Water, Water, Everywhere and Nowhere

By Gordon Morris Bakken

> The idle windlass turns to rust;
> the sagging sluice-box falls;
> The holes you digged are water to the brim;
> Your little sod-roofed cabins
> with the snugly moss-chinked walls
> Are deathly now and moldering and dim.
>
> The battle-field is silent where of old
> you fought it out:
> The claims you fiercely won are lost and sold.
> But there's a little army that they'll never put to rout-
> The men who simply live to seek the gold.
>
> Robert Service, "The Prospector,"
> *Collected Poems of Robert Service*, 1940

Water was ubiquitous in mining of all types. The placer miner washed pay dirt from river bottom gravel with a pan, splashed buckets into a rocker, or flushed cubic yards of potential down a long tom to determine whether there was color at the end of the run. Hardrock miners fought water as it seeped into mines and battled its power to rot the timbers that held overburden in place. Smeltermen needed thousands of gallons a day to cool equipment and to sluice tailings down the hill. As placer miners moved up stream and prospected ancient stream beds, their need for water grew ever more critical.

Water was necessary for all phases of gold mining. When a miner wanted to determine whether the dirt of a streambed was pay dirt, he washed it in a pan of between a foot and a foot and a half in diameter. He kneaded the dirt in water and moved the pan steadily, with water oscillating through the dirt and washing it from the pan, leaving gold at the bottom. Whether in 1848 in the Mother Lode country of California or at Knott's Berry Farm today, the technique has not changed.

The rocker, or cradle, increased the volume of dirt that could be washed in a day. It was an oblong wooden box with a bar across the middle. The upper end of the box contained a sieve of sorts to stop rocks from traversing the system, and the lower end had riffles constructed of horizontal strips of wood and designed to catch the gold as it traversed the box. The long tom was an adaptation and extension of the rocker, larger in size, with a hopper at the upper end and a riffle box at the lower. The long tom could wash more dirt in less time due to its design.

The sluice box was another extension, open at both ends to allow a miner to slap multiple sluice boxes together in a continuous line. Riffles caught the gold as it tumbled down the box in the dirt wash fed by dozens of men. This volume of dirt required more water, and the larger the box, the greater the demand. The logic was that if you could make the box large enough, you could simply divert a river into it and more efficiently process tons of dirt.[1] Water moved dirt to reveal gold.

Processing ores also required water. The Ray Mine in Arizona produced ore, but the concentrator needed "a good source of water and a large tailings disposal area. It was decided to locate the mill near the junction of the Gila and San Pedro Rivers, where there was a broad valley as well as good water possibilities."[2] Similarly, the

Grand Gulch Company in Arizona needed water, so its Salt Lake City attorneys, Bennet, Sutherland, Van Cott and Allison, wrote to Louis H. Chalmers in Phoenix seeking advice on Arizona water law. Grand Gulch needed "to appropriate water near its mining claim." The Salt Lake attorneys thought "that probably a good plan would be to appropriate a subdivision of Government land for agricultural purposes and thus hold the water."[3] Water by any means was a necessity.

Drought and seasonal rains impeded California miners. Alfred E. Donaldson wrote from Weaverville, California, on 17 October 1852, "the mines are not doing very well at present for want of water."[4] Henry A. Guernsey in Riverside, California, reported a quarter century later that "they have hauled some of the surface dirt 3/4 of a mile to water and rocked it out and made fair wages."[5] Elias S. Ketcham confided to his diary at Murphy's Camp, California, on 13 January 1853, that "the water we had to wash with today was so little that it passed through the riffle box quite thick. It prevented us from washing the usual amount of dirt." By 31 January, a water company supplied his needs at one dollar per inch per day and "about 6 inches are required for a tom stream."[6] John Hurley of Keystone Ranch, California, had to wait longer for water company mining water, and predicted in 1854 that "there will be a good deal of mining going on about [here] soon when water comes."[7]

Samuel T. Hauser, 1884. Photograph by Beckwith & Bowen, Helena, Montana. (Courtesy of the Montana Historical Society, Helena, 942-607.)

