ny was one of the "best financed and managed" dredge companies in Idaho and perhaps the most successful. On the other hand, underfunded or inexperienced operators working mostly on hope and hype rarely earned enough to pay expenses.

Idaho's dredging history is replete with rampant speculations and dubious promotions, with few successes and many failures. Dredge operators faced many obstacles, including frequent breakdowns, bad weather, transportation problems, sketchy financing, management shortcomings, process failures, and the scarcity of high-grade deposits—all of which are dutifully chronicled in this narrative. What emerges is a picture of a highly risky, speculative industry seemingly based as much on promotional hyperbole as rational analysis of basic economics. This, of course, is not an unusual condition in mining history, but dredging involved bigger investments, and therefore mining companies had more to lose, than the low-tech surface diggers that characterized nineteenth- and early twentieth-century placer mining.

Mining is widely unpopular today and heavily regulated, but the author is careful to avoid judging the past by present standards. Dredging brought jobs to the back country but left behind a de-vegetated, topsy-turvy landscape, with piles of cobble, ruined fishing streams, silted up downstream waterways, and polluted drinking water. Opposition increased as dredging resumed after its mandatory shutdown during World War II, but the powerful state mining industry kept serious regulatory laws off the books until late 1960s. By that time dredging was nearly dead, with little pay dirt left and costs exceeding revenue. Not until the 1980s, as the author notes, did Idaho begin serious reclamation efforts, funded in large part by federal legislation requiring the Bonneville Power Administration to spend part of its profits cleaning up the Columbia River watershed.

This is not a book for general audiences, but mining historians will enjoy this monumental foray into the details of a large and diversified industry.

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Michael C. Mix. ***Leaded: The Poisoning of Idaho's Silver Valley.*** Corvallis: Oregon State University Press, 2016; 276 pp., 6 b&w photos, 3 maps, 2 tables, 2 figs., notes, bib., ind., paper, $29.95. ISBN: 9780870718755

Leaded is a welcome addition to the mining scholarship of the American West inspired by the author's family history. Michael Mix, a retired Oregon State University professor of biology, grew up in Spokane, Washington, and fondly recalls picnics at a great aunt's mansion on Lake Coeur d'Alene. From Lucy Mix Day, the young author learned about her husband, Jerome Day, who with his brothers famously struck it rich at the Hercules Mine, one of the bonanzas in the Idaho panhandle's Coeur d'Alene Mining District.

"Silver Valley" refers to that district along the South Fork of the Coeur d'Alene River and its major tributaries from the town of Mullan downstream past Wallace and Kellogg. Local boosters, who by the 1970s popularized the term Silver Valley, celebrated the precious metal mined from lead-zinc ores that made the district the world's largest silver producer as well as home to significant lead and zinc producers. The largest and best-known of these, Kellogg's Bunker Hill Company, also owned a metal-refining and smelter complex. That complex closed in 1981 and two years later was designated a Superfund site. Today the Environmental Protection Agency continues its cleanup, while miners toil thousands of feet below in the two mines still active.

Although *Leaded* sets the ambitious goal to be an environmental history of the Silver Valley, it focuses on the operations of the Bunker Hill Company and the environmental destruction it caused, principally through the lead it released that denuded the Silver Valley's hillsides, con-

taminated its air and water, and thus endangered the health of residents as well as workers. After reviewing the company's history to explain how mining and processing of ores transformed the valley into a "toxic, barren, desert-like landscape" (p. 40), Mix updates conditions from the smelter's closure through three decades of not only cleanup but also tumultuous economic reconfiguration. Those interested in the role of other Coeur d'Alene companies have available John Fahey's works and the new study by Bradley Dean Snow, *Living with Lead: An Environmental History of Idaho's Coeur d'Alenes, 1885-2011* (2017) [reviewed below].

The strength of *Leaded* lies in its investigation of airborne lead pollution. Mix recounts the deliberate decision to run the Bunker Hill lead smelter for months from 1973 into 1974, despite a fire-damaged emissions control system, because lead prices were high. The price was high for children too. A 1974 study of those growing up within a mile of the smelter revealed that 99 percent showed abnormally high blood lead levels, with 21 percent high enough to be classified as "unequivocal lead poisoning" (119). Mix analyzes unstintingly the permanent harm that resulted and that a *Newsweek* article titled "We Are 'The Leaded'" confirmed in 2016.

Other accounts detail this deliberate lead-polluting incident, especially Katherine Aiken's *Idaho's Bunker Hill* (2005), but Mix's benefits immeasurably from his access to the trial documents of Paul Whelan, a Seattle attorney in the Yoss case, a lawsuit against the company by affected families. Mix asserts that the case records in Seattle's Federal Records Center are incomplete and that only in Whelan's records was he able to access many documents. Interested researchers should note that Marianne Sullivan's *Tainted Earth* (2014), for its chapter on the Bunker Hill smelter, also cites the importance of working with Whelan's case files.

