Globalization and the Twentieth Century California Gold Rush: Development of the Continuous High-pressure Oxidation Process for Gold Recovery at the McLaughlin Mine

By Eleanor Herz Swent

McLaughlin Mine, at the junction of Lake, Napa, and Yolo counties, California, aerial view. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

I recently asked Roger Hahn, professor of the history of science and technology at the University of California at Berkeley: Is it discouraging to be a historian in times like these? He said, no, a historian knows that there have always been bad times, and that they always end. Or, as metallurgist Frank Aplan says often in his oral history interview, "What goes around, comes around."

When we look at mining history, we see that there is very little new under the sun. There are new aids for old processes: modern filters substitute for golden fleeces and Komatsu loaders for picks and shovels. Mass spectrometers and satellite photographs expand the province of the hand lens and the Brunton compass. Mining in western North America has been an international enterprise from the start. The California gold rush brought Chilean, Mexican, and Chinese workers, Cornish technology like the long tom and the Cornish pump, the patio process from Mexico, dredging from New Zealand, and investment from Great Britain. Mining communities from Butte to Bisbee have been polyglot and multicultural, as evidenced by place names such as China Camp, Slavonian Alley, Spanish Flat.

Sensitivity to environmental protection, however—whether genuine or in response to community action and government regulation—is indeed a new factor in the production of

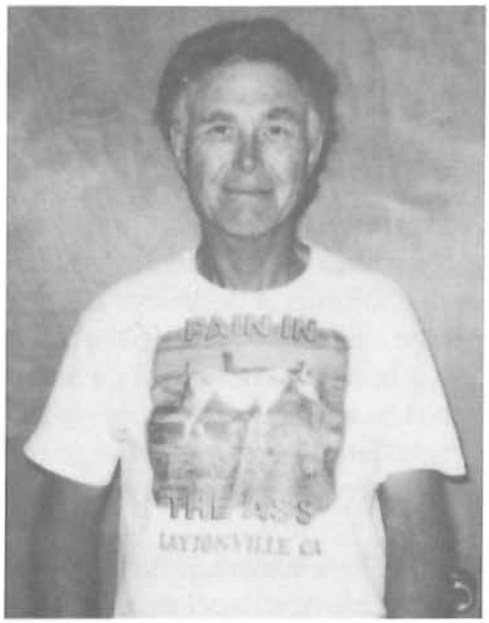
Scenery from UC Natural Reserve containing the Davis Creek Reservoir, along with a mixture of grassland, oak woodland, and serpentine chaparral habitats. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

minerals. It affects the process of obtaining permits, limits the ore treatment possibilities, and adds reclamation to the miner's responsibilities.

In 1985, the Regional Oral History Office, a division of the Bancroft Library at the University of California at Berkeley, launched its oral history series, "Western Mining in the Twentieth Century," to document the contemporary mineral industry through personal histories of significant participants. More than one hundred interviews have been conducted with people who have actively worked in mines, their supervisors, the geologists who find mines, the suppliers who equip them, and the investors who own them—as well as some of the neighbors who welcome or fear them. These interviews dramatically illuminate the changes which have taken place in business and labor practices, the use of natural resources, safety and health concerns, and environmental awareness.

The twenty-five-year story of the McLaughlin Mine in northern California, from 1978 to 2003, demonstrates that in response to a new concept—environmentalism—the Homestake Mining Company employed a traditional strategy: globalization. Opposition to the mine on philosophical grounds was expressed most articulately by Will Baker, professor of English at the University of California at Davis, who led a group of environmental activists. This is an excerpt from his interview:

> The newspaper woman was interviewing me and [Homestake president] Harry Conger. . . . A couple of the things he said, from my point of view, didn't square with reality. One was all these fears of exploitation and exhausting the planet's resources were misguided because the resources of nature are infinite. And I thought immediately, no, my friend, we measured it: the planet is not quite eight thousand miles through and twenty-four thousand-something around, and that's it. That's finite. What he meant, of course, is that human ingenuity will find a way to keep combining and