Miners relying on nature had other problems. D. L. Beach of Rattlesnake Bar, California, reported in 1855 "the more water the greater the Damage that it does[,] for it is bound to run over the Bank of the Ditch unless some one is at hand to turn it off as soon as the slides take place." The rains in northern California were seasonal and Beach "had a p[r]etty good time last win[t]er of about 4 nights in a week for two months[,] and I trust that I am in a good condition for [a] run during the comeing Stormes [*sic*]."[8] Water companies quickly emerged to supply the placer miners.

Supply and demand often pushed mine owners into expending capital to build water systems, but vertical integration of the mining and smelting process had its limitations. Water supply could be guaranteed by building a dam and supply system, if it worked. In 1883, Tom Grant reported to Robert B. Todd of Vulture City, Arizona Territory, that "the dam washed out last night. Will send up water as soon as it gets so it is fit to use."[9] J. F. Blattner, the assistant secretary of the Maginnis Mining Company of Montana wrote to Samuel T. Hauser in 1885 that the water shortage problem in their system had been solved. Blattner relayed that

> A squad of 4 workmen started in to uncover [the] ditch and found in one

"Photo No. 136.2400 sill Mountain Con Mine. This is as wet a place as can be found."
Water draining out of a Butte, Montana, mine.
No date; photographer unidentified.
(Courtesy of the Montana Historical Society, Helena, Lot 8 Box 1/11.06.)

> place where numerous holes had been bored in [the] box [and] a strip taken out and a pair of pants, old shirt & drawers inserted almost completely stopping water. Mr. E [Superintendent A.M. Esler] was justly indignant and has offered a reward of five thousand dollars for the discovery and conviction of the miscreant, and I have strong hopes an accomplice may accept [the] reward and disclose [him], as the party suspected (Jenkins the town barber) the last time arrested had a man with him to cut the new ditch."[10]

Blattner averred that Jenkins was doing this out of spite. In April 1885, Jenkins raised the stakes by filing suit against the Maginnis Mining Company, asking for five thousand dollars in damages and title to the spring the company depended upon for its water supply.[11] The company took affirmative action to preserve its water supply, sinking wells in August that provided "plenty of water" by November.[12] Water was life for mining, and companies with assets had alternatives.

The availability of water created extremes in markets. Miners needed a regular supply for washing dirt and operating concentrating machinery. Where supply was uncertain and a water company had a monopoly of supply, monopoly prices quickly emerged.[13] Even if water companies were not the culprits, miners were equally jealous of their water. In the Montana diggings, "each miner swore at the men above him, who wer[e], he was sure[,] wasting" water. "He built a dam, if he could, behind which water deepened until there was enough for a freshet to spill down his sluice-way." When the water arrived, "everyone worked double-quick to wash as much dirt as possible in the brief floodwaters."[14]

The competition for waters in Lead, South Dakota, between the Homestake and Father DeSmet mining companies extended to each buying up water companies to harass the other.[15] In Tonopah, Nevada, the "lack of adequate water and timber" stunted mining development.[16] Milling operations in Goldfield, Nevada, were limited by the water supply until "a pipeline from the Lida-Magruder Mountain region to the south finally brought plentiful water to Goldfield in the autumn of 1907."[17] The ore of Searchlight, Nevada, was processed at mill and smelter facilities in Needles, California, because of Searchlight's water supply problem. A mill on the Colorado River and a narrow-gauge railroad made shipping Searchlight's ore to Needles economical, but water seeping into the Quartette Mine created a supply for a local mill.[18] Ore without water for processing simply had little value unless extremely rich. This was clearly part of the mine owner's equation.