Mix tells not only the morality tale of the choice for profit over health, but also the saga of complex relationships among government offices, the company, and the community. Silver Valley residents became pawns in a high-stakes game that pitted the new regulatory agencies, the EPA and the Occupational Safety and Health Administration, and their attempts to establish safe standards for ambient air lead and blood lead levels against industries that would be affected. Although Bunker Hill is the principal actor here, others waged similar litigious and delaying campaigns against those standards. Mix nods to industry-wide tactics, but those who wish to put the company's actions in national context must look elsewhere. Also acknowledged but undeveloped is the crucial role outside ownership and out-of-state executives played in Bunker Hill decisions after its 1968 takeover by Texas-based Gulf Resources. These comments are quibbles, however, when measured against Mix's compelling assessment of the 1970s battles over smelter workplace conditions and emissions and of the long-term consequences for communities.

The book is not a comparative study. Unlike Sullivan's *Tainted Earth*—which examines the public health effects of the Bunker Hill as well as ASARCO smelters in El Paso, Texas, and Tacoma, Washington—*Leaded* makes scant reference to other smelters despite the rich opportunity afforded by the nearby and still-operating Teck Resources Ltd. (Cominco) smelter complex in Trail, British Columbia. Those versed in environmental justice critiques may ask about the rest of the world when Mix declares the end of lead health issues in the United States. Although the last American primary lead smelter closed in 2013, because lead is a still-useful metal, smelters continue to operate, but often in poorer countries with few restrictions; thus people and landscapes continue to be leaded.

In its choice of "poisoning" and "Silver Valley," the book's title juxtaposes effects with a celebration of mining heritage and economic vitality. Mix struggles to reconcile the tension between those two elements when residents embrace that heritage and their "Uncle Bunker" amid the es-

calating environmental damage. MHA members who attended the 2002 conference held in the Silver Valley may recall the yard signs reading "Just Say No to the EPA."

Those who wonder why cleanup is such a contentious issue must look to Aiken's Bunker Hill book or Laurie Mercier's *Anaconda*, about another smelter town, for in-depth analysis of how communities, dependent on a single industry or company over which they have little control, may forgo their own health to keep jobs and often display great distrust of outsiders, whether they be from the EPA or the *Washington Post*. That tension between proud heritage and environmental legacy plays out throughout this volume as it does throughout the history of many communities in the mining West.

The force of *Leaded's* relentless probe of the environmental impact of Bunker Hill activities overpowers these criticisms. Mix's book complements Aiken's company history and Julie Whitesel Weston's 2009 memoir *The Good Times Are All Gone Now* (reviewed in the 2010 *Mining History Journal*) about growing up in Kellogg. Together they vividly portray not only changing mining and processing practices and their environmental legacy but also the people who call the Silver Valley home.

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Hjalmar Fors. ***The Limits of Matter: Chemistry, Mining and Enlightenment.*** Chicago: University of Chicago Press, 2015; 241 pp., 10 illus., notes, bib., ind., cloth, $40.00. ISBN: 9780226194998

In 1676 Stockholm, Urban Hiärne, later head of the Swedish Bureau of Mines' *Laboratorium Chymicum*, sat on a tribunal that sentenced a witch to be burnt at the stake and decapitated. As the witch hunt continued, he and his peers became skeptical, questioned the accusers' motives, and required better evidence. The trial process, with new criteria, stopped and then reversed the outcome for later accused witches.

In *The Limits of Matter: Chemistry, Mining and Enlightenment*, Hjalmar Fors uses the witch trials and Hiärne's role as symbols of shifts in thought on mysticism. They also lead into the discussion of transformations within the mining industry from myth and wizardry to the beginnings of a more enlightened approach. At the onset, Fors suggests to the reader that the witch trials are "a powerful reminder that people of the late seventeenth century defined reality quite differently from most who live in the early twenty-first century" (p. 20).

This is an important point, to lead the reader away from our secure view of progress, science, and technology, to a distant world at the "edge of the map," where there be dragons. The author transports us to a very different time and place. Historian Fors teaches at the Department of History of Science and Ideas at Uppsala University, Sweden, and uses a surprising wealth of extant, original source materials for his study. He is also passionate about his topic, the Swedish Bureau of Mines, founded 1637, and its part in seventeenth- and eighteen-century evolution of "knowledge" during what we conveniently call the Scientific Revolution. In the usual histories of science, Sweden is slighted, he believes. Fors provides a superb corrective to the literature through the examination of the mining bureau and its members' experiences.

Fors starts with an overview of major concepts and a brief synopsis of the chapters, then begins chapter two with the witch trials. He describes the world of miners and their strongly held belief in the spiritual or mystic, a world populated by trolls, gnomes, mine keepers, and "demons of the underworld." The first published description of such beings, Fors writes, was in Agricola's lesser-known book *De Animantibus Subterraneis* (1549) on "demons of the mines," which included mine creatures deadly to dangerous, harmless to,