remnants we can use to solve metallurgical puzzles. Thus, care must be taken to evaluate foundation footings, contemporary descriptions and photographs to describe plants. At the long vanished city of Pinal, Arizona, the silver lixiviation process was perfected in 1885. The mill was destroyed over eighty years ago, but the tailings pile and foundations remain, as do numerous photographs and descriptions of the significant mill. Also, a similar later plant, the Lexington mill of Butte, Montana, had complete drawings published. With these tools, the on-the-ground outline of the Pinal mill can be retraced, the system outlined (though not exactly described) and the scale of operation calculated. Combining these sources, the Pinal mill's significance under Criterion D can be detailed and placed in its appropriate

location in the history of Western mining technology. Similar work could be done at Aspen, Tombstone, Calico, Park City and elsewhere.

The mills and mining sites just described represented the technology of the day. For several generations mining determined a particular lifestyle, quite different from what we experience today. Mining was done on a more human scale, yet more dangerous. The all-too-few derelict mills, abandoned tailings and mine headframes are part of a human story, important for study, preservation, and interpretation. With some care, what was once dismissed as rusted debris can properly be seen as the battery and stamps of an abandoned mill--the workplace for a community that no longer exists. My hope is that identification and recognition of a mining system will cause the preservation of a complete system, or, at least, its documentation, to show us how the early plants operated. Because mining sites were designed by mining engineers who adapted their mining systems to the terrain--mining operations took advantage of gravity as much as possible--mining sites evaluation should take into consideration the work of these craftsmen, even if only the earthworks and foundations remain. This is a complex issue.

I believe that the textbook descriptions of the nineteenth-century plants did not reflect the rule-of-thumb practices of a typical small-scale mine or stamp mill. What is needed is further inventory, to locate the important remains; documentation of the significant sites through delineation, photography and process drawings; and the full-scale restoration of at least one nineteenth-century Western mining complex.

This latter necessity is important, because without that site people will fail to understand the efforts to get minerals. Understanding should be emphasized. As nineteenth-century historian William Dilthey wrote, "the role of history is not to tell, or to explain, but to understand." Let us not just tell about the parts of a stamp battery or sluice, but help others understand the why and how of turning dirt and rock into gold.

* This paper is an adaption of the author's "Mining Technology and Historic Preservation with Special Reference to the Black Hills," published in: Jeff Buechler, editor, *Proceedings of the Workshop on Historic Mining Resources, Defining the Research Questions for Evaluation and Preservation* (Vermillion, South Dakota: State Historical Preservation Center, 1987)

BIBLIOGRAPHY OF MINING TECHNOLOGY

Aaron, C. H. *Assaying in Three Parts*, Part I (Fifth Edition). San Francisco: The Mining and Scientific Press, 1904.

Aaron, C. H. *Assaying in Three Parts*, Parts II and III (Third Edition). San Francisco: The Mining and Scientific Press, 1900.

Abbe, Donald R. *Austin and the Reese River Mining District, Nevada's Forgotten Frontier.* Reno: University of Nevada Press, 1985.

Agricola, Georgius [Georg Bauer]. *De Re Metallica.* Translated by Herbert Clark Hoover and Lou Henry Hoover, 1912. Reprint, New York: Dover Publications, 1950.

Arnold, Emmett L. *Gold-Camp Drifter, 1906-1910.* Reno: University of Nevada Press, 1973.

Axford, H. William. *Gilpin County Gold, Peter McFarlane 1848-1929, Mining Entrepreneur in Central City, Colorado.* Chicago: The Swallow Press Inc., 1976.

Backus, Harriet Fish. *Tomboy Bride.* Boulder, Colorado: Pruett Publishing Company, 1969.

Baldwin, George P., ed. *The Black Hills Illustrated, a Terse Description of Conditions Past and Present of America's Greatest Mineral Belt, its Agriculture and Cattle Resources, Principal Cities, Financial, Commercial, Educational and Religious Institutions, Railways, Scenery and Health and Pleasure Resorts.* The Black Hills Mining Mens's Association, 1904. Reprint, Deadwood, South Dakota: Dakota Graphics, 1987.

Brown, Ronald C. *Hard Rock Miners: The Intermountain West, 1860-1920.* College Station: Texas A & M University Press, 1979.

Brown, Walter Lee. *Manual of Assaying, Gold Silver Copper and Lead Ores, with One Colored Plate and One Hundred and Thirty-two Illustrations on Wood*, Fourth Edition. Chicago: E. H. Sargent & Co., 1892.

Browne, J. Ross. *Adventures in the Apache Country: A Tour through Arizona and Sonora, with Notes on the Silver Regions of Nevada.* New York: Harper and Brothers, 1874.

Burt, S. W. and E. L. Berthoud. *The Rocky Mountain Gold Regions Containing Sketches of its History, Geography, Botany, Geology, Mineralogy and Gold Mines, and Their Present Operations. With a Complete History of the Mills for Reducing Quartz Now Operating.* Denver: Rocky Mountain News Printing Company, 1861. Reprint, Denver: Old West Publishing Company, 1962.

Cash, Joseph H. *Working the Homestake.* Ames: The Iowa State University Press, 1973.

Caughey, John Walton. *The California Gold Rush.* Originally published as *Gold is the Cornerstone.* The Chronicles of California. Berkeley: University of California Press, 1948. Reprint, Berkeley: University of California Press, 1975.

Christiansen, Paige W. *The Story of Mining in New Mexico.* New Mexico Bureau of Mines & Mineral Resources, Scenic Trips to the Geological Past No. 12. Socorro: University of New Mexico Press, 1974.

Cleland, Robert Glass. *A History of Phelps Dodge, 1834-1950.* New York: Alfred A. Knopf, 1952.

Crane, Walter R. *Gold and Silver Comprising an Economic History of Mining in the United States, the Geographical and Geological Occurrence of the Precious Metals, with their Mineralogical Associations, History and Description of Methods of Mining and Extraction of Values, and a Detailed Discussion of the Production of Gold and Silver in the World and the United States.* New York: John Wiley & Sons, 1908.

Davis, Sam P., ed. *The History of Nevada*, 2 vols. Reno: Elms Publishing Company, 1913. Reprint, Las Vegas: Nevada Publications, n.d.

De Quille, Dan [William Wright]. *The Big Bonanza, an Authentic Account of the Discovery, History, and Working of the World-Renowned Comstock Lode of Nevada Including the Present Condition of the Various Mines Situated Thereon, Sketches of the Most Prominent Men Interested in Them, Incidents and Adventures Connected with Mining, the Indians, and the Country-Amusing Stories, Experiences, Anecdotes, Etc., Etc. and a Full Exposition of the Production of Pure Silver, 1876.* Reprint, New York: Thomas Y. Crowell Company, Apollo Edition, 1969.

Egleston, Thomas. *The Metallurgy of Silver, Gold, and Mercury in the United States.* New York: John Wiley & Sons, 1887.

Eissler, M. *The Metallurgy of Gold.* New York: 1896 (1st ed., 1888).

Elliott, Russell R. *Nevada's Twentieth-Century Mining Boom, Tonopah, Goldfield, Ely.* Reno: University of Nevada Press, 1966.

Fell, James E., Jr. *Ores to Metals, The Rocky Mountain Smelting Industry.* Lincoln: University of Nebraska Press, 1979.

Fielder, Mildred. *The Treasure of Homestake Gold.* Aberdeen, South Dakota: North Plains Press, 1970.

Fossett, Frank. *Colorado, its Gold and Silver Mines, Farms and Stock Ranges, and Health and Pleasure Resorts.* Tourist's Guide to the Rocky Mountains, Second Edition. New York: C.G. Crawford, 1880.

Gaudin, A.M. *Flotation.* McGraw-Hill, 1932.

Greever, William S. *The Bonanza West, the Story of the Western Mining Rushes, 1848-1900.* Norman: University of Oklahoma Press, 1963.

Gressley, Gene M., ed. *Bostonians and Bullion, the Journal of Robert Livermore, 1892-1915.* Lincoln: University of Nebraska Press, 1968.

Hayward, Carle R. *An Outline of Metallurgical Practice.* New York: D. Van Nostrand Company, 1929.

A Historical, Descriptive and Commercial Directory of Owyhee County, Idaho. Silver City, Idaho: Press of the Owyhee Avalanche, 1898.

Hittell, John S. *The Resources of California: Comprising Agriculture, Mining, Geography, Climate, Commerce & etc., and the Past and Future Development of the State,* Fourth Edition. San Francisco: A. Roman and Company, 1868.

Hofman, H. O. *Metallurgy of Copper.* New York: McGraw-Hill, 1914.

Hollister, Ovando J. *The Mines of Colorado.* Springfield, Mass.: Samuel Bowles & Company, 1867. Reprint, New York: Promontory Press, 1974.

Holliday, J.S. *The World Rushed In, the California Gold Rush Experience.* New York: Simon and Schuster, 1981.

Ingalls, Walter Renton. *Lead and Zinc in the United States: Comprising an Economic History of the Mining and Smelting of the Metals and the Conditions which Have Affected the Development of the Industries.* New York: Hill Publishing Co., 1908.

Ingersoll, Ernest. *Gold Fields of the Klondike.* Originally published as *Gold Fields of the Klondike and the Wonders of Alaska.* St. John, New Brunswick: Earle Pub. House, c1897. Reprint, Langley, British Columbia: Mr. Paperback, 1981.

Kelly, J. Wells. *First Directory of Nevada Territory containing: the Names of Residents in the Principal Towns; a Historical Sketch; the Organic Act, and Other Political Matters of Interest; together with a Description of All the Quartz Mills; Reduction Works, and All Other Industrial Establishments in the Territory; as Also of the Leading Mining Claims; and Various Mineral Discoveries, Works of Internal Improvements, Etc. with a Table of Distances, List of Public Officers, and Other Useful Information. Compiled from the Most Recent and Authentic Sources, and Including Sketches of the Washoe Silver Mines by Henry De Groot, 1862.* Reprint, Introduction by Richard Lingenfelter. Los Gatos, California: The Talisman Press, 1962.

King, Joseph E. *A Mine to Make a Mine: Financing the Colorado Mining Industry, 1859-1902.* College Station: Texas A & M University Press, 1977.

Kustel, Guido. *A Treatise on the Concentration of all Kinds of Ores including the Chlorination Process for Gold Bearing Sulphurets, Arseniurets, and Gold and Silver Ores Generally.* San Francisco: Mining & Scientific Press, 1867.

Lingenfelter, Richard E. *Death Valley and the Amargosa, A Land of Illusion.* Berkeley: University of California Press, 1986.

Lord, Eliot. *Comstock Mining and Miners, 1883.* Reprint, Berkeley: Howell-North, 1959.

Louis, Henry. *A Handbook of Gold Milling.* London: Macmillan and Co., 1902.

MacFarren, H. W. *Text Book of Cyanide Practice.* New York: McGraw-Hill, 1912.

Malone, Michael P. *The Battle for Butte, Mining and Politics on the Northern Frontier, 1864-1906.* The Emil and Kathleen Sick Lecture-Book Series in Western History and Biography. Seattle: University of Washington Press, 1981.

Marcosson, Isaac F. *Anaconda*. New York: Dodd, Mead & Company, 1957.

Marcosson, Isaac F. *Metal Magic, the Story of the American Smelting & Refining Company*. New York: Farrar, Straus and Company, 1949.

McGrath, Roger D. *Gunfighters, Highwaymen & Vigilantes, Violence on the Frontier*. Berkeley: University of California Press, 1984.

Molinelli, Lambert. *Eureka and its Resources; A Complete History of Eureka County, Nevada, containing the United States Mining Laws, the Mining Laws of the District, Bullion Product and other Statistics for 1878, and a List of County Officers*. San Francisco: H. Keller & Co., 1879. Reprint, Reno: University of Nevada Press, Vintage Nevada, 1982.

Niebur, Jay E. and James Fell. *Arthur Redman Wilfley: Miner, Inventor, and Entrepreneur*. Western Business History Research Center, Colorado Historical Society, n.d.

Parker, Watson. *Deadwood, the Golden Years*. Lincoln: University of Nebraska Press, 1981.

Parker, Watson. *Gold in the Black Hills*. Norman: University of Oklahoma Press, 1966.

Parsons, Arthur B. *The Porphyry Coppers*. New York, 1933.

Paul, Rodman W. *California Gold, the Beginning of Mining in the Far West*. Lincoln: University of Nebraska Press, a Bison Book, 1947.

Mining Frontiers of the Far West 1848-1880. Histories of the American Frontier. New York: Holt, Rhinehart and Winston, 1963.

Peele, Robert. *Mining Engineers Handbook*. New York: John Wiley & Sons, 1918. pp. 1927-1957.

Phillips, J. Arthur. *Elements of Metallurgy*. London: Charles Griffin and Company, 1887.

Pliny. *Natural History*, as translated in J. Arthur Phillips, *The Mining and Metallurgy of Gold and Silver*. London: 1867.

Pepper, John Henry. *The Playbook of Metals: Including Personal Narratives of Visits to Coal, Lead, Copper, and Tin Mines; with a Large Number of Interesting Experiments Relating to Alchemy and the Chemistry of the fifty Metallic Elements*. London: George Routledge and Sons, 1866.

Rickard, T. A. *Interviews with Mining Engineers*. San Francisco: Mining and Scientific Press, 1922.

Journeys of Observation. San Francisco: Dewey Publishing Company, 1907.

Pyritic Smelting. New York: Engineering and Mining Journal, 1905.

The Stamp Milling of Gold Ores. New York: Scientific Publishing Company, 1898.

Ricketts, Pierre de Peyster and Edmund H. Miller. *Notes on Assaying*. New York: John Wiley & Sons, 1897.

Ryder, David W. *The Merrill Story*. Privately Printed, 1958.

Smith, Duane A. *Mining America, The Industry and the Environment, 1800-1980*. Lawrence: University Press of Kansas, 1987.

Spence, Clark C. *Mining Engineers and the American Mining West, The Lace Boot Brigade, 1849-1933*. New Haven: Yale, 1970.

Trimble, William Joseph. *The Mining Advance into the Inland Empire.* Madison: University of Wisconsin, 1909. Reprint, Fairfield, Washington: Ye Galleon Press, 1986.

Voynick, Stephen. *Leadville, a Miner's Epic.* Missoula: Mountain Press Publishing Company, 1984.

Wells, Merle W. *Gold Camps & Silver Cities, Nineteenth Century Mining in Central and Southern Idaho.* Reprint, Boise: Idaho State Historical Society, 1983.

Wilhelm, Walt. *The Last Rig to Battle Mountain.* New York: William Morrow & Company, Inc., 1970.

Wyman, Mark. *Hard Rock Epic, Western Miners in the Industrial Revolution, 1860-1910.* Berkeley: University of California Press, 1979.

Young, Otis E., Jr. *Western Mining, an Informal Account of Precious Metal Prospecting, Placering, Lode Mining, and Milling on the American Frontier from Spanish Times to 1893.* Norman: University of Oklahoma Press, 1970.

MINING PROPERTY TYPES: INVENTORY AND SIGNIFICANCE EVALUATION

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In the broadest possible sense, what might be called the "archaeology of mining" is the study of the material correlates of mining and miners. From this perspective, the surviving remains of historic mining contain not only information about the practice of mining and the lives of miners, but also the "symbols," cast in iron, wood, glass, pottery, and stone, that tell us something about the meaning of mining to the people involved. Thus, the historic mining site is something like a repository of information about mining and miners that is independent of, complementary to, and sometimes different from other sources of information such as written accounts or the memory of still living miners. It follows that the proper management of the material remains of historic mining, what might be called the archaeological record, requires some attention to what information is contained within the material things.

INVENTORY OF MINING PROPERTY TYPES

Within the context of the National Register and the Secretary of the Interior's "Standards and Guidelines for Archeology and Historic Preservation," the key to managing historic mining sites is the "property type." In the archaeological record, mining property types, the material correlates of mining and miners, include such things as mine shafts, machine pads, boarding house sites, industrial trash dumps, and mill tailings. Mining property types, however, should not be interpreted as the material correlates of mining "frozen" in time; rather, the property types are the end products of mining processes taking place during the lifetime of the mine. Mill sites, for example, often include the material correlates of two or more milling technologies that have been installed at different time periods and then abandoned. The archaeological record of the Tenabo Mill in the Cortez Mining District of central Nevada, for example, is the end product of two milling processes: the Russell lixiviation process was installed in 1886 when the mill was built, but the mill was refitted in 1908 for a cyanide process (Hardesty 1988b: 51). Surviving property types at the mill site reflect both technologies, partly separated in space and partly overlapping.

MINING FEATURE-SYSTEMS: PUTTING FEATURES INTO CONTEXT

The most visible and easily definable property types at historic mines are archaeological features, which fall into three distinct groups. One group is related to technology and includes such things as mine shafts, adits, machine pads, building foundations, cyanide can dumps, charcoal and sag scatters, and the like. Another group is related to the domestic life of miners, including such features as house sites, privies, tin can and glass bottle dumps, and stable/corral outbuildings. And yet another group of archaeological features is related to mining landscapes, including rock waste dumps at mines, mill tailings, open pits, slag heaps, and the like.

Such easily observable and isolated features, however, may be only a small part of a larger complex of features and objects, all of which have originated in the same human activity. In mining sites, examples would include the surviving remnants of a hoisting system for a mine or an ore reduction system for a mill. Such complexes can be referred to as a "feature-system" (Hardesty 1988b: 9-11). The feature-system is an interface of the spheres of history, archaeology, and ethnography; that is, it is defined by combining information from documentary accounts, the memory of living people, and observations of the archaeological record. A good argument can be made for evaluating the significance of feature systems as a whole rather than evaluating individual features. The feature system provides the context for archaeological features by establishing linkages in time, place, and theme. Three kinds of feature systems can be identified: technological, residential or domestic, and landscape.

Technological Feature Systems: The two principal mining feature-systems related to technology are mining and milling. What is likely to be in the archaeological record of a mine is illustrated by the Montana Bullfrog Mine in the Bullfrog Mining District in southern Nevada (Hardesty 1987). The features documented at the site of the Montana Bullfrog include a mine shaft, a rock waste dump, a mineral

prospect, a concrete machine pad, a road with a rock retaining wall, a building foundation, and sheet refuse. At one level, each of the features can be inventoried and evaluated for significance separately. That all of the features originated in the same technological process, however, is suggested by a 1907 photograph of the mine. For this reason, the archaeological features, which are now geographically isolated, were combined into a single feature-system covering a relatively large geographical area. The Montana Bullfrog Mine feature-system then was inventoried and evaluated for significance as a whole. Using National Register criterion D, for example, the "historical value" of the feature-system was rated by comparing what information it could provide about the operation of a small mine to other similar mining feature-systems in the Bullfrog Mining District (Hardesty 1987).

Residential/Domestic Feature Systems: The next group of feature-systems in historic mining sites is related to the domestic life of miners, including the household and the larger community. Documentary and ethnographic images of the household suggest variability and change in group size, activities, age/gender composition, organization, and ethnicity, among other things. For example, at least five distinct kinds of household organization in mining camps can be identified, including single person, cooperative, occupational, family, and boarding house (Hardesty 1989). The archaeological record of each is distinctive and includes features related to residence, refuse disposal, and other activities. House sites, privies, outbuildings, yards, sheet refuse, and trash dumps are typical.

Community feature-systems are made up mostly of households clustered into localities and participating to a greater or lesser degree in regional and world system networks. In localities or settlements, households are clustered into "neighborhoods" along the lines of class, ethnicity, and gender, among other things. The 19th century settlement of Shoshone Wells in the Cortez Mining District in central Nevada, for example, appears to include at least five such ethnic- and class-structured neighborhoods (Hardesty 1988b: 84). Localities often are linked together into larger-scale regional and world system "communities" by social interaction networks, which can sometimes be identified in the documentary or archaeological record. Residential/domestic feature-systems at the regional level include settlement patterns organized around a hierarchy of settlement types within the region such as towns, camps, hamlets, and isolated house sites, along with interconnecting roads and railroads. In the Bullfrog Mining District of southern Nevada, for example, the hierarchy includes two towns of several thousand, several camps of a hundred or more, hamlets of a score or so, and isolated houses (Hardesty, 1987; Lingenfelter 1986). As a working model, the networks of social interactions within the regional community are structured by distance, class, ethnicity, and gender.

Landscape Feature Systems: Mining landscapes are another kind of feature-system. Mining landscapes include large scale topographic features originating in mining activities such as rock waste dumps from mines, mill tailings, and open pits (Francaviglia 1982). Such landscape features are large scale recapitulations of the technological and geomorphological history of the mining district (Francaviglia 1988).

ASSESSING THE SIGNIFICANCE OF MINING PROPERTIES

For National Register purposes, the significance of historic properties in general is derived from their **historic context,** which is defined as information about the property that is related to theme, place, and time. Identifying the significance of historic archaeological sites, then, begins with questions about context.

Time: The historical properties from mining sites must be placed within a chronological framework in order to properly assess their significance under any of the four National Register criteria. General models of chronology often can be developed from documentary data. In the Comstock Mining District of western Nevada, for example, Pre-Boomtown (1850-1859), Boomtown (1859-1880), and Post-Boomtown (after 1880) periods were identified in this way and used to establish a general context for historical properties (Hardesty and Firby 1980). Dates for specific historical properties on mining sites, however, are often missing in written accounts and more often require archaeological investigation, greatly increasing the significance of the archaeological record as a potential source of chronological information. Questions about chronology, therefore, are critical both to establishing proper historical context and to evaluating the significance of archaeological sites containing information about time.

Place: One problem with many research designs for mining sites is the failure to consider the varying geographical scales at which historical context must be evaluated and at which research questions for

evaluating significance should be asked. The world system, the region, and the locality are three "contextual levels" that are most commonly encountered (Hardesty 1988b).

World System Interactions: Despite their remoteness, many mining operations in the American West were connected to the urban centers of America and Europe by means of a vast transportation and communications network. Indeed most mines can be considered "colonies" in the sense that they were financed, staffed, and supplied by these centers. Railroads and telegraph lines, for example, linked San Francisco, Chicago, New York, and other major American cities to most of the mining frontier. The social, economic, technological, and ideological patterns that emerge from such interactions are described by Wallerstein (1974) as a "world system." Research questions about variability and change in world system interactions, therefore, are needed to help identify the proper geographical context or scale of historic mines. Such questions are aimed at large-scale national and international processes and events, including the impact of industrialization and large corporations on the mining workplace; capitalization and mining economics; the labor market and world demographic patterns; and the belief systems carried by miners and management such as Victorianism and ethnic folk cultures. Most important is the understanding that historic mines are not isolated places on the frontier but participate in regional and world system social and economic networks on a large geographical scale.

Region: Another important scale for evaluating the geographical context of historic mines is the region or mining district. Mines often are the economic and social centers of surrounding regions (Godoy 1985), linking together outlying settlements and isolated households into a single interactive network or "community." The Bullfrog Mining District in southern Nevada, for example, can be described as a regional community with a settlement hierarchy made up of a few towns of several thousand, several camps of a hundred or so, hamlets of a score or less, and isolated homesteads (Hardesty 1987; Lingenfelter 1986). For this reason, questions about variability and change in the mining district or region also are needed to assess the geographical context of mining sites. Such questions have to do, among other things, with the population dynamics of the region; the organizing principles of the regional community, including the roles of kinship, ethnicity, class, and gender in structuring patterns of social and economic interaction; regional transportation networks; and patterns of mining technology and workplace.

Themes: Two strategies or "questioning frameworks" for asking questions about mining and miners can be identified. In the first strategy, which Schuyler (1988) has referred to as "historical ethnography," the research questions are directed toward combining documentary, ethnographic, and archaeological information to study a specific group of people. In this sense it is comparable to what ethnographers do by observing and talking to living people or what historians do from documents, but differs in using the archaeological record as well. Questions that are important to historical ethnography have to do with the geographical and historical context of community, household, ideology and world view, ethnicity and ethnic relations, social geography and structure, political organization, economics, and technology and the workplace, among other things. The second strategy asks questions about the general processes that create variability and change in technology, household, community, and landscape. The use of general theories explaining the impact of industrialization or the outcome of culture contact would be included. Comparative studies of mining communities are required.

Within the two questioning frameworks of historical ethnography and cultural process, several key "problem domains" or themes can be identified. Variability and change in the miner's household, for example, is one key set of questions about mining sites that can be answered with archaeological data. Another problem domain is community variability and change, including questions about community layout, scale, boundaries, social geography, regional settlement hierarchies, and world system interactions. The common occurrence of domestic trash dumps and other refuse at historic mining sites suggests the importance of questions about change and variability in consumer behavior and subsistence. Questions about the geography of the domestic marketplace and the social and cultural correlates of consumption, such as class, ethnicity, and gender, are included (Spencer-Wood 1987). Other key problem domains are related to the material correlates and social geography of ethnicity, class, gender, technology and the workplace, and landscape.

DATA REQUIREMENTS

Making the questioning framework workable for evaluating the significance of archaeological sites also demands that the archaeological data needed to answer each of the questions about context be stipulated.

Questions about household consumer behavior, for example, requires maker's marks and other data on market geography, time, and use (e.g., Hardesty 1988a). Archaeological data on morphology and activity are needed to answer questions about household variability and change, including house sites with identifiable floor areas, age/gender diagnostics, privies and other outbuildings, relationships among house sites, and the like. The identification of social class differences among households requires data on the material correlates of wealth, including architecture and the relative cost of artifacts and food items. And questions about mining technology and the workplace require data about the function, time, and arrangement of features that can be used to reconstruct "technological systems" to link archaeological features from different localities.

ASSESSING THE INFORMATION CONTENT OF PROPERTY TYPES

After the feature-systems at historic mines have been inventoried, their potential as repositories of information needed to answer key questions about historical context must be assessed. Content, comparative value, and integrity are three dimensions of the archaeological record related to information potential.

Content: Assessing the information content of an historic mining site requires two steps. First, an inventory must be made of the "packages" in which the information is organized, including archaeological features such as trash dumps, privies, and structures and feature-systems such as settlements, mills, and mines. Second, each of the packages must be evaluated for the quality and quantity of archaeological data that can meet the requirements of the key questions about historical context (e.g., diagnostics of age, gender, ethnicity, class, subsistence, household size, technology, time, and interaction spheres). Sampling procedures may be required in both cases. In all but Class III surveys, for example, inventories of historic mines require methods that can be used to extrapolate entire populations of features and feature-systems from field samples. And assessing the quality and quantity of data from an archaeological feature also may require sampling methods. Hardesty (1988a), for example, used sampling methods to evaluate the data content of several early 20th century trash dumps at Rhyolite, Nevada.

Comparative Value: Whatever the information content of a feature-system or property, its "value" as an information repository is relative, varying in importance with what is contained with other similar properties in the area being evaluated. For this reason, a comparative pool or data base of similar properties must be developed for the mining district or neighboring region. The information value of the Montgomery Shoshone Mill site in the Bullfrog District in southern Nevada, for example, can be assessed only in comparison to other mill sites in the district and neighboring districts (Hardesty 1987). Likewise, the value of the archaeological remains of the mining camp of Gold Bar in the same district can be assessed only in comparison to other mining camp sites elsewhere in the district and neighboring districts as a source of information about community and household on the mining frontier in the early 20th century.

Integrity: An understanding of the structure and formation processes of historic mining sites is essential to assessing integrity (Hardesty 1988b: 11-12). Mining sites are formed through sequential episodes of occupation and abandonment. The structure of the site that results can be viewed best as a set of overlapping features, depositional strata, and objects. Underground workings, however, often are the largest portion of historic mining sites, making their site structure somewhat like an iceberg. In both cases, the archaeological record of earlier mining episodes tends to be destroyed in whole or in part by later occupations, making mutilation one of the most common postdepositional processes (Hardesty 1988b: 11-12). In many cases, only one or a few features, strata, or objects from the earlier occupation will be left. The surviving features or strata may occur on any part of the site, either on the edge or in the center. For this reason, the structure of mining sites should be viewed as discontinuous remnants of multiple occupations and activities, not as a continuous accumulation of historic debris. New mining episodes have much the same kind of impact upon the archaeological record of underground workings. Pre-existing features such as drifts, stopes, rises, and the like are partly destroyed or reworked or survive untouched, and new ones are created. What is left is a new image, the last of which is observed by the archaeologist. But each successive image is actually a montage containing warped and twisted images of earlier mining episodes. Without question, assessing the integrity of historic mines is a difficult problem.

LITERATURE CITED

Godoy, Ricardo
1985 Mining: Anthropological Perspectives. *Annual Review of Anthropology* 14:199-217.

Francaviglia, Richard
1982 Copper Mining and Landscape Evolution. *The Journal of Arizona History* (Autumn 1982):267-298.

1988 The Ultimate Artifact: Interpreting and Evaluating the Man-Made Topography of Historic Mining Districts. Paper Presented at the 21st Annual Meeting of the Society for Historical Archaeology, Reno, Nevada.

Hardesty, Donald L.
1987 *Cultural Resources Evaluation of the Bullfrog-Montgomery Shoshone Project.* Report Prepared for Bond Gold Bullfrog Inc., Beatty, Nevada.

1988a *Archaeology of the Rhyolite Trash Dumps, Nye County, Nevada.* Report Prepared for Bond Gold Bullfrog, Inc., University of Nevada-Reno Research Reports in Anthropology Number 88-2.

1988b *The Archaeology of Mining and Miners: A View from the Silver State.* Special Publication Number 6, Society for Historical Archaeology.

1989 The Miner's Household: Comparative Perspectives from History and Anthropology. Paper Presented at the Joint Archaeological Congress/Society for Historical Archaeology, Baltimore, Maryland.

Hardesty, Donald L., and Valerie Firby
1980 *Managing Archaeological Resources on the Comstock.* Heritage Conservation and Recreation Service, National Architectural and Engineering Record, Washington, D.C.

Lingenfelter, Richard
1986 *Death Valley and the Amargosa.* University of California Press.

Schuyler, Robert L.
1988 Archaeological Remains, Documents, and Anthropology: A Call for the New Culture History. *Historical Archaeology* 22(10:36-42).

Spencer-Wood, Suzanne (Editor)
1987 *Consumer Choice in Historical Archaeology.* Plenum Press.

Wallerstein, Immanuel
1974 *World Systems, Volume I.* Academic Press, New York.

MANAGING THE ARCHAEOLOGY OF HISTORIC MINING SITES

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The western United States is rife with the physical remnants of historic mining sites and their associated communities. When such properties are threatened by development projects we can probably agree that, where required by statute or regulation, they will be professionally identified, inventoried and evaluated within the planning process to determine if the properties involved have important values worthy of some form of treatment or preservation.

Yet, beyond this point the consistency of our expectations begins to fragment. Agents responsible to make final decisions about the nature and importance of historic mining sites often fail to recognize the full range of resource values requiring attention in inventory and evaluation studies, and address the properties from their own, often myopic, disciplinary framework. In particular, resource managers often fail to recognize, or totally ignore, the archeological value of mining sites which were originally identified for their architectural, engineering, historic values.

Many archeologists are equally remiss. Surveyors trained in prehistory, who often conduct surveys involving historic sites, are not prepared to deal with mining sites except on a rather trivial level. Lack of familiarity with the technologies involved, and the content or composition of mining sites makes what is recorded and how it is interpreted and evaluated extremely suspect. Many a survey also has failed to adequately identify mining resources in a standardized manner, diminishing the comparative information so vital to contextual assessments of resource values.

Historical data are often collected after survey is completed in an effort to connect the pieces and explain the remains recorded, rather than conducted prior to survey to inform the effort, to identify the overall historic properties involved, and to identify locations needing unique survey methods. The list could go on and on and on. Suffice it to say that both the professionals and resource managers who deal with historic mining sites operate under a wide and often inconsistent, disorganized and conflicting spectrum of assumptions about the approaches, criteria of significance, and preservation options open to them in managing such sites.

Some might view this diversity of perceptions as a good thing, a kind of radiant evolution which will eventually produce a mutant set of options that will be general enough to really deal with the problem at hand. It might be noted, however, that the number of mining sites is finite for any period, boom, or region, and this free-wheeling approach would eventually trash a lot to arrive at a good way of dealing with the few marginal properties left.

Intense public interest in the remains of historic sites and the vicarious experience of the past through treasure hunting, bottle collecting and other activities has increased the degradation of this non-renewable resource base. Development has continued unabated and seems to increase logarithmically in some historic mining areas. The ease with which historic mines have been reopened to new and devastating technologies at the fluctuation of the value of ore is increasing. All of these factors suggest that we must try to cut through the confusion and establish reasonable standards about how to identify, evaluate and manage the full range of resources on historic mining sites--whether archeological, architectural, engineering, geographical, or historical--and we must do it now.

FEDERAL GUIDANCE FOR HISTORIC ARCHEOLOGICAL PROPERTIES

Several types of federal guidance have been offered to help direct the evaluation and treatment of all historic mining properties. The regulations of the National Register of Historic Places (Register) at 36 CFR 60 and at 36 CFR 800 provide criteria and processes that are to be used in the process of determining the importance and preservation needs of historic properties involved in any federal

undertaking. Criterion D, regarding the information potential of a site, has remained until recently the vague threshold which professionals have had to meet in order to have properties considered under the National Historic Preservation Act (NHPA). Designed to allow for a wide variety of property types across the nation, this criterion is quite inexplicit and its use has definitely been inconsistent. Further guidance has been needed for some time.

We have other, perhaps more useful guidance to assist us. The need for consistent and defensible decisions and coordinated planning for all historic properties resulted in the infamous Resource Protection Planning Process, affectionately known as RP3, in the late 1970s. This process, regardless of its rhetorical shortcomings, established a new tone in historic preservation. It recommended upfront planning for resources, rather than the more traditional reactionary and piecemeal decisionmaking that epitomized management to that point. It also recommended that historic properties be planned for in a comprehensive manner, that resources related to a similar theme, period and geographic area--the historic context--should be managed together, rather than in segregation and conflict. State Historic Preservation Offices, which have been responsible for such planning since the implementation of the NHPA in 1966, were eventually mandated by the early 1980s to develop comprehensive state plans for resource protection. Federal agencies were also mandated to develop such preservation plans for properties within their jurisdiction by Section 110 of the NHPA.

Continued concern over the quality of historic preservation planning and recognition of the need for the National Park Service to fulfill its mandate to provide leadership and direction for the national historic preservation program resulted in the creation of another preservation tool, the Secretary of the Interior's "Standards and Guidelines for Archeology and Historic Preservation," published in late 1983. These standards establish minimal expectations for the conduct of the national historic preservation program. Of use at local, state and national levels, the standards are also used in the review of each state's historic preservation office to determine if a state should be approved for continued receipt of Historic Preservation Fund money. In this way Interior has produced a generic means of guiding and measuring the quality of work produced at a local, state or national level. The general nature of these standards was purposefully chosen because of the wide range of situations in which historic preservation occurs in the U.S.

The Register has also provided better advice by completely revising its nomination process so that, among other things, it closely parallels the intent of the Secretary's planning standards, and by producing publications in its "How to Nominate" series, addressing important issues regarding the evaluation of particular property types, such as rural landscapes.

Thus, we can see that over the course of the last decade the National Park Service has made efforts to try to provide technical assistance on issues raised within the historic preservation program. All of these guidelines provide us with tools that can help in more clearly defining the resources that compose a historic mining site, and ways of recognizing and treating them in a consistent and defensible manner.

WHAT ARE HISTORIC CONTEXTS?

Historic contexts coalesce information on similar historic properties in order to better determine their preservation needs, and to develop efficient guidance on the identification, recording and assessment of their composition and significance. The size or complexity of a context is flexible and depends more on immediate management needs than on some unyielding definition of the process of context production.

Historic contexts are the single most important means of developing clear and defensible criteria for evaluating historic archeological features or the historic properties of which they are a part. They provide the avenue to establish local, regional, statewide, or national approaches to preservation work and the vehicle in which the multiple disciplines that attribute value to such features can be expressed and incorporated into a unified research agenda.

It should be noted here that more than a decade of experimentation has been conducted by states and agencies in developing usable contextual plans. Many states have already established plans for particular periods, themes or geographic areas that contain historic archeological considerations. Several states, including Tennessee, Vermont, Wisconsin, South Dakota, Nevada, Colorado and Arizona have or are beginning to establish historic contexts that incorporate issues regarding the historic archeology of mining

sites. The Society for Historical Archeology has also just published Don Hardesty's *The Archaeology of Mining and Miners: A View from the Silver State*, a major contribution. Contextual models exist to experiment with.

Unfortunately, there is a lot of perceptual baggage that the words "comprehensive planning" and "historic contexts" carry with them. Once, while I was talking about preservation planning, someone said to me, "Oh, you must be an archeologist if you're interested in resource planning." I have heard others bemoan the hellish world foisted upon them by their having to prepare a comprehensive preservation plan--which eventually appeared as a document affectionately nicknamed a Cultural Resource Action Plan, or CRAP for short. Some states have patiently and stubbornly avoided any sincere involvement in developing such a planning process, hoping for its sudden and quiet death so that management can return to a more easily manageable ad hoc system. At least one resource manager banned the term "comprehensive planning" in correspondence with another federal agency's regional personnel because of the unnecessary fear and loathing created by the "CP" word or its synonyms.

Comprehensive planning is not an archeological technique; it is a method of achieving more consistent and balanced historic preservation, regardless of the properties involved. We should not fear that which we most need: disciplinary consensus resulting in explicit guidelines for the identification, assessment of significance, and development of management alternatives for similar historic resources; a means of pooling information about the status of resource types so that decisions about them can be easily arrived at and justified; a planning process which can incorporate new information resulting from preservation activities. Comprehensive planning requires coordination, cooperation and commitment, but it will provide federal, state and local agencies and organizations an easier way of understanding how to deal with historic resources such as mining sites.

There is no way to fully explain the value, flexibility or potential of contextual planning within this paper. The Secretary's Standards and Guidelines present the core definition, and Register Bulletin #16 contains excellent discussions about the development and use of historic contexts. Finally, the Interagency Resources Division of the National Park Service in Washington has established a special quarterly bulletin called "Compendium" which provides continual updates and guidance on the use of the Secretary's Standards, and has created a Preservation Planning Handbook which provides useful information in developing this process.

There is currently no other single method more useful in dealing with the management of historic mining sites and their associated values than the contextual planning process.

HISTORIC ARCHEOLOGY BULLETIN

The National Park Service has nearly completed another important tool for dealing with the archeological remains of mining sites. In the near future a new draft bulletin will be available on the identification and evaluation of historic archeological sites. This document was originally made available in January of 1988, but has since been substantially rewritten based on substantive review and the efforts of a small working group of historical archeologists. The bulletin is designed to provide practical advice and direction to a wide audience including the general public, cultural resource managers, and to those professionals of diverse disciplines who will have occasion to be involved in the inventory and assessment of such properties.

It should be recalled that the bulletin has been developed as a general framework for evaluating the archeological significance of historic sites. Because the potential range and diversity of such sites constitutes the sum of historic human activity represented by extant physical remains, the bulletin will not provide definitive answers to all the situations that can arise in assessing such resources. Here, again, is where the development of more refined state, regional or local historic contexts become critical; they will relate the general standards to the specific situation and its particular management needs.

Basic Elements of the Historic Archeology Bulletin:

1. The focus of a historic archeological evaluation should be the overall historic property of which it is a part.

Historic sites and their contributing features and values need to be comprehensively identified and evaluated. Currently the Register contains innumerable listed historic sites whose records are effectively incomplete because of a myopic disciplinary approach taken historically to defining each property's significance. Similarly, past policies of the Register have tended to atomize assessments, allowing a focus on only particular resource values as sufficient to nominate a historic property.

An important corollary of this maxim of holistic evaluation is that historic properties need to be identified with reasonable consideration for the entire system of which they are a part. Mills, mines, residences, and auxiliary features and structures constitute the major components of a mining site or district, and every effort should be made to inventory and evaluate each property in relation to the whole rather than as individual sites. Surveys conducted without consideration for the interconnected nature of associated sites have fragmented mining systems involving camp sites, placering areas, flumes, and interconnecting roads or trails into a welter of distinctly recorded and evaluated sites, making integrated research, interpretation and management difficult or impossible.

Of course, logical exceptions to this rule may be required because of the great distances between the components of a single mining system, and the management needs of a particular situation. For example, the charcoal kilns in Wildrose Canyon, California are nearly 30 miles from the smelters that used them in the lead-silver mines of the Argus Range. In these cases it may be better to consider an industrial system as having several discontiguous sites composed of a core site and numerous "outliers". Ranches and farms that supported mining districts may also be seen as "outlier" sites. The concept of a single industrial site logically begins to fall apart at the level of a national corporation's holdings, or on the level of a world system involving industrial capitalism, although these are both legitimate analytic constructs in a site's evaluation.

The basic idea here is that it is inappropriate to inventory or assess a site without a reasonable effort to determine all the values that distinguish or contribute to it. Historic properties may contain contributing features including archeology, architecture, engineering features, landscapes and may have critical associations with other historic trends, events or persons. The inventory and evaluation process should be as holistic as possible.

It follows from this holistic approach that preservation activities such as historical research, survey design and evaluation must allow for a dynamic interchange among those disciplines which may impart significance to the sites involved. There may be very good reason to include the disciplines of social and economic history, historical architecture, historical geography, folklife and folklore, for they too have played an important role in the eclectic development of historical archeology and they need to somehow be incorporated into the evaluatory process. The distinct research foci which have developed in different disciplines provide a broader pool from which to determine strategies and methods for dealing with such sites, if we have the patience and foresight to use them, which we rarely seem to do.

How can a comprehensive consideration of a site be accomplished within existing constraints of time, manpower, patience, and funding? By contextual planning, which the bulletin will also encourage. If developing useful historic contexts and a planning process were recognized as being as important, if not more important, than the day-to-day reactionary activities conducted by most managers, we would be on our way to the historic preservation millennium. Historic contexts could provide property-specific guidelines that could pinpoint the kinds of expertise needed in a given situation. Different disciplines would contribute to a synthetic and preliminary research or preservation agenda that would define the kinds of assessment, measures of significance, and types of treatment possible before a project began. Novel approaches, new ideas and data could be incorporated and used by all users of the context. The net result, easier and quicker decisionmaking with maximal disciplinary involvement; reduced duplication of research efforts used in establishing separate contexts for every project; and a much larger information pool from which to draw in developing other planning constructs.

The challenge of ironing out how agencies, organizations, and individuals can begin to really cooperate and plan together for the preservation of historic mining sites, and the fundamental challenge of developing a unified research agenda for historic archeological or historic geographic evaluations will require some radical changes in the way we operate and think. We have all become accustomed to working within our finite jurisidiction, and to consider resource planning that requires decisions of context that go beyond the safety of our area of control and understanding is truly a challenge. But we should

invite the opportunity to rattle our own cages of complacency and assess the unconscious assumptions we use in decisionmaking everyday. Maybe in so doing we can achieve a more effective way of conducting historic preservation.

2. Refinement of Register criterion D will be encouraged by reference to the current scholarly interests, research designs and theoretical positions of concerned disciplines.

The bulletin will provide basic information about the range of ways that historical archeology imparts research value to property types. For example, we find certain prevalent issues and approaches that can help to frame the questions or refine criteria to be responded to in the evaluatory process. Both history and archeology have multiple approaches to description and explanation; neither is purely "scientific" or "humanistic." The effect of this on historical archeology has been an outgrowth of several relatively distinct paradigms or approaches for looking at the past which might be reified to include: 1) a direct historical approach emphasizing descriptive history; 2) a "historical" or "anthropological" pattern recognition approach emphasizing scientific method, behaviorism and processual analysis about changes in the development of historical cultures, and; 3) a structural or critical approach that attempts to analyze material culture to reconstruct or expose past ideological systems. A potential fourth approach would be studies specifically developed to establish chronometric, diagnostic or other tools to facilitate analysis. Of course numerous other tangents have developed involving aspects of materialism, cultural ecology, dependency models, socioeconomic relations, and technological history. These can in one way or another be related to one of the three main paradigms mentioned above. Presentation of realistic summaries of each paradigm and their overall historical development in the bulletin will provide an excellent background to the differing values that can be attributed to historic archeological properties, thereby defining the information potential of a property. Brief case studies will elaborate on these issues and an annotated bibliography will offer additional models for consideration.

3. Evaluations of historic archeological properties can be made without recourse to test excavations.

This is an important and new consideration. If, in the process of establishing a context for the evaluation of a property type, it is determined that important information has typically been recovered from such property types, then that property could be considered significant based on: 1) contextual justification of importance, accompanied by sufficient historical data to suggest that the property probably exists and has integrity; or, 2) the results of a more traditional test excavation accompanied by contextual data. This is a clear departure from earlier expectations that archeological sites had to be "tested" to determine their value; often a difficult problem given the dispersed nature of archeological features on some historic sites, and the cost of such work. Presumed integrity will of necessity require a carefully documented explanation involving historical data on disturbances that may or may not have affected the features and deposits of value. Other integrity issues requiring consideration might include the duration, function and number of occupations that have occurred on the property since its period of significance.

4. Greater flexibility will be allowed in the definition of "sufficient documentation" to recognize the very different kinds of management situations in which historic archeological evaluations and nominations are conducted.

There is a great deal of difference between historic properties faced with total obliteration by development, and ones merely needing recognition within, say, a historic mining district. It seems reasonable to assume that documentation for a site that will not be impacted may not be as rigorous as that required for a site potentially in need of data recovery, as long as some effort is made to identify the range of historic values present. This also raises important questions about the original intent of the "information potential" Criterion D and of the Register itself. Criterion D seeks an evaluation of the **potential** of a site to yield, not the more frequently unstated need to first demonstrate that the site has yielded. The Register was originally created as a management tool in preservation planning, and planning tools should be flexible to meet varying management needs. Arguments developed on theoretical, contextual, comparative and documentary grounds could provide an adequate analysis of natural and cultural transformations or disturbances on a site, as well as the site's potential to yield important information, without costly test excavations. By allowing a sliding scale of sufficient documentation, perhaps defined more explicitly within a historic context, we can encourage the incorporation of archeological resources in historic site assessments involving local government surveys, architectural surveys and assessments normally focussing on Criteria A, B, and C.

5. Historic archeological properties can also be eligible under criteria A, B, and C.

This too is a marked departure from the earlier equation of archeology with criterion D. This is particularly important in regard to criterion A, in which a mining boom camp composed of tent or cabin pads, fireplaces or stone ovens and little more may be eligible as representative of the mining boom period and pattern of settlement, yet may not contain sufficient associated archeological remains to have information potential.

6. Features and deposits on historic properties that typically have information potential will be presented.

Creating hit lists can have a detrimental effect on those features not listed and could forestall academic creativity, but, by providing a sense of the kinds of properties involved in archeological research, the general public and managers can have an enhanced understanding of what historic archeologists are after in research and preservation.

7. The popular and myth-ridden issue of the relationship of documentary and archeological sources and which is more important will be discussed.

Historic archeological sites often constitute the only information available on some historic activities or groups, or they often provide important complementary data to the existing or known oral or historic record. On the other hand, historic sites have been subjected to costly archeological research whose design may have been better addressed through the available documentary record. There is, of course no easy answer to this dilemma, for the balance among the documentary, oral and physical forms of evidence available on or about a historic property will vary depending on the focus of research. This suggests that there is all the more reason to coordinate these issues within contextual planning rather than have them present themselves in a frustrating and irresolvable manner, exposing themselves to biased or uninformed decisions, in the midst of the compliance or review process.

8. The Bulletin will note that archeological testing requires either consultation with or supervision by a qualified historical archeologist.

Nonetheless, the contextual planning conducted about particular property types might provide important areas in which avocational archeologists, paraprofessionals or the general public can be involved, if not actually conduct portions of the evaluation process.

CONCLUSIONS

These are some of the main issues that the Bulletin either currently addresses or I think might be addressed in the draft about to be released. A site should be evaluated with reference to a comparative analysis of similar properties and their multi-disciplinary considerations as expressed within an explicit historic contextual statement. Research interests and the physical or analytical integrity of the resource establish the criteria of assessment by delineating the kinds of information needed within a site, and the degree of intactness needed of the information in order to address research interests. An explicit and unified research agenda will ensure that sites are scrutinized with a reasonably consistent perspective.

So where do you come in on this? First, the National Park Service is seeking your comments and recommendations on this document. Because this bulletin is the first formal statement made by the Register on historical archeology, local, state and federal resource managers will be turning to it to resolve the problems they have in addressing this subject. Planning policies at all levels of preservation work may be strongly affected. Your comments on the effectiveness of the bulletin may be critical.

Secondly, you should realize the power you have in promoting the development of historic contexts that address historic mining sites or similar problematic properties. More consistent and coordinated planning is needed to insure that decisions are typically made with reference to a formal planning tool rather than politics, idiosyncracies or the bad lunch someone just ate. States and federal agencies are responsible to plan for historic resources if they are recognized as an important priority. Currently, historic archeological resources are falling rapidly through the cracks between disciplines and resource definitions; this is painfully apparent at most of our National Historic Landmarks, such as Virginia City, Nevada;

Bodie, Coloma, Columbia, and New Almaden Quicksilver Mines in California. It is also apparent in federal agency actions, inlcuding those of the National Park Service.

The Park Service's Western Regional Historian John Hussey noted in the 1940s that historic mining sites and districts need to include the full spectrum of historic resources that compose them, not only the architecture. It was the "full environment" of a mining district that he sought to have recognized in the West. Today, almost half a century later, we are still trying to achieve that goal. We can intellectually understand that buildings, structures, archeology and landscape all compose the remnants of an historic mining system, but we still find it difficult to enact this understanding in coordinated management.

The National Park Service has produced standards and explanatory bulletins to help us better manage the nation's heritage. Rather than stand by and wait or expect each State Historic Preservation Office or federal agency to produce the specific contextual plan that we need, we should use the tools and resources available to us to work with states and federal agencies in producing multi-jurisdictional contextual plans for the management of historic mining and other properties.

THE STATUS OF ARCHAEOLOGICAL STUDIES AT NEVADA MINING CAMPS

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In his 1978 review of the status of archaeological studies of mining camps in Colorado, S. G. Baker noted the general lack of late 19th and early 20th century sites that had been subjected to professional archaeological inquiries, and suggested many approaches to such sites that have since been widely adopted (Baker 1987:14). George Teague also found information on historic camp layouts to be "woefully slim" in 1980 when he was attempting to find comparable data for his work at the Reward Mine in Arizona (Teague 1980:141). In 1982, when I gave a paper in Reno on our findings at historic mining sites at Borealis and at the Nevada Test Site (Reno 1982), the only such studies yet published in Nevada were those by Hardesty and Firby at the Comstock Historic District in 1980, and by Hardesty at Bullfrog in 1980-1981.

Since that time, the mining industry has greatly increased activity in historic mining districts (Fig. 1). The areal destruction caused by the shift from underground to open pit methods and the large scale of work required for the companies to turn a profit is unprecedented in Nevada. The fact that many of these developments have taken place on public lands has led to a significant increase in archaeological studies of the affected mining districts as a result of inventory, assessment, and in rare cases mitigation efforts in the affected districts.

Mines may be in the open now, but archaeological reports are of the underground variety. The bibliography of historical archaeology in Nevada compiled by Furnis (1986) through a campaign of personally contacting CRM contractors and universities that worked in Nevada was an invaluable help in finding the materials for this paper, but this document is already badly out of date for this topic. Again, it required repeating the process of personal contacts to obtain recent documents. It is hoped that funding will become available for the Nevada Division of Historic Preservation and Archaeology to publish annually a bibliography of the reports that pass through that office. Once found, acquiring the documents for this survey was something of a trial by xerox, for most are out of print. This process was somewhat haphazard, so it is probable that some reports that should have been included in this summary have been overlooked.

SCOPE OF INQUIRY

Studies of mining districts can focus on a variety of themes, depending on the data present, the study area boundaries, and research interests. Primary themes that have been addressed archaeologically include mineral extraction, processing, transportation, and support facilities. The first three are primarily the domain of industrial archaeology--the last is the area focused on in this paper. Fenenga (1967:81) has noted the greater potential for archaeological study of the relatively undocumented mining camps; the tremendous amount of literature generated by miners has focused on the industrial aspects and generally ignored life in the camps. Building surveys have been excluded from this study; only archaeological reports dealing with the total range of cultural remains in mining camps are considered.

Studies concerning thirteen mining camps or towns were selected for inclusion in this overview, plus an additional survey of twelve mining camps in White Pine County (Fig. 2). There are four major types of archaeological studies of mining camps: model, inventory, assessment and mitigation.

Ideally, a model of expected distributions of cultural remains from historically documented activity in a study area is prepared before any archaeological field work is completed. Usually such models are incorporated in archaeological studies, but in some cases the models are prepared as separate entities. Such a model has been included in the overview of the Battle Mountain District for the BLM (Bowers and Muessig 1982), but the only detailed model for a single mining district is for the Comstock Historic District (Hardesty and Firby 1980).

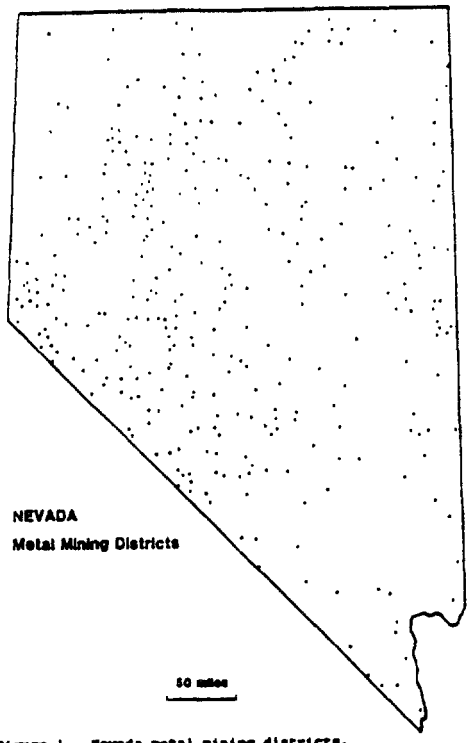

Figure 1. Nevada metal mining districts. (after Schilling 1976)

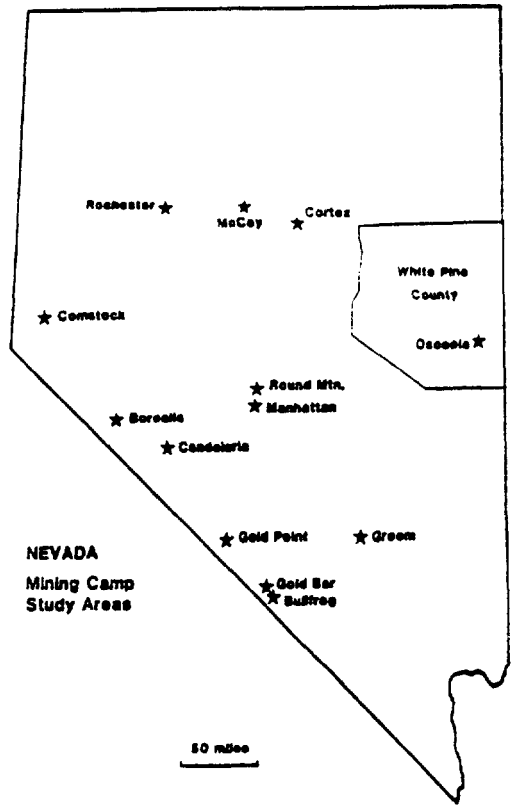

Figure 2. Locations of archaeological studies of mining camps in Nevada. White Pine County is the location of an inventory of 12 mining camps by Price (1987).

Many mining camps have been inventoried to a certain extent during the course of archaeological surveys. Of the literature reviewed for this paper, seventeen mining camps have been studied at the inventory level, twelve of which are from Price's White Pine County survey. Only three of these sites were considered unworthy of additional archaeological study.

Six sites have been subjected to further assessment to determine eligibility to the National Register of Historic Places and to identify further research potential of the sites. Five of these sites (Cortez, Candelaria, Gold Point, Lower Osceola, Gold Bar) clearly have additional data potential. Only McCoy was determined to lack sufficient integrity for further study, due to the extent of damage to the site (Fig. 3).

Only three sites, Rochester, Borealis, and Bullfrog, have undergone separate archaeological mitigation phases.

Study normally has progressed through these phases, though in some instances two steps have been combined, and in others, sites are so clearly significant that the assessment phase has been skipped.

Table 1. Summary of types of reports concerning mining districts by year.

Research Data Year	Design	Inventory	Assessmnt	Recovery	School	Total
1980	1	-	1	-	-	2
1981	-	-	-	1	1	2
1982	-	-	-	1	1	2
1983	-	-	-	-	-	0
1984	-	-	-	-	-	0
1985	-	-	1	-	-	1
1986	-	3	3	1	-	7
1987	-	2	-	-	1	3
TOTAL	1	5	5	3	3	17

LEVELS OF ANALYSIS

Artifact

Artifacts are studied to a certain extent in all reports, primarily to help infer when the site was occupied, and to determine the activities present. rtifacts are normally reported in terms of their function, and the major functional classes used are relatively comparable, most derived from South's classification scheme.

A major problem with historic artifacts is the tremendous number and bulk of artifacts present at major sites. This wealth of material culture makes collection and curation of all materials impossible. Projects rely heavily on field identification and tabulation of artifacts, using a wide variety of tabulation forms. A standard debris scatter form is now in preparation as part of a joint effort by the Nevada Division of Historic Preservation and the Nevada Council of Professional Archaeologists to standardize the conduct of historic archaeology in Nevada (Hardesty 1986a).

Two major problems with this reliance on field tabulations are an absolute dependence on the quality of the field identification, and the inability to take the time needed to make the more detailed descriptions and measurements needed to refine current ideas about artifact types. An example of such a refinement is shown in Figure 4, which shows ranges of measurements of tin cans along with traditional identifications of the cans. Clearly, archaeology can provide a different perspective on such artifacts if resources are allotted to such studies, but with non-collection methods applied even to mitigation levels of data collection, it is clear that studies of individual artifact types will be retarded.

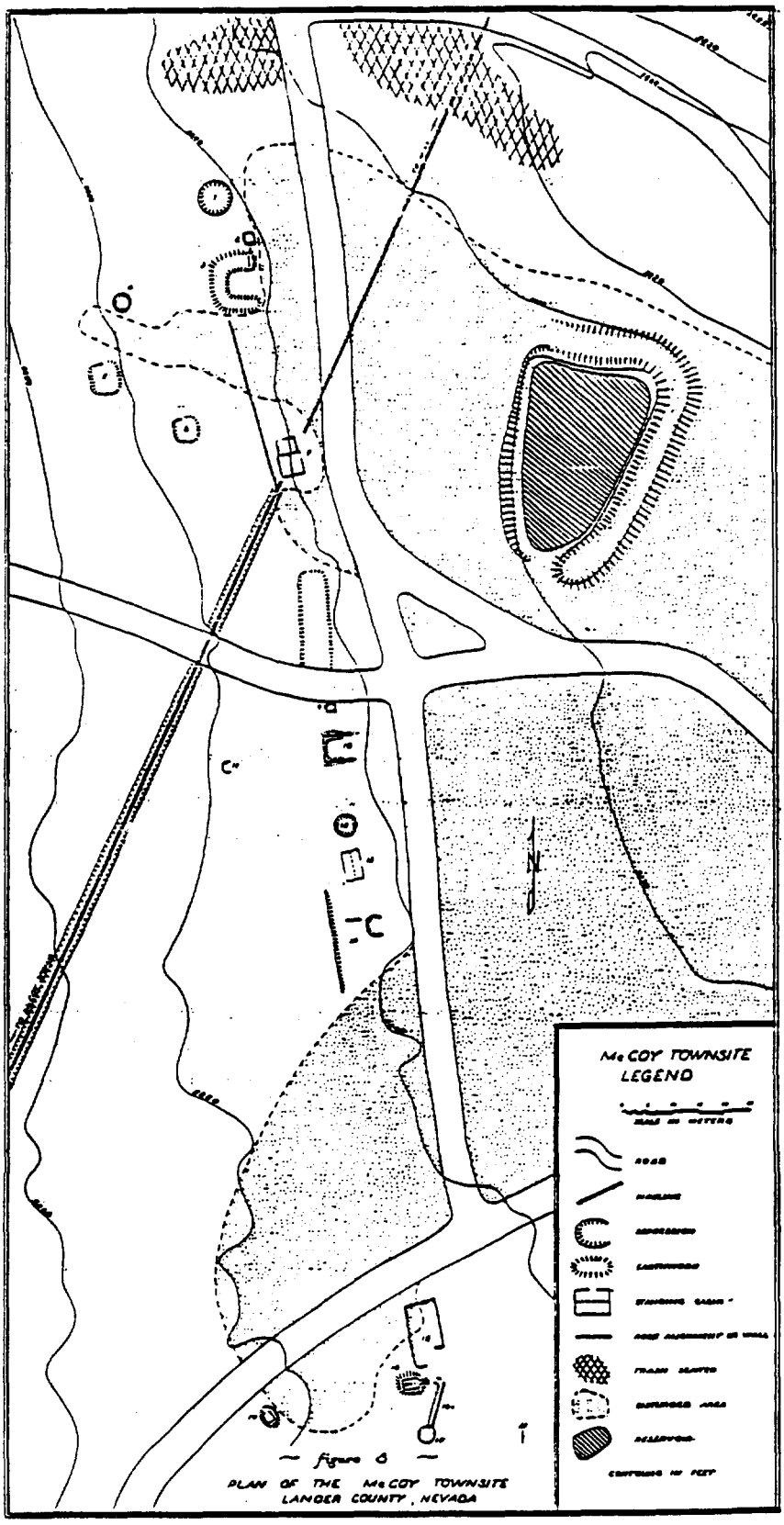

Figure 3. An example of a heavily disturbed mining camp. The entire eastern half of the McCoy townsite (stippled area) has been destroyed by bulldozing and trampling by livestock (after Reno 1986).

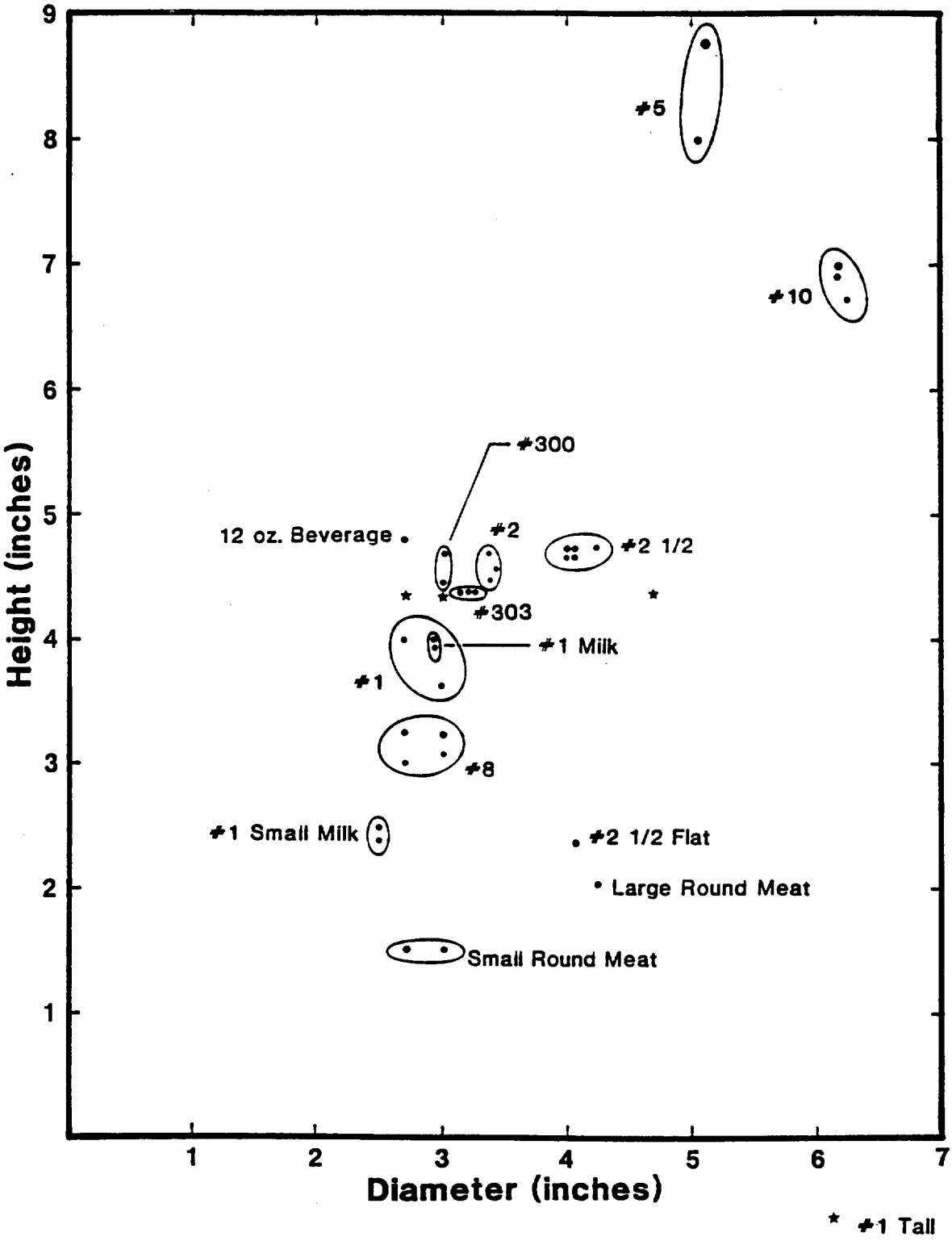

Figure 4. Scatter diagram of dimensions of round food and beverage cans from Borealis (after Reno and McLane 1987).

Feature

Detailed feature sketches are often present only on site forms, and not reproduced in final reports. This is unfortunate in that the spatial relations of artifacts and features are critical to a number of more difficult research questions such as ethnicity and change in world view through time. When present, the recording of features is normally quite good (Fig. 5). The next step of preparing maps showing the distributions of different artifact classes has not normally been done either at the artifact or site level in Nevada, primarily due to the level of quantification required, and due to the relatively small number of sites that have reached the stage of data collection and analysis required of mitigation efforts.

Site

Good site maps are the rule (Figs. 6-8), but a common problem is the lack of intermediate scale maps to accurately link individual feature sketches with the town or district map. This has made such exercises as the nearest neighbor analysis attempted by Reno (1988) impossible for many project areas. A particularly useful device, when applicable, has been to overlay the archaeological map on the plat map (Fig. 9).

Mining District

The mining district has been recognized by most researchers as an ideal study unit for mining activities (Edaburn 1982:235). Due to the relatively large size of most districts, it has often proved impractical for archaeological researchers to study entire districts in detail. In the case of Manhattan (Fig. 10) the fragmentation of the study area and avoidance of many of the most significant parts of the district reaches extreme levels. This problem was recognized by the researchers, who pleaded for a study of the district as a whole as soon as possible (Furnis 1986:2). The inventory of mining camps in White Pine County deliberately focused on residential areas in the interest of quickly obtaining a large body of data on different sites in a minimum amount of time, the lack of information on other cultural remains in the districts was recognized, and further data collection based on districts was strongly recommended (Price 1987:63-64).

The reports summarized above all concern individual sites, though the completeness of analysis varies. Most make some effort to compare the site in question with other historic sites, but none, with the exception of the White Pine County report (Price 1987), are specifically designed to compare historic mining sites in Nevada. As Baker (1978) noted, that is the next step, but it is a difficult one to fund. It is probably a good target for thesis work because of the limitations on the operations of CRM archaeologists.

The present data set is adequate to make a start at comparing artifacts, features, and sites throughout Nevada, and developing more general patterns. So far such comparisons have generally been at the artifact pattern level. A possible approach to using the locational information now available for comparison of settlement patterns among sites was suggested by Reno (1988). Price (1987:59-62) provides additional ideas concerning differences in settlement patterns through time.

There now exist enough data on Nevada mining camps to start making comparative studies at a variety of levels. In addition, rapid progress is being made toward increasing the comparability and quantitative emphasis of historic archaeological data collected in Nevada. It is primarily at the comparative level of analysis that we can expect to discern widespread patterning of material remains. With the explanation of why these patterns have emerged we can hope to progress beyond the study of idiosyncratic behavior and in time develop a new understanding of the mining frontier.

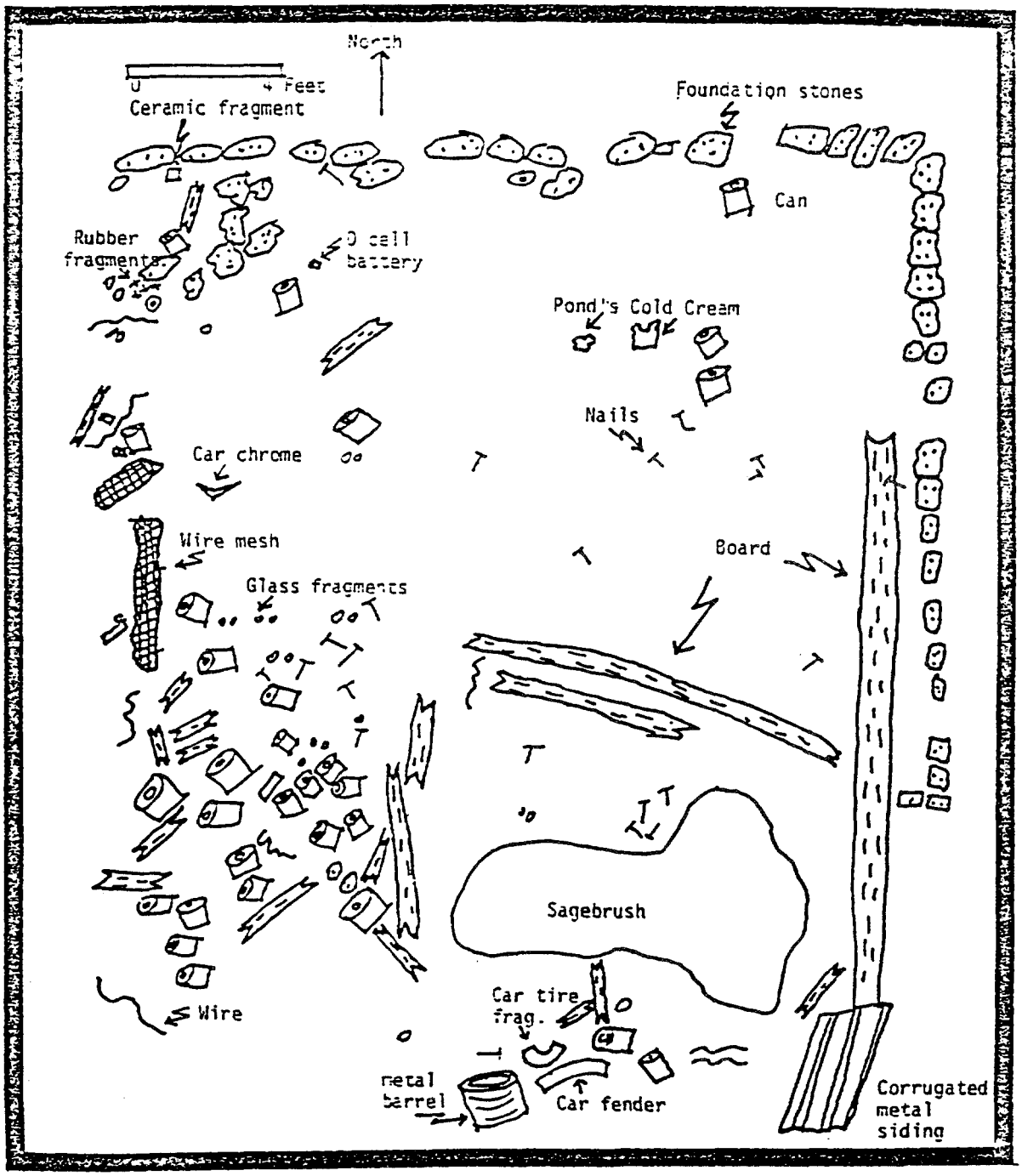

Figure 5. Sketch of a tent platform at Bullfrog (after Hardesty 1980).

