Smithsonian American Art Museum

Mining Technology during the Gold Rush

The painting *Miners in the Sierras*, depicts a type of mining called **placer mining**. The figure in the red shirt wields a pick-axe to loosen rock and gravel from the riverbed, while the figure next to him shovels rock into the bed of the long wooden device called a **long tom**. The long tom is balanced on the rocks of the river in such a way that water can course through it, so that the heavier particles of gold sink and become trapped at the bottom. The second figure in red at the end of the long tom sifts the debris in the box with a shovel. Gold Rush miner Luther M. Schaeffer, a native of Frederick, Maryland, spent nearly three years mining the gold fields in Nevada County, California and recalled the operation of the long tom. The description of the process in his journal entry from 1851 (the same year *Miners in the Sierras* was painted) makes it clear that this mining technology was already considered to be outdated:

Miners in the Sierras (detail) 1851-1852

> *Mining implements had undergone a vast improvement since the days of my first experience in mining. Then we used a rocker or cradle; now the ''long-tom'' was introduced, by which twenty times as much dirt could be washed out. A long-tom is a trough about sixteen feet long, with a perforated sheet of iron inserted at one end; water is let on, and dirt thrown in, which it is only necessary to stir up and throw out the stones. It was a strange sight to see a hundred men working in pits, some digging, some throwing up the mud and stones, others shoveling it into the box, and others again stirring up the mass and throwing out the rocks. The noise was so great that one could scarcely hear anything beside the incessant rattle, rattle, rattle. Men worked faithfully, constantly and expeditiously.*

The heyday of placer mining, or surface mining, occurred between 1848 and 1855. Over 1400 towns or camps were set up along hillsides along mountain streams. Miners worked the streams with long toms searching for gold in the surface gravel, but this supply was depleted rapidly, and placer mining went into a steep decline on the western slope of the Sierra Nevada from 1854 onwards. By the late 1860's, only part-time miners and miners of Chinese ethnicity (who due to racial prejudice, were excluded from many industrial mines) continued to employ the old-fashioned methods used in placer mining.

During the dry months of the summer and early fall, the lack of rain and scarcity of water made it difficult to run the long toms. In a journal entry from June 14, 1851, about the same time that Nahl was in the mining camp Rough and Ready, miner Luther Schaeffer wrote that:

> *The great difficulty which miners labored under at this time, was in procuring a sufficient supply of water to wash their ''dirt.'' No water and ditch companies had yet been formed, and men who owned valuable claims, were compelled to exercise the patience of grandfather Job, in waiting until the rainy season came around . . . During the summer months not a drop of water descends upon the parched ground, and those settlements destitute of never-failing streams, present a languishing aspect. But the winter months bring copious showers, and during this season everything assumes a cheerful appearance, and the miner's heart is gladdened.*

When surface deposits of gold declined, placer mining and the settlements built for this purpose were abandoned. If the harder to access deposits of gold were to be extracted, a new, more effective method would have to be implemented.

The Transition to Hydraulic Mining

Union Diggings, Columbia Hill, Nevada County (detail) ca. 1871

The advent of the **Industrial Revolution** brought with it a stunning array of technological changes with a wide scope of applicability to different industries. Americans with their eyes on the West saw an opportunity to apply these technologies to the booming mining industry. At the forefront was hydraulic mining, a process in which large, pressurized water cannons propelled hundreds of gallons of water per second to wash away hillsides into **sluices** where the heavy gold could be separated from lighter particles and debris. This new technology, implemented by large-scale mining corporations, was faster, broader, and less labor intensive than any previous form of mining had been. In his 1873 California guidebook, author Charles Nordhoff described the hydraulic mining process:

> *Water brought from a hundred and fifty miles away and from a considerable height is fed from reservoirs through eight, ten or twelve in iron pipes through . . . a nozzle, five or*