Getting water to the ore was part of the equation for profit, and sometimes called for extreme measures. Entrepreneurs drained whole rivers into water company flumes to supply mine and mill owners. Andrew Wampler of Murderers Bar, California, on the Middle Fork of the American River, described the process of constructing flumes, water wheels, and pumps for a water company in 1851: "Water is coursed for many miles by ditches [t]hereby supplying the dry diggings in the vicinity of Nevada. Profitable mining might be done in many parts ver[y] remote from water, tho[ugh] we found it is cheaper to take the water to the ground than to take the ground to the water."[19]

Diverting water for mining created conflicts with other purposes, but miners clearly thought their purposes were the highest and best. N. B. Ringeling, superintendent of the Hope Mining Company at Philipsburg, Montana, wrote to President John C. Porter in St. Louis in 1895 "the N.P. RR Co. is interfering with the tailing water by turning the creek into the reservoirs. I have notified the agent to leave the reservoirs alone and not change the water course."[20] Many of these conflicts evolved into lawsuits or at least the threat of lawsuits.

Water could be valueless if fouled by others' use. Waters bearing fines or sand tailings could be worthless for washing dirt or milling.[21] Joseph Warren Matthews confided to his diary in September 1899 that he had "plenty of water at the tunnel, but it is not fit to use being full of copper poison." In October he again observed near Panoche, California, that there was "plenty of water for camp use running out of the lower or long tunnel, but it is so impregnated with copper and iron that it is unfit for use." Matthews also noted the smelter smoke "brought into these mountain by the west winds."[22] His camp had all of the elements of nineteenth-century mining: ore, fouled water, and unhealthful air. Other miners, like C. P. Arnold of Wyoming, noted legal liability for pollution.[23] Water quality and supply were problems for miners where aridity or other adverse hydrological conditions held sway.

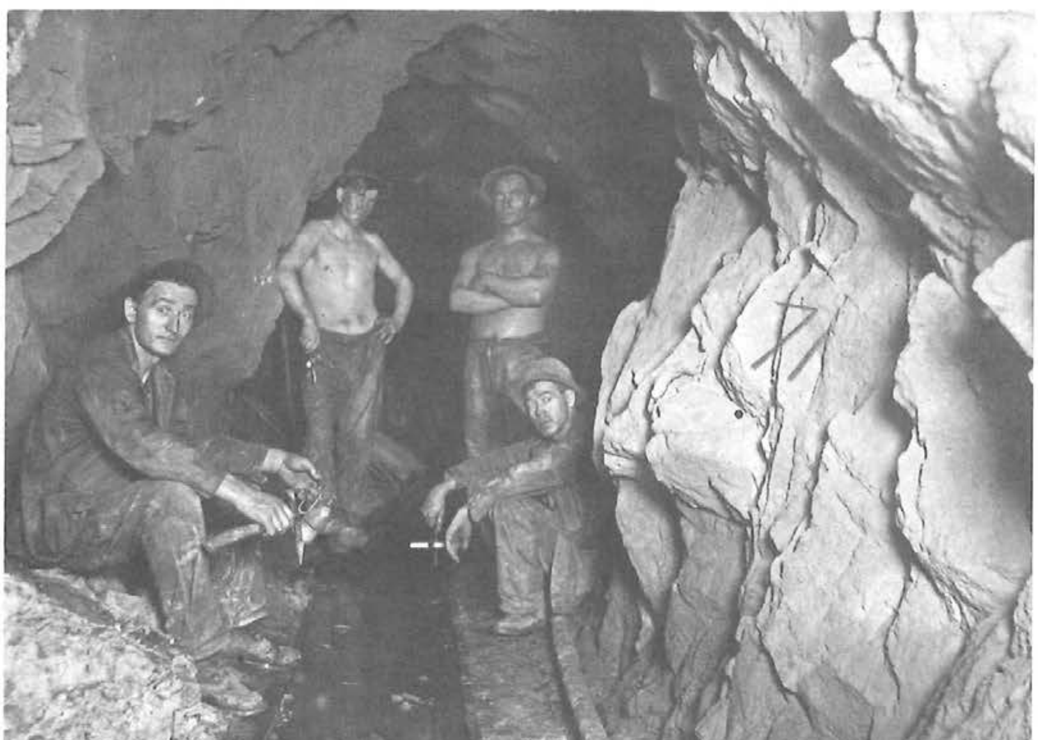
Water in abundance, particularly in subterranean rivers and lakes, caused both engineering problems and costs. The Comstock Lode in Nevada was infamous for its water problems at depth, flooding chambers with hot water and necessitating a massive drain tunnel.[24] The copper mines in Butte, Montana, were plagued by acidic mine waters.[25]