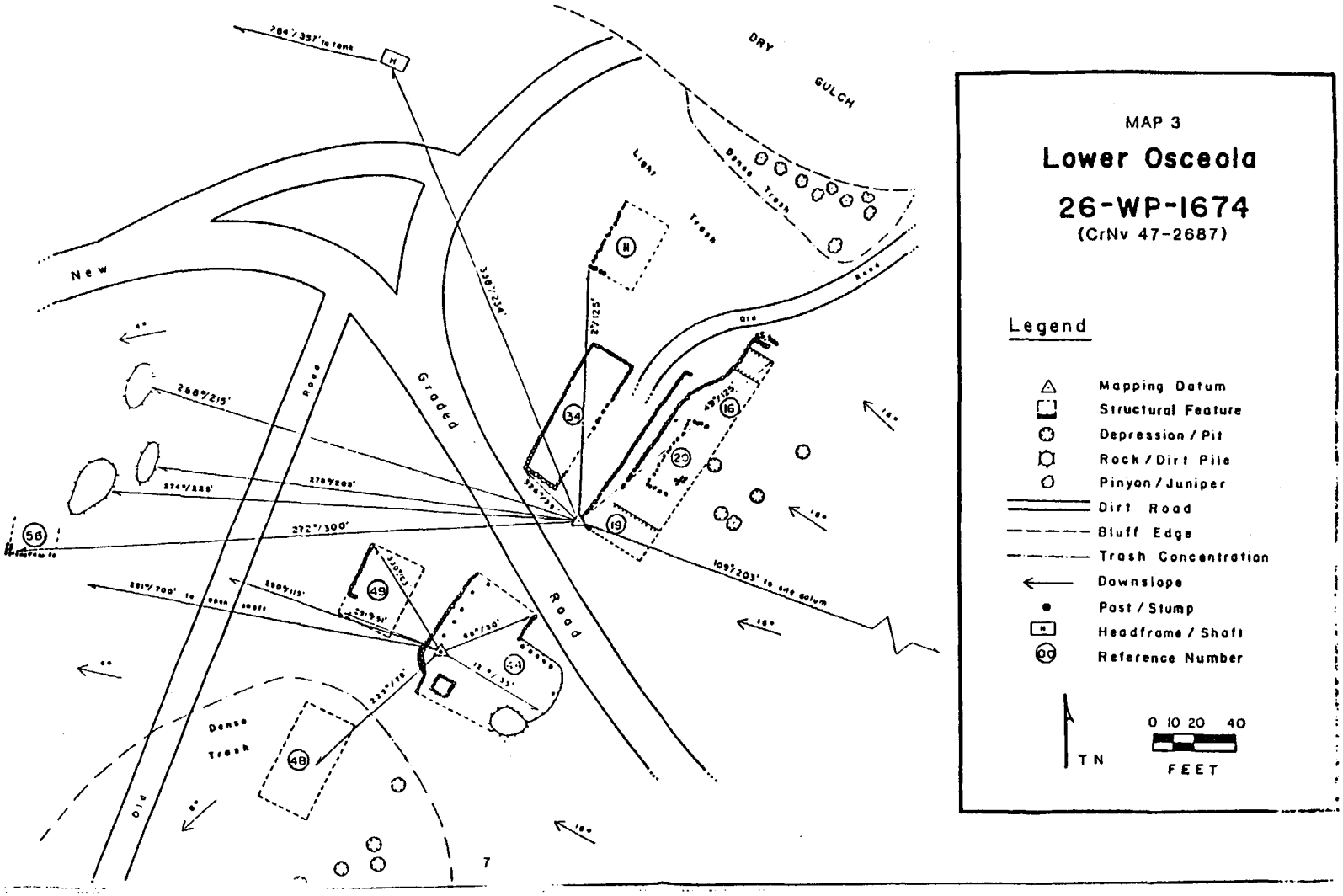

Figure 6. Map of Lower Osceola (after Price 1985).

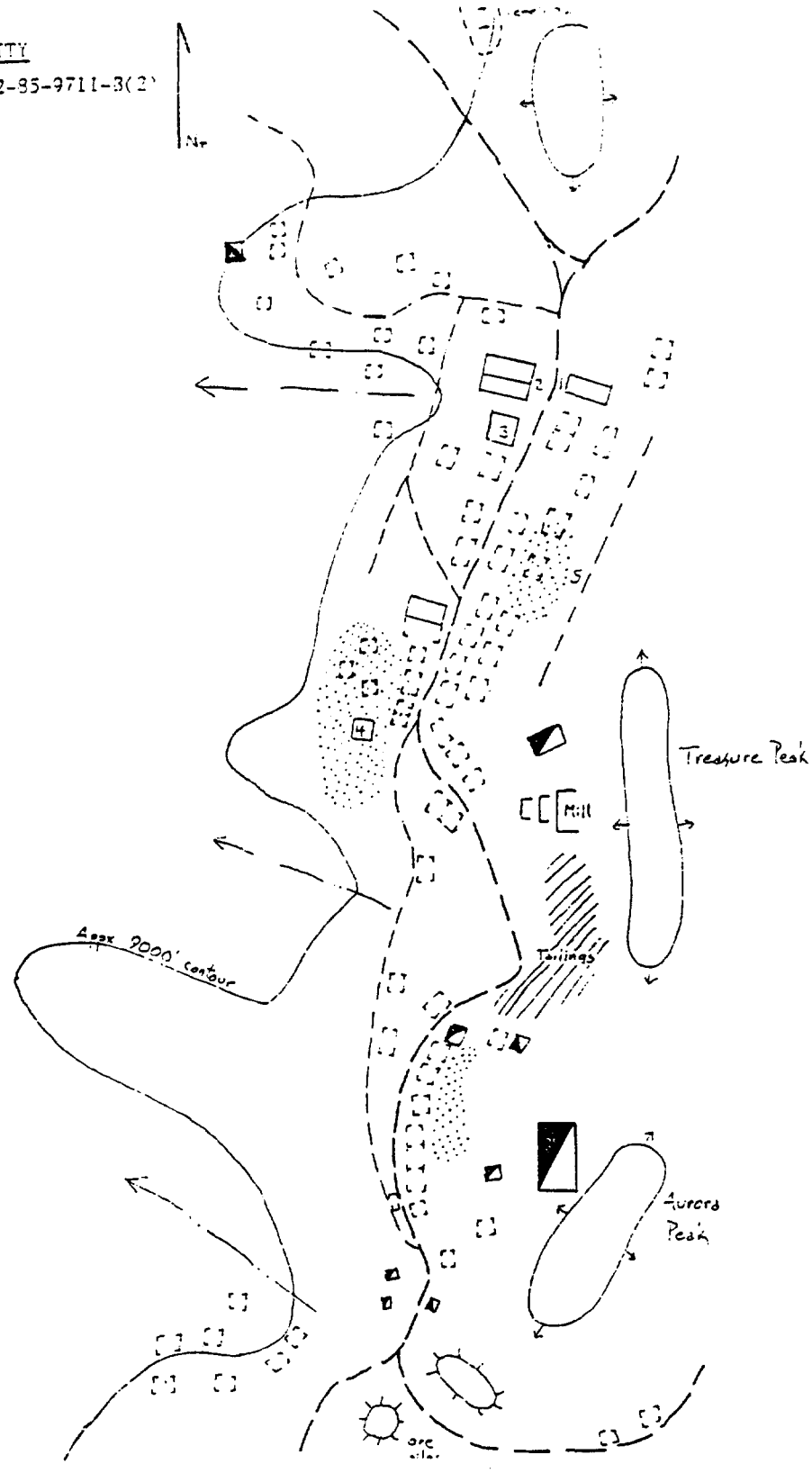

Figure 7. Map of Treasure City (after Price 1987 site forms)

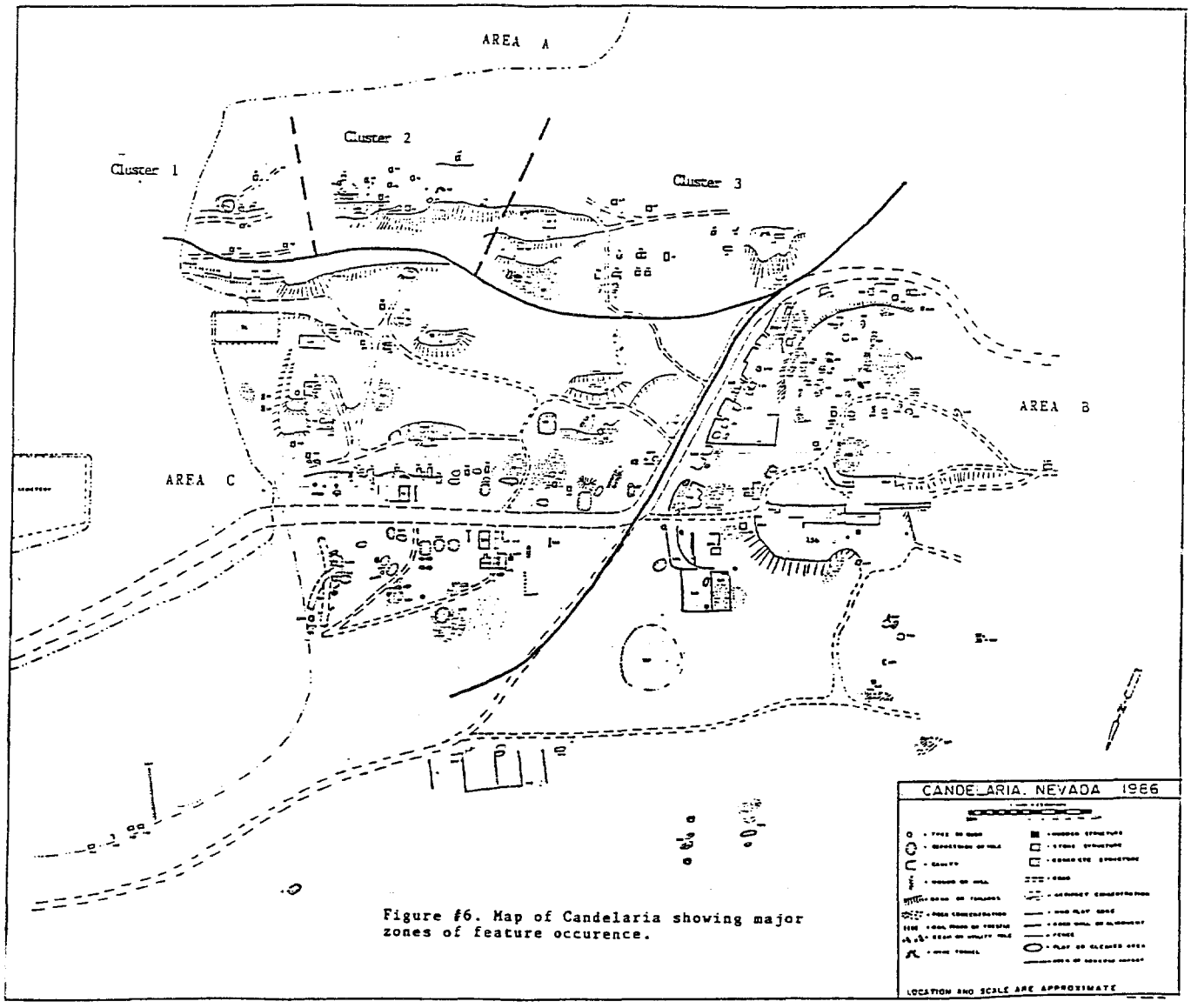

Figure #6. Map of Candelaria showing major zones of feature occurence.

Figure 8. Map of Candelaria (after Queen 1987).

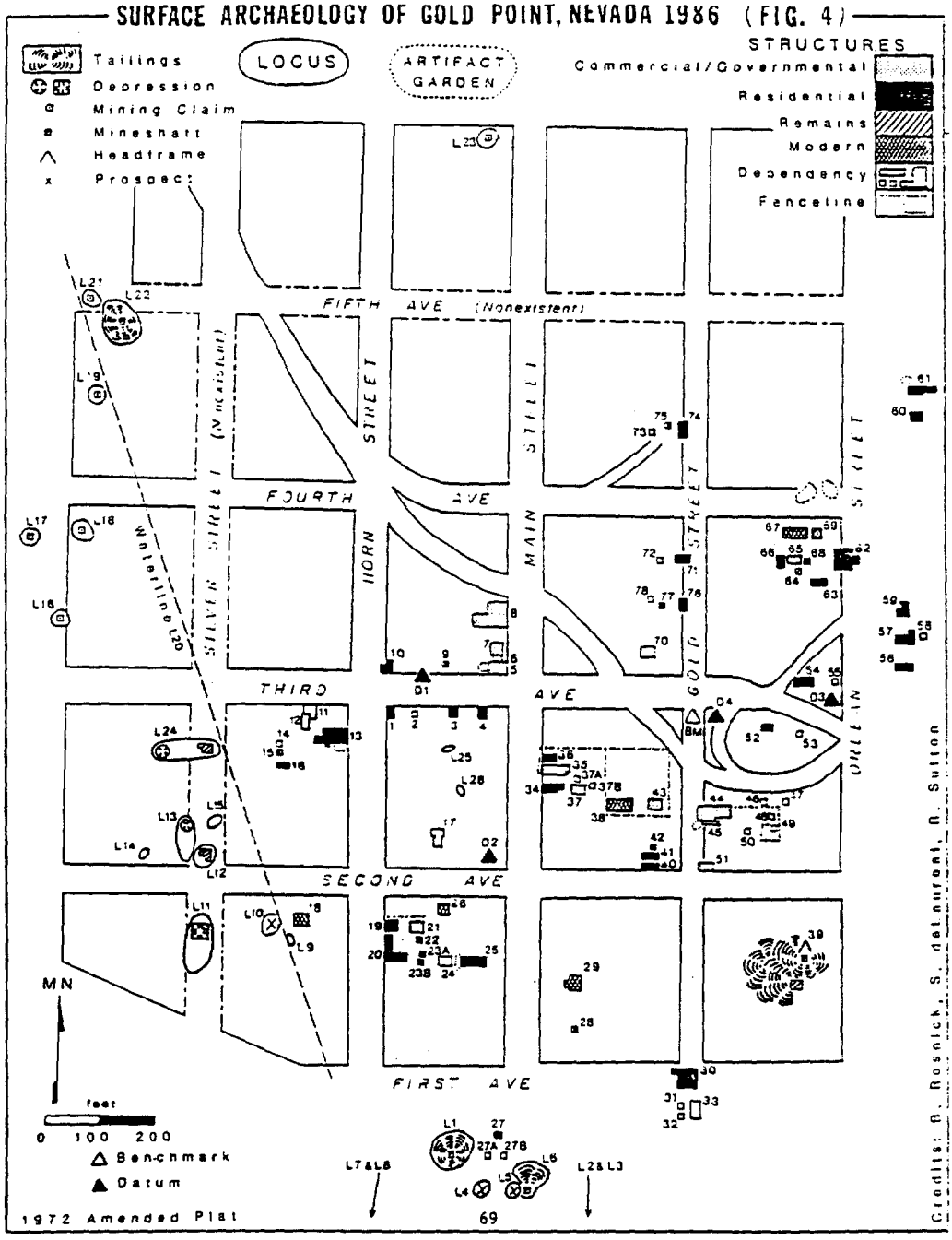

Figure 9. Map of Gold Point illustrating the superposition of archaeological features on a town plat (after Sutton 1986).

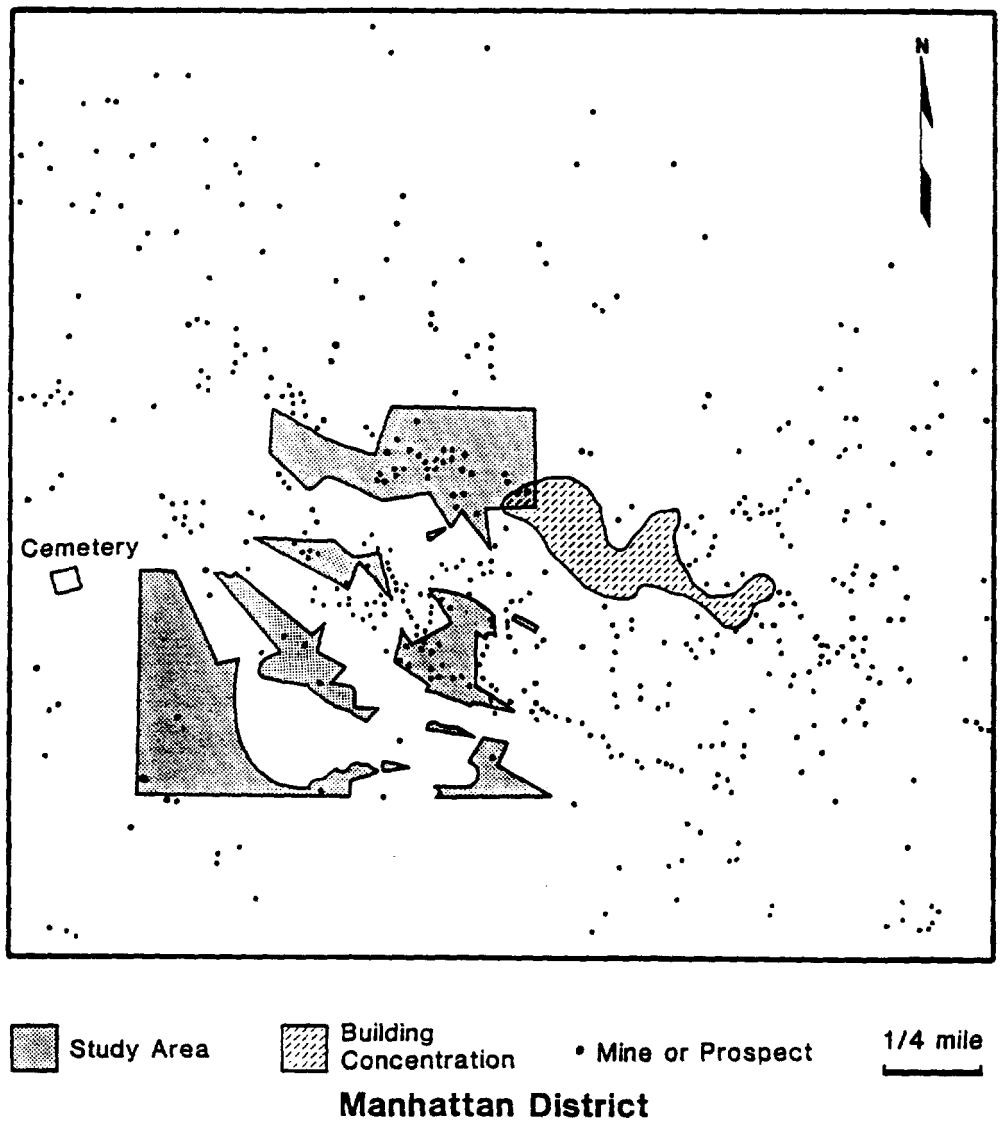

Figure 10. An extreme example of a fragmented study area (after Furnis 1986).

REFERENCES CITED

Baker, S.G.
1978 Historical Archaeology for Colorado and the Victorian Mining Frontier: Review, Discussion, and Suggestions. *Southwestern Lore* 44(4):11-31.

Bowers, M.H. and H. Muessig
1982 *History of Central Nevada: An Overview of the Battle Mountain District.* Cultural Resource Series No. 4, Bureau of Land Management, Reno.

Burke, T.D. and C.L. Furnis
1987 *Cultural Resource Inventory of the Smoky Valley Common Operation Expansion Project, Nye County, Nevada.* Prepared for Round Mountain Gold Corp. and ERT by Archaeological Research Services, Virginia City.

Edaburn, S.
1982 Mining and Industry Activities. In *An Archaeological Element for the Nevada Historic Preservation Plan.* Nevada Division of Historic Preservation and Archaeology, Carson City.

Furnis, C.L.
1986a *Preliminary Cultural Resource Investigation of Tenneco Minerals Company/Manhattan Project: Ten Unpatented Parcels, Nye County, Nevada.* Prepared for Tenneco Minerals Co. by Archaeological Research Services, Virginia City.

1986b A Partial Bibliography of Historical Archaeology in Nevada. In *Issues regarding the conduct of historical archaeology in Nevada*, edited by Donald L. Hardesty, Appendix C, Nevada Council of Professional Archaeologists Publication Series No. 1, Silver City.

Fenenga, F.
1967 Post-1800 Mining Camps. *Historical Archaeology* 1:80-82.

Hardesty, D. L.
1980 *Evaluation of Historical Archaeological Resources in Bullfrog Claim and Mining Sites: Nye County, Nevada, Death Valley National Monument.* National Park Service/University of Nevada, Reno.

1981 *Recovery of Historical Archaeological Data: Bullfrog Claim and Mining Sites, Nye County, Nevada, Death Valley National Monument.* National Park Service/Univ. of Nevada, Reno.

1986 *Evaluation of Cultural Resources at the Gold Bar Mine, Death Valley National Monument.* University of Nevada, Reno.

1986a *Issues Regarding the Conduct of Historical Archaeology in Nevada.* Nevada Council of Professional Archaeologists Publication Series No. 1, Silver City.

Hardesty, D. L. and V. Firby
1980 *Managing Archaeological Resources on the Comstock.* National Architectural and Engineering Record, U.S. Dept. of Interior, Washington, D.C.

Hardesty, D. L. and Eugene Hattori
1982 *Archaeological Studies in the Cortez Mining District.* Technical Report No. 8, Bureau of Land Management, Nevada.

1983 *Archaeological Studies in the Cortez Mining District, 1982.* Technical Report No. 12., Bureau of Land Management, Nevada.

Price, B. A.
1985 *An Evaluation of Lower Osceola Historic Site (26WP1674), White Pine County, Nevada.* Intermountain Research, Silver City.

1987 *Boom Towns and Copper Camps: An Archaeological Survey of Historic Sites in White Pine County, Nevada.* Nevada Division of Historic Preservation and Archaeology, Carson.

Reno, R. L.
1982 Temporary Camps and Historic Archaeology. Paper presented at the 1982 Great Basin Conference, Reno.

1986 *Historic Archaeology of the McCoy Mining District, Lander County, Nevada.* Archaeological Research Services Reports, Virginia City.

1988 Archaeological Studies of Nevada Mining Camps. Paper presented at the Society for Historical Archaeology, Reno.

Reno, R. L. and A. R. McLane
1987 *Historic Archaeology of the Borealis Mine, Mineral County, Nevada.* Desert Research Institute, Social Sciences Center Technical Report No. 29 (a revision of an unpublished report submitted in 1982 to Houston International Minerals Corporation).

Reno, R. L. and L. C. Pippin
1986 *An Archaeological Reconnaissance of the Groom Range, Lincoln County, Nevada.* Desert Research Institute, Social Sciences Center Technical Report No. 46.

Schilling, J. H.
1976 *Metal Mining Districts of Nevada.* Nevada Bureau of Mines and Geology Map 37, 3rd ed.

Zeier, C. D.
1986 *Archaeological Investigations at Rochester Heights and Nearby Historic Settlements, Pershing County, Nevada.* Intermountain Research, Silver City.

SURVEYING THE MONARCH MINE, YOHO NATIONAL PARK, CANADA

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For many years it was the policy of the Canadian Parks Service to remove the physical evidence of mining and other industrial activities from the landscape of the National Parks of Canada. In the Rocky Mountain Parks straddling the British Columbia-Alberta border, coal mining communities around Banff were the first to be removed. During the Second World War scrap metal drives resulted in the destruction of additional features including early oil well sites in Waterton Lakes National Park. Small operations in Jasper and Kootenay Parks were systematically obliterated in the post-war years. When the Monarch mine in Yoho National Park was abandoned in 1954, the company salvaged the milling equipment and razed the structures. Even the tailings were removed by the Parks Service in an effort to return the area to a more natural state. Since that time, the industrial heritage of the area has been re-evaluated and gained a greater significance in the planning process. This presents an interesting problem in resource identification: areas that were once subjected to systematic efforts to erase them are now potential interpretation sites.

During June 1988, a field survey of the Monarch and closely associated Kicking Horse mines located near Field, British Columbia, was conducted on behalf of the Historic Resource Conservation Branch of the Western Regional Office of the Canadian Parks Service, Calgary, Alberta. The purpose of the survey was to locate, identify and record any significant artifacts "as found" and place them in historical and spatial contexts. Since many of the surface features were known to have been destroyed, emphasis was placed on an investigation of the mines' underground workings. There was a wealth of rumour about what was in the mines but very little hard evidence.

Prior to the field survey, a detailed chronology of events in and around the mines was prepared to facilitate the location and dating of artifacts. Mining historians and archaeologists in British Columbia have an invaluable source in the Annual Reports of the Minister of Mines for the Province. Detailed reports, often including lists of machinery installed, are available on a yearly basis up until the late 1940s. In the case of the Monarch, this is particularly valuable since few company records have been located. Plans of the underground workings at various points in their development were also obtained. Since a closing plan was also available there was no need to establish a base map of the mine during the survey. Plans of the surface area were prepared during the course of the field work by a draftsman provided by the Calgary office.

The Monarch is one of the oldest lode mining sites in western Canada. Situated high on a near vertical cliff overlooking the Kicking Horse River in the Canadian Rockies, it was first explored as a mineral site during the construction of the Canadian Pacific Railway in 1883. Five years later, the lead ore in the deposit was first extracted commercially. Hand drilling methods were used and the ore was transported across the cliff along a car track blasted into the rock and then lowered to the railway. The mine was operated intermittently over the next 65 years by a succession of mining companies.

Mining and milling practices at the site changed several times over the years. Machine drills replaced hand drilling in 1909, and the first of a series of double reversible aerial tramways was installed in 1911. The following year, a gravity concentrator was erected near the railway. This structure was replaced with a flotation mill in 1929 and both lead and zinc ores were processed. Change was not so dramatic in the underground operations. The replacement ore bodies occurred as irregularly located lenses which precluded large-scale development and highly mechanized haulage. Instead, ore cars were hand-trammed from the stopes to a central incline where a reversible inclined plane fed the ore to an aerial tramway. It was not until 1950--two years before the mines closed--that compressed air and diesel locomotives were introduced for mainline haulage. In the production stopes, ore was moved by hand until scrapers were introduced in the late 1920s.

The surface areas associated with the mine were surveyed first, and a surprising number of artifacts were located considering the effort expended to obliterate all evidence of mining during the 1960s and early

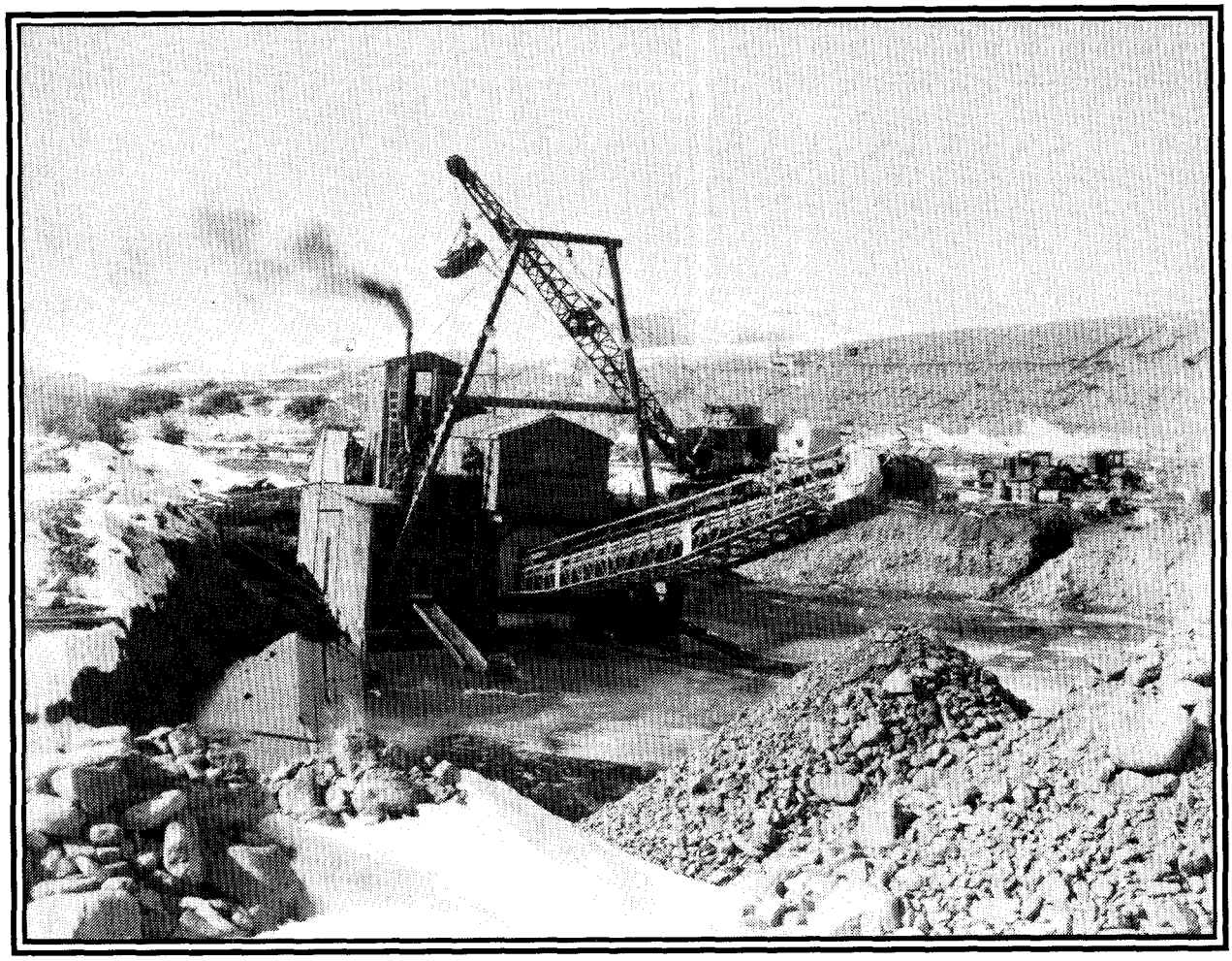
1970s. One bucket from the aerial tramway was found near the millsite, as was a major casting from a Huntington mill installed in the initial gravity concentrator. On the hillside below the cliffs, a collapsed but otherwise undisturbed development camp--complete with blacksmith's tools--was found in dense forest as suggested by the Annual Reports.

The major concentrations of artifacts were located underground. These included three intact aerial tramway terminals hidden in portals blasted into the cliffs and the complete controlling mechanism and two gable-bottomed ore cars associated with the inclined plane that fed ore to the Monarch tramway. Four machine drills--two drifters dating from the late 1920s, one from the early 1940s, and a jackhammer--were found along with over thirty mine cars of varying age and design. The oldest scoop-end cars date from at least the early 1920s. The remains of a second inclined plane using side-dump cars was also located. Approximately one dozen small air hoists--both single and double drum--and the associated scraper blades used to move ore to draw points in the stopes were identified. All but one of the tuggers utilized turbine type air motors. The exception was a piston type in common use shortly after 1900 which had probably been used in another mine prior to being installed in the Monarch.

All told, over ninety major pieces were identified and recorded. In addition, there were literally hundreds of small tools and pieces of scrap metal in the underground shop areas as well as miles of water and compressed air line and galvanized ventilation tubing. While nothing was in perfect condition, the unusually cold air of the mine had slowed deterioration and most of the major pieces could be restored. The end result of the underground survey was a rich store of artifacts available for interpretive and display purposes that would not have been available if the survey had been restricted to the more readily accessible surface areas.

N.B.: While the Monarch and other underground surveys have been rewarding, anyone considering such an undertaking should pay particular attention to safety. To state the obvious: old mines are dangerous. Rock can fall without apparent warning and wooden ladders are often deceptively weak. Old, unstable explosives are usually scattered about. In addition, unguarded openings in tunnel and stope floors are the rule, not the exception. Good and assured lighting is essential. If at all possible, closing plans of the workings should be obtained prior to entering the mine since it is easy to become disoriented and lost in all but the simplest mine layouts. The survey party should be led by someone with practical mining experience and preferably mine rescue training. Caving experience would also be acceptable although the ground conditions and hazards in a natural cave differ considerably from those encountered in a mine.

Compliance Issues & Abandoned Mine Reclamation



Gold dredge, Lynx Creek, Arizona (1930s). Photo courtesy of Arizona Historical Foundation, Spude Collection, Tempe.

MINING PAST AND PRESENT ON BUREAU OF LAND MANAGEMENT LANDS IN CALIFORNIA

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The California Bureau of Land Management (BLM) manages a large portion of California--some 17 million acres--with 12-1/2 million in the Southern California desert. We also manage some 1-1/2 million acres in northwest Nevada. Administratively, we have four District Offices and sixteen Area Offices statewide. The Bureau currently funds 20 cultural resource staff positions in California, all but one with a prehistoric archeological background. We utilize the contract community through our cultural use permit system. Increasingly the need for historic expertise is required, though proportionally our workload is dominated (over 90 percent) by prehistoric/ethnohistoric workload and concerns.

MINING RESOURCES ON BLM LANDS

Major mining areas on BLM lands include Northwest Nevada/Northeast California, Sierra Nevada (Motherlode), Trinity area, Eastern Sierra Nevada and the southern desert portion of California.

Historic mining remains include evidence of all forms of mining technology. Commonly encountered are remains of hand mining, hydraulic mining, hardrock mining, as well as exploratory work leading to various types of mining. Types of resources commonly encountered include water diversion, reservoir and canal systems, roads and trails. Structural remains represent a variety of purposes, some directly related to mining operations or from community based support services, such as hotels, bunkhouses and transportation systems. Those remains directly related to mining include mines and support structures, smelting facilities, etc. Some of the more permanent mining developments included schools, churches, cemeteries and other aspects of socio/economic behavior.

One major effect of Federal mineral policy is that many historic resources are inextricably linked with mining development, dating from the 1850s to the current period. On BLM lands, mining has never ceased and has, along with deterioration, led to major problems--not in identifying areas where mining took place, many of which are documented in Bureau cultural resource overviews, but in documenting/evaluating on-the-ground resources.

LEGAL CONSIDERATIONS

Let's take a brief look at the legal basis for mining on Bureau lands in the West. A recent publication on the Bureau of Land Management (*Opportunity and Challenge, The Story of BLM*, USDI, BLM, 1988) discusses the history of modern mining law. The genesis of current Federal policy is the 1872 mining law, which is summarized as follows:

> Congress restated its mining policy in 1872 with the passage of the General Mining Law. This law declared that "valuable" mineral deposits rather than simply "mineral deposits" as stated in the Lode Mining Law of 1866, were to be "free and open to exploration and purchase." Local mining customs were still recognized. Lode locations, however, could be no more than 1,500 feet long and 600 feet wide. Furthermore, individual claimants were limited to 20 acres, while associations or groups could still have 160 acre claims. To protect their claims from others, claimants had to perform $100 of assessment work yearly and show at least $500 worth of improvements before the claims could be

patented. Milling or processing sites could be entered on non-mineral lands but could not exceed 5 acres. Survey requirements and the per-acre cost of patenting a claim remained the same as before."

The enactment of the mining laws transformed miners from trespassers into legitimate occupants of the public lands. Valid claims were given a status akin to private property. More important, the development of minerals on the public lands was given priority over other possible land uses.

Modern mining on Bureau lands runs the gamut from what is termed recreational mining (panning small suction dredges, etc.) to major open pit mines, utilizing state-of-the-art technology.

It is axiomatic that mining tends to occur where mineralization occurs, though historically we know of cases where the opposite proved to be the case. From the perspective of a Bureau cultural employee, it is clear that modern mining will take place in areas of previous exploration and development as long as the excavation costs and the price of gold remain stable in the marketplace.

Recently-promulgated regulations to manage mining include 43 CFR 3802 and 3809. These surface management regulations address issues such as site reclamation, plans of operation, prevention of unnecessary or undue degradation, environmental protection, relationship to state law and other areas of concern. Of direct concern, these include provisions for protection (read "consideration") of cultural resources, and the specific requirement that the mining plan cannot be approved until BLM has complied with Section 106 of the National Historic Preservation Act.

Consistent with the 1872 mining law, the objective of the 3809 regulation is to "provide for access, entry, exploration, location, development, and purchase of the Federal lands under the mining laws in a manner that will not unduly hinder such activities but will assure that they are conducted so as not to cause unnecessary or undue degradation of Federal lands" (BLM Surface Management Manual 3809.02).

The position of mining with respect to Federal land management is even reflected in PL 96-95 (Archological Resource Protection Act). Section 12(a) of the Act specifically includes a provision which notes that the Act will not impose additional restrictions on mining or mineral leasing.

SECTION 106 ISSUES

Given the Bureau mining mandate, what are some of problems we commonly encounter in the processing of mining plans on Bureau lands? One of the troublesome issues for the Bureau is the nature of land ownership patterns in many of the historic mining areas in California. Because many historic mining ventures have been patented, leading to fragmented land ownership patterns in many mining districts, conflicts result, inasmuch as the Section 106 process requires evaluation of properties in a contextual framework, rather than on an administrative/land ownership basis. Conflicts with multiple ownership can result also when different management mandates occur, due to split ownership patterns, or where requirements of state law (where historic cemeteries occur, for example) must be taken into account.

Another problem that can occur is with private ownership of historic mining structures on Federal lands. While it many seem reasonable to assume that "historic" properties after a period of time may be considered abandoned and therefore Federal property, we have had several situations where current mining claimants expressed concern about the removal of historic mining developments. Removal, for example, of a small stamp mill for relocation to a museum prompted a protest by a modern mining claimant. Assumption of ownership of historic mining developments on the part of the Bureau becomes a formal process and not a simple assertion that ownership somehow reverts to the Federal agency upon presumed disuse or neglect.

Evaluation of historic mining resources, or other historic resources for that matter, has been difficult for California Bureau staff in that we have limited expertise in historic archeology or related disciplines. We are looking more and more at acquiring the requisite expertise through the contract/permitting process to solve this dilemma. The use of consultants has worked well for us, and demonstrates to a considerable extent the willingness of industry to cooperate with the Bureau in meeting our Section 106 obligations. The nature of most mining-related sites on Bureau lands precludes intensive analysis, limits evaluation techniques and ultimately, conditions our Section 106 compliance approach to many situations involving

historic resources. For some resources, problems exist in that the nature of the remains precludes on-site evaluation other than simple recording.

Few standing structures are extant on Bureau lands, and some of those which survive possess questionable integrity from a National Register viewpoint. Clearly, we need solid contextual studies as a background for individual site evaluation. Work performed as part of the California Desert Plan includes considerable data, but much remains to be done. Initial identification of major mining areas or other economically related developments is included in many of the Bureau Class I overviews not only for the desert but on a statewide basis.

The Bureau has also designated some historic sites as cultural Areas of Critical Environmental Concern, a status which affords special consideration of the extant historic values. We should touch, albeit briefly, on the effects of modern mining on consideration of in-situ preservation. Modern open pit mining and heap leach processing methods preclude, to a large extent, consideration of in-place preservation of historic values. For the most part, this situation has led the Bureau to emphasize recording and whatever investigative alternatives we may be in a position to consider. As noted previously, the nature of the resources on our lands strongly supports decisions based on this premise.

To give you some idea as to our workload, we are including data from our California Desert District (CDD) related to gold mining. The CDD processes an average of 160 mining plans of operation per year, and another 150-175 Notices of Intent. Environmental and cultural clearances (at some level) are performed for all mining plans. Fewer than a dozen plans each year have cultural resources that require consultation under Section 106. Most sites located to date have been prehistoric in nature. However, with the increase of gold processing, we are encountering more historic resources and we expect that ratio to increase.

On an annual basis, we submit an average of seven projects to the State Historic Preservation Office/Advisory Council recommending actual mitigation. Many, but not all, are mining related. Keep in mind that most affected areas are small, and that avoidance is our first option.

MINING PROJECTS ON BLM LANDS IN CALIFORNIA

Following is a brief summary of projects of larger areal extent where impacts to sites have been inevitable. These few projects account for the bulk of the affected historic and prehistoric properties in the past few years. Some are large and have resulted in multiple submissions.

1. New Collosseum Mine (was Amselco). Area of Effect: about two square miles.

   Fourteen sites located. Nine historic sites recorded, tin cans, etc., picked up prior to destruction. The eligibility issue was unclear, but correspondence indicated that we felt the sites were eligible. Of the five prehistoric sites, four were eligible and mitigated through data recovery. Mitigation on the historic sites conforms to mid-level recording, i.e., more than a site record but not to HABS-HAER standards. Sites included mill foundations, powder bunker, loose rock foundations, dugouts and associated debris.

2. Castle Mountain Venture (in progress). Area of Effect: about two square miles.

   Although dozens of sites were recorded in the project vicinity, the actual area of effect will result in impacts to only four sites, all prehistoric. A small cemetery plot and associated mining community (remnants thereof) is being avoided.

3. Mesquite Gold Fields Mine. Area of Effect: now about 12 square miles.

   To date, it looks like more than 150 sites have been involved (another 40 have been recorded, but eligibility status not resolved). One hundred thirty-six sites were not eligible and subject to destruction, including seven historic sites. These seven sites were primarily WWII or later military encampments, with one possible 1890s-era road way-station. Sixteen sites were found eligible and all were destroyed after mitigation except the one historic site. The 1890s-era wagon road was preserved in situ, and is now protected through a covenant on the deed

transfer to the mining company.

4. American Girl Mine. Area of Effect: about three square miles.

Five ineligible historic sites. One eligible district comprising three discrete but related sites. Sites included six standing structures and associated collapsed structures, foundations and debris. The district was eligible under Criteria A and D. Data recovery is in progress for those aspects of the property eligible under Criterion D. Although mid-level recording and photo documentation, as well as a narrative history are being prepared, it was determined that recording/data recovery could not completely mitigate the adverse effects of destruction. Avoidance was not possible, and the structures could not be moved. A Determination of Adverse Effect was reached, in accordance with the provisions of our PMOA. Structures were of vernacular design and architecture of the period--adobe walls and corrugated sheetmetal roofs, and/or woodframe with sheetmetal covering.

As a last note on this project, there is a small cemetery on the premises. State law was considered to have primacy due to the relatively recent dates of the known interments. Under state law, the remains are not archaeological and not historic. We plan removal under appropriate court order, exhumation with dignity, and re-interment in a bona fide cemetery.

In summary, the Bureau is deeply involved in current mining efforts on a statewide basis. The stresses and strains are many but, hopefully, we can meet our historic preservation commitments while allowing the reasoned use of cultural resources on Bureau lands.

THE STATE OF HISTORIC MINING SITES PRESERVATION IN MONTANA: SECTION 106 AND PRESERVATION PLANNING

Kathy Huppe
Montana State Historic Preservation Office
Helena, Montana

I plan to discuss Section 106 compliance as we have experienced it in Montana relative to mining-related cultural resources. Before I do, however, I'd like to spend a few minutes on the sorts of problems and paradoxes we've heard so much about already this week.

In Montana, we are celebrating our Centennial as a state in 1989, which makes a consideration of our origins most appropriate. Those of you from other states have doubtlessly heard Montana called the "Big Sky Country," in recognition of our vast landscapes and few people. We are also known as the "Land of Shining Mountains" and, in more recent travel promotions, as "Naturally Inviting." But before we were anything else, Montana was the "Treasure State," a nickname which recognizes that mining was seminal to our development. Our state motto is "Oro-Y-Plata"--gold and silver, and our state seal shows a crossed pick and shovel over a plow. The Montana Bureau of Mines estimates that $35 million worth of mostly free placer gold was mined in Montana between 1863 and 1865. From 1865 to 1868, an additional estimated $45 million worth of precious metals were produced. Growth in our mining industry was directly responsible for creation of the territory of Montana in May 1864, and our governmental and social structure as well as our economic stability continued to be closely related to mineral production for the next century. After a short lull, mining is once again gaining importance in the Treasure State as we enter our second century of statehood.

It seems a paradox of sorts, then, that mining sites in Montana have received little preservation attention, and that public support for studies of the role of mining in our development is just beginning. As long ago as 1966, preservationists in Montana recognized the importance of mining by supporting several mining areas as National Historic Landmark Districts. These efforts were focused on the large, unquestionably historic places--the Bannacks and the Virginia Cities--and occurred during a time in our history when renewed mining was not anticipated. Key resources in these Districts were, and remain, the townsites, however, even at Virginia City where the District contains almost 20,000 acres. Today's visitors to Bannack, now a state Park, or to the Virginia City National Historic Landmark District only see the remains of actual mines on their own initiative. There are no interpretive tours of the mines, nor are most of them even inventoried. And these are the impressive, easily understood mining districts. Literally hundreds of smaller mining sites and districts remain to be dealt with in Montana. The question is how?

In a state where mining has been ubiquitous, we obviously encounter such resources on a regular basis and in a wide variety of compliance situations. As a rule of thumb, we rarely know as much as we should in order to make informed choices and recommendations, and we are almost never in a position to ask for more. The reasons for this are many and varied, and we have discussed most of them at length already. The nature of mining and its legal development as an industry have created unique laws tailored to facilitating mineral exploration and extraction. Then, too, nearly every Section 106 mining-related project we see involves a minor amount of Federal surface and a whole lot of patented or other private land. Thus, the amount of oversight Federal agencies are willing to exercise is often quite limited. Mining on private lands in Montana is controlled by our Department of State Lands, which has 25 days to review a request for an operating permit. Our comments, although regularly solicited, must also be made within that time frame and under the auspices of the Montana Antiquities Act rather than 36 CFR 800. Finally, many undertakings are not extensive enough to support the sort of carefully developed, interdisciplinary evaluations we would all agree should be done.

We have the best luck in these situations when a significant percentage of Federal surface is involved, or with large, quite public mining companies careful of their image. We have much less success with the bulk of miners, who are small-time operators with neither capital nor concerns about public visibility.

ABANDONED MINE RECLAMATION PROJECTS

The projects or series of projects subject to 36 CFR 800 which have consumed the majority of our time and raised the thorniest compliance issues for us during the past two years have been associated with the Office of Surface Mining's Abandoned Mine Reclamation Programs in Montana. Administered by our Department of State Lands, these programs have often been massive in scale or otherwise difficult to deal with in a traditional Section 106 format. On the other hand, they have served to raise important issues and forced us to begin to seek new ways of thinking about mining and historic preservation. I will focus on two quite different Abandoned Mine Reclamation (AMR) projects here, and discuss how we have approached compliance in each situation.

The first began two years ago when the Department of State Lands presented us with an AMR proposal to remove tailings associated with four historic mining sites near the little town of Rimini in Lewis and Clark County. These tailings were located in Ten Mile Creek, or were within drainage channels feeding the creek, which is the city of Helena's primary source of drinking water.

We began compliance for the Rimini project by recommending inventory and evaluation of the four mines scheduled for reclamation. Background research and limited field checking, however, quickly showed that to properly consider cultural resources at Rimini our scope would have to be broadened considerably. Using that research, let me digress for a moment and provide you with a little background.

Located just 12 miles west of Helena, the four mines in question were only part of a much larger mining district organized when an extension of exploration stimulated by the rich placer strikes at Last Chance Gulch discovered gold in the Ten Mile Creek drainage in 1864. Lode claims staked at Rimini that year were some of the earliest claims of that type in the state, as miners in other camps along the Rocky Mountain Front concentrated on collecting free placer gold. Rimini's refractory ores slowed development of the District until advances in transportation and the availability of smelting facilities allowed their exploitation. The District's period of greatest activity was from 1885-1890, when an estimated seven million dollars worth of precious metals were produced. While most early production was in gold, silver was increasingly important as sporadic mining continued, and lead was the District's dominant product from 1920 until the 1950s. The town of Rimini lent its name to the District, and initially functioned as a supply depot and residential community for the mines. Today, the townsite consists of one street of false-fronted buildings, and a second of houses and cabins framed in a flat spot along wooded Ten Mile Creek by impressive collections of mine tailings. Dumps and tailings line the drainage for miles, and the surrounding hills are littered with prospect pits, adits and associated tailings piles, cabins, ore bins, access roads and railroad grades from the more than seventy mines which followed the Rimini ore body. Crowning the landscape is the dramatic rise of Red Mountain at the head of the gulch, which soars to an elevation of over 8,800′ and was the location of James J. Hill's failed Red Mountain Consolidated Mine. While never supporting mining on the scale of places like Butte, Rimini is typical of the small, often isolated mountain mining districts of western Montana where individuals, partners and small corporations conducted sporadic mining operations for a summer or a series of summers. Very few of the hundreds of claims filed in the Rimini District were developed into consistently producing mines, but some production continued into the 1950s there, both also patterns characteristic of Montana's hardrock mines. Research demonstrated that an effective interrelationship of urban and rural mining components was present within the Rimini District, with the townsite itself exhibiting identifiable business and residential structures.

With the background research in hand, we found ourselves on the horns of a dilemma. Although it appeared that a very good case could be made for eligibility of the whole Rimini Mining District, the AMR program would result in inventorying only four of the 70-plus mines once operating in the District. Reclamation proposals involved complete removal of the tailings from two of the affected mines, and--given the pollution problems--we were unsuccessful in eliciting either alternatives or compromise. To compound the problem, consultation established that just two of the mines could be considered individually eligible for Register listing. Even for the mines which could not qualify individually, however, it seemed clear that removal of their striking tailings would have an effect on the historic district we all felt was present.

Our solution to this problem was to sort of expand the traditional Section 106 process, using the consensus determination of eligibility as a way to recognize the importance of the Rimini developments

without completely identifying properties that might contribute to the historic district. We have come to call such entities minimally defined districts. Critical to their definition is the ability to draw defensible boundaries using geological and geographical information modified and confirmed by field checking. Also critical is the ability to develop contexts, periods of significance and a preliminary or developmental framework of research questions to guide future work in the district. As projects are done and data accumulates, the eligible historic district takes shape.

These goals were accomplished in short order at Rimini. The next question was obviously one of appropriate mitigation. It was at this stage of the process that DSL informed us an additional seven mines had been added to the project, along with a second phase which would involve excavation within the Rimini townsite for replacement of water lines. Since neither the additional mines nor the townsite had received much attention during inventory and evaluation, our minimally defined district concept was put to the test early on. The format allowed us to assume, with a minimum of additional documentation, that each mine and a vast majority of the townsite would contribute to the District, and that the project as a whole would adversely affect its eligible qualities. Inventory and evaluation of the additional mines was agreed to as a stipulation in the Memorandum of Agreement (MOA) being developed, as was the drafting, approval and implementation of a testing plan to identify subsurface cultural deposits which might be affected by water line excavation in the townsite. The question of how to mitigate the loss of massive tailings piles remained, as did determining a process whereby all threatened elements in the historic district could be recorded relative to one another and to the historic mining landscape.

MITIGATION AND DOCUMENTATION

For this type of project, we concluded that traditional 4" x 5" HABS/HAER photographic documentation might not prove very useful as a research tool. In our experience, 4" x 5" photography doesn't record setting or landscapes with buildings in them very well. We presented a couple of recording alternatives which we felt might do a better job. One was stimulated by a previous discussion with DSL's project manager, who had mentioned the possibility of cooperating with the film and video department at Montana State University to produce a documentary film on hardrock mining in Montana. We suggested footage from Rimini could be shot now, although we recognized the actual film was still in the very preliminary planning stages. We also suggested that filming could become an ongoing mitigative process that could be built into other AMR projects.

A second option we felt might be appropriate would be to develop and present a Helena/Rimini area program on Rimini history which could then be made available to the interested public through one of our research institutions.

DSL's project people liked the film idea, and have both equipment and in-house operational expertise available. At the time, in fact, we were consulting with DSL concerning production of a similar film to document the history of coal mining in our state. Although the coal mining film was not geared specifically to compliance, we believe documentary films hold great potential for mitigation. They often reach a public which has never thought about the historical significance of mining, unlike more traditional, archivally-oriented methods. In addition, they can serve to cogently package technical, landscape and oral historical documentation. The film is called "Against The Darkness." It cost about $100,000 to produce, and video copies will be available from DSL after March 1, 1989 at about $25.00 apiece.

That bit of advertising shamelessly done, let me hasten to add that our filming proposal proved untimely at Rimini, where the potential significance of mine tailings had already been the subject of months of discussion. The MOA we did put together included, besides the stipulations noted above, a commitment from DSL/OSM to provide a photographic record of the present state of the Rimini Historic District using video filming from both the ground and air. This documentation will be designed in consultation with our office to illustrate the interrelationships among mine, townsite and landscape features within the district. Final copies will be available for use at the Montana Historical Society in Helena.

As with much of our AMR compliance, this is a work in progress. We have little sense of how effective and useful the products of this MOA will be, but remain hopeful that at least the video option will prove to be an appropriate mitigation for the loss of historic landscapes. We also hope its readily available format will encourage the sort of public use and education we believe is vital to preservation efforts of all sorts in Montana.

AMR HAZARDOUS MINE OPENING PROGRAM

The other project I would like to more briefly discuss here is an AMR Hazardous Mine Opening Program. Also administered by DSL under the auspices of OSM, this program differs from the reclamation effort in both scope and scale. As its title implies, the program largely involves the closure of adits and shafts rather than the large-scale removal of waste piles, buildings and the like common to single mine site reclamation projects like Rimini. Frankly, we had few concerns with the program prior to 1988. It was quite limited in terms of numbers of closures, and closure techniques were generally nonpermanent, often amounting only to fencing hazardous openings. The program was not spatially concentrated in recognized mining areas, and involved little Federal surface.

All that changed in 1988, when DSL provided us with a list of some 200 mine openings scheduled for treatment. After a detailed review of planned closures using file search information, slides, topographic engineering drawings which specified proposed work, and other information available from DSL and their engineering consultant, several things became clear. A few of the mines involved had already been determined eligible for Register listing, and several closures were planned within the boundaries of Bannack State Park. Other closure work was concentrated in recognized mining districts, several of which we had targeted as possibly eligible. A substantial amount of the work was permanent in nature, often using waste rock or tailings to backfill adit and shaft openings. Above all, it was abundantly clear that trying to deal with the masses of planned closures on an adit-by-adit basis was out of the question. Discussions with DSL confirmed our suspicion that the adit closure program was just gearing up, and that ensuing phases would be just as intensive, if not more so.

A programmatic approach seemed to be the best way to both accomplish inventory and assess the newly-intensive program's impact for future years. With closures scheduled to begin in less than three months, however, and given the Advisory Council's time requirements for review of Programmatic Agreements, it seemed unlikely that a formal Programmatic could be concluded in a timely manner.

Although we were and are committed to continuing development of a more comprehensive agreement that will legally address altered compliance procedures for hazardous mine openings and some other types of AMR projects, what we did last year was write an agreement specific to the 1988 closure program. Our goal was to assess some of the compliance concepts we'd been working through, although not with any explicit intention of duplicating them in the larger agreement. In the resultant MOA we asked first that normal Section 106 procedures be applied to sites already formally determined Register-eligible. Second, and based on the premise that the greatest impact to potentially eligible sites would likely be cumulative under this program, we recommended regular inventory for all proposed work in three recognized mining districts where roughly 35 percent of the closures were planned. Except for monitors, who were geologists from the engineering firm and for whom we provided training in prehistoric site identification, we did not then recommend any form of inventory for other planned closures. The mining districts we focused on were ones on our potentially eligible list, and inventory work was designed using the same precepts that had guided the definition of the Rimini Historic District. Our thinking was that inventory in a few concentrated areas would better serve to record the range and intensity of mining methods and features than would inventory of some closures throughout all the proposed project locations. Historical context sufficient to evaluate the existence of a National Register eligible mining district was to be developed as part of the inventory process in the selected areas.

For the Bannack District, we agreed that maps and video recording of the affected sites would be completed prior to any closure work. Following closure, the same sites would be taped again, providing a "before" and "after" record which would help us evaluate the extent of impact resulting from closure work.

A stipulation for avoidance of all structural remains at project sites was included, the only exceptions being two headframes already determined not eligible. Where shafts with standing headframes had to be closed, provision was made for installation of modular grates which could be fit around the structures.

Some of the products of this MOA have been completed and reviewed, and our agreement has met with varying degrees of success. The Bannack video documentation prior to closure probably accomplished no more in that district than well-selected vantage points for traditional 4" x 5" photography would have. We have yet to receive or evaluate the post-closure filming. We neglected to mention fieldwork for

inventory of affected mines in the MOA, and consequently received inventory and evaluation based on available documentation without field checking. We did all agree that one of the three districts involved in the 1988 program is eligible for listing, which at least gives us a clear management framework for additional work there. In retrospect, and in keeping with our growing belief that dissemination of information gained from these and similar bodies of work is vital to the health of preservation efforts in Montana, our biggest regret is that we did not ask for the generation of some sort of cultural resources technical bulletin as part of the MOA. What we have in mind, and will try to pursue this season, is a short publication providing a summary of the contextual information collected for each district along with bibliographic sources for the use of both researchers and the general public.

WORKS IN PROGRESS

Here are just a few quick notes, if I may, on some of our works in progress:

1) We are currently working on a Programmatic Agreement with the Deerlodge National Forest which would kick in at the exploration level and be district-specific. Our aim with this type of agreement is to ensure that research is cumulative. The Forest archaeologist will organize and manage the program and, in consultation with us, will build a data base by requiring that minor projects contribute some effort to the overall goal of defining and inventorying districts on Forest lands. We see agreements like this as the next step along the road in our minimally-defined districts.

2) In districts like the Butte National Historic Landmark District, where we already have mounds of data, we are increasingly trying to use interpretation as a mitigative measure, and are working closely with local historic preservation and community development groups. Part of this process, we hope, will be to develop a major research design into which all of the projects currently proposed and anticipated in Butte will feed information. We also hope the Butte Historic Preservation Office will undertake coordination and oversight of the process.

3) For the first time this year, we are using a portion of our Survey and Planning grant monies to fund a major effort in the Virginia City National Historic Landmark District. Some of those funds will be devoted to inventorying mines within the district and in an adjacent 6,000 acres of Alder Gulch. Our hope is that with this project we can begin trying to correct the bias against actual mining sites to which we have unwittingly contributed in the past.

THE NPS ABANDONED MINERAL LANDS PROGRAM AND THE ROLE OF THE MINING AND MINERALS BRANCH

David Sharrow, Environmental Protection Specialist
Mining and Minerals Branch, Land Resources Division
National Park Service
Denver, Colorado

The National Park Service has an active Abandoned Mineral Lands (AML) Program that is administered through the Mining and Minerals Branch of the Land Resources Division. The objectives of this program are to eliminate or mitigate safety hazards and resource impacts associated with abandoned mines and to preserve significant natural and cultural resource values associated with these mines. By their very nature, these objectives can result in very different approaches to eliminating the problems presented by abandoned mines while retaining their historic values.

MINING AND MINERALS BRANCH

The Mining and Minerals Branch (MMB) of the National Park Service was created in 1983 to provide direction and oversight for parks in the administration of active and proposed mineral operations. A staff that includes Geologists, Mining Engineers, Petroleum Engineers, Environmental Protection Specialists and Policy and Regulation Specialists is available to provide technical assistance. At this time MMB has no historian or cultural resource specialist on staff. We must rely on the parks, regional offices and Denver Service Center for historical expertise.

Phil Cloues and I are responsible for the Abandoned Mineral Lands program. Requests for information or assistance should be directed to us through your NPS regional office or by calling at (303) 969-2090 or FTS 327-2090.

Before elaborating on our AML program, I think it is important to examine the differences between our approach to active and abandoned mining operations. Mining claims and active hardrock mines are regulated under 36 CFR Part 9A, and non-federal oil and gas wells are regulated under Part 9B. Both regulations are written so that they approach a minerals operation with the assumption that the operation is a temporary feature. When mining ceases the site must be reclaimed and hazardous conditions corrected. The regulations require that an operator plan to remove equipment and man-made debris, correct nuisances and damage to federal lands, regrade and revegetate the site, and return the land to its pristine beauty. In practice, we often achieve something less, but the intent is to eliminate the impacts and evidence of mining.

There are mechanisms within our administration of a plan of operations that allow for the consideration of historic resources. Stipulations can be made that require the retention of important historic features when the mine is closed and reclaimed. The point I want to make here is that historic concerns must be considered during the plan of operations review so that significant historic features can be protected during mine operations and reclamation. It is also worth noting that many, if not a majority, of NPS managers and employees will approach mines and oil and gas wells with an attitude that they are not culturally significant and should be eliminated.

In contrast, we have very different goals for the management of abandoned mine lands. They are to:

* Eliminate or mitigate critical health and safety problems
* Correct or mitigate impacts to natural and cultural resources
* Preserve significant historic resources
* Consider wildlife use of abandoned mines
* Provide opportunities for visitor appreciation of abandoned mines

Even here there is some inherent contradiction, but that is an inevitable and even desirable situation. It means we, as an agency, will have to make a concerted, thorough and cooperative effort to achieve the

best solutions to the problems and opportunities presented by abandoned mines.

HAZARDOUS WASTE

A situation that can drastically affect the management of abandoned mines is the presence of hazardous wastes. Process wastes, mine drainage, mill and smelter tailings, and waste chemical products may all be considered hazardous waste. A considerable amount of management discretion is lost when a site is designated as hazardous under the Comprehensive Environmental Response Liability Act (CERCLA or Superfund Act). Once a site is designated, the Environmental Protection Agency has all of the authority to identify problems and recommend remedial actions. The land manager will have input, but final decisions rest with EPA, even if the land management agency is funding the cleanup. The possible presence of hazardous wastes should be a consideration when acquiring abandoned mines.

ABANDONED MINERAL LANDS IN THE NATIONAL PARK SYSTEM

Why are we so interested in abandoned mines in the National Park Service? We have over 2,400 AML sites that probably include over 10,000 openings. These numbers are estimates made from a fairly limited inventory. A variety of problems exist as a result of abandoned mines including soil erosion, acid mine drainage, salt contamination from oil wells, hazardous wastes, abandoned explosives, and other obvious hazards to personal safety. At least two fatalities have occurred in the past decade from falls into abandoned mine shafts in NPS units.

There are at least 106 NPS units that contain AML sites. (With the acronym AML we refer to abandoned mineral lands which include abandoned oil and gas wells, as well as abandoned mines). Abandoned hardrock mines are found in 61 NPS units. Abandoned sand and gravel operations are known to exist in 41 NPS units, though these sites are often overlooked in park inventories. Abandoned oil and gas wells exist in at least 20 units. The importance of these wells to our AML program goes beyond their limited occurrence and number because the cost of plugging a well averages about $15,000. In contrast, mine openings cost $500 to $5,000 each to close, not including reclamation of disturbed lands or stabilization of historic structures. We know of over 200 wells on NPS lands that need to be plugged to prevent degradation of natural resources. Abandoned coal mines are found in 12 NPS units.

AML PROGRAM UPDATE

The Mining and Minerals Branch became active in the management of abandoned mines when we recognized the need for consistent servicewide AML management and additional funding. Prior to MMB involvement each park was responsible for recognizing the existence of AML sites and taking appropriate actions. Some parks have developed outstanding programs, Death Valley N.M., Organ Pipe Cactus N.M. and New River Gorge N.R. being examples. A few other parks have had active AML programs in the past but with changing management priorities have allowed mine closures to fall into a state of disrepair. Many, in fact most, NPS units with abandoned mineral lands have yet to recognize their significance or take adequate action to correct problems or preserve valuable features.

In an effort to gather some general data on the extent of the AML problem, the MMB initiated a servicewide inventory of the number and type of AML sites in 1985. The inventory was updated in 1987 and we are currently working to improve the information from parks which have a past history of mining but have reported few AML sites. This inventory is a general park-by-park inventory rather than a specific site inventory.

In 1986 the National Park Service established a cooperative agreement with the Office of Surface Mining Reclamation and Enforcement for the treatment of AML sites in four NPS units. Work under this agreement has been very beneficial, allowing the NPS to spend up to $1,000,000 for the inventory, reclamation and treatment of abandoned coal mines. Several very hazardous coal mines have been backfilled or closed with steel grates in four eastern parks. Several hundred openings remain to be treated.

In September of 1988, MMB presented an AML workshop that focused on raising the awareness of AML issues among park managers and staff and sharing information on solutions to AML problems. MMB is currently developing a handbook for AML management that will provide a step-by-step guide for park

staff. We are also developing an Issue Paper to raise the level of awareness of AML issues among the NPS directorate. As part of this effort, we are drafting an NPS policy for the management of abandoned mineral lands.

RECOMMENDED AML PROGRAM

In order to be effective and achieve the park's management goals, an AML program must be complete. A partial program will often result in wasted effort and funds, the unnecessary loss of historic resources, and the continued deterioration of natural resources. A program focused solely on reducing safety hazards and government liability may not be effective because the decision-making process is poorly documented and valuable historic resources or wildlife habitat may be lost. In the long run, a complete AML program should be much more cost effective than a marginal program or no AML program at all.

An inventory is a key element in any AML program. All subsequent decisions and actions are based on the information gathered during the inventory. A good inventory not only identifies the location of AML sites, but gathers information about the characteristics of each site that will guide decision making.

AML sites can be located using USGS topographic maps, aerial photographs, claim and deed records, historic records and maps, historic resource inventories, geologic maps, and personal knowledge of the park staff. It is important that during the inventory, each mine and opening be recorded in a system that insures that each opening can be positively identified and relocated at any time. The site record should make use of maps, photographs, site drawings, written descriptions and permanent site markings such as aluminum tags. An example of excellent site location information is included in Figure 1, an excerpt from the abandoned mines inventory for Organ Pipe Cactus N.M.

An inventory should also address safety hazards, impacts to natural and cultural resources, the significance of historic resources, use of mine openings by wildlife, the presence of sensitive, threatened or endangered species in the area, and visitor use characteristics. It is not likely that a single individual will be able to adequately address all of these concerns. In an ideal situation, particularly where access is difficult, the inventory will be conducted by a multi-disciplinary team that could address all concerns. As a next best alternative we recommend that the initial inventory identify major features and concerns and evaluate safety hazards. More specialized inventories can follow as needed.

In making decisions with regard to abandoned mines, managers must consider all of the available information and treatment options. This, of course, requires a good inventory and may also require consultation with MMB, other parks and agencies, and specialists in the field to identify the best treatment alternatives.

The decision-making process must be well documented. It is perfectly appropriate to spend scarce funds on the highest priority sites, and leave other sites for a later date, if that decision is a rational one and is well documented. Such documentation will be extremely valuable in demonstrating a wise use of management discretion should the government be sued over an injury or death at an AML site.

Part of the decision-making process includes compliance with all of the various laws and mandates governing federal actions. These include NEPA, Section 106 (National Historic Preservation Act), Section 7 (Threatened and Endangered Species), and Executive Orders protecting Floodplains and Wetlands. If a park-wide AML inventory is complete, then compliance can be completed for the park AML program as a whole. The environmental assessment for a park AML program will be a valuable tool for evaluating various treatment alternatives and is the logical place to document decisions. The actions selected should be cost effective and achieve management objectives. Actions that achieve a long-term solution are preferred because they are less likely to deteriorate from lack of regular maintenance and monitoring.

Maintenance and monitoring of mine closures and other abandoned mine features are often the most neglected aspects of AML management. Some mine closures have deteriorated to a condition that is more hazardous than before the mine was closed. Safety is implied by the closure, but not actually provided.

Deterioration is commonly the result of natural weathering and vandalism. All abandoned mines that

have been temporarily closed, and even those left untreated, should be monitored regularly and their condition documented. The monitoring schedule depends on weather conditions, the type of closure and amount of visitation the site receives. Weekly or daily monitoring may be necessary at a heavily visited mine with numerous potential hazards, while a remote shaft that has been backfilled may only need to be monitored once every 3-5 years. Typically, temporary closures such as fencing, signing and cable nets, which receive light visitation, should be monitored at least once a year.

In conclusion, there is a clear need for an active abandoned mineral lands program in the National Park Service. We will be working to bring this about and to insure that each park has the highest quality program. The integration of historic and other cultural resource considerations with safety and resource management concerns is a major challenge. When we accomplish this, we will succeed in protecting the varied resources under our management, while offering the inquisitive visitor and serious historian the continued opportunity to experience and study our historic mines with a reasonable degree of safety.

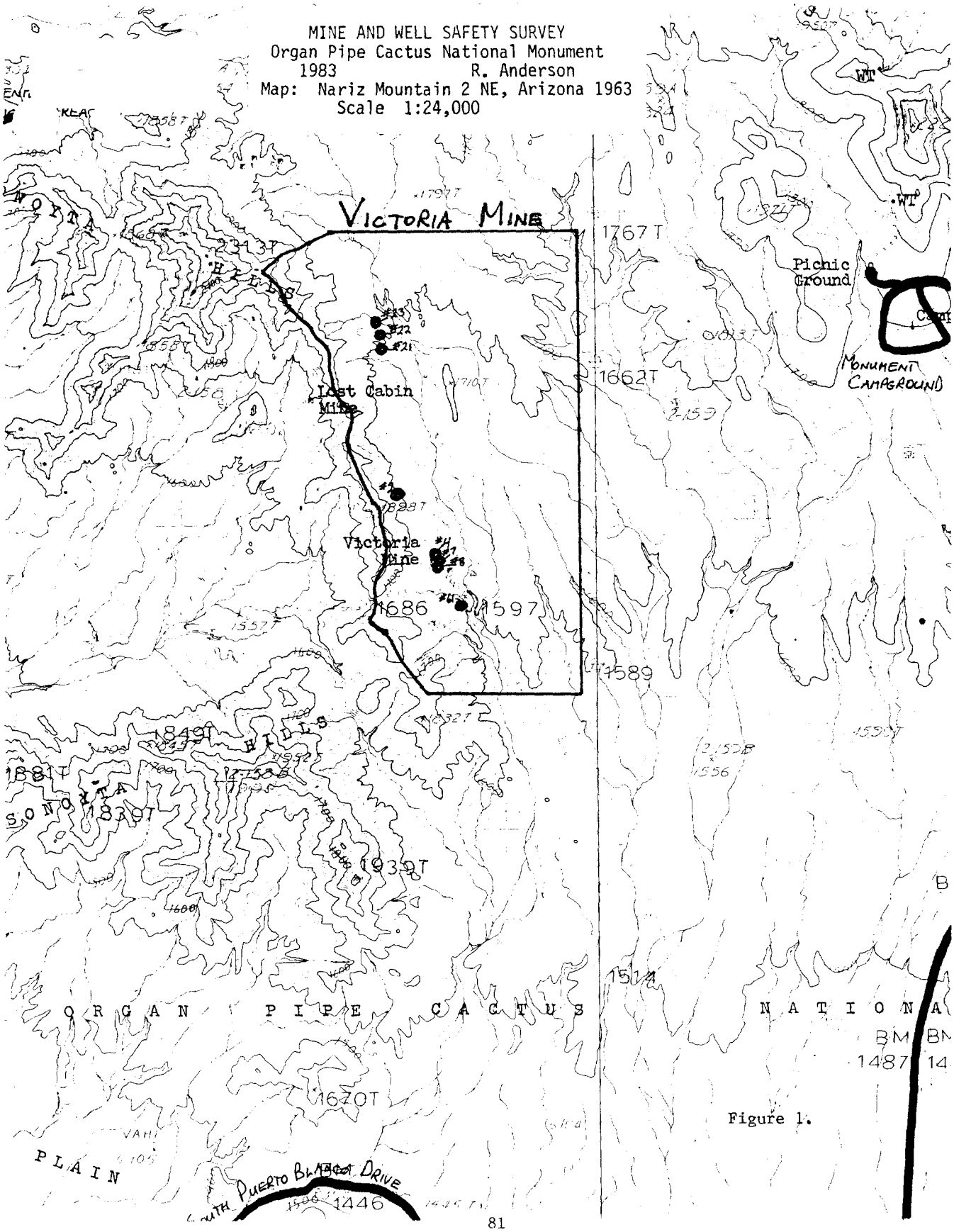

MINE AND WELL SAFETY SURVEY
Organ Pipe Cactus National Monument
1983 R. Anderson
Map: Nariz Mountain 2 NE, Arizona 1963
Scale 1:24,000
VICTORIA MINE
Lost Cabin Mine
Victoria Mine
#13
#12
#21
#3
#4
#1
#6
#5
Picnic Ground
MONUMENT CAMPGROUND
1767T
1662T
1686
1597
1589
1670T
1446
ORGAN PIPE CACTUS
NATIONAL
PLAIN
PUERTO BLANCO DRIVE

Figure 1.

MINE AND WELL SAFETY SURVEY

FIGURE 1. (Continued) Organ Pipe Cactus National Monument

[X] Mine [ ] Well Date of Survey 7/25/83

NAME AND NUMBER: Victoria Mine, Hole #7 HAZARDOUS: [X] Yes [ ] No

LOCATION

USGS Quad, Scale, Date: Nariz Mountain, 2 NE Az. 1:24,000 1963

Longitude and Latitude: W 112° 50', N31° 56'

Access: 30m NW of the stone house; entrance capped by thick concrete slab; at a slightly higher elevation than the stone house.