> *six inches in diameter, is thus forced against the side of a hill one or two hundred feet high. The stream when it leaves the pipe has such force that it would cut a man in two if it should hit him. Two or three and sometimes even six such streams play against the bottom of a hill, and earth and stones, often of great size, are washed away until at last an immense slice if hill itself gives way and tumbles down. . . . I suppose they wash away into the sluices half a dozen acres a day, from fifty to two hundred feet deep, and in the muddy torrent which rushes down at railroad speed through the channels prepared for it, you may see large rocks helplessly rolling along. . . the gold is saved in long sluice boxes, through which the earth and water are run, and in the bottom of which gold is caught by quicksilver. . . . But, in order to run off this enormous mass of earth and gravel, a rapid fall must be got into some deep valley or river. . . .the acres washed away must go somewhere and they are filling up the Yuba River. This was once, I am told by old residents, a swift and clear mountain torrent; it is now a turbid and not rapid stream, whose bed has been raised by the washings of the miners not less than fifty feel above its level in 1849. It once contained trout, but now I imagine a catfish would die in it.*

As effective as hydraulic mining was, it was not without consequences, as this type of mining was the most damaging to the region's ecosystem. The lighter debris from the hillsides, including sand, clay, rocks, and wood, was washed downstream, clogging and flooding rivers. Thousands of acres of farmland were buried beneath the silt and debris. The giant nozzles, called monitors, which sprayed the pressurized water onto the hillsides could, depending on the size of the monitor, eject anywhere from 5,000 to 11,000 gallons of water per minute. This caused flooding and mudslides to become major problems. The addition of heavy rains and floods in 1861 and 1862 exacerbated the problem, pushing the silt and debris from mining operations into once-clear streams and rivers of the Sacramento Valley. One observer wrote in January 1862 that "the Central Valley of the state is underwater – the Sacramento and San Joaquin valleys – a region 250 to 300 miles long and an average of at least twenty miles wide," and that prior "to 1848 the [Sacramento] river was noted for the purity of its water, flowing from the mountains as clear as crystal; but, since the discovery of gold, the '**washings**' render it as muddy as the Ohio in spring flood."

The farming industry was the hardest hit by the mining activities. The resulting deluge of debris from hydraulic mining had washed silt and sediment – 4.5 million cubic yards annually – onto crop fields and had poisoned water supplies. Yet a cruel paradox existed, for in many cases the farmers owed much of their prosperity to the miners; the wheat, potatoes, and other food commodities grown by farmers were purchased by the ever-expanding mining communities.

Any effort to curtail the mining industry would be both a blessing and a curse. The editor of the Nevada City *Transcript* opined on the dilemma, writing in 1875:

> *What are the owners of farms to do? It is an industry the whole world desires to foster. The Government will encourage it, notwithstanding agriculture may suffer. Hydraulic mining is in its infancy. The very storms which are so destructive to the valleys are just what the mines require. The sediment, which has been accumulated for years in the ravines and river beds, and preventing a good fall, has all been washed away, and made a place for the deposit of other quantities unwashed . . . It is evident mining will have to be stopped or that country will have to be abandoned for its present purposes, unless some method can be devised to overcome the difficulty. It is certain mining will never be stopped . . . What relief can be afforded we cannot apprehend.*

Additional economic activities needed to support mining operations, such as hunting and fishing, also took their toll on the environment. The fish and wild game populations were absolutely devastated with the influx of miners in the years after the start of the Gold Rush. Already by 1877, residents were complaining to the state government of the conditions, stating that "a few years ago deer and kindred game were plentiful; in our mountains and valleys [because of] the wanton destructions of these animals [they] . . . will soon become extinct."