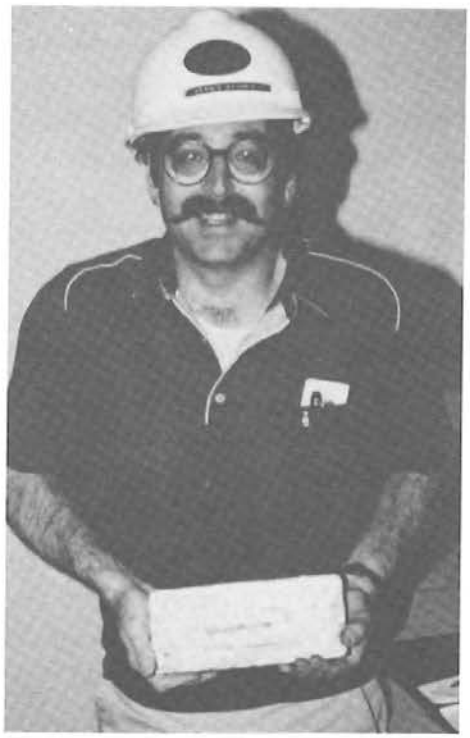
William Baker, professor of English, University of California-Davis. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

> recombining and mining asteroid belts or whatever we have to do so that this pattern of development and progress is never going to end. And I realized that probably most people in the country agree with him; they still think that the human race is capable of a kind of infinite command, gradually increasing over the universe. I deeply do not believe this.[1]

Homestake's lawyer, Dennis Goldstein, who guided the permitting process has this to say about the mine's impact on the environment:

> If you had seen this property, it was pretty nearly a moonscape. . . there were pits and holes and piles and the vegetation had been stripped off. There were big pits and gouges and trenches. . . . It really was among the most devastated terrain I had ever seen. One could argue that what we would bring to that property in some ways was an improvement. Even though we would excavate, there would be drainage control. We would take away some of the exposed materials and piles of waste that were lying around and we would dispose of them in a proper manner or run them through our mill and reduce them such that they were no longer in a dangerous state or a state of being hazardous in the technical sense of the term.[2]

The Manhattan gold deposit, the source for the McLaughlin mine, was discovered on the site of the old Manhattan mercury mine in 1978. The discovery was announced in 1980, and the first production began in 1985. A good deal of the intervening time was taken up in the struggle to obtain 327 permits from dozens of local, regional, state, and federal agencies. James Anderson, Homestake geologist and vice president, and



Dennis Goldstein, Homestake corporate lawyer, with the first gold bar poured at the McLaughlin Mine, March 1985. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

a member of the California State Mining and Geology Advisory Board, recruited Raymond Krauss as environmental manager for the site. Krauss, was a biologist with the Sonoma County planning department and another member of the California State Mining and Geology Board. In his interview, he explained why he took the job, which encompassed the permitting process, overseeing environmental compliance through the life of the mine, and managing the reclamation conducted simultaneously with development.

> Sometime during 1980, on one of our trips, Jim said, "Well, do you think it's possible to permit a gold mine in Napa County?"
>
> I just laughed and said, No. You've got to be kidding. Napa County, right

James H. Hickey, Director of Conservation, Development, and Planning for Napa County; Raymond Krauss, environmental manager, McLaughlin Mine; and James O'Laughlin, Napa County planning staff member, with permit requests. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

> next to San Francisco, the home of all the environmentalism, you're going to put a tailings pond? No, it's not possible. You're wasting your time.
>
> Finally he asked me if I would be interested in helping the company get the permits for this mine. I thought about it for a long time and said yes, that would be an interesting experience. If I'm party to it, maybe I can make it a better project than it would otherwise be. If you take the long-term view, one of my conclusions is that what's economically sound is also environmentally sound, so long as you keep your garbage at home. I've always believed that as a society, we depend upon our resources, and the only issue was: how do we go about providing those social needs, those cultural needs, in a way that's environmentally acceptable?[23]

Krauss also had a perceptive comment on the importance of keeping ahead of regulations:

> We were all clearly working under the directive that we needed to be sure that we complied with all state, federal, and local law. In fact, I think, had we simply strictly followed the letter of the law, we probably would have gotten into substantial legal problems, environmental problems, liability problems. At a conference once, somebody stood up and said: "Well, you did a good job, but you only did it because the regulators forced you to do it." And I said: "No, if I had done simply what the regulators forced me to do, I would be in jail today."
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> Really there are two parts of the law: one [is] performance standards. . . . You have to measure the quality of the water downstream of your site, and it cannot be degraded from either its historical quality, or its upstream quality. And then the other half of the law is that you must build your facilities according to these engineered standards. If you

Davis Creek reservoir, Yolo County, California. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

simply applied the engineered standards that they prescribed, they would not be sufficient to achieve the performance standard, and it's not surprising, because regulation really lags the science and the technology that's evolved by industry. The regulators don't make tailings ponds, they don't make sediment ponds. All they do is watch the ones that fail and then revise the laws accordingly. There's inevitably a lag in the regulations over the cutting edge of the state-of-the-art practice in the industry.[4]