SITE DESCRIPTION

Terrain: Undulating, gently sloping, heavily worked, between hills & bajada

Elevation: 503m (1,650 ft)

Aspect and Slope: SW, 5°

Soil Mapping Unit Symbol (SCS "Soil Survey Report", 1972): LoE

Dominant Vegetation: LATR (Creosote) CEMI (Paloverde)

Fence: [X] Yes [ ] No Description: erected on 10/6/83, fenced with 4-strand barbed wire

Cover: [X] Yes [ ] No Description: Concrete slab w/ 2 'handles' for placement by crane or helicopter, 2m x 2.5m x 15cm (lid dimensions)

Water Present: [ ] Yes [X] No Depth to water in meters:

SITE USE

Wildlife Use: none observed

Human Use: in the Victoria visitor use area

OTHER

Dimensions (according to D. Acree): 1m x 2m x 100m

Large, dangerous hole open at edge, noticed 10/6/83; had opened between 9/20/83 & 10/6/83

RECOMMENDATION: Cover with a secure, permanent cap

ORPI 49-1 By: R. L. Anderson

MINE AND WELL SAFETY SURVEY
FIGURE 1. (Continued) Organ Pipe Cactus National Monument

[X] Mine [ ] Well Date of Survey 7/25/83

Name and Number: Victoria Mine, Hole #7

Sketch of Mine/Well by: R. L. Anderson

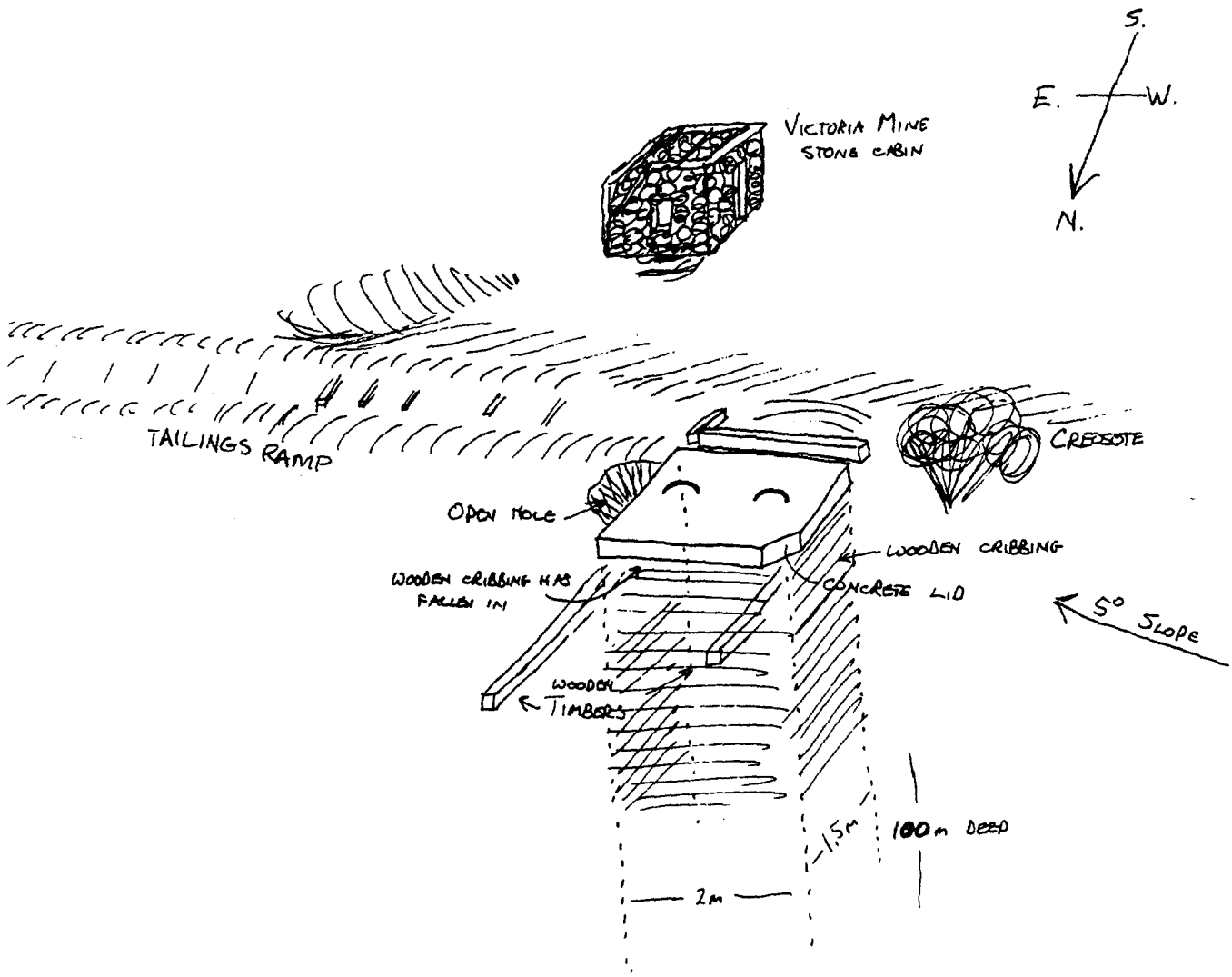


PHOTO DOCUMENTATION AVAILABLE:

Aerial Photos: 3/16/76 FL3-2 1:12,000

Black & White prints: 1/81 (D. Acree) 7/25/83 (R. Anderson)

Color slides: 7/25/83 (R. Anderson)

Color prints: 7/25/83 (R. Anderson)

HAVE NET WILL TRAVEL

Mel Essington, Mining Engineer
Death Valley National Monument
Death Valley, California

The public safety liability posed by hazardous abandoned mine openings is a problem common to many parks. The mines, at the same time, often constitute historic sites which should be preserved and are of great interest to visitors. Death Valley National Monument has developed a system of net closures for these sites which is working very well and gaining widespread recognition. The system is very adaptable and highly flexible, allowing its application to a high percentage of problem sites. The system is nondestructive, reversible and considered long-term (100 years). The Death Valley safety net mine closure system is perhaps the most cost effective treatment of these sites, and is supported by the U.S. Attorney's office in San Francisco which has dealt with tort claims resulting from sites on federal land.

A precarious test of the net closure system. Photo courtesy of Bob Spude, National Park Service.

Death Valley's trained and skilled resources maintenance crew is available to execute installations for other areas. The crew is very adept at working with historic mine structures and their stabilization. Historic structures are often disassembled, permitting technically superior net installations, and the structures reassembled and stabilized in the process. The nets can be installed in a manner permitting authorized access. The nets have a normal 6-inch square mesh allowing air and small animal passage as well as observation. The nets can be modified to provide for the passage of bats if required. Inquiries about possible application of the system to your hazardous mine sites and requests cost estimations can be addressed to Mel Essington, Mining Engineer, Death Valley National Monument, (619) 786-2331, ext. 257.

Editor's Note: During the conference, participants were shown the successful use of the net system for mine closures developed by the staff at Death Valley National Monument. The system has been determined to have no impact on the historic integrity of National Register-eligible mine openings.

BULLION BECK HEADFRAME FIRE DAMAGE MITIGATION

J. Chris Rohrer, Reclamation Specialist
Utah Abandoned Mine Reclamation Program
Salt Lake City, Utah

The Utah Abandoned Mine Reclamation (AMR) Program is the agency responsible for reclaiming abandoned mines in Utah under the Surface Mining Control and Reclamation Act of 1977 (SMCRA, P.L. 95-87). It is almost axiomatic that abandoned mines date from the historic era, and many abandoned mines were significant in the development of the state. SMCRA's goals of eliminating safety hazards and environmental problems sometimes are at odds with the preservation goals of the Historic Preservation Act. The Bullion Beck headframe fire incident shows that the needs of both acts can be met. The Bullion Beck headframe is a National Register site that was inadvertently damaged during a reclamation project. This report will show how a severe, but unanticipated, adverse effect was mitigated.

The Bullion Beck headframe is located in Eureka, Utah, about fifty miles southwest of Salt Lake City. Eureka is one of several hardrock mining boom towns that sprang up in the Tintic Mountains in the late 1800s. It still survives today with a population of 700.

The Bullion Beck and Champion Mining Company was started by John Beck, a German immigrant who started mining in Utah in 1870. After several failures he struck valuable ore and became very wealthy. The mine went through a major capital development phase in 1890, when a structure housing the shaft, headframe, hoist, boilers, and shops was built. The mine declined during World War I, and in 1925 the exterior structure was torn down for salvage, leaving the exposed headframe. The mine was revived in 1940 under new ownership, using the original headframe and a new hoist. It continued to operate until 1960.

The Bullion Beck headframe is an A-type (also known as a 2-post or Montana) headframe constructed in 1890 of massive wooden timbers. It is 67 feet by 32 feet by 56 feet high. It stands over a shaft 1200-1500 feet deep. The shaft has two four-foot square compartments for skips and a smaller manway. Three vertical timbers extend from the top of the headframe down into the shaft to quide the skips as they travel. Significant to the story, but not apparent to observers or from photographs, is the below-ground structure. The primary support for the headframe is not concrete footers, but wooden beams and cribbing buried in the fill around the shaft. The headframe was listed on the National Register of Historic Places in 1976, along with the three other headframes remaining in Eureka. The Utah State Historical Society erected a commemorative marker on the site and put chain link fencing around the shaft.

The condition of the headframe steadily deteriorated after its abandonment. Two platforms, one where ore was dumped from the skips and one by the sheave wheels, fell and hung swinging in the breeze. The unconsolidated material around the shaft collar sloughed outside the wooden sheathing supporting the sides of the shaft. The sloughing extended past the fencing placed by the historical society, so that it was possible to stand outside the fence and fall into the shaft.

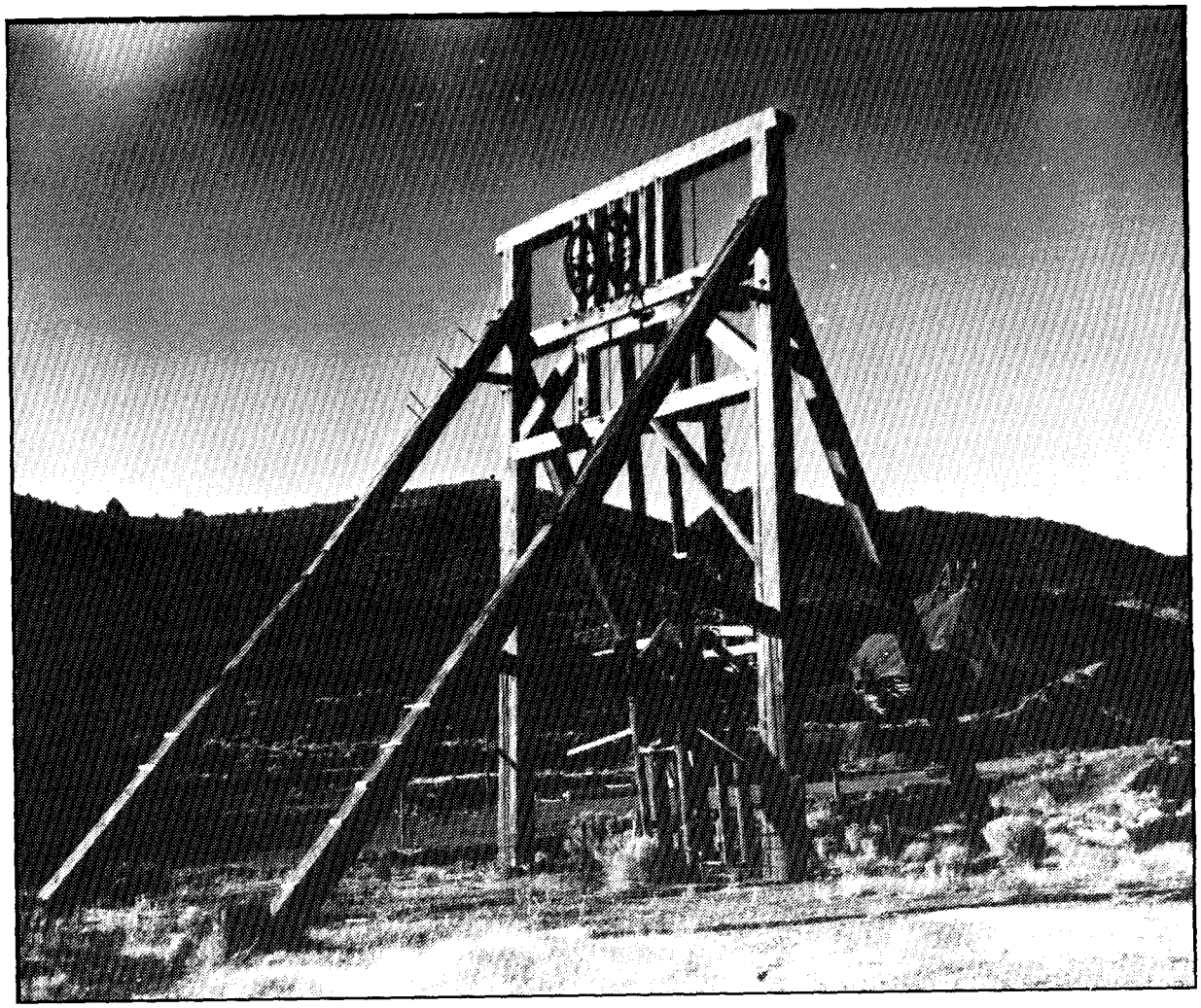
These conditions led the AMR program to include the Bullion Beck headframe in a 1985 project to address hazards at 24 shafts and two adits in the town of Eureka. Most of the mine openings were backfilled; four shafts, including the Bullion Beck, were to be closed with a steel grate. The grate is made of 1/4-inch steel rod woven like a chain link fence held by I-beam supports and soil anchors. The plan was to work around the skip guides and to move the wood in the shaft only to the extent necessary to install the grate. After getting the necessary approvals and putting precautionary language in the construction specifications, the project was bid and work began in the fall of 1985.

The project proceeded well until late March 1986, when the contractor moved onto the Bullion Beck site. Working ahead of schedule and without AMR program supervision (both in breach of the contract), the contractor broke the skip guides and other wooden structural members with a backhoe. These fell into the shaft and lodged on square sets in the shaft. Unable to remove them, he burned them. The wooden collar and the buried wooden supporting members were damaged and the parts that had fallen into the

shaft were destroyed. Fortunately, the aboveground structure was not damaged by the fire. However, the upper parts of the skip guides were left dangling with ragged ends.
In response to the incident, the AMR program met and worked with the State Historic Preservation Office, the Tintic Historic Society (representing the Certified Local Government), the U.S. Office of Surface Mining, and the Advisory Council on Historic Preservation to see what could be done to mitigate the damage. An engineering study determined that the loss of the collar could lead to continued sloughing of the shaft and ultimately the structural failure of the headframe. With this in mind a four-part mitigation plan was developed:

* Collar stabilization to prevent further sloughing
* Stabilization of the broken skip guides to prevent them from falling
* HAER documentation of the headframe
* Public interpretation to put the headframe into the context of the overall mine operation and the Bullion Beck mine into the context of mining in Utah.

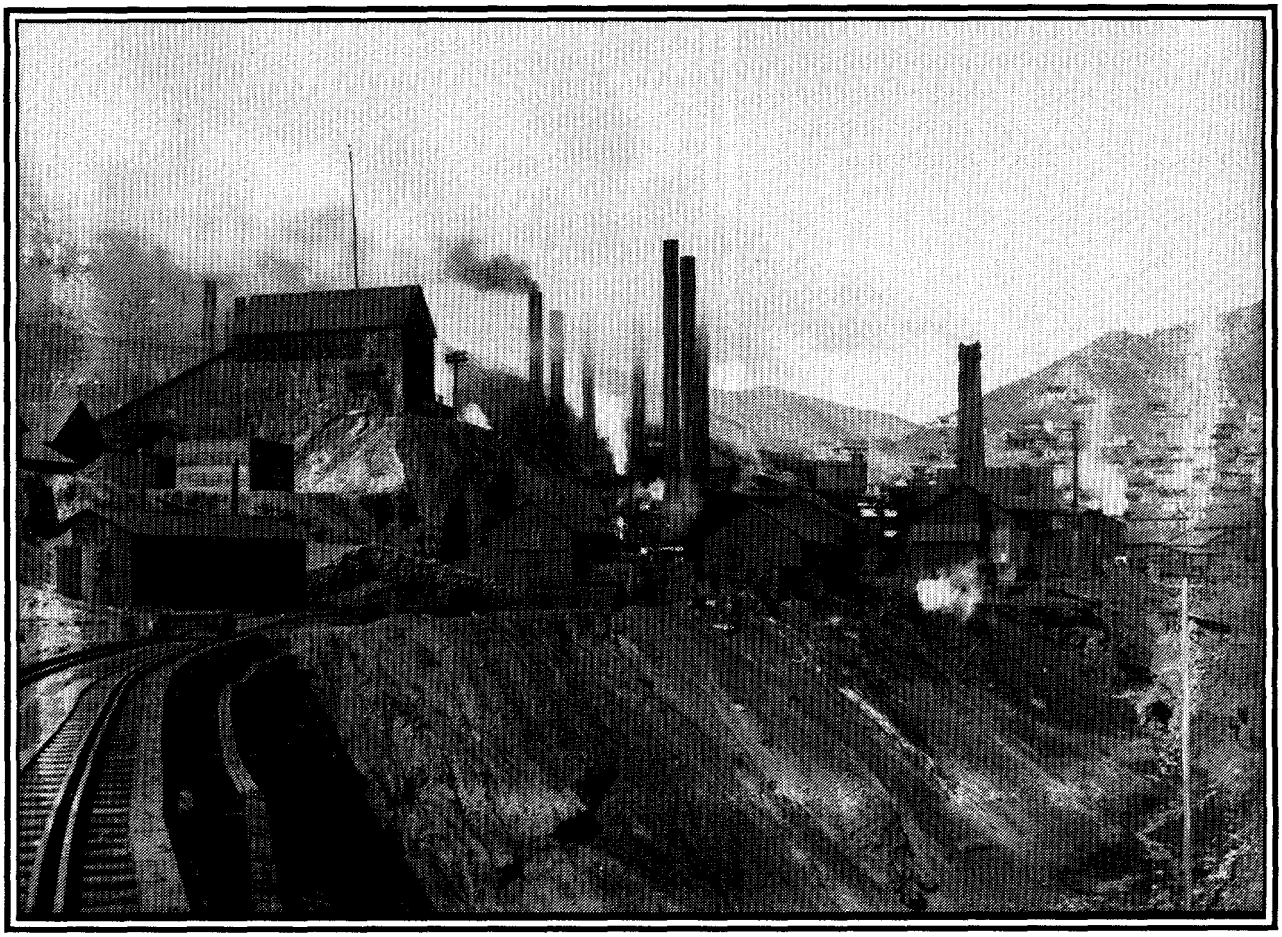
The public interpretation would take the form of a monument with an interpretive plaque at the headframe and an interpretive pamphlet for distribution at the Tintic Museum in Eureka.



Bullion Beck headframe, Eureka, Utah. (Built 1890, photo taken in 1977). Photo courtesy of J. Chris Rohrer.

The HAER documentation and collar stabilization were completed in the fall of 1986. To stabilize the collar, the shaft was cleared and a reinforced concrete slab floor was cast twenty feet down the shaft. Reinforced concrete walls were then cast to support the sides of the shaft. The excavation outside the walls was then backfilled. Timber sets and lagging were placed over the concrete walls to recreate the original shaft appearance. A steel safety grid over the opening prevents anyone from falling in but permits viewing down the shaft. In the summer of 1987 the broken skip guides were spliced with matching timbers and extended to ground level. A stone monument with interpretive plaque was built at the same time. The interpretive pamphlet has been written and will soon be printed.

HISTORIC AMERICAN ENGINEERING RECORD



Industrial complex of Copper Queen Consolidated Mining Company showing hoist house, smelter, railroad and town of Bisbee, Arizona (ca.1900). Photo courtesy of the Arizona Historical Foundation, Spude Collection, Tempe.

ACCESSING THE HAER COLLECTION

Eric DeLony
Chief, Historic American Engineering Record
National Park Service, Washington, D.C.

What is the Historic American Engineering Record? It is an agency of the National Park Service responsible for compiling a graphic and written archive of drawings, photographs and written data on America's industrial, engineering and technological heritage. It is an archive in the Library of Congress consisting of 1,800 sheets of measured drawings, 24,000 large-format photographs, and 20,000 data pages that document 1,800 structures. Perhaps most important, it is 300 to 400 students and faculty of architecture, engineering, history, photography and the graphic arts from colleges and universities throughout the world who, for the past 19 years, have converged on historic industrial and engineering sites every summer to produce the documentation.

HAER was established in 1969 by ratification of a tripartite agreement among the National Park Service, the Library of Congress and the American Society of Civil Engineers. The National Park Service administers the program, while the Library of Congress is the repository for the drawings, photographs and written data and services requests from the public for reproductions. The American Society of Civil Engineers supports recording projects and provides professional counseling to the HAER staff through its national membership. A protocol signed in 1987 adds the support of other engineering societies--the American Society of Mechanical Engineers, the Institute of Electrical and Electronics Engineers, the American Institute of Chemical Engineers, and the American Institute of Mining, Metallurgical and Petroleum Engineers--to the HAER program.

Staffed by architects, engineers, historians, photographers and illustrators, HAER conducts a nationwide documentation program in cooperation with state and local governments, other bureaus of the federal government, historical organizations, professional societies, universities and preservation groups. Documentation projects focus on individual sites or systems, usually organized by geographic and political area or industrial type. The primary criterion in selecting sites is whether the site can reveal information critical to understanding and interpreting the history of engineering, industry and technology.

Architects measure the structure noting their measurements and other information in field notebooks and then prepare inked drawings on archivally stable Mylar sheets. Historians and engineers prepare historical reports on each site using primary and secondary sources, but focus on the remains of the physical structure itself. Large-format (4 x 5- or 5 x 7-inch), black-and-white photographs supplement the drawings and written data, as do photographic copies of historical maps, illustrations and old photographs. HAER documents complex industrial processes with traditional drawings (plans, elevations, sections) but in addition, interprets them by flow diagrams and axonometric drawings and in some instances, documentary films. In addition to documentation produced by summer teams, an increasingly significant amount of documentation is being added to the collection from donated projects and mitigatory documentation. Mitigatory documentation is produced for historic engineering and industrial sites, listed on or eligible for listing in the National Register of Historic Places, when such sites are threatened with alteration or demolition by a project funded or licensed by a federal agency.

HOW TO REQUEST HAER DOCUMENTATION PROJECTS

If you have a site, structure or object that you would like documented to HAER standards, what do you do? First, the site must meet certain general criteria: Is it listed on the National Register? Is it essentially unaltered with machinery and equipment intact? Is it a National Park Service-owned property? Is it a National Historic Landmark or recognized by one of the engineering societies as nationally significant? Is the site inadequately represented in the HAER collection? If the site meets several of these criteria, then you need to assess whether you or your organization can pay for the documentation. Usually, HAER requests cooperating sponsors to pay for documentation projects since our Congressional appropriation only covers staff salaries, office operating and travel costs. HAER does absorb some project overhead, however, depending on the importance of the site and the resources available to the requesting organization.

Costs of HAER recording projects range from $2,500 to $50,000: $2,500 pays for the HAER staff photographer to comprehensively photodocument a site, the cosponsor providing the captions and written data; $50,000 is the cost of a full-fledged team in the field for 12 weeks, consisting of a project supervisor, project historian, engineer, three architects, research historian and a photographer. HAER assumes all administrative costs and assigns a project manager to monitor the project from the Washington Office. At the end of 12 weeks, the cosponsor receives draft copies of the documentation for review and comment. Upon receipt of the comments from cosponsors, the documentation is edited into final form and transmitted to the Library of Congress. At this time, cosponsors receive final copies of the documentation. Normal turnaround time from initiating the project in the field to transmittal to the Library of Congress is 15-18 months. Use of documentation for exhibits or publications prior to transmittal is open to negotiation. The instrument for establishing a cooperative recording project is a memorandum of agreement. This document spells out the scope-of-work, project responsibilities, financial commitments, deliverables and deadlines.

The HAER staff always is interested in hearing about your industrial archeological finds, be it a bridge, turbine or iron furnace. If you cannot afford the costs of HAER documentation services, the staff will provide you or your group with HAER documentation standards and will comment on written and photographic documentation and will "red-line" measured drawings. Once these draft records have been approved by the HAER staff, we will supply you with the official HAER Mylar sheets, archival negative sleeves and photo-mount cards to complete the project. Your donation will then become part of HAER's national collection at the Library of Congress.

WHO USES HAER DOCUMENTATION?

HAER documentation is used by historians and scholars researching industrial, engineering and technological history. Architects and engineers working on the rehabilitation, restoration or adaptive reuse of sites recorded by HAER often find the documentation invaluable. Editors and publishers have discovered that the HAER collection often is the only source for drawings and photographs, particularly when a site has been destroyed. Even railroad enthusiasts have used HAER drawings for constructing stations and model train layouts.

Documentation in the HAER collection is in the public domain and may be used without restriction other than the courtesy of a credit line identifying the program and the individual who produced the documentation.

HOW TO ACCESS THE COLLECTION

At this writing, the HAER collection can be accessed in two ways--by visiting the Library of Congress in Washington or by ordering copies of the records by telephone or mail. All documentation has been produced in standard formats and archival media (papers, sheet films, Mylars) with a required shelflife of 500 years. Drawings are on 24 x 36-inch Mylar sheets; photographs are on 4 x 5- or 5 x 7-inch sheet film; written reports are typed on 8 1/2 x 11-inch pages. Full-size reproductions of drawings can be supplied as xerox-on-vellum or they can be reduced to 8 x 10-inch photographic prints or xeroxes. Photographs can be printed as 4 x 5- or 5 x 7-inch contact prints or enlarged to 8 x 10-inch black-and-white glossy or exhibition quality prints.

The drawings, photographs and written data are maintained by the Prints & Photographs Division at the Library of Congress. Contact Mary Ison, Reference Specialist, Architecture, Design & Engineering Collections, Prints & Photographs Division, Library of Congress, Washington, DC 20540, (202) 707-8867.

For further information on HAER's national documentation program, contact Eric DeLony, Chief, Historic American Engineering Record, National Park Service, P.O. Box 37127, Washington, D.C. 20013-7127, (202) 343-9603.

DOCUMENTING A COPPER MINE: THE QUINCY MINE RECORDING PROJECT, SUMMER OF 1978

Charles K. Hyde, Historian
Department of History, Wayne State University
Detroit, Michigan

The Quincy Mine Recording Project emerged from the Historic American Engineering Record (HAER) inventory process in almost textbook fashion. I completed a HAER inventory of historic engineering and industrial sites in the Lower Peninsula of Michigan in 1975-1976 and then surveyed the Upper Peninsula in 1977. During that survey, I literally stumbled upon the surviving buildings, structures, and artifacts of the Quincy Mining Company. Quincy was a medium-sized copper mining firm located near Hancock, Michigan, on the Keweenaw Peninsula, that engaged in mining from 1846 until 1945, with a brief closing during the Great Depression.

I dragged Larry Lankton from the HAER Washington office up to the Quincy site and the two of us concluded that a full-scale recording project was warranted. We were most impressed by the fact that several dozen surface buildings, often with equipment inside, had survived, along with dozens of other artifacts, including rock skips, railroad locomotives, and the like. Substantial parts of the mining community had survived as well, including company-built housing, schools, churches, and related buildings. The survival of virtually all of Quincy's records, including engineering drawings, from the earliest days of operations, was the clincher for us. While Quincy was not as large as the giant Calumet and Hecla Mining Company located in Calumet, the C & H surface plant was largely destroyed and its records inaccessible. So we decided that Quincy was an excellent candidate for a recording project.

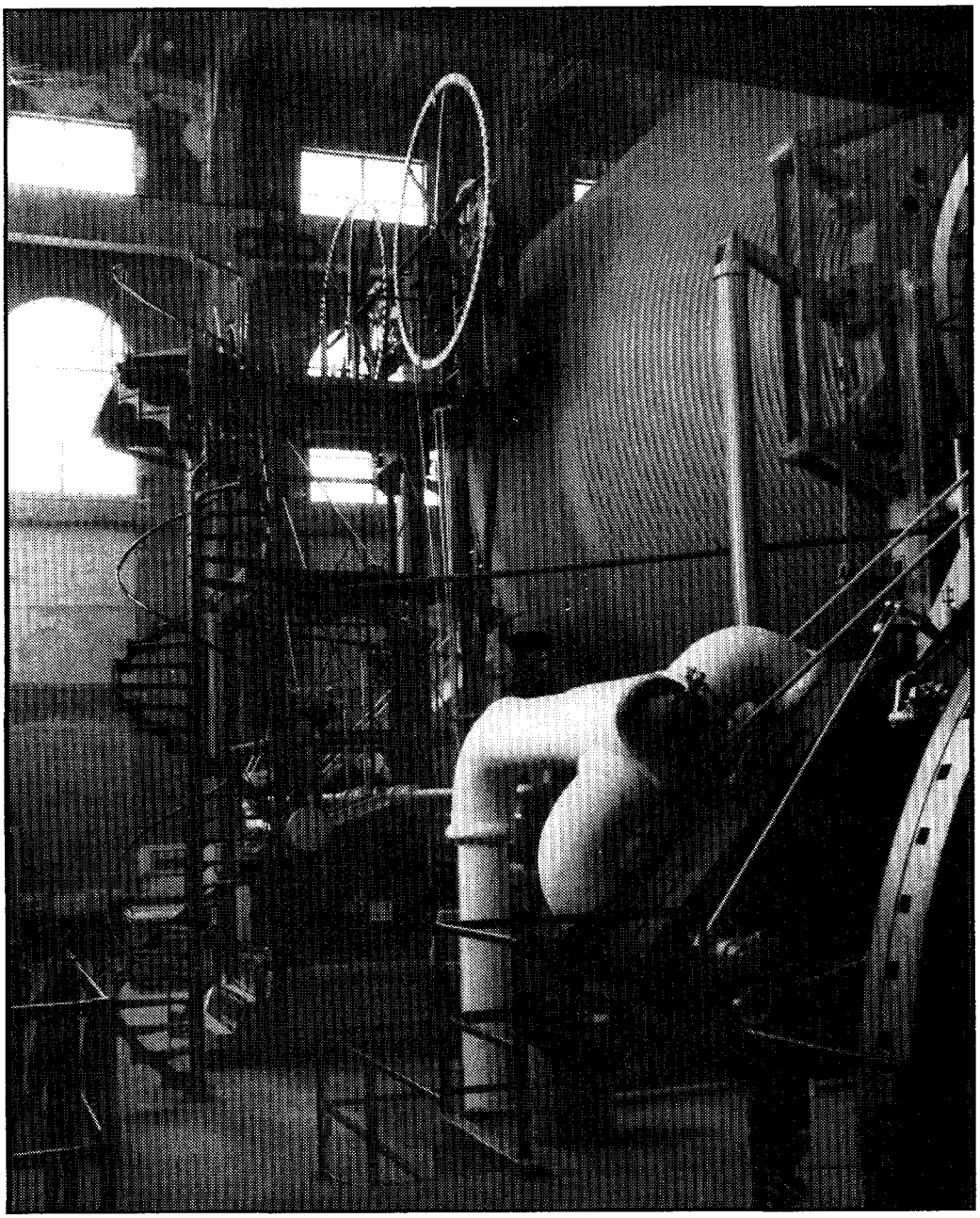
Larry Lankton and I were able to piece together a funding package which allowed us to field a summer team of eleven individuals. Three sponsors, the Quincy Mining Company, the Michigan History Division (the State Historic Preservation Office), and HAER, each contributed one-third of the cash cost of the project, roughly $36,000. Michigan Technological University provided free office space and subsidized student housing for the team. The HAER Washington office also provided two of the team members, namely Larry Lankton, the Project Director, and Richard Anderson, Jr., who served as Supervisory Architect.

The recording project team consisted of eleven people altogether, including six historians and five architects. We had several overlapping and competing goals when we began work. Recording (documenting) the existing buildings and artifacts was the primary goal, but we also tried to recreate (on paper) buildings and artifacts that had not survived. Our last major goal was documenting the history of the Quincy Mining Company and the communities that developed in the vicinity of the mine. We paid serious attention to the history of technology, business history, labor relations, and social history.

The historic resources we had to work with were in many ways overwhelming. Besides dozens of standing buildings and ruins of a score more, the mine site included hundreds of artifacts that needed assessment and interpretation. The work was further complicated by the existence of a separate, but largely-destroyed stamp mill site, the remains of the railroad that connected the mine and stamp mill, and a surviving smelter built in 1898. The company's records were virtually intact from its foundation in 1846 to the present, including engineering drawings of buildings, machinery, and underground workings. Of necessity, the recording project was highly selective in terms of focus.

The team produced an impressive volume of documentation on the Quincy Mining Company. The historians generated seven reports (totalling about 700 pages) on the following topics: the history of technology at the mine; the economic and business history of the firm; the development of stamp mill technologies; the construction and operation of the Quincy and Torch Lake Railroad; the history of smelting technology as used in the Quincy Smelter; the evolution of Quincy's paternalistic and community activities; and, finally, the ethnic and labor history of the work force. Photographic documentation was an important part of our efforts and included photographic copies of about 200 historic views and drawings, as well as about 90 large-format photographs of the buildings and artifacts extant in 1978. Finally, the architects prepared 34 sheets of measured drawings, primarily of major buildings and

machinery at the mine site. The architects prepared longitudinal sections showing the surface and underground appearance of the mine in 1860, 1866, and 1879. In addition, they drew site plans which showed the evolution of the mine site, stamp mills, and smelter over time. All these materials are now in the HAER collection at the Library of Congress.



Quincy Mining Company Hoist (1920). Photo courtesy of Charles K. Hyde.

The Quincy Mine Recording Project produced longer-term results as well. Using the project materials as the base, Larry Lankton and I published a company history, *Old Reliable: An Illustrated History of the Quincy Mining Company* (Hancock, Michigan: The Quincy Mine Hoist Association, 1982). We are both currently working on longer scholarly monographs dealing with the history of copper mining in Michigan and the United States. Finally, the Quincy Mine Recording Project has indirectly led to the current initiative to establish an Historic Mining National Park in Michigan's Copper Country.

HAER PROJECTS IN ALASKA: THE KENNECOTT MINES AND OTHERS

Robert L. Spude, Historian
Chief, National Preservation Programs Division
National Park Service, Rocky Mountain Regional Office
Denver, Colorado

From 1978 to 1987 I worked in the Alaska Region of the National Park Service and was involved with or directed a number of Historic American Engineering Record projects. The National Park Service Regional Office had the responsibility to advise Federal agencies on HAER documentation. Additionally the NPS conducted HABS/HAER projects for private or public entities under cooperative agreements. And finally, the office documented properties on National Park Service lands. The following is a description of some of those projects undertaken during my tenure that may serve as examples for others wishing to document mining sites.

Alaska has a rich mining history, beginning with minor gold rushes in the 1860s, prior to the 1867 acquisition of Russian America, up to the most recent times and the discovery of oil at Prudhoe Bay. The first major gold rush occurred in 1880 at Juneau, which became the territorial capital. This rush was quickly followed by a series of gold discoveries along the Yukon River. The 1896 discovery of the Klondike gold fields in Canada near the Alaska border caused the last great, international gold rush in 1898. The miners soon discovered other fields, most notably at Nome and Fairbanks. Copper discoveries followed close on the heels and such developments as those at Kennecott, Alaska, caused the territory to become a major copper producer as well. Mining began to wane by the 1920s and barely survived the 1930s. Because of the cost to remove machinery from Alaska's isolated mining regions, the equipment left in the mining districts remains today in surprising abundance.

With the creation of over 50 million acres of new parkland as a result of passage of the Alaska National Interest Land Claims Act of 1980, many of the lesser-known mining regions became parklands. The abundance of machinery and equipment as well as the mandate to inventory Federal Lands for historic resources, prompted the NPS regional office to inventory mining sites. Because of the significance of machinery in place, Historic American Engineering Record techniques were used.

The Washington office of HABS/HAER, directed by Robert Kapsch, agreed to assist the Alaska Region with staff time and technical assistance. John "Jet" Lowe was loaned to the Region to help photograph important sites, such as the Hammond Gold Company dredges and plant at Nome, as well as park properties. Kim Hoagland was loaned to the Region to assist with inventories. Eric DeLony and his staff, especially Richard Anderson, gave technical assistance.

Eric, with HAER since its founding, and historian Allen Comp had helped shape the recording philosophy, which had shifted from merely producing documents like the older, sister program at Historic American Buildings Survey (HABS) to creating records that explained the work of the engineer. Where the HABS staff recorded the static works of architects, HAER included the engineer and processes. This shift is evident by comparing examples of HAER projects completed in the 1970s and reproduced in Theodore Anton Sande's *Industrial Archeology* (Park City, Utah's Silver King Coalition tramway and the Tintic Standard Reduction Company mill) and Allan Comp's "The Tooele Copper and Lead Smelter," *IA, The Journal of the Society of Industrial Archeology* (Summer 1975), with the later recording project at the Quincy mine described by Charles Hyde. The HAER departure with the work at Quincy is exemplary. Drawings not only documented structures but helped the reader understand the engineering process through interpretive engineering drawings. John Bowie explained the HAER philosophy in an article published in *APT* (Vol. XVII, No. 1, 1985). The Alaska Region followed this example.

THE KENNECOTT RECORDING PROJECT

After conducting an inventory of significant mining regions within the 12-million-acre Wrangell-St. Elias National Park and Preserve in 1982-1983, several sites were recommended for further documentation.

Jet Lowe photographed them and a field team of historians inventoried the sites. Kennecott, a former mining camp within the preserve, but not owned by the National Park Service, was determined to be of such significance that a thorough HAER project was recommended.

The most important feature at Kennecott was the standing, twelve-story concentrator which still retained all of its machinery. Built in 1910-12 and expanded up until its closing in 1938, it was a classic gravity concentration mill, though a leaching plant and small scale flotation plant had been added. The mill also was a striking red and white-trim structure stepping up the slope of Bonanza ridge, adjacent the Kennicott glacier (note the two different spellings of the name).

During 1985-1986, I directed the HAER recording project at the Kennecott copper concentrator. The property owner provided access to original drawings and assistance on-site. In 1985, I completed a National Historic Landmark nomination. Richard Anderson, who had worked on the Quincy project, and Robert Vogel of the Smithsonian visited the site and made recommendations on preservation and documentation. The recording project final report was compiled by Sande Faulkner and me; reprinted and re-titled *Cordova to Kennecott*, it is for sale by the Cordova Historical Society, P.O. Box 391, Cordova, Alaska 99574.

The philosophy behind recording the plant may be a useful example of how to approach the documentation of such large-scale resources. The recording team determined that the emphasis of the project would be to delineate the processes used in the mill: concentration (1910), leaching (1915), and flotation (1922). The intent was to show an engineer's view of the machinery, not the architect's view of the structure's construction (we had the original construction drawings). The flow of the ore was drawn to show the process through the machinery, from the primary crusher, through the jigs and concentration tables, and on through the plant.

The Kennecott project was enlightening and guided us on our next projects. For example, in the course of the study we learned that workers only knew the operation of their particular machines or stations (such as at a jig or crusher), and could not provide accurate information about the complete process through the mill. Thus, our documentation through oral interviews proved less effective than observation of in-place machinery. We learned, too, that machinery used in the first process or operating system of the mill, after expansion or remodeling to adopt new processes, might be left in place, derelict and unattached to the system. One jaw crusher, at the base of the elevator, was attached to none of the ore-feed systems by the time of the 1938 closure, but still remained bolted to its foundation, trapped in place by surrounding walls and machinery. We also learned that original design drawings often do not reflect the building and machinery placement as built or expanded.

In order to conduct accurate documentation, we learned that it is essential that the recording of mining sites should focus on the process rather than on individual objects or structures. To understand a mining operation one must look at everything from the mine adit to the mill tailing pile or smelter slag heap. The process includes transport systems for the ore, from the mine, its headframe, to the tram or road to the mill; the milling system--the ore bin, preliminary crushers, stamp or ball mills or cone crushers, amalgamation tables or concentration tables or jigs, the classifiers, pumps, tailing pipes, and retort or assay room; and the outbuildings at the mine and mill. A site plan and a flow diagram are essential to the understanding of what remains and what is missing. They help identify what is missing as much as what remains.

We also learned that mills and plants are not static, they evolve, their external skin of wood or metal stretching to cover the all important machinery and processes. A mill building should be documented as it stands, not as originally planned. Expansion or remodeling was common. Most mills began as simple stamp batteries or crushers under a barn-like gable roofed building. Next a shed addition might be added to cover concentration tables. Then a wing or another lower level shed addition would cover chlorination or cyanide vats or flotation cells or any number of added pieces of machinery. These parts make up the whole of a mine engineering work, which has as a main focus the processing of ore.

For example, at the Kennecott site we found the original drawings of the North Midas gold mill, a plant located in the nearby Kuskalana River valley. When the team arrived to record the mill, we found that a wing had been added to house a diesel engine to power the ball crusher, a shed roof addition was installed over a small cyanide plant, and the original aerial tramway terminal had been rebuilt.

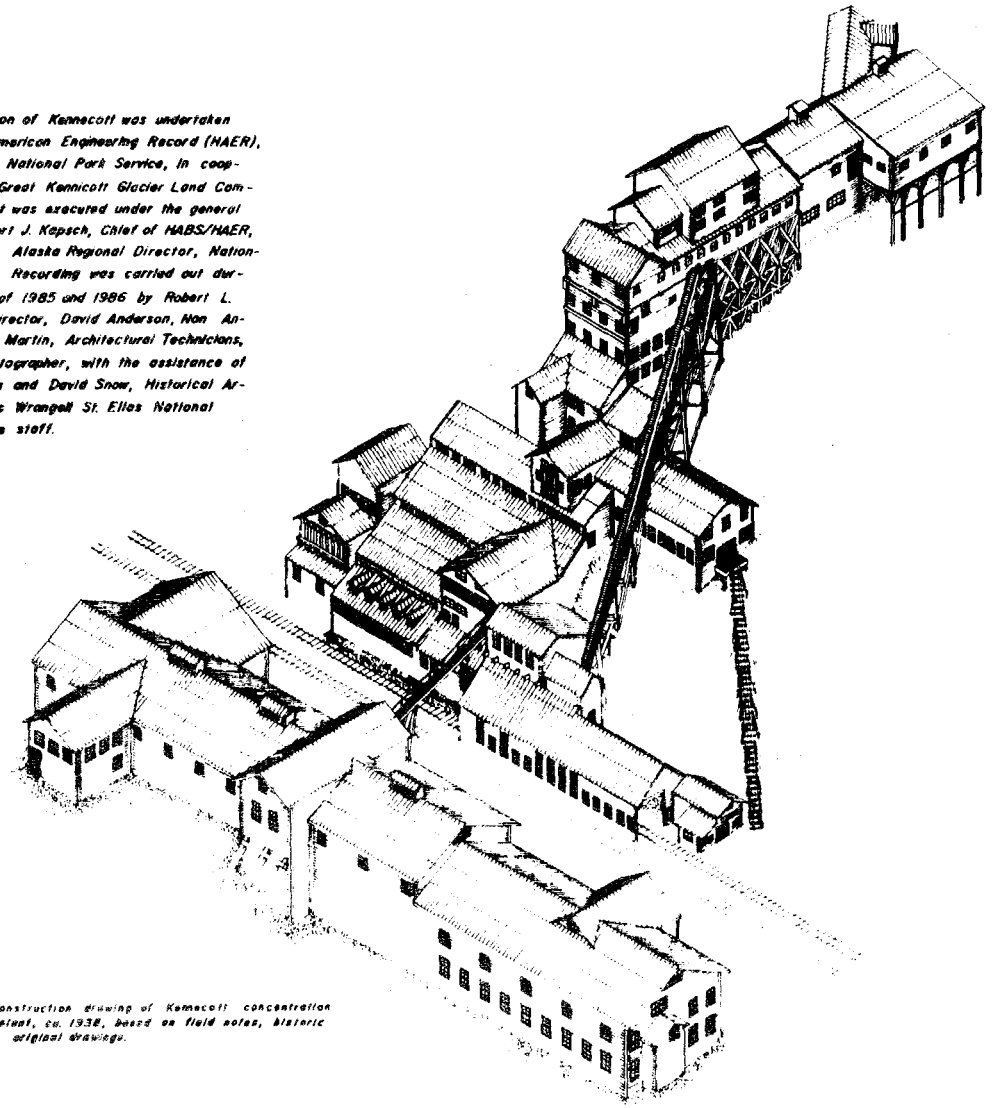
As we expanded our inventory to include gold placer mining sites we used the same recording philosophy. Placer mining operations need to be documented to the same level of understanding as hard rock mines and mills. Dams and flume or ditch systems, with their siphons or aqueducts, then the sluice boxes or the hydraulic giants, need to be mapped and documented in relationship to each other rather than as individual foci or features. They are part of designed mine engineering systems. In the larger hydraulic and dredging operations, camps, often portable, were built to house functions from the cook house to the machine shop. Again, rare is the mining site that contains but one structure or one element. They are complexes that interrelate and are defined by a process. To best understand the process, we learned to avoid mapping a series of independent foci: a flume, a giant nozzle, or tailing pile. Rather, we viewed them as interconnecting units in a mine engineering complex that is defined by the process of hydraulic mining.

An example of placer mining systems was recorded in the Koyukuk district of Alaska. The site was a placer gold operation, which utilized small-scale techniques dating from the California gold rush. The remains of the Ace Willcox mine were recorded to show the small-scale drift mining technique. The HABS/HAER team found the flume and gee pole collapsed and fallen down, and the cabin ruinous but still containing the boiler which powered the skip and hoist. The record drawing of the site was a well-documented reconstruction of the process of removing pay dirt from the drift at bedrock to the dump, where the gold was washed from the gravels by flume and long tom.

The NPS Alaska Regional Office is continuing to document mining sites--a gold dredge within Yukon Charley Rivers National Preserve, and a tramway system which hauled miners' goods over the Chilkoot Pass within Klondike Gold Rush National Historical Park. It is hoped that these examples, as well as that at the Quincy recording project and more recent projects at New River Gorge undertaken by Eric DeLony and his staff, will improve our understanding and interpretation of mining systems.

KENNECOTT COPPER CORPORATION
KENNICOTT, ALASKA

Documentation of Kennecott was undertaken by the Historic American Engineering Record (HAER), a Division of the National Park Service, in cooperation with the Great Kennicott Glacier Land Company. The project was executed under the general direction of Robert J. Kapsch, Chief of HABS/HAER, and Boyd Evison, Alaska Regional Director, National Park Service. Recording was carried out during the summers of 1985 and 1986 by Robert L. Spude, Project Director, David Anderson, Ron Anderson, and Ken Martin, Architectural Technicians, John Lowe III, Photographer, with the assistance of Richard Anderson and David Snow, Historical Architects, and the Wrangell St. Elias National Park and Preserve staff.



Note: Partial reconstruction drawing of Kennecott concentration mill and leaching plant, ca. 1938, based on field notes, historic photographs, and original drawings.

In 1900, prospectors discovered the copper outcrops located atop Bonanza Ridge in the Wrangell Mountains, Alaska. The high-grade surface ore, assaying up to 70% copper, astounded the mining world, but years of litigation over ownership and the distance from cheap transportation delayed development of the mines. In November, 1906, the House of JP Morgan and Company and the Guggenheims united to consolidate ownership of the richest claims, fund mine work, build a milling plant, and complete the Copper River and Northwestern Railway from the coast to the Kennecott mines. The railroad reached Kennicott on March 29, 1911, and full scale production began.

The high grade ore was shipped directly to the Guggenheims' Tacoma smelter, while low grade ore was first processed in the concentration mill below the mines. The mill town and mines were equipped with advanced machinery and the latest technolical innovations in mineral benefaction. The first successful application of the ammonia leaching process occurred here in 1915.

In 1916, the most productive year, the copper produced amounted to 55,085.8 tons, making the Kennecott mines the third-largest producer in the United States. That year, the newly formed Kennecott Copper Corporation began acquiring other properties which would eventually include mines throughout the world.

The Kennicott deposit, though a unique, high grade deposit, proved to be of limited extent. Altogether, $300 million worth of copper and silver were produced by the time Kennecott closed the mines in 1938. Standing above the mill town, the mill and its machinery remain today, a classic example of early twentieth century mining technology, while the Kennecott Copper Corporation continues as an international mining conglomerate.

Note: The town and glacier are named for Alaska explorer Robert Kennicott. The company name is a misspelling of the glacier name.

KENNECOTT COPPER CORPORATION: COVER SHEET
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE
ALASKA

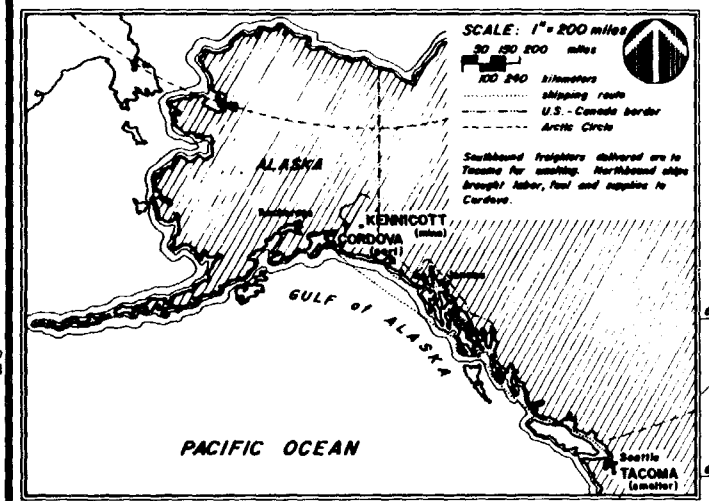
KENNECOTT

HISTORIC AMERICAN ENGINEERING RECORD AK-1

SHEET 1 of 15

DELINEATED BY: K. Martin, 1986

COPPER ORE TRANSPORTATION
1911-1938



Three modes of transportation carried Kennecott ore from mine to smelter:

1. Aerial Tramways (manufactured by the Trenton Iron Company)
2. Railroad (the Copper River & Northwestern Railway, a 196 mile line from Cordova to Kennicott, completed in 1911 at a cost of $ 23,000,000)
3. Steamship (operated from Cordova to Tacoma by the Alaska Steamship Company)

All three systems were controlled by the Alaska Syndicate, an organization consolidating the backing of N.O. Havemeyer, the House of Morgan, the Guggenheims and the Kuhn Loeb Company. In 1915 the syndicate incorporated as the Kennecott Copper Corporation.

Trams and the railway both ceased operations in 1938 when Kennecott closed its mines. Only the Alaska Steamship Company continued servicing Alaska's coast until superceded by air transport in 1971.

NOTE: Though the town name is spelled Kennicott, the company name is spelled Kennecott.

Based on U.S.G.S. 1:250000 series, 1960 with 1981 revisions, Valdez, McCarthy, and Cordova Quadrangles.

AERIAL TRAM SYSTEM

from	length	capacity	year
Bonanza	16,000'	600 tons/day	1908
Jumbo	16,000'	600 tons/day	1913
Erie *	2,100'	ea	1916
Glacier †	5,500'	ea	1920

* The Erie tram was operated primarily for supplies. Ore was transported to the Jumbo tram via the 12,000' Jumbo - Erie crossover.

† The Glacier tram spurred off the Jumbo tram at the junction station.

Based on charts from the Kennecott Copper Corporation and "A History of the Kennecott Mines", by William C. Douglass, October, 1964.

KENNICOTT COPPER CORPORATION COPPER ORE TRANSPORTATION
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE
ALASKA

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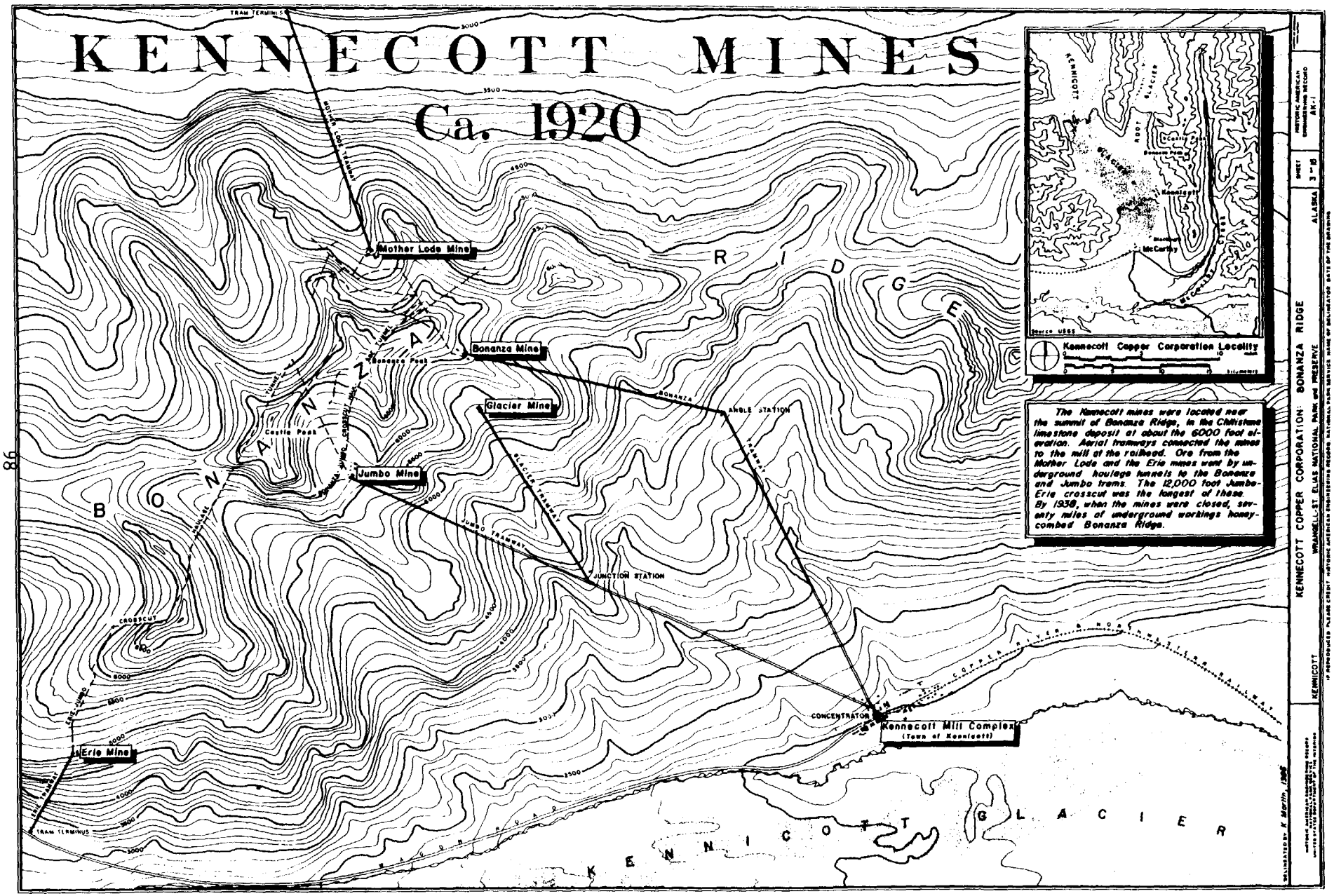
KENNECOTT MINES
Ca. 1920
Mother Lode Mine
Bonanza Mine
Glacier Mine
Jumbo Mine
Erie Mine
Kennecott Mill Complex
(Town of Kennecott)
BONANZA RIDGE
BONANZA PEAK
Castle Peak
JUNCTION STATION
ANGLE STATION
CONCENTRATOR
TRAM TERMINUS
KENNICOTT GLACIER
Kennecott Copper Corporation Locality
The Kennecott mines were located near the summit of Bonanza Ridge, in the Chitistone limestone deposit at about the 6000 foot elevation. Aerial tramways connected the mines to the mill at the railhead. Ore from the Mother Lode and the Erie mines went by underground haulage tunnels to the Bonanza and Jumbo trams. The 12,000 foot Jumbo-Erie crosscut was the longest of these. By 1938, when the mines were closed, seventy miles of underground workings honeycombed Bonanza Ridge.
KENNECOTT COPPER CORPORATION: BONANZA RIDGE
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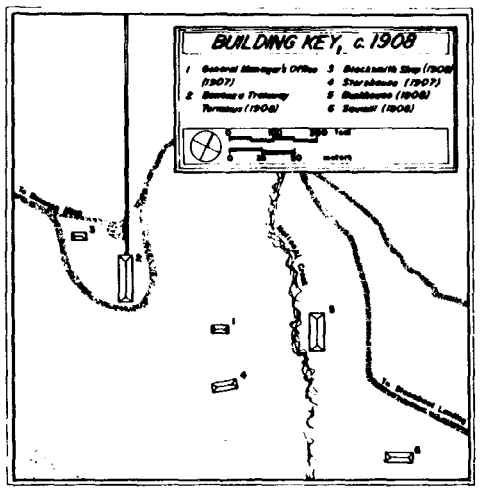
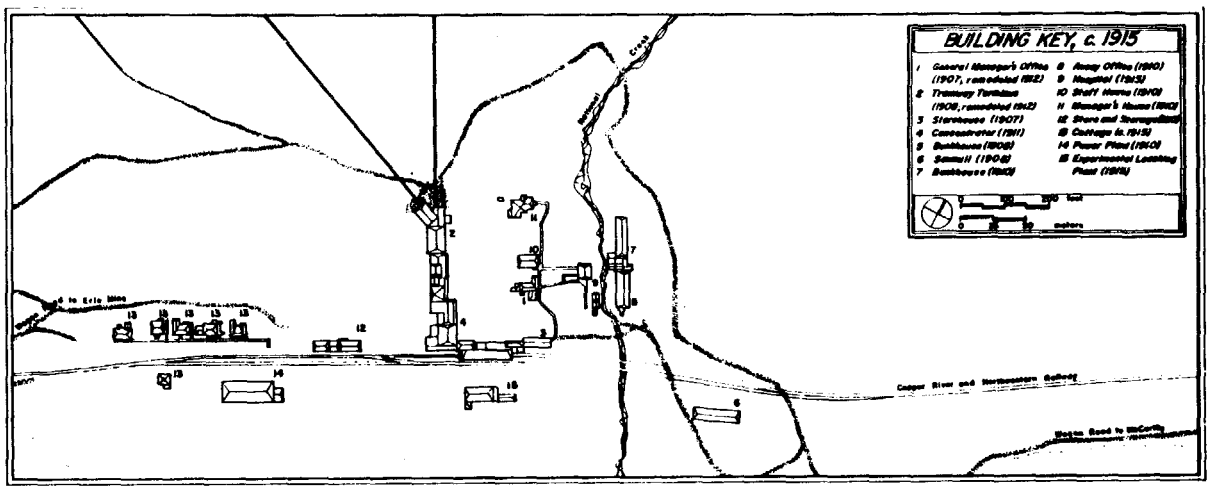
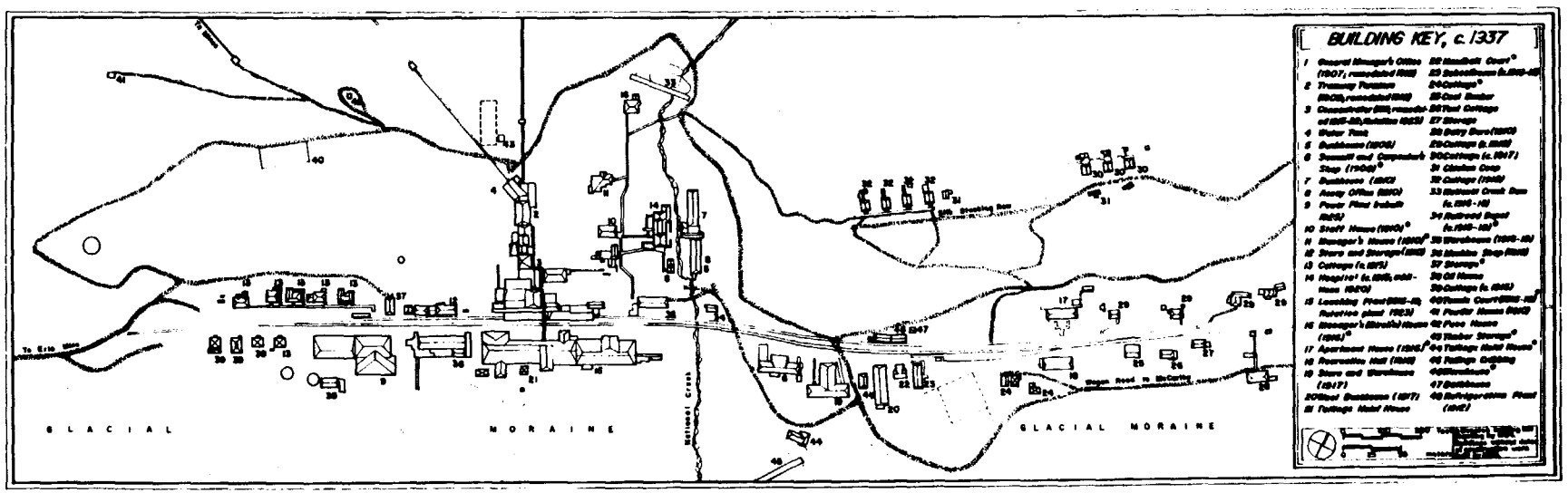




KENNICOTT MILL TOWN



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KENNECOTT COPPER CORPORATION: SITE PLANS
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE
KENNICOTT
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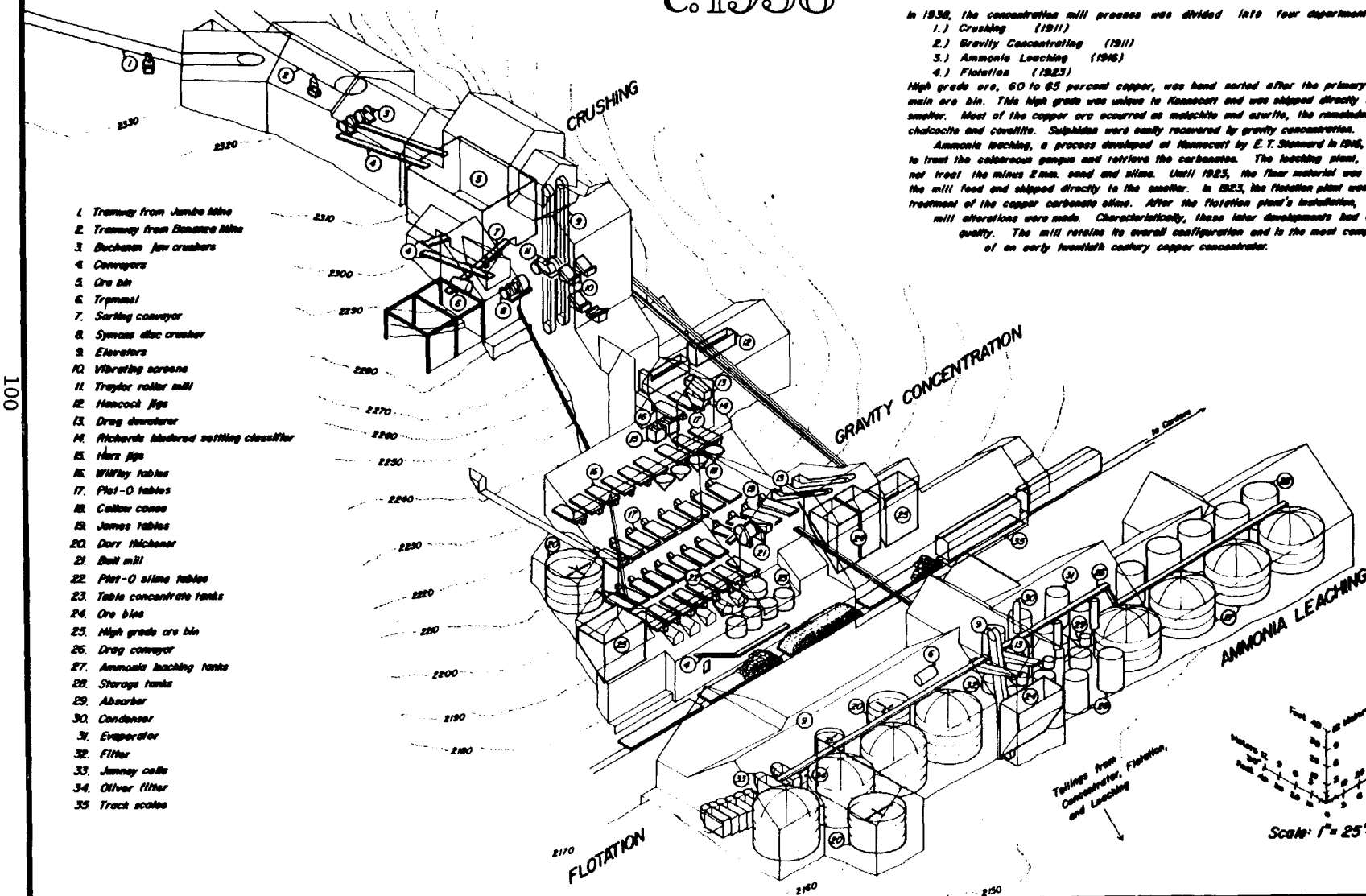
CONCENTRATION MILL / LEACHING PLANT
c. 1938



1. Tramway from Jumbo Mine
2. Tramway from Bonanza Mine
3. Buchanan jaw crushers
4. Conveyors
5. Ore bin
6. Trommel
7. Sorting conveyor
8. Symons disc crusher
9. Elevators
10. Vibrating screens
11. Traylor roller mill
12. Hancock jigs
13. Drag dewaterer
14. Richards Modified settling classifier
15. Harz jigs
16. Wilfley tables
17. Plat-O tables
18. Callow cones
19. James tables
20. Dorr thickener
21. Ball mill
22. Plat-O slime tables
23. Table concentrate tanks
24. Ore bins
25. High grade ore bin
26. Drag conveyor
27. Ammonia leaching tanks
28. Storage tanks
29. Absorber
30. Condenser
31. Evaporator
32. Filter
33. Janney cells
34. Oliver filter
35. Track scales

In 1938, the concentration mill process was divided into four departments.

1.) Crushing (1911)
2.) Gravity Concentrating (1911)
3.) Ammonia Leaching (1916)
4.) Flotation (1923)

High grade ore, 60 to 65 percent copper, was hand sorted after the primary crushing and main ore bin. This high grade was unique to Kennecott and was shipped directly to the Tacoma smelter. Most of the copper ore occurred as malachite and azurite, the remainder being sulphide - chalcocite and covellite. Sulphides were easily recovered by gravity concentration.

Ammonia leaching, a process developed at Kennecott in 1916, was incorporated to treat the calcareous gangue and retrieve the carbonates. The leaching plant, however, could not treat the minus 2 mm. sand and slime. Until 1923, the finer material was screened from the mill feed and shipped directly to the smelter. In 1923, the flotation plant was added for treatment of the copper carbonate slime. After the flotation plant's installation, only minor mill alterations were made. Characteristically, these later developments had a jerry-built quality. The mill retains its overall configuration and is the most complete example of an early twentieth century copper concentrator.

Scale: 1" = 25'-0"

KENNECOTT COPPER CORPORATION, KENNECOTT CONCENTRATION MILL - c. 1938
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE
ALASKA
KENNECOTT
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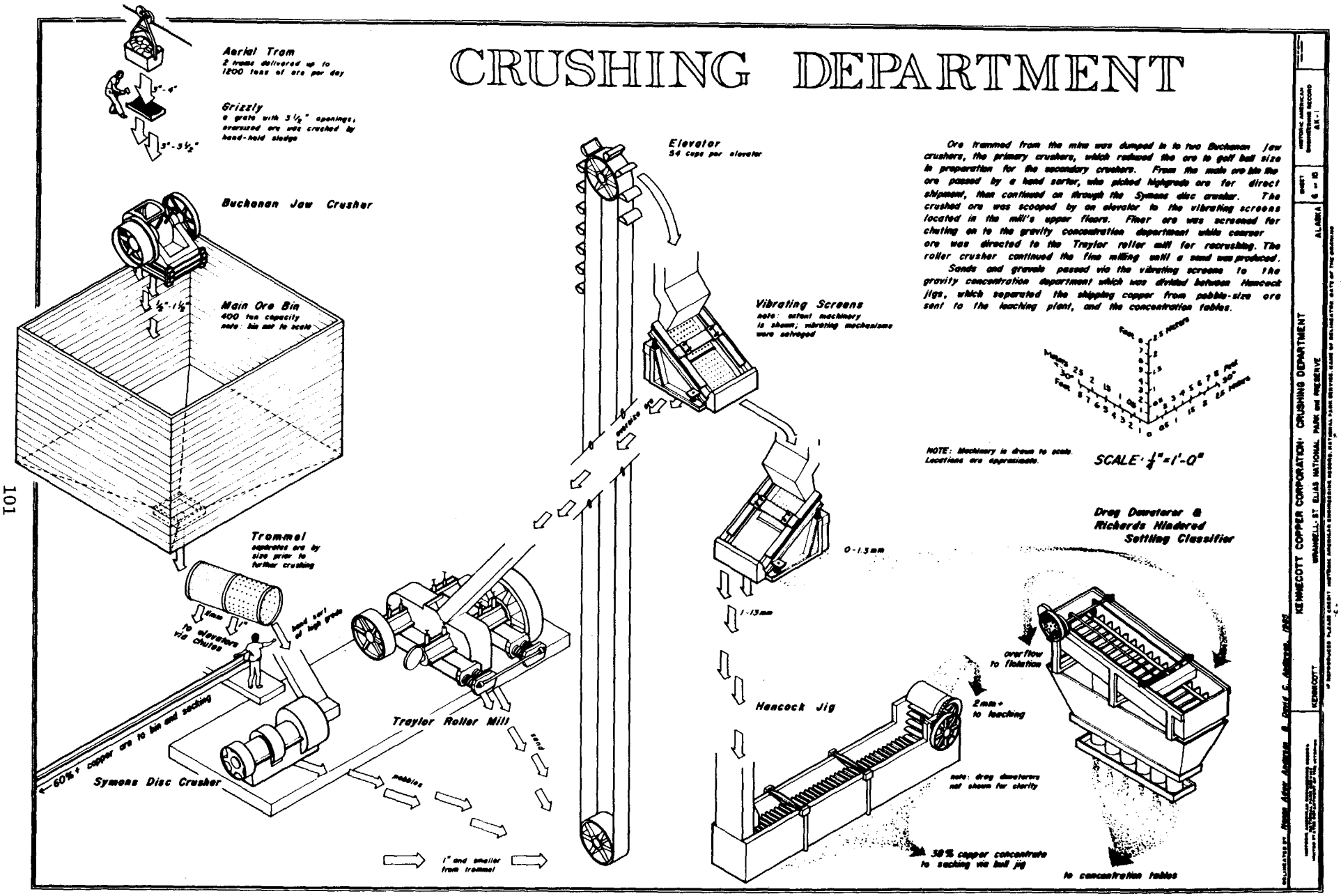
CRUSHING DEPARTMENT



Ore trammed from the mine was dumped in to two Buchanan jaw crushers, the primary crushers, which reduced the ore to golf ball size in preparation for the secondary crushers. From the main ore bin the ore passed by a hand sorter, who picked highgrade ore for direct shipment, then continued on through the Symons disc crusher. The crushed ore was scooped by an elevator to the vibrating screens located in the mill's upper floors. Finer ore was screened for chuting on to the gravity concentration department while coarser ore was directed to the Traylor roller mill for recrushing. The roller crusher continued the fine milling until a sand was produced.

Sands and gravels passed via the vibrating screens to the gravity concentration department which was divided between Hancock jigs, which separated the shipping copper from pebble-size ore sent to the leaching plant, and the concentration tables.

NOTE: Machinery is drawn to scale. Locations are approximate.

SCALE: ¼"=1'-0"

KENNECOTT COPPER CORPORATION: CRUSHING DEPARTMENT
WRANGELL-ST ELIAS NATIONAL PARK and PRESERVE
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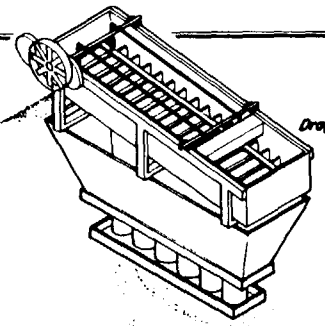
CONCENTRATION DEPARTMENT



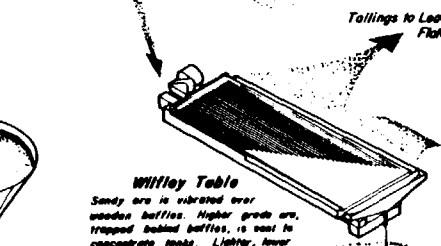
Gravity concentration of ore is a purely mechanical operation. Its purpose is to separate the ore into two portions:

1.) a small part which contains 60 to 95 percent of the valuable minerals, and

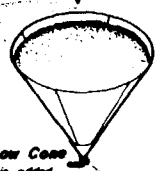
2.) a large part which can be discarded as waste.

Although concentration at Kennecott included all operations in the mill, the primary process was in the gravity concentration plant, built in 1911 and expanded through the 1920's. The sands from the crushing department arrived via the Richards Hindered Settling Classifier, which prepared the ore for the 39 concentration tables. The table's vibrating action separated the heavier metals from the lighter waste rock, which always carried with it a slight percentage of copper. The series of tables removed the copper from the waste until the point of diminishing returns was reached. Tailings were sent to the leaching or flotation plant, while the copper washed into the concentration tanks. A plug in the tank was removed and the copper concentrate slid into sacks for shipment to the smelter in Tacoma.

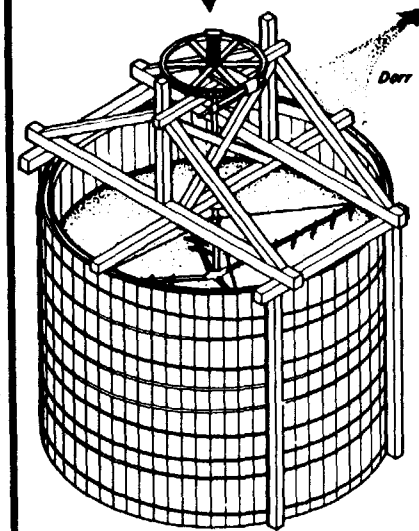
Note: Machinery is drawn to scale. Locations are approximate.

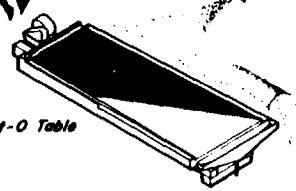


Wilfley Table
Sandy ore is vibrated over wooden baffles. Higher grade ore, trapped behind baffles, is sent to concentrate tanks. Lighter, lower grade ore is directed to further treatment.

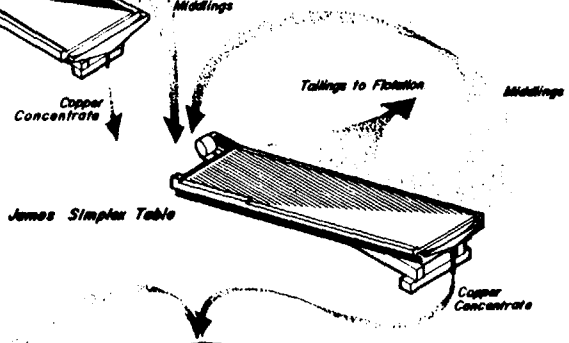


Callow Cone
Some oil is added for preliminary flotation. Overflow is sent to the Dorr Thickener for further settling. Discharge drains to Plat-O tables.