Conservation Movement in California

Today with our twenty-first century eyes, it is easy to view the destruction caused by hydraulic mining and think about the long-term effects. Yet, in the nineteenth century, Americans were far less, if at all, concerned with the long-term effects of the hydraulic technique as they were with its output and the large financial gains to be made. This is because a unique dichotomy existed in the mind of the nineteenth century American, where a harmonious intersection between industry and the natural world existed, and was in fact celebrated. Nature was prized for very different reasons than we celebrate it today. Then, nature was valued for its ability to promote a particular sensibility. The first preserved lands in the nation, such as Yosemite in 1868, were not set aside for modern-day conservation concerns, but rather they were preserved for their potential to produce natural resources. It was believed that by tapping into natural resources, Americans could transform the beautiful, yet unproductive and uncivilized, wilderness into an equally beautiful, yet cultivated and bountiful garden. This sentiment was very much in keeping with the idea of manifest destiny, that it was the duty of Americans to civilize and settle the land from Atlantic to Pacific. Therefore it should come as no surprise that Carleton Watkin's photographs were at the time, celebrated for both their representations of both nature and industry.

As long as the extraction of resources did not interfere with those elements of the landscape which provided Americans with a visual representation of their cultural values (e.g. vistas and geological formations), the public had no objection to such activities as mining, land development, farming etc. It was thought that the natural world was actually improved when man interfered and put his mark on nature. Whereas today, we value the American wilderness as an example of the world untouched by mankind; one that must be preserved from any kind of human interference or development.

There were some observers, however, who lamented the transformation of the California landscape by mining operations. In 1857 traveler J.D. Borthwick stated, "Young as California was, it was in one respect older than its parent country, for life was so fast that already it could show ruins and deserted villages . . . even villages of thirty or forty shanties were to be seen deserted and desolate, where the diggings had not proved so productive." Lorenzo Sawyer, later chief justice of the California State Supreme Court, wrote as early as 1850 that miners had spoiled the California landscape: "Cast your eye along those vallies [*sic*], Deer creek, Little Deer creek, Gold run and many others, see their beds to a great depth thrown up, behold the pine, the fir, the cedar, the oak, these monarchs of the forest undermined, uprooted."

After observing the crippling effects mining activities had on the environment, wilderness conservationist **John Muir** remarked that "the hills have been cut and scalped and every gorge and gulch and broad valley have been fairly torn to pieces and disemboweled, expressing a fierce and desperate energy hard to understand." Likewise, in his 1868 survey of California's natural resources, author Titus Fey Cronise lamented the havoc the mines had caused:

> *By no other means does man so completely change the face of nature than by this process of hydraulic mining. Hills melt away and disappear under its influence. . . . The desolation that remains after the ground, thus washed, is abandoned, is remediless and appalling. The rounded surface of the bed rock, torn with picks and strewn with enormous boulders too large to be removed, shows here and there islands of the poorer gravel rising in vertical cliffs with red and blue stains, serving to mark the former levels, and filling the minds with astonishment at the changes, geologic in their nature and extent, which the hand of man has wrought.*

The expanding ecological disasters caused by hydraulic mining did little to slow down operations, despite the constant complaints of farmers and valley landholders. Industrialists were not unaware of the resulting conditions, and certainly the profits produced for them by the exploitation of gold and other resources outweighed any concerns during the 1850s and 1860s. The mining companies also had far too much political influence for any complaints from

farmers or land holders to take effect. It took many sessions of the California state legislature and the U.S. Congress before any regulations were put into place. Even then, the regulations were largely ineffectual until 1884 when a federal injunction finally put an end to hydraulic mining. It has been estimated that nearly one third of the gold extracted during the Gold Rush era, approximately $100 million worth, was extracted by hydraulic mining.

Glossary

Industrial Revolution: a series of economic, social, and technological changes, characterized by the replacement of hand tools with power-driven machines, the growth of factories, and the mass production of goods.

John Muir: (1838-1914) American environmental philosopher, author, and early proponent of wilderness preservation. Founder of the Sierra Club, a prominent conservation organization.

long tom: a trough for washing gold-bearing deposits.

placer mining: the mining of placers, or mineral deposits, in a stream or river bed for precious metals such as gold.

sluices: long inclined troughs with strips of wood or metal laid perpendicular to the trough so as to catch the gold during mining operations while allowing the water and debris to slide down the trough.

washings: excess mining material, including gold dust, gravel, and other minerals; essentially the debris and refuse from mining operations.