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Kent A. Curtis. *Gambling on Ore: The Nature of Metal Mining in the United States, 1860-1910.* Mining the American West Series. Boulder: University Press of Colorado, 2013. xv + 323 pp. $39.95 (cloth), ISBN 978-1-60732-234-4.

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Mining in the West: Knowing Nature through Uncertainty and the Problem of the Declensionist Narrative in Environmental History

According to Kent A. Curtis, the biggest obstacle for miners in the American West was uncertainty. Gold, silver, and copper were randomly dispersed in the ground, making it impossible for any extractor to know where rich deposits might be found. Overcoming uncertainty was a crucial step in the process of transforming America into a "mining nation" by the 1880s. To do this, miners increased the scale of their operations, causing environmental devastation in parts of western Montana, where the study is set. Producers that became large enough churned out metal, copper most importantly, in vast quantities, causing consumers to disassociate the finished product with the adverse effects of production. *Gambling on Ore* blends the history of capitalism with environmental history to show the corporate causes and environmental effects of industrial metal production. The book is organized in an intuitive way, tracing the development of three types of mining in chronological order, starting with a chapter on small-scale gold mining, moving on to a chapter on silver lode mining, followed by two chapters on large-scale copper production.

The random dispersal of gold, silver, and copper was the result of prehistoric tectonic activity that superheated stone and precious metals, pressurizing them and forcing the mixture up to the surface. Once solidified, these mixtures, called "veins," were sometimes exposed to surface erosion, which freed metals from rock and deposited them in the beds of waterways. Some lucky western settlers might have stumbled on this eroded gold flake in streams, but most miners were led to metal deposits by rumors and samples carried to cities. In the 1850s and 1860s, Montana's gold miners set up low-tech "placer mines" that used water and gravity to separate gold flake from refuse. By 1865, Montana's gold production was in decline and most miners were unsuccessful, though the collective reconnoitering of thousands of these entrepreneurs successfully, and unintentionally, mapped Montanaâs geological features. This mapping made future mining endeavors for metals like sliver or copper more certain investments.

Silver was less valuable but more abundant than gold, so miners had to increase the scale of their operations to make production profitable. This meant abandoning placer mining and digging up ore, a process called "lode mining." Silver is highly reactive and readily bonds to sulfur, making sliver sulfide. When silver ore was found in this state it had to be crushed, treated with mercury and sometimes roasted, a process that required large-scale investment and decreased the certainty of success. Most of Curtis's second chapter describes how changes in laws regarding claim rights in 1866 and 1872, along with the professionalization of mining, helped incentivize silver mining, allowing for increased scale of production and reducing the inherent uncertainties of nature.

The uncertainty of mining was nearly conquered by the 1880s and 90s, when entrepreneurs used novel corporate strategies to maximize the scale of production. Chapters 3 and 4 are on the industrial exploitation of copper recourses, a material that had miniscule value compared to the energy required to process it. Copper ore was processed like silver but it also had to be superheated to a liquid state so impurities could be skimmed away as "slag." For those with foresight and access to credit, profit could be wrested from copper deposits utilizing massive reinvestment, economies of scale, and vertical and horizontal integration. These strategies allowed the ominously named Anaconda Company to develop into the worldâs largest copper manufacturer by the late 1880s, processing six thousand tons of ore a day (p. 155).

Anaconda and Montanaâs other copper producers flooded the American market with copper. Like American railroads, copper was produced "ahead of demands," allowing copper production and American electrification to progress on a "co-evolutionary trajectory," each industry building on the other's success (p. 143). But consumers who enjoyed expanded access to electricity were blind to the huge environmental costs of metal production. In Montana between 1880 and 1900, the copper industry produced eleven billion pounds of gas waste, twenty-five billion pounds of tailings (pulverized rock), and about ten billion pounds of slag, all of which killed everything it touched (pp. 170-171). In 1902, Montana farmers filed suits against the copper producers for poisoning and blocking their waterways, but America's legal framework was becoming skewed to favor large-scale industrial producers and pollution continued. In his discussion of pollution, Curtis argues that government and corporate officials were always aware of the environmentally destructive effects of industrial mining, but they "willfully ignored [them] in the name of corporate interests," a familiar narrative (p. 198). *Gambling on Ore* furthers the arguments made by William Cronon in *Nature's Metropolis: Chicago and the Great West* (1991) by showing the destructive effects of alienating natural resources from their production processes. This book successfully deepens our understanding of industrialization and corporate organization in the Gilded Age by demonstrating that natural uncertainly mandated that extractive industries be either unstable and ephemeral, like gold mining, or huge and intractable, like copper mining.

Gambling on Ore is less successful in its attempt to avoid the declensionist narrative found in many environmental histories. Curtis is aware of the problem, writing that he does not want this study to become an "environmental impact statement written backwards" (p. 5), but when the mining story is told using corporate records and the legal suits of affected farmers, environmental destruction becomes the singular important conclusion. For copper workers, who are often less visible in the archives, the story was likely different. As historians Karl Jacoby, Richard Judd, Thomas Andrews, and others have shown, when environmental changes are viewed from the bottom up, what seem like formulaic narratives can sometimes be turned on their heads. The best example is Jacoby's *Crimes against Nature: Squatters, Poachers, Thieves, and the Hidden History of American Conservation* (2003), which demonstrates that what has been seen as a great success of the early environmental movement, the creation of national and state park systems, was not as triumphant when viewed from the bottom up. Uncertainty as a way of "knowing nature" has limited use in upsetting the declension because it was an obstacle that entrepreneurs, businessmen, and corporations overcame before dominating nature. Uncertainty was not relevant for most people involved in copper production. Those hoping to meaningfully contribute to the emerging history of capitalism should also remember the benefits of a bottom-up approach or their work risks becoming little more than business histories.

In chapter 2, Curtis begins to access workers' understanding of metal production in his description of how silver workers' knowledge of nature changed as mining was professionalized. He finds that professional miners were able to transcend the "agricultural or superficial perspective" of armature miners (p. 97). He does not elaborate on this "agricultural perspective," or tract it through industrialization in any detail. Perhaps this line of inquiry should be saved for another volume, as Curtis is already able to accomplish so much in this concise, well-researched study.

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