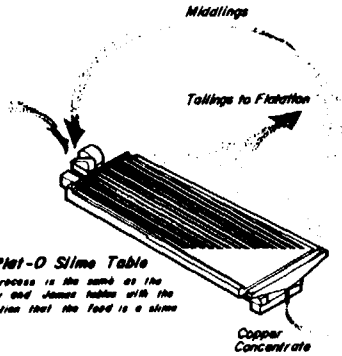




Plat-O Table



James Simplex Table



Plat-O Slime Table
The process is the same as the Wilfley and James tables with the exception that the feed is a slime.

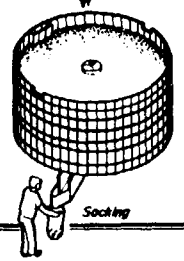
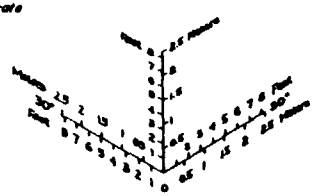


Table Concentrate Tank
Copper concentrate settles and is washed while overflow water goes to waste.



SCALE: 1" = 1'-0"

KENNECOTT COPPER CORPORATION: CONCENTRATION PROCESS
WRANGELL-ST. ELIAS NATIONAL PARK AND PRESERVE
ALASKA
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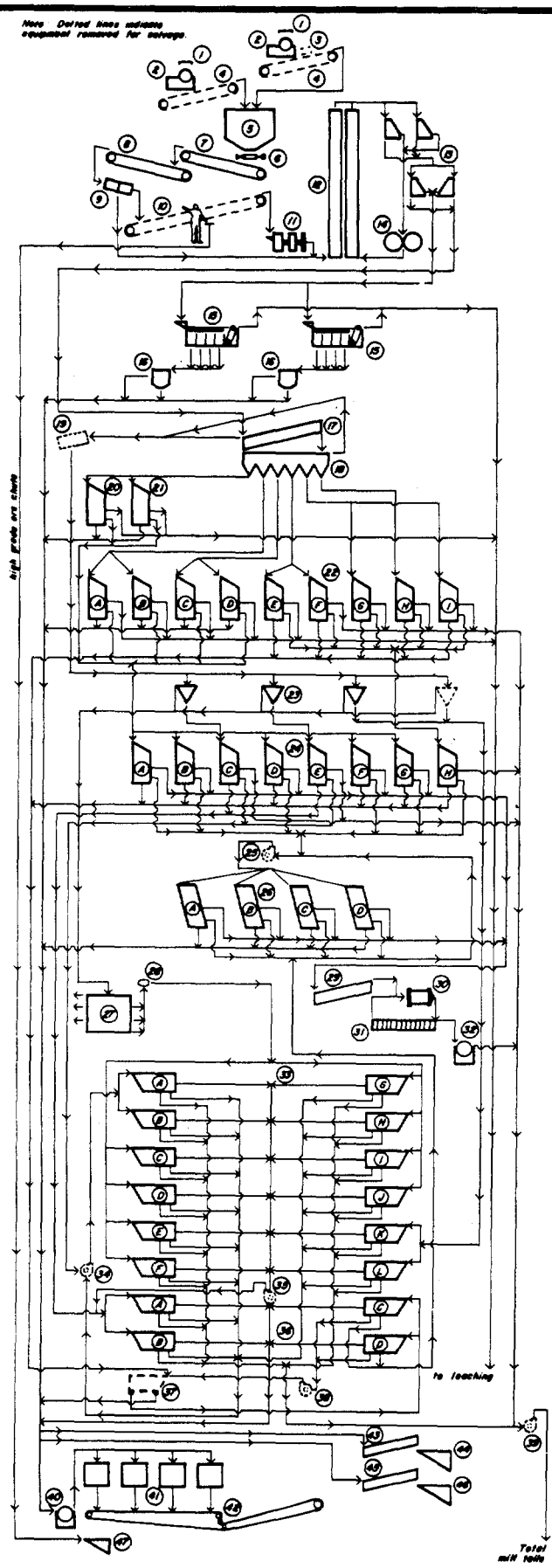

CONCENTRATION MILL - 1938 FLOW SHEET

1. 2 Grizzlies
2. 2 Buchanan jaw crushers: 13" x 24"; 250 rpm; 3 1/2" opening
3. Cobbing magnet
4. 2 Conveyors: Jumbo & Bonanza - 22" width; 5 ply;
5. Ore bin: 400 ton; 32' width; 32' length; 20' depth
6. Stevens - Adamson apron feeder
7. Conveyor: 40' length; 32" width; 5 ply; 60 fpm
8. Conveyor: 52' length; 32" width; 5 ply; 60 fpm
9. Trommel: 4' diameter; 27"-11mm; 30"-1" mesh; 16 rpm
10. Sorting conveyor: 40' length; 32" width; 5 ply; 50 fpm
11. Symons disc crusher: 36"; 335 oscillations; 135 rpm; 1" opening
12. 2 Elevators: 58' length; 18" width; 10 ply; 380 fpm; 54 cups
13. 4 Vibrating screens
14. Traylor rolls: 54" x 20"; 83 rpm
15. 2 Hancock jigs: 195 rpm; 1/8" lift; 3/8" throw; 3'-1 1/2" depth of pocket; 3'-7 1/2" width of pocket
16. 2 Harz jigs: 265 rpm; 3/4" stroke; 4 mm screen
17. Drag dewaterer: 32' length; 30" width; no. 830 chain; 3 7/8" in 12"
18. Richards hindered settling classifier; 6 spigots; 30' water head
19. Chip trommel: 5' length; 3' diameter; 16 rpm; 4mm screen
20. Wilfley table: 15/16" stroke; 3/4" in 12" slope; 258 rpm
21. Plat-O table: 13/16" stroke; 11/16" in 12" slope; 304 rpm
22. 9 Wilfley tables:

	rpm	slope per foot inches	stroke, inches
A	256	13/16	3 1/4
B	270	7/8	1
C	248	7/8	7/8
D	276	5/8	1 1/16
E	258	13/16	1 1/16
F	257	15/16	1 1/16
G	259	13/16	15/16
H	256	13/16	15/16
I	260	13/16	7/8

23. 4 Callow cones: 8' diameter
24. 8 Plat-O tables:

	rpm	slope per foot inches	stroke, inches
A	335	9/16	1/2
B	335	9/16	5/8
C	335	1/4	3/4
D	261	7/8	7/8
E	320	7/8	5/8
F	262	13/16	5/8
G	315	9/16	7/8
H	318	9/16	7/8

25. Wilfley centrifugal pump: 2"
26. 4 James tables:

	rpm	slope per foot inches	stroke, inches
A	245	5/8	3/4
B	247	5/8	3/4
C	230	5/8	3/4
D	230	5/8	11/16

27. 2-tray Dorr thickener: 20' diameter; 16' height
28. Dorr pump
29. Drag dewaterer
30. Ball mill: 4' x 4'; 30 rpm
31. Esperanza classifier
32. Frenier pump
33. 12 Plat-O slime tables: each 305 rpm; 7/8" in 12" slope; 3/16" stroke
34. Frenier pump: 48" x 6"
35. Frenier pump: 48" x 6"
36. 4 Plat-O slime tables:

	rpm	stroke, inches
A	305	3/16
B	305	3/16
C	280	7/8
D	280	7/8

37. 2 spigot classifier
38. Byron Jackson centrifugal pump: 2" x 9"
39. Wilfley centrifugal pump: 4"
40. Frenier pump: 48" x 6"
41. 4 Table concentrate tanks: 9' diameter; 5' height
42. 2 Conveyors: 25' length; 22" width; 5 ply; 14 fpm; 5 7/8" in 12" slope
43. Drag dewaterer (from Hancock jig concentrate): 26' length; 40" width; 3 7/8" in 12" slope; 12 fpm
44. Bin: 110 ton capacity
45. Drag dewaterer (from ball jig concentrate): 26' length; 14" width; 3 7/8" in 12" slope; 12 fpm
46. Bin: 140 ton capacity
47. High grade ore bin

Based on 1938 flow sheet from "Flotation and Leaching", E. J. Duggan, Engineering and Mining Journal, 1938, and on 1988 field observations

DELINEATED BY Hanna Adair Anderson & David C. Anderson, 1988

KENNECOTT COPPER CORPORATION; CONCENTRATION MILL FLOW SHEET 1938
KENNECOTT
WRANGELL-ST. ELIAS NATIONAL PARK and PRESERVE
ALASKA
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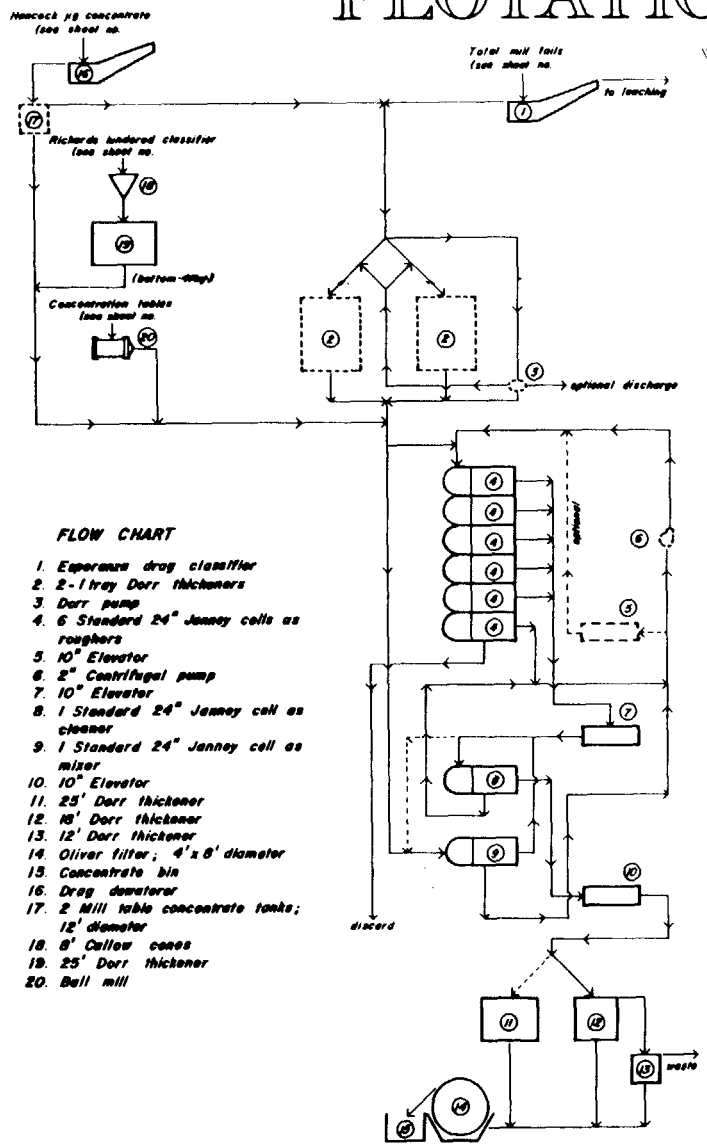
HISTORIC AMERICAN ENGINEERING RECORD AK-1

FLOTATION DEPARTMENT



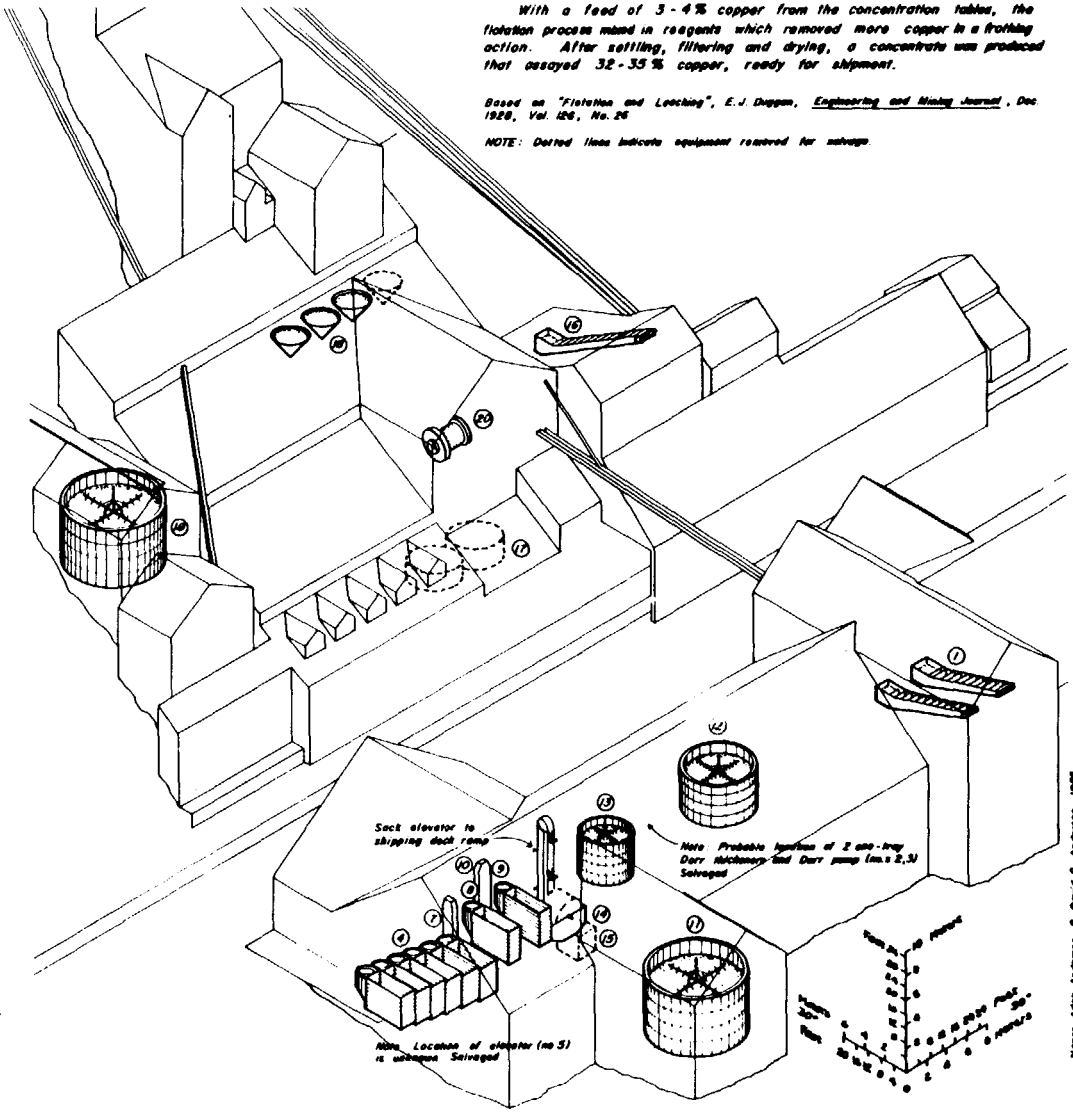
FLOW CHART

1. Esperanza drag classifier
2. 2-I tray Dorr thickeners
3. Dorr pump
4. 6 Standard 24" Janney cells as roughers
5. 10" Elevator
6. 2" Centrifugal pump
7. 10" Elevator
8. 1 Standard 24" Janney cell as cleaner
9. 1 Standard 24" Janney cell as mixer
10. 10" Elevator
11. 25' Dorr thickener
12. 18' Dorr thickener
13. 12' Dorr thickener
14. Oliver filter; 4'x 8' diameter
15. Concentrate bin
16. Drag dewaterer
17. 2 Mill table concentrate tanks; 12' diameter
18. 8' Callow cones
19. 25' Dorr thickener
20. Ball mill

With a feed of 3-4% copper from the concentration tables, the flotation process mixed in reagents which removed more copper in a frothing action. After settling, filtering and drying, a concentrate was produced that assayed 32-35% copper, ready for shipment.

Based on "Flotation and Leaching", E.J. Duggan, Engineering and Mining Journal, Dec 1928, Vol. 126, No. 26

NOTE: Dotted lines indicate equipment removed for salvage



SCALE: 1/8"=1'-0"

KENNECOTT COPPER CORPORATION; FLOTATION PROCESS
WRANGELL-ST. ELIAS NATIONAL PARK PRESERVE
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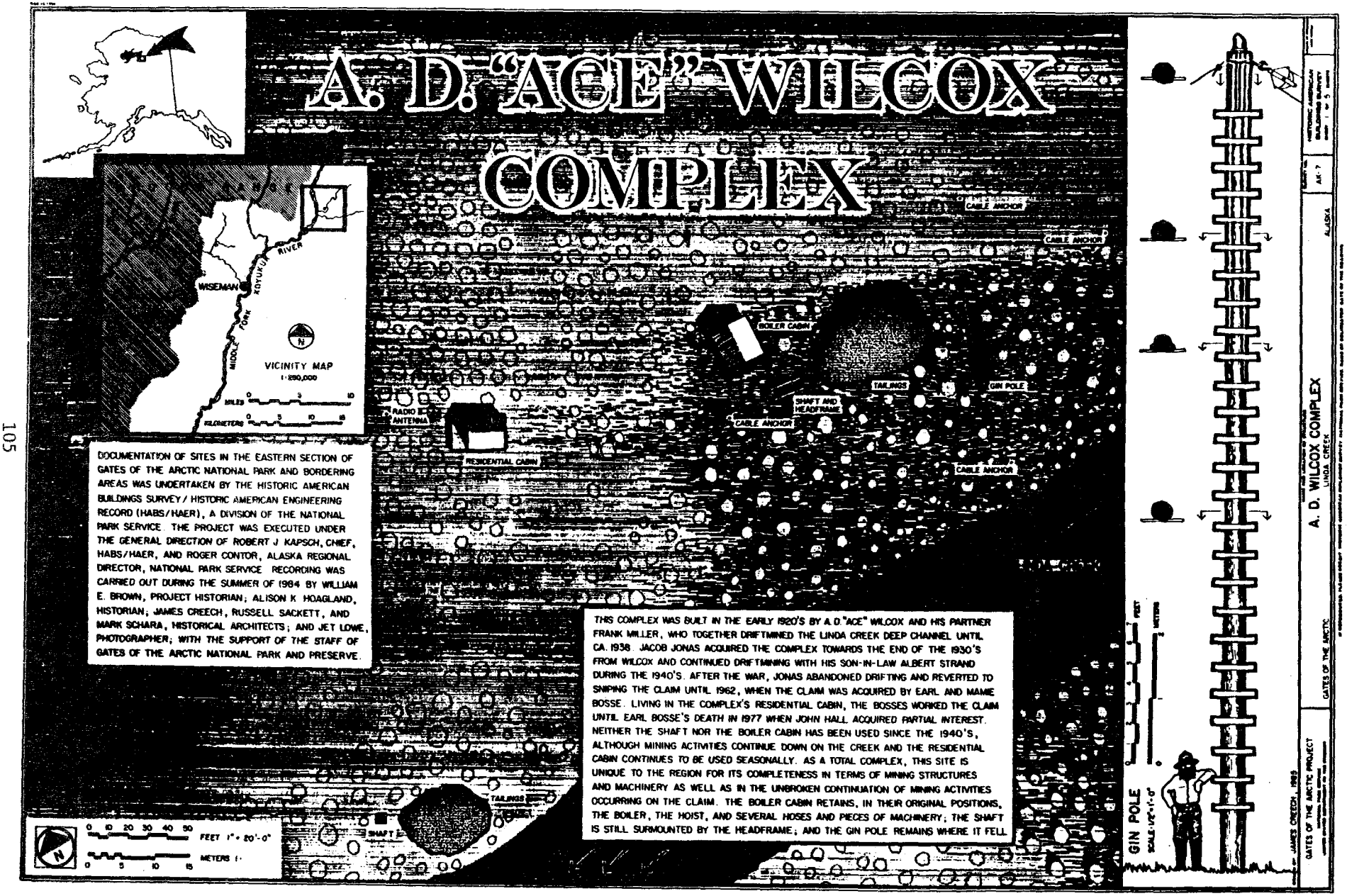
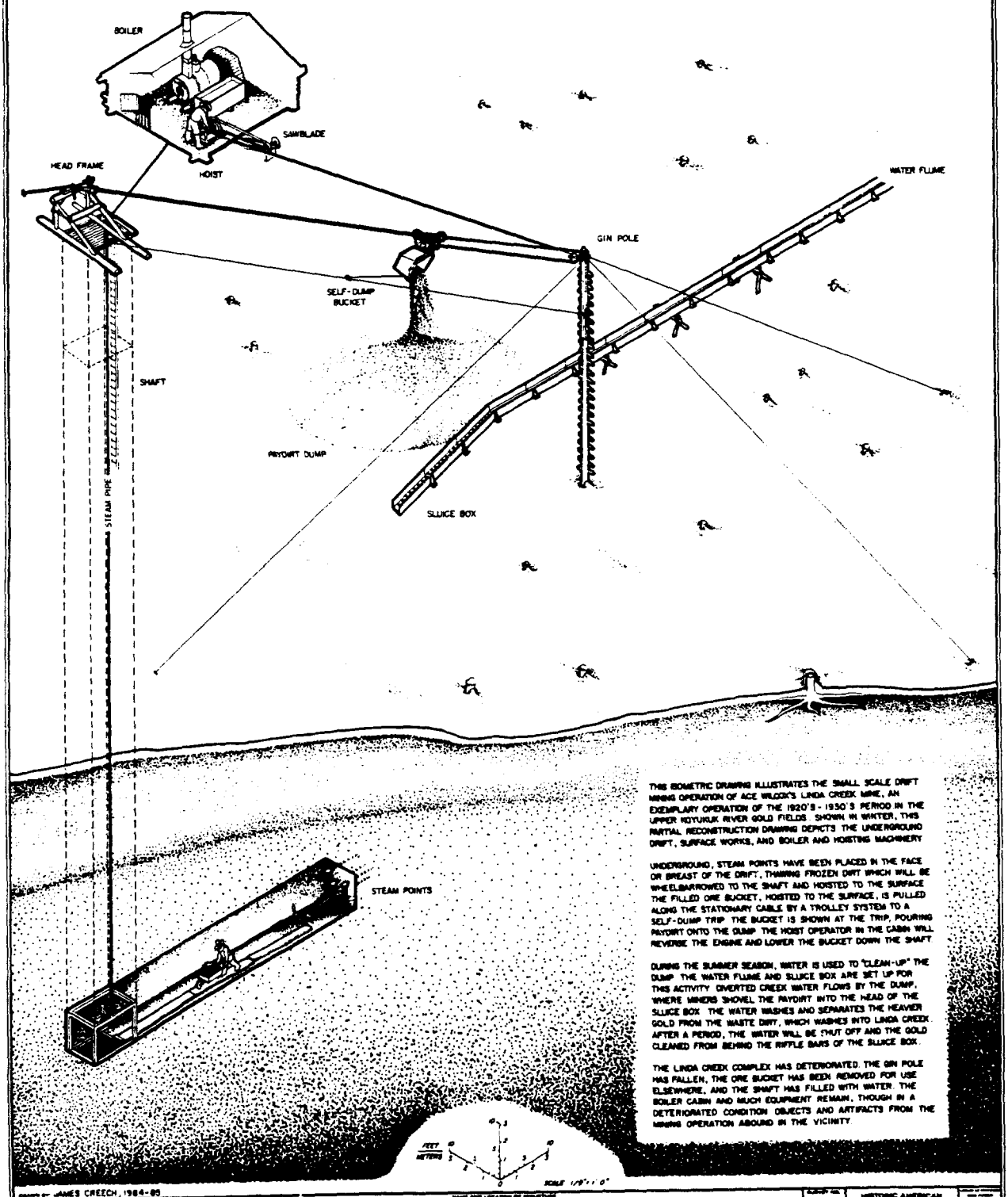

A. D. "ACE" WILCOX COMPLEX
VICINITY MAP
1:250,000
WISEMAN
KOYUKUK RIVER
MIDDLE FORK
MILES
KILOMETERS
DOCUMENTATION OF SITES IN THE EASTERN SECTION OF GATES OF THE ARCTIC NATIONAL PARK AND BORDERING AREAS WAS UNDERTAKEN BY THE HISTORIC AMERICAN BUILDINGS SURVEY / HISTORIC AMERICAN ENGINEERING RECORD (HABS/HAER), A DIVISION OF THE NATIONAL PARK SERVICE. THE PROJECT WAS EXECUTED UNDER THE GENERAL DIRECTION OF ROBERT J. KAPSCH, CHIEF, HABS/HAER, AND ROGER CONTOR, ALASKA REGIONAL DIRECTOR, NATIONAL PARK SERVICE. RECORDING WAS CARRIED OUT DURING THE SUMMER OF 1984 BY WILLIAM E. BROWN, PROJECT HISTORIAN; ALISON K. HOAGLAND, HISTORIAN; JAMES CREECH, RUSSELL SACKETT, AND MARK SCHARA, HISTORICAL ARCHITECTS; AND JET LOWE, PHOTOGRAPHER; WITH THE SUPPORT OF THE STAFF OF GATES OF THE ARCTIC NATIONAL PARK AND PRESERVE.
CABLE ANCHOR
CABLE ANCHOR
BOILER CABIN
TAILINGS
GIN POLE
SHAFT AND HEADFRAME
RADIO ANTENNA
CABLE ANCHOR
RESIDENTIAL CABIN
CABLE ANCHOR
THIS COMPLEX WAS BUILT IN THE EARLY 1920'S BY A.D. "ACE" WILCOX AND HIS PARTNER FRANK MILLER, WHO TOGETHER DRIFTMINED THE LINDA CREEK DEEP CHANNEL UNTIL CA. 1938. JACOB JONAS ACQUIRED THE COMPLEX TOWARDS THE END OF THE 1930'S FROM WILCOX AND CONTINUED DRIFTMINING WITH HIS SON-IN-LAW ALBERT STRAND DURING THE 1940'S. AFTER THE WAR, JONAS ABANDONED DRIFTING AND REVERTED TO SNIPING THE CLAIM UNTIL 1962, WHEN THE CLAIM WAS ACQUIRED BY EARL AND MAMIE BOSSE. LIVING IN THE COMPLEX'S RESIDENTIAL CABIN, THE BOSSES WORKED THE CLAIM UNTIL EARL BOSSE'S DEATH IN 1977 WHEN JOHN HALL ACQUIRED PARTIAL INTEREST. NEITHER THE SHAFT NOR THE BOILER CABIN HAS BEEN USED SINCE THE 1940'S, ALTHOUGH MINING ACTIVITIES CONTINUE DOWN ON THE CREEK AND THE RESIDENTIAL CABIN CONTINUES TO BE USED SEASONALLY. AS A TOTAL COMPLEX, THIS SITE IS UNIQUE TO THE REGION FOR ITS COMPLETENESS IN TERMS OF MINING STRUCTURES AND MACHINERY AS WELL AS IN THE UNBROKEN CONTINUATION OF MINING ACTIVITIES OCCURRING ON THE CLAIM. THE BOILER CABIN RETAINS, IN THEIR ORIGINAL POSITIONS, THE BOILER, THE HOIST, AND SEVERAL HOSES AND PIECES OF MACHINERY; THE SHAFT IS STILL SURMOUNTED BY THE HEADFRAME; AND THE GIN POLE REMAINS WHERE IT FELL.
TAILINGS
SHAFT
0 10 20 30 40 50 FEET 1" = 20'-0"
METERS 1:
0 5 10 15
GIN POLE
SCALE: 1/2"=1'-0"
FEET
METERS
JAMES CREECH, 1985
GATES OF THE ARCTIC PROJECT
GATES OF THE ARCTIC
A. D. WILCOX COMPLEX
LINDA CREEK
ALASKA
AK-7

DRIFT MINING
1920 - 1930



THIS ISOMETRIC DRAWING ILLUSTRATES THE SMALL SCALE DRIFT MINING OPERATION OF ACE WILCOX'S LINDA CREEK MINE, AN EXEMPLARY OPERATION OF THE 1920'S - 1930'S PERIOD IN THE UPPER KOYUKUK RIVER GOLD FIELDS. SHOWN IN WINTER, THIS PARTIAL RECONSTRUCTION DRAWING DEPICTS THE UNDERGROUND DRIFT, SURFACE WORKS, AND BOILER AND HOISTING MACHINERY.

UNDERGROUND, STEAM POINTS HAVE BEEN PLACED IN THE FACE OR BREAST OF THE DRIFT, THAWING FROZEN DIRT WHICH WILL BE WHEELBARROWED TO THE SHAFT AND HOISTED TO THE SURFACE. THE FILLED ORE BUCKET, HOISTED TO THE SURFACE, IS PULLED ALONG THE STATIONARY CABLE BY A TROLLEY SYSTEM TO A SELF-DUMP TRIP. THE BUCKET IS SHOWN AT THE TRIP, POURING PAYDIRT ONTO THE DUMP. THE HOIST OPERATOR IN THE CABIN WILL REVERSE THE ENGINE AND LOWER THE BUCKET DOWN THE SHAFT.

DURING THE SUMMER SEASON, WATER IS USED TO "CLEAN-UP" THE DUMP. THE WATER FLUME AND SLUICE BOX ARE SET UP FOR THIS ACTIVITY. DIVERTED CREEK WATER FLOWS BY THE DUMP, WHERE MINERS SHOVEL THE PAYDIRT INTO THE HEAD OF THE SLUICE BOX. THE WATER WASHES AND SEPARATES THE HEAVIER GOLD FROM THE WASTE DIRT, WHICH WASHES INTO LINDA CREEK. AFTER A PERIOD, THE WATER WILL BE SHUT OFF AND THE GOLD CLEANED FROM BEHIND THE RIFFLE BARS OF THE SLUICE BOX.

THE LINDA CREEK COMPLEX HAS DETERIORATED. THE GIN POLE HAS FALLEN, THE ORE BUCKET HAS BEEN REMOVED FOR USE ELSEWHERE, AND THE SHAFT HAS FILLED WITH WATER. THE BOILER CABIN AND MUCH EQUIPMENT REMAIN, THOUGH IN A DETERIORATED CONDITION. OBJECTS AND ARTIFACTS FROM THE MINING OPERATION ABOUND IN THE VICINITY.

DRAWN BY: JAMES CREECH, 1984-85

GATES OF THE ARCTIC PROJECT

GAAR

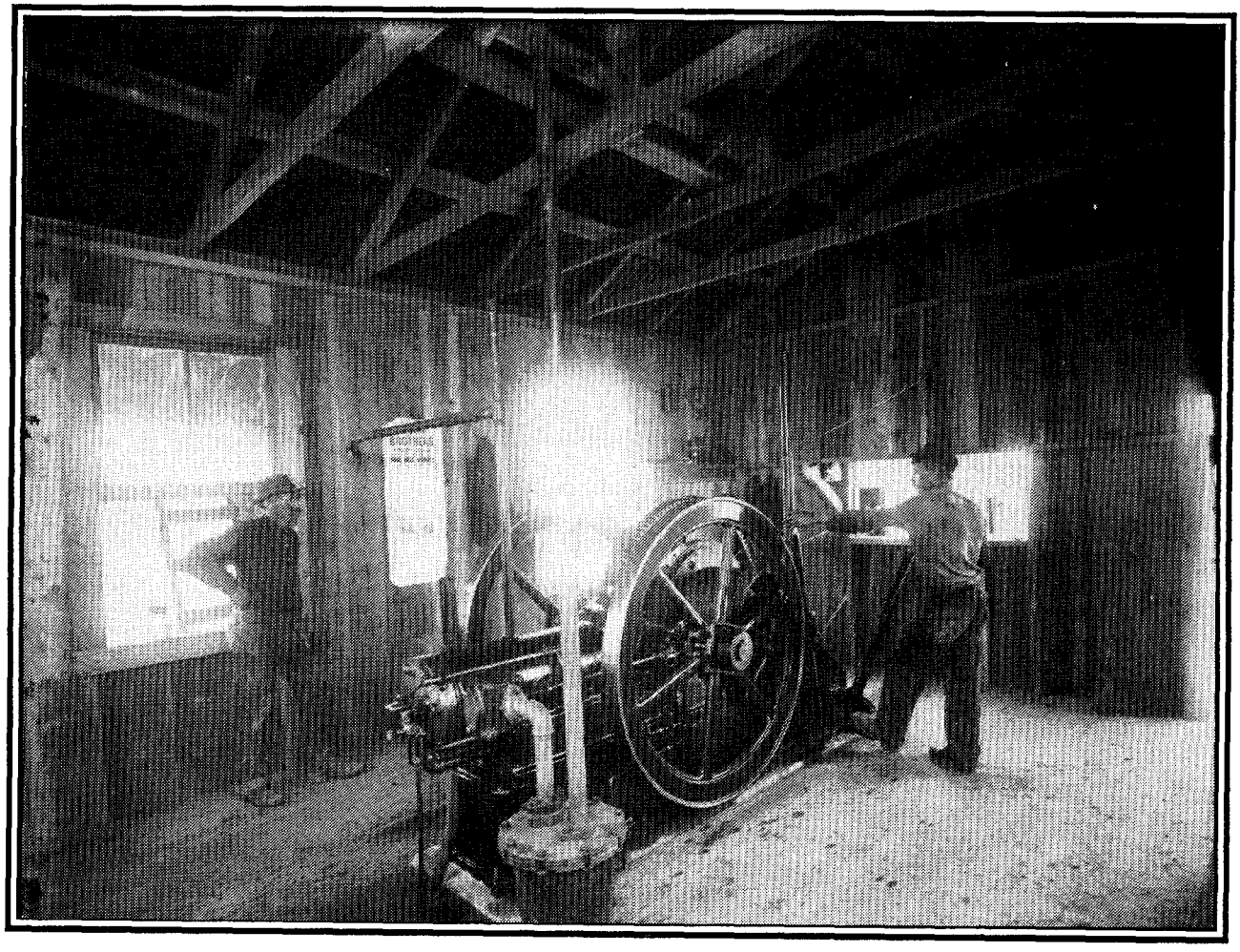
A.D. WILCOX COMPLEX
LINDA CREEK, WISEMAN VICINITY

ALASKA

AK-7

HISTORIC AMERICAN ENGINEERING RECORD

MANAGEMENT & INTERPRETATION



Interior of Angel Camp hoist house with "distillate" engine. Photo courtesy of the Arizona Historical Foundation, Spude Collection, Tempe.

PRESERVING AND INTERPRETING OUR MINING HERITAGE: IMAGINATION AND PARTNERSHIP

James B. Thompson, Superintendent
Rocky Mountain National Park
Estes Park, Colorado

Mining has played an important role in the history of exploration, settlement, development and economic growth of the United States. With a few notable exceptions, our mining heritage is preserved primarily through neglect, and interpreted in a very random way through museums and a few sites where active properties have been turned into tourist attractions. There are many reasons why this should be the case. Industry has not often been much interested in preserving a heritage. Rather, its efforts with a few exceptions have been geared to public relations. On the other hand, the antagonism between mining and environmental protection has generally placed preservationists and industry in a non-constructive relationship. The history of liability issues has placed both land managers and mining companies in non-preservationist roles.

It will take some creative formulas, relationships and alliances to arrest the loss of our mining heritage, and to tell that story to the American people in a constructive historical context. The following are considerations for the management of mining properties for the purposes of historic preservation and interpretation of the mining heritage for the public. These are considerations that should be evaluated in planning and implementing such a program.

LEGISLATIVE PURPOSE OR MISSION

The land manager must be concerned with the legislative purposes of the reservation. It is that legislative purpose which identifies the primary mission of the reservation he or she manages. The context or role of both active and historic mining properties will be determined by that mission. In the case of the National Park System, each area is established by a specific Act of Congress or Presidential proclamation, so it cannot be assumed that there is a single policy toward mining and mining resources which suits all areas. However, the National Park Service enabling legislation of 1916 places a policy umbrella of protection over natural and historic resources. This is an overall guiding principle for National Park System managers, although it may apply differently to different areas due to the specific legislative purposes and judicial rulings.

MANAGEMENT OPTIONS FOR ACTIVE PROPERTIES

If the specific mission of a reservation authorizes mining and gives the land manager some role in management of mining, then some specific objectives relating to the area's mission should be explicitly articulated and widely shared. Where historic values of past mining activity exist they should be evaluated in relation to these objectives. When the objectives include preservation of these features, the manager may find it even more difficult to protect them than natural resources for several reasons. They are most likely to be in the way of mining operations, their constituency is relatively small, they are susceptible to both accidental and deliberate destruction, and they are nonrenewable. On the other hand, someone in company managenent may have a strong affection for the history of the company or of the site and can be an ally of preservation when it gets in the way of other company objectives and concerns.

If the land manager has a plan approval or permitting role, preservation of historic properties should be a consideration. If it is primarily or secondarily within the area's mission, it should be listed as one of the land manager's objectives in setting or negotiating terms.

MANAGEMENT OPTIONS FOR INACTIVE PROPERTIES

The land manager's options for inactive properties vary widely based on the status of ownership of surface and mineral rights. Although not as immediately threatened, such properties are more prone to vandalism. There is also less leverage that can be applied on the owner, and the owners are often

multiple and absentee. Where the land manager holds surface rights, they should be exercised to protect the area's mission values. Validity examinations and other legal tools are available to protect those values which may include the historic evidences of the previous mining activity.

SAFETY AND PUBLIC USE

There are at least three kinds of public safety hazards that are of concern to both land managers and miners. One is the obvious hazard of mining operations. Another is the hazard of abandoned shafts, adits, tunnels, etc. A third type is the buildings, machinery, dumps, tailings, toxic materials, etc. When mining properties are on public land or are surrounded by it there will be public use problems. Putting up "keep out" signs may protect the owners but it doesn't protect the public. The public perceives that it has rights on publicly owned lands regardless of the legal rights conveyed by mining laws, regulations, etc. Land managers and miners alike need to be responsible in protecting the public from harm, and to do so through constructive actions.

LEGAL ISSUES AND LIABILITY

Closely tied to public safety are the questions of liability. Unfortunately, the positive actions for protecting the government and owner from liability, or the public from harm, have resulted in the loss of historic resources. Blocking a mineshaft is generally considered a constructive action. The destruction of structures and machinery, however, is not necessarily the only solution to reducing liability. It is simply the most convenient.

Several years ago I was briefly involved in an effort to get permission from a major company for access to one of the best-preserved old mines and mills that I know of in Colorado. The purpose of access was to record the structures both photographically and through measured drawings before they collapsed from the weight of time and high country snows. The proposal was vetoed by company lawyers on the basis of liability. No imagination was applied, no effort to find a solution, not even the recognition that their professed legal argument was, in this case, probably invalid. The result is, or will be a very sad loss of our heritage.

In another instance I was personally preparing a set of drawings of a large partially collapsed stamp mill, on behalf of a historical society. A small company was preparing to obliterate the site for their operations. The mine manager not only gave me access but assisted my efforts. I'm sure the company attorneys were never consulted. The building is no longer standing but the drawing provides a historical record for the future.

RANGE OF PRESERVATION OPTIONS

There are, of course, well-known preservation options. They range from benign neglect, to graphic documentation, to stabilization. These are the standard approaches of historic preservation professionals. As a philosophical enemy of standardization, I would urge that where standard approaches are unsuited or unacceptable, imaginative approaches that achieve a desirable end should not be automatically rejected because of the means. Governmental entities often are more commited to the means than to the end.

RANGE OF INTERPRETIVE OPTIONS

If there is one area where preservationists and miners are often closest together, it is in their polarization against public use and appreciation, albeit for different reasons. Yet this I believe is the area where the greatest opportunities for preservation lie. Both preservationists and miners have a lot to gain by bringing about greater public understanding. If it can be accepted that the purpose of preservation of resources is for the appreciation and enlightenment of the public and future generations, rather than for the pleasure of the profession, then the options for preservation and public support begin to open. The Viking Center developed by Anthony Gaynor in York, England, is probably anathema to some archeologists because of its Disneyesque approach to site interpretation. But the public is learning about the Vikings, about the site, and about the science of archeology because the interpreter has bridged the gap between what interests the scientists and what interests the layman.

People are relatively astute in recognizing propaganda. And pure commercial tourist attractions generally produce a purely commercial response, as opposed to a learning experience. Those who develop the interpretation need to beware of the temptation to focus so much on movement and things that their meaning and place in history is lost. At the other extreme, museums generally do a better job as archives than as interpreters.

If I were to interpret historic mining in the ideal manner, I would start with a different concept of a museum. It would be a dispersed site museum which would be an evocation of the entire spectrum of the culture of the mine and mining camp. People would ride on a rail system through full scale exhibits of movement, sound and smells. Not only would they learn, but their respect for the people, the industry, the processes, the history and its relics would be immeasurably enhanced. Of course such an approach is expensive and would require capital and payback. However, as the Viking Center and industries such as Corning Glass and Hershey's Chocolate demonstrate, people will pay to take the tour, and they want to learn. The point is that a full range of interpretive and educational options should be considered.

RANGE OF FUNDING OPTIONS

Preservation costs money. So does good interpretation. If miners, preservationists and land managers could all come to recognize and embrace some common interests, rather than letting differences set the tone of all relationships, some good things could be accomplished. All three parties could benefit a great deal from better public understanding and appreciation. There are really a lot of ways to fund projects that enhance preservation, public safety, respect for historic properties and understanding of modern and historic industry. As long as each party considers such projects someone else's role, not much will get done. Combinations of fund sources, such as government, industry, donations, grants and loans can turn small amounts of available dollars into an amount large enough to do preservation/interpretation projects. For example, the Harmony Borax Works restoration and stabilization work in Death Valley was jointly funded by industry, a non-profit organization, the National Park Service and the State.

The revenue potential of large-scale projects should not be ignored as part of the funding solution. The keys to funding are the same as the keys to preservation and interpretation--imagination and partnership.

INTERPRETATION AND MANAGEMENT OF KLONDIKE GOLD RUSH NATIONAL HISTORICAL PARK

Clay Alderson, Superintendent
Klondike Gold Rush National Historical Park
National Park Service
Skagway, Alaska

Skagway was an Alaskan frontier boomtown, located on the primary route to the Klondike gold-bearing regions. To clarify a common misconception, there are no mines in or near the Pacific coast town of Skagway or even within the Klondike Gold Rush National Historical Park. Skagway was established in 1887 because its founder, Captain William Moore, believed that gold would someday be discovered in the interior of Alaska or in the Yukon Territory. Ten years later this speculation proved prophetic as a huge gold strike was made on Bonanza Creek, a tributary of the Klondike River. In 1897 Captain Moore's homestead was suddenly overrun by tens of thousands of gold-hungry stampeders making their way to the Klondike, 500 miles distant in Canada.

Skagway has survived to the present time as a transportation link between coastal Alaska and the interior via the White Pass and Yukon Route Railroad. The town prospered during the Klondike gold rush of 1897-98 and flourished for about 18 months as the wildest boom town in the West, described by one observer as "little better than a hell on earth." The town matured with the commercial gold mining that continued after the initial stampede.

Until recently, ore concentrate was hauled from the Klondike by truck 220 miles to the rail head in Whitehorse, then shipped by rail the remaining 110 miles to Skagway. When rail transportation was no longer feasible, the ore was hauled in large specially-designed trucks the entire 330 miles from the mine to Skagway. Later, mines in the Cassiar region of British Columbia yielded tons of asbestos which were hauled to Skagway by rail for barge shipment to southern ports for processing. In the late 1960's large deposits of lead, zinc, and copper were discovered near Faro, Yukon Territory, and again the closest port for shipment was the port of Skagway.

Skagway's role as an entrepot, however, was at first uncertain. The long established Chilkoot trail, which for years had carried Native people and a few early prospectors and explorers to the interior, was the most popular route to the Klondike. Over 20 thousand stampeders chose to cross the Chilkoot in the winter of '97 and '98. The boom-town of Dyea, five miles up the coast from Skagway, sprang up on the tidal flats near the old Healy and Wilson trading post at the head of the trail. Stampeders climbed the steep inclines bordering the Taiya river, establishing the towns of Canyon City and Sheep Camp along the way. At the summit the Northwest Mounted Police established a check point where travelers were required to check in with a ton of goods sufficient to sustain their existence for one year in the gold fields.

The parallel White Pass trail began at Skagway and was developed to offer stampeders an easier alternative to the rigorous Chilkoot trail. The trail was a disaster for men and meant a tortuous and agonizing death for thousands of horses and pack animals during that winter of 1897 and 1898. Although the summit was lower than the Chilkoot and the grades were gentler, overloaded animals broke through the thin mantle of solid footing to jagged rocks beneath, breaking their legs and ripping open their bellies and were left to die on what came to be known as the "dead horse trail."

Jack London wrote of the trail, "the horses died like mosquitoes in the first frost and from Skagway to Bennett they rotted in heaps. They died at the rocks, they were poisoned at the summit, and they starved at the lakes; they fell off the trail, what there was of it, . . . in the river they drowned under their loads or were smashed to pieces against the boulders; they snapped their legs in the crevices and broke their backs falling backwards with their packs; in the sloughs they sank from fright or smothered in the slime; and they were disemboweled in the bogs where the corduroy logs turned end up in the mud; men shot them, worked them to death and when they were gone, went back to the beach and bought more. Some did not bother to shoot them, stripping the saddles off and the shoes and leaving them where they fell.

Their hearts turned to stone--those which did not break--and they became beasts, the men on the dead horse trail."

The White Pass trail was replaced by the Brackett wagon road, which by the end of the gold rush was realigned and stabilized and fitted with a pair of shiny steel bands and for ninety years has carried the trains of the White Pass and Yukon Railway. With the railway, Skagway's future was assured.

Skagway is prospering once again from its role in mining and the gold rush of 1897 and 1898. The National Historic Sites Survey recognized the significance of Skagway for its importance in Alaska's turn-of-the-century gold rushes and the town and historic trails were designated a National Historic Landmark in 1962. Congress authorized the Klondike Gold Rush National Historical Park in 1976 to "preserve in public ownership for the benefit and inspiration of the people of the United States, historic structures and trails associated with the Klondike gold rush of 1898." The city council designated downtown Skagway a local historic district to recognize the historic value of the buildings and to protect the integrity of Broadway as a gold rush artifact.

INTERPRETIVE THEMES

The Klondike gold rush was so global in its impact upon the American economy and upon the consciousness of the world that the focus of interpretive themes has taken on a linear aspect not found in any other unit of the national park system. The Skagway story is told in three segments in and around the town. Park-owned lands along the White Pass trail are currently undeveloped and largely unexplored.

In addition to the story of boom-town Skagway there are sites in Seattle, Washington, and in Canada's Yukon Territory that tell other important chapters in the history of the gold rush. In Seattle, another park tells the story of the economic panic that gripped the "lower 45" near the end of the nineteenth century and how the gold rush turned economic depression into a financial boom that established Seattle as the preeminent port city in the Pacific Northwest.

Beyond the Chilkoot summit lies Canada. The Canadian park service has managed the north end of the Chilkoot trail since the mid-1970s. A plan to establish the area as a Canadian national historic park was approved in 1988 and park officials expect to have most of the facilities constructed within the next seven years.

Parks Canada also manages the Klondike historic sites which include Dawson, the town spawned by the gold rush, and properties along the Klondike River and Bonanza Creek where gold was discovered in 1896 and mined until the early 1960s. The historic buildings of Dawson, like Skagway, have been preserved and restored to give a flavor of the gold rush to the modern day surroundings.

In Skagway the interpretive focus is centered on the park visitor center. The facilities are housed in the former depot and baggage room built for the railroad in 1898. The building was abandoned in the late 1960s due to its severe disrepair. The condition of the structure continued to deteriorate until 1982 when the National Park Service began work on a complete restoration for visitor center purposes and for administrative office space.

Interim exhibits were installed in 1985 to provide an orientation to the gold-rush theme to an ever-increasing number of visitors. The orientation includes a 30-minute film entitled "Days of Adventure, Dreams of Gold," which makes excellent use of historic photographs to illustrate the rigors of life on the trail to the gold fields. In the summer park interpreters conduct guided walks through the historic district to better acquaint visitors with the gold rush story.

To preserve the gold rush appearance of Skagway and to add to our interpretive capabilities sixteen historic buildings were purchased from private owners. Since Skagway has never been swept by fire most of the buildings date back to the gold rush. The buildings are in the process of being rehabilitated for modern uses. Rehabilitation includes state-of-the-art interiors with an exterior facade representing the period 1898-1911 when the buildings were primarily used. Five buildings have been leased to private individuals for retail business purposes. The most recent award was for use of the Hern liquor store and the Pacific Clipper Steamship Company office. With several years of leasing experience and an expanded

tourism economy in Skagway the park is gaining rapport with the business community. This offering had five prospective lessees competing for the use of the building. With earlier offerings we were lucky to get one offer.

Four of the buildings are designated for interpretive purposes. Exhibits are being prepared for the visitor center to portray the themes of the discovery of gold, transportation through boom-town Skagway, historic and modern uses of the Chilkoot trail, and orientation to the gold rush. The Mascot Saloon, scheduled for completion in September 1989, will tell the story of city life. It will be equipped with a bar of the exact style and manufacture as the original and gaming tables and paraphernalia that were either known to exist in the building or of the type that might logically have been there. The William Moore cabin, the first structure to have been built on the beach at the mouth of the Skagway River, has been completely restored and serves as a monument to the founding of the town and of the foresight of Captain Moore.

Bernard Moore's house is also scheduled for restoration with an exhibit depicting family life in Skagway as the gold boom passed and the town became a more suitable place for families and there were good paying jobs with the railroad. There is excellent photographic evidence of the appearance of the interior of the Moore's living room which will enable exhibit specialists from the National Park Service interpretive design center in Harpers Ferry, West Virginia, to create the ambiance of the frontier Victorian frame residence.

Photographs have been an important part of the research that has gone into learning what the town and its individual component buildings looked like during the early days. Being one of the first events of worldwide importance to take place after the invention of the portable camera, there was great interest in recording the events of the gold rush on film. Many of these photographs, taken by professionals and amateurs alike, have found their way into the archives of the various libraries and research centers where gold rush history is being recorded and preserved.

Each year our visitor center at Skagway receives leads on sources where information, photographs, journals, and items of gold rush importance can be found. These leads are not the painstaking work of researchers and historians but are the result of a sign prominently displayed in the visitor center requesting visitors who know of someone who was part of the gold rush and who left some record of that involvement to provide a name and address where this information can be obtained. This has led to volumes of information that fill many gaps in our information files. This information would be lost were it not for the cooperation of people who retain an interest in an event that predated our present generation by less than 50 years.

MANAGEMENT ISSUES

On the management side, Klondike Gold Rush National Historical Park has suffered through some growing pains as most new parks do. In 1982 the park was beset with public controversy over how lands within the authorized boundary should be managed. That same year the railroad lost the contract to haul ore and was forced to cease operations. People who were openly antagonistic about park development were then faced with the choice of leaving town to find work or staying in Skagway to work on the newly expanding park construction crew. It was a bitter pill for some, but former opponents have become the most supportive of park operations.

Of the nearly thirteen thousand acres of land that make up the park, over 10,000 acres belong to the state of Alaska. The state Park system is currently overburdened with management responsibilities but is reluctant to turn the land over to the National Park Service for fear of public criticism. In the meantime all maintenance and visitor services on the Chilkoot trail are accomplished by National Park Service employees at a cost of thousands of dollars annually. As a tenant which can be displaced from the state land on 30 days written notice, the National Park Service will find it difficult to continue such an active responsibility indefinitely. The memorandum of understanding giving the National Park Service authority to manage the trail will be renegotiated in 1989. We will make a strong argument for the state to transfer all state-owned lands within the authorized boundaries of the park to the National Park Service.

In the downtown Skagway historic district park-owned properties are scattered throughout the district. This frequently brings park management policies into play when dealing with the city and private owners

of lands adjacent to park properties. An annual cash payment is made to the city to offset costs brought about by the existence of a park in the town. This is not "payment in lieu of taxes" but is a negotiated annual payment for services provided by the city. In addition, park employees have been active in the volunteer fire department, emergency medical response team, city council, and other volunteer and elected capacities.

In all, the amalgamation of city and park ebbs and flows like the tides in the Upper Lynn canal. Currently there is a great deal of cooperation and trust being shown by both entities. Issues and actions, however, can spark controversies which keep managers alert and keep city council members faithful to their constituencies.

The final irony may be that the mining boom-town that has no mine may yet be done in by--what else?--ore. Recent tests conducted throughout the city reveal that the prolonged transshipment of the lead and zinc ore has left areas of town contaminated with the heavy metals. Blood testing reveals that the imminent risk to public safety may be minimal. The clean-up, however, could become an environmental catastrophe. The harbor is polluted by lead and shellfish have lead residue in their muscles far above the acceptable level. Gardens may have to be abandoned or have topsoil replaced. Lead compounds will have to be removed before they oxidize into the soils to a depth that could threaten the very water that we drink.

The asbestos that once supported Skagway's economy is also a threat to its continued well-being. As piles of asbestos-laden sludge dredged from the harbor dry out, microscopic fibers are dispersed into the air. The health threat is obvious but a solution has not been proposed.

For the town that has no mines, mining and its recollections and residues continue to play the major role in determining Skagway's destiny.

CASE STUDY: PRESERVING AND INTERPRETING THE RUSH HISTORIC DISTRICT, BUFFALO NATIONAL RIVER, ARKANSAS

Suzanne Rogers, Park Historian
Buffalo National River
National Park Service
Harrison, Arkansas

The Rush Historic District is a 1300-acre zinc mining area within the boundaries of Buffalo National River, a National Park Service area in Arkansas. The district was entered on the National Register February 27, 1987, after a rather up and down existence in the development planning for Buffalo National River.

Buffalo National River was established March 1, 1972. The early planning documents for the river, as well as the final Master Plan approved in 1975, identified the Rush area as a significant historic resource for the park, and stated that the area would have interpretation and protection. This was easier said than done, however, for the bulk of the Rush area was still in private hands, purchased in the 1960s by a Kansas City businessman from the remnant ownership of the Morning Star Mining Company--which, despite the cessation of mining fifty years earlier, had held on to the property. It was rumored that the Kansas City man planned to make an amusement park out of the old mining area. If true, no evidence of his plans were ever seen, and the old "ghost town" continued to deteriorate from weathering and vandalism, so much so that by 1978 the original park plans to save the structures had been scrapped and replaced with a policy of "benign neglect."

The Rush area is contained in a narrow tributary valley of the Buffalo River. It can be divided into three sections: the Morning Star "ghost town area"; a mid-section which belonged to other mining ventures; and the river frontage mining areas. The river frontage area was acquired first for the park; here limited park visitor services were made available: continuation of a popular river access point; a primitive campground; and a contact ranger station. In 1978, with the purchase of the mid-section of the valley, the first permanent ranger was stationed in Rush and given living quarters in the privately-remodeled Hicks General Store, dating to 1916. The on-site ranger presence ended with the record-high flood of December 1982, which destroyed the contact station and flooded the residence.

In 1983 the most visible portion of Rush--the Morning Star lands--were brought under federal ownership. Real decisions had to be made about the area's preservation. Rush had always been a popular mecca in the region--for rockhounds, history buffs, university geology classes, the media, and recreational visitors intrigued by the sense of discovery of the valley's mining remnants. It was becoming more and more obvious that the preservation and interpretation of Rush could not be put on a shelf. In 1984 a Historic Structure Report was begun for Rush. Based on the draft's initial findings, the Southwest Region Office of the National Park Service approved the first preservation work in the valley: stabilization of the 1886 smelter and the 1890s livery barn. This was accomplished in the summer of 1985 by the National Park Service's Southwest Region historic preservation team. Visitors to Rush were amazed to see these structures rise out of the weeds again.

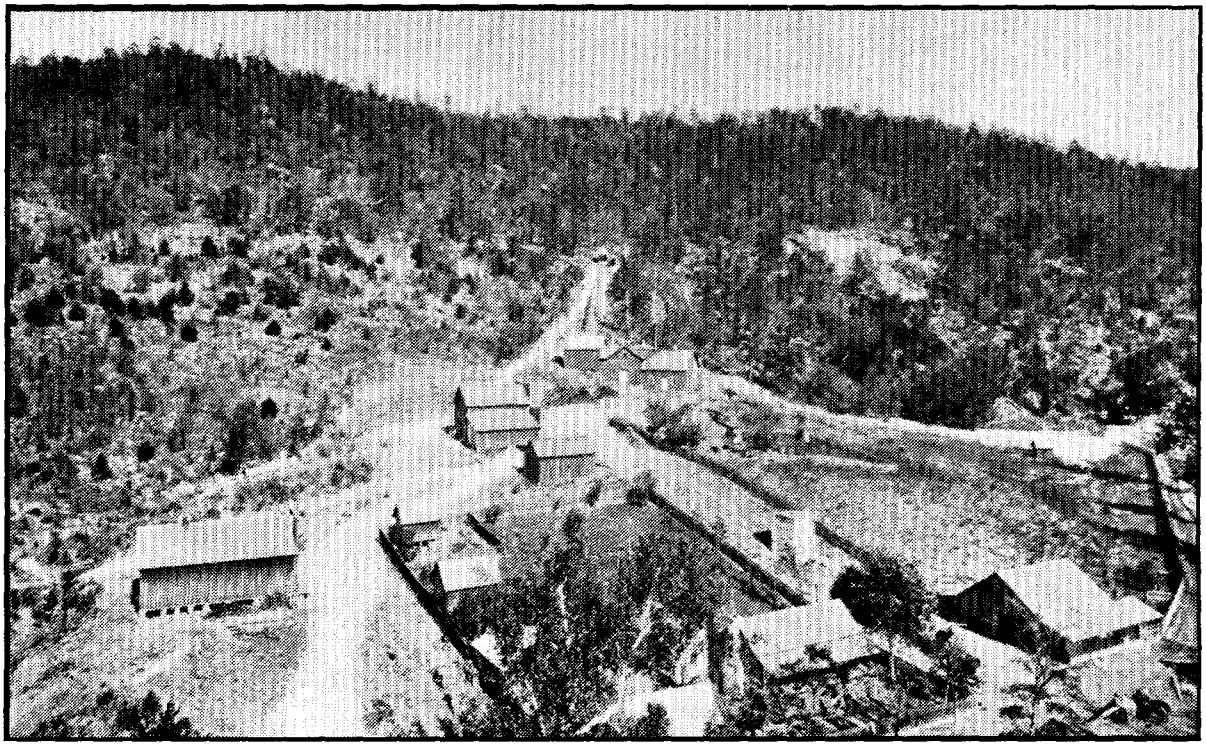
The draft Historic Structure Report recommended that Rush had National Register eligibility. After more than a year of wordmanship, Rush was found eligible for the Register based on Criterion A, for its part in the development of Arkansas's mineral resources; Criterion C, for the cohesive unity of the overall mining landscape remains; and Criterion D, for its ability to yield further information about mining technology of the period and community life. It also enjoys a regional reputation as the only mining ghost town in the area.

Management at Rush has gone full circle again. From benign neglect, the standing structures are being treated to limited stabilization and historic building maintenance. This, coupled with an expanding program of visitor interpretation, has brought Rush out of a place of memories to an area which should once again come alive for visitors. To do this, though, will require balancing the intricate threads of

historic site management, multi-recreational use, and preservation decisions for an area which is eighty percent ruins and archeological sites.

THE HISTORIC DISTRICT

Rush is the site of the original discovery of zinc ore in the Arkansas Ozarks and served as a significant contributor to development of the state's mineral resources, as well as to regional economic development. Rush was the "granddaddy," the place to which potential investors went for a first look; it continued as a regional leader in zinc ore production into the 1920s. When the Morning Star's zinc carbonate sample won a gold medal at the 1893 Chicago World's Fair, national fame resulted. Rush's mining was unique in the tri-state lead and zinc area: a fault zone contributed to an ore zone which could be reached by tunnelling rather than shafts, so much so that some accounts waxed eloquently about "quarrying" the ore. Only zinc was ever mined at Rush--despite the hopes for silver which led to the construction of the old rock smelter. By World War II even the free-ore mining had ceased, a status which remained, except for a short-lived mine reopening in the late 1950s. A resident population remained at Rush until the late 1960s. Three families still reside near the park boundaries.



Morning Star Mining Company, Rush Historic District, Buffalo National River, Arkansas.
Photo courtesy of Suzanne Rogers, National Park Service.

The historic district encompasses almost all of the original Rush mining district, with the exception of some land still in private ownership. In all, three town areas and thirteen mining companies operated in the Rush district from the 1880s to the 1930s. The historic isolation of the Rush valley, which plagued the mining companies' transportation of ore to markets, continues today and is a contributing factor to the integrity of the overall landscape. The Morning Star area contains the only standing structures (with the exception of the remodeled Hicks store), but this is a significant grouping of structures which are very characteristic of the Rush story: the 1886 smelter dating from the earliest mining ventures; the house row and general store from the 1899 and World War I boom periods; and the blacksmith shop from the

1920s revival of mining. The frame structures are now shells, but even without totally intact exterior walls they retain integrity of design. Not even modern plumbing ever graced their interiors. The standing structures, along with the collective ruins and sites, provide a complete pattern of technological development and responses to problems of environment, as well as a look at community development and needs.

Also included within the district are the various tunnels, shafts and prospects of the mining eras, fences, and historic transportation systems--both for vehicles and for resources, such as water. Bits and pieces of the Rush story lie everywhere, in the undergrowth and up and down the steep slopes. The overall site has a great deal to tell about the mingling of mining facilities with community life, of the solutions of problems of terrain, power supply, and isolation. Nine large concentrating mills, ranging from wood-fueled to oil, boomed their presence in the small valley. Piers, foundations, pipe, and portions of brick boiler rooms, accessory pump houses and rock houses all remain for a glimpse at the mining technology of the 1880s to the 1920s, as well as site modifications from the 1930s and 1950s. Until the recent closing of the mines by the park for safety considerations, the mines themselves were a significant resource for regional universities and the source of a number of academic papers.

PRESERVATION AND INTERPRETATION--THE PROBLEMS AND SOME SOLUTIONS

Preservation and interpretation at Rush are guided by some very tangible concerns. Foremost is that Rush is a multi-use recreational area and will continue to be managed as such. Concurrent with visitor use is the overriding consideration of safety--both that of the visitors encountering the mining landscape structures, ruins, and mines, and that of the impact on the landscape by the visitor. Secondly, the terrain itself poses particular problems of accessibility and maintenance.

Rush is popular for canoeing, fishing, johnboating, hiking, horseback riding (the Lower Wilderness Trail system begins at Rush), rockhounding (not allowed but a pre-park use which will still need to be regulated), camping, and casual sightseeing. The only vehicle access to Rush is by the historic roadway, which runs today, as it did in the past, through the middle of the community area. Visitors wishing to view the structures and ruins, or reach the hiking trail, contend with the river access traffic, which in the summertime is considerable.

Safety remains a paramount concern. For this reason the mines have been fenced and signed, and all access is forbidden. This has been detrimental to the researchers accustomed to using the area, but was deemed necessary in the light of unstable rock conditions. Also for safety, the house row of the ghost town had to be fenced off from visitor approach, both for the safety of visitors and the preservation of the structures. Some of the visitor safety problem was relieved when poorly-constructed shed additions built by occupants of the 1950s and 1960s, were removed. A preservation plan will consider how to provide access to the houses. Emergency stabilization of foundation piers and framing, preservative treatment for exterior wood and metal roofs, as well as removal of encroaching vegetation, continues by the park maintenance division. Given the deterioration of the buildings, any additional work would be verging on restoration and would be impractical. Architecturally, the five houses and general store offer individual building styles characteristic of the Ozarks of the early twentieth century and are an important part of the Rush story. Preservation of the building remnants should be a prime consideration.

All interpretation and preservation at Rush are dependent on keeping the landscape visible. If anything has impacted the integrity of the landscape it is the problem of constant revegetation. Even in one season greenbriers and poison ivy, new-growth sumac and cedar can obscure old foundations and surround standing structures, making both identification and interpretation difficult. Much of the initial vegetative clearing at Rush was accomplished by youth groups such as the Youth Conservation Corps (YCC) and a local high school group. They cleared around the standing structures, removed vegetation from old foundations in the Morning Star area, and brushed footpaths. This clearing needs to continue or even driving tours of Rush will be reduced to views dense vegetation.

A sense of discovery has contributed to visitor interest in Rush; it is this flavor which we want to preserve. As much as possible, visitor access routes follow the historic roads and footpaths. Structures and ruins will remain accessible as long as visitor impact is not detrimental. The mines will remain closed, however, unless a way can be found to safely open one of the tunnels. The Morning Star area is the focus of formal interpretation, both because of the greater variety of resources it offers, and

because of its distance from river recreation uses. With only a road-width to work with in the narrow valley, it was necessary to make a small pull-out parking area in the Morning Star tailings to provide off-road parking. From this point visitors can walk a roadside path to the smelter and livery barn, and continue on to other ruins via the hiking trail. An interpretive sign orients the visitor. In summer, a park ranger leads tours in the Morning Star area. Eventually, interpretive leaflets will provide a self-guiding driving tour and walk. A hiking trail which incorporates natural features can also be reached at the Morning Star for those interested in the overall area resources.

But what about the numerous other mining sites, most of which are ruins, buried in the valley's vegetation? Field mapping was done in conjunction with the Historic Structure Report, but new pieces of foundations or anchor bolts continue to turn up. A historic foot trail connects some of these features, as well as following the mine level. For the present, the others remain as discovery sites, until the impact of visitation on the fragile remains can be assessed and regulated, although for now, visitors are not forbidden to walk off trails (however the terrain in summer has its own limiting factors). Some river sites face potential impact from future park recreational access development. For example, piers of the old White Eagle mill already abut the present river landing parking area. Piers of two other mills are just off the campground. The campground itself is both a prehistoric archeological site, and a historic site--the location of early pioneer settlers and the World War I era mining boom town for the district. Although few above-grade remains are left, development at the campground and landing will be dependent on the outcome of present archeological contract studies.

Interpretation potential at Rush is tremendous. A good collection of historic photographs from the mining period and a core collection of oral histories will augment that interpretation. But Rush is more than the National Register periods of mining significance. Rush has a story of 10,000 years of human history. Although emphasis will be on the mining history, recreational visitors at Buffalo National River will be introduced to the past links in Rush's landscape: prehistoric Indian, pioneer farmer, miner, early recreational user. And hopefully will discover the weaving of human activity within the natural resource.

BIBLIOGRAPHY

Adams, George I. *Zinc and Lead Deposits of Northern Arkansas.* United States Geological Survey, Professional Paper 24, Washington, D.C.: Government Printing Office, 1904.

McKnight, Edwin. *Zinc and Lead Deposits of Northern Arkansas.* United States Geological Survey, Bulletin 853. Washington, D.C.: Government Printing Office, 1935.

National Park Service. *Final Master Plan, Buffalo National River, Arkansas.* Approved 1975.

National Park Service. *Development Concept Plan, Rush Area, Buffalo National River, Arkansas.* Approved 1985.

National Register nomination, Rush Historic District. Prepared by Suzanne Rogers. Entered February 27, 1987.

Rogers, Suzanne. "Historic Structure, Morning Star Area" report. In draft, 1985. National Park Service.

BLACK DIAMOND MINES: DEVELOPMENT OF AN HISTORIC MINING AREA

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Black Diamond Mines is a 3,649-acre Regional Preserve. It is one of 50 parks administered by the East Bay Regional Park District, a 65,000-acre, two-county park agency on the east side of California's San Francisco Bay. The Preserve is located approximately 35 miles northeast of San Francisco.

Black Diamond is both a natural and historic preserve. Its location in a transition zone between moist coastal and dry inland valley climates provides an environment that supports a wide variety of plants and animals, including several rare and endangered species. Marine sandstones and shales pushed up to steep angles by the emergence of nearby Mt. Diablo form a rugged topography that clearly shows millions of years of geological development and makes it an outstanding geological classroom.

The Preserve's historical importance is the result of almost 100 years of mining activity. Black Diamond is the site of the Mt. Diablo Coal Field, California's largest coal mining development. From the early 1850s to the turn of the century, mining operations supported five towns and three railroads. More than a dozen mines supplied coal to the rapidly expanding urban and industrial centers of the San Francisco Bay area. The mines had produced almost 4 million tons of coal by the time increasing production costs, competition from higher quality Washington Territory coal, and the advent of oil as an industrial energy source forced closure in the early 1900s. Underground mining was resumed in the early 1920s, this time to produce high quality glass and foundry sands. Production totaled almost one million tons when sand mining ended in the late 1940s.

When the Park District began acquisition of the Preserve in 1974, the mines were the area's greatest historic asset and also its greatest liability. Rapid urban expansion had brought population centers close to the abandoned workings and the mining area had become a de facto recreation area. Thousands of young "explorers" were drawn to the mines, where at least ten lost their lives and many more were injured. Asphyxiating gasses were the cause of most fatalities, and falls down connections between underground mining levels accounted for most injuries. Even as deterioration in the old workings created ever-worsening structural conditions and serious air quality hazards, their popularity increased.

The Park District's highest priority in developing the Preserve was, and still is, the closure of openings into the more than 200 miles of underground workings. Since mining company records are virtually non-existent, the initial closure project involved extensive ground searches, guided by a geological reconnaissance of the area and information researched from sources such as the California Division of Mines and Geology, the California Mines Index in San Diego, and the University of California's Bancroft Library. As openings were discovered, records were made of their location, original ownership, functional designation, condition upon discovery, and potential historic resource value. The same recording process is still used for newly-discovered openings.

MINE CLOSURES

When openings have been identified and recorded, site-specific closure designs are developed. Closure design and construction is complicated by the Preserve's rugged terrain and the necessity that the work be done with minimum damage to natural and historic resources and, at the same time, be resistant to the skillful and determined efforts of local youth to regain access. Vandals have knocked down, cut through, and excavated around closures; in one case jackhammering through 12 inches of reinforced concrete and cutting through a 3-inch steel bridge grate to reopen a popular area of the workings that was the site of four deaths and several serious injuries over a six year period.

Closure design varies considerably from site to site, owing to the variety of opening types, the often unstable condition of the sandstones and shales in which they are located, and the difficult access created by the rugged topography. Whatever their construction details, however, the designs fall into two categories: ventilating and solid.

Ventilating closures are some form of steel grate set into a reinforced concrete collar. They are installed to maintain air quality in underground areas open to public use and, to the extent practical, to abandoned areas where subsidence, erosion or vandalism might create new access into the workings. In a few instances, ventilating closures are installed to provide Preserve visitors with a view of the underground, irrespective of the need to maintain air flow. Gates are built into some closures to provide access for research, rescue, and maintenance work.

Solid closures are some form of barrier that completely blocks visual and physical access. Reinforced concrete cast-in-place or beam-block walls are commonly used where construction access is not too great a problem. At more difficult locations, rubble-form concrete walls minimize transportation problems by using on-site rock as forming and to add bulk. Where rock structure near the surface is badly degraded, walls are installed in stable material as far underground as necessary and the area is back-filled to daylight. This technique avoids the possibility of a new opening occurring immediately behind the closure structure.

Overall mine safety and reclamation expenditures to date total $1,265,000. Of this amount, $1,101,000 has been funded by the Dept. of the Interior, Office of Surface Mining (OSM), and $255,000 has been funded by the Park District. Closure construction continues at a rate of two to three projects per year as erosion, subsidence, or the failure of decades-old closures creates new openings into the workings. The Park District has maintained a perfect safety record on mined lands under its control.

TECHNICAL AND CULTURAL HISTORY

Concurrent with the original mine closure project, research began on the area's technical and cultural history. Initial technical studies were associated with the mine closure project, which established the extent of the mined area and the location of individual mines. This was followed by underground field work to record the nature and progression of mining methods and technical details such as transportation, ventilation, and ground control systems. An effort to find living miners who had worked in the mines during either the coal or silica sand phases of the operations and who might be able to provide first-hand knowledge of these matters was virtually unsuccessful. The investigations involved re-establishing access to several of the earliest mined areas of the coal and sand workings.

Eventually, one coal mine and one sand mine were chosen for more detailed study. This study consisted of mapping the entire mine and researching the progression of the development, the geology, and the technical details specific to that operation. In the case of the coal mine, the hazardous condition of the workings made it necessary to develop information from written documentation, surface evidence, study of the structural geology, and information gained from the study of accessible mined areas throughout the Preserve. The majority of the geological research was carried out under the direction of Dr. Raymond Sullivan of San Francisco State University. Research into the area's technical history is continuing as part of the process of designing the Underground Mining Museum being developed at the Preserve.

Investigation of the mining area's cultural history has consisted of a major archaeological dig directed by Dr. James Deetz of the University of California, Berkeley, Archaeology Department, and the on-going work of the Preserve's Naturalist staff. The archaeological excavations were centered on the residential area of Somersville, one of the two largest communities on the Coal Field. The work of Preserve staff is centered on developing an audio and videotape record of former coal field residents, developing a library of written documentation and photographs, and administering an accessioning program that organizes and safeguards an ever-growing collection of thousands of artifacts. Information gathered during these investigations is the basis for interpretive programs and displays that provide Preserve visitors with an accurate picture of the mining area's historical importance and the lives of the people who lived that history.

PUBLIC ACCESS AND INTERPRETATION

When initial mine hazard abatement and historical research had been completed, work began on developing the mines for recreational, research, and educational use. This development has taken two forms: the rehabilitation of several limited underground areas that provide access to representative examples of the area's mining technology or geologic history; and the development of the Underground Mining Museum, an extensive underground facility containing replicated examples of typical coal and sand mining operations.

