

Chapter 8
The Business Of Mining:
Challenges of Deep-Lode Mining, Working Bonanzas at Belcher & Crown Point

As the Comstock shifted from placer mining to lode mining, miners had no manuals or maps to consult on how to proceed. Some had experiences as quartz miners in California or elsewhere, and some had training in fields of science and engineering that were related to mining. They could apply the knowledge that they brought with them, but they had to move quickly and decisively beyond that fairly limited information base if they were to succeed. To be successful in exploiting the Comstock's riches they had to become quick learners and risk takers. The Comstock hid its valuable minerals in places and under circumstances that could not be divined from the surface markings. So many stories can be told about the Comstock, and even though the financial shenanigans have often supplied so much of the material for its modern histories, the retrieval of the ore may well be the Lode's real story. These became the deepest mines in America with tunnels, drifts, upraises and winzes that covered hundreds of miles. The deeper mines, the higher the temperatures, the greater the risk of flooding from scalding water and the poorer the ventilation. Perhaps the most remarkable underground accomplishment was the Sutro Tunnel, a four-mile-long tunnel from the Lode to the Carson River through Six Mile Cañon to drain the mines as well as to extract any ores found during its construction. No less impressive were the erection of huge mills with giant machines for refining the ores, the construction of roads and rails across steep, rugged terrain and the installation of a system to supply potable water from the Sierras. But the first order of business was to find and extract the ores.

By the middle of the 1860s surveys and maps of Comstock began to appear in print. The configuration of claims and boundaries along and around the Comstock Lode certainly looked different from 1859 and 1860. The consolidation of mining claims had accompanied the arrival of mining companies. The first (documented) official inquiry of the State's mining industry appeared as part of Surveyor-General S. H. Marlette's report to the 3rd Legislative Session in 1867.¹ He had compiled as comprehensive a list as possible of mining and milling operations throughout the state along with other information on roads, water resources and related geographic and topological concerns. Much of the report focused on the Comstock and the mining and milling operations that had been set up in Storey County and surrounding counties. It is worth recalling at this stage that the Comstock Lode was a quartz formation with outcroppings along the base of Mt Davidson from the northern edge of Virginia City to the southern edge of Gold Hill, a distance of several miles. At both ends the Lode forked and eventually terminated. Underground the quartz formations angled from the footwall at the base of Mt Davidson eastward toward an edge known as the hanging wall. The distance that the Lode angled away from the footwall toward the hanging wall was as much as 1,000 feet. The Lode may have had a surface area of more than a million square feet, but the surface area of the productive mines was only a fraction of that total figure. And yet mining claims were staked across the entire Lode and beyond for many miles on the assumption that the region was filled with quartz formations. A few of these outlying properties produced

¹ Beginning in 1867, the Legislature would meet in January every two years.

profitable ores, but most of them occupied barren ground. The Lode was located in Story County except perhaps for a small section that spilled over into Lyon County at Silver City south of Gold Hill. The terminus on the southern end was a matter of dispute. Two Tables appear in Marlette's report: a Table, entitled "Mines on the Comstock Lode", identified all the mining properties from the northern end (in Virginia City) and to the southern end (in Gold Hill) all within Story County; an accompanying Table, entitled "Tabular List of Mills Crushing Ore from Mines on the Comstock Lode During the Year 1866", identified the mills not only in Story County but in adjacent counties since Comstock mines sent ores to mills in Lyon and Ormsby Counties to the south and Washoe County to the west. The mill data will be treated later in this chapter.

In 1866 the Surveyor-General assembled a list of 43 mines on the Comstock Lode. His list included the length in feet along the Lode that each company or miner claimed. The average length was 513 feet, but the median was only 210 feet. A distribution by frequency shows that 17 claims or 40 percent had 100 feet or less, 12 claims or 28 percent had between 101 and 500 feet, 7 claims or 16 percent had 501 to 1,000 feet and another 7 had 1,001 feet or more. The longest claims belonged to Baltimore American (2,600 feet) and North American (2,000), both on the upper branch of the southern tip. The next longest claim of 1,959 feet was Sierra Nevada on the northern end, although the Surveyor-General's footnote indicated that it was originally 3,000 feet. At the core of the Comstock (in Virginia City proper) the following mines had claims of significant lengths: Chollar Potosi with 1,434 feet, Ophir 1,400 and Gould & Curry 1,200. The remaining claims in both Virginia City and Gold Hill fell between 10 feet (Plato) and 1,000 feet (Utah). Some of the smallest claims (under 100 feet) were located in the northern part of Gold Hill between Virginia City's border and Gold Hill's Yellow Jacket on the southern end. Disputed claims were also noted. Gould & Curry claimed Best & Belcher's 222 feet while at the same time Best & Belcher and Sides claimed 279 feet of Gould & Curry (222 feet and 57 feet respectively). The Surveyor-General also thought the claims of Baltimore American and Overman (1,200) were doubtful. (He may have meant to include North American as well.) The total of all 43 claims was more than 22,000 feet. A crucial statistic - width - was not given.²