The hydrological realities of Butte and the Comstock necessitated pumps and drains, but subterranean water surprises even occurred in the Arizona desert. Ewald Kipp of Warren, Arizona, reported one such discovery to his company's president in 1941: "Last Saturday, the two miners on #12X [cross]cut on the 2700 level of the Cambell Mine blasted their round as usual. It blasted into a water course; and the water came out so damn fast that there was no chan[ce] of closing the water door (it takes two men to close one of the[s]e $10,000 re-enforced concrete doors)."

The result of the flood was a mine filled to the 2400-foot level and "the Shattuck Dean Mine about two miles from the PD Mine[s] was completely drowned out" necessitating pumping for "two months or maybe a year."[26] The hydrology necessitated flood doors and the miners were almost prepared, albeit training was required as well as clarity. Flooding caused additional expenses and a total loss of production.

Miners pumped, siphoned, and bored drainage tunnels to rid themselves of water. Where that water went and what it contained seldom concerned miners plagued with too much water. In Fairview, Utah, mine water was siphoned out and "went down the gully" from 1923 until 1946.[27] The Mineral Hill Copper Mine in Pima County pumped 140 gallons per minute in 1957.[28] Mine waters in Albany County, Wyoming, were "so great that large boulders are sometimes borne long distances." Even more importantly, Douglas Creek emptied into the Platter River, "a stream 500 feet wide, and from four feet to eight feet deep, with a fall of about eighty feet to the mile, all debris can be swept away by that river."[29] In Pima County, Arizona, the San Xavier Mine pumped "a million gallons of water . . . daily."

Sometimes such superabundances were turned to non-mining purposes. Water from the Rush Valley Mining District near Stockton, Utah, flowed from a tunnel at a rate exceeding the needs of milling and tailings sluicing, so some was diverted into orchards producing "many carloads of fruit."[30] Obviously these mine waters did not contain sufficient toxic wastes to kill fruit trees. At the San Xavier Mine in Pima County, Arizona, in 1950, the water was "clear and pure and is being used for domestic purposes in the mine



"Photo No. 71, south east sill, 2390, great deal water on track, water box extends under track." An engine pumping water out of a mine. No date; photographer nidentified. (Courtesy of the Montana Historical Society, Helena, Lot 8 Box 1/9.07.)

dwellings. The domestic water is chlorinated as a precautionary measure, and regular analyses are made by the Tucson office of the State Heath Department."[31]

Whether put to good uses or ill, removing excess waters also drained away profit. Tombstone, Arizona Territory, was an ill-omened city because of mine water that could not be pumped out fast enough. In 1883 the Grand Central mine installed twelve-inch Cornish pumps that expelled a million gallons per day. The waters refused to yield. In 1884 the Grand Central installed fourteen-inch pumps with a capacity of one and a half million gallons, but those failed to quell the tide. In 1885 the Grand Central installed still larger pumps with a two-million-gallon capacity, but those did not stem the flood and in 1889 the mine was only paying expenses. The waters never receded and the ark sank, drowned in expense and the falling price of silver.[32]

More typically in desert environments, the problem was too little water. The *Arizona Sentinel* of Yuma reported on 24 May 1879 of the Vulture Mine near Wickenburg, Arizona Territory, that "sufficient water for domestic uses . . . is obtained from the old flume of P. W. Smith, which carries water for thirteen mile[s], but the bed of the river there is as dry as the streets and there is not water for the mill at present."[33] When abundant, water could serve many customers bound together in the mining enterprise, but when scarce, conflicts were almost inevitable.