Several relatively limited underground areas have been discovered that contain good examples of the area's geologic or mining history and that require a minimum of rehabilitation to be made safe for access. Eight of these areas located throughout the Preserve are currently available to unrestricted public access and four more are available to historians, geologists and other interested professionals by prior arrangement. The extent of the areas varies from Jim's Place, a small underground dwelling extending about 15 feet underground, to Stewartville Prospect, an 1860s exploration tunnel providing a 400 foot cross-section of the geologic formation containing the sand and coal beds. Development work typically consists of removing caved material to improve access and air flow and doing the ground control work necessary to insure safety. The underground access these areas provide make them popular destinations for Preserve visitors.

In addition to the limited underground areas, an extensive area in one of the sand mines is being developed as the Underground Mining Museum. The museum will consist of replications of a typical sand mine circa 1945 and a typical coal mine circa 1865, as well as a single large underground room that will serve as a reception and auditorium area and as a location to house displays that would be out of place in the period mine replications.

The mines were chosen as the Preserve's interpretive focus because of their central influence on the economic and social life of the mining communities. Recreated underground workings where visitors would be literally inside the display were chosen as the best method of providing an immediate experience of the mines. In order to maximize their effectiveness, both the coal and sand mine sections of the museum are being developed to represent entire mining operations, from portal to face, in the most accurate possible form. Displays involving cultural and natural history will be limited to the 10,000 square foot underground room being developed as a more traditional museum facility.

The biggest museum development problems have been technical and design difficulties involving historical accuracy. The technical problems involve creating accurate representations of 45- and 120-year-old active mines in forms that are safe for public access and usable as interpretive facilities. While methods have been devised to hide or disguise most modern engineering features, interpretive aids such as the lighting of significant features and visitor safety items such as walkways and railings invariably require compromises in historical accuracy.

Design problems involve creating faithful representations of the two mining operations in the absence of comprehensive design models. The preferred development plan would have entailed recreating specific mining operations at specific points in time. This was not possible because of the lack of detailed information about underground operations at any given time, and the necessity of using the workings as they exist today with a minimum of major engineering alterations. The alternative was to develop "typical" mining operations from both eras. The drawback of this generic approach is that without a detailed historic record to serve as a guide (and final arbiter), the final product could simply be an entertaining underground hike, rather than represent anything that ever existed. Without constant attention to the historic record, the museum could become a designer's vision of what mines should have been, if only they had been there to design them properly; or a marketing expert's idea of what would be most entertaining to the visitor; or a repository for unrelated mining artifacts.

The first of three phases of museum development, the replica silica sand mine, is currently operational on a limited basis and is serving about 10,000 visitors per year. Research, engineering and basic site development work is in progress on Phases II and III, the coal mine replication and the reception, auditorium and display area. More than 30,000 square feet of workings are currently available to public access or viewing. This area will be increased to over 45,000 square feet when the museum is complete.

AN INTRODUCTION TO HISTORIC MINING DITCHES (WATER CONVEYANCE SYSTEMS)

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Many aspects of historic mining are of interest to the archaeologist; among them are the physical remains and information potential of mining sites. Several of the papers delivered at the Historic Mining Workshop have focused on individual mines and their internal features. This paper, composed in three parts, presents some of the physical variability and information contained in one mining feature, water conveyance systems. The first section presents historical and componential information about ditches built in the 1850s to 1880s in California's "gold country," particularly in Tuolumne County. The second section discusses some of the socio-economic and other changes which resulted from the ditches. Included in this section is a list of some of the kinds of archaeological sites which are found adjacent to ditches. The final section contains a brief discussion of a few management issues which might be involved in the treatment of ditches.

FEATURES AND HISTORY OF DITCHES

Context

When gold was found at Sutter's Mill on the American River in 1848, few could have predicted the vast changes the discovery would bring to California and the world. The gold-bearing deposits of the western Sierra Nevada helped bring about the 1848-49 Gold Rush, a mass and rapid infusion of an estimated 100,000 people. Much of the landscape of more than 3000 square miles in the Sierra foothills has seen some sort of mining or temporally-related activity. Parenthetically, when archaeologists record historic mining sites in the foothills, an appropriate research strategy includes discussion of historic landscape features, rather than sites and boundaries.

The richest deposits of gold were found in a region which typically receives 20-30 inches of precipitation a year. Almost all processes of placer mining, save dry washing or winnowing, require large quantities of water; the high specific gravity of gold makes water basic to the recovery process (Young 1970). Consequently, most early placer mining was done near or in drainages during the spring and early summer, when there was a ready supply of water. By about 1853, only four years after the first discovery of gold, most of the easily retrievable metal was gone. To make matters worse, just when the gold was harder to find, the foothill counties of California experienced a drought. These two factors, decreasing quantities of free gold and the need for vast quantities of water, spurred the development of large-scale water storage and conveyance systems. It is these mining features, the ditches, which are briefly presented now.

History

Ditches occupy an important place in California mining. Indeed, it may be said that without them the mines of the state would be relatively insignificant. At least four-fifths of the gold is obtained with the assistance, direct or indirect, of ditch water (Browne 1869:179) .

One of the first attempts to bring water via ditch to the gold miners occurred in March, 1850, at Coyote Hill in Nevada County (Bowie 1891). By late 1850, most of the major mining communities up and down the foothills had begun exploration of the Sierran rivers and many had commenced construction of ditch systems. Water is seasonal in the Sierra Nevada, and flows as long as the snows melt; it is not uncommon to see dry river beds in late August. Thus, the ultimate goal of the water companies was to provide the miners with a year-round supply of "white gold", their name for precious water. One of the earliest and most successful companies with the greatest longevity was the Tuolumne County Water Company.

In 1851, the Tuolumne County Water Company was organized in the knowledge that water would be needed to supply the miners. Guided by their resourceful engineer, Englishman John Wallace, the men

of the company planned to bring water, by ditch and flume, from the South Fork of the Stanislaus River some 25 miles east in the mountains to the town of Columbia. This ambition was quickly accomplished and water was stored at the ditch wellhead in Lyons Reservoir. Eventually this system was expanded in Tuolumne County to include more than 400 miles of ditches, built by 15 companies.

While ditches were important before 1853, they became big business with the invention of the monitor and the advent of hydraulic mining. As early as 1852, Antoine Chabot used a hose to wash gravel into his sluice box (Coleman 1952:108), followed by Edward E. Mattison who attached a rawhide hose to his ditch and washed the earth with water forced through a wooden nozzle (Bowie 1891). By the early 1860s, more than 730 companies had built nearly 6,000 miles of conveyance systems at a cost of $16 million dollars (Paul 1947). While the figures quoted here vary from author to author, the important thing is that no single miner could afford to build ditches of any length or volume. Water companies and consortia were formed. Pacific Gas & Electric Company, for example, which supplies energy to much of northern California, was formed from as many as 520 separate water companies, many of which had their origin in the California Gold Rush (Coleman 1952:93).

Mining, together with irrigation and domestic uses, continued to be the central purpose of the ditch system until the late 1880s. Many of the ditches were not in good repair, the post-gold rush consumers of water being less affluent than the gold miners of the past. By the 1890s, economic stability and technological advances allowed for a greater exploitation of resources and a hydroelectric phase of development. The demand for electricity to provide power and light meant that existing water sources, the ditches and reservoirs, had to be repaired. Many of the ditches that were improved during the boom period of hydroelectric development survive. In Tuolumne County, for example, the mining ditches supply a majority of the domestic and agricultural water used today. This is one of the important aspects of mining ditches--while most were built to assist the miners, the ultimate value was to agriculture and residential settlement.

GENERAL FEATURES OF MINING DITCHES

Early mining ditches were usually earth-berm, constructed by hand with picks and shovels, and flowed by gravity using flumes or inverted siphons to carry water across major drainages. Flumes were also often necessary in the higher elevations, where water had to be conveyed around the face of vertical granitic cliffs. In this case, flumes were hung by iron slings and braces, spikes and guy wires; other flumes were supported by trestles. Pipelines and tunnels were also used to convey water.

Ditches employed various release mechanisms, including spillways, to decrease head, divert water in case of downstream accidents, or release excess water, snow, or ice. Differences in construction are frequently displayed. For example, to defray maintenance costs and facilitate construction, ditches dug in the higher elevations were often deeper and narrower than those found below the snow line.

Bowie (1891:135,136) lists some of the construction principles of California mining ditches:

> (1) The source of supply should be at sufficient elevation to cover the greatest range of mining ground at the smallest expense...
> (2) An abundant and permanent supply of water during the summer months should be secured.
> (3) The snow line, when possible, should be avoided, and the ditch, especially in snow regions, located so as to have a southern exposure.
> (4) All water-courses on the line of the ditch should be secured; their supply partially counteracts the loss by evaporation, leakage, and absorption, and frequently furnishes an additional quantum of water during several months of the year.
> (5) At proper intervals waste-gates should be arranged so as to discharge the water, when necessary, without risk of damage to the ditch...
> (6) Ditches, when practicable and the cost not being excessive, should be preferred to flumes.

The grade and capacity of the ditches varied with location and ultimate purpose. Ditches might display a grade of as much as 20 feet per mile, and might carry as many as 160 cubic feet per second. Volume was also measured at first, in tom streams or heads (a two-inch stream was considered optimum for washing gold over the rough ridges of the long toms) or later, in miners inches, usually defining the

amount of water which would pass through a one-inch-square opening at a certain head over a certain period of time.

Main canals could be as many as eight to fifteen feet wide at the top, from four to six feet wide at the bottom, and more than three feet in depth. In earth berm ditches, more water flowed at the surface of the ditch than at the bottom, due to a tapered contour. Information can thus be gained from recording of the width at the base and at the top (inside berms) of the ditch, while depth measurements should be taken from the center line and a profile drawn to indicate whether the extant ditch is shaped in a "U", "V" or rectangle. Not only are existing features important, but archaeological features as well. Ditches can be excavated to provide information on depth, reuse, construction and maintenance.

Other appropriate measurements of the ditches include overall length, gradient and elevation (feet above mean sea level). The largest ditches are often the longest: the Columbia and Stanislaus River Water Company ditch was often 15 feet wide and 12 feet deep, and traveled more than 60 miles; the Yreka, or Big Ditch, follows about 95 miles on contour over 30 air miles. Measurements of the grade can provide information on the source and ultimate destination of the ditch and further provide clues as to the intended purpose of the ditch water.

One of the important things to consider in looking at the ditch systems in the California foothills is that they have been in existence for nearly 140 years, making them one of the oldest engineering features on the landscape. Construction of the Tuolumne County Water Company ditch took place within four years of the initial discovery of gold in the county, and while all of the original flumes have been removed or replaced, the manner in which water is obtained for this region and the general routes followed have remained essentially the same.

RESULTS OF AND MODIFICATIONS TO WATER CONVEYANCE SYSTEMS

As noted, ditches were first used to bring water to mining regions, first to wash dirt (sluicing, panning) and then to move dirt (ground sluicing, hydraulic mining). Later uses included enabling machinery (steam and hydroelectric power), as well as other industrial, agricultural, and domestic uses. These uses brought many changes to the economy and society of the foothills; four of these--demography, agriculture, mining technology, and social change--are briefly discussed below.

Demography/Settlement Patterns

During the Gold Rush, the largest segment of the extremely heterogeneous population was involved in mining--an estimated 80 per cent of the work force (Moratto, et al. 1988). Miners camped near the gold, of course, and the merchants and business people settled nearby. Agriculturalists and ranchers, on the other hand, settled where the resources, particularly soil and water, were favorable. Once the fervent activity of the gold rush ceased and the free placer gold was gone, miners and others began moving into the higher elevations to take advantage of the cooler weather, the trees for building, cooking and heating, as well as the animal resources and good soils for growing plants. The mining ditches provided a ready source of water, much as a perennial stream; people began to settle near the ditches, either taking the water to supply their rapidly expanding orchards, using it to irrigate row crops for feeding the animals, or for domestic purposes. By 1857 virtually all mining camps in Tuolumne County had access to water (Lang 1882). The Homestead Act of 1862 further encouraged settlement near the ditches in the high country.

Agriculture

The reliable source of water provided by the ditches was a boon to the early agriculture of Tuolumne County. In the early Gold Rush, the miners helped keep the price of water low enough that water purchase for irrigation was possible. When ditches were no longer needed for mining, they were often modified for new uses, largely related to agriculture. Truck gardens and row crops were started in areas where the absence of naturally-occurring water was notable; ditches provided that water.

For the most part, homesteaders, farmers and ranchers used the water to grow products for their own consumption; the excess was sold to the rest of the county. Apples, pears and other orchard fruit were the exception, however. The orchards, which thrived upon ditch water irrigation, produced fruits which

were exported to other states and even as far away as China. In the early 1900s, orchards from Tuolumne County and other foothill communities produced prize-winning apples and other fruit at many fairs (Davis-King 1988a).

Mining Technology

Outside of the gold itself, water was the most important determinant of where and how the miners of the 1850s worked. In the early days, it was possible for miners to live and pan along the streams and rivers; when the free gold was depleted, the miners worked away from the drainages. At first they took their pay dirt to the water by animal, if they were lucky, or carried it on their backs. Later, after the ditches were constructed, water was brought to the gold, affecting not only the quantity of gold which was extracted, but the location. Dependence upon seasonal water became less important with the availability of ditch water; placer mining became a year-round occupation.

Both placer and quartz vein mining utilized ditch water. The greater and more reliable quantities of water provided by the ditches allowed the long tom, introduced by 1850, and sluice boxes, in use by 1851, to become important. Soils found on the hills could be mined by ground sluicing or by shoveling the dirt into extended sluice boxes. Hydraulic mining could never have been so extensive without the water which came from the mining ditches and reservoirs. Hard rock mining was also important in the gold country, and required some sort of crushing and washing to extract the gold from the quartz. Early stamp mills ran on water power, although a few used steam or horses; the water came from the ditches and reservoirs (Langley 1862:257).

The foreign miners, by which was usually meant the Chinese, Mexicans and other Latin Americans, were the most obviously discriminated against. Often, they were pushed the furthest from the water (or the ditches), and had to mine in ways which were less immediately dependent upon water. This included the "bedsheet" dry-washing and dry-panning developed by both the Chinese and the Chileans, the arrastras developed by the Latin Americans (based on the grinding they were familiar with from silver mining in their own countries) and other methods (Young 1970).

Social Changes

The nearly all-male mining societies underwent great changes, with the mixing of diverse cultures, the later addition of women and children, sudden wealth, and numerous other factors. Ditches, by changing mining patterns, indirectly changed mining society. In 1850, a single miner could extract gold alone. When the long tom and the sluice box were introduced, miners found it more economical to group together, either as hired workers or by forming small mining companies. Groups were often formed on ethnic or linguistic boundaries, creating small pockets of miners who had come from one geographic region.

ARCHAEOLOGICAL SITES TO EXPECT

Ditches led to something or somewhere, originally to the mining claims or to holding ponds. Through time, the mining ditches have changed in purpose and a variety of site types can be observed alongside of the canals; some are related to the use of ditches; others may be examples of sites normally found in the foothills. Features directly related to ditches may include spillways, rock-reinforced pathways, and repair stations. Ditch and flume debris, such as wood planks, spikes, lap-riveted pipe, and tools are also common. At least twelve different site types have been found adjacent to ditches in Tuolumne County (Davis-King and Goldberg 1988); these are discussed generally below.

Native American: The Native Americans who had lived in the foothills were displaced when the miners arrived. Many traditional camps and villages were destroyed, and the Indians were forced to find new living and food acquisition areas. In most of the foothill areas, the ethnohistoric Indians collected and ground acorns, requiring running water in order to leach the meal. It appears that the Indians considered ditches a semi-permanent source of water; historic bedrock mortars are found adjacent to ditches. The age of these mills is inferred because of their proximity to the ditches, and also because of the presence of new raw materials: broken ceramics and glass were manufactured into tools. Not only had a new source of water been provided to the Indians, but it was much less seasonal than those which occurred naturally, perhaps changing the time of year which the Indians lived in the foothills.

Homesteads: Homesteads are found as both archaeological sites and as standing structures. The cabins of miners, particularly those who remained after 1860, are also found adjacent to the ditches.

Ditch tenders' cottages: The ditches needed constant maintenance (one estimate is given at $400.00 per year per mile [Bowie:1891:138]). Ditch tenders usually lived in company-owned cottages which were located next to the main ditches. When the ditch systems were sold to the larger water companies during the first half of this century, most of the houses were also sold. Several of these cottages are still standing in Tuolumne County, and others exist as archaeological properties. Pacific Gas and Electric Company archives contain excellent lists of the structures, contents and equipment for these cottages.

Mines: Mining ditches pass through and lead to hundreds of placer and quartz mines. While some mines have no significant features or artifacts surviving, others have the remains of stamp mills, assay offices, shafts, exploratory openings, tramways, hoists and other architectural or archaeological remains. Waste rock and tailings can also be observed.

Roads/Transportation Corridors: As ditches were usually built on an incline of no more than 0.4 per cent, they provided excellent transportation routes. In Tuolumne County, this included roads into the high country, and more importantly, networks of logging railroads, such as the Sugar Pine. Native American trails used for thousands of years were often adapted by the early settlers to the region, being modified for roads or ditch routes. Trails have been established along most ditches; originally for maintenance operations, they have since became recreational trails. Transportation of materials has also been important in ditches, particularly lumber, logs and ice.

Sawmills, Logging: Especially important in the higher elevations, where flumes were more common, sawmills were critical economic facilities for the water companies. Mills were portable and could be moved to new locations when needed. John Wallace, the English engineer who designed the Tuolumne County Water Company ditches, surveyed the Stanislaus River and noted the locations of logging camps and steam sawmills on his map (Wallace 1862). Similar maps survive for other ditch systems. In the latter part of the nineteenth century, transportation of lumber and logs via ditch canals became particularly important, especially in the northern and southern Sierra Nevada (cf Theodoratus Cultural Resources 1984:299-303).

Smithies: Blacksmith shops commonly moved as the ditch building progressed; remains are often located in flats near flumes (where the materials were most needed).

Work Camps: The camps associated with the ditch builders also survive archaeologically and may provide excellent information about food habits, ethnic composition of the work crews, technology, and social life.

Trash Dumps: Trash dumps are very common sites or features alongside the ditches; many are downslope cast-off ditch materials. Flume materials are especially common, as they require replacement as often as every six to ten years (Browne 1869:180).

Orchards: Spring is a particularly good time of year to observe old apple and pear orchards adjacent to ditches.

Ranches: Various landscape features related to ranching can be observed near ditches, including irrigation channels, ponds, fields of former row crops, houses, outbuildings and so forth.

Other Ditches: Lateral ditches were constructed to take water in new directions. In Tuolumne County, these laterals were often large ditches themselves, such as the Section 4 Ditch which took water to at least two different large mining camps (Davis-King 1988b), and led to stamp mills, mining operations, orchards and other areas which required water. Others, such as side-hill or round-hill ditches, were built with the intention of decreasing head or gathering the runoff from a hill. Remains of main canals, altered for a myriad of reasons through time, can also be observed.

Dams/Reservoirs/Ponds: Mill ponds, reservoirs, dams, and storage ponds related to hydroelectric power generation, irrigation, and other industrial or agricultural uses can be observed.

MANAGEMENT ISSUES

Until quite recently, mining sites and their features were not given much attention. Within the past decade, exploration and reworking of the old mines has begun; at the same time the foothills of California are experiencing a dramatic population increase. Mining sites, many of which are in excess of 100 years, are being impacted more than ever before. Included among these impacted properties are the ditches, whose physical length makes recording, assessment of significance, and management more difficult.

As linear sites, ditches often begin and or end outside of a project area, crossing mineral claims, federal, state or private land. Archival research needed to date and evaluate the system is costly, and generally an assessment of the entire site is not possible or practical. Dividing ditches into management sections for purposes of evaluation and assessment of integrity has been suggested by Supernowicz (1987), to handle significance evaluations, as is particularly useful when the site passes through more than one type of property.

An appropriate comparative context has yet to be established for the evaluation of historically significant ditches. Information about relative integrity, construction, use and condition is not available. Little has been documented about the construction and maintenance of mining ditches; indeed, excavation of ditch cross sections might be warranted to obtain that information. Some ditch edges, for example, are rubble-filled and seem to have experienced breaching less often than earth-berm ditches. Also, mucking operations typically place silts on top of berms; these silts do infrequently contain temporally diagnostic artifacts as well as stratigraphic information. Well-maintained ditches must be mucked, usually once a year, or they ultimately fill with silt and will no longer flow, or at the very least, will carry minimal quantities of water.

As with most mining sites, research issues according to certain themes include questions about technology (e.g., what changes are found in ditch construction over time?), economy (what can be documented on the history of the water development business?), demography (how did the conveyance of water in ditches effect demographic composition?), and socio-cultural considerations (what was the ethnic composition of the labor crews?). Obviously other questions can be asked of the data. Supernowicz (1987) listed several criteria to assist in the evaluation process, including date of construction, associated features, size and length, and the integrity of the features and the canal system itself. Some ditches may be ineligible for listing on the National Register as individual sites, but as features of a larger mining operation may be incorporated into an eligibility determination. Many canals were modified and adapted to fit the needs of hydroelectric facilities; as a feature of those systems, particularly if still operational, they may be considered significant.

BIBLIOGRAPHIC REFERENCES

Browne, J. R.
1869 *Resources of the Pacific Coast*. D. Appleton and Co., New York.

Bowie, A. J.
1891 *A Practical Treatise on Hydraulic Mining in California*. 4th Edition. D. Van Nostrand Co, New York.

Coleman, C. M.
1952 *P. G. and E. of California: The Centennial Story of Pacific Gas and Electric Company, 1852-1952.* McGraw-Hill, New York.

Davis-King, S.
1988a The History of Apples in Tuolumne County. Paper presented to the Tuolumne County Historical Society, on file Tuolumne County Museum, Sonora, California.

1988b *Cultural Resources Investigations for the Black Oak Estates Subdivision, Unit #3.* Submitted to Tuolumne County Planning Department, Sonora, California.

Davis-King, S. and S. K. Goldberg
1988 *Cultural Resources Investigations for the Phoenix Hydroelectric Project License Application (FERC 1061).* Volume I. Submitted to Pacific Gas and Electric Company.

Lang, H. O.
1882 *History of Tuolumne County, California.* B. F. Alley, Publishers, San Francisco.

Langley, H. G.
1862 *The State Register and Year Book of Facts for 1859.* H. G. Langley, San Francisco.

Moratto, M. J., J. D. Tordoff and L. H. Shoup
1988 Culture Change in the Central Sierra Nevada, 8000 B.C.-A.D. 1950. *Final Report of the New Melones Archaeological Project Volume IX.* Submitted to the National Park Service, Washington, D. C.

Paul, R. W.
1947 *California Gold.* Harvard University Press, Cambridge.

Supernowicz, D. E.
1987 A Contextual History and Programmatic Agreement (PA) for Historic Water Conveyance Systems. Eldorado National Forest, California. Ms. on file, Eldorado National Forest, Placerville, California.

Theodoratus Cultural Research, Inc. and Archaeological Consulting and Research Services, Inc.
1984 *Cultural Resources Overview of the Southern Sierra Nevada.* Submitted to the United States Department of Agriculture, Bishop, California.

Wallace, J.
1862 Map of the Ditches, Flumes and Reservoirs of the Tuolumne County Water Company with Adjacent Camps and the General Topography of the Surrounding Country. Tuolumne County Water Company map, on file, Bancroft Library, University of California, Berkeley.

Young, O. E.
1970 *Western Mining.* University of Oklahoma Press, Norman and London.

CULTURAL RESOURCE MANAGEMENT AT A NATURAL HISTORY PARK: RED ROCK CANYON STATE PARK, KERN COUNTY, CALIFORNIA

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Red Rock Canyon has long been viewed as a landscape of scenic wonder harboring significant elements of natural history. The geology of Red Rock Canyon combined with local tectonics has unveiled an intricately carved badlands topography noted for its majesty. The motion picture, television and commercial advertising industries have long used the canyon's distinctive scenery. But the geology of this canyon, carved in the western end of the EL Paso Mountains, is just as important as an outdoor geologic textbook. Nearly twenty colleges and universities throughout the state have used Red Rock Canyon for their geology field trips. Residing within this carved terrain, Red Rock Canyon contains an impressive and significant flora and fauna as well. Approximately fourteen uncommon plants and twenty sensitive animals which require monitoring are found nestled within these canyon walls. One plant species is found nowhere else in the world, and within the past year a new species of plant was identified. It is these features of scenic wonder and scientific interest that usually attract the majority of attention.

Red Rock Canyon's cultural resources are less significant by comparison and have thus received less attention than they deserve. Red Rock Canyon State Park is a suitable model for reviewing past and present treatment of its overshadowed cultural resources. More specifically, the treatment of the unit's historic mining resources represents an opportunity to view the cumulative effect of many interacting variables as diverse as funding, unit designation, resource directives, public safety and whether historic events were of statewide or only local significance.

INITIAL MANAGEMENT FACTORS

Red Rock Canyon was the site of a minor placer gold rush which had little statewide significance, but remains prominent in the local human history of this landscape. The majority of the historic mining occurred along the northeast branch of the Red Rock Canyon watershed known as Iron Canyon and two of Iron Canyon's tributaries to the east known as Bonanza Gulch and Santa Monica Gulch. Mining influenced the landform of these canyons from 1893 until approximately 1965.

Public support for establishing Red Rock Canyon as a State Park existed as early as 1928. In 1933, 1940, 1948 and again in 1963, Kern County residents and other concerned individuals attempted to secure and protect the canyon as a National Park System unit. Finally, in 1968 the citizenry convinced the California Legislature to pass AB561 (authored by Assemblyman Kent Stacey) which provided funding to acquire the canyon as a unit of the State Park System.

The purchase of private land in Red Rock Canyon began in 1969 and the first ranger was stationed at the new unit in May of 1970. Management of the new facility began with the focus primarily on the significant natural resource content. The unit's cultural resources received less scrutiny. However, the initial two-year mining boom and the seventy years of subsequent mining influences left significant evidence upon select portions of the Red Rock Canyon watershed. The numerous remnant adits and shafts posed a potential hazard to the visiting public. Reduction of these potential hazards was necessary, but the exact methodology remained to be determined.

Red Rock Canyon was set aside as a unit of the State Park system during a period of rapid acquisition of additional park acreage. During the 1960s and 1970s a growing awareness and concern arose surrounding California's vanishing open space as a direct consequence of the state's rapidly expanding population. A large portion of the fiscal resources of the State Park system were directed to acquisition of new parklands and expansion of existing units before such opportunities might vanish. This effort finally led to the inclusion of Red Rock Canyon within the state system. Once acquired, the emphasis on acquisition left limited funds available to develop the newly established unit and to manage its

resources. In addition, Red Rock Canyon was just one of a number of new units which, having just been acquired, were competing for the limited development monies available. Public safety concerns had to be met. Into this arena the most influential determination that would shape resource management decision-making was set to take place--that of unit designation.

On July 13, 1973, the California State Park and Recreation Commission, after receiving heavy pressure from the off-highway vehicle lobby, voted to designate Red Rock Canyon as a State Recreation Area rather than a State Park. This judgment was later reversed by the Commission on February 9, 1980, but not before the original management decision concerning the unit's historic mining resources and the potential hazard they represented was rendered.

The *Resource Management Directives for the California Department of Parks and Recreation* (May 1979) provide the necessary guidelines for making resource management decisions within each unit. The *Directives* indicate that within a State Recreation Area the recreation potential is considered the primary resource with natural or cultural values supporting and enhancing the recreational experience (directive 1816). In such units planning and management activities are aimed at providing optimal recreational experiences, in both quantity and quality. Natural features may be altered or managed to enhance the recreational experience. At Red Rock Canyon the potentially hazardous mining terrain could be viewed as a factor limiting recreation potential. The cultural mining resources, in comparison to the principal natural resources, were relegated to a secondary status. The historic mining resources were considered to be not significant in a statewide capacity. To a certain extent the mining sites were also viewed as scars on the natural landscape in need of repair.

The departmental *Resource Management Directives* (May 1979) regarding Safety Factors (directive 1831.7) relate that the safety of the public is a primary factor for determining resource management programs on specific sites within a park unit. Further, special hazard control techniques may be a necessity in some instances. Major hazard reduction efforts may be appropriate in areas that support intensive recreational use. The *Directives* for Cultural Resources (1832.3) state that historic structures that are not of prime value for preservation and interpretation as fully authentic resources may be made available for adaptive uses.

A decision was rendered. Monies for archeological surveys were not available. A hazardous condition existed limiting recreational access. Site modification seemed the most appropriate and accessible means of reducing departmental liability while increasing recreation potential and visitor safety. To prevent access in June 1975 the majority of the placer mining adits within the unit were blasted closed by a demolitions expert from the U.S. Forest Service and a trainee from the California Division of Forestry.

To date no map or records indicate the number, location and nature of the mining adits closed, nor any artifacts which may have existed nearby. Over the past 13.5 years erosion has reopened a significant number of adits, which were resurveyed by the park staff recently. The volume of adits which have not (yet?) reopened appears significant based on landscape topography, but can not be quantified.

FACTORS IMPROVING MANAGEMENT POTENTIAL

The decade of the 1980s has witnessed positive management revision both for the California Department of Parks and Recreation and for Red Rock Canyon as an individual unit. These revisions allow greater latitude in resource management options and stewardship protection. The redesignation of Red Rock Canyon to a State Park from its original State Recreation Area classification provides in and of itself greater protection for the unit's natural and cultural resources. The department's *Resource Management Directives* (May 1979) state that a State Park protects and makes available to the public an outstanding natural feature or group of features (directive 1811.1). The most important distinction of a State Park designation remains that resources may not be managed or manipulated to enhance the recreational experience (directive 1811.2 (5)).

The change in the classification was not without incident in the case of Red Rock Canyon. Shortly after the original decision of the California State Park and Recreation Commission, State Assemblyman Ray Gonzales introduced AB2645 which attempted to reclassify Red Rock Canyon as a State Park overriding the Commission's decision. The legislation was passed by the Senate on a vote of 27 to 2 and by the Assembly on a vote of 69 to 9, but was vetoed by then Govenor Ronald Reagon on May 31, 1974. It

thus was left to the Commission itself to modify their original decision, redesignating Red Rock Canyon as a State Park on February 9, 1980.

Along with the revised unit designation other modifications on a departmental level have occurred increasing resource management efficiency. Increased funding availability for resource management concerns has enabled units to adequately address problems that a decade earlier had no solution in sight. The greater availability of specialized resource personnel to the unit field personnel has also improved resource stewardship. During the 1970s specialized resource personnel positions were based out of the departmental headquarters in Sacramento, leaving most resource problems to the care of less trained field personnel. Increased resource management funding has provided for the addition of numerous specialized resource personnel at each of the four Regional State Park system offices. These individuals guide or direct the resource management projects funded for individual units within their respective Regions and are available for limited consultation concerning the resolution of non-funded projects.

The positive resource management steps enacted by the California Department of Parks and Recreation have allowed for the correction and improvement of many resource problems or threats both to the system and to individual units. The accessibility of specialized resource personnel at the Regional level can improve the resource management dialogue in the field, inspire field personnel to locate and correct resource problems within their units and ultimately can improve the quality of our unit stewardship. Through such a program we can strive to improve our secondary resource protection (such as cultural) within units created with a natural history focus.

MINING HISTORY

Red Rock Canyon was little more than a stage stop until placer gold was discovered in 1893. The discovery of gold brought many miners to the canyon and the surrounding El Paso Mountains in search of personal fortune. Hundreds of claims were filed in the region about Red Rock Canyon in 1893 and 1894, but only a few were actually worked (Fairbanks 1894:457). The place name of Bonanza Gulch (in the Red Rock vicinity) was established at this date, and was listed as "perhaps the richest gulch on the north side of the (El Paso) range" (Fairbanks 1894:456). The initial gold rush recovered several nuggets and possibly several thousand ounces of gold (Troxel and Morton 1962:183), but lasted primarily two years (Tucker 1929:46). One account states that the original discoverer in 1893 recovered $410.00 in gold in their first six working days (Weight 1956:20). However, by 1896 only five investment groups remained employing a mere eighteen men who utilized seven dry washers with a recovery that was said to "pay wages" (Crawford 1896:195). Within a short time the mining claims were eventually sold or abandoned.

No direct literature or field artifacts have surfaced detailing the residential structures utilized by these original miners. A concurrent photograph taken of a similar mining camp farther east in the El Paso Mountains indicates tent residences were being utilized (Fairbanks 1894:456). James E. Sharp (personal communication 1989) has stated that during explorations of the vicinity (1940-1963) he encountered the remains of the original mining camp and a blacksmith shop located on the flat ground at the entrance to Bonanza Gulch. Only scattered occasional artifacts have survived at this site.

In 1896, a former San Francisco brewer during the Barbary Coast era, Rudolf B. Hagen, began his 34 year residence in the canyon. Hagen eventually filed a series of patented placer mining claims totaling 3000 acres (Tucker 1929:46; Tucker and Sampson 1934:246), once the principal miners abandoned the canyon and left to search for gold elsewhere. Claim notices (on file at the park) show two of his claims were filed in 1899.

Hagen established his first residence at the mouth of Iron Canyon, about one mile from the placer mining center at Bonanza Gulch. Along with the residence he established a stage stop and store which he called Ricardo. Around 1913 his residence and business relocated to the present site of Ricardo campground.

While a resident Hagen dabbled in many enterprises, including mostly unsuccessful attempts to recover gold. His gold prospecting was accomplished in tandem with a Mr. Rollo Muller who arrived in the desert in 1906. Muller, prospecting on Hagen's claims, re-entered the old placer mining adits that remained from the original gold rush and removed gold nuggets from the base of tunnel pillars, the largest being the size of an olive (*Mojave Desert News* 7-3-80). In the late 1920s Hagen and Muller spent considerable money in an attempt to excavate to bedrock portions of a major wash downstream from

Bonanza Gulch, but failed when they encountered excessive water at surface and shallow depths (Tucker 1929:46; *Mojave Desert News* 7-3-80). Tucker (1929) places the site of the excavation in Iron Canyon. This seems unlikely as information regarding a hand-dug well in Iron Canyon places bedrock but no water at 60 to 70 feet (Russel Nelson, personal communication 1989) and a second account places two drilled Iron Canyon water wells at 500 feet and 920 feet (James Sharp, personal communication 1989), indicating a much greater water depth. More likely is the account by Rollo Muller (Mojave Desert News 7-3-80) placing the excavation site in the main Red Rock Canyon wash which even today contains a spring with surface flow extending over one-half mile.

A few concurrent mining accounts have surfaced from the "Hagen years." In 1912 an Oakland company of capitalists headed by a W. Mott constructed a derrick and sank multiple ten-inch casings to bedrock to test the gold content of the wash gravels (*Morning Echo* 2-6-12). Discouraging results cancelled a proposed outlay of $200,000 for a dredge at the mouth of the main Red Rock Canyon wash. This failed investment venture was not unusual for Red Rock Canyon. The same *Morning Echo* newspaper article stated: "No doubt in the past ten to twelve years men that represented plenty of capital and no doubt might have spent thousands in prospecting Red Rock,..."

Another account from the Hagen era involved the recovery of a large nugget (possibly nine pounds) from Santa Monica Gulch in 1914 and its subsequent sale for approximately $2,000 in San Francisco (Bailey 1964:23; Archer 1925:19; Engle n.d.; Salazar n.d.).

As a result of Red Rock Canyon's arid environment the placer gold was usually recovered by a dry concentration process known as "dry washing." Fairbanks (1894:458) states: "Dry washers are used exclusively in this district (1894), but there are comparatively few places where the gold is abundant enough to make that method pay. If water can be introduced there is no doubt a great future for the district." Many attempts to introduce water to these diggings were thus proposed. Hagen is known to have at different times sold stock in a Ricardo Land and Water Company (stock certificate on file at state park), commissioned a geologist to examine the feasibility of a water tunnel (Newman 1906) and to have constructed a stone and earth dam in an attempt to pond water (Bailey 1964:28).

In 1930 Hagen retired to Bakersfield, California, from his Ricardo homesite and began to lease his mining claims to L. P. Conway who transfered the lease to L. E. Wisenberg of the Iron Canyon Mining Company. This company installed two 3-cylinder (25 horsepower) diesel engines, a generator (75 h.p.), two 900-g.p.m. single-stage centrifugal pumps and a two-stage rotary pump for the purposes of pumping water with which to hydraulic the hills on the east side of Iron Canyon (Tucker and Sampson 1933:324). The plan was abandoned when it was found that sufficient water was not available. A three-ribbed cement foundation remaining in Iron Canyon is believed to be the foundation for the two diesel engines. It is known that this foundation predates 1939 as a landscape feature (James Sharp, personal communication 1989; Russel Nelson, personal communication 1989). A second foundation of a building containing two large cement buttress blocks located near the mouth of Iron Canyon also predates 1939, but its use is not known (James Sharp, personal communication 1989).

During the construction of the Los Angeles Aqueduct a gentleman by the name of Roy Sharp first visited Red Rock Canyon. R. Sharp returned to the canyon, as best as can be determined, during the late Hagen years (late 1920s) and initiated a lengthy family history of mining at Red Rock Canyon, where R. Sharp acquired ownership of a half section (section 36) north of the Hagen claims (James Sharp, personal communication 1989). Little is known of Roy Sharp's activities in the canyon during the 1930s. R. Sharp did form a partnership with his wife Louise Long and a gentleman named Meyer, and in 1939 they employed several men to gather samples from the old diggings for analysis. One of the men hired was Russel R. Nelson (personal communication 1989) who resided and worked (for 3% of the gross) in the canyon from 1939 to 1941. Nelson indicated that gold was recovered by chipping around the base of previous adit pillars (one inch or so above the bedrock), by re-entering abandoned mining shafts (using the windlass method) and reworking previous adit waste rock to recover gold dissolved by weathering from the "caliche" (calcium carbonate). Nelson relayed that after a couple of months he had acquired a small bottle full of gold (including a flat nugget) which when assayed weighed a little under one ounce and was said to be "900 fine."

Most of the gold was recovered by "dry washers," but one attempt, communicated by Nelson, involved the laying of two-inch pipe from nearby Sullivan Spring across Iron Canyon to a 3,000 gallon water tank.

The water from this tank was at one time used to test a scale model of a "vacuum dredge" (photograph by Nelson on file at park) which was designed to vacuum gravel from a shaft into a chamber with water and then release this slurry down a sluice box. The full scale model was never apparently constructed due to lack of water and/or the volume of gold available for recovery.

Three cabins existed in Iron Canyon during Nelson's residency. The first, known as the "White Cabin" after a former owner, was situated at the mouth of Bonanza Gulch; the second, known as the "Tie Cabin" (constructed of railroad ties) at the mouth of Santa Monica Gulch, was the only occupied cabin; and the third cabin (exact location unknown) was visible to the north of the Tie Cabin (Russel Nelson, personal communication 1989; James Sharp, personal communication 1989).

Nelson and the other employed miners left Red Rock Canyon in 1941 to participate in World War II. The mining was idle until 1943 when Roy Sharp moved into the White Cabin and prospected the lower slopes towards the mouth of Iron Canyon. During 1943 and 1944 Roy Sharp excavated "Sodium Springs" in the main Red Rock Canyon wash, ponded the water (perhaps constructing the now silt-laden wooden dam present at this site) and pumped water approximately one quarter mile into Iron Canyon to process his workings (James Sharp, personal communication 1989). Roy Sharp died in December 1944 concluding his contribution to local history.

The mining was again idle until early 1948 when activity was noted (Freeman and Freeman 1948:409). About this time a man by the name of Hill accidentally constructed a cabin on the Sharp property (James Sharp, personal communication 1989). Hill worked his claim (to the north of the Sharp property) which involved a continuing excavation of a hardrock adit, drift and winze (possibly initiated during the 1930s) where he reportedly was pursuing cinnabar (Russel Nelson, personal communication 1989; Bart Arthur, personal communication 1987). In 1950, a location approximately two miles into Iron Canyon was explored for placer gold by unnamed individuals, but when the tests proved unencouraging the project was abandoned (Dibblee and Gay 1952:47).

From 1951 to 1953 the Sharp property was again active when Louise Long Sharp leased the property to a Mr. Sig Schmidt who drilled three wells (two sites are known) in an attempt to secure water for a "bowl mill", which contained large centrifugal bowls designed to spin and feed dirt through a shaker (James Sharp, personal communication 1989). Large cuts from the base of the Iron Canyon hills between the Tie Cabin and the Hill Cabin were reported (by Sharp) to have been processed.

From late 1953 through 1959 there is no record of resident miners in Red Rock Canyon. The White Cabin was reportedly destroyed in 1954 by a Boy Scout outing. James E. Sharp (the son of Roy Sharp) constructed a cabin approximately 150 feet south of the Hill Cabin in 1960, residing and mining in the canyon until 1963 (James Sharp, personal communication 1989). James Sharp has indicated that he was joined in the canyon by his uncle Jack Pease who refurbished the Tie Cabin where he resided with his family in 1960 and 1961. According to Sharp, after Pease abandoned the Tie Cabin in 1961, a Frank Donohue (Sr.) and family arrived, residing in the Tie Cabin until 1963, at which time they switched to the Sharp Cabin (upon James's departure), where they lived until 1965.

The departure of the Donohues and the subsequent arson of the unoccupied Sharp Cabin concluded the mining history of Red Rock canyon. The residents from the 1960s described their existence as a rough living (James Sharp, personal communication 1989) and the daughter of one miner stated the family had to collect deposit return bottles to help make ends meet (Pepita Pease Klinger, personal communication 1985). In 1968 when the California Legislature passed the enabling legislation authorizing expenditure to purchase Red Rock Canyon no resident miners remained.

During the early 1930s the gold content within Red Rock Canyon was estimated at 35 cents per yard (Tucker and Sampson 1933:324). The state of California has estimated that mineral recovery for the entire El Paso Mountains mining district "probably exceeds several hundred thousand dollars" (Troxel and Morton 1962:31). This is a far cry from the other published but unsubstantiated figure of 16 million dollars from Red Rock Canyon alone (Bailey 1964:23; Freeman and Freeman 1948:409).

PRELIMINARY FIELD INVENTORY

In recent months the staff at Red Rock Canyon State Park has undertaken an initial field survey effort

to inventory the number of adits that still express surface openings, identify potential archeological sites and artifacts and document current hazards to the visiting public. The preliminary results follow. The gathered data should provide a foundation upon which further more detailed investigations can proceed.

Mining Landscape Features

The initial park survey has documented 91 adit openings (of various dimensions) and 33 significant shafts and pits within the park-owned lands.

The mining of gold was mostly pursued in placer form. A minor amount of placer gold was derived from uplifted Miocene stream gravel near the base of the Ricardo Group's Cudahy Camp Formation. The majority of the placer gold recovered in the Red Rock Canyon watershed originated from the lowermost portions of Quaternary fanglomerates. These beds of angular gravel were probably deposited as a result of interglacial erosion, and now usually exist as remnant benches atop relatively low gulch-flanked ridges. The angular casts are commonly partially cemented by interlaid calcium carbonates. The historic prospectors tunneled into these gravels utilizing an arched design. Constructing no support structures, the bare arched adits are hazardous and must have routinely suffered partial collapse. The washes below these benches were also mined by sinking shafts (probably to bedrock) for the suspected secondary placer content.

The height of these placer adits ranges from a maximum of five to six feet down to low, and sometimes relatively long, crawl spaces (around two feet high). The placer adit and drift lengths are usually short, although the longest reaches a maximum of 150 feet. Most adits now observable are shorter than thirty feet and are not uncommonly honeycombed with small to intermediate side drifts.

Remaining unknown is the extent to which the original 1890s placer mining adits were altered by subsequent mining periods. The ensuing "montage," as described by Hardesty (1988:12), has provided little archeological evidence enabling separation.

In addition to the placer tunnel network, a few hardrock adits occur inside the park unit as well. Usually protruding into crystalline basement rock normally consisting of granitics or metamorphics, the adits appear to follow intrusive veins which have filled fissures in the crystalline basement. These veins were presumably mined for their lode gold ore content. However, a few hardrock adits may have been constructed in pursuit of mercury (Bart Arthur, personal communication 1987; Russel Nelson, personal communication 1989) or copper (Dibblee and Gay 1952:47). The park's hardrock adits and drifts range from 30 to 150 feet in length. Their height is normally five to six feet and the width near the same (three to six feet).

Shafts occur at the unit also both entering hardrock and sedimentary deposits. The deeper, more significant shafts (which may have accompanying side drifts) remain unexplored due to their hazardous nature.

Artifacts

For the length and extent of mining activity in Red Rock Canyon there remain surprisingly few significant artifacts. Examination of the interior of the network of tunnels located only an infrequent solder-top can and in one adit a tub and metal bowl. No tools or implements of prospecting have been found. Three wooden pillars located in the 150 foot placer drift are the only shoring found in any horizontal mine.

Outside these near weatherless wombs more artifacts exist in various states of decomposition. Close to the predominant placer mines solder-top cans, sardine-style cans, piping and various sheet metal parcels are scattered in the landscape and sometimes clumped (possibly near former residences). In Bonanza Gulch the remains of a bulldozer and toilet seat abandoned in 1970 (James Sharp, personal communication 1989) are still in the landscape. It appears that the original 1893-96 Bonanza Gulch diggings were not significantly disturbed by subsequent mining efforts and James Sharp (personal communication 1989) credits the wooden debris occasionally encountered as the remains of dry washers utilized around the turn of the century. High on the northern ridge above the lower portions of Santa Monica Gulch, one 50 foot mining shaft still displays the wooden frame windlass used for lowering men and equipment. Scattered in the landscape, the remains of rock claim monuments are observable, but inside the park no containers bearing claim notices or wooden marker posts remain.

No residence or processing structures remain from the mining era, although residence foundations and ground preparations, two machinery foundations and a wooden dam still exist in the landscape. Well casings, a well pump and the apparent base of a water tank have also been documented. Occasional concentrated garbage piles have also been located. The surface of many of these dumps displays material dating from the mid-1960s. These caches have not been probed to determine the extent or time span encompassed if the materials were examined to their base.

A PLAN FOR FUTURE MANAGEMENT

Having identified cultural resources in need of proper archeological reconnaissance, a request for funding to secure the field presence of more specialized personnel should be submitted. The process of acquiring the necessary resource management funding can be lengthy and balances on the amount of funding each governmental authority has available, the placement of one's submitted proposal on a list of priorities and to a certain extent, one's persistence.

In the case study at hand public safety hazards have been identified as well. The 91 adits and 33 shafts and pits identified in our initial inventory are in need of review by a structural engineer to determine and prioritize the extent of the necessary mitigation. Depending on the agency, funding to improve visitor safety may require a second separate funding request.

Whether the funding is achieved from one source or two, proper stewardship requires preservation of the non-renewable cultural resources combined with access to public heritage, while at the same time insuring adequate public safety and reducing agency liability. Difficult decisions must take place balancing public safety and cultural resource preservation. The blocking of mine shafts for public safety in a manner that preserves the remaining "fabric" or cultural heritage may represent the best long-term solution.

Metal gates or cable screens at the entrances of structurally unsafe adits or shafts can allow the public a limited "visual entry" experience while barring potentially hazardous physical entry. The ability to visually protrude beyond the mine adit or shaft safety barrier undoubtedly stimulates some enticed visitors to vandalize the barriers to achieve physical entry. While a solid physical blockage of the portal to even internal vision might reduce vandalism, the additional visual public access to a portion of their heritage, achieved with a cable screen, outweighs the minor risk of increased vandalism. The retention of a "few" adits, determined to be structurally sound, in an open state for public exploration can add a dimension of public interpretation and enrichment that cannot be accomplished by any other alternative, and can significantly improve a "dispersed site museum's" appeal.

Once the desired resource management funding is acquired the field project can proceed. The development of a plan to evaluate the historic mining cultural resources serves to inventory and record resources, identify significant interpretive elements or potential, to identify, prioritize and reduce on-site hazards and to reduce potential agency liability. The prepared plan would normally be divided into a minimum of two phases. The initial phase would involve a thorough archeological field reconnaissance (coupled with archival research if needed), a site review by a structural or mining engineer to evaluate public hazards, and possibly a site review by an interpretive specialist. The initial phase would conclude with the preparation of an action plan to implement resource protection, interpretive and public safety features. A segment of this report should evaluate and prioritize the public hazards and establish a procedure and timetable for implementing the corrective safety measures. The plan must also contain a provision to revisit "corrected" sites periodically to inspect the continued structural soundness of the installed protective barriers.

The second phase of our funding plan would serve to initiate field implementation of the first phase action plan.

The design of any plan to evaluate the cultural resources present at a given park unit should preserve the integrity of the resource by adopting a "holistic" approach. Landform features and the historic remains of machinery and residences should not be viewed separately, but rather considered as to their interrelationship and effect upon the mining system.

Our cultural resources are non-renewable. Certain management decisions can irreversibly affect the nature of these historical sites for all generations that follow. While mining and other cultural resources

are not the primary resource for which most natural parks are preserved, they nevertheless represent an integral part of the human history of these special landscapes chosen by our society for retention in perpetuity. The awareness and realization of the importance of cultural resources within any natural history park is a necessary enlightenment mandated by proper resource stewardship.

REFERENCES

Archer, Fred
1925 In the Canyon of Red Rocks. *Touring Topics*, February 1925, pp. 16-19, 42.

Bailey, Richard C.
1964 Red Rock Canyon. In *Westerners Brand Book*, Number 11 - Los Angeles Corral, pp. 20-30.

Crawford, J. J.
1896 *Thirteenth Report of the State Mineralogist.* California State Mining Bureau, pp. 195, 199.

Dibblee, T. W., Jr. and T. E. Gay, Jr.
1952 Mineral Deposits of Saltdale Quadrangle. In *Geology of the Saltdale Quadrangle, California*, by T.W. Dibblee, Jr., California Division of Mines Bulletin 160, pp. 45-66.

Engle, Martin
n.d. [Notes Transcribed From a Brief Oral History Interview by D.W. McMullin.] Ms. on file at Red Rock Canyon State Park.

Fairbanks, H. W.
1894 *Red Rock, Goler and Summit Mining Districts, in Kern County.* Twelfth Report of the State Mineralogist, California State Mining Bureau, pp. 456-458.

Freeman, Catherine and Dick Freeman
1948 Red Rock Canyon. *Natural History* (November) 57:408-411.

Hardesty, Donald L.
1988 *The Archeology of Mining and Miners: A View from the Silver State.* Special Publication Series, Number 6, The Society for Historical Archeology, p. 12.

Newman, E.
1906 Correspondence to Rudolf B. Hagen Regarding the Water Potential of Developing a Water Tunnel. July 1, 1906. On file at Red Rock Canyon State Park.

Salazar, Ruben
n.d. [Notes transcribed from a brief oral history interview by Caroline Engle.] Ms. on file at Red Rock Canyon State Park.

Troxel, Bennie W. and Paul K. Morton
1962 *Mines and Mineral Resources of Kern County, California.* California Division of Mines and Geology, County Report 1, pp. 29-31, 183.

Tucker, W. B.
1929 Kern County, California. *State Mineralogist Report* XXV, California Division of Mines and Mining, p. 46.

Tucker, W. B. and R. J. Sampson
1933 Gold Resources of Kern County. State Mineralogist Report XXIX, *California Journal of Mines and Geology* 29(1&2):276, 323-324.

Weight, Harold O.
1956 Red Rock Canyon Gem Trails. *Desert Magazine* 19(2):18-22.

HITE COVE HISTORY CENTER

S. N. "Nick" Nixon, Area Manager
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GOLD!--the cry that brought thousands of fortune-seekers to California, is still bringing thousands of visitors, prospectors, and students to the Mother Lode. Gold has had a tremendous impact on the cultural and economic history of Mariposa County, California, and indeed, the nation. The U.S. Forest Service has been presented with the opportunity of interpreting historic mining at the old Hite mine, a gold mine that began production in 1862, located in Mariposa County on the South Fork of the Merced River.

Mariposa County is a three- to four-hour drive from San Francisco. Passing through the historic mining town of Mariposa visitors begin to see evidence of its mining history. Leaving the town of Mariposa travellers ascend along Highway 140 to the community of Midpines at an elevation of 2600 feet, then descend to 1300 feet, where the highway meets the Merced River at Briceburg. The highway follows the river through its many twists and turns, crossing the South Fork at its confluence with the main stem en route to El Portal and Yosemite National Park. The Hite mine is on the north side of the river at Hite Cove and the Gibbs mine is on a nearby ridge top. Also located at the confluence is Savage's Trading Post, the trailhead for the Hite Cove trail.

The Merced is one of the last rivers in the central Sierra that flows from high alpine peaks down to oak woodland chaparral in an almost totally pristine state. Along its route is a complete spectrum of habitat representative of the central Sierra Nevada. The South Fork of the Merced originates at nearly 12,000 feet in Yosemite National Park. About half its length is in the National Park and half in the Stanislaus National Forest. From the Clark Range it descends for 43 miles through a continuous series of rapids, cascades, pools and waterfalls to its confluence with the Merced. This area is ecologically tied to the park by providing the primary wintering habitat for the Yosemite deer herd which in turn is followed by perhaps one of the largest populations of mountain lions in California. The area provides excellent habitat for other predators as well. The river canyon is considered by botanists to have one of the richest and most diverse flora in the central Sierra Nevada. Of special interest are several species of rare and locally endemic plants. Congress has entrusted the U.S. Forest Service with the additional stewardship of preserving the Merced River and the South Fork by designating them for wild and scenic river status.

The river has always been a prime recreational area. The spring wildflower display is so spectacular that it attracts thousands of visitors from around the world. The South Fork provides a variety of recreational opportunities. Fishermen, swimmers and gold prospectors using dredges and pans dot the landscape throughout the canyon. Trout fishermen are offered the unique experience of fishing the unstocked, totally natural stream. Hiking opportunities of the 22-mile trail range from easy walking along the 3.6 miles from Savage's Trading Post to Hite Cove to rugged wilderness hiking from the Hite Cove area along the South Fork upstream to Wawona. Swimming is popular in the clear, clean waters. During the spring runoff rafters and kayakers can be observed maneuvering through the whitewaters of the Merced River. Rafting and kayaking have only recently been attempted on lengthy sections of the river because of its relative inaccessibility and steep descent. Recreational interests in the South Fork increase each year as word of its outstanding features spread and as a result of rapid population growth in nearby areas to the west.

The South Fork drainage was very important in the prehistory of the area. It was used as a travel corridor and is known to contain many sites which were occupied by Native Americans over thousands of years.

Visitors to the Mariposa area are reminded of the gold rush days and their influence on the history of the surrounding communities. Since the arrival of the '49ers, approximately $60 million worth of gold has been taken from Mariposa County. Hundreds of mines existed and some of them are still active. Many large mining operations recovered gold from veins several hundreds of feet in depth. Gold

production was active until the mid-1930s when reduced values and increased costs made mines uneconomical to operate.

John R. Hite established a gold mining claim on the South Fork in 1862. He built a 40-stamp mill and established a town with a hotel at Hite Cove and operated the mine for 17 years. The Hite mine was one of the most colorful and productive mines in Mariposa County. The value of the gold recovered has been estimated at $3 million. A number of persons and companies continued to operate the mine over the years. As recently as 1976, the Hite Mining Company made an effort to work the mines, which proved to be an unprofitable venture.

In 1941, the Federal Government suspended mining operations throughout the United States. Most of the mining equipment was confiscated by executive order and very little historic equipment remains at the mine.

Authentic turn-of-the-century gold mining equipment which has been restored to its original condition has been offered to the U.S. Forest Service by Mike Garoogian, owner and operator of the Gibbs mine. Included in the donation are buildings and artifacts to create an interpretive history center at Hite Cove. He has offered his expertise to move the historic equipment to the area, construct a building to house the five-stamp mill, install tracks with ore carts from an existing tunnel to the mill, and electrify the tunnel and mill building by use of a Pelton wheel.

Virtually everything needed to interpret a turn-of-the-century gold mine is included. The centerpiece is the magnificent five-stamp mill built by Union Iron Works in San Francisco--a rare item to be found intact and operational. The buildings offered to be relocated represent the structures to house miners and provide for their needs so far from civilization. Hite Cove could give the same feeling of isolation and need for self-sufficiency which faced inhabitants of this region 100 or more years ago.

On September 13, 1988, Mike Garoogian, sent the following letter to the Forest Service.

> "I, Mike Garoogian, sole owner of AT&E mines located at El Portal, California, do hereby donate all of the old mill equipment to the U.S. Forest Service for the purpose of establishing a visitors center at Hite Cove.
>
> "Those things that are to be donated are, old buildings, stamp mill, ball mill, tables, ore cars, motors, compressors and most all things necessary to operate a 5 ton stamp mill.
>
> "It is my wish that one day the history of mining in our area can be known to everyone as being as rich and exciting as any of the mines in the old Mother Lode.
>
> "I also agree to offer my expertise to construct the mill building, as well as setting up the area as close to the original state as it was in its greatest moments.
>
> "I am donating the above because of my love for mining as it once was. Once this old equipment leaves our area, there and then, we will have lost the romance of a bygone era. Therefore, it is my wish that by donating the above, the rich past will never be lost, and I will have been but a small part of 'yesterday.'"

The original mine workings consist of 1,000 feet vertically and 8,000 to 12,000 feet horizontally which are available and accessible. The veins and methods of recovering ore are clearly visible and available for interpretation. The unique environment of the mine provides a learning tool for beginning and professional students of mining and geology.

The East Bay Regional Parks District has established an interpretive mining center at the Black Diamond Mines in Antioch, California, which is open to the public. They have assisted with the development of six other historic mines throughout the State and have offered their expertise in the areas of mine safety and interpretation. They have inspected the Hite mine and are enthusiastic about our opportunity to interpret the underground mine and the historic site based on their expertise.

The window of opportunity is open. It is important to recognize the unique and extraordinary elements which are present. We must carefully analyze this unique opportunity and pursue a course of action appropriate to the challenge.

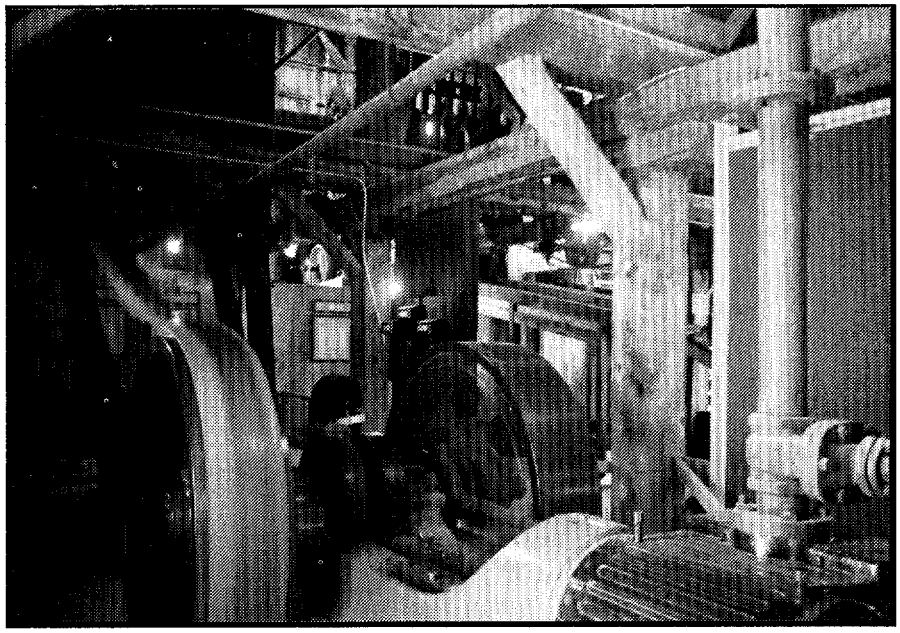
To the best of my knowledge the Forest Service has not undertaken a project of this nature to date. Any information that can be shared with the Forest Service on the "how to's" of putting this project together will be greatly appreciated.

THE WESTERN MUSEUM OF MINING

Larry Frank, Curator of Collections
Western Museum of Mining
Colorado Springs, Colorado

The Western Museum of Mining and Industry, in Colorado Springs, Colorado, is a non-rofit organization whose mission is twofold. Our goal is to teach the history of mining in the American West from the 1850s through the 1940s, while the other goal is to preserve those mining artifacts that were used throughout the American West from vandalism by high-country week-end "jeepers" or total destruction by the re-emerging mining industry. Our present approach to this mission uses a collection of operational machinery collected through four basic sources. Our first source was Frederick M. Farrar, the museum's founder, who collected mining artifacts throughout the West during the 1950s and 1960s. Our second source is private individuals or companies who own historic mining artifacts. Third is local auctions, and our fourth source has been trades with other museums.

The museum houses its collection in a main exhibit hall/library building, the reconstructed Yellow Jacket II l0-stamp ore mill, and a reconstructed blacksmith shop and hoist house. In addition to these exhibits, a headframe and a number of large mining machines have been erected on the grounds. Most of the machinery is interpreted and operated on a regular basis by the interpretive staff.



Yellow Jacket II ten stamp mill. Photo courtesy of Larry Frank, Western Museum of Mining.

SITE INTERPRETATION

Mining history presents great interpretive challenges for our staff, since mining is generally portrayed as the destroyer of our beautiful landscape. But mining is also one of our two major providers of raw materials, the other being agriculture; "if it can't be grown, it has to be mined." Another interpretive challenge is realized when static machinery is presented out of its original context. These machines become boring and confusing to the casual visitor. The reconstructions of the l0-stamp mill, blacksmith shop, and hoist house alleviate much confusion, but it is still the interpreter who must illustrate the actual, intended use for each machine. The interpreters must read their audiences carefully and adjust their presentations accordingly. I have found that different kinds of visitors have different questions and

the visitors fall into three basic categories. Visitors with technical expertise, such as engineers and mechanics, want to know machine specifications and the basic engineering principles of design. Hobbyists, such as railroad buffs or historians, are curious about provenance and source of acquisition. And casual visitors and tourists ask about the intended use and previous locations of artifacts, as well as the artifact's effects on miners' daily lives.

For example, the main exhibit in the lobby of the exhibit/library building is a ca. 1895 George H. Corliss steam engine, which was the primary power source for a paper mill. The technical visitor will be most interested in the cross-compound double-acting steam engine with Corliss' patented patented rotary valves; the engine's 500 h.p. at 100 r.p.m. of the 15-foot, 17-ton flywheel. The hobbyist visitor will be most interested in the Hollingsworth and Vose Company, the paper manufacturer that owned the machine, as well as the fact that machines of this size were uncommon in the mills of the mining West. The visitor may also want to know that the museum's library has several books that discuss the set-up and adjustment of this machine. The casual visitor will be most interested in the engine's use at a paper mill in Massachusetts from 1910 until 1972, that it powered the entire mill during those years but was taken out of service when the steam boilers became too expensive to fire, and that as a state-of-the-art power machine in 1895 (when it was built) a similar engine was exhibited at the Chicago World's Fair.

The Yellow Jacket II, a 10-stamp ore mill, is our most complete, easy to understand and exciting exhibit. On two different occasions during the summer we operate the mill and crush ore in order to interpret both the stamp milling process and the technology that replaced it. We begin with a brief history of the special building style required for a stamp mill, talk about stamp milling in general, and explain the supporting equipment. Then we continue with an introduction to basic ore types and the actual milling process. Finally, we turn on the water and drop the stamps for about 10 minutes. A question-and-answer session rounds out the operation, followed by more technical discussions about ore dressing and mill operations for those visitors who desire more details. After running the mill this way for the past two seasons, some things have become very apparent. Casual visitors are able to easily understand how a stamp mill used to operate by seeing the ore move through the process. Also, if a piece of equipment is not working properly, or if pieces of equipment are missing, some knowledgeable visitor will point it out. And finally, we have found that it is confusing to fill up the extra floor space in the mill building with other machinery. We are fortunate to have some excellent primary source materials in our library, which is invaluable in preparing interpretation of the milling process as well as in answering tough questions from the visitors. Some of these sources are: the *1902 Mine & Smelter Supply Company Catalog* (Denver); the *1905 Hendrie & Bolthoff Mfg. & Supply Catalog* (Denver); the *1902 Allis Chalmers Company Gold & Silver Mills Catalog* (Chicago); *The Stamp Milling of Gold Ores* (T. A. Rickard, 1906); and *Ore Dressing* (Robert Richards, 1908).

The variety of exhibits in the main exhibit building and in the mill, as well as the diverse interests of the visitors, both allow and encourage our staff to develop personal expertise in different areas of mining. Some interpreters have chosen to specialize in ore dressing and milling processes, while others have become experts on drilling, blasting, and mining, assaying and mineral identification, or blacksmithing and drill sharpening techniques. This offers our visitors an in-depth interpretation of mining history and offers the repeat visitor new interpretations and knowledge with every visit.

SITE MANAGEMENT

The everyday requirements for site management in an establishment of this type are challenging and occasionally expensive, since we must preserve artifacts which are operated frequently if not daily. The main exhibit/library building offers the fewest problems since the primary concern is keeping the machines clean and lubricated. The Yellow Jacket II mill requires much more specialized care, because of the immense size of the machine. Here we must check and tighten all bolts on the stamp mill, as well as the timber connectors throughout the building. A regular lubrication schedule is essential, and requires turning the grease cups on all the bearings along the entire length of the line shafts and oiling all the machinery. It is also necessary to check the drive belts for fraying or excessive cracking, to tighten and align the belts as required, and to treat the belts with belt dressing. In addition, the mortar must be prepared before every running by wetting the stamp shoes, mucking out the mortar, and cleaning the screen.

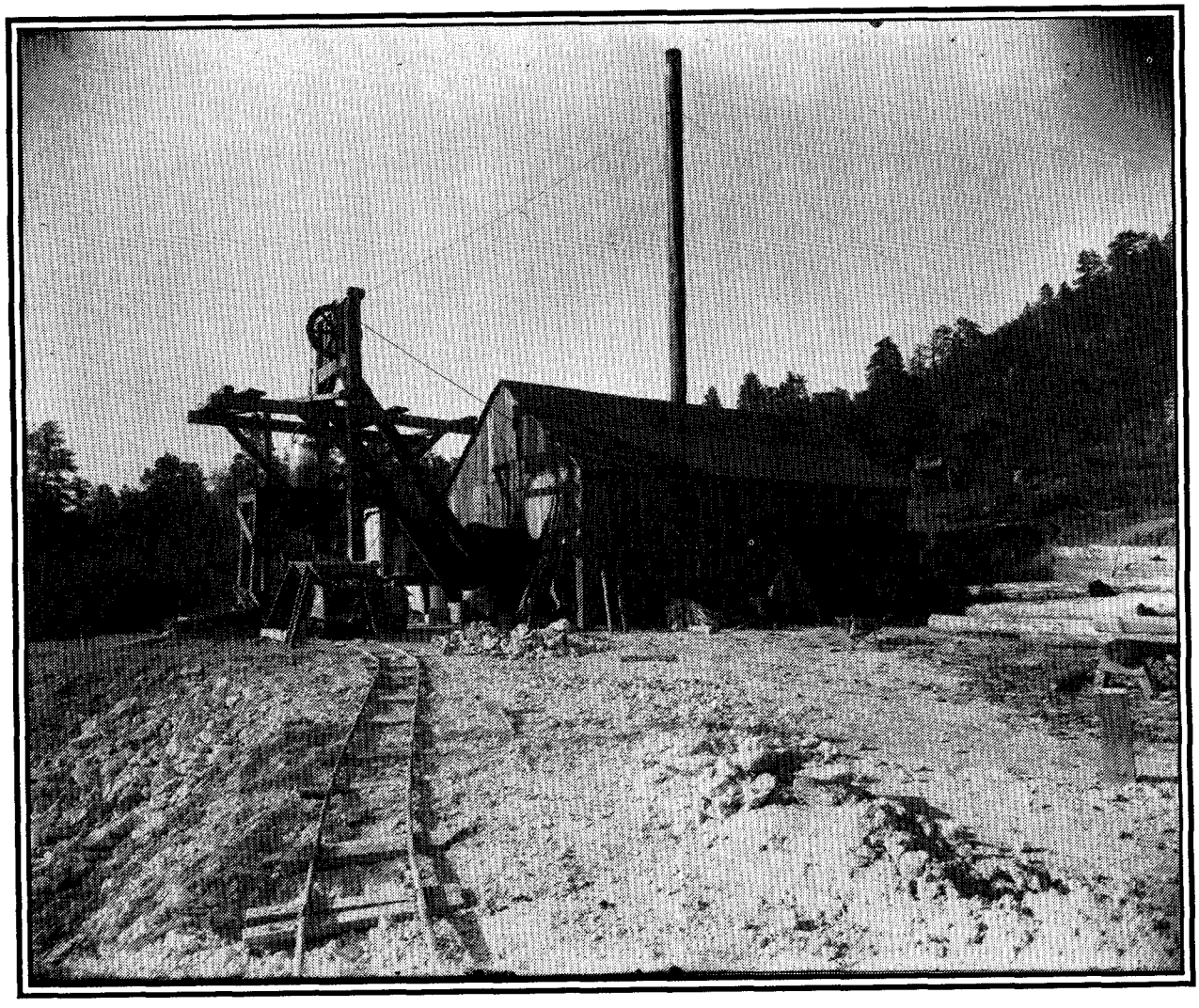
Machinery which is not currently on exhibit must be stored responsibly if it is to be operated at a future date. Fortunately, this requires little more than just moving the artifact indoors and protecting it from the elements. In some cases a machine must be disassembled in order to move it or to store it. Before disassembling any artifact, detailed photographs, drawings and notes must be made to facilitate its reassembly at a future time. Another important step is to store all pieces belonging to each machine with that machine, since it is far too easy to forget where pieces are when they become scattered. Currently, we are concentrating on cleaning up our storage yard and moving our worthwhile artifacts inside. Artifacts which are too badly damaged to be restored or which are out of the museum's focus are either kept for parts or taken to the scrap yard. This is a formidable task because of the weight and size of most mining machinery. We use a forklift and a crane, as well as a smaller pallet loader and mighty mites for the indoor work.

RECOMMENDATIONS

In perspective, operating a museum of this type or a historic site is always a big job, although it can be made easier by keeping a few guidelines in mind. It is most important to carefully judge your audience as to their level of interest and adjust your interpretation accordingly. Also, the average visitor will find a technical display much easier to understand if it is operational; visual aids and operating exhibits should be the basis for interpretation whenever possible. We have found that most mining machinery is far from delicate, and that problems of excessive wear are eliminated by regular lubrication and inspection. Spare parts are generally difficult to find for this antique machinery, and that is why we rarely operate the machines at full speed or for any great length of time. The alternatives are to either operate the artifact carefully and perform lubrication and repairs conscientiously, or to maintain only static exhibits and deprive the visitor of the chance to observe how industry and technology have changed in the mining West.

The Western Museum of Mining and Industry is always ready to help out other mining-related institutions. If we can assist you with research or documentation of any mining machinery and its use, or if you are missing parts or a machine to fill a gap at your historic site, please feel free to contact us. We will do our best to assist you through our collection of artifacts and catalogues.

Case Studies



Unidentified Yavapai County mine, Arizona (1900-1910). Photo courtesy of the Arizona Historical Foundation, Spude Collection, Tempe.

PRESERVING A NATIONAL HISTORIC LANDMARK: VIRGINIA CITY, NEVADA

Larry A. Wahrenbrock
Preservation Consultant
Silver City, Nevada

Mining activities in historic areas are increasing in number and size. Current mining technology focuses on large-scale surface mining techniques to extract ore and large-scale heap leach operations to process the ore. Both of these activities consume large areas of land and drastically alter the landscape. Historic mining in the West primarily used underground mining techniques which produced limited surface disturbance. These historic mining areas have distinct landscapes as a result of the historic underground mining and milling technology utilized in the extraction and processing of the ores. Land ownership in these historic mining areas is predominantly fee simple private ownership as a result of the "patenting" of original claims made during the historic mining period. With this in mind the following questions have presented themselves as unresolved issues.

1) Is there a threshold for landscape degradation due to contemporary surface mining in existing historic mining areas with distinctive cultural landscapes produced by underground mining techniques?

2) Does/Can/Should/Must the issuance of an air and/or water quality permit as required by a state environmental protection agency working under an approved program to carry out the provisions of the Federal Environmental Protection Act constitute a federal undertaking and therefore require a Section 106 review of mining projects wholely on private land?

3) For those who deal with private properties designated as National Historic Landmarks I would direct you to Section 1908 of the Mining in National Parks Act (PL 94-429) for some interesting reading.

IMPACT ASSESSMENT USING COMPUTER GRAPHICS

The use of computer technology to evaluate the visual impacts of surface mining to cultural landscapes has seen extremely limited application. The use of three-dimensional (3D) computer graphics for the interpretation and assessment of impacts to cultural landscapes by surface mining activities is exemplified by the Nevex Gold Company Inc. project in Silver City, Nevada.

In 1987 a surface mining project by Nevex Gold Company Inc. (Nevex) immediately adjacent to a historic mine/mill building complex and within the primary viewshed of the main street and the town as a whole was proposed in Silver City, Nevada, a part of the Virginia City National Landmark Historic District. The project was reviewed by the Lyon County Planning Commission under the provisions of the Lyon County Land Use Ordinance and Special Use Permit procedures.