Once Homestake obtained the permits for the mine, the challenge became to adjust mining and processing methods to the constraints of the permits. To preserve air quality, company officials decided to employ a continuous autoclaving process to treat the ores. Harry Conger, president and CEO, later chairman, of Homestake, had this to say:

> This was a refractory gold ore; it needed to be oxidized. In the old days, oxidation was easily accomplished by roasting material and letting the sulfur dioxide just go up into the air. We looked at roasting, but felt that the state of the technology for capturing SO_2 and other gases was not such that we could get it licensed here in California. So we went to the autoclaving choice; that increased the costs. Then we had to start the permitting process. That was another layer of costs. By the time we got the mine completed, we needed a $400 gold price to get a return on our investment at a profit. That [mine] went into production in 1985. By 1982 the gold price was down to $285. Today we still haven't seen $400 gold.[5]

Autoclaves, McLaughlin Mine processing plant, Lake County, CA. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

Harry M. Conger III, President, CEO (and later Chairman) of Homestake Mining Company. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

To use autoclaves in order to meet air quality standards meant quite literally searching the globe for answers to technical questions. Valves and liners were critical components. James Anderson, Homestake's vice president for exploration, who was still in charge of the project, said of this search:

> I traveled to South Africa to find out about the autoclaves. They were thinking about much bigger operations for autoclaves in South Africa to treat some of the big huge waste dumps they have, and they would use our three-thousand-

> ton-a-day facility as a pilot plant for their own much bigger ones."[6]

Much has been made of the fact that the McLaughlin plant was put on line without a pilot plant. This interview reveals that the relatively small Homestake plant was itself a pilot for the much larger ones eventually developed in Nevada and elsewhere.

Mechanical engineer Roger Madsen had worked for Homestake at its flagship gold mine in Lead, South Dakota, and at is uranium mines and processing plants in Ambrosia Lake, New Mexico. The company also enlisted him in the search for appropriate autoclaves and valves. He recalls a hunt covering both hemispheres, from Helsinki to Johannesburg:

> We had a trip lined up to go to England, several places in Germany, and one in Austria, looking at pumps for pumping liquid slurry [a] long distance under high pressure, and for pumping the hot slurry into the autoclaves, and also we were looking at some autoclaves there. Not necessarily in the order that I'm saying, we went to Helsinki and looked at more autoclaves up there at Outokumpu. We went to Spain. In South Africa we were talking about the valves and the guy said: "We build our own." It took them five years to solve the mechanical problem; this valve was completely different from anything I had ever seen before. They had marvelous machine shops where they could do these things. . . . Okay, we're going to have autoclaves; what type of autoclave are we going to have? The decision was the steel one that was brick-lined, German brick.[7]

Roger A. Madsen, mechanical engineer, Homestake Mining Company. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

The autoclaves were shipped from northern Europe to Benicia on the Suisun Strait of San Francisco Bay, and more special permits were required to transport them to the mine site. Many people recall the day that they passed through the small town of Lower Lake, and out along Morgan Valley Road. Later, workers from Germany arrived to install the liners.

Australian metallurgist John Turney, who had earned his Ph.D. at the Colorado School of Mines, was responsible for the training of workers and the startup of the McLaughlin operation. In his oral history, he traces the development of the equipment used to process the ores.

> Nobody had ever used an autoclave to commercially treat refractory gold ores. Bull Dawson in Salt Lake had done one autoclave test with uncontrolled pressure and temperature. Halpern, a professor of metallurgy at [the] University of British Columbia in the late forties, and Frank Forward did work on oxidizing sulfides. Sherritt Gordon, [in Ft. Saskatchewan, Alberta] developed ba-

Autoclaves, slurry heaters, and flash tanks, McLaughlin Mine processing plant. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

> sically these ideas of how you could treat these sulfides under pressure with oxygen. But the question was always: How could it be possible to actually develop the equipment to do that? That's really what the real story of McLaughlin is about: the pressure letdown system. Richard Kunter had worked in western Australia and knew about the autoclave systems that existed at Western Mining and Kanowna. We spent a lot of time working with a consulting firm [in Toronto] called A. H. Ross. Bob Pendreigh actually had worked in South Africa at the time of the beginning of one of the first attempts at autoclaving the Witwaterstrand uranium ores at Western Deep [Mines]. He was one of the key early pilot plant operators who actually ran a continuous autoclave. So we then set up a program at Hazen Research in Golden.[8]

Here is a global linkage of Australian nickel mines and South African uranium mines with a professor in British Columbia, a laboratory in Alberta, a consulting firm in Toronto, another laboratory in Salt Lake City, and a research firm in Golden, Colorado, all coming together at a California gold mine.