Further, having a water supply and using it were two different matters which depended upon market and cost factors. One case in point is the dilemma of the Nevada Porphyry Gold Mining Company in the 1940s. In 1940 L. D. Gordon of Fallon, Nevada, wrote to E. S. Sullivan at the home office in San Francisco about their non-use of water. He explained that Nevada's laws provided that a failure to use water beneficially for five years created an automatic lapse in "the right to use the water." This meant trouble for the company. "So far as I know," Gordon warned, "this water has not been beneficially used by anyone for a period of more than five years, and if we now resume the beneficial use of the water, we would reinstate our title." He advocated leasing their land and water "for the production of 'wild voluntary grass' or some other use" as a means of maintaining their water right.[34]

In July 1942, Gordon wrote to the company's secretary-treasurer, H.G. Mayer, complaining that "we are not using the water for any beneficial purpose, and there is a great danger of some intervening rights being established, as a couple of the ranchers are using water beneficially."[35] That November, Reno attorney H.R. Cooke took up the issue with Edward A. Michal of Round Mountain, Nevada. "Unless some way is found to put this water to beneficial use," he declared, "we are sooner or later going to have trouble with parties seeking adverse claims."[36] Yet the wartime ban on gold mining crimped the company's maneuverability.

By March 1944, Cooke was very concerned. He told the corporate board of "the general legal status of all of our water rights, [the] possibility of same being lost by forfeiture or abandonment, etc.[,] because of [the] inability of the Company to make beneficial use of such water for the duration [of the war,] due to the virtual complete ban on gold mining." Although the ban had been considered as a mitigating factor, Cooke warned that the Nevada statute contained no exceptions. He suggested

> that the mining fraternity be organized into an effort to get the next Nevada Legislature to amend the Nevada Statute re [the] 5-year non-user [provision], etc.[,] by incorporating a clause to the substance that where the non-use is the result of a ban on mining or other conditions beyond the control of the owner, that the period should not be included.

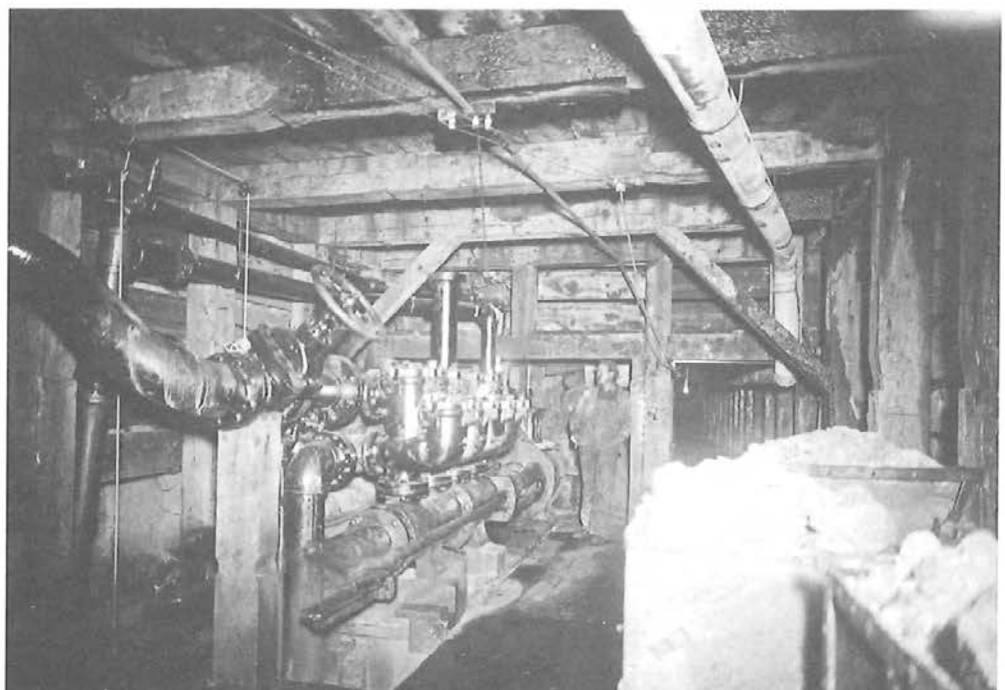
> The Legislature meets in January next and if there is concerted action by the mining fraternity I am satisfied there would be good prospects for such bill passing.[37]