A group of local residents (the Silver City Residents Association or SCRA) formed an association for the purposes of reviewing and assessing impacts of the project. SCRA prepared a comprehensive review of the Nevex project based on the company's Change of Land Use (zoning change) and Special Use Permit applications. Potential impacts to the town, the inhabitants and the historic district were assessed and evaluated.

Among the many potential impacts identified for specific study by SCRA was the visual impact the proposed surface mine would have on the landscape. Nevex provided specific pit design data in their application to Lyon County Planning Department. The design was drawn to scale and provided specific data on the location, shape and depth of the pit at completion. USGS mapping of the area was available at a scale of 1:62500 and a contour interval of 40 feet. Using a three-dimensional wire frame type graphic computer program, a model of the existing topography was generated. The pit design data was then reconciled to the scale of the USGS mapping. The result was the ability to accurately represent the visual impacts of the proposed surface mining activity in a graphic fashion with imagery that could be readily interpreted by everyone. A variety of "before" and "after" images were prepared using

selected homes as the observation point. Attached is a location map for the observation points and resultant computer images.

Below is a synopsis of the Silver City Residents Association's presentation to the Lyon County Board of Commissioners. The Silver City Residents Association is a group of 25 to 30 concerned citizens in Silver City, Nevada. The group provided time, money, energy, creativity and expertise to the overall task. I was only a part and would like to recognize each and every member's contribution to the total effort.

SUMMARY OF PRESENTATION TO LYON COUNTY BOARD OF COMMISSIONERS

The position of the Silver City Residents Association has been exhaustively prepared. Every aspect of the material submitted by Nevex Gold Co., Inc. has been carefully reviewed. Each area of concern has been specifically addressed by recognized authorities. The scope of the project is broad and complex. The questions raised are substantial. The concerns of the residents are genuine. A tremendous amount of personal sacrifice in time, money, and energy by the Residents Association has been brought to bear on the issue. Our dedication is not to be minimized and will not be compromised.

It has been more than five years since the people of Silver City first perceived the potential threat of modern mining to their community. The spirit of responsible citizenship generated a movement to seek reasonable protection within the established framework of the Lyon County Zoning Ordinance. The result was the adoption of the "mining" section of that law. This ordinance was created only after a great deal of study and deliberation by a group of citizens and representatives of the mining industry. Subsequently the ordinance was amended, limiting the areas of the county where it would apply to only that area within the boundaries of the Comstock Historic District. The people of Silver City protested this geographic reduction but accepted the outcome, knowing that at least they were still protected.

Why is it important? Why all the effort? Silver City is part of a National Landmark Historic District. The Comstock is recognized as being important to the development of our nation. The state of Nevada was born of the Comstock. It is here that future generations can look to see and learn about the past.

The people of Silver City consider themselves stewards of this national treasure. They have accepted a responsibility to respect the physical manifestations of that treasure by investing in the maintenance of the land and buildings. They accept the regulation of their efforts through strict architectural control by the Comstock Historic District Commission. They purposefully respect their environment and they gratefully enjoy their life style.

The residents of Silver City <u>do not oppose</u> mining. They oppose the destruction of their environment through modern open-pit mining technology. They oppose the impacts that open-pit mines have on the integrity of the National Landmark. Many of them drive by the Gold Hill pit each working day and are reminded of the magnitude of ruination this kind of technology produces. They are reminded of the permanence of the decimation visible there. They are resound in their opinion that open pits are not safe, not pretty, not appropriate, and not necessary.

In an effort to demonstrate how Nevex's mine will impact Silver City, a computer model of the existing landscape was generated based on USGS data. Four views of Grizzly Hill, from four residences, were produced. (See maps and graphics following.) Then using the information provided by Nevex, the pit was delineated by the model in each view. The results are plain to see. The magnitude of the proposed mine is undisguised. The blight on the visual setting is self-evident. The impact on the historic integrity is pronounced. The reason for the residents' concern is inescapable.

It is important to note the composition of this scar. It is manifestly distinct from the kind of landscape deformities left by historic mining. A pit is a negative image, a void. Historic scars are positive images: additives to the landscape in the form of piles of rock associated with vertical shafts, and assemblages of mill wastes. When a visitor comes to the Comstock he expects to see these kinds of contextual elements, not open pits. The history here is of underground technology. Any activity which destroys these historic features or creates derangement in the landscape leads to visitor disorientation and adversely impacts the integrity of the district.

The situation now is that the "mining" ordinance is being tested. Nevex Gold Company has acquired property in Silver City and they wish to extract gold and silver by means of modern open-pit methods. They have submitted an application outlining their intentions and the residents have prepared their response. Lyon County must weigh the evidence and make a decision. The task will not be easy; it has not been easy for the mining company or the people of Silver City either. Important tasks require effort.

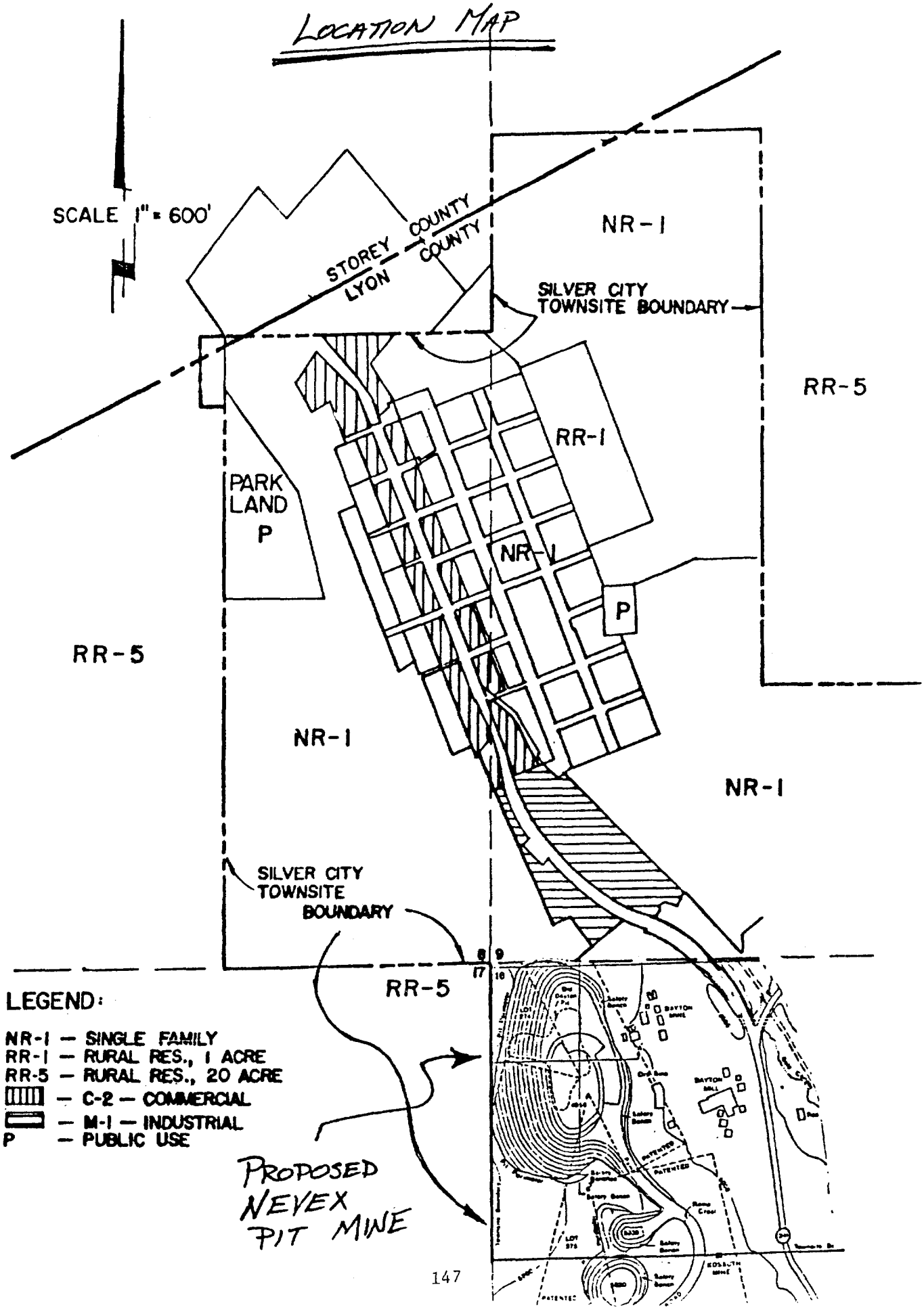
The Silver City Residents Association has provided this response as an aid to Lyon County and our assistance will not end here. We expect a studied review. We place our trust in your decision making ability. We fully understand the complexities involved. We can be relied upon to continuously participate in this exercise of local governmental process. We do not expect to rely on federal or state procedures. We have recognized our responsibilities. We worked for a framework in which those responsibilities are delineated and we will persist in our efforts to maintain our position.

CONCLUSIONS

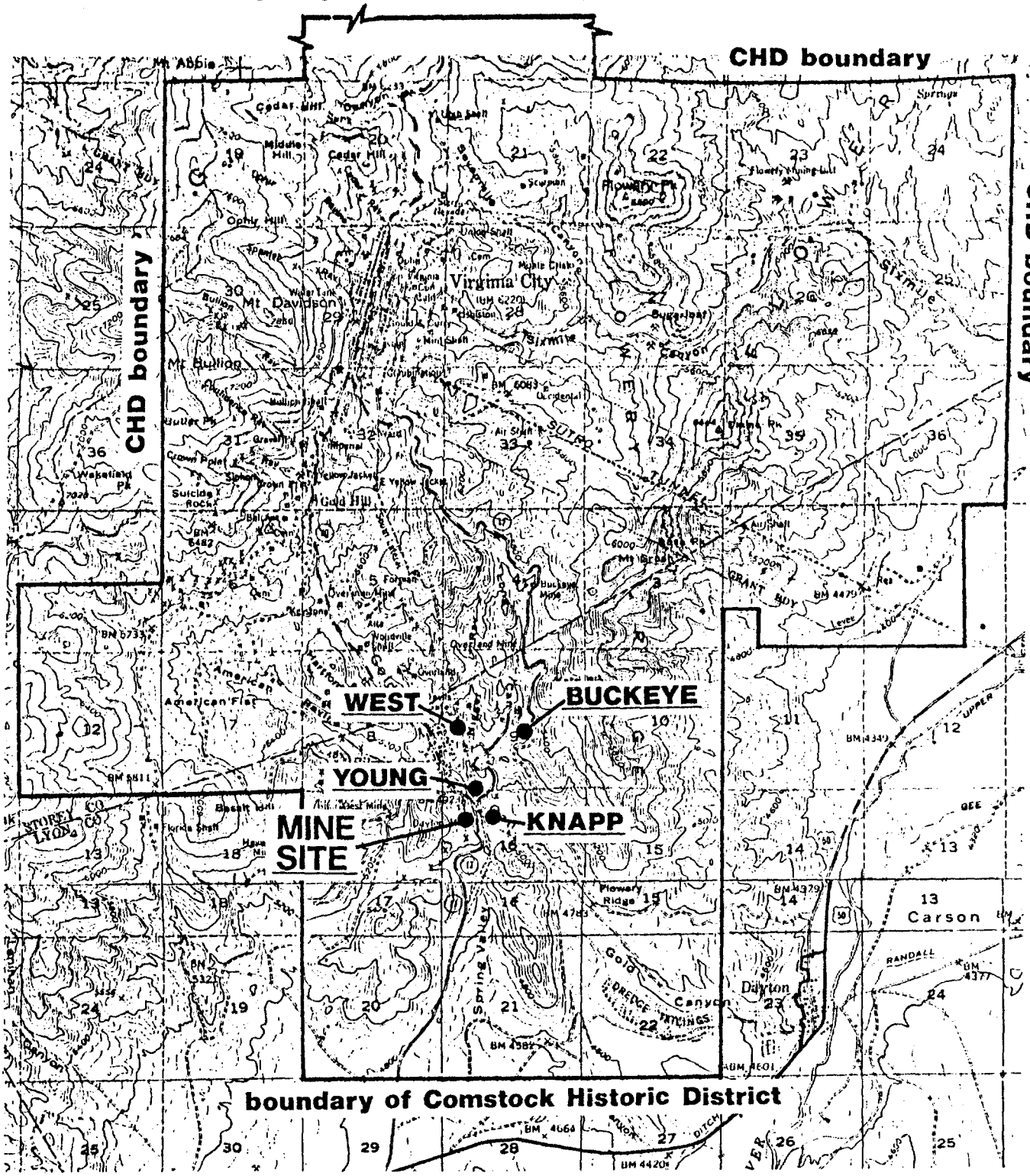
Two important observations can be made from this case study. The first is that "public opinion drives public policy." The testimony prepared by SCRA and presented at public hearings held by the Lyon County Planning Commission and the Board of County Commissioners provided facts, figures, and graphic representations of the impacts of the proposed mine project. As we all know, a picture is worth a thousand words. To obtain an accurate "picture" of visual impacts from a proposed activity can be a difficult task. Computer technology, however, provides a method of producing such a "picture." The various "views" prepared of the the existing landscape and the landscape at the completion of the mining project showed the extent of the visual impact. The result was a kind of humanizing of the issue of visual impacts in a fashion that was readily accepted by the public, the members of the Lyon County Planning Commission and the Lyon County Board of Commissioners.

The second observation is that the assessment of visual impacts is no longer such a difficult task. The availability of computer 3D graphic programs which generate accurate, scaled landscape models which can then be manipulated is a reality. Further advances in these types of programs have been created since this work was done and more is expected in the future. Professionals working in historic preservation and particularly with historic mining landscapes need to become familiar with and begin using this technology.

LOCATION MAP

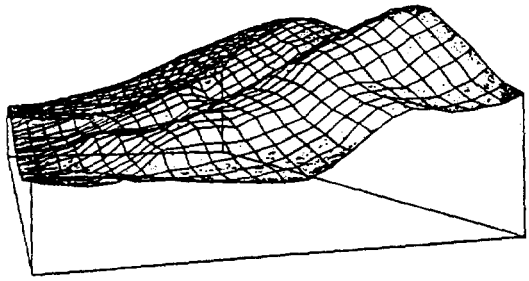


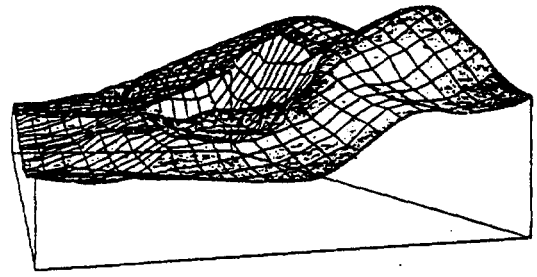
location of properties to proposed mine site



EXISTING VIEWS

PROPOSED PIT VIEWS





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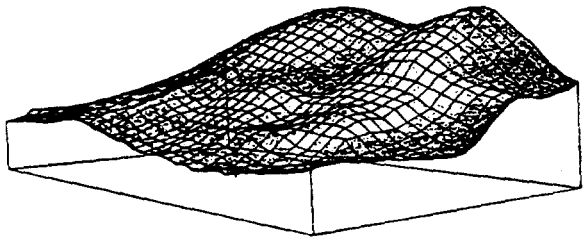
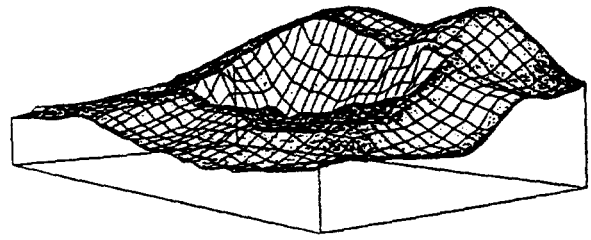
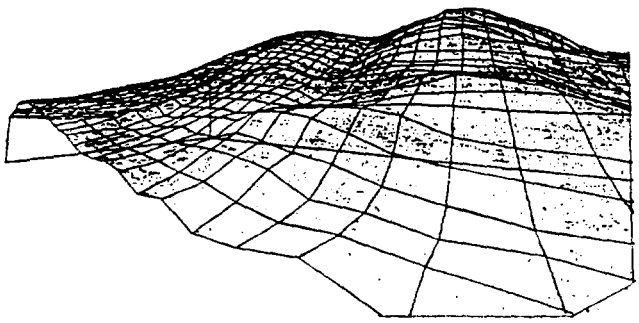
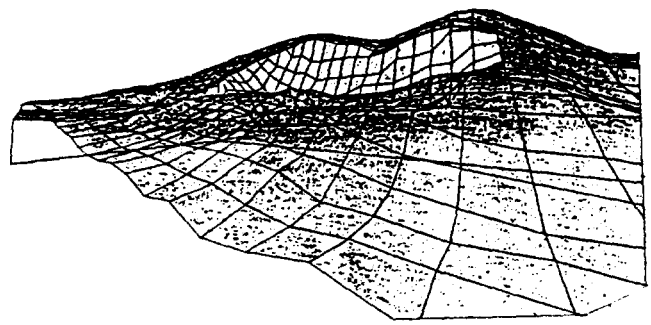


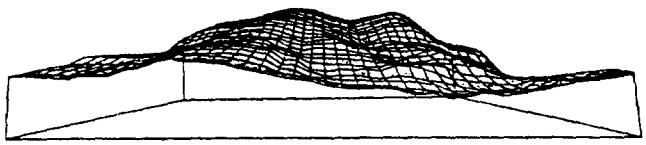


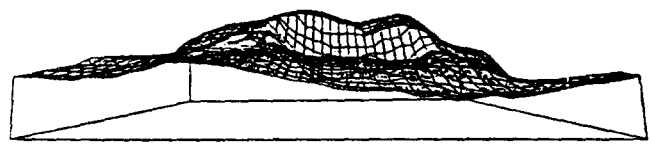
BUCKEYE MINE SITE





YOUNG RESIDENCE





KNAPP RESIDENCE

COMPUTER SIMULATED VIEWSHEDS OF THE PROPOSED NEVEX GOLD COMPANY PROJECT SILVER CITY, NEVADA

MODERN MINING'S VIEW OF HISTORIC MINING

Doug Dreisner, Administrator
Division of Abandoned Mine Lands
Nevada Department of Minerals
Carson City, Nevada

Mining affects our daily lives by producing the raw materials needed by our society. Mining companies, like any other businesses, exist to try to make money. That is, they have to produce a product for less than they can sell it for. That is their bottom line.

There is no sharp break between historic mining and modern mining. Advances in the techniques and technology of mining have been continuously evolving--and continue to do so. Mining companies are interested in their heritage but also realize that their present operations will be the history of tomorrow.

Mining companies are sometimes willing to provide funding for historic restoration. Below is a listing of mining associations from several states. These mining associations can provide information on which companies might be possible candidates to approach for funding a project.

STATE MINING ASSOCIATIONS

ARIZONA MINING ASSOCIATION
2702 North Third Street, Suite 2015
Phoenix, Arizona 85004
(602) 266-4416

CALIFORNIA MINING ASSOCIATION
1010 11th Street, Suite 213
Sacramento, California 95814-3807
(916) 447-1977

COLORADO MINING ASSOCIATION
1500 Grant Street, Suite 330
Denver, Colorado 80203
(303) 894-0536

IDAHO MINING ASSOCIATION
P.O. Box 1660
Boise, Idaho 83701
(208) 342-0031

MONTANA MINING ASSOCIATION
P.O. Box 132
Helena, Montana 59624
(406) 443-7297

NEVADA MINING ASSOCIATION
1 East First Street
Reno, Nevada 89501
(702) 323-8575

NEW MEXICO MINING ASSOCIATION
P.O. Box 5527
Santa Fe, New Mexico 87502
(505) 983-6457

NORTHWEST MINING ASSOCIATION
414 Peyton Building
Spokane, Washington 99201
(509) 624-1158

OREGON MINING ASSOCIATION
P.O. Box 400
Rogue River, Oregon 97537

UTAH MINING ASSOCIATION
825 Kearns Building
Salt Lake City, Utah 84101
(801) 364-1874

WYOMING MINING ASSOCIATION
P.O. Box 866
Cheyenne, Wyoming 82001
(307) 635-0331

SURVEY AND MITIGATION AT ROYAL/MOUNTAIN KING MINES, CALAVERAS COUNTY, CALIFORNIA

Judith Cunningham, Historian
Foothill Resource Associates
Murphys, California

This paper will describe the archaeological and historical survey of a major mining project in Calaveras County, California, as well as the proposals for mitigation. The Felix/Hodson District was determined to be eligible for the National Register of Historic Places and a mitigation plan was developed which would provide the mining company and the public with the retrieval of the most significant historical aspects and information potential. Of the three mitigation products--the preparation for publication of a popular historical book on the mining district, the salvage and preservation of certain significant objects of mining history, and the preparation of a scholarly report on the project area--I believe the publication of the popular book to be the most interesting and rewarding to the general public.

PROJECT DESCRIPTION

The Royal/Mountain King mining project, in Calaveras County, California, is being developed by Meridian Minerals, Inc. of Englewood, Colorado. The project encompasses approximately 2,400 acres in Salt Spring Valley, just north of Copperopolis, at an elevation of 5,000 feet. On the property are remnants of both ranching and mining activities, roads and settlements, and a pre-historic site. Meridian Minerals plans a project of ten or more years to recover gold from the Hodson Hills, located in the west belt of the California Mother Lode, using open-pit mining methods.

The area had been sporadically mined from the late 1850s to the early 1940s with numerous types of mining methods. The drainages in the Hodson Hills were first placered in the early 1850s. Hardrock mining commenced on a small scale during the late 1850s and continued through the early 1860s (when a ditch system was constructed to bring water to the mills). The late 1880s through the early 1900s were the boom years for the region, with the construction of the 120-stamp Royal mill, as well as smaller mills on the Mountain King, Empire and Etta claims. This period then saw the introduction of a large ethnic labor force of second generation Mexicans from New Almaden, California.

This boom was over by the late 1900s, but small scale mining and prospecting continued through the depression era, which was characterized by simple technologies and a migrant population. The late 1940s saw the extraction of some rich pockets of ore near the company town of Hodson, while periodic exploration and survey work was conducted during the 1950s, 1960s, and 1970s. In 1987 Meridian Minerals began exploration and development work for the proposed mining project. Construction of the haul roads, dams, storage sites, mill, offices, and support facilities began in early 1988 and the mill commenced operations in February 1989.

An initial achaeological and historical survey of 1200 acres was conducted by INFOTEC Research, Incorporated, during the spring of 1987. This area was resurveyed by Archaeological Services, Incorporated, along with an additional 850 acres, in the summer of 1987. For this second survey, Foothill Resource Associates was responsible for identification of and research on historical sites and features, determinations of significance, and management recommendations. All field work and research were conducted by historical archaeologist Julia Costello and the author.

In total, 738 archaeological features were identified in the project area; these were grouped into 269 numbered features and sites. All but 13 of these were located within the boundaries of the historic Madam Felix Mining District and were directly or indirectly related to mining. Included were remains of the earliest placer mining and prospecting activities of the 1850s and 1860s, the first successful milling operations of the 1870s, and the booms and closings of the four large, 20th century mining and milling operations. Associated with this archaeological record of mining were the remains of the early settlements, cabin sites, commercial enterprises, and the company town of Hodson where miners lived.

A typology was developed which distinguished features related to: geologic mineral resources, mineral recovery, mineral milling, support facilities, water supply, transportation, and residences (Table 1).

TABLE 1

CLASSIFICATION OF ARCHAEOLOGICAL MINING SITES AND FEATURES

I. Geologic Mineral Resource Sites
- A. Veins
- B. Outcroppings
- C. Ancient River Channels

II. Mineral Recovery Sites
- A. Placer Mining
  1. Hand surface mining
  2. Mechanized surface mining (hydraulicking)
  3. Mechanized underwater mining (dredging)
  4. Underground mining (drift mines)
- B. Lode (Hardrock) Mining
  1. Surface
     - a. Hand excavated
       - (1) Prospect hole
       - (2) Trenching
       - (3) Surface vein mining
       - (4) Open pit or cut
     - b. Machine excavated
       - (1) Modern drill holes
       - (2) Bulldozer scrapes
       - (3) Trench
       - (4) Open pit
         - (a) Power shovel
         - (b) Heavy machinery
  2. Underground
     - a. Shafts
       - (1) Vertical
       - (2) Incline
       - (3) Associated features
         - (a) Working (hoist) platform
         - (b) Headframe
     - b. Adits
     - c. Raises or glory hole to surface
  3. Secondary Mining
     - a. Waste rock and gravel
     - b. Re-processed tailings

III. Mineral Milling Sites
- A. Crushing and grinding the ore
  1. Grinding mills
     - a. Arrastras
     - b. Chilean (chili) mill
  2. Gravity stamp mill
  3. Crushing mill
  4. Revolving mill
  5. Ore bins
- B. Recovery: Separation and concentration
  1. Physical
     - a. Tables
     - b. Vanners
     - c. Flotation

TABLE 1 continued

2. Chemical
    a. Amalgamation and retorting
    b. Chlorination
    c. Cyanidization

C. Assaying
D. Smelting
E. Waste Disposal
1. Mine waste rock
2. Mill tailings
3. Equipment
    a. Pumps, siphons
    b. Wheels

F. Ore storage vault

IV. Support Facilities
A. Power supply
1. Water (See V. below)
2. Electricity
3. Steam (boilers)
    a. Wood fuel
    b. Oil

B. Powder house
C. Maintenance
1. Blacksmith/Machine shop
2. Vehicle
3. Carpentry

D. Office
E. Changing room
F. Bunkhouse
G. Toilets
H. Compressor

V. Water Supply Sites
A. Spring
1. Undeveloped
2. Developed

B. Creek or stream
1. Seasonal
2. Year round

C. River
D. Pond
1. Natural
2. Reservoir/Dam
3. Side hill reservoir

E. Well
F. Water transporation
1. Ditch
2. Side hill ditch
3. Flume
4. Pipeline
5. Pumping facilities

G. Storage Tank

VI. Transportation Sites
A. Trails
B. Roads

TABLE 1 continued

1. Private, industrial road
   a. Inter-mill site
   b. Long-haul heavy equipment
   c. Mine access road
2. Local convenience (private)
3. Tertiary: leads to service center
4. Secondary: connects service center and town
5. Primary: connects towns

C. Railway and tramway lines
1. Mining
2. Recovery site to mill site
3. Commercial spurs to mill
4. Commercial lines

D. Airfields
1. Landing strips
2. Airports

E. Bridges

VII. Residential Sites

A. Small (one to three structures)
1. Simple leveled pad(s)
2. Pad(s) with fireplace(s), basement(s), and other improvements
3. Stone walled structure(s); other improvements
4. Frame structure(s)
5. Domestic trash
6. Support facilities (outhouses, sheds, wells)

B. Service Center: commercial structures and residences

C. Town: includes public services such as post office, church, school, meeting hall, etc.

A district chronology was also developed and was used to place the activities within seven major time periods.

The significance of these remains was evaluated according to criteria for listing on the National Register of Historic Places. Although the Felix/Hodson District had virtually no standing buildings, no intrusive (non-mining) elements had been imposed upon the landscape. Despite some layering of activities on the same location, evidence of all periods of mining and historic mining techniques were preserved. The concentration of mining and mining-related features appeared to be eligible as the Felix/Hodson District. It included nearly all of what was historically known as the Madam Felix mining district. It was potentially eligible under Criterion A (associated with events that have made a significant contribution to the broad patterns of our history) and Criterion D (may be likely to yield information important to history). Historic and archaeological research questions dealt with five major themes: environmental change, technological change, economic change, geographic/demographic change, and social and cultural dynamics.

Documentary research was conducted in the publications of the State Division of Mines and Geology, the *Mining and Scientific Press*, the *Engineering and Mining Journal*, publications of the Calaveras County Historical Society, and in the official records of Calaveras County (mining claims, deeds, homesteads, land claims, tax assessment records, notes of the General Land Office surveyor, the Federal Census, and the Great Register of Voters).

The historic maps of the Felix/Hodson District were also studied for specific roads, mining and milling features, and habitation sites. These included the U.S.G.S. 7.5 minute series quadrangle maps, the ca. 1870 General Land Office maps, the Bureau of Land Management claim maps, and the maps produced by various mining companies of both above ground features and underground workings of the mines.

Individuals who had worked or resided in the area were contacted for their recollections of places and events. Their reminiscences, totalling over 40 hours of interviews, were taped, transcribed, and indexed for pertinent information and eventual deposition at a recognized archival agency. Descendants of families who were from the area were also contacted regarding possible photographic collections and all probable archival repositories were researched for photographs. All of the historic photographs were reproduced for possible publication and eventual archival storage.

The Felix/Hodson area was unique and special in that it had families that had resided locally for many generations, providing a continuity with all the mining phases. They had also retained numerous photographs of the communities, mills, underground mining, and individuals who worked and resided in the region. Most of those who were interviewed had extraordinary memories regarding not only the mining and milling processes, but also the social and economic life of the area.

Mining consultants were used to decipher the resources in conjunction with the historic and informant evidence. They were able to determine technological changes in mining and milling processes, to identify remnants of equipment scattered about the project area, and to recognize different time periods of mining and milling operations.

Finally, the report was greatly benefitted by the more than 15 years research conducted in the area by mining geologist Willard Fuller, Jr., and the 10 year historical interest of the author. The district was significant partly because of all of these extraordinary resources, enabling the authors to document the almost total history of the Felix/Hodson District.

PROPOSED TREATMENT PLAN

The size and scope of the proposed Royal/Mountain King project would completely destroy major portions of the historic district. Options to avoid this adverse impact to the resources were: redesign of the project to avoid the resources, preservation of certain portions of the resources, or retrieval of the significant historic aspects and information potential of project area resources.

Because ore bodies crucial to the economic success of the project encompassed a major portion of the district, avoidance was not a viable alternative. Although certain resources could be preserved to compensate for the destruction of others, it was the totality of the resources, not individual elements, that

provided the greatest significance. Therefore, it was recommended that the retrieval of significant historical aspects and information potential be pursued.

Specific mitigation tasks included obtaining extensive historical documentation, conducting systematic informant interviews, and the preparation of an inventory catalogue of all these historic materials, all to be filed at an accessible archive. Archaeological work included excavations at three sites, the removal of specific objects for salvage, and the organization of recorded features into historically and technologically relevant groupings to assist in the production of maps of the cultural landscape at different time periods. The remains of 6 mills and related industrial features of the district would be technically recorded and photographed according to guidelines established by the Historic American Engineering Record.

The specific mitigation products resulting from the completion of the mitigation tasks would be:

l. The preparation for publication of an historical account of the Felix/Hodson mining region that would "preserve" the significant historical aspects of the District for a general audience of interested persons. This publication would include historic maps, photographs, and pertinent data from informants. It would be a detailed, accurate, and readable account of the mining and social activities of the area written for a general audience.

2. The salvage and preservation of certain significant objects of mining history.

3. The preparation of a scholarly report on the project area resources incorporating data pertinent to the proposed research questions. It would draw on the same historical, ethnographic, and archaeological research that contributed toward the popular publication, but would provide an anthropological synthesis of the information and include data too technical for the more generalized volume.

CONCLUSIONS

There are two imporant points I would like to make regarding the production of historic and archaeological surveys of mining sites. The first is that we should use consistent and correct mining terms to describe sites, features, and processes. Mining engineers and geologists have developed a nomenclature over a long period of time and for specific reasons. If we use terms like "waste rock" and "tailings" interchangeably, no one reading our reports is certain of what we are describing. We should accurately use "adits," "tunnels," "shafts," "winzes," and "stopes" to describe mine entrances and places where ore is removed, as well as other terms often misused regarding the entire mining and milling processes. By using mining nomenclature to describe mining sites, our reports will be much more useful and credible to the agencies and companies for whom they are produced, as well as to the public who reads them for accurate information.

The second point I would like to emphasize is the importance of producing a popular publication. This product could vary from a short article in a local historical society journal to the hardbound book described here, and should be built into the project as a mitigation measure, not expected as extra work by the researchers. If we are extracting significant historic information from resources under the mandate of federal and state laws, the project mitigation should provide for making our results available to the public which supports us, not simply to the archaeologists, historians, engineers, biological scientists, politicians and bureaucrats who may, of necessity, read our often lengthy and boring reports. If we are ever to provide any real value to history, we must make it available to our public in a palatable manner in which it can partake.

RESEARCHING THE GALT #8 COAL MINE IN LETHBRIDGE, ALBERTA

Margaret Kennedy
Department of Geography, University of Lethbridge
Lethbridge, Alberta

One of the most distinctive landmarks on the horizon of the City of Lethbridge in southern Alberta, Canada, is the site of the Galt #8 coal mine. Its tipple, water tower and imposing brick buildings are very familiar to the citizens of Lethbridge, and are evocative of a time when coal mining was the lifeblood of the community. Once there were dozens of mines tapping the coal resources of the Lethbridge region. Today, due only to the interest taken by the present landowner, the Galt #8 is one of the few extant historic surface coal plants in all of Alberta.

The Galt #8 was run by Lethbridge Collieries, whose roots lay ultimately with the enterprising Galt family who first initiated full-scale mining activities in the Lethbridge region beginning in 1882. The #8 first started up in 1935 on 8,000 acres of proven coal lands west of the Oldman River, borrowing much of the equipment from the #6 mine which had closed that same year. The #8 produced over 3.5 million tons of sub-bituminous (heating or domestic) coal before it closed in 1957. Although almost all of the equipment was later sold and the interiors of the buildings gutted to accommodate the new owners (a concrete company), the shells of almost all the original structures still stand intact.

Since January 1989, the members of my Archaeology course at the University of Lethbridge have been studying various aspects of the coal industry in Lethbridge region by focussing on the Galt #8. The indepth study of the Galt #8 has proven timely in a number of ways. First, the ultimate purpose of the course is to introduce students to the philosophy, methods and techniques of heritage preservation. The Galt #8 is, as mentioned above, one of the few remaining surface plants, representative of an earlier era when coal was our predominant energy resource. Others that survived the end of the reign of coal after the 1950s with the rise in use of oil and gas, have unfortunately suffered from modern development, neglect, and indifferent attitudes towards preservation of such features by certain landowners. Therefore, both the rarity of such industrial complexes and their historical significance elevates the necessity to preserve them intact. Therefore, one aim behind the student research into the Galt #8 was to produce a document with all possible historical and architectural details recorded. This manuscript could then serve as a data base from which to promote preservation of the site. Students are currently investigating topics such as: the structural history of the extant buildings--construction style, alterations and modifications; "as-found" inventory of remaining original equipment; labour history of the Lethbridge coal industry, particularly as it relates to #8; accidents and safety records of the industry; miners' housing in specific former coal mining neighbourhoods in North Lethbridge; study of socioeconomic conditions of the mining population and its ethnic composition.

The second rationale for focussing upon the Galt #8 relates to the rapidly growing field of tourism development here in the province of Alberta. Heritage preservation and interpretation have been closely allied with economic development through tourism, Albertans having appreciated that they have a very interesting and diverse historic past. The City of Lethbridge is seeking to promote a major tourism destination facility, possibly related to the interpretation of plains settlement and resource development. The Galt #8 is worthy for restoration/interpretation, either on its own or as a potential component of a broader multi-facility concept. Whether or not it would be restored as a model of a working coal mine surface plant, or be put to alternate usage with low-key interpretation cannot be stated at this point. (One student is attempting a feasibility plan for his individual research project).

Hopefully by term end, the project will have accomplished two goals. First, it will have allowed first-hand appreciation by the students of the multifaceted steps involved in the study, preservation and interpretation of historic sites. Second, it will hopefully provide a useable document from which overtures can be made for this site's future preservation status. Whatever the outcome, it has proved to be an enjoyable learning experience for all involved.

RYAN, CALIFORNIA: THE CURIOUS CASE OF THE "PORTABLE" BORATE MINING CAMP NEAR DEATH VALLEY

Gordon Chappell, Regional Historian
Park Historic Preservation Division
National Park Service, Western Region
San Francisco, California

Ryan, California, largely survives as a preserved borate mining camp of the mid-1920s, closed to the public but maintained in a state of arrested decay by its owner, the U.S. Borax and Chemical Corporation. This firm succeeded the builder of Ryan, the historic Pacific Coast Borax Company controlled originally by Francis Marion "Borax" Smith.

The history of borax mining in the United States is dominated in the public mind by the harvesting, beginning in 1871, of surface deposits of "cottonball" borax and other borax salts from dry lake beds and salt marshes along the California-Nevada border. These included Columbus Marsh, Teel's Marsh, Rhodes Marsh, Little Borax Lake, and the salt sink of the Amargosa River in Death Valley, as well as other lesser alkali flats in the desert country. Above all, the public image embraced the romantic story of the long haul of immense wagon loads of borax from Death Valley to the distant Southern Pacific Railroad at Mohave, California, by enormous teams of twenty mules. Less well known is the lengthier and more complex history of underground mining of borate minerals through tunnels, shafts, and stopes. Ryan and its mines represented this later, underground phase of borate mining.

Mining in the vicinity of Ryan had a long history. In December 1882 a prospector found an outcrop of a new borax ore, soon named colemanite for borax developer William T. Coleman, south of Furnace Creek Wash in the vicinity of Monte Blanco near Corkscrew Canyon on the east side of Death Valley. Miners reached lodes and veins of colemanite through the customary tunnels and shafts. But discovery of similar ore in 1883 in the Calico Mountains southwest of Death Valley led to borate mining there, since that ore deposit lay only six miles as a crow flies from a railroad. When Coleman's company failed in 1888, "Borax" Smith, the portly, flamboyant entrepreneur who had pioneered development of borax processing at Teel's Marsh, acquired the Calico property and incorporated the Pacific Coast Borax Company.

In a canyon in the Calico Mountains, Smith built in the late 1880s a mining camp of wood frame, board-and-batten-finished shacks, which he named "Borate." Mule teams hauled the colemanite ore down a twelve-mile road to Daggett on the Atlantic & Pacific Railroad (a part of the Santa Fe System). In 1894, the company bought a coal-burning steam tractor to haul a pair of ore wagons, but it burned too much fuel and did not pull well either in soft sand or on steep grades. After a year of using "Old Dinah," as the tractor came to be called, the company reverted to mule teams and wagons, but in 1898 it constructed a narrow gauge (three-foot gauge) railroad whose locomotives were lettered "Pacific Coast Borax Co." but whose freight cars carried the name "Borate and Daggett R.R." The company bought two Heisler locomotives, christened with "Borax" Smith's first and middle names--the Francis and the Marion. Borate mining proceeded in the Calico Range, while the company placed its ore bodies in the Death Valley region in reserve status, and continued there only the assessment work necessary to retain the claims. In 1899, Smith and British associates formed Borax Consolidated, Limited, in London, a holding company which thereafter owned the Pacific Coast Borax Company.

In 1903, the borax deposits in the Calico Mountains neared exhaustion, and the company sought a new source of colemanite. Reexamining their reserves near Death Valley, they focused on the Lila C. Mine. Prospectors had located outcroppings of colemanite in 1884 in a hill a few miles east of the Greenwater Range and east of Death Valley in the valley of the Amargosa River. But it lay 120 miles from the nearest railroad. Smith and his associates decided to build a railroad to serve it, and also to tap from the south some of the potential traffic from the booming gold and silver mining districts around Tonopah, Goldfield, and Bullfrog, Nevada. Smith's right-hand man, John Ryan, began to build a railroad north from Las Vegas, but Senator William A. Clark's Los Angeles and Salt Lake Railroad would not permit

a track connection. Worse, Clark soon began his own rail line north from Las Vegas, the Las Vegas and Tonopah Railroad. Smith's men instead had to lay out a longer railroad north from Ludlow on the Santa Fe. Organized late in 1904, this Tonopah and Tidewater Railroad completed track to the Lila C. Mine on August 16, 1907.

Meanwhile, borate ore in the Calico Mountains had run out and the company rapidly developed the Lila C. Mine as a replacement. Initially the company built a steam traction road with railroad-like grades over which "Old Dinah" could haul its two wagons of ore until the railroad could be finished. The company also moved board-and-batten buildings from Borate to the new camp, which it named for its General Superintendent of Mines and Mills, John Ryan. Once the railroad had reached Death Valley Junction, it paused in main line construction and extended a branch seven miles southwest to the Lila C. Mine and the new borate camp of Ryan. Then the Tonopah & Tidewater continued track construction north from the junction to Gold Center, and eventually Beatty, where it connected with the Bullfrog Goldfield Railroad to provide a through line to Goldfield, Nevada.

The original mining camp of Ryan consisted of little more than the mining camp of Borate moved to a new location. The end of the standard gauge Lila C. Branch of the Tonopah & Tidewater curved south around the west side of a borate-rich hill. There, east of the track on the west slope of the hill, lay the mine adits, while west of the track stood the four company houses, the company store, the boardinghouse, a bunkhouse, and shacks and dugouts of the miners. Eventually the Pacific Coast Borax Company dismantled the old Borate & Daggett Railroad and moved its two locomotives and other salvageable material to Ludlow, where it lay unused.

Even though the annual output of the Lila C. far exceeded expectations, with much more rich ore blocked out for future extraction, by 1908, if not earlier, F.M. Smith envisioned its eventual exhaustion, and had John Ryan begin reviewing other company reserves. He focused on those around Monte Blanco and in Corkscrew Canyon south of Furnace Creek Wash, and surveyors began seeking alternative routes for a railroad line to those claims. Unlike the easy route across the Amargosa Valley to Ryan, the new line would have to climb around the northern end of the Greenwater Range and then find a suitable grade through the Greenwater Valley and around the north end of the Black Mountains of the Funeral Range to reach these claims. En route, the most suitable alignment passed in the vicinity of a group of six claims on the west slope of the Greenwater Mountains that Coleman's prospectors had located in 1883 and 1884: the Played Out (which was not yet), the Upper Biddy McCarthy, the Lower Biddy McCarthy, the Lizzie V. Oakley, the Grand View, and the Widow. Enough ore existed in this vicinity, about fifteen miles northwest of Ryan, to keep the company busy for some years before it would extend its track down into the Greenwater Valley and Corkscrew Canyon.

In 1913 Clarence Rasor surveyed a final location for a another branch of the Tonopah & Tidewater to the vicinity of the six aforementioned claims. When the California State Railroad Commission refused to allow the T. & T. to increase its capitalization to cover the cost of the new construction, which would depart from the Lila C. Branch about three miles southwest of Death Valley Junction, Borax Consolidated management instead incorporated the new line separately as the Death Valley Railroad. The company also decided to build it as a narrow gauge, reusing some of the old Borate & Daggett engines and equipment. A crew of 325 men and 150 mules took ten months in 1914 to build the twenty mile Death Valley Railroad at a cost of about $400,000, most of the expense invested in the last ten miles of the line. The locomotive Francis moved construction trains until the railroad could purchase a new consolidation locomotive.

The company stripped Ryan of its buildings, moving most of them to the townsite established at the temporary end of the new narrow gauge near the Upper Biddy McCarthy claim. Wooden shacks originally built at Borate made their second move. Initially, the company named the new borate camp "Devar," an acronym derived from DEath VAlley Railroad. However, when in 1920 the U.S. Geological Survey revised its Bullfrog Mountain quadrangle map to include the new railroad and mining camp, it locked in print forever the erroneous spelling of "Devair." Anyway, within a short time the company moved the name of its town at the Lila C., entirely dismantled by 1916, to join the rest of the salvage, and called new the camp "Ryan". After all, the "new" Ryan consisted at first largely of buildings and equipment moved from "old" Ryan, so why not move the name too? No one considered that, forever after, people would have to qualify Ryan as to whether they spoke of the "new" or the "old" Ryan, but it was only the "new" Ryan that survived. In a sense, then, this was the third location and incarnation

of essentially the same mining camp, consisting of many of the same buildings, equipment, and people having been established at three successive locations--Borate, "old" Ryan, and "new" Ryan. At least, this was its status from 1914 until 1922.

Unfortunately, in 1914, just as the "old" Ryan moved to the "new" Ryan, even as men spiked rails to ties on the Death Valley Railroad, F.M. Smith's financial empire collapsed due to problems involving his real estate and electric railway investments, and he resigned from the borax firm.

This Ryan, like the old, proved an unpleasant place to live for the first six or seven years. The camp was unsanitary. Mules supplied most of the local transportation and left droppings everywhere, which spread unpleasant odors and caused a seemingly ineradicable infestation of flies. Hogs kept nearby to supply pork to the boarding house added more droppings, which attracted more flies. Some of the old shacks that dated to Borate still housed miners as well as a variety of bugs. Many miners preferred dugouts in the hills above or the gulch below to the bug-infested shacks. "A stranger would have been amused to see the heads pop up all over the place like prairie dogs when the warning whistle blew before breakfast," recalled Harry Gower.

Billy Smithran, mine superintendent at the Lila C., moved to the new camp, but with obviously failing health from what now is called silicosis. The company brought in William H. Faulkner, a humorless, "stuffed shirt" English mining engineer, to replace him.

Ryan sat in the middle of a group of mines. Immediately south lay the Upper and Lower Biddy McCarthy, while two miles to the north on the railroad the company mined the Played Out claim. Late in 1914, or early in 1915, in order to reach the mines south of Ryan, the company commenced construction of a cheap two-foot-gauge railroad operated by gasoline engines pulling ore cars of three tons capacity each. At first this line reached only to the Grand View. Soon the company extended this tramway, locally dubbed the "Baby Gauge," to the Lizzie V. Oakley, a half mile farther south, where a quarry opened in 1916. After the end of World War I in 1918, the company extended the Baby Gauge to the Widow claim, about four miles south of Ryan. The Baby Gauge ore cars brought borate to Ryan, where the tramway cars went out on top of a wooden ore bin into which they dumped their loads. The bins emptied into the three-foot gauge hopper cars of the Death Valley Railroad.

Harry Gower recalled life at Ryan during its early years:

> Living and working conditions at Ryan up to 1922, when we began to get some new bunk houses and staff residences, were pretty rough by today's standards though probably no worse than most other mining camps. Some of the men wouldn't even live in the ramshackle old cabins provided, but built for themselves rock huts or lean-tos on the hillside above or in the gulch below town.... Neither were the meals anything to write home favorably about. Eight hours a day, seven days a week and no travel time was the schedule, and I mean every day. I remember what a concession it was, and the saintlike expression of the superintendent as he said on Christmas morning, "Let the boys knock off at three o'clock today, they may want to clean up before dinner."

Ryan was a non-union camp, despite efforts by representatives of the International Workers of the World, a left wing labor union, to organize the miners:

> The I.W.W. would send out a couple of organizers once in awhile but didn't seem to have much to offer to a gang, who for the most part wanted only to make a stake and get out. One morning two of them showed up and planned a noontime meeting at the Widow Mine where 75 men were employed. They were not allowed on our little ore train [on the Baby Gauge] and had to walk the three and a half miles along the narrow gauge track to get there. I took a short cut over the hills and picking up three or four men, went down the track a ways to meet them. Ostensibly we were repairing a switch as they came along to wonder how in hell I had gotten there ahead of them. They took the hint, retraced their steps to camp and pulled out on the afternoon train for Death Valley Junction.

Ryan would remain a non-unionized camp until the mines shut down.

Miners at Ryan did not entirely lack entertainment. The Pacific Coast Borax Company found in Rhyolite, a nearby gold mining camp by then nearly abandoned, and purchased, an old Catholic church, reportedly built with money donated by Rhyolite's saloons. The company moved it to the hillside below Mesa Negra at the northeast corner of Ryan and turned it into a reading room and recreation hall, and eventually installed a stage so it could double as a theater.

At that time conventional wisdom held that women could not stand or endure the heat of the desert as well as men, so the few women in camp tended to move to the Los Angeles area for summer months. But when she was at Ryan the rest of the year, the wife of the assistant superintendent, Pauline Gower, who played the piano well, periodically participated in entertainments. The recreation hall frequently featured silent films, and Pauline provided musical scores on the piano in the darkened room, often accompanied by a violin or other instrument depending upon what musical talents were available on a given night.

Out of a hundred borate minerals known, twenty-five occurred in the Death Valley region, in addition to naturally occurring boric acid, known as sassolite. But the principal commercially-valuable borate ores were: borax, a hydrous sodium borate which occurred as glassy, clear, or translucent monoclinic crystals which, when dehydrated of half their water by very dry air, turned white and became tincalconite; kernite, a hydrous sodium borate with less water than borax, which could be found in large crystalline plates or cleavable masses which cleaved easily into splintery fragments; colemanite, a hydrous calcium borate which appeared as clear to white prismatic crystals or as granular to massive aggregates; and ulexite, a hydrous sodium calcium borate occurring as rounded aggregates of soft white radiating needlelike fibers, which led to its being called "cottonball" borax. Colemanite and ulexite comprised the ores dug out of Ryan's mines. They appeared in large underground beds, the purest colemanite at the top, with increasing admixture of ulexite with depth. They occurred in shale formations also impregnated with lime--the shale could be separated out easily, but the lime proved difficult to treat. At the same time the Pacific Coast Borax Company built the railroad to Ryan, it moved a processing mill from "old" Ryan to Death Valley Junction to separate out the borates in low grade ore. High grade ore, however, travelled by rail to refineries at Alameda, California, and Bayonne, New Jersey.

Initially, no one had foreseen the presence of ulexite mixed with the colemanite, and at first the company had no way to deal with it, because concentrating it required a different process than the one used to concentrate colemanite, so the miners separated it out and piled it on the dump. Finally the company built a wet-processing plant at Ryan; it burned and the company rebuilt it. The company also built a Stebbins dry-deshaling plant to remove all the shale mixed with the colemanite and ulexite. These efforts finally solved the ore processing problems.

In 1921 the Pacific Coast Borax Company assigned Bill Faulkner elsewhere at his own request and hired an Australian, Julian Boyd, as Superintendent at Ryan. Boyd and his family made two impressions on Ryan's residents when they arrived: (1) nobody could understand a word he said, because of his thick Australian accent; and (2) his four young children all wore heavy fur coats. The coats vanished quickly; alas, the Australian accent lingered. When Boyd said "pie die" he meant pay day, and so on. For many years the railroad superintendent of the T & T, a great jokester, always introduced him as "Major Julian Bird" whereupon the Major would say "No, not Boid; The name is Boyd."

An Australian army major during the war, Boyd proved an effective manager. He had the hogs all slaughtered and replaced mulepower with electric hoists, gasoline speeders, automobiles, and motor trucks. That eliminated the manure that attracted the flies. Then laborers tracked the remaining flies to their breeding places and destroyed them by sprinkling the area with borax powder.

Assistant Superintendent Harry Gower remembered the day an employee showed Major Boyd an infestation of bugs in one of the old cabins moved from Borate. Boyd pulled out a case of matches, struck a light, dropped the flaming match on the mattress, and in short order flames reduced four cabins to ash and cinders.

Also in short order, the Pacific Coast Borax Company opened its coffers for construction of new, clean, fireproof dormitories and a dozen modern cottages for staff members with families. Everything the

company built had an industrial flavor; characteristically, even the little schoolhouse with a bell tower had not only the roof but also its walls clad in industrial corrugated metal. The Ryan of today is largely the Phoenix that grew from the ashes left by Boyd's match. Boyd also had a sewage system installed in the camp and imported purer drinking water by railroad tank cars from a well near Shoshone.

By 1928 the Pacific Coast Borax Company had developed vast new reserves of a new kind of borate ore in the Kramer District, specifically at Boron, California, rasorite that was cheaper to mine, transport, and refine than the borates of the Death Valley region. At Ryan, meanwhile, although the Played Out had finally lived up to its name and the ore in the upper and lower Biddy McCarthy mines neared exhaustion, the Widow Mine, originally believed to contain only a modest amount of ore, proved instead to have vast deposits of borates.

Still, Ryan's output could not compare in price with the output in the Kramer District, and in 1928 the Pacific Coast Borax Company shut down mining at Ryan and placed its remaining ore deposits back in reserve status. The Death Valley Railroad would never resume construction down through the Greenwater Valley to Corkscrew Gulch and Monte Blanco.

Surprisingly, about that same time the Pacific Coast Borax Company decided to enter the tourist business. It added accommodations to the old Greenland Ranch and called it Furnace Creek Ranch. At the top of an alluvial fan southeast of the ranch, at Willow Spring, the company built the Furnace Creek Inn in 1928. It turned its community center at Death Valley Junction into the Amargosa Hotel, and the dormitories at Ryan into the Death Valley View Hotel, whose west porches offered the tourist a marvelous vista of Death Valley in the distance down Furnace Creek Wash.

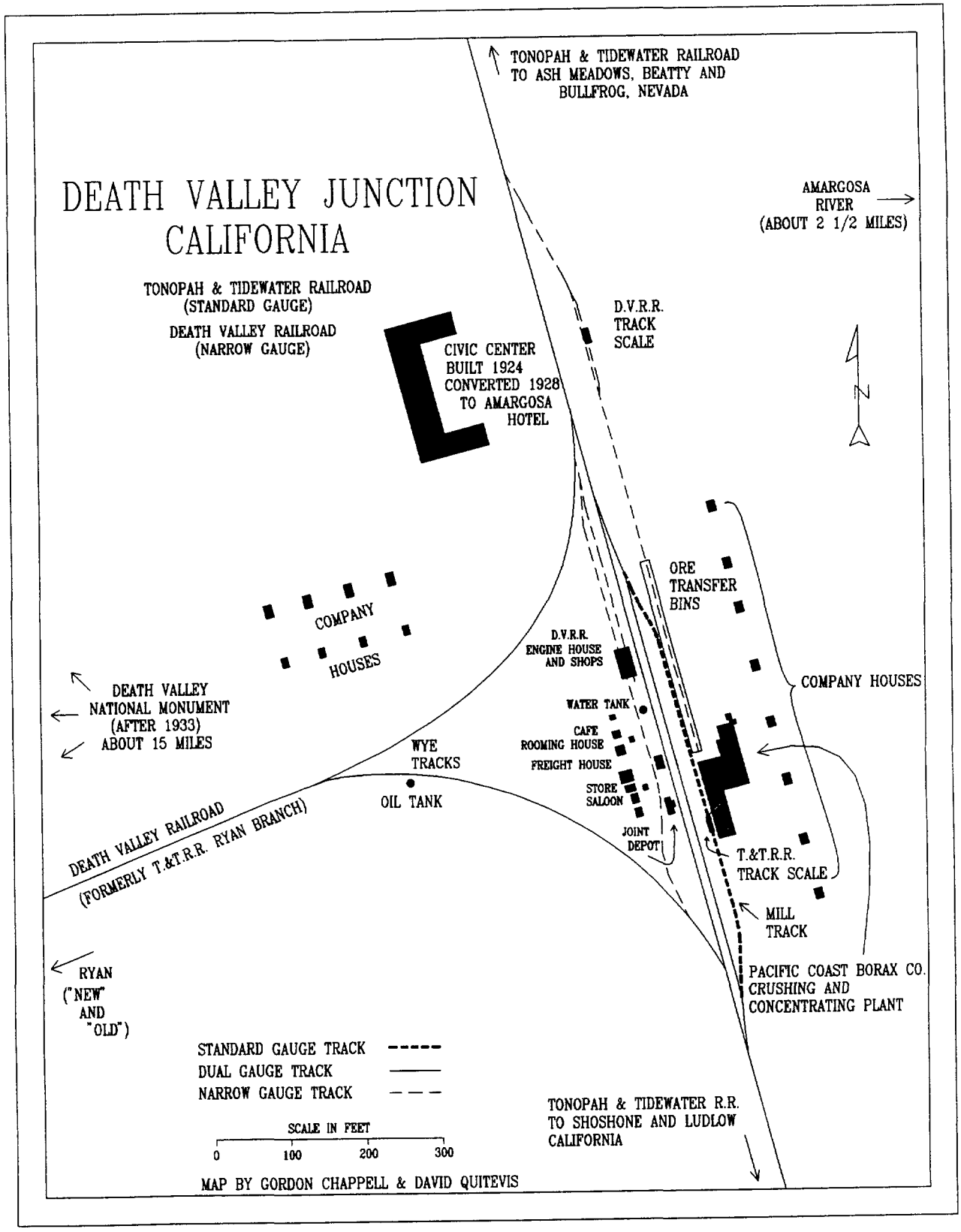
The Death Valley Railroad purchased a Brill combination baggage-passenger motorized car in which to haul visitors from Death Valley Junction to Ryan, the Tonopah & Tidewater acquired a similar but larger standard gauge car in which to carry tourists from Ludlow to Death Valley Junction and on to Beatty, and the Pacific Coast Borax Company added seats to four "Baby Gauge" flat cars, enabling the two-foot gauge trains to carry tourists along the scenic route to the Widow Mine. Pacific Coast Borax joined with the Union Pacific Railroad to promote tourism to Death Valley, each publishing colorful brochures to advertise the traffic.

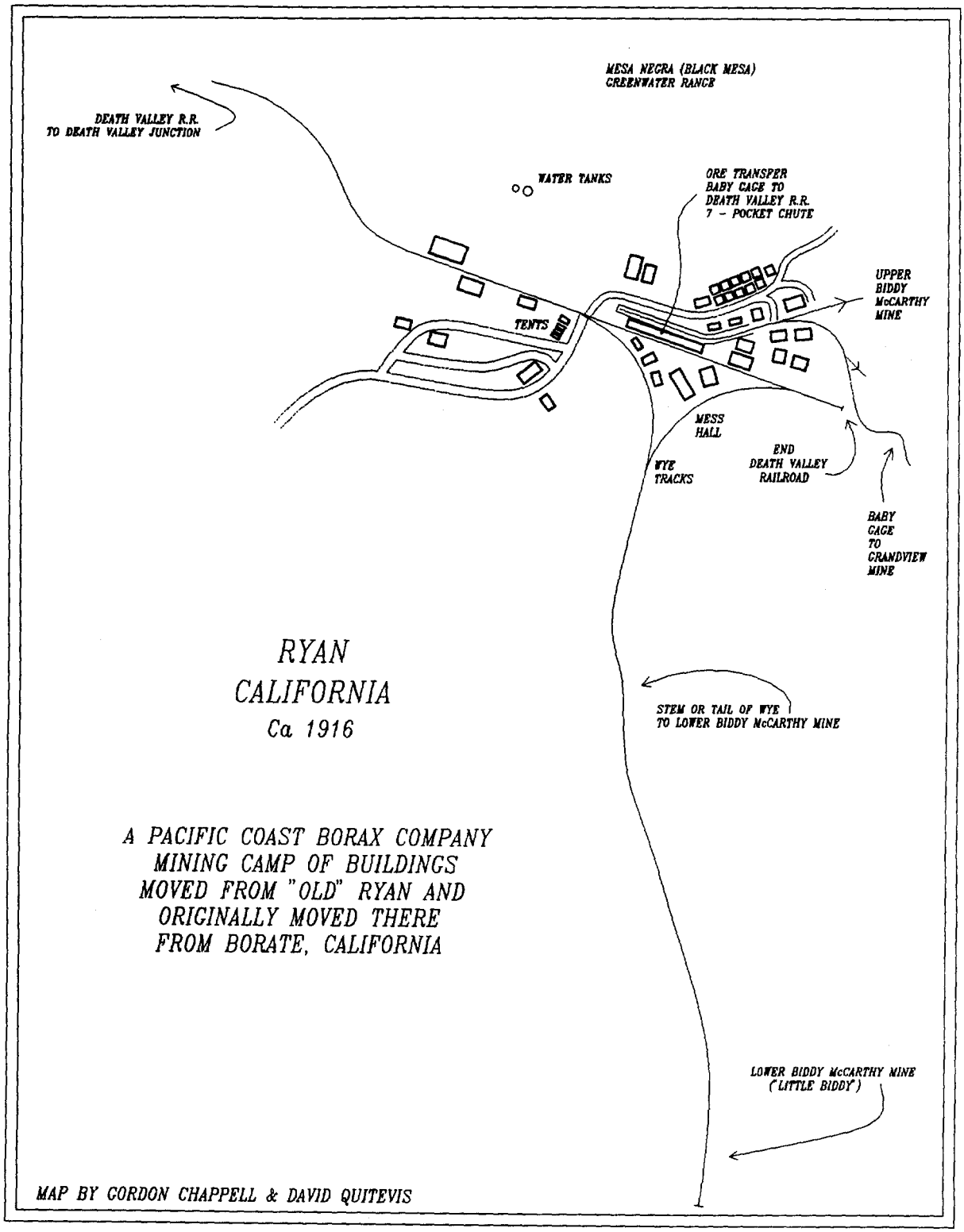
Alas, Black Thursday's stock market crash in the fall of 1929 brought on the Great Depression which quickly ended the tourist boom, and shut down the Death Valley View Hotel and the Death Valley Railroad. In 1931 the company dismantled the railroad and shipped it, along with its employees, to Carlsbad, New Mexico, where it operated for many more years as the mine railroad of the United States Potash Company, a Pacific Coast Borax subsidiary.

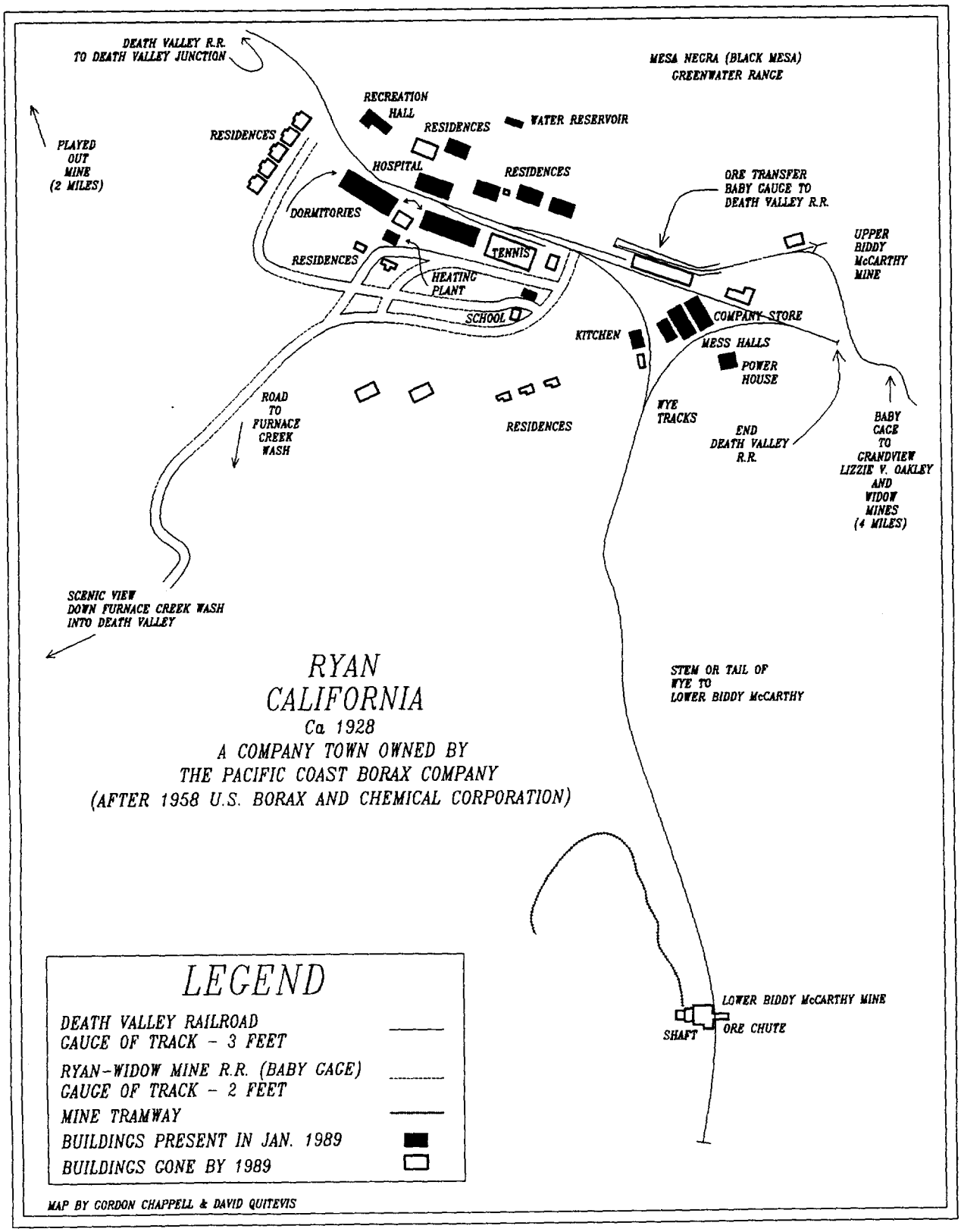
In 1959, Pacific Coast Borax Company became U.S. Borax and Chemical Corporation, which preserves Ryan as a base for future exploitation of borates in its nearby mines and elsewhere in the vicinity. Occasionally a conference or meeting is held there.

The Death Valley Railroad tracks, the ore bins into which the Baby Gauge dumped ore which in turn emptied into three-foot gauge hopper cars, two or three residences that burned, and one or two other industrial buildings, as well as all the old wooden buildings from "old" Ryan and from Borate, are long gone. But at least 16 buildings in Ryan, including most of the major ones, remain. Two large two-story dormitories and their oil-fired steam heat plant, the two-story hospital with quarters upstairs for doctors and nurses, the recreation hall from Rhyolite, four residences, two mess halls, the powerhouse, the kitchen/warehouse, and the school rest on the steep hillside below Mesa Negra, awaiting the return of borate miners to the Death Valley region.

The Baby Gauge (spelled "Baby Gage" on a schedule board at Ryan) continued to haul tourists sporadically until 1950, and even on occasion as late as the early 1960s. As of 1990, four of its maximum of seven miles of track remained in place, and Ryan's Area Manager had restored its friction-drive Plymouth gasoline engine and one of its tourist cars. Perhaps some day it may again haul people.


DEATH VALLEY JUNCTION
CALIFORNIA
TONOPAH & TIDEWATER RAILROAD
TO ASH MEADOWS, BEATTY AND
BULLFROG, NEVADA
AMARGOSA
RIVER
(ABOUT 2 1/2 MILES)
TONOPAH & TIDEWATER RAILROAD
(STANDARD GAUGE)
DEATH VALLEY RAILROAD
(NARROW GAUGE)
CIVIC CENTER
BUILT 1924
CONVERTED 1928
TO AMARGOSA
HOTEL
D.V.R.R.
TRACK
SCALE
N
ORE
TRANSFER
BINS
COMPANY
HOUSES
D.V.R.R.
ENGINE HOUSE
AND SHOPS
COMPANY HOUSES
DEATH VALLEY
NATIONAL MONUMENT
(AFTER 1933)
ABOUT 15 MILES
WATER TANK
CAFE
ROOMING HOUSE
FREIGHT HOUSE
STORE
SALOON
JOINT
DEPOT
WYE
TRACKS
OIL TANK
DEATH VALLEY RAILROAD
(FORMERLY T.&T.R.R. RYAN BRANCH)
T.&T.R.R.
TRACK SCALE
MILL
TRACK
RYAN
("NEW"
AND
"OLD")
PACIFIC COAST BORAX CO.
CRUSHING AND
CONCENTRATING PLANT
STANDARD GAUGE TRACK
DUAL GAUGE TRACK
NARROW GAUGE TRACK
TONOPAH & TIDEWATER R.R.
TO SHOSHONE AND LUDLOW
CALIFORNIA
SCALE IN FEET
0
100
200
300
MAP BY GORDON CHAPPELL & DAVID QUITEVIS


MESA NEGRA (BLACK MESA)
GREENWATER RANGE
DEATH VALLEY R.R.
TO DEATH VALLEY JUNCTION
WATER TANKS
ORE TRANSPER
BABY CAGE TO
DEATH VALLEY R.R.
7 - POCKET CHUTE
UPPER
BIDDY
McCARTHY
MINE
TENTS
MESS
HALL
WYE
TRACKS
END
DEATH VALLEY
RAILROAD
BABY
CAGE
TO
GRANDVIEW
MINE
RYAN
CALIFORNIA
Ca 1916
A PACIFIC COAST BORAX COMPANY
MINING CAMP OF BUILDINGS
MOVED FROM "OLD" RYAN AND
ORIGINALLY MOVED THERE
FROM BORATE, CALIFORNIA
STEM OR TAIL OF WYE
TO LOWER BIDDY McCARTHY MINE
LOWER BIDDY McCARTHY MINE
("LITTLE BIDDY")
MAP BY GORDON CHAPPELL & DAVID QUITEVIS


DEATH VALLEY R.R.
TO DEATH VALLEY JUNCTION
MESA NEGRA (BLACK MESA)
GREENWATER RANGE
RECREATION HALL
RESIDENCES
WATER RESERVOIR
RESIDENCES
PLAYED OUT MINE (2 MILES)
HOSPITAL
RESIDENCES
ORE TRANSFER
BABY GAUCE TO
DEATH VALLEY R.R.
DORMITORIES
UPPER BIDDY McCARTHY MINE
TENNIS
RESIDENCES
HEATING PLANT
SCHOOL
COMPANY STORE
KITCHEN
MESS HALLS
POWER HOUSE
ROAD TO FURNACE CREEK WASH
RESIDENCES
WYE TRACKS
END DEATH VALLEY R.R.
BABY CAGE TO GRANDVIEW LIZZIE V. OAKLEY AND WIDOW MINES (4 MILES)
SCENIC VIEW DOWN FURNACE CREEK WASH INTO DEATH VALLEY
RYAN
CALIFORNIA
Ca 1928
A COMPANY TOWN OWNED BY
THE PACIFIC COAST BORAX COMPANY
(AFTER 1958 U.S. BORAX AND CHEMICAL CORPORATION)
STEM OR TAIL OF WYE TO LOWER BIDDY McCARTHY
LOWER BIDDY McCARTHY MINE
SHAFT
ORE CHUTE
LEGEND
DEATH VALLEY RAILROAD
CAUCE OF TRACK - 3 FEET
RYAN-WIDOW MINE R.R. (BABY CAGE)
CAUCE OF TRACK - 2 FEET
MINE TRAMWAY
BUILDINGS PRESENT IN JAN. 1989
BUILDINGS GONE BY 1989
MAP BY GORDON CHAPPELL & DAVID QUITEVIS

BIBLIOGRAPHY

Gower, Harry P., *50 Years in Death Valley; Memoirs of a Borax Man* (N.P.: Death Valley '49ers, 1969) 145 pp.

Gerstley, James M., *Borax Years, Some Recollections, 1933-1961* (Los Angeles: U.S. Borax and Chemical Corporation, 1979) 93 pp.

Greene, Linda W., *Historic Resource Study; A History of Mining in Death Valley National Monument.* (Denver: National Park Service, 1981) Vol II, pp 976-1021.

Hildebrand, George, *Borax Pioneer: Francis Marion Smith.* (San Diego: Howell-North Books, 1982) 318 pp.

Lingenfelter, Richard, *Death Valley & The Amargosa; A Land of Illusion*, (Berkeley: University of California Press, 1986) 664 pp.

Maumundar, Hasmukhrai H., "Borate Mining History in Death Valley," *California Geology* Vol. 38, No.8, August 1985 p.p. 171-177.

McAnnally, Margaret, "Way Back When," *Pioneer* [House magazine of The U.S. Borax & Chemical Corporation] Vol. 30 No. 3 1989, pp 20-21.

Myrick, David F., *Railroads of Nevada and Eastern California*, Vol 2 (Berkeley: Howell-North Books, 1963) p.p. 608-621, 823-826.

Travis, N.J., and Cocks, E.J., *The Tincal Trail; A History of Borax.* (London: Harrap Limited, 1984)

Woodman, Ruth C., "History of Pacific Coast Borax Company," 1949, MS., 929 pp. Special Collections, University of Oregon Library Eugene, Oregon.

Woodman, Ruth C., *The Story of the Pacific Coast Borax Company*
(N.P.: Borax Consolidated, Ltd., 1951) 60 pp.

Acknowledgements

The author is indebted for assistance in researching and revising this article to: The Public Relations staff of U.S. Borax and Chemical Corporation in Los Angeles, specifically Joe Kern, Charles Davis and Tana Asker; to the firm's Manager Jeff Moore; to National Park Service Historians Linda Greene, Bob Spude and Ann Huston and National Park Service Historical Archeologist Leo Barker; to Death Valley historian Richard Lingenfelter; to Colorado Railroad Museum Executive Director Bob Richardson; to Death Valley National Monument Mining Engineer Mel Essington and Curator Shirley Harding.

APPENDICES

Leo R. Barker

A: HISTORIC MINING PROPERTIES OF HABS AND HAER

B: HISTORIC MINING PROPERTIES OF THE NATIONAL REGISTER

C: WESTERN MINING HISTORY: A GENERAL BIBLIOGRAPHY

D: THE ARCHEOLOGY OF HISTORIC MINING SITES: SOURCES

John Lemoigne preparing gold ore for testing. Death Valley (ca.1910). Photo courtesy of the Arizona Historical Foundation, Dane Coolidge Collection, Tempe.