Mining has ceased at McLaughlin and the reclamation plan has been implemented. The story of the workers is another chapter that cannot be told here, but, in brief, a phased shutdown used stay bonuses and extensive job counseling and referral. Some workers transferred to jobs in Nevada, Alaska, Australia, and Canada in a typical mining diaspora. A good number stayed in the area in service jobs that were a result of the stimulus given to the local economy by the McLaughlin Mine.

Dennis Goldstein, the lawyer who worked on the original land acquisition, was also involved in planning the reclamation. He says:

Sylvia McLaughlin and Dr. Susan Harrison, Chairman of the UC McLaughlin Reserve Management Committee. (Courtesy of The Regional Oral History Office, The Bancroft Library, Berkeley, California.)

> We needed to have, to comply with the Surface Mining Act, a post-mining land use. And the land had very little use to begin with. It could barely support grazing in its natural state, and it certainly couldn't support any grazing after it had been ripped up. So we proposed that we make an environmental research station out of it and give it to a university. We have now entered into an agreement with the University of California. They have a series of natural reserves to [represent] the seven or eight natural habitats of California. This one is their serpentinite reserve. This is one of the few areas of the state where the natural serpentinite soil is obvious to the eyesight and still in part untouched, that still has native plants growing there.[9]

On 3 May 2003, the mine was formally decommissioned and turned over to the University of California for use as the Donald and Sylvia McLaughlin Natural Reserve. After being mined for nearly a century and a half, first for mercury and then for gold, the land has now been returned to something like its original condition, to the delight of environmentalists. A new community college branch, a new library, an expanded hospital, telephone service, water and sewer systems, and an improved road are still there. These remain as reminders of the last twenty years of mining, which brought hundreds of workers and observers, as well as equipment and ideas, from all over the world.

In his essay on "Environmental History in the West" John Opie wrote that

> the history of boomtowns is invariably an environmental history. Natural resources, whether gold, silver, or copper, lumber, oil, or coal. . . create momentum for rapid localized development. This almost invariably means the invasion of a human population far beyond local capacity to support. The results are not only the spoilation [sic] of the land, but also community pollution, waste, crowding, violence, and other human hardships.[10]

The reclaimed McLaughlin Mine demonstrates that waste, pollution, and spoiling of the land are no longer invariably the results of mining.

Notes:

1 Oral history quotations are from *The Knoxville Mining District, The McLaughlin Gold Mine, Northern California* (8 vols.), Western Mining in the Twentieth Century Series, Regional Oral History Office, University of California, Berkeley, 1995 to 2003 (hereafter *McLaughlin Gold Mine*). Elisions are omitted from quotations from the oral histories. Will Baker, "Citizen Activist, Yolo County," *McLaughlin Gold Mine* I, 91-2.

2 Dennis Goldstein, "Homestake Corporate Lawyer," *McLaughlin Gold Mine* 3, 189-90.

3 Raymond Krauss, "Environmental Manager, McLaughlin Mine," *McLaughlin Gold Mine* 8, 205-6, 210, 223, 224.

4 Raymond Krauss, *McLaughlin Gold Mine* 8, 244.

5 Harry M. Conger, "President, Chairman, and CEO, Homestake Mining Company, 1977 to 1994," *McLaughlin Gold Mine* 2, 187-8. This paper does not examine financing, but like the mine's technological innovation, this too became a global undertaking. Conger was one of the founders of the World Gold Council and obtained listing for Homestake on foreign stock exchanges.

6 James Anderson, "Homestake Vice President-Exploration," *McLaughlin Gold Mine* 1, 39.

7 Roger Madsen, "Homestake Mechanical Engineer," *McLaughlin Gold Mine* 5, 176-83.

8 John Turney, "McLaughlin Metallurgist: Pioneering Autoclaving for Gold," *McLaughlin Gold Mine* 7, 233-5.

9 Dennis Goldstein, *McLaughlin Gold Mine* 3, 232-3.

10 John Opie, "Environmental History in the West," in *The Twentieth-Century West: Historical Interpretations*, ed. by Gerald Nash and Richard Etulain (Albuquerque: University of New Mexico Press, 1989), 215.