But even after the war ended and the mining ban was lifted, the company persisted in its indolence. Starting in 1947, pressure came from the Nevada state engineer, who ordered that the company "commence work, complete work and place water to beneficial use." The company pled poverty and in 1949 Alfred Merrit Smith, the state engineer, gave the company a one-year extension to complete the work.[38]

The problems associated with mine and smelter tailings became acute in Montana at the same time. E. P. Dimock's 20 February 1947 report on tailings to the Anaconda Copper Mining Company found seventy-two million tons of material in the ponds and the end dams thirty-eight to fifty feet high. He reported "no record of failure of dams built by this system" and included a proposal to deal with "the dust problem."[39]

In the 1950s the company started to take a look at the percolation of water from the ponds into the ground water. Henry F. Adams, mill superintendent at the Inspiration Consolidated Copper Company in Arizona, told F. F. Frick, the company's research engineer, that

> Anaconda is fortunate in having what appears to me, an ideal "site" for tailings disposal. The tailing[s] dam is located on a large flat, the soil of which I assume to be more or less sandy [or], at least, pervious to water. This means



Ophir Mine, Butte, Montana. Worthington Duplex Dun, capacity eight hundred gallons per minute, 500-foot station, Jan. 1907. Dun was a nineteenth-century term for brown-grey waste water, in this case exiting a mine. Photographer unidentified.
(Courtesy of the Montana Historical Society, Helena, Mines and Mining Collection.)

> that the water percolating down through the impounded tailings will continue to percolate into the original soil, drain off through underground channels to an underground reservoir, and finally to the river. Under these conditions, the likelihood that seepage will occur anywhere in the dyke, from top to toe, is minimized.[40]

One recalls William Wraith's advice regarding the Warm Springs property acquisitions of 1912, to purchase lands "between our north line of our slum field, and the Warm Springs Road." Wraith thought such a purchase good policy because it "would be a protection from any complaints of an increase of underground water from the slum field on account of the greater drainage of the country in that direction." Wraith also noted that, given the expense of dikes and fences, "it would be cheaper to own the lands adjacent."[41] We know why the company started to study percolation in the 1950s: groundwater contamination and water supply.

A more potent reason, of course, was rising environmentalism in the Montana legislature and the nation. But in the early twentieth century, these issues were already being brought to Washington's attention. W. L. Stanton, chairman of the Deer Lodge Valley Farmers Association, wrote to former president Theodore Roosevelt on 18 June 1909 complaining about mining companies' use of water, water quality, and the quantity available to valley farmers.

> This water so reservoied [*sic*] is for their own use in their Smelter, and is so polluted after going through that plant that it is a detriment to the streams of Montana, as it is poisonous to stock and vegetable [a]like, and in no streams but two have they any reservoirs, and there are eight creeks coming into the Valley[,] only one of which they have a reservoir on, and on this creek litigation has been begun to determine the prior rights, as there is now not enough water for the farms.[42]

Water, beyond the washing of pay dirt, the cooling of smelters, and the sluicing of tailings, played a crucial part in western mining. It was the fluid that greased the system or impeded the enterprise. Time, place, and technology played clear roles in working with or flushing out water in the mining enterprise.

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3 Bennett, Sutherland, Van Cott & Allison to L.H. Chalmers, 28 Mar. 1902, Louis H. Chalmers Papers, MSS, Box 2, Arizona Collection, Hayden Library.

4 Alfred E. Donaldson to Emeline Donaldson Guernsey, 17 Oct. 1852, Guernsey Family Papers, MSS, Box 1, Huntington Library.