APPENDIX A: HISTORIC MINING PROPERTIES IN THE RECORDS OF THE HISTORIC AMERICAN BUILDING SURVEY AND THE HISTORIC AMERICAN ENGINEERING RECORD
(up to January 1990)

Control#	BS/ER#	Property Name	City/Town	DOCUMENTATION AVAILABLE Drwgs	Photos	Data	Location
AK0003	AK-1	KENNECOTT MINES	KENNECOTT	15	144	62	HH
AK0007	AK-2	SOLOMON RIVER GOLD DREDGE		0	9	0	HH
AK0008	AK-3	HAMMON CONSOLIDATED GOLD FIELDS		0	4	1	HH
AK0049	AK-7	A.D. WILCOX DRIFT MINE	BETTLES VIC.	0	1	1	LC
AK0178	AK-7-A	A.D. WILCOX DRIFT MINE, BOILER CABIN	BETTLES VIC.	0	4	0	LC
AK0179	AK-7-B	A.D. WILCOX DRIFT MINE, HEADFRAME	BETTLES VIC.	0	1	0	LC
AK0180	AK-7-C	A.D. WILCOX DRIFT MINE, CABIN	BETTLES VIC.	0	4	0	LC
	AK-8	INDEPENDENCE MINE	PALMER VIC.	0	4	0	LC
AK0181	AK-9	GREEN BUTTE COPPER CO.	MCCARTHY VIC.	0	6	1	HH
AK0182	AK-9-A	GREEN BUTTE COPPER CO., MGRS. HOUSE	MCCARTHY VIC.	0	2	1	HH
AK0183	AK-9-B	GREEN BUTTE COPPER CO., BATHHOUSE	MCCARTHY VIC.	0	1	1	HH
AK0184	AK-9-C	GREEN BUTTE COPPER CO., BUNKHOUSE	MCCARTHY VIC.	0	3	1	HH
AK0185	AK-9-D	GREEN BUTTE COPPER CO., STABLES	MCCARTHY VIC.	0	8	1	HH
AK0186	AK-9-E	GREEN BUTTE COPPER CO., TIN SHED	MCCARTHY VIC.	0	1	1	HH
AK0187	AK-9-F	GREEN BUTTE COPPER CO., TRAM TERMINOUS	MCCARTHY VIC.	0	1	1	HH
AK0188	AK-9-G	GREEN BUTTE COPPER CO., WAREHOUSE	MCCARTHY VIC.	0	3	1	HH
AK0189	AK-9-H	GREEN BUTTE COPPER CO., PORTAL SHED	MCCARTHY VIC.	0	6	1	HH
AK0190	AK-9-I	GREEN BUTTE COPPER CO., COVERED STAIRWAY	MCCARTHY VIC.	0	2	1	HH
AK0193	AK-11	GOLD PLACERS INC.	EAGLE VIC.	0	0	1	HH
AK0194	AK-11-A	GOLD PLACERS INC., DREDGE	EAGLE VIC.	0	14	0	HH
AK0195	AK-11-B	GOLD PLACERS INC., WAREHOUSE	EAGLE VIC.	0	2	0	HH
AK0196	AK-11-C	GOLD PLACERS INC., MESS HALL	EAGLE VIC.	0	1	0	HH
AK0197	AK-11-D	GOLD PLACERS INC., WORKER QUARTERS	EAGLE VIC.	0	1	0	HH
AK0227	AK-19	ESKA COAL MINE	SUTTON	0	0	17	HH
AK0228	AK-19-A	ESKA COAL MINE, FAQUHAR DRIVE UNIT	SUTTON	0	3	0	HH
AK0229	AK-19-B	ESKA COAL MINE, JEFFERY FAN/BLOWER UNIT	SUTTON	0	5	0	HH
AK0230	AK-19-C	ESKA COAL MINE, MCNALLY DRYER UNIT	SUTTON	0	2	0	HH
AK0231	AK-19-D	ESKA COAL MINE, ROOF PARTS	SUTTON	0	1	0	HH
AK0212	AK-22	BUFFALO COAL MINE	SUTTON	0	0	9	HH
AK0233	AK-22-A	BUFFALO COAL MINE, VULCAN CABLE HOIST	SUTTON	0	6	0	HH
	CA-114	NEW ALMADEN QUICKSILVER MINE	NEW ALMADEN	16	16	14	LC
	CA-120	GUADALUPE MINE, MINERS' CABINS	NEW ALMADEN	0	1	0	LC
	CA-157	GUADALUPE MINE, CHURCH & SCHOOLHOUSE	NEW ALMADEN	0	3	0	LC
	CA-1125	MINE HILL SCHOOL	NEW ALMADEN	3	6	10	LC
	CA-1186	GOLD DREDGE	CARRVILLE	0	1	0	LC
	CA-1209	MINE BUILDING, ANDREW WILLIAMS RANCH	ANGELS CAMP VIC.	0	1	0	LC
	CA-1420	HYDRAULIC MINE	DOWNIEVILLE VIC.	0	1	0	LC
	CA-1421	OLD MINE	SIERRA CITY	0	2	0	LC

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(up to January 1990)

Control#	BS/ER#	Property Name	City/Town	DOCUMENTATION AVAILABLE Drwgs	Photos	Data	Location
	CA-1492	UTICA MINE	ANGELS CAMP	0	1	0	LC
	CA-1679	GOODYEAR'S BAR		0	1	0	HH
	CA-1919	MINERS' UNION HALL	BODIE	5	3	3	LC
CO0170	CO-23	PARAMOUNT MINE	ST. ELMO	0	8	0	HH
CO0231	CO-26-A	MARY MURPHY MINING COMPLEX, SUP. HOUSE	IRON CITY	0	2	0	HH
CO0232	CO-26-B	MARY MURPHY MINING COMPLEX, BOARDING HOUSE	IRON CITY	0	3	0	HH
CO0233	CO-26-C	MARY MURPHY MINING COMPLEX, MINE SHAFT HOUSE	IRON CITY	0	4	0	HH
CO0234	CO-26-D	MARY MURPHY MINING COMPLEX, SLUICE	IRON CITY	0	2	0	HH
CO0235	CO-26-E	MARY MURPHY MINING COMPLEX, MILL & TAILINGS	IRON CITY	0	2	0	HH
CO0236	CO-26-F	MARY MURPHY MINING COMPLEX, ORE BIN & CHUTE	IRON CITY	0	2	0	HH
CO0237	CO-26-G	MARY MURPHY MINING COMPLEX, IRON CITY CEMETERY	IRON CITY	0	4	0	HH
CO0199	CO-38	SAN JUAN & NY MINING & SMELTING: SMELTER STACK	DURANGO	0	8	10	LC
CO0211	CO-38-A	SAN JUAN & NY SMELTER: SUPERINTENDENT'S HOUSE	DURANGO	0	3	9	LC
CO0202	CO-39	GREGORY TAILINGS (RUINS)	BLACK HAWK	0	12	4	HH
	ID-14	MINERS' EXCHANGE BLOCK	IDAHO CITY	5	9	9	LC
	MI-2	QUINCY MINING COMPANY	HANCOCK	34	278	679	LC
	MO-1716	CANNON CREEK MINE, SMELTER	CANNON CREEK	0	2	0	LC
	MT-15	MINERS' UNION HALL	GRANITE	11	12	6	LC
MT0184	MT-30	GIFFEN MINE	STOCKETT VIC.	0	1	14	HH
MT0230	MT-30-A	GIFFEN MINE, TIPPLE	STOCKETT VIC.	0	3	0	HH
MT0231	MT-30-B	GIFFEN MINE, FAN HOUSING	STOCKETT VIC.	0	1	0	HH
MT0232	MT-30-C	GIFFEN MINE, MINE SHOP	STOCKETT VIC.	0	1	0	HH
MT0185	MT-31	FOSTER GULCH MINE	RED LODGE VIC.	0	4	1	LC
MT0197	MT-31-A	FOSTER GULCH MINE, TIPPLE (RUINS)	RED LODGE VIC.	0	1	0	LC
MT0198	MT-31-B	FOSTER GULCH MINE, BOILER HOUSING	RED LODGE VIC.	0	1	0	LC
MT0199	MT-31-C	FOSTER GULCH MINE, MACHINE SHOP	RED LODGE VIC.	0	2	0	LC
MT0200	MT-31-D	FOSTER GULCH MINE, CHANGE HOUSE	RED LODGE VIC.	0	1	0	LC
MT0201	MT-31-E	FOSTER GULCH MINE, ELECTRIC POWER STATION RUIN	RED LODGE VIC.	0	1	0	LC
MT0202	MT-31-F	FOSTER GULCH MINE, COAL BIN	RED LODGE VIC.	0	1	0	LC
MT0203	MT-31-G	FOSTER GULCH MINE, FAN HOUSING	RED LODGE VIC.	0	1	0	LC
MT0168	MT-32	SMITH MINE	RED LODGE VIC.	0	3	30	LC
MT0191	MT-32-A	SMITH MINE, PROCESSING PLANT	RED LODGE VIC.	0	3	0	LC
MT0192	MT-32-B	SMITH MINE, TIPPLE	RED LODGE VIC.	0	2	0	LC
MT0193	MT-32-C	SMITH MINE, MACHINE SHOP/MAINTENANCE BLDG.	RED LODGE VIC.	0	1	0	LC
MT0194	MT-32-D	SMITH MINE, BLACKSMITH/MINE CAR REPAIR BLDG.	RED LODGE VIC.	0	1	0	LC
MT0195	MT-32-E	SMITH MINE, ELECTRIC TRANSFER BLDG.	RED LODGE VIC.	0	1	0	LC
MT0196	MT-32-F	SMITH MINE, BOILERS (RUINS)	RED LODGE VIC.	0	1	0	LC
MT0040	MT-35	BUTTE HISTORIC DISTRICT	BUTTE VIC.	0	80	7	HH

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Control#	BS/ER#	Property Name	City/Town	DOCUMENTATION AVAILABLE Drwgs	Photos	Data	Location
MT0041	MT-36	BUTTE MINEYARDS	BUTTE VIC.	0	5	1	LC
MT0095	MT-36-A	BUTTE MINEYARDS: ANSELMO MINE	BUTTE VIC.	0	32	0	LC
MT0096	MT-36-B	BUTTE MINEYARDS: DIAMOND MINE	BUTTE VIC.	0	19	0	LC
MT0097	MT-36-C	BUTTE MINEYARDS: STEWARD MINE	BUTTE VIC.	0	23	24	LC
MT0098	MT-36-D	BUTTE MINEYARDS: BERKELEY PIT	BUTTE VIC.	0	3	0	LC
MT0125	MT-36-E	BUTTE MINEYARDS: KELLEY MINE	BUTTE VIC.	0	6	0	LC
MT0126	MT-36-F	BUTTE MINEYARDS: MOUNTAIN CON MINE	BUTTE VIC.	0	2	0	LC
MT0127	MT-36-G	BUTTE MINEYARDS: ORIGINAL MINE	BUTTE VIC.	0	1	0	LC
MT0128	MT-36-H	BUTTE MINEYARDS: BELMONT MINE	BUTTE VIC.	0	1	0	LC
MT0129	MT-36-I	BUTTE MINEYARDS: BADGER STATE MINE	BUTTE VIC.	0	12	0	LC
MT0101	MT-37	ANACONDA REDUCTION DEPARTMENT		0	8	3	HH
MT0140	MT-38	PINEAU PLACER MINING CAMP	GOLDCREEK VIC.	0	1	2	HH
MT0141	MT-38-A	PINEAU PLACER MINING CAMP,RESERVOIR & CABIN	GOLDCREEK VIC.	0	2	2	HH
MT0142	MT-39	MASTER PLACER MINING CAMP		0	1	2	HH
MT1043	MT-40	COPPER STATE MINE	MAXVILLE VIC.	0	1	2	LC
MT0148	MT-46	MOONLIGHT MINING CAMP	MAXVILLE VIC.	0	1	2	LC
MT0149	MT-47	ROYAL BASIN MINE & MILL SITE	MAXVILLE VIC.	0	1	2	LC
MT0151	MT-50	SUNRISE MINE	HALL VIC.	0	1	2	LC
MT0206	MT-54	LOMBARD COKE OVENS	LOMBARD VIC.	0	8	21	HH
MT0216	MT-54-A	LOMBARD COKE OVENS, TIPPLE	LOMBARD VIC.	0	2	0	HH
MT0217	MT-54-B	LOMBARD COKE OVENS, CARETAKER'S CABIN	LOMBARD VIC.	0	2	0	HH
MT0215	MT-54-C	LOMBARD COKE OVENS, FOUNDATION	LOMBARD VIC.	0	0	0	HH
NC0051	NC-4	COGGINS GOLD MINE, RICH-COG MINING COMPANY	ALBEMARLE	8	15	15	LC
NV0084	NV-3	DONOVAN'S MILL		0	46	6	HH
NV0087	NV-2	BULLFROG MINE	RHYOLITE VIC.	0	81	65	LC
NV0085	NV-4	MITZPAH MINE	TONOPHA	0	26	7	LC
	NV-10-1	SUTRO TUNNEL ENTRANCE	DAYTON VIC.	0	1	0	HH
	NV-15-2	BRICK VAULTS:CONS. VA. MINING CO.	VIRIGINIA CITY	0	1	0	LC
	NV-15-12	SAVAGE MINING OFFICE	VIRGINIA CITY	0	2	0	LC
	NV-15-14	MINERS' UNION HALL	VIRGINIA CITY	0	4	0	LC
	NV-15-20	MINERS' UNION HALL	VIRGINIA CITY	5	2	0	LC
	NV-15-41	NORCROSS MINING OFFICE	VIRGINIA CITY	0	3	0	LC
	NV-15-84	SHAFT HOUSE, ACTIVE MINE	VIRGINIA CITY	0	1	0	LC
	NV-15-85	SHAFT HOUSE, CA & VA MINE	VIRGINIA CITY	0	1	0	LC
	NV-15-86	MINE, GENERAL VIEW	VIRGINIA CITY	0	1	0	LC
	OR-9	ROCK CREEK DISTRICT:UPPER,LOWER & WATERMAN DITCH	DAYVILLE VIC.	0	9	13	LC
UT097	UT-10	DELAMAR MERCURY MINES CO.:GOLDEN GATE MILL	OPHIR	0	34	3	LC
UT0086	UT-11	SILVER KING MINING CO.:ORE LOADING STATION	PARK CITY	6	20	2	LC

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UT0116	UT-12	TINTIC STANDARD REDUCTION MILL		4	13	13	HH
UT0100	UT-20	INT'L SMELTING & REFINING CO.:TOOELE SMELTER		5	15	2	HH
UT0101	UT-20-A	INT'L SMELTING & REFINING CO.:SMELTER,POWERHSE		3	7	1	HH
UT0102	UT-20-B	INT'L SMELTING & REFINING CO.:OFFICE BUILDING		0	1	0	HH
UT0103	UT-20-C	INT'L SMELTING & REFINING CO.:RECEIVING BINS		0	3	1	HH
UT0104	UT-20-D	INT'L SMELTING & REFINING CO.:SAMPLE MILL		0	1	0	HH
UT0105	UT-20-E	INT'L SMELTING & REFINING CO.:ORE BINS		0	2	1	HH
UT0106	UT-20-F	INT'L SMELTING & REFINING CO.:ROASTER BLDG		0	5	1	HH
UT0107	UT-20-G	INT'L SMELTING & REFINING CO.:SMELTER		0	8	2	HH
UT0108	UT-20-H	INT'L SMELTING & REFINING CO.:ORE BINS		0	1	1	HH
UT0109	UT-20-I	INT'L SMELTING & REFINING CO.:SINTER PLANT		0	3	0	HH
UT0110	UT-20-J	INT'L SMELTING & REFINING CO.:CHARGE BINS		0	3	1	HH
UT0111	UT-20-K	INT'L SMELTING & REFINING CO.:BLAST FURNACE		0	6	1	HH
UT0112	UT-20-L	INT'L SMELTING & REFINING CO.:DROSSING PLANT		0	5	1	HH
UT0029	UT-21	UTAH COPPER COMPANY:BINGHAM CANYON MINE	BINGHAM CANYON	4	26	2	LC
UT089	UT-22	SILVER KING MINING CO.: SILVER KING MINE	PARK CITY VIC.	1	10	0	LC
UT090	UT-22-A	SILVER KING MINING CO.: MAIN SHAFT & HOIST	PARK CITY VIC.	3	6	11	LC
UT091	UT-22-B	SILVER KING MINING CO.: ORE MILL	PARK CITY VIC.	0	12	7	LC
UT092	UT-22-C	SILVER KING MINING CO.: COVERED TRAMWAY	PARK CITY VIC.	0	10	7	LC
UT093	UT-22-D	SILVER KING MINING CO.: WAREHOUSE	PARK CITY VIC.	0	2	0	LC
UT094	UT-22-E	SILVER KING MINING CO.: WATER TANKS	PARK CITY VIC.	0	2	0	LC
UT0033	UT-24	UTAH/KENNECOTT COPPER CO.:MAGNA CONCENTRATOR		4	8	1	HH
UT0176	UT-25	FRISCO CHARCOAL KILNS		0	5	15	HH
UT0169	UT-25-A	FRISCO CHARCOAL KILNS: KILN NO.2		0	5	0	HH
UT0170	UT-25-B	FRISCO CHARCOAL KILNS: KILN NO.3		0	5	0	HH
UT0171	UT-25-C	FRISCO CHARCOAL KILNS: KILN NO.4		0	2	0	HH
UT0172	UT-25-D	FRISCO CHARCOAL KILNS: SMELTER		0	1	0	HH
UT088	UT-28	KEYSTONE MILL		0	8	1	HH
UT0183	UT-31	KENILWORTH MINE:INDEPENDENT COAL & COKE CO.		0	117	32	HH
UT087	UT-32	CALIFORNIA COMSTOCK MILL		0	10	7	HH
UT0204	UT-43	JONES MINE	SCOFIELD	0	17	8	HH
UT0205	UT-44	WINTER QUARTERS MINE	SCOFIELD	0	21	9	HH
UT0206	UT-45	DAY-MUTUAL MINE	HELPER	0	4	10	HH
UT0207	UT-46	BULLION BECK AND CHAMPION MINE HEADFRAMES	EUREKA	0	9	14	HH
UT0213	UT-47	PARK UTAH MINING CO.:KEETLEY MINE COMPLEX	HEBER CITY VIC.	1	9	16	HH
UT0290	UT-47-A	PARK UTAH:KEETLEY MINE:MACHINE/WELDING SHOP	HEBER CITY VIC.	0	1	0	HH
UT0291	UT-47-B	PARK UTAH:KEETLEY MINE:TAILING CAR SNOWSHED	HEBER CITY VIC.	0	3	0	HH
UT0292	UT-47-C	PARK UTAH:KEETLEY MINE:SAWMILL/CARPENTER SHOP	HEBER CITY VIC.	0	2	0	HH

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UT0293	UT-47-D	PARK UTAH:KEETLEY MINE:TIPPLE/ORE CAR SNOWSHED	HEBER CITY VIC.	0	10	0	HH
UT0294	UT-47-E	PARK UTAH:KEETLEY MINE:LIME STORAGE SHED	HEBER CITY VIC.	0	1	0	HH
UT0295	UT-47-F	PARK UTAH:KEETLEY MINE:POWER SHED	HEBER CITY VIC.	0	1	0	HH
UT0296	UT-47-G	PARK UTAH:KEETLEY MINE:OFFICE BUILDING	HEBER CITY VIC.	0	2	0	HH
UT0297	UT-47-H	PARK UTAH:KEETLEY MINE:NEW OFFICE & STORAGE	HEBER CITY VIC.	0	1	0	HH
UT0298	UT-47-I	PARK UTAH:KEETLEY MINE:RESIDENTIAL AREA	HEBER CITY VIC.	0	4	0	HH
UT0299	UT-47-J	PARK UTAH:KEETLEY MINE:EMPLOYEE GARAGE	HEBER CITY VIC.	0	3	0	HH
UT0300	UT-47-K	PARK UTAH:KEETLEY MINE:EMPLOYEE STORAGE SHEDS	HEBER CITY VIC.	0	2	0	HH
UT0301	UT-47-L	PARK UTAH:KEETLEY MINE:SUPERINTENDENT'S HOUSE	HEBER CITY VIC.	0	3	0	HH
UT0268	UT-53	ROLAPP MINE	HELPER VIC.	0	0	6	HH
UT0302	UT-53-A	ROLAPP MINE, LAMPHOUSE	HELPER VIC.	0	6	7	HH
UT0303	UT-53-B	ROLAPP MINE, TRAMWAY	HELPER VIC.	0	2	4	HH
UT0267	UT-52	LIBERTY FUEL COMPANY, MINE OFFICE	STANDARDVILLE VIC.	0	9	14	HH
UT0269	UT-54	RAINS MINE, BATHHOUSE	STANDARDVILLE VIC.	0	13	10	HH
UT0270	UT-55	STANDARD MINE, TIMBER TRESTLE	STANDARDVILLE VIC.	0	4	12	HH
UT0289	UT-56	SWEET MINE	GORDON CREEK	0	7	11	HH
	UT-59	COKE OVEN		2	1	4	HH
WA0228	WA-19	GOAT TRAIL MINING ROAD (1890s)	NEWHALEM VIC.	4	0	0	HH
	WA-163	LIBERTY HISTORIC DISTRICT		3	1	15	HH
	WA-163-C	LIBERTY HISTORIC DISTRICT: ASSAY OFFICE		0	1	0	HH
	WA-163-W	LIBERTY HISTORIC DISTRICT: WATER POWERED ORE MILL		0	2	0	HH
	WI-28-14	CORNISH MINER'S HOUSE, NO.2	MINERAL POINT	1	1	1	LC
	WI-28-17	CORNISH MINER'S HOUSE, NO.1	MINERAL POINT	1	1	4	LC
	WV-38	KAY MOOR COAL MINE	FAUETTEVILLE VIC.	16	95	0	HH
WY0137	WY-18	CLIFF MINE	CENTENNIAL VIC.	0	0	9	LC
WY0139	WY-18-A	CLIFF MINE, BUNKHOUSES	CENTENNIAL VIC.	0	5	1	LC
WY0140	WY-18-B	CLIFF MINE, LOG MILL	CENTENNIAL VIC.	0	5	1	LC
WY0141	WY-18-C	CLIFF MINE, TAILINGS PILE	CENTENNIAL VIC.	0	1	1	LC
WY0142	WY-19-A	QUEEN MINE, SHAFTHOUSE	CENTENNIAL VIC.	0	7	1	LC
WY0143	WY-19-B	QUEEN MINE, OUTHOUSE	CENTENNIAL VIC.	0	1	1	LC
WY0144	WY-19-C	QUEEN MINE, LOG STRUCTURES	CENTENNIAL VIC.	0	1	1	LC
	WY-30	THE CARISSA MINE	SOUTH PASS CITY	0	27	8	LC
	WY-42	PALMETTO GULCH STAMP MILL		0	5	3	HH
	WY-56	THE B & H MINE	SOUTH PASS CITY	0	8	0	LC
	WY-57	DUNCAN MINE	SOUTH PASS CITY	0	9	0	LC
	WY-58	CARRIE SHIELDS MINE	SOUTH PASS CITY	0	5	0	LC
	WY-59	MINER'S DELIGHT	MINER'S DELIGHT	0	19	3	LC
	WY-68	PIEDMONT CHARCOAL KILNS		3	12	5	HH

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Key

AK = Alaska	MI = Minnesota	NV = Nevada	WY = Wyoming
CA = California	MO = Missouri	OR = Oregon	
CO = Colorado	MT = Montana	UT = Utah	HH = HABS/HAER Archives
ID = Idaho	NC = N.Carolina	WA = Washington	LC = Library of Congress

APPENDIX B: HISTORIC MINING PROPERTIES IN THE RECORDS OF THE NATIONAL REGISTER OF HISTORIC PLACES
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Control#	Property Name	City/Town/Vic.	Criteria	Notes
ALASKA				
	Anchorage Borough-Census Area			
78000517	Crow Creek Consolidated Gold Mining Company	Girdwood	A	gold
89001762	Indian Valley Mine	Indian		gold
	Fairbanks North Star Borough-Census Area			
79003753	Chatanika Gold Camp	Chatanika	A,g	dredge and camp
87000703	Ester Camp Historic District	Ester	A,b	gold
84000637	Goldstream Dredge No. 8	Fairbanks	A,C,b	gold dredge
79003755	Nabesna Gold Mine Historic District	Nabesna	B	gold
	Haines Borough-Census Area			
73000376	Pleasant Camp	Haines	A	on gold rush trail
76000358	Porcupine District	Haines	A,g	gold mining town
	Juneau Borough-Census Area			
88001347	Fries Miners' Cabins	Juneau	A	tract houses built for gold miners
	Kenai Peninsula Borough-Census Area			
78003419	Hirshey Mine	Hope	A	gold
72001583	Hope Historic District	Hope	A	log cabin, gold camp
	Matanuska-Susitna Borough-Census Area			
74000440	Independence Mines	Palmer	A,g	gold
73000379	Knik Site	Wasilla	A	supply center and trailhead
	Nome Borough-Census Area			
66000159	Anvil Creek Gold Discovery Site	Nome	A	NHL: gold
78000535	Cape Nome Mining District Discovery Sites	Nome	A	NHL: gold
76000362	Erik Lindblom Placer Claim	Nome	A,B	gold
87001579	Fairhaven Ditch	Nome	C	hydraulic mining
76000363	Snow Creek Placer Claim No. 1	Nome	A	gold
	Skagway-Yakutat-Angoon Borough-Census Area			
75002120	Chilkoot Trail and Dyea Site	Skagway	A	NHL: trail
76002189	Klondike Goldrush National Historical Park	Skagway	A,C	gold town, trailheads
66000943	Skagway Historic District and White Pass	Skagway	C	NHL: trail, supply center
	Southeast Fairbanks Borough-Census Area			
	Coal Creek Dredge and Camp	Eagle		gold
70000919	Eagle Historic District	Eagle	A	NHL: supply center for gold mines
75002161	Kink, The	Fairbanks	A,C	river diversion for gold
	Valdez-Cordova Borough-Census Area			
85002999	Chisana Historic District	Chisana	A,C	log cabin, gold camp
78003420	Kennecott Mines	Kennecott	A,g	NHL: copper
74002264	Sourdough Lodge	Gakona	A	gold miner roadhouse
	Yukon-Koyukuk Borough-Census Area			
87001202	Frank Slaven Roadhouse	Eagle	A	gold miner's home and roadhouse
82004898	Ruby Roadhouse	Ruby	A,g	center of gold camp
	Wiseman Historic District	Wiseman		log cabin, gold camp
ARIZONA				
	Cochise County			
80004487	Bisbee Historic District	Bisbee	A,C	copper camp
85000146	Douglas Historic District	Douglas	A,C	copper smelter town

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Control#	Property Name	City/Town/Vic.	Criteria	Notes
78000541	Pearce General Store	Pearce	A,C	center of silver camp
71000109	Phelps Dodge General Office Building	Bisbee	A	NHL: copper company
66000171	Tombstone Historic District	Tombstone	A	NHL: silver
	Coconino County			
74000347	Grandview Mine	Grand Canyon	A	copper
76000374	Lees Ferry	Page	A	gold mining HQ and trading post
	Gila County			
87000862	Globe Downtown Historic District	Globe	A,C	copper camp
	Greenlee County			
77000236	Dell Potter Ranch House	Clifton	A,C	mine promoter's house
	Mohave County			
83002988	Dublin Hotel	Oatman	C	center of gold camp
	Pima County			
78000350	Growler Mine Area	Lukeville	A,D	copper
78000351	Milton Mine	Lukeville	A,g	gold and copper
78000349	Victoria Mine	Lukeville	A	silver
	Pinal County			
76000381	Boyce Thompson Southwestern Arboretum	Superior	A,B,D	copper magnate house and garden
75000358	Butte-Cochran Charcoal Ovens	Florence	A	for silver smelter
	Santa Cruz County			
75000361	Ruby	Ruby	A	silver-lead camp
	Yavapai County			
	Cottonwood MRA	Cottonwood	A,B,C	copper smelter town
66000196	Jerome Historic District	Jerome	A	NHL: copper
78000570	Poland Tunnel	Poland	A,C	haulage tunnel linking mines and mill
	Prescott Territorial Buildings MRA	Prescott	A,B,C	supply center for mines
76000383	Walker Charcoal Kiln	Prescott	A	for silver smelter
	Yuma County			
70000117	Old La Paz	Ehrenburg	A,D	gold camp
	Additional Arizona Mining Properties			
	Mohave Hope Mine and Mining Camp			DOE: 1870-1920s silver mine
ARKANSAS				
	Marion County			
87000105	Rush Historic District	Yellville	A,C,D	lead and zinc
CALIFORNIA				
	Alameda County			
82004646	Hearst Memorial Mining Building, UCB	Berkeley	C	education/laboratory
	Amador County			
78000655	Fiddletown	Fiddletown	A,C	gold mining town
81000146	Kennedy Tailing Wheels	Jackson	A,C	gold
	El Dorado County			
66000207	Coloma	Placerville	A	NHL: gold mining town

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85003522	Hattie, Priest and Silver Pine Mines and Stampmill	Placerville	A,D	gold
Inyo County				
74000338	Eagle Borax Works	Furnace Creek	A	borax
74000339	Harmony Borax Works	Stove Pipe Wells	A	borax
75000221	Leadfield	Death Valley	A	fraudulent mine claim
74000349	Skidoo	Death Valley	A,g	gold mine and townsite
Mono County				
66000213	Bodie Historic District	Bridgeport	A	NHL: gold mines and ghost town
Nevada County				
77000318	Empire Mine	Grass Valley	A,C	gold
73000418	Malakoff Diggins/North Bloomfield HD	North Bloomfield	A,C,a,b	hydraulic mining and townsite
85002520	Nevada City Downtown Historic District	Nevada City	A,C	gold mining town
Placer County				
73000419	Dutch Flat Historic District	Dutch Flat	A,C	gold mining town, hydraulic mining
70000138	Old Auburn Historic District	Auburn	A,C	supply center for gold fields
Plumas County				
73000421	Plumas-Eureka Mill, Jamison Mines District	Blairsden	A	gold
Riverside County				
76000216	Desert Queen Mine	Twentynine Palms	A,g	gold
75000175	Ryan House and Lost Horse Well	Twentynine Palms	A,C	mine developer's house
Sacramento County				
66000219	Old Sacramento Historic District	Sacramento	A	NHL: supply center for gold fields
San Bernardino County				
75000176	Wall Street Mill	Twentynine Palms	A,g	gold
San Francisco County				
66000231	Old United States Mint	San Francisco	A,g	NHL: depository of gold and silver mined in the West
Santa Clara County				
66000236	New Almaden Historic District	San Jose	A	NHL: quicksilver
Shasta County				
72000257	French Gulch Historic District	French Gulch	A	gold
Siskiyou County				
78000793	White's Gulch Arrastra	Sawyers Bar	D	gold processing
Stanislaus County				
71000208	Gold Dredge	La Grange	A,g	gold
75000490	Knight's Ferry	Knight's Ferry	A,C	gold mining town
Trinity County				
84001219	Helena Historic District	Helena	A,C,D	gold
Tuolumne County				
66000242	Columbia Historic District	Sonora	A,C	NHL: gold mining camp
78000382	Great Sierra Mine Historic Site	Lee Vining	A,C	silver mining town
75000494	Niagara Camp	Tuolumne	A,C,g	gold camp
COLORADO				
Boulder County				
	Metal Mining and Tourist Era Resources MRA			mines and camps
78000833	Modoc Mill	Ward	A,C	gold
84000798	Walker Ranch Historic District	Boulder	A,C,D	gold processing - cyanide millsite
Chaffee County				

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78000835	Littlejohn Mine Complex	Granite	A,C	silver-lead and bismuth mine and camp
76000548	Ohio-Colorado Smelting/Refining Company Smokestack	Salida	A,C	
79000577	St. Elmo Historic District	St. Elmo	A,C	gold camp
77000364	Vicksburg Mining Camp	Buena Vista	A	silver
80000883	Winfield Mining Camp	Buena Vista	A	silver
	Clear Creek County			
78000836	Argo Tunnel and Mill	Idaho Springs	A	haulage tunnel and gold mill
66000243	Georgetown-Silver Plume Historic District	Silver Plume	A	NHL: gold-silver towns
84000801	Idaho Springs Downtown Commercial District	Idaho Springs	A,C	gold
71000214	Lebanon and Everett Mine Tunnels	Silver Plume	A	silver-lead
71000213	Ore Processing Mill and Dam	Georgetown	A	silver
	Denver County			
72000270	Denver Mint	Denver	A,C	depository
87002544	Hendrie and Bolthoff Warehouse Building	Denver	A,C	mining machinery plant
	Dolores County			
74000574	Rico City Hall	Rico	A,C	silver camp center
	El Paso County			
82001018	Old Colorado City Historic Commercial District	Colorado Springs	A,C	gold mining town
	Gilpin County			
66000246	Central City - Black Hawk Historic District	Central City	A	NHL: gold mines and town
	Grand County			
76002292	Dutchtown	Grand Lake	A	silver campsite
77001562	Lulu City Site	Grand Lake	A	silver
	Gunnison County			
74002279	Town of Crested Butte	Crested Butte	C,a,g	silver camp, later coal
85001493	Crystal Mill	Crystal	A	water powered mill
	Hinsdale County			
78000859	Lake City Historic District	Lake City	A,C,a	silver camp
	Lake County			
66000248	Leadville Historic District	Leadville	A,C	NHL: silver-lead town
	Las Animas County			
85000083	Cokedale Historic District	Cokedale	A,C	
	Ouray County			
83003537	Ouray Historic District	Ouray	A,C	silver town
	Pitkin County			
75000529	Ashcroft	Aspen	A	ghost town
	Aspen MRA: Mining and Milling 1879-1893	Aspen	A,B,C	silver
73000484	Independence and Independence Mill Site	Ghost Town	A	gold, ghost town
87000194	Smuggler Mine	Aspen	A,C	silver
	San Juan County			
66000255	Silverton Historic District	Silverton	A	NHL: mining town
	San Miguel County			
79000621	Smuggler-Union Hydroelectric Power Plant	Telluride	A,C	
66000256	Telluride Historic District	Telluride	A	NHL: gold camp
	Summit County			
80000927	Breckenridge Historic District	Breckenridge	A,B,C,a,g	gold town
	Teller County			
66000939	Cripple Creek Historic District	Cripple Creek	A	NHL: gold
85001463	Victor Downtown Historic District	Victor	A,C	gold town and mines

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Control#	Property Name	City/Town/Vic.	Criteria	Notes
	Additional Colorado Mining Properties			
89000998	Snowbound Mine Holden Mining and Smelting Company	Gold Hill		gold, silver and lead silver millsite
	GEORGIA			
	Lumpkin County			
74000692	Calhoun Mine	Dahlonega	A	NHL: gold
80001111	Dahlonega Consolidated Gold Mine	Dahlonega	A,D	gold
	White County			
86002742	Sautee Valley Historic District	Sautee	A,C,D	gold mining area
	IDAHO			
	Ada County			
66000305	Assay Office	Boise	A,C	mineral assay
	Adams, Idaho, and Nez Perce Counties			
84000984	Hells Canyon Archeological District	Lewiston	A,D	gold
	Blaine County			
82002506	Bellevue Historic District	Bellevue	C	silver
	Boise County			
75000626	Idaho City	Idaho City	A,C	gold
84001029	Placerville Historic District	Placerville	A,C	gold
	Canyon County			
82000335	A.K. Stennenberg House	Caldwell	C	assasinated governor's house
	Clearwater County			
83000285	Moore Gulch Chinese Mining Site 10-CW-159	Pierce	A,D	gold
66000310	Nez Perce National Historical Park	Spalding	A,B,C	includes gold rush sites
72000100	Pierce Court House	Pierce	A	gold rush center
	Custer County			
76000671	Bayhorse	Challis	A,C	gold camp and mill
81000207	Custer Historic District	Custer	C	gold camp
	Elmore County			
77000459	Atlanta Historic District	Atlanta	C	gold camp
75000629	South Boise Historic Mining District	Rocky Bar	A	gold mines and towns
	Idaho, Lewis, and Nez Perce Counties			
86002170	Lower Salmon River Archeological District	Cottonwood	A,C,D	gold
	Lemhi County			
72001577	Charcoal Kilns	Salmon	A	for silver-lead mine
75000634	Leesburg Historic District	Salmon	A	gold camp
	Owyhee County			
76000679	Delamar Historic District	Silver City	A,C	gold mine and town
72000446	Silver City Historic District	Silver City	A	NHL: gold-silver mines and towns
	Shoshone County			
84001160	Bullion Tunnel	Avery	A	

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84001179	Pulaski Tunnel and Placer Creek Escape Route	Wallace	A	
83000289	Wallace Historic District	Wallace	A,C,g	silver-lead town
Valley County				
85002157	Braddock Gold Mining and Milling Company	Thunder City	A,C	forge and log building
87001186	Stibnite Historic District	Yellow Pine	A,g	tungsten and antimony mine
	Additional Idaho Mining Properties			
	Chinese Sites in the Warren Mining District MPS			gold
IOWA				
Dubuque County				
88002666	Mines of Spain Archeological MPS:	Dubuque	D	lead
88002664	Lead Mining Community Archeological District	Dubuque	D	lead
88002665	Dubuque Trading Post-- Village of Kettle Chief Archeological District	Dubuque	D	lead
MASSACHUSETTS				
Worcester County				
83004141	Tantiusques Reservation	Sturbridge	A	lead/graphite; prehistoric and colonial
MICHIGAN				
Dickinson County				
81000305	Chapin Mine Steam Pump Engine	Iron Mountain	A,C,B	iron
Houghton County				
89001097	Calumet Historic District	Calumet		copper
74000985	Calumet and Hecla Industrial Historic District	Calumet	A	copper mining company buildings
70000271	Quincy Mine No. 2 Shaft Hoist House	Hancock	A,C	copper
89001095	Quincy Mining Company Historic District	Hancock		copper
Iron County				
83003672	Caspian Mine Headframe: Iron County MRA	Caspian	A	
83003681	Dober Mining Company House: Iron County MRA	Caspian	A,C	
83003711	Hiawatha Mine Number One Complex: Iron County MRA	Stambaugh	A	
83003721	James Mine Historic District: Iron County MRA	Mineral Hills	A	
83003736	Munro - Hanna Mining Company Office: Iron County MRA	Iron River	A	
Keweenaw County				
74000991	Central Mine Historic District	Central	A,C	copper
77000153	Minong Mine Historic District	Isle Royale NP	A,D	copper
	Additional Mining Properties in Michigan			
	Copper Peak			copper
MINNESOTA				

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Control#	Property Name	City/Town/Vic.	Criteria	Notes
	Itasca County			
86002126	Hill Annex Mine	Calumet	A	
	Koochiching County			
77000155	Gold Mine Sites	Island View	A	gold
75000226	Little American Mine	Island View	A	gold
	St. Louis County			
78003124	Bruce Mine Headframe	Chisholm	C	
66000904	Hull-Rust-Mahoning Open Pit Iron Mine	Hibbing	A	NHL: iron
68000052	Mountain Iron Mine	Mountain Iron	A	NHL: iron
78003127	Pioneer Mine Buildings and A Headframe	Ely	A,C,g	
66000905	Soudan Iron Mine	Tower	A	iron
MISSOURI				
	St. Francois County			
74002281	Bonne Terre Mine	Terre	A	lead
78001647	Pearson Creek Archeological District	Springfield	A,D	lead
	Additional Missouri Mining Properties			
	Missouri Mines State Park			lead mines and mill
MONTANA				
	Beaverhead County			
66000426	Bannack Historic District	Dillon	A	NHL: gold
	Deer Lodge County			
87000607	Anaconda Copper Mining Company Smoke Stack	Anaconda	A,C	copper smelter site
	Granite County			
	Garnet Ghost Town	Garnet	A,C	gold town
86002787	Philipsburg Historic District	Philipsburg	A,C	silver, manganese
	Lewis and Clark County			
72000737	Helena Historic District	Helena	A,C,g	gold town turned capital
	Madison County			
87001264	Pony MRA: Pony Historic District	Pony	A,C	gold mining town
87001266	Powder House	Pony	A,C	explosive storage for gold mining
87001265	Strawberry Mine Historic District gold	Pony	B,C	gold
66000435	Virginia City Historic District	Virginia City	A	NHL: gold
	Silver Bow County			
66000438	Butte Historic District	Butte	A	NHL: copper
87002227	Ramsay Historic District	Butte	A,C	gold-silver
	Additional Montana Mining Properties			
	Alta Mine			DOE: silver mine, 1878-
	Bluebird Mine			DOE: gold, silver, copper & lead mine, 1880s-
	Comet Town Site			DOE: flotation milling operation, 1930s
	Copper State Mine			DOE: copper
	Elkhorn Historic District			DOE: silver, gold, lead, zinc, and copper

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Control#	Property Name	City/Town/Vic.	Criteria	Notes
	Gray Eagle Mine Complex			DOE: silver, gold & lead mine, 1890s-
	Gregory Mine			DOE: silver mine, 1864-
	Miner's Union Hall			surviving building of silver mining town
	Morning Glory Mine Complex			DOE: precious metals mine, 1919-50s
	Mount Washington Mine			DOE: silver mine, 1892-
	Sunrise Mine			DOE: gold mine and mill
NEVADA				
	Clark County			
85001601	Homestake Mine	Searchlight	A,D	gold-silver
74001144	Potosi	Las Vegas	A	silver-lead
	Esmeralda County			
82003213	Goldfield Historic District	Goldfield	A,B,C,D	gold-silver company town
	Eureka County			
73001078	Eureka Historic District	Eureka	A	silver-lead
	Lander County			
71000489	Austin Historic District	Austin	C	silver town
	Lincoln County			
72000765	Bristol Wells Town Site	Pioche	A,D	silver town
78001724	Lincoln County Court House	Pioche	A,C	silver town center
	Mineral County			
74001147	Aurora	Hawthorne	A	gold-silver
	Nye County			
72000766	Belmont	Tonopah	A,D	silver mining campsite
71000490	Berlin Historic District	Berlin	A	gold-silver company town
	Tonapah MRA	Tonopah	A,B,C	gold-silver mining town
74001149	Tybo Charcoal Kilns	Tonopah	A,C	for silver smelter
	Storey County			
66000458	Virginia City Historic District	Virginia City	A,C	NHL: silver
	Washoe County			
82003258	MacKay School of Mines Building, UNR	Reno	A,C	education/laboratory
	White Pine County			
77001544	Fort Schellbourne	Ely	A,D	gold-silver mining camp
71000491	Ward Charcoal Ovens	Ely	A,C	for silver smelter
	Additional Nevada Mining Properties			
	Homestake-Cold Bar Mines and Mills			DOE: 2 mines & camps, 1905-8
NEW JERSEY				
	Sussex County			
80000410	Old Mine Road Historic District	Wallpack Center	A,C	possible 17th c. copper mines

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NEW MEXICO				
	Catron County			
87001541	Mogollon Historic District	Mogollon	A,C,g	gold
87001567	Socorro Mines Mining Company Mill	Mogollon	A,C,g	gold
	Colfax County			
78001813	Catskill Charcoal Ovens	Raton	A,C	
	Santa Fe County			
77000928	Madrid Historic District	Madrid	A,C	coal
84002945	Pinos Altos Historic District	Pinos Altos	A,C,a	gold
78001817	Silver City Historic District	Silver City	A,B,C,a	silver-copper
73001141	Shakespeare Ghost Town	Lordsburg	A	silver
70000403	White Oak Historic District	White Oaks	A,C	gold
NORTH CAROLINA				
	Cabarrus County			
66000587	Reed Gold Mine	Concord	A	NHL: gold
OKLAHOMA				
	Comanche County			
81000455	Arrastra Site	Cache	D	gold
78002230	Meers Mining Camp	Lawton	A	mining camp store associated with gold mines
	Pittsburg County			
80004290	Mine Rescue Station Building	McAlester	A	
OREGON				
	Baker County			
71000676	Sumpter Valley Gold Dredge	Sumpter	A,g	gold
	Jackson County			
66000950	Jacksonville Historic District	Jacksonville	A	NHL: gold mining town
	Wallowa County			
84000984	Hells Canyon Archeological District	Imnaha	A,D	
	Additional Oregon Mining Properties			
	Camp Carson Mine Historic District			DOE: gold mines & town site
	Chinese Walls			DOE: hand-mining of residual gold
SOUTH CAROLINA				
	McCormick County			
85003341	Dorn Gold Mine	McCormick	D	gold

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SOUTH DAKOTA				
	Lawrence County			
66000716	Deadwood Historic District	Deadwood	A	NHL: gold
74001892	Lead Historic District	Lead	A,C	
	Pennington County			
77001251	Harney Peak Tin Mining Company Buildings	Hill City	A,C,c	tin
TENNESSEE				
	Polk County			
83003059	Burra Burra Mine Historic District	Ducktown	A,C	copper
TEXAS				
	Brewster County			
74000279	Mariscal Mine	Big Bend NP	A	quicksilver
	Terlingua	Big Bend NP		quicksilver
	Presidio County			
76002058	Shafter Historic Mining District	Shafter	A	silver mining town
UTAH				
	Beaver County			
82004793	Frisco Charcoal Kilns	Milford	A	for silver smelter
	Iron County			
77001305	Gold Spring	Modena	A	Mormon gold mining camp
	Juab County			
	Tintic Mining District MRA:	Eureka/Mammoth	A,C,D,d	gold, silver and lead mining
79003481	Centennial-Eureka Mine			
79003482	Diamond Cemetery			
79003482	Eagle and Blue Bell Mine			
79003469	Eagle Cemetery			
79002514	Eureka Historic District			
79003471	Fitch Cemetery			
79003480	Grand Central Mine			
79003468	Mammoth Historic District			
79003475	Showers Mine and Headframe			
79003473	Silver City Cemetery			
79003477	South Iron Blossom Headframe			
79003476	Sunbeam Mine			
79003472	Tintic Smelter Site			
	Salt Lake County			
66000736	Bingham Canyon Open Pit Copper Mine	Salt Lake City	A	NHL
86002642	Copperton Historic District	Copperton	A,C,g	mill town
76001830	Salt Lake Stock and Mining Exchange Building	Salt Lake City	A,C	

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Control#	Property Name	City/Town/Vic.	Criteria	Notes
85003422	Utah Copper Company Mine Superintendent's House	Copperton	A,C	copper
	Summit County			
	Mining Boom Era Houses TR	Park City	C	silver town
79002511	Park City Main Street Historic District	Park City	A,C	silver town
78002698	Silver King Ore Loading Station	Park City	A	silver
	Utah County			
	Tintic Mining District MRA:	Eureka/Mammoth	A,C	gold, silver and lead mining
79003483	Beck No.2 Mine			
79003486	Big Hill Shaft Headframe			
79003491	Charcoal Kilns			
79003488	Dividend Miner's Dry			
79003487	Eureka Lilly Headframe			
79003479	Iron Blossom No. 3 Mine			
79003490	Lime Kilns			
79003484	Yankee Headframe			
78002700	Tintic Standard Reduction Mill	Goshen	A,C	silver-lead
	Washington County			
71000861	Wells Fargo & Company Express Building	Silver Reef	A	silver
	Additional Utah Mining Properties			
	Soldier Creek Kilns			for silver smelter
WASHINGTON				
	Chelan County			
74000914	Black Warrior Mine	Stehekin	A	galena
74001941	Blewett Arrastra	Cashmere	A,C	gold
	King County			
72001271	Assay Office German Club	Seattle	A,C	established for Klondike gold rush
	Kittitas County			
74001965	Liberty Historic District	Liberty	A,C	gold mining town
	Snohomish County			
81000590	Horseshoe Bend Placer Claim	Sultan	C	gold
	Whatcom County			
74000909	Devil's Corner Cliff Walk	Newhalem	A	suspension bridges and half tunnels; miners trail
WISCONSIN				
	Grant County			
79000079	St. John Mine	Potosi	A	
WYOMING				
	Carbon County			
73001927	Boston Wyoming Smelter Site	Encampment	A	copper, Grand Encampment Mining Region

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Control#	Property Name	City/Town/Vic.	Criteria	Notes
73001928	Ferris-Haggarty Mine Site Fremont County	Encampment	A	copper, Grand Encampment Mining Region
80004047	Hamilton City	Atlantic City	A,d	gold
70000670	South Pass City	South Pass City	A	NHL: gold mining town

Key

NHL: National Historic Landmark
MPS: Multiple Property Submission
MRA: Multiple Resource Area
TR: Thematic Resources
DOE: Determination of Eligibility

APPENDIX C: WESTERN MINING HISTORY: A GENERAL BIBLIOGRAPHY

Leo R. Barker, Historical Archeologist
National Register Programs
National Park Service, Western Regional Office
San Francisco, California

Abbe, Donald R.
1985 *Austin and the Reese River Mining District, Nevada's Forgotten Frontier.* University of Nevada Press, Reno.

Adney, Tappan
1900 *The Klondike Stampede.* New York.

Ageton, Richard V.
n.d. Milling Manganese Ore at the Algonquin Mine, Phillipsburg, Montana. *Engineering and Mining Journal* 116:181-183.

Agricola, Georgius. [Georg Bauer]
1912 *De Re Metallica.* Translated by Herbert Clark Hoover and Lou Henry Hoover. Dover Publications, New York. Reprinted 1950.

Akrigg, G. P. V. and Helen B. Akrigg
1977 *British Columbia Chronicle 1847-1871, Gold & Colonists.* Discovery Press, Vancouver.

Albert, H.W.
1967 *Odyssey of A Desert Prospector.* University of Oklahoma Press, Norman.

Allen, J.B.
1966 *The Company Town in the American West.* University of Oklahoma Press, Norman.

Allsop, Thomas
1853 *California and Its Gold Mines.* London

Anderson
1877 *Silver and Gold of the South-West.* St. Louis.

Anderson, A.L.
1950 *Silver-Gold Deposits of the Yankee Fork District, Custer County, Idaho.* Pamphlet 83, Idaho Bureau of Mines and Geology, Moscow.

Anderson, Eloise H.
1981 *Frontier Bankers, a History of the Idaho First National Bank.* Idaho First National Bank, Caldwell.

Andrews, John R.
1967 *The Ghost Towns of Amador.* Carlton Press, New York.

Anonymous
1857 Quartz Mining in California. *Hutching California Magazine* 2(4):146-155.

1964 Early Trails and Camps of Plumas County. *Plumas County Historical Society Publication* 15, Quincy.

1871 Quartz Mills of the Pacific Coast. *Mining and Scientific Press* 22(1):12.

1876 The Silver Mountains of Utah. *Harpers New Monthly Magazine* 50:647-651.

1883 Hydraulic Mining in California. *Century Magazine* 25(3).

1898 *A Historical, Descriptive and Commercial Directory of Owyhee County, Idaho.* Press of the Owyhee Avalanche, Silver City, Idaho.

1975 *Cariboo, the Newly Discovered Gold Fields of British Columbia.* Reprinted, Ye Galleon Press, Fairfield, Washington.

1977 *Anatomy of A Mine From Prospect To Production.* Intermountain Forest and Range Experiment Station, USDA, Ogden, Utah.

1978 Kennecott: Alaskan Origins of A Copper Empire, 1900-1938. *Western Historical Quarterly* 9(2):197-211.

1880 The Poor Man's Mill. *Mining and Scientific Press* 41(23):360.

1886 Working Gold and Silver Ores. *Mining and Scientific Press* 53(15).

1888 Steam Arrastras. *Mining and Scientific Press* 55(23):363.

1891 The Arrastra. *Mining and Scientific Press* 63(8):120.

1895 Arrastra - The Poor Man's Mill. *Mining and Scientific Press* 74(17):341.

1897 Arrastras. *Mining and Scientific Press* 74(17):341.

1899 The Arrastra and Its Uses. *Engineering and Mining Journal* 68(26):760.

1903 Usefulness of the Arrastra. *Mining and Scientific Press* 86(10):145.

1932 The Arrastra Returns to Use in California Mines. *Engineering and Mining Journal* 16(7):17.

Aaron, C. H.
1900 *Assaying in Three Parts.* Part I. 5th Edition. The Mining and Scientific Press, San Francisco.

1904 *Assaying in Three Parts.* Part II, and III. 3rd Edition. The Mining and Scientific Press, San Francisco.

Arnold, Emmett L.
1973 *Gold-Camp Drifter, 1906-1910.* University of Nevada Press, Reno.

Ashley, Palmer C.
1971 Ancient Rastres. *Desert Magazine* 34(1):16-17.

Athearn, Robert G.
1960 *High Country Empire: the High Plains and Rockies.* McGraw-Hill, New York.

Aubury, Lewis E.
1908 The Copper Resources of California. *California Mining Bureau Bulletin* 50, Sacramento.

Averill, Charles Vollney
1946 Placer Mining for Gold in California. *Division of Mines Bulletin* 135, San Francisco.

Axford, H. William
1976 *Gilpin County Gold, Peter McFarlane 1848-1929, Mining Entrepreneur in Central City, Colorado.* Swallow Press Inc., Chicago.

Backus, Harriet Fish
1969 *Tomboy Bride.* Pruett Publishing Company, Boulder, Colorado.

Bailey, Edgar H.
1951 The New Almaden Quicksilver Mines. In *Geologic Guidebook of the San Francisco Bay Counties,* Bulletin 154, Division of Mines, San Francisco.

Bailey, Gilbert E.
1902 Saline Deposits of California. *California State Mining Bureau Bulletin* 24, Sacramento.

Bakewell, P.J.
1971 *Silver Mining and Society in Colonial Mexico: Zacatecas 1546-1700.* Cambridge University Press, Cambridge.

Balcom, Mary G.
1976 *Ghost Towns of Alaska.* Adams Press, Chicago.

Baldwin, George P. (editor)
1904 *The Black Hills Illustrated, a Terse Description of Conditions Past and Present of America's Greatest Mineral Belt, its Agriculture and Cattle Resources, Principal Cities, Financial, Commercial, Educational and Religious Institutions, Railways, Scenery and Health and Pleasure Resorts.* Black

Hills Mining Mens' Association. Reprinted 1987, Dakota Graphics, Deadwood.

Ball, Nicholas
1891 *The Pioneers of '49.* Boston.

Bancroft, Hubert Howe
1981 *History of Nevada, 1540 - 1888.* Reprinted with an introduction by Jerome E. Edwards. Nevada Publications, Las Vegas.

Bancroft, Hubert H.
1889 *History of the Life of Simeon Wenban.* Chronicles of the Kings, History Company, San Francisco.

Barlee, N.L.
1970 *Gold Creeks and Ghost Towns [southern British Columbia].* Canada West Magazine, Summerland, British Columbia.

Barrick, James S.
1959 *The Golden Chain of the Mother Lode.* Division of Parks and Beaches, Department of Natural Resources, California.

Barsness, Larry
1962 *Gold Camp, Alder Gulch and Virginia City, Montana.* Hastings House, New York.

Bateman, Alan M. and D.H. McLaughlin
1920 Geology of the Ore Deposits of Kennecott, Alaska. *Economic Geology* 15:1-80.

Bean, Edwin F.
1867 *Bean's History and Directory of Nevada County, California.*

Becker, George F.
1882 *Geology of the Comstock Lode.* United States Geological Survey. Washington, D.C.

Belden, L. Burr and Ardis Manly Walker
1962 *Searles Lake Borax 1862-1962.* Inland Printing and Engraving Company, San Bernardino.

Bennett, Estelline
1928 *Old Deadwood Days.* J. H. Sears, New York. Reprinted 1982, University of Nebraska Press, Lincoln.

Berton, Pierre
1958 *The Klondike Fever.* New York.

Billeb, Emil W.
1957 Bodie's Railroad That Was. *Pony Express* 24(1):3.

1968 *Mining Camp Days.* Howell-North Books, Berkeley.

Bird, Isabella L.
1987 *A Lady's Life in the Rocky Mountains.* Introduction by Ann Ronald. Comstock Editions, Inc., Sausalito.

Blake, William
1871 *Notices of Mining Machinery and Various Mechanical Appliances in Use Chiefly On the Pacific Coast.* Charles C. Chatfield and Company, New Haven.

Bonwick, J.
1872 *Mormons and the Silver-Mines of the West.*

Bouslaugh, Allen D. and J. Thomas Drake
1981 *Ghost Towns of Dawson County.* Glendive Commercial Club, Glendive, Montana.

Bowers, M.H. and H. Muessig
1982 *History of Central Nevada: An Overview of the Battle Mountain District.* Cultural Resource Series Monograph 4, Bureau of Land Management.

Bowie, August J.
1878 *Hydraulic Mining in California.* Edinburgh.

1885 *A Practical Treatise on Hydraulic Mining in California.* D. Van Nostrand Company, New York.

Boyd, William Harland
1952 *Land of Havilah 1854-1874: The Story of Keyesville, Kernville, and Havilah in the Kern River Country, California.* Kern County Historical Society, Bakersfield.

Breckenridge, William M.
1928 *Helldorado.* Houghton Mifflin Company, Boston and New York.

Brooks, A.H.
1908 *The Gold Placers of Parts of Seward Peninsula, Alaska.* Bulletin 328, United State Geological Survey.

Brown, J. Cabel
1892 *Calabazas Or Amusing Recollections of an Arizona "City".* Valleau & Peterson, San Francisco.

Brown, Donald C.
1958 *The New Almaden Quicksilver Mines.* Unpublished Master's thesis, San Jose State College.

Brown, Marjorie
1968 *Lady in Boomtown, Miners and Manners on the Nevada Frontier.* American West Publishing Company, Palo Alto.

Brown, Robert L.
1968 *Jeep Trails To Colorado Ghost Towns.* Caxton Printers, Caldwell, Idaho.

1973a *Colorado Ghost Towns - Past & Present.* Caxton Printers, Caldwell, Idaho.

1973b *Ghost Towns of the Colorado Rockies.* Caxton Printers, Caldwell, Idaho.

Brown, Ronald C.
1979 *Hard-Rock Miners: the Intermountain West, 1860-1920.* Texas A & M University Press, College Station.

1987 *Ghost Towns of Canada.*

Brown, Walter Lee
1892 *Manual of Assaying, Gold Silver Copper and Lead Ores, with One Colored Plate and One Hundred and Thirty-two Illustrations on Wood.* 4th Edition. E. H. Sargent & Co., Chicago.

Browne, John Ross
1865a *The Bodie Bluff Mines Located in Mono County, California, Belonging To the Empire Gold and Silver Mining Company of New York.* Clark & Maynard, New York.

1865b A Trip To Bodie Bluff and the Dead Sea of the West. *Harpers Monthly Magazine* 31:274-287, 411-419.

1868 *The Mineral Resources of the States and Territories West of the Rocky Mountains.* Government Printing Office, Washington D.C.

1869 *Adventures in Apache Country: A Tour Through Arizona and Sonora, With Notes On the Silver Regions of Nevada.* Harper Brothers, New York.

1961 *Mining Adventures.* Paisano Press, Balboa Island.

Browne, John Ross and James W. Taylor
1867 *Reports Upon the Mineral Resources of the United States.* Government Printing Office, Washington D.C.

Buffum, E. Gould
1850 *Six Months in the Gold Mines.* Philadelphia and London.

Bugbee, E.E.
1922 *A Textbook of Fire Assaying.* John Wiley and Sons, New York.

Burchard, Horacio
1882 *Report of the Director of the Mint Upon the Statistics of the Production of Precious Metals in the United States.* Government Printing Office, Washington, D.C.

Burt, S. W. and E. L. Berthoud
1861 *The Rocky Mountain Gold Regions Containing Sketches of its History, Geography, Botony,*

Geology, Minerology and Gold Mines, and Their Present Operations. With a Complete History of the Mills for Reducing Quarts Now Operating. Rocky Mountain News Printing Company, Denver. Reprinted 1962, Old West Publishing Company, Denver.

Buskett, E.W.
1907 *Fire Assaying.* D. Van Nostrand, New York.

Cain, Ella M. (Cody)
1956 *The Story of Bodie.* Introduction By Donald I. Segerstrom. Fearon Publishing, San Francisco, in Cooperation With Mother Lode Press, Sonora.
1961 *The Story of Early Mono County.* Fearon Publishers, San Francisco.

Calhoun, Margaret
1984 *Pioneers of Mono Basin.* Artemisia Press, Lee Vining.

Canfield, Chauncey L.
1920 *Diary of a Forty-Niner.* Boston.

Carr, Stephen L.
1972 *The Historical Guide To Colorado Ghost Towns.* Western Epics, Salt Lake City.

Carson, James H.
1852 *Early Recollections of the California Gold Mines: An Account of Early Discoveries of Gold, with Anecdotes and Sketches of California and Miner's Life, and a Description of the Great Tulare Valley.* Reprint 1950, Biobooks, Oakland.

Carter, William
1978 *Ghost Towns of the West.* Lane Publishing, Menlo Park.

Cash, Joseph H.
1973 *Working the Homestake.* Iowa State University Press, Ames.

Caughey, John Walton
1948 *Gold is the Cornerstone.* Chronicles of California, University of California Press, Berkeley. Reprinted 1975, *The California Gold Rush*, University of California Press, Berkeley.

Chadwick, Robert
1982 Montana's Silver Mining Era: Great Boom and Great Bust. *Montana* 32:2:16-31.

Chalfant, W.A.
1947 *Gold, Guns and Ghosts Towns.* Stanford University Press, Stanford.

Champness, W.
1972 *To Cariboo and Back in 1862.* Ye Galleon Press, Fairfield, Washington.

Chan, Loren Briggs
1973 *Sagebrush Statesman: Tasker L. Oddie of Nevada.* University of Nevada Press, Reno.

Chappell, Maxine
1947 *Bodie and the Bad Man: Historical Roots of A Legend.* Unpublished Master's thesis, University of California, Berkeley.

Chase, J. Smeaton
1919 *California Desert Trails.* Houghton Mifflin Company, Boston.

Christiansen, Paige W.
1974 *The Story of Mining in New Mexico.* New Mexico Bureau of Mines & Mineral Resources, Scenic Trips to the Geological Past No. 12. University of New Mexico Press, Socorro.

Clappe, Louise
1949 *The Shirley Letters from the California Mines, 1851-1852.* New York.

Clark, Dwight L.
1969 *William Tecumseh Sherman: Gold Rush Banker.* California Historical Society, San Francisco.

Clark, William B.
1976 Gold Districts of California. *California State Division of Mines and Geology Bulletin* 193, Sacramento.

Cleland, Robert Glass
1952 *A History of Phelps Dodge, 1834-1950.* Alfred A. Knopf, New York.

Clifford, Henry B.
1908 *Rocks in the Road to Fortune or the Unsound Side of Mining.* Gotham Press, New York.

Conlin, Joseph R.
1986 *Bacons, Beans and Galantines: Food and Foodways on the Western Mining Frontier.* University of Nevada Press, Reno.

Conner, Daniel Ellis
1970 *A Confederate in the Colorado Gold Fields.* Edited by Donald J. Berthrong and Odessa Davenport. University of Oklahoma Press, Norman.

Coolidge, Dane
1937 *Death Valley Prospectors.* Reprinted 1985, Sagebrush Press, Morongo Valley, California.

Coon, S.J.
1930 Influence of the Gold Camps on the Economic Development of Western Montana. *Journal of Political Economy* 38:580-599.

Cox, Annie
1938 *History of Bisbee: 1877 To 1937.* Unpublished Master's thesis, University of Arizona, Tucson.

Crampton, C.G. and D.L. Smith
1941 *The Opening of the Mariposa Mining Region, 1848-1859.* Unpublished Ph.D. Dissertation, University of California, Berkeley.

1961 *The Hoskaninni Papers, Mining in Glen Canyon, 1897-1902.* University of Utah Archaeological Papers 54, Glen Canyon Studies 15.

Crane, Walter R.
1908 *Gold and Silver Comprising an Economic History of Mining in the United States, the Geographical and Geological Occurence of the Precious Metals, with their Mineralogical Associations, History and Description of Methods of Mining and Extraction of Values, and a Detailed Discussion of the Production of Gold and Silver in the World and the United States.* John Wiley & Sons, New York.

Crawford, J.J.
1894 Mines and Mining Products of California. *California Mining Bureau Report* 12, Sacramento.

Croft, Helen Downer
1961 *The Downs, the Rockies - and Desert Gold.* Caxton Printers, Caldwell, Idaho.

Curley, Edwin A.
1877 *Edwin A. Curley's Guide to the Black Hills, Comprising the Travels of the Author and His Special Artist.* Chicago. Reprinted 1973, Dakota Wesleyan University Press, Mitchell.

Cushman, Dan
n.d. Cordova Comstock Lode. *Montana* 9(4):12-15.

1964 Garnet: Last Booming Gold Camp. *Montana* 14:38-55.

1973 *Montana- the Gold Frontier.* Stay Away Joe Publishers, Great Falls.

Davis, Jean
1962 *Shallow Diggin's: Tales From Montana's Ghost Towns.* Caxton Printers, Caldwell, Idaho.

Davis, Richard Harding
1892 *The West from a Car Window.* Harper & Brothers, New York.

Davis, Sam P. (editor)
1913 *The History of Nevada.* 2 volumes. Elms Publishing Company, Reno. Reprinted, Nevada Publications, Las Vegas.

Dean, Sheila
1982 *Acid Drainage From Abandoned Metal Mines in the Patagonia Mountains of Southern Arizona.* Coronado National Forest, USDA, Tucson.

DeDecker, Mary
1966 *Mines of the Eastern Sierra.* La Siesta Press, Glendale.

DeGroot, Henry
1860 *Sketches of the Washoe Silver Mines, with a Description of the Soil, Climate, and Mineral Resources of the Country East of the Sierras.* Hutchings and Rosenfield.

DeHaas, John N., Jr. (editor)
1975 *Central Montana Ghost Towns: Kendall, Giltedge, Maiden, and Fort Maginnis.* Montana Ghost Town Preservation Society, Bozeman.

1976 *Historic Buildings in Bannack and Dillon.* Montana Ghost Town Preservation Society, Bozeman.

Delano, Alonzo
1854 *Life on the Plains and Among the Diggings.* Auburn and Buffalo.

DeQuille, Dan [William Wright]
1876 *The Big Bonanza: An Authentic Account of the Discovery, History, and Workings of the World-Renounced Comstock Lode of Nevada Including the Present Condition of the Various Mines Situated Thereon, Sketches of the Most Prominent Men Interested in Them, Incidents and Adventures Connected with Mining, the Indians, and the Country- Amusing Stories, Experiences, Enecdotes, Et., Etc. and a Full Exposition of the Production of Pure Silver.* Reprinted 1969, Thomas Y. Crowell Company, Apollo Edition, New York.

Dempsey, Stanley and James E. Fell, Jr.
1987 *Mining the Summit: Colorado's Ten Mile District, 1860-1960.*

Dimsdale, Thomas J.
1866 *The Vigilantes of Montana or Popular Justice in the Rocky Mountains, Being a Correct and Impartial Narrative of the Chase, Trial, Capture, and Execution of Henry Plummer's Road Agent Band Together with Accounts of the Lives and Crimes of Many of the Robbers and Desperadoes, the Whole Being Interspersed with Sketches of Life in the Mining Camps of the "Far West"; Forming the Only Reliable Work on the Subject Ever Offered to the Public.* Reprinted 1953, University of Oklahoma Press, Norman.

Dorr, John V. N.
1936 *Cyanidation and Concentration of Gold and Silver Ores.* McGraw-Hill Book Company, New York.

Douglas, William C.
1971 *A history of the Kennecott Mines, Kennecott, Alaska.* Division of Parks, State of Alaska, Anchorage.

Drury, Wells
1936 *An Editor on the Comstock Lode.* Reprinted 1984, University of Nevada Press, Vintage Nevada, Reno.

Duggan, E.J.
1933 Ammonia Leaching At Kennecott. *Transactions of the American Institute of Mining and Metallurgical Engineers* 106:547-558.

Dunn, Russell L.
1888 Drift Mining in California. *Eighth Annual Report of the State Mineralogist*, California State Mining Bureau, Sacramento.

1889 River Mining. *Ninth Annual Report of the State Mineralogist*, California State Mining Bureau, Sacramento.

Dunning, Charles H. and Edward H. Peplow, Jr.
1959 *Rock to Riches.* Southwest Publishing Company, Phoenix.

Eberhart, Perry
1959 *Guide To the Colorado Ghost Towns and Mining Camps.* Sage Books, Chicago.

Egenhoff, Elisabeth L. (compilor)
1949 *The Elephant as They Saw It.* California Department of Natural Resources, Sacramento.

Egenhoff, R.L.
1925 Hydraulic Mining Problems in California. *Military Engineer* 17:378-380.

Egleston, Thomas
1881 The Theis Process of Barrel Chlorination. *School of Mines Quarterly* 2:138-147. Columbia.

1887 *Metallurgy of Silver, Gold and Mercury in the United States.* 2 volumes. John Wiley and Sons, New York.

Eissler, Manuel
1898 *The Metallurgy of Silver.* 4th Edition. Crosby, Lockwood and Son, London.

Ellingsen, John D.
1977 *If These Walls Could Talk: The History of the Buildings of Virginia City.* Montana Ghost Town Preservation Society, Bozeman.

Elliott, Russell
1966 *Nevada's Twentieth Century Mining Boom: Tonopah, Goldfield, Ely.* University of Nevada Press, Reno.

Emmons, William Harvey
1937 *Gold Deposits of the World.* New York and London.

Farish, Thomas Edwin
1904 *The Gold Hunters of California.* Chicago.

Farquhar, Francis P. (editor)
1966 *Up and Down California in 1860-1864, the Journal of William H. Brewer, Professor of Agriculture in the Sheffield Scientific School from 1864 to 1903.* University of California Press, Berkeley.

Fatout, Paul
1956 *Ambrose Bierce and the Black Hills.* University of Oklahoma Press, Norman.

1969 *Meadow Lake, Gold Town.* Reprinted 1974, University of Nebraska Press, Bison Books, Lincoln.

Fay, Albert H.
1920 *A Glossary of the Mining and Mineral Industry.* Bulletin 95, United States Bureau of Mines.

Fell, James E., Jr.
1979 *Ores to Metals, the Rocky Mountain Smelting Industry.* University of Nebraska Press, Lincoln.

1982 *Arthur Redman Wilfley, Miner, Inventor, and Entrepreneur.* Colorado Historical Society, Denver.

Fielder, Mildred
1970 *The Treasure of Homestake Gold.* North Plains Press, Aberdeen, South Dakota.

Finck, J.W.
1932 *Prospecting for Gold Ores.* Idaho Bureau of Mines, Moscow.

Fisher, Vardis and Opal Laurel Holmes
1979 *Gold Rushes and Mining Camps of the Early American West.* Caxton Printers, Caldwell, Idaho.

Fleming, Jack
1987 *Copper Times, an Animated Chronicle of White Pine County, Nevada.* Seattle.

Fletcher, Thomas C.
1987 *Paiute, Prospector, Pioneer: A History of the Bodie-Mono Lake Area in the Nineteenth Century.* Artemisia Press, Lee Vining.

Florin, Lambert
1961 *Western Ghost Towns.* Superior Publishing, Seattle.

1963 *Ghost Town Trails.* Superior Publishing, Seattle.

1967 *A Guide to Western Ghost Towns.* Superior Publishing, Seattle.

1968 *Ghost Town El Dorado.* Superior Publishing, Seattle.

1971a *Ghost Towns of the West.* Promontory Press, New York.

1971b *Montana, Idaho, and Wyoming Ghost Towns.* Superior Publishing, Seattle.

1987 *Ghost Towns of the Pacific Frontier.* Promontory Press, New York. (Abridged From "Ghost Towns of the West").

1987 *Ghost Towns of the Rockies.* Promontory Press, New York. (Abridged From "Ghost Towns of the West").

1987 *Ghost Towns of the Southwest.* Promontory Press, New York. (Abridged From "Ghost Towns of the West").

Fossett, Frank
1880 *Colorado it Gold and Silver Mines, Farms and Stock Ranges, and Health and Pleasure Resorts. Tourist's Guide to the Rocky Mountains.* 2nd Edition. C.G. Crawford, New York.

Francaviglia, Richard
1982 *Mining Town Trolleys: A history of Arizona's Warren-Bisbee Railway.* Copper Queen Publishing Company, Bisbee.

Fritzberg, A.E.
1927 Mining Manganese Dioxide: The Trout Mine at Phillipsburg. *Engineering and Mining Journal* 129:645-647.

Fryer, Harold
1976 *Ghost Towns of Alberta.* Stagecoach Publishing, Langley, British Columbia.

1983 *Ghost Towns of Southern Alberta.* Heritage House, Surrey, British Columbia.

Galloway, R. E.
1932 History of Gold Mining in Kern County. *California Mining Journal* (January).

Glassock, Carl B.
1931 *The Big Bonanza: the Story of the Comstock Lode.* Indianapolis.

1932 *Gold in Them Hills, the Story of the West's Last Wild Mining Days.* Bobbs-Merrill Company, Indianapolis.

1935 *The War of the Copper Kings.* Bobbs-Merrill, New York.

Graeme, Richard
1981 Famous Mineral Localities: Bisbee, Arizona. *Mineralogical Record* (September-October) 12:258-319.

Graf, W.L.
1979 Mining and Channel Response. *Annals of the Association of American Geographers* 69(2):262-275.

Grauman, Melody Webb
1977 *Big Business in Alaska: the Kennecott Mines 1898-1938.* Cooperative Parks Study Unit, University of Alaska, Fairbanks.

Greene, Linda W., and John A. Latschar
1980 *Historic Resource Study: A History of Mining in Death Valley National Monument.* 3 volumes. Historic Preservation Branch, Denver Service Center, National Park Service, Denver.

Greever, William S.
1963 *The Bonanza West: Story of the Western Mining Rushes, 1848-1900.* University of Oklahoma Press, Norman.

Gressley, Gene M. (editor)
1968 *Bostonians and Bullion, the Journal of Robert Livermore 1892-1915.* University of Nebraska Press, Lincoln.

Grimmett, Robert G.
1977 *Cabal of Death: Harry Orchard and His Associates in Murder in the Western Mining Wars.* University Press of Idaho.

Grinnell, Joseph
1901 *Gold Hunting in Alaska.* Chicago.