5 Guernsey to William D. Guernsey, July 26, 1878, Box 2, Huntington Library.

6 Elias S. Ketcham, Entry of 13 Jan. 1853, Elias S. Ketcham

Diary, MSS, Huntington Library.

[7] John Hurley to Milton B. Stevens, 24 Oct. 1854, Milton B. Stevens Correspondence, MSS, Box 2, Huntington Library.

[8] D. L. Beach to Amos Parmalee Catlin, 10 Dec. 1855, MSS, HM60667, Huntington Library.

[9] Tom Grant to Robert B. Todd, 23 Dec. 1883, Vulture Mine Records, MSS, Box 1, Arizona Historical Foundation, Hayden Library.

[10] Blattner to Hauser, 29 Jan. 1885, Samuel T. Hauser Papers, MSS, Box 12, Montana Historical Society.

[11] Howard J. Brother to Hauser, 4 Apr. 1885, Samuel T. Hauser Papers, MSS, Box 12, MHS.

[12] Howard J. Brother to Hauser, 3 and 13 Aug., and 15 Nov. 1885, Samuel T. Hauser Papers, MSS, Box 12, MHS.

[13] Hero Eugene Rensch, *Columbia, A Gold Camp of Old Tuolumne: Her Rise and Decline, Together with some Mention of Her Social Life and Cultural Strivings* (Berkeley: California Department of Natural Resources, 1936), 60-94.

[14] Larry Barsness, *Gold Camp: Alder Gulch and Virginia City, Montana* (New York: Hastings House 1962), 62.

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[16] Russell R. Elliott, *Nevada's Twentieth-Century Mining Boom: Tonopah, Goldfield, Ely* (Reno: University of Nevada Press, 1966), 7.

[17] Sally Zanjani, *Goldfield: The Last Gold Rush of the Western Frontier* (Athens, OH: Swallow Press/ Ohio University Press, 1992), 65. See also Hugh A. Shamberger, *Story of Goldfield* (Reno: U.S. Geological Survey and the Nevada Department of Conservation and Resources, 1970).

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[19] Andrew Wampler to Sir, 1 June 1851, Milton B. Stevens Correspondence, MSS, Box 2, Huntington Library.

[20] Ringeling to Porter, 23 Sep. 1895, Hope Mining Company of St. Louis Papers, MSS, Box 4, Montana Historical Society.

[21] J. M. Knott, *Sedimentation Discharge in the Trinity River Basin, California* (Washington, D.C.: U.S. Geological Survey, 1974).

[22] Joseph Warren Matthews Diaries, 1899, 1900, MSS, 8 Sep., 2 and 5 Oct. 1899, Bancroft Library.

[23] C. P. Arnold, Case Notes, MSS, Box 22, American Heritage Center, University of Wyoming.

[24] Grant H. Smith, *The History of the Comstock Lode* (Reno: Nevada Bureau of Mines and Geology, 1943). Rodman Paul, *Mining Frontiers of the Far West, 1848-1880* (New York: Holt, Rinehart and Winston, 1963), 67. See also: Hugh A. Shamberger, *Story of the Water Supply for the Comstock* (Reno: U.S. Geological Survey and the Nevada Department of Conservation and Resources, 1972).

[25] Isaac F. Marcosson, *Anaconda* (New York: Dodd, Mead & Company, 1957).

[26] Kipp to William Hill, 4 Sep. 1941, Ewald Kipp Papers, MSS, Accession #777, Box 9, Manuscript Division, Special Collections, Marriott Library, University of Utah.

[27] Russel Q. Madsen Interview, MSS, Charles Redd Center for Western Studies, Brigham Young University (accessed at Utah Historical Society, Salt Lake City), 8-15.

[28] Walter R. Stone and Allan B. Bowman, "Mining Methods and Practices at the Mineral Hill Copper Mine, Banner Mining Company, Pima County, Arizona," U.S. Department of the Interior, Bureau of Mines, *Information Circular 7786* (May 1957), 24.