Griswold, Don L. and Jean Harvey Griswold
1951 *The Carbonate Camp Called Leadville.* University of Denver Press, Denver.

Gudde, Erwin G.
1975 *California Gold Camps.* University of California Press, Berkeley.

Hafen, Leroy R. (editor)
1941 *Colorado Gold Rush, Comtemporary Letters and Reports 1858-1859.* Arthur H. Clark Company, Glendale, California.

Hafen, Leroy R. and Ann W. Hafen (editors)
1954 *Journals of the Forty-Niners, Salt Lake to Los Angeles.* Far West and Rockies Series II. Arthur H. Clark Company, Glendale, California.

1961 *Reports from Colorado, The Wildman Letters 1859-1865, with other Related Letters and Newspaper Reports, 1859.* Arthur H. Clark Company, Glendale, California.

Hague, J.D.
1870 *The Cortez District.* United States Geological Exploration of the 40th Parallel. Volume 3. Washington, D.C.

Hamilton, Patrick
1883 *The Resources of Arizona.* A.L. Bancroft & Company, San Francisco.

Hammond, Helen
1983 *Garnet: Montana's Last Gold Camp.* ACME Press, Missoula.

Hammond, John Hays
1935 *The Autobiography of John Hays Hammond.* 2 volumes. Farrar & Rinehart, Inc., New York.

Hart, Arthur A.
1986 *Basin of Gold, Life in Boise Basin, 1862-1890.* Idaho City Historical Foundation/Historic Boise, Boise.

Haskins, C.W.
1890 *The Argonauts of California.* New York.

Hayward, Carle R.
1929 *An Outline of Metallurgical Practice.* D. Van Nostrand Company, New York.

Heikes, V.C.
1927 *Reduction Mills in Nevada in 1925.* Information Circular 6028, US Bureau of Mines, Washington D.C.

Hensher, Alan and Jack Peskin
1980 *Ghost Towns of the Kern and Eastern Sierra.* Privately published, Los Angeles.

Hezzelwood, G.W.
1930 *Mining Methods and Costs at the Consolidated Cortez Silver Mine, Cortez, Nevada.* Information Circular 6327, United States Bureau of Mines, Washington, D.C.

Hibbard, Benjamin H.
1939 *A history of Public Land Policies.* Macmillan Company, New York. Revised Edition. Originally Published 1924.

Hickson, Howard
1972 *Mint Mark: "CC", the Story of the United States Mint at Carson City, Nevada.* Edited by Guy Shipler. Nevada State Museum, Carson City.

Hill, James M.
1912 *The Mining Districts of the Western United States.* Bulletin 507, United States Geological Survey, Government Printing Office, Washington, D.C.

Hill, Jim D.
1962 The Early Mining Camp in American Life. *Pacific Historical Review* 1:295-311.

Hinckley, Spiers and Hayes
1889 *Fulton Iron Works, Catalogue of Mining Machinery.* Crocker and Company, San Francisco.

Hine, Robert
1980 *Community On the American Frontier.* University of Oklahoma Press, New York.

Hittell, John S.
1877 *Resources of California: Comprising Agriculture, Mining, Geography, Climate, Commerce. & etc. and the Past and Future Development of the State.* 4th Edition. A. Roman and Company, San Francisco.

Holliday, J.S.
1981 *The World Rushed In, the California Gold Rush Experience.* Simon and Schuster, New York.

Hollister, Ovando J.
1867 *The Mines of Colorado.* Samuel Bowles & Company, Springfield, Massachusetts. Reprinted 1974, Promontory Press, New York.

Hollon, W. Eugene
1956 *A Spanish 'Arrastra' in the Wichita Mountains.* Chronicles of Oklahoma 443-447.

Homsher, Lola M. (editor)
1960 *South Pass, 1868, James Chisolm's Journal of the Wyoming Gold Rush.* University of Nebraska Press, Lincoln.

Hoover, Herbert C. and L.H. Hoover (translators)
1912 *De Re Metallica*, By Georgius Agricola [Georg Bauer]. (Latin, 1556) Dover Publications, New York.

Horner, Jon Willard
1950 *Silver Town.* Caxton Printers, Caldwell, Idaho.

Howard, Robert West
1962 *The Race West: Boom Town to Ghost Town.* New American Library, New York.

Hubbard, Douglass H.
1958 *Ghost Mines of Yosemite.* Awani Press, Fresno.

Hughes, Richard B.
1957 *Pioneer Years in the Black Hills.* Arthur Clarke, Glendale.

Hungerford, Edward
1949 *Wells Fargo, Advancing the American Frontier.* Bonanza Books, New York.

Hunt, William R.
1974 *North of 53, the Wild Days of the Alaska-Yukon Mining Frontier 1870-1914.* MacMillan Publishing, New York.

Ingalls, Walter R.
1907 The Silver-lead Mines of Eureka, Nevada. *Engineering and Mining Journal* 84(23):1051-1058.

Ingersoll, Ernest
1885 *The Crest of the Continent: a Record of a Summer's Ramble in the Rocky Mountains and Beyond.* R. R. Donnelley & Sons, Chicago.

1897 *Gold Fields of the Klondike and the Wonders of Alaska.* Earle Pub. House, St. John, New Brunswick. Reprinted 1981, Mr. Paperback, Langley, British Columbia.

Ingham, G. Thomas
1880 *Digging Gold Among the Rockies.* Hubbard Brothers, New York.

Jackson, Joseph Henry
1941 *Anybody's Gold: The Story of California's Mining Towns.* D. Appleton-Century, New York.

Jackson, W. Turrentine
1962 *Historical Material On the Mining Town of Bodie, California: A Critical Bibliography.* Division of Beaches and Parks, [Department of Parks and Recreation] State of California, Sacramento.

1963 *Treasure Hill: Portrait of a Silver Mining Camp.* University of Arizona Press, Tucson.

1967 *The North Bloomfield Mining District: Report on the Malakoff Mine, the North Bloomfield Mining District and the Town of North Bloomfield.* California Department of Parks and Recreation, Sacramento.

1984 *Wells Fargo & Co. in Idaho Territory.* Idaho State Historical Society, Boise.

Jackson, W. Turrentine (editor)
1965 *Twenty Years on the Pacific Slope, Letters of Henry Eno from California and Nevada, 1848-1871.* Yale University Press, New Haven.

Janson, Lone
1975 *The Copper Spike.* Alaska Northwest Publishing Company, Anchorage.

Jenkins, Powell
1952 Recovering Gold the Hard Way. *Desert Magazine* 15(4):14-15.

Jenkinson, Michael, and Karl Kernberger
1968 *Ghost Towns of New Mexico.* University of New Mexico Press, Albuquerque.

Jensen, Vernon H.
1950 *Heritage of Conflict, Labor Relations in the Nonferrous Metals Industry up to 1930.* Cornell University Press, Ithaca, New York.

Johansen, Harley E., Olen Paul Matthews, and Gundars Rudzitis (editors)
1987 *Mineral Resource Development: Geopolitics, Economics, and Policy.* Westview Press, Boulder.

Johnson, Florence Riddle
1964 Ghost Trails Country. Anaconda, Montana.

Johnson, Kenneth M.
1963 *The New Almaden Quicksilver Mine, with an Account of the Land Claims Involving the Mine and its Role in California History.* Los Gatos.

Johnson, Robert N.
1974 *California-Nevada Ghost Town Atlas.* Cy Johnson & Son, Susanville.

1975a *Northwest Gem Fields and Ghost Town Atlas.* Cy Johnson & Son, Susanville.

1975b *Southwestern Ghost Town Atlas.* Cy Johnson & Son, Susanville.

Johnson, Russ and Anne Johnson
1967 *The Ghost Town of Bodie As Reported in the Newspapers of the Day.* Chalfant Press, Bishop.

Johnson, William Weber
1976 *The Forty-Niners.* The Old West Series. Time-Life Books, New York.

Joralemon, Ira B.
1973 *Copper: the Encompassing Story of Mankind's First Metal.* Howell-North, Berkeley.

Kelley, Robert L.
1959 *Gold vs. Grain: The Hydraulic Mining Controversy in California's Sacramento Valley - A Chapter in the Decline of the Concept of Laissez-Faire.* Arthur H. Clark, Glendale.

Kelly, J. Wells
1862 *First Directory of Nevada Territory containing: the Names of Residents in the Principal Towns; a Historical Sketch; the Organic Act, and Other Political Matters of Interest; together with a Description of All the Quartz Mills; Reduction Works, and All Other Industrial Establishments in the Territory; as Also for the Leading Mining Claims; and Various Mineral Discoveries, Works of Internal Improvements, Etc. with a Table of Distances, List of public Officers, and Other Useful Information. Compiled from the Most Recent and Authentic Sources, and Including Sketches of the Washoe Silver Mines by Henry De Groot.* Reprinted 1962, Introduction by Richard Lingenfelter, Talisman Press, Los Gatos, California.

Kemp, Donald C.
1949 *Colorado's Little Kingdom, Pictures and Text Showing the Little Kingdom's Development from the Time of its Inception through its Heyday and Decline to the Present Day.* Sage Books Inc., Chicago.

Kent, Florence Knight
1930 *The Western Mining Frontier, 1858-1866.* Unpublished Master's Thesis, University of Iowa.

Kersten, Earl W.
1964 The Early Settlement of Aurora, Nevada, and nearby Mining Camps. *Annals of the Association of American Geographers* 54(4):490-507.

King, Joseph E.
1977 *A Mine to Make a Mine: Financing the Colorado Mining Industry, 1859-1902.* Texas A & M University Press, College Station.

Kinyon, Edmund
1949 *The Northern Mines: Factual Narratives of the Counties of Nevada, Placer, Sierra, Yuba, and Portions of Plumas and Butte.* Union Publishing Company, Grass Valley-Nevada City.

Krause, Alfred Frank
1969 *Riding the Ghost Town Trail.* Potomac Corral of the Westerners, Washington.

Kustel, Guido
1863 *Nevada and California Processes of Silver and Gold Extraction.* Carlton, San Francisco.

Lamb, Mark R.
1908 Hacienda Buburon, an Old Mexican Silver Mill. *Engineering and Mining Journal* 86(14):663-664.

Latschar, John and Linda W. Greene
1981 *A History of Mining in Death Valley National Monument.* 4 volumes. National Park Service, San Francisco.

Laxalt, Robert
1973 Golden Ghosts of the Lost Sierra. *National Geographic* 144(3):332-353.

Lee, Mabel Barbee
1958 *Cripple Creek Days.* Doubleday & Company, New York. Reprinted 1984, Bison Book.

Leete, Harley M., Jr.
1943 *Sketches of the Gold Country.* Nugget Press, Nevada City.

Leggett, Thomas
1894 Electric Power Transmission Plants and the Use of Electricity in Mining Operations. *California Report of the State Mineralogist* (1892-1894) 12:413-455.

Leroux, Dolores and Virgil Collins
1977 *Mill Sites of the Calico Mining District.* Mojave River Valley Museum Association, Barstow.

Leshy, John D.
1987 *The Mining Law: A Study in Perpetual Motion.*

Lewis, Leroy
1988 The Art and Science of Fire Assaying For Gold. *Idaho Yesterdays* 32:2:15-21.

Lewis, Marvin (editor)
n.d. *The Mining Frontier.* [contemporary 19th century accounts]

Lewis, Oscar
1947 *Silver kings: the Life and Times of Mackay, Fair, Flood, and O'Brien, Lords of the Nevada Comstock Lode.* New York.

Likes, Robert C. and Glenn R. Day
1975 *From This Mountain - Cerro Gordo [CA].* Chalfant Press, Bishop.

Lincoln, Francis C.
1923 *Mining Districts and Mineral Resources of Nevada.* Nevada Newsletter Publishing Company, Reno. Reprinted 1982, Nevada Publications, Las Vegas.

Lindstrom, Joyce (editor)
1984 *Idaho's Vigilantes by William J. McConnell, Captain of the Payette Vigilantes and James S. Reynolds, Member of the Boise City Vigilantes.* University Press of Idaho, Moscow.

Lingenfelter, Richard E.
1974 *The Hardrock Miners, a History of the Mining Labor Movement in the American West, 1863-1893.* University of California Press, Berkeley.

1986 *Death Valley and the Armargosa, a Land of Illusion.* University of California Press, Berkeley.

Livingston-Little, D. E.
1965 An Economic History of North Idaho, 1800-1900. *Journal of the West,* Los Angeles.

Loose, Warren
1971 *Bodie Bonanza, the True Story of a Flamboyant Past.* Exposition Press, New York.

Lord, Eliot
1883 *Comstock Mining and Miners.* Monograph 4, United States Geological Survey, Washington D.C. Reprinted 1959, Howell-North, Berkeley.

Looney, Ralph
1968 *Haunted Highways: The Ghost Towns of New Mexico.* Hastings House, New York.

Loose, Warren
1971 *Bodie Bonanza:The True Story of A Flamboyant Past.* Exposition Press, New York.

Louis, Henry
1902 *A Handbook of Gold Mining.* Macmillan and Company, London.

Love, Frank
1974 *Mining Camps and Ghost Towns [lower Colorado].* Westernlore Press, Los Angeles.

Luebbert, N.C.
1978 *History of the Yankee Fork Mining District, Custer County, Idaho.* Senior Honor's thesis, Dartmouth College.

Luecke, Mary, Brian Power and Jim Rock
n.d. *A Glossary of Mining Terms.* Klamath National Forest, Region 5, USDA.

Lyden, C.H.
1948 The Gold Placers of Montana. *Montana Bureau of Mines and Geology Memoirs* 26. Butte.

Lyman, George D.
1934 *The Saga of the Comstock Lode.* New York.

1937 *Ralston's Ring: California Plunders the Comstock Lode.* New York.

MacKnight, James Arthur
1892 *The Mines of Montana: Their History and Development to Date.* Prepared for the National Mining Congress, July 12, 1892, at Helena, Montana. C.K. Wells Company, Helena.

Malone, Michael P.
1981 *The Battle for Butte, Mining and Politics on the Northern Frontier, 1864-1906.* University of Washington Press, Seattle.

Marcosson, Isaac F.
1949 *Metal Magic, the Story of the American Smelting & Refining Company.* Farrar, Straus and Company, New York.

1957 *Anaconda.* Dodd, Mead & Company, New York.

Mann, Ralph E.
1982 *After the Gold Rush: A Social History of Grass Valley and Nevada City, 1849-1870.*

Matson, R.C.
1932 *Prospecting and Exploration.* Michigan College of Mines.

Maule, William M.
1938 *A Contribution To the Geographic and Economic History of the Carson, Walker, and Mono Basins in Nevada and California.* Forest Service, California Region, San Francisco.

McGrath, Roger D.
1984 *Gunfighters, Highwaymen & Vigilantes, Violence on the Frontier.* University of California Press, Berkeley.

McMillan, A.C.
1964 A Young Clergyman Looks at Granite's Glittering Glory. *Montana* 14(3):62-73.

McNaughton, Margaret
1896 *Overland to Cariboo, an Eventful Journey of Canadian Pioneers to the Gold-Fields of British Columbia in 1862.* Reprinted 1966, Argonaut Press Limited, New York.

Meleski, Patricia F. and Richard P. Meleski
1972 *New Mexico's Ghost Towns.* University of New Mexico Press, Albuquerque.

Miller, Alfred
1900 *A Manual of Assaying.* John Wiley, New York.

Miller, Don C.
1974a *Ghost Towns and Mining Camps: Selected Papers.* Papers From the Ghost Towns and Mining Camps Preservation Conferences, Boise, Idaho (May 1974), and Flagstaff (April 1975). Preservation Press, Washington, D.C.

1974b *Ghost Towns of Montana.* Pruett Publishing, Boulder, Colorado.

1977a *Ghost Towns of Washington and Oregon.* Pruett Publishing, Boulder, Colorado.

1977b *Ghost Towns of Wyoming.* Pruett Publishing, Boulder, Colorado.

1978 *Ghost Towns of California.* Pruett Publishing, Boulder, Colorado.

1979 *Ghost Towns of Nevada.* Pruett Publishing, Boulder, Colorado.

Miller, Ronald Dean
1968 *Mines of the High Desert.* La Siesta Press, Glendale.

1976 *Mines of the Mojave.* La Siesta Press, Glendale.

Molinelli, Lambert
1879 *Eureka and its Resources; A Complete History of Eureka County, Nevada, containing the United States Mining Laws, the Mining Laws of the District, Bullion Product and other Statistics for 1878, and a List of County Officers.* H. Keller & Co., San Francisco. Reprinted 1982, University of Nevada Press, Vintage Nevada, Reno.

Montana Ghost Town Preservation Society
1983 *Reflections of the Past: Feature Articles from the Newsletter of the Montana Ghost Town Preservation Society, 1970-1983.* Bozeman.

Montana Highway Commission
1966 *Ghost Towns of Montana.* Montana Highway Commission, Advertising Department, Helena.

Moore, Joseph and George Dickie
1877 *Pumping and Hoisting Works For Gold and Silver Mines.* A.L. Bancroft and Company, San Francisco.

Morenhout, Jacques Antoine
1935 *The Inside Story of the Gold Rush.* Translated by Abraham P. Nasatir. California Historical Society, San Francisco.

Morgan, Dale L. and James R. Scobie (editors)
1964 *Three Years in California, William Perkin's Journal of Life at Sonora, 1849-1852.* University of California Press, Berkeley.

Morley, Jim and Doris Foley
1965 *Gold Cities: Grass Valley and Nevada City.* Howell-North Books, Berkeley.

Morrell, William P.
1941 *The Gold Rushes.* MacMillan and Company, New York.

Morris, Henry Curtis
1955 *Desert Gold and Total Prospecting.* Washington, D.C..

Mowry, Sylvester
1864 *Arizona and Sonora: the Geography, History, and Resources of the Silver Region of North America.* New York: Harper and Brothers, 1864.

Muckler, Billie Phyllis
1941 *History of the Guadalupe Quicksilver Mine.* Unpublished Master's Thesis, History, University of California, Berkeley.

Murbarger, Nell
1956 *Ghosts of the Glory Trail.* Westernlore Press, Los Angeles.

1964 *Ghosts of the Adobe Walls.* Westernlore Press, Los Angeles.

Murphy, Robert J.
1972 *Wildrose Charcoal Kilns.* Chalfant Press, Bishop.

Myers, John
1950 *The Last Chance: Tombstone's Early Years.* E.P. Dutton & Company, New York.

Myres, S. D.
1968 *Pioneer Surveyor, Frontier Lawyer, The Personal Narrative of O. W. Williams, 1877-1902.* Texas Western Press, El Paso.

Nadeau, Remi
1965 *Ghost Towns and Mining Camps of California.* Ward Ritchie Press, Los Angeles.

Naramore, C. and C.G. Yale
1910 *Gold, Silver, Copper, Lead and Zinc in the Western States and Territories in 1908.* Government Printing Office, Washington, D.C.

Nash, June
1979 *We Eat the Mines, the Mines Eat Us.* Columbia University Press, New York.

Navin, Thomas R.
1978 *Copper Mining and Management.* University of Arizona Press, Tucson.

Niebur, Jay E.
n.d. *Arthur Redman Wilfley, Miner, Inventor, and Entrepreneur.* Western Business History Research Center, Colorado Historical Society.

North, Diane M. T.
1980 *Samuel Peter Heintzelman and the Sonora Exploring and Mining Company.* University of Arizona Press, Tucson.

Notarianni, Philip
1982 *Faith, Hope and Prosperity: the Tintic Mining District.* Tintic Historical Society, Eureka, Utah.

Oberbillig, Ernest
1967 Development of Washoe and Reese River Silver Processes. *Nevada Historical Society Quarterly* 10:2:.

O'Connor, Richard
1954 *High Jinks on the Klondike.* Indianapolis.

Odens, Peter
1973 *Picacho: Life and Death of a Great Gold Mining Camp.* Yuma.

Olson, Lawrence E.
1931 *The Mining Frontier of South Dakota, 1874-1877.* Unpublished Master's Thesis, University of Iowa.

O'Neill, Wm. O.
1887 *Central Arizona, for Homes, for Health, for Wealth.* Hoof and Horn Print, Prescott.

Oregon Historical Society
1970 *Oregon Ghost Towns and Some Historical Communities.* Portland.

Pace, Dick
1970 *Golden Gulch: The Story of Montana's Fabulous Alder Gulch.* Virginia City, Montana.

Paher, Stanley W.
n.d. *Tonopah: Silver Camp of Nevada.* Nevada Publications, Las Vegas.

1970a *Northwestern Arizona Ghost Towns.* Gateway Press, Las Vegas.

1970b *Nevada Ghost Towns and Mining Camps.* North-Howell Books, Berkeley.

1973 *Death Valley Ghost Towns.* Nevada Publications, Las Vegas.

1976 *Colorado River Ghost Towns.* Nevada Publications, Las Vegas.

Park, Jo
1977 *Waterman Silver Mine.* Mojave River Valley Museum Association, Barstow.

Parker, Morris B.
1971 *White Oaks, Life in a New Mexico Gold Camp, 1880-1900.* Edited by C. L. Sonnichsen. The University of Arizona Press, Tucson.

1979 *Mules, Mines and Me in Mexico, 1895-1932.* Edited by James M. Day. The University of Arizona Press, Tucson.

Parker, Russell L.
1947 The Mystery of the Los Spanish Mine. *New Mexico Magazine* 25(7):15-17,53.

Parker, Watson
1966 *Gold in the Black Hills.* University of Oklahoma Press, Norman.

1981 *Deadwood: the Golden Years.* University of Nebraska, Lincoln.

Parker, Watson and Hugh K. Labert
1974 *Black Hills Ghost Towns.* Sage Books, Chicago.

Patterson, Lawson B.
1862 *Twelve Years in the Mines of California.* Cambridge.

Paterson, T.W.
1975 *Ghost Trails of Vancouver Island.* Stagecoach Publishing, Langley, British Columbia.

Paul, Rodman Wilson
1947 *California Gold: the Beginning of Mining in the Far West.* University of Nebraska Press, Lincoln.

1963 *Mining Frontiers of the Far West, 1848-1880.* Holt, Rinehart and Winston, New York. Reprinted 1974, University of New Mexico Press, Albuquerque.

1988 *The Far West and the Great Plains in Transition, 1859-1900.* Harper & Row, New York.

Paul, Rodman Wilson (editor)
1972 *A Victorian Gentlewoman in the Far West, the Reminiscences of Mary Hallock Foote.* Huntington Library, San Marino, California.

Paul, Wolfgang
1970 *Mining Lore: An Illustrated Composition and Documentary Compilation With Emphasis on the Spirit and History of Mining.* Morris Printing Company.

Payne, Nellie
1977 *Coolgardie Placer Mines.* Mojave River Valley Museum Association, Barstow.

Peattie, Roderick (editor)
1952 *The Black Hills.* New York.

Peele, Robert (editor)
1918 *Mining Engineers Handbook.* Wiley, New York.

1941 *Mining Engineers Handbook.* 3rd Edition. Wiley, New York.

Pence, Mary Lou and Lola M. Homsher
1956 *The Ghost Towns of Wyoming.* Hastings House, New York.

Pepper, John Henry
1866 *The Playbook of Metals: Including Personal Narratives of Visits to coal, Lead, Copper, and tin Mines; with a Large Number of Interesting Experiments Relating to Alchemy and the Chemistry of the Fifty Metallic Elements.* George Routledge and Sons, London.

Phillips, J. Arthur
1867 *The Mining and Metallurgy of Gold and Silver.* London.

1887 *Elements of Metallurgy.* Charles Griffin and Company, London.

Phillips, Paul C. (editor)
1925a *Prospecting For Gold: From Dogtown To Virginia City, 1852-1864.* [Granville Stuart] Arthur H. Clark Company, Glendale, California. Reprinted 1977, University of Nebraska Press, Lincoln.

1925b *Pioneering in Montana, the Making of a State, 1864-1887.* [Granville Stuart] Arthur H. Clark Company, Glendale, California. Reprinted 1977, University of Nebraska Press, Lincoln.

1957 *Forty Years of the Frontier as seen in the Journal and Reminscences of Granville Stuart.* Arthur H. Clark Company, Glendale.

Pike, L.F.
1909 Nevada's Latest Stampede. *Sunset Magazine* 23(1):67-70.

Potter, Elizabeth G.
1945 Columbia, Gem of the Southern Mines. *California Historical Society Quarterly* 24: .

Preston, E.B.
1895 California Gold Milling Practices. *California State Bureau of Mines Bulletin* 6, San Francisco.

Probert, Frank H.
1907 Primitive Mexican Crushing and Dressing Plant. *Engineering and Mining Journal* 83(14):655-656.

Procter, Hazel T.
1975 *Tenderfoot to Sourdough, the True Adventures of Amos Entheus Ball in the Klondike Gold Rush as Told in His Own Words.* New Holland, Pennsylvania.

Pruitt, R.G.
1977 *Digest of Mining Claim Laws.* Rocky Mountain Law Foundation. Boulder, Colorado.

Quiett, Glenn Chesney
1936 *Pay Dirt: A Panorama of American Gold Rushes.* New York.

Rae, W. F.
1871 *Westward by Rail: the New Route to the East.* D. Appleton & Company, New York. Reprinted 1974, Promontory Press, New York.

Ramsey, Bruce
1963 *Ghost Towns of British Columbia.* Mitchell Press, Vancouver.

Raymond, Rossiter W.
1867 *Statistics of Mines and Mining in the States and Territories West of the Rocky Mountains.* Government Printing Office, Washington D.C. [Annual Report].

Reid, R. L.
1926 *The Assay Office and the Proposed Mint at New Westminster, A Chapter in the History of the Fraser River Mines.* Victoria.

Reps, John
1975 Bonanza Towns: Urban Planning on the Western Mining Frontier. In *Pattern and Process: Research in Historical Geography*, Edited By Ralph E. Ehrenberg, :271-289, Howard University Press, Washington D.C.

1979 *A History of Frontier Urban Planning.* Princeton University Press, Princeton.

Rhead, E.L. and Humboldt Sexton
1902 Assaying and Metallurgical Analysis. Longmans, Green and Company, London.

Rice, George Graham
1986 *My Adventures With Your Money.* Reprinted, Nevada Publications, Las Vegas.

Richards, Robert H. and Charles E. Looke
1977 *Textbook of Ore Dressing.* McGraw-Hill, New York.

Richardson, Ann Carol
1960 *Development of the California Mining Industry, 1866-1882.* Unpublished Ph.D. Dissertation, University of California, Davis.

Rickard, Thomas A.
1901 *The Stamp Milling of Gold Ores.* 3rd Edition. the Scientific Publishing Company, New York. Originally Published 1897.

1907 *Journeys of Observation.* Dewey Publishing Company, San Francisco.

1909 *Through the Yukon and Alaska.* San Francisco.

1921 *The Bunker Hill Enterprise.* San Francisco.

1922 *Interviews with Mining Engineers.* Mining and Scientific Press, San Francisco.

1932 *A History of American Mining.* New York.

1945 *The Romance of Mining.* San Francisco.

Ricketts, Pierre de Peyster and Edmund H. Miller
1897 *Notes on Assaying.* John Wiley & Sons, New York.

Robinson, Fayette
1849 *California and Its Gold Regions.* New York.

Rockwell
1851 *Compilation of Spanish and Mexican Laws Relating To Mines.* New York.

Rohe, Randall
1982 After the Gold Rush: Chinese Mining in the Far West, 1850-1890. *Montana* 32:4:2-19.

Rohrbough, Malcolm J.
1986 *Aspen, the History of a Silver Mining Town.* Oxford University Press, New York.

Rolle, Andrew F. (editor)
1960 *The Road to Virginia City, the Diary of James Knox Polk Miller.* University of Oklahoma Press, Norman.

Ross, C.P.
1963 *Mining History of South-central Idaho.* Idaho Bureau of Mines and Geology, Moscow.

Rossillon, M.P.
1980 An Overview of history in the Drainage Basin of the Middle Fork of the Salmon River. *Anthropological Research Manuscript Series* 60, University of Idaho, Moscow.

Saltiel, E. H. and George Barnett
1868 *History and Business Directory of Cheyenne and Guide to the Mining Regions of the Rocky Mountains.* Cheyenne. Reprinted 1975, Yale University Library, New Haven.

Sawatsky, Don
1975 *Ghost Trails of the Yukon.* Stagecoach Publishing, Langley, British Columbia.

Scheidel, A.E.M.
1894 *The Cyanide Process.* State Printing office, Sacramento.

Schilling, John H.
1976 *Metal Mining Districts of Nevada.* 3rd Edition. Nevada Bureau of Mines and Geology, Map 37.

Schreier, Nancy B.
1981 *Highgrade, the Mining Story of National, Nevada.* Arthur H. Clark Company, Glendale, California.

Settle, Glen A.
1969 *Tropico-Red Hill with a Glamorous History of Gold.* Privately printed, Rosamond. [CA]

Settle, Raymond W. and Mary Lund Settle (editors)
1971 *Overland Days to Montana in 1865, the Diary of Sarah Raymond and Journal of Dr. Waid Howard.* Arthur H. Clark Company, Glendale, California.

Shamberger, H.A.
1978 *Candelaria and its Neighbors.* Historical Press, Carson City.

Shaw, D.A.
1900 *Eldorado, or, California As Seen by a Pioneer, 1850-1900.* Los Angeles.

Sherman, James E. and Barbara H. Sherman
1969 *Ghost Towns of Arizona.* University of Oklahoma Press, Norman.

1975 *Ghost Towns and Mining Camps of New Mexico.* University of Oklahoma Press, Norman.

Shinn, Charles Howard
1885 *Mining Camps: A Study in American Frontier Government.* Charles Scribner's Sons, New York. Reprinted 1948, Alfred A. Knopf, New York. Reprinted 1965, Harper & Row, New York.

1910 *The Story of the Mine, as Illustrated by the Great Comstock Lode of Nevada.* Story of the West Series, D. Appleton, New York. Reprinted 1980, University of Nevada Press, Vintage Nevada, Reno.

Shumate, Albert
1986 *The Notorious I.C. Woods of the Adams Express.* Arthur H. Clark Company, Glendale, California.

Shumway, Gary L., L. Vredenburgh, and Russell Hartill
1980 *Desert Fever: An Overview of Mining in the California Desert Conservation Area.* Submitted To Desert Planning Staff, Bureau of Land Management, Riverside.

1901 *The Story of the Mine.* Appleton and Company, New York.

Silliman, Benjamin and William Blake
1864 *Prospectus of the Empire Gold and Silver Mining Company of New York, With Reports thereon of Professor B. Silliman, Jr. of Yale College, and Professor W.P. Blake, Mining Engineer of California.* William H. Arthur, Stationer, New York.

Simonin, Louis L.
1966 *The Rocky Mountain West in 1867.* Translated by Wilson O. Clough. University of Nebraska Press, Lincoln.

Simons, Frederick
1954 Nineteenth-century Mines and Mineral Spring Resorts of Lake County, California. *California Journal of Mines and Geology* 50:2:295-319.

Sisco, A.G. and C.S. Smith
1951 *Treatise On Ores and Assaying,* By Lazarus Ercker. (German 1580) University of Chicago Press, Chicago.

Sloane, Howard N. and Lucille N.
1970 *A Pictorial History of American Mining.* Crown Publishers, New York.

Smith, C.S. and M.T. Gnudi
1942 *Pirotechnica,* By Vannoccio Biringuccio. (Latin 1540) M.I.T. Press, Cambridge.

Smith, Duane A.
1967 *Rocky Mountain Mining Camps: the Urban Frontier.* Indiana University Press, Bloomington. University of Nebraska Press, Lincoln.

1974 *Silver Saga, the Story of Caribou, Colorado.* Pruett Publishing Company, Boulder, Colorado.

1981 *Horace Tabor, His Life and the Legend.* Pruett Publishing Company, Boulder, Colorado.
1985 *The Untapped Ore of History.* State Historical Society of Colorado.

1987 *Mining America: The Industry and the Environment, 1800-1980.* University Press of Kansas, Lawrence.

Smith, Dwight L. (editor)
1969 *John D. Young and the Colorado Gold Rush.* R. R. Donnelley and Sons Co., Chicago.

Smith, E.A.
1913 *The Sampling and Assay of the Precious Metals.* Charles Griffin and Company, London.

Smith, Grant Horace
1925 Bodie: the Last of the Old-time Mining Camps. *California Historical Society Quarterly* 4:64-80.

1929 More Notes On Tioga Mining history. *Yosemite Nature Notes* 8(3):25-27.

1943 The History of the Comstock Lode, 1850-1920. *University of Nevada Bulletin, Geology and Mining Series* 37(3). Reno. Reprinted 1980, Mackay School of Mines, University of Nevada, Reno.

Sonnichsen, C. L.
1974 *Colonel Greene and the Copper Skyrocket, the Spectacular Rise and Fall of William Cornell*

Greene: Copper King, Cattle Baron, and Promoter Extraordinary in Mexico, the American Southwest, and the New York Financial District. University of Arizona Press, Tucson.

Sorte, Donald L.
1960 *The Hope Mining Company of Philipsburg.* Unpublished Master's Thesis, Montana State University, Bozeman.

Sparling, Wayne
1976 *Southern Idaho Ghost Towns.* Caxton Printers, Caldwell, Idaho.

Spence, Clark C.
1970 *Mining Engineers and the American West: the Lace Boot Brigade, 1849-1933.* Yale University Press, New Haven.

Splitter, Henry W.
1957 Quicksilver At New Almaden. *Pacific Historical Review* 26: .

Sprague, Marshall
1953 *Money Mountain: The Story of Cripple Creek Gold.* Little, Brown, and Co., Boston. Reprinted 1971, Ballantine Books, New York.

Spude, Robert L.S.
1972 Big Bug Mining District. *Journal of Arizona History.*

Spude, Robert L.S. and Sandra McDermott Faulkner (compilors)
1983 *Klondike Gold Rush: Skagway, District of Alaska 1884-1912.* Occasional Paper 36, Cooperative Park Studies Unit, University of Alaska, Fairbanks and the Alaska Region office, National Park Service.

1987 *Kennecott, Alaska: Historic American Engineering Record Recording Project.* National Park Service, Alaska Region, Anchorage.

Steffen, Jerome
1980 *Comparative Frontiers.* University of Oklahoma Press, Norman.

Stellman, Louis J.
1934 *Mother Lode.* San Francisco.

Stetefeldt, Carl A.
1895 *The Lixiviation of Silver-Ores with Hyposulphite Solutions with Special Reference to the Russell Process.* 2nd Edition. Tuttle, Morehouse and Taylor Press, New Haven.

Stoehr, Eric C.
1975 *Bonanza Victorian: Architecture and Society in Colorado Mining Towns.* University of New Mexico Press, Albuquerque.

Stoll, William T.
1932 *Silver Strike: The True Story of Silver Mining in the Coeur d'Alenes.* Boston.

Storms, William H.
1909 *Timbering and Mining.* McGraw-Hill, New York.

1911 How To Build an Arrastra. *Engineering and Mining Journal* 91(22):1053-1054.

Stumpf, Gary
1979 *Gold Mining in Siskiyou County 1850-1900.* Siskiyou County Historical Society, Yreka.

Talbitzer, Bill
1985 *Echoes of the Gold Rush: Tales of the Northern Mines.* Oroville Features, Oroville.

Tallent, Annie E.
1889 *The Black Hills.* St. Louis.

Tays, E.A.H.
1908 Mining in Mexico: Past and Present. *Engineering and Mining Journal* 86(14):665-667.

Thomas, Sewell
1959 *Silhouettes of Charles S. Thomas, Colorado Governor and United States Senator.* Caxton Printers, Caldwell, Idaho.

Thompson, George
1967 The Story of the Arrastra. *Desert Magazine* 30(11):30-31.

Tilton, Cecil G.
1935 *William Chapman Ralston, Courageous Builder.* Boston.

Titley, Spencer and Carol Hicks (editor)
1966 *Geology of Porphyry Copper Deposits of Southwestern North America.* University of Arizona Press, Tucson.

Todd, Arthur C.
1967 *The Cornish Miner in America.* Clark, Glendale.

Trimble, William Joseph
1909 *The Mining Advance Into the Inland Empire.* University of Wisconsin, Madison. Reprinted 1986, Ye Galleon Press, . Fairfield, Washington.

Tucker, W.B.
1934 Current Mining Activity in Southern California. *California Mining Bureau Report* 30, Sacramento.

Tucker, W.B. and R.J. Sampson
1940 Current Mining Activity in Southern California. *California Division of Mines Report* 36, Sacramento.

Turnbull, Elsie G.
n.d. *Ghost Towns and Drowned Towns of West Kootenay.*

United States Bureau of Mines
1967 *A Dictionary of Mining, Mineral, and Related Terms.* Department of Interior, Washington D.C.

United States Department of the Interior
1967 Prospector, Cowhand, and Sodbuster: historic Places Associated With the Mining, Ranching and Farming Frontiers in the Trans-Mississippi West. Volume 11, *National Survey of Historic Sites and Buildings.* National Park Service, Government Printing Office, Washington, D.C.

United States Treasury Department
1873 *Statistics of Mines and Mining in the States and Territories West of the Rocky Mountains,* 5th Annual Report of Rossiter W. Raymond, U.S. Commissioner of Mining Statistics. Government Printing Office, Washington, D.C.

U.S. Borax
1985 *The Story of Borax.* 6th Edition. Macson Printing and Lithography, Glendale. For U.S. Borax and Chemical Corporation, Los Angeles.

Van Saun, Edwin
1910 Cyaniding At the Montgomery-Shoshone Mill. *Engineering and Mining Journal* (January 22):217-219.

Vanderburg, W.O.
1936 Placer Mining in Nevada. *University of Nevada Bulletin* 30(4). Reprinted, Nevada Bureau of Mines and Geology Bulletin 27 (1976).

1938 *Reconnaissance of Mining Districts in Eureka County, Nevada.* Information Circular 7022, United States Bureau of Mines, Washington D.C.

VerPlanck, W.E.
1956 History of Borax Production in the United States. *California Journal of Mines and Geology* 52, Sacramento.

Vinett, A.
1882 *Buena Vista and Tributary Mining Camps: A Sketch of the Mines of Cottonwood and La Plata Mining Districts in Chaffee County, Colorado.* Times Book and Job Rooms, Buena Vista, Colorado.

Von Bernewitz, M.W.
1943 *Handbook for Prospectors and Operators of Small Mines.* 4th edition. New York and London.

Voynick, Stephen
1984 *Leadville, a Miner's Epic.* Mountain Press Publishing Company, Missoula.

Wagner, Jack R.
1970 *Gold Mines of California.* Howell-North Books, Berkeley.

Wagner, Philip
1955 Parras: A Case History in the Depletion of Natural Resources. *Landscape* 5:1:19-28.

Waite, Susan
1974 *An Historical Inventory of the Marysville Ghost Town.* Bureau of Land Management, Missoula.

Walbauer, Richard C.
1986 *Grubstaking the Palouse: Gold Mining in the Hoodoo Mountains of North Idaho, 1860-1950.* Washington State University Press, Pullman.

Wallace, Andrew
1965 *Pumpelly's Arizona, An Excerpt from "Across America and Asia" by Raphael Pumpelly, Comprising Those Chapters Which Concern the Southwest.* The Palo Verde Press, Tucson.

Wallace, Robert
1976 *The Miners.* The Old West Series. Time-Life Books, New York.

Walton, Clyde C. (editor)
1960 *An Illinois Gold hunter in the Black Hills, the Diary of Jerry Bryan March 13 To August 20, 1876.* Illinois State Historical Society, Springfield.

Warren, A. Helene and Robert H. Weber
1979 *Indian and Spanish Mining in the Galesteo and Hagan Basins.* Special Publications 8:7-11. New Mexico Geological Society.

Wasson, Joseph
1878 *Bodie and Esmeralda, Being an Account of the Revival of Affairs in Two Singularly Interesting and Important Mining Districts, Including Something of Their Past History, and the Gist of the Report By Profs. Benj Silliman and Em. P. Blake [and Others]...* Spaulding, Barto and Company, Steam Book and Job Printers, San Francisco.

1879a *Complete Guide To the Mono County Mines. Description of Bodie, Esmeralda, Indian, Lake, Laurel Hill, Prescott, and Other Mining Districts.* San Francisco.

1879b *The Mines of Bodie.* New York.

Waters, Frank
1937 *Midas of the Rockies: The Story of Stratton and Cripple Creek.* New York. Reprinted 1972, Swallow Press Inc., Chicago.

Watkins, T.H.
1971 *Gold and Silver in the West.* American West Publishing, Palo Alto.

Webb, Todd
1961 *Gold Strikes and Ghost Towns.* New York.

Wedertz, Frank
1969 *Bodie: 1859-1900.* Chalfant Press, Bishop.

1978 *Mono Diggings.* Chalfant Press, Bishop.

Weight, Harold O.
n.d. *Lost Mines of Death Valley.* Calico Press, Twentynine Palms.

1955 *Twenty Mule Team Days in Death Valley.* Calico Press, Twentynine Palms.

1969 *Greenwater: Death Valley's Greatest Copper Camp on Earth.* Calico Press, Twentynine Palms.

Weight, Harold O. and Lucille Weight
1970 *Rhyolite, the Ghost City of Golden Dreams.* 5th Edition. Calico Press, Twenty Nine Palms.

Weis, Norman D.
1971 *Ghost Towns of the Northwest.* Caxton Printers, Caldwell, Idaho.

1977 *Helldorados, Ghosts and Camps of the Old Southwest.* Caxton Printers, Caldwell, Idaho.

Wells, John H.
1969 *Placer Examination: Principles and Practice.* U.S. Government Printing Office, Washington D.C.

Wells, Merle W.
1961 Rush To Idaho. *Idaho Bureau of Mines and Geology Bulletin* 19, Moscow.

1983 Gold Camps and Silver Cities: Nineteenth Century Mining in Central and Southern Idaho. *Idaho Bureau of Mines and Geology Bulletin* 22. 2nd Edition. Moscow.

n.d. [descriptions of the Silver City and Idaho City areas]. *Idaho Bureau of Mines and Geology Bulletin* 32, Moscow.

Wells, William V.
1860 How We Got Gold in California: By a Miner of the Year '49. *Harpers New Monthly Magazine* 10:598-616.

West, Elliott
1979 *The Saloon on the Rocky Mountain Mining Frontier.* University of Nebraska Press, Lincoln.

West, Robert C.
1946 *The Mining Community in Northern New Spain: the Parral Mining District.* Unpublished Ph.D. Dissertation, University of California, Berkeley.

1949 The Mining Community in northern New Spain: the Parral Mining District. *Ibero-Americana* 30, Berkeley.

1952 *Colonial Placer Mining in Columbia.* Louisiana State University Press, Baton Rouge.

1952 Folk-Mining in Colombia. *Economic Geography* 28:323-330.

Wheat, Carl I.
1939 Pioneer Visitors to Death Valley After the Forty-Niners. *California Historical Society Quarterly* 18: .

White, Helen McCann (editor)
1966 *Ho! For the Gold Fields, Northern Overland Wagon Trains of the 1860s.* Minnesota Historical Society, St. Paul.

White, Katherine A.
1930 *A Yankee Trader in the Gold Rush, the Letters of Franklin A. Buck.* Houghton Mifflin Company, Boston.

Wilhelm, Walt
1970 *The Last Rig to Battle Mountain.* William Morrow & Company, Inc., New York.

Wilkins, James H. (editor)
1958 *The Great Diamond Hoax and Other Stirring Incidents in the Life of Asbury Harpending.* University of Oklahoma Press, Norman.

Williams, George, III
1980 *Rosa May: the Search For A Mining Camp Legend.*

1981 *The Guide To Bodie and Eastern Sierra Historic Sites.* Tree By the River Publisher, Riverside.

Williams, J. Gary and Ronald W. Stark (editors)
1975 *The Pierce Chronicle, Personal Reminiscenses of E. D. Pierce as Transcribed by Lou A. Larrick.* Idaho Research Foundation, Inc., Moscow.

Williams, Stephen
1930 *The Chinese in the California Mines: 1848-1860.* Unpublished Master's Thesis, Stanford University, Stanford.

Wilson, Eldred D.
1933 Arizona Gold Placers. *Arizona Bureau of Mines Bulletin* 135. University of Arizona, Tucson.

1961 Gold Placers and Placering in Arizona. *Arizona Bureau of Mines Bulletin* 168. University of Arizona, Tucson.

Wilson, Eldred P., J.B. Cunningham and G.M. Butler
1934 Arizona Lode Gold Mines and Gold Mining. *Arizona Bureau of Mines Bulletin* 137. University of Arizona, Tucson.

Wolf, David
1985 Pyritic Smelting at Deadwood. *South Dakota History*, (Winter) 15(4).

Wolle, Muriel Vincent Sibell
1953 *The Bonanza Trail: Ghost Towns and Mining Camps of the West.* Indiana University Press, Bloomington.

1963 *Montana Pay Dirt: A Guide to the Mining Camps of the Treasure State.* Sage Books, Denver.

1974 *Stampede To Timberline: Ghost Towns and Mining Camps of Colorado.* Sage Books, Chicago.

Woodward, Arthur (editor)
1949 *The Jayhawker's Oath and Other Sketches.* Warren F. Lewis, Los Angeles.

Wyckoff, Robert M.
1962 *Hydraulicking: A Brief History of Hydraulic Mining in Nevada County, California.* Osborne/Woods, Nevada City.

Wyman, Mark
1979 *Hard Rock Epic: Western Miners in the Industrial Revolution, 1860-1910.* University of California Press, Berkeley.

Wynn, Marcia Rittenhouse
1949 *Desert Bonanza: The Story of Early Randsburg, Movaje Desert Mining Camp.* M.W. Samuelson, Culver City. Reprinted 1963, Arthur H. Clark, Glendale, California.

Xantos, John
1975 *Letters from North America.* Translated and edited by Theodore Schoenman and Helen Benedek Schoenman. Wayne State University Press, Detroit.

Yale, Charles S.
1882 *List of Working Mines On the Pacific Coast.* George Spaulding and Company, San Francisco.

Young, Otis E., Jr.
1970 *Western Mining: An Informal Account of Precious Metal Prospecting, Placering, Lode Mining, and Milling on the American Frontier from Spanish Times to 1893.* University of Oklahoma Press, Norman.

1975 Philipp Deideheimer, 1832-1916, Engineer of the Comstock. *Historical Society of Southern California Quarterly* 57:361-369.

1976 *Black Powder and Hand Steel: Miners and Machines on the Old Western Frontier.* University of Oklahoma Press, Norman.

Zamonski, Stanley W. and Teddy Keller
1962 *The Fifty-Niners.* Denver.

Zeitelhack, June and Jan Zeitelhack La Barge
1977 *Operations of the Pacific Coast Borax Company 1883-1907.* Mojave River Valley Museum Association, Barstow.

Basic Periodicals, Series, and Sources

American Historical Review
American West
Annals of the Association of American Geographers
Arizona and the West
California Historical Society Quarterly
California History
Canadian Historical Review
Colorado Magazine of History
Colorado Quarterly
Desert
Frontier Times
Historical Society of Southern California Quarterly
Idaho Yesterdays
Landscape
Magazine of Western History
Montana
Montana Ghost Town Quarterly
Nevada Historical Society Quarterly

North Dakota History
New Mexico Historical Review
Oregon Historical Quarterly
Pacific Historical Review
Pacific Northwest Quarterly
South Dakota Historical Society Collections
Southwestern Historical Quarterly
Utah Historical Quarterly
Western Historical Quarterly

American Journal of Mining, Milling, ...Etc. 1866-1869
Arizona Bureau of Mines Bulletin
California Division of Mines Report
California Journal of Mines and Geology
California Mining Bureau Report
California Mining Bureau unpublished field notes
Colorado School of Mines Magazine (Golden) 1910-1920
Economic Geology
Engineering and Mining Journal (New York) 1866-1920
Engineering Magazine 1893-1898
Idaho Bureau of Mines and Geology Pamphlets
Idaho Bureau of Mines and Geology Bulletin
Mineralogical Record
Mining and Scientific Press (San Francisco) 1872-1920
Mining Record (New York)
Mining Reporter (Denver) 1905-1907
Mining Review
Mining Science
Nevada Bureau of Mines and Geology Bulletin
Pacific Coast Annual Mining Review and Stock Ledger (~1878)
Pacific Coast Miner (San Francisco) 1902-1910
Pahapsa Quarterly (Rapid City) 1912-1923
Salt Lake Mining Review (Salt Lake City) 1912-1920.
School of Mines Quarterly (New York) 1879-1914.
Scientific Press (San Francisco) 1860-1872
Transactions, American Institute of Mining Engineers, (New York) 1871-1919.
United States Bureau of Mines Information Circulars
United States Geological Survey Bulletins
United State Geological Survey Professional Papers
Western Chemist and Metallurgist (Denver) 1905-1910

Reports of the State Mineralogist (by State)
Register of Mines and Minerals (by County; State Published)

Articles of Incorporation (County Recorder)
Bank and Water Claims (County Recorder)
Books of Deeds (County Recorder)
Tax Rolls (County Tax Assessor)

United States Census Bureau
United States Mining Statistics

APPENDIX D: THE ARCHEOLOGY OF HISTORIC MINING SITES: SOURCES

Leo R. Barker, Historical Archeologist
National Register Programs
National Park Service, Western Regional Office
San Francisco, California

Alanen, Arnold J.
1979 Documenting the Physical and Social Characteristics of Mining and Resource-Based Communities. *Association of Preservation Technology Bulletin* 11(4):49-68.

Aschmann, Homer
1970 The Natural History of a Mine. *Economic Geography* 46:2:172-189.

Ayres, James E.
1979 (Notes on Jerome NHL work, AZ.) *Society for Historical Archeology Newsletter* 12(2):22.

1988 Rosemont: The History and Archeology of Post-1880 Sites in the Rosemont Area, Santa Rita Mountains, Arizona. *Arizona State Museum Archaeological Series* 147, Volume 3. University of Arizona, Tucson.

Babcock, William A., Daniel Gallacher, Christine Amos, Sally T. Greiser and T. Weber Greiser
1982 *Historical Cultural Survey of Selected Abandoned Mine Sites in the State of Montana.* 2 volumes.

Babcock, William, Daniel Gallacher, and Pamela Liggett
1982 *Historical Resources Study: Garnet Ghost Town, Montana.* Report prepared by Historical Research Associated for the Bureau of Land Management. Butte District Office, Butte.

Baker, Steven G.
1978 Historical Archeology for Colorado and the Victorian Mining Frontier: Review, Discussion and Suggestions. *Southwestern Lore* 44(4):11-31.

Bente, Vance G., and Mary Hilderman-Smith
1983 *Cottonwood Creek Project, Shasta and Tehama Counties, California: Dutch Gulch Lake, an Evaluation of Selected Historic Archaeological Resources.* Report submitted to Theodoratus Cultural Reserach, Fair Oaks, CA. Prepared for the U.S. Corps of Engineers, Sacramento District, Sacramento.

Berge, Dale L.
1968 *Historical Archaeology in the American Southwest.* Unpublished Ph.D. dissertation on file, Arizona State Museum, University of Arizona, Tucson.

Brown, Marley R., III
1980 Research Design for Historical Archaeology - New Melones. Ms. on file at Interagency Archeological Services, National Park Service, San Francisco.

Buechler, Jeff (editor)
1988 *Proceedings of the Workshop on Historic Mining Resources: Defining the Research Questions for Evaluation and Preservation.* South Dakota State Historical Society, Vermillion.

Busch, Jane
1981 An Introduction to the Tin Can. *Historical Archaeology* 15(1):95-104.

Campbell, Paul and David J. Cuming
1984 Mines and Mills at Gold Rock. In *Continuity with Change*, edited by Mark Fram and John Weiler, pp.177-219. Dundurn Press, Toronto.

Cazier, Kris Ann and Dennis Thompson
1972 Historic Paiute Site Near Geiger Grade. *Nevada Archeological Survey Reporter* 6(2):9-11.

Chavez, David, Laurence H. Shoup, James G. Maniery, with contributions by Mary L. Maniery and Vance G. Bente
1984 *Cultural Resources Evaluations for the Upper Mokelumne River Hydroelectric Projects, Calaveras and Amador Counties, California: Middle Bar Project Inventory.* David Chavez & Associates, Mill Valley.

Childress, Jeffrey G. and Eric W. Ritter
1967 *An Archaeological Survey of the Proposed Auburn and Sugar Pine Reservoirs in El Dorado and Placer Counties.* Prepared for the National Park Service, San Francisco.

Clark, C.M.
1987 Trouble At T'mill: Industrial Archaeology in the 1980s. *Antiquity* 61:169-179.

Costello, Julia G.
1981a Gold Rush Archaeology: Excavating the Mother Lode. *Archaeology* 34(2):18-26.

1981b Material Culture of the Gold Rush Mother Lode. Ms. in possession of author, Mokelumne Hill, California.

Craib, John L.
1978 *Death Valley National Monument: Archaeological Survey of 187 Mining Claims.* Western Archeological Center, National Park Service, Tucson.

Deagan, Kathleen
1982 Avenues of Inquiry in Historical Archaeology. In *Advances in Archaeological Method and Theory*, Volume 5, edited by Michael Schiffer, :151-178, Academic Press, New York.

Druss, Mark and Claudia Druss
1983 *Archeological Investigations at the Sunbeam Mine, Central Idaho.* Submitted to the U.S. Forest Service, Challis National Forest.

Edaburn, Sharon
1981 Mining and Industry Activities. In *An Archaeological Element for the Nevada Historic Preservation Plan*, edited by Margaret M. Lyneis, :235-253, Nevada Division of Historic Preservation and Archaeology, Carson City.

Emmons, William H.
1910 *A Reconnaissance of Some Mining Camps in Elko, Lander, and Eureka Counties, Nevada.* US Geological Survey, Bulletin 408, Washington D.C.

Felton, David L., Francis Lortie, Kathleen Davis, and Leslie Lewis
1977 *The Cultural Resources of Bodie State Park.* State of California Resources Agency, Department of Parks and Recreation, Sacramento.

Felton, David L., Bonnie S. Porter and Phillip W. Hines
1979 *Survey of Cultural Resources at Malakoff Diggins State Historic Park.* State of California Resources Agency, Department of Parks and Recreation, Sacramento.

Fenenga, Franklin
1967 Post-1800 Mining Camps. *Historical Archaeology* 1:80-82.

Foley, Vincent P.
1968 On the Meaning of Industrial Archaeology. *Historical Archaeology* 2:66-68.

1969 Reply to Vogel. *Historical Archaeology* 3:93-94.

Fontana, Bernard L.
1965 On the Meaning of Historic Sites Archaeology. *American Antiquity* 31(1):61-65.

Francaviglia, Richard
1982 Copper Mining and Landscape Evolution: A Century of Change in Arizona's Warren Mining District. *Journal of Arizona History* 23(3):267-298.

1987 Time Exposures: The Evolving Landscape of An Arizona Copper-Mining District. In *Mineral Resource Development: Geopolitics, Economics, and Policy*, edited by Harley E. Johansen, Olen Paul Matthews, and Gundars Rudzitis. Westview Press, Boulder.

Fredrickson, David A.
1979 *An Archaeological Survey of the Knoxville-Manhattan Mine Area, Napa County, California.* Report on file at the Anthropological Studies Center, Sonoma State University, Rohnert Park.

1982 *Cultural Resources Study in the Knoxville Region: Lake, Napa and Yolo Counties, California.* Report prepared by the Anthropological Studies Center, Sonoma State University, Rohnert Park. Submitted to D'Appolonia Consulting Engineers, Inc.

Godoy, Ricardo
1985 Mining: Anthropological Perspectives. *Annual Review of Anthropology* 14:199-217.

Gradwohl, David M. and Nancy M. Osborn
1984 *Exploring Buried Buxton.* Iowa State University Press, Ames.

Greenwood, Roberta
1982 Data Recovery from Historical Sites: New Melones Archaeological Project, California. *Final Report of the New Melones Archaeological Project*, Volume 5. Submitted to the National Park Services, Washington D.C.

Greenwood, Roberta and Vance Bente
1976 *Evaluation of Historical Resources, New Melones Reservoir Project Area.* Submitted to the Corps of Engineers, Sacramento District.

1977a *Final Evaluation of Historic Resources, New Melones Lake Project.* Submitted to the Corps of Engineers, Sacramento District.

1977b *Survey and Site Evaluation, Tuttletown Access Road, New Melones Lake Project.* Submitted to the Corps of Engineers, Sacramento District.

Greenwood, Roberta S. and Laurence H. Shoup
1983 New Melones Archaeological Project, California: Review and Synthesis of Research at Historic Sites. *Final Report of the New Melones Archaeological Project*, Volume 7. Submitted to the National Park Service, Washington D.C.

Hantman, Jeffrey L. and Jeanette A. McKenna
1985 *O'Rourke's Camp: Social Archaeology of an Early Twentieth Century Construction Town.* Anthropological Field Studies 7, Office of Cultural Resources Management, Arizona State University, Tempe.

Hardesty, Donald L.
1973 Comstock Era Archaeology: A Preliminary Report on the Little Valley Project. *Nevada Archeological Survey Reporter* 7(2):18-19.

1980a *Evaluation of Historical Archeological Resources in Bullfrog Claim and Mining Sites: Nye County, Nevada, Death Valley National Monument.* Archeological Survey, Department of Anthropology, University of Nevada, Reno. Prepared for the National Park Service, Death Valley National Monument.

1980b Historic Sites Archeology on the Western American Frontier: Theoretical Perspectives and Research Problems. *North American Archeologist* 2(1):67-81.

1981 *Recovery of Historical archaeological Data in Bullfrog Claim and Mining Sites, Nye County, Nevada.* University of Nevada, Reno and National Park Service, San Francisco.

1982 Overview of Historic Sites Research in the Carson City District. In *Cultural Resource Overview, Carson City District, West Central Nevada*, Lorann S.A. Pendleton, Alvin R. McLane, and David Hurst Thomas, Cultural Resource Series 5: 139-149, Bureau of Land Management, Nevada.

1985 Evolution on the Industrial Frontier. In *The Archaeology of Frontiers and Boundaries*, edited by Stan Green and Steve Perlman, :213-229, Academic Press, New York.

1986a *Evaluation of Cultural Resources at the Gold Bar Mine, Death Valley National Monument.* Report prepared by Columbus Mines, Inc., Reno.

1986b Industrial Archaeology on the American Mining Frontier: Suggestions for a Research Agenda. *Journal of New World Archaeology* 6(4):47-56.

1986c Rethinking Cultural Adaptation. *The Professional Geographer* 38(1):11-18.

1986d *Issues Regarding the Conduct of Historical Archaeology in Nevada.* Nevada Council of Professional Archaeologists, Publication Series 1, Silver City. Prepared for the Nevada Division of Historic Preservation and Archeology, Carson City.

1987a *Cultural Resources Data Recovery at the Gold Bar Mine, Death Valley National Monument.* Columbus Mines, Inc., and the Department of Anthropology, University of Nevada, Reno.

1987b *Evaluation of Cultural Resources in the Bullfrog/Montgomery-Shoshone Area.* Report prepared for St. Joe Gold Corporation, Tucson.

1988 *The Archaeology of Mining and Miners: A View from the Silver State.* Special Publication Series 8, Society for Historical Archaeology.

Hardesty, Donald L. and Valerie Firby
1980 *Managing Archeological Resources on the Comstock.* The Comstock Project, Heritage Conservation and Recreation Service, Department of the Interior, Washington D.C.

Hardesty, Donald L. and Eugene M. Hattori
1982 *Archaeological Studies in the Cortez Mining District, 1981.* Technical Report 8, Bureau of Land Management, Reno.

1983 *Archaeological Studies in the Cortez Mining District, 1982.* Technical Report 12, Bureau of Land Management, Reno.

1984 *Archaeological Studies in the Cortez Mining District, 1983.* Technical Report, Bureau of Land Management, Battle Mountain District, Reno.

Hardesty, Donald L., Valerie Firby and Gretchen Siegler
1982 *An Archaeological Survey of the Virginia City National Historic Landmark.* Prepared by the Department of Anthropology, University of Nevada at Reno for the State of Nevada, Division of Historic Preservation and Archeology, Carson City.

Hattori, Eugene M. and Alvin R. Mclane
n.d. *Preliminary Report of Archaeological and Historical Studies at Cornucopia, Elko County, Nevada.* Nevada State Museum, Carson City.

Hattori, Eugene M., and Marna Area Thompson
1987 Using Dendrochronology for Historical Reconstruction in the Cortez Mining District, North Central Nevada. *Historical Archaeology* 21(2):60-73.

Hattori, Eugene M., Marna Area Thompson, and Alvin R. McLane
1984 Historic Pinyon Pine Utilization in the Cortez Mining District in Central Nevada: The Use of Dendrochronology in Historical Archaeology and Historical Reconstruction. *Desert Research Institute Social Science Center Technical Report* 39, Reno.

Heizer, Robert and Franklin Fenenga
1949 *The Mother Lode Country.* Bulletin 141, California Division of Mines and Geology.

Heizer, Robert, Franklin Fenenga and Aubrey Neasham
1947 *California Gold Discovery: Centennial Papers on the Time, the Site and the Artifacts.* California Historical Society, San Francisco.

Henton, Gregory H.
1980 *Final Report of the Hall City Research Project.* California State University, Chico.

Heritage Conservation and Recreation Service
1980a *Greiner's Bend: A Case Study.* The Comstock Project, U.S. Department of the Interior.

1980b *A Search for Balance: Conservation and Development on the Historic Comstock.* The Comstock Project, U.S. Department of the Interior.

Holland, Ross F. and Robert V. Simmonds
1971 *Eagle Borax Works, Harmony Borax Works, Death Valley National Monument, California: Historic Structures Report.* National Park Service, San Francisco.

Hudson, Kenneth
1976 *The Archaeology of Industry.* Charles Scribner's Sons, London.

1979 *World Industrial Archaeology.* Cambridge University Press, New York.

Hunt, Charles B.
1959 Dating Mining Camps with Tin Cans and Bottles. *Geotimes* 3(8):8-10,34.

Jackson, W. Turrentine, S. D. Mikesell, and Harvey Schwartz
n.d. *Historical Survey of the New Melones Reservoir Project Area.* Western Regional Office, National Park Service, San Francisco.

Jensen, Peter M.
1980 *Diggin' Harrison Diggin's: Archaeological Excavations at an Historic Mining Camp in the Northern Sierra Nevadas.* U.S. Forest Service, Quincy, California.

Johnson, Jerald J.
1967 *The Archaeology of the Camanche Reservoir Locality, California.* Sacramento Anthropological Society.

Jones, Terry, with contributions by David Hunt, Michael Jablonowski, Adrian Praetzellis, Mary Praetzellis, and Dwight Simons
1982 *Archaeological Survey of the Hawkfly and the North Yuba Timber Compartments and the Pride Timber Sale.* Prepared for the Tahoe National Forest, USDA, California.

Kelly, Roger E.
1978 Preliminary Report: Investigation of Petroglyph Wash Arrastra Site, Lake Mead National Recreation Area, Arizona. Ms. on file, Western Region Office, National Park Service, San Francisco.

Kelly, Roger E. and Marsha C.S. Kelly
1983 Arrastras: Unique Western Historic milling Sites. *Historical Archaeology* 17(1):85-95.

LaLande, Jeffrey Max
1981 *Sojourners in the Oregon Siskiyous: Adaptation and Acculturation of the Chinese Miners in the Applegate Valley, ca. 1855-1900.* Unpublished Master's Thesis, Department of Interdisciplinary Studies, Oregon State University.

Leone, Mark P. and Parker B. Potter, Jr. (eds.)
1988 *The Recovery of Meaning: Historical archaeology in the Eastern United States.* Smithsonian Institution Press, Washington D.C.

Levy, Benjamin
1969 *Lost Horse Mine: Historic structures Report.* Joshua Tree National Monument. Division of History, Office of Archaeology and Historic Preservation, National Park Service.

Newell, Diane (ed.)
1978 Symposium on Industrial Archaeology and the Human Sciences. *Occasional Publications of the Society for Industrial Archaeology.*

Ostrogorsky, Michael
1980 *Idaho Model of Frontier Settlement.* Idaho State Historical Society, Boise.

Palka, Eugene J.
1986 *The Cultural Landscape of the Athens County Coal Region: A Reflection of its Mining Activities from 1885-1927.* Unpublished Master's Thesis, Department of Geography, Ohio University, Athens.

Parker, Patricia
1980 *One Hundred Years of History in the California Desert: An Overview of Historic Archeological Resources at Joshua Tree National Monument.* Western Region Office, National Park Service, San Francisco.

Pippin, Lonnie C.
1980 PreHistoric and Historic Patterns of Lower Pinyon-Juniper Woodland Ecotone Exploitation at Borealis, Mineral County, Nevada. *Desert Research Institute Social Science Center Technical Report* 17, University of Nevada, Reno.

Pippin, Lonnie C. (editor)
1982 *Archaeological Investigations at the Borealis Mine, Mineral County, Nevada.* Desert Research Institute, University of Nevada, Reno. Submitted to the Houston International Minerals Corporation, Denver, Colorado.

Pippin, Lonnie C. and Ronald Reno
1983 *Archaeology of the Borealis Project Area.* Social Science Center, Desert Researchg Institute, Reno.

Pohs, H.A.
1974 Early Underground Mine Lamps. *Museum Monograph 6*, Arizona Historical Society, Tucson.

Porter, Bonnie, D.L. Felton and Paul Nesbitt
1979 *Malakoff Diggins State Historic Park Resource Management Plan.* Department of Parks and Recreation, Sacramento.

Praetzellis, Adrian and Mary Praetzellis
1988 *Interim Report: Cultural Resources of the Proposed Brush Creek Joint Mining Venture/Pioneer*

Mine Expansion, Sierra County, California. Cultural Resources Facility, Anthropological Studies Center, Sonoma State University, Rohnert Park.

Rackerby, Frank
1965 *The Archaeology of the Middle Fork of the American River Project, Placer County, California.* Submitted to the National Park Service, San Francisco.

Rees, D. Morgan
1969 *Mines, Mills and Furnaces: Introduction to Industrial Archaeology in Wales.* National Museum of Wales.

Reno, Ronald L.
1983 Candle Lanterns. *Nevada Archaeological Survey Reporter* 12(1):17-22.

1986 *Historic archaeology of the McCoy Mining District, Lander County, Nevada.* Archaeological Resource Services, Virginia City, Nevada. Report submitted to Tenneco Minerals Company, Lakewood, Colorado.

Reno, Ronald L. and Alvin R. McLane
1987 *Historic Archaeology of the Borealis Mine, Mineral County, Nevada.* Desert Research Institute Social Sciences Center, Technical Report 29, Reno.

Reynolds, William E., S. Sobelman, M. McCarthy, and G. Kinkade
1974 Archaeological Investigations at Jackrabbit Mine: Preliminary Report. *Arizona State Museum Archaeological Series* 39, University of Arizona.

Ritchie, Neville
1981 Archaeological Interpretation of Alluvial Gold Tailing Sites, Central Otago, New Zealand. *New Zealand Journal of Archaeology* 3:51-69.

Ritter, Eric W.
1970 *Archaeological Investigations in the Auburn Reservoir Area, Phase 2 and 3.* Submitted to the National Park Service, San Francisco.

Rocha, Guy Louis
1980 Nevada Mining Law, Eminent Domain, and Historic Preservation: A Study in Conflicting Public Use and the Limitations of the Police Power. Ms. on file, Department of Anthropology, University of Nevada, Reno.

Rock, James
1984 Cans in the Countryside. *Historical Archaeology* 18(2):97-111.

Rodman, Valerie
1985 *Modeling as a Preservation Planning Tool in Western Gold and Silver Mining Districts.* Unpublished Master's Thesis, Department of Anthropology, University of Nevada, Reno.

Rohe, Randall
1986 Origins and Diffusion of Traditional Placer Mining in the West. *Material Culture* 18(3):127-166.

Sande, Theodore A.
1976 *Industrial Archaeology: A New Look at the American Heritage.* Stephen Greene Press, Brattleboro, Vermont. Reprinted 1978, Penguin Books.

Schuyler, Robert L.
1970 Historical and Historic Sites Archaeology as Anthropology: Basic Definitions and Relationships. *Historical Archaeology* 4:83-89.

Scott, Frank K.
1971 California Gold Mining Landscapes. *The California Geographer* 12:38-44. California Council for Geographic Education.

Shenk, Lynette
1978 Historical Archeology in Death Valley National Monument: Potentials for Further Research. In *Death Valley National Monument: archaeological survey of 187 mining claims*, edited by John Craib, Appendix 1. Western Archeological Center, National Park Service, Tucson.

Simms, S.R. and J.A. Vlasich
1980 Archeological Survey in the Bayhorse Mining District, Custer County, Idaho and the History of the Bayhorse Mining District. *Archeological Center Reports of Investigations* 80-11, Archaeological Center, Department of Anthropology, University of Utah.

South Dakota State Historic Preservation Center
1985 *Standards for the Survey of Historic Mining and Milling Sites.* Vermillion, South Dakota.

Stapp, Darby C. and Julia Longenecker
1984 1983 Test Excavations at 10-CW-159, the Pierce Chinese Mining Site. *University of Idaho Anthropological Research Manuscript Series* 80. Laboratory of Anthropology, University of Idaho, Moscow.

Stevenson, Mark G.
1982 Toward an Understanding of Site Abandonment Behavior: Evidence from Historic Mining Camps in the Southwest Yukon. *Journal of Anthropological Archaeology* 1(3):237-265.

Stumpf, Gary
1981 19th Century Gold Mining: Frontier Ties to the Outside World. Ms. in author's possession.

Sutton, P.A.
1986 *Cultural Resource Evaluation of the Gold Point Historic Mining Camp, Esmeralda County, Nevada.* Archaeological Resource Services, Virginia City, Nevada. Submitted to Battle Mountain District, Bureau of Land Management.

Teague, George
1980 Reward Mine and Associated Sites. *Publications in Anthropology* 11, Western Archeological Center, National Park Service.

1987 *The Archaeology of Industry in North America.* Unpublished Ph.D. dissertation, University of Arizona, Tucson.

Teague, George and Lynette Shenk
1977 Excavations at Harmony Borax Works. *Publications in Anthropology* 6, Western Archeological Center, National Park Service.

Tordoff, Judith D. and Mary L. Maniery
1986 *Analysis, Evaluation, Effect Determination and Mitigation Plan for Two Chinese Mining Sites in Butte County, California.* Report submitted to the Lassen National Forest, Susanville, California.

Tordoff, Judith D. with Dana McGowan Seldner
1987 *Dutch Gulch Lake Excavation at Thirteen Historic Sites in the Cottonwood Mining District. Cottonwood Creek Project, Shasta and Tehama Counties, California.* Prepared by the Hornet Foundation of California State University, Sacramento, and Theodoratus Cultural Research, Fair Oaks. Submitted to the Sacramento District Corps of Engineers.

Turner, Arnie and Linda Armentrout
1986 The Correlation of Cultural Resource Management and Mining Regulations. In *Issues Regarding the Conduct of Historic Archaeology in Nevada*, by Donald L. Hardesty, Appendix B. Publication Series 1, Nevada Council of Professional Archaeologists.

Vaughan, Trudy
1986 *Archaeological Investigations at a Sacramento River Mining Camp (CA-Sha-1450), Shasta County, California.* Report prepared for the City of Redding and the Bureau of Land Management, Redding Resource Area, Redding, California.

Vogel, Robert M.
1969 On the Real Meaning of Industrial Archaeology. *Historical Archaeology* 3:87-93.

Wallace, William J.
1954 Archeological Reconnaisance of Wildrose Canyon, 1952-3, Death Valley National Monument. Ms. on file, Western Region Office, National Park Service, San Francisco.

1971 The Wildrose Charcoal Kilns: the Archaeological Record. Ms. on file, Western Region Office, National Park Service, San Francisco.

1972 Exploratory Excavations at the Harmony Borax Works, Death Valley National Monument. Ms. on file, Western Archeological and Conservation Center, National Park Service, Tucson.

1974 An Enterprise That Failed: Death Valley's Eagle Borax Works. Ms. on file, Western Region Office, National Park Service, San Francisco.

Weitzman, David
1980 *Traces of the Past: A Guide to Industrial Archaeology.* Charles Scribner's Sons, New York.

Western Cultural Resource Management, Inc.
1988 *Draft: A Data Recovery Plan for a Portion of the Copperton Townsite, Carbon County, Wyoming.* Prepared for the National Park Service, Rocky Mountain Regional Office.

Zeier, Charles
1985 Archaeological Data Recovery Associated with the Mt. Hope Project, Eureka County, Nevada. *Cultural Resources Series* 8, Bureau of Land Management, Reno.

1986 *Archaeological Investigations at Rochester Heights and Nearby Historic Settlements, Pershing County, Nevada.* Report prepared for Coeur-Rochester, Inc., by Intermountain Research, Silver City, Nevada.

1987 Historic Charcoal Production Near Eureka, Nevada: An Archaeological Perspective. *Historical Archaeology* 21(1):81-101.

Zier, C.K., C. Schweigert, and R. Rosenberg
1987 *Cultural Resource Inventory of the Wyoming Forest Highway 11 (Battle Lake Road) Corridor in Medicine Bow National Forest, Carbon County, Wyoming.* Rocky Mountain Regional Office, National Park Service, Denver.

Zindel, Udo
1987 *Landscape Evolution in the Clifton-Morenci Mining District, Arizona, 1872-1986.* Unpublished Master's Thesis, Department of Geography, Arizona State University, Tempe.

National Park Service
Department of the Interior