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[31] Grover J. Duff and Charles A. Kumke, "Mining and Milling Methods at San Xavier Mine, The Eagle-Pitcher Mining & Smelting Company, Pima County, Arizona," U.S. Department of Interior, Bureau of Mines, *Information Circular 7581* (Sept. 1950), 10.

[32] Eric L. Clements, *After the Boom in Tombstone and Jerome, Arizona: Decline in Western Resource Towns* (Reno: University of Nevada Press, 2003), 70-82. See also Robert L. Spude and Stanley W. Paher, *Tombstone: Arizona Silver Camp* (Las Vegas: Nevada Publications, 1979); and Stanley W. Paher and Robert L. Spude, *Colorado River Ghost Towns* (Las Vegas: Nevada Publications, 1976).

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[34] L. D. Gordon to E. S. Sullivan, 25 Oct. 1940, Nevada Porphyry Gold Mining Company Papers, MSS, Box 1, Huntington Library.

[35] Gordon to H.G. Mayer, 8 July 1942, Nevada Porphyry Papers, Box 1, Huntington Library.

[36] H. R. Cooke to Edward A. Michal, 14 Nov. 1942, Nevada Porphyry Papers, Box 10, Huntington Library.

[37] H. R. Cooke to Board of Directors, 17 Mar. 1944, Nevada Porphyry Papers, Box 10, Huntington Library.

[38] Alfred Merrit Smith to Nevada Porphyry Co., 10 Jan. 1949, Nevada Porphyry Papers, Box 10, Huntington Library.

[39] E. P. Dimmock, "Report on Tailings Disposal at the Anaconda Reduction Works," p. 6, MSS, Anaconda Copper Mining Company Records, MC169, Box 91, Montana Historical Society.

The company's history, including its problems with pollution associated with its smelting operations, is extensive. See Michael Malone, *Battle for Butte* (Seattle: University of Washington Press, 1981); and Isaac F. Marcosson, *Anaconda* (New York: Dodd, Mead & Company, 1957). See also W. J. Wilcox, "His Record of Anaconda Company," MSS, Butte-Silver Bow Archives, Butte, Montana. The manuscript is a typescript compilation of newspaper stories relating to the Anaconda Copper Mining Company.

The Butte *Daily Miner* carried stories on smelter location in 1882 and 1883. A typescript of these stories may be found in Anaconda Copper Mining Company Records, Reduction Department (Anaconda), MC 169, Box 454, Montana Historical Society, Helena, Montana. The best study of the "company" is Frederic L. Quivik, "Smoke and Tailings: An Environmental History of Copper Smelting Technologies in Montana, 1880-1930" (Ph.D. diss., University of Pennsylvania, 1998).

The 1910 ACMC Corporate Annual Report (Montana Historical Society, Helena) contains a section entitled "Reduction Works," in which the new capacity of the Anaconda or Washoe Reduction Works is noted: 3,302,523.46 tons of ore from Anaconda companies were treated at the facility, in addition to the 13,668.01 tons of slimes from the Old Works treated at the Reduction Works.

[40] Adams to Frick, 20 Mar. 1950, MSS, Anaconda Copper Mining Company Records, MC169, Box 91, Montana Historical Society.

[41] Wraith to E.P. Mathewson, 21 Feb. 1912, MSS, Anaconda Copper Mining Company Records, MC169, Box 441; Montana Historical Society. Oscar L. Olsgaard to Frick, 7 June 1950; T. G. Fulmer to Frick, 15 June 1950; William Flynn and John Grant, "Tailing Disposal with Emphasis on Enlarged Tonnage and Thickening of Pulp," MSS, Anaconda Copper Mining Company Records, MC169, Box 91, Montana Historical Society.

[42] Stanton to Roosevelt, 18 June 1909, MSS, RG 60, Department of Justice Central Files, Straight Numerical Files, Box 274, National Archives.