While the Surveyor-General could identify 43 mining properties, he could only account for 22 producing mines among the 43. That they were not productive in 1865 or 1866 did not mean that they had not been productive or would not become productive. When one recalls that hundreds of claims existed on and around the Comstock, one soon realizes that at a time Comstock registered about \$12 million in bullion two-dozen mines made that possible. Should this have troubled the mining or investing community? Five years after the initial discoveries the grand forecasts from pundits to speculators had little grounding in reality. It was improbable that the Comstock was at risk of being closed down soon, but it was becoming less and less probable that under Story County lay a vast uniform body of gold and silver ore. The two most productive mines in terms of bullion per ton were of medium size and contiguous properties in Virginia City's center: Hale &

² "Annual Report of the Surveyor-General...1866" in *State Journal and Appendix*, 3rd Legislative Session (1867), Tables are inserts between p. 21 and p. 25 and between p. 26 and p. 29. See p. 29 for a reference to North American.

Norcross at \$46 per ton and Savage at \$45 per ton.³ The majority of productive mines were producing ores that had yields that were not even half as large as those figures. Although not yet fully apparent the consolidation that had occurred since 1860 would simply intensify in the coming years.

How miners went about their business was a subject of interest to various state officials but especially to the State Mineralogist. Richard Stretch was appointed to the position in 1864-1865. From 1865 through 1870 Asa White served as Mineralogist (by appointment), and he and his successor, Henry Whitehill, who was elected rather than appointed, provided the Legislature (as discussed earlier) with long reports, county by county, on mining conditions as well as general demographic and economic conditions. Beginning with the 4th Legislative Session in 1869, (covering two previous years, 1867 and 1868) the State Mineralogist rather than the State Surveyor-General reported to the Legislature on mining operations. This continued until 1879 when the 9th Legislative Session abolished the office of the State Mineralogist as a cost-cutting measure. In his first report, White, formerly a member of the team of geologists and surveyors under Clarence King of the States Geological Service, described Story County as a “broken and barren” territory that just happened to contain the Comstock Lode, a “universal notoriety”. He described the topography and the geology much of which had been worked in the previous years by various investigators. The vein was contained in a fissure that ran three miles from 5,800 feet in Gold Hill to 6,200 feet in Virginia City. It was located between sienite (syenite, also known as silica-poor granite), a plutonic igneous rock on the west side of the Lode toward Mt Davidson and propylite, a crystalline igneous rock on the east side away from Mt Davidson. The propylite (which miners also called porphyry) lay against the Lode for its entire length, and from the surface it dipped 45 degrees to the west (toward Mt Davidson), gradually became vertical and then at about 400 feet dipped 45 degrees to the east. In some mines, Overman for example, the eastward dip was 70 degrees. The propylite was not regular in its formation – alternating between nearly vertical to nearly horizontal – and could change its direction suddenly. On the surface the fissure that contained the vein was measured as 500 feet in width, but underground the walls appeared to be “constantly approaching and receding [toward and from each other] without regularity.” The structure of the fissure on the southern end was different from the northern branch. At the time that report was written more was known about the underground structure on the southern Lode because more discoveries had been made there. Also the miners had not explored much beyond the 500- to 800-foot level so that the structural changes at 1,000 feet and below still awaited them. White observed, as had others, that the richest underground deposits lay against the east wall but that between 400 and 800 feet the size and number of these bodies decreased. Worrisome to White and the mining companies was the fact that so much of the vein was barren of profitable ores after 100 to 200 feet across the entire Lode. So extensive were these barren areas, wrote White, “that constant explorations are necessary to sustain the supply of ore...at heavy cost.”⁴

³ “Annual Report of the Surveyor-General...1866,” in *Senate Journal and Appendix*, 3rd Legislative Session (1867), Table following p. 21.

⁴ White’s appointment as State Mineralogist took effect 1 March 1869, even though he presented his first biennial report to the Legislature that met between 4 January and 4 March 1869. “Biennial Report of the State Mineralogist of the State of Nevada for the Years 1867 and 1868” in *Senate Journal and Appendix*, 4th

Although output had increased between 1865 and 1869, when White rendered his report to the Legislature's biennial session, it had been a difficult period for many companies. The ore bodies with major outcroppings, of which there were about a half dozen, had been mainly exhausted. What was both puzzling and disconcerting to the miners were the long stretches of barrenness as they probed the ground below shallow ore bodies. Bonanzas found since 1859 had proved to be rich but of short duration. White reported that companies were pursuing two different strategies, both with some success. Shallower levels, thought to have been "worked out", were being rehabilitated and were yielding some low grade but modestly profitable ores. The second strategy was to deepen the search. Not entirely certain or clear how to proceed below 500 feet companies were dropping shafts from various surface locations in hopes of reconnecting with mineral-bearing sections of the Lode that for all intents and purposes was being squeezed out 500 feet and below. Shafts were being driven to 800 feet, 1,000 feet and even 1,200 feet in an effort to relocate the vein. Eventually this approach began to pay off. The largely barren ground between 500 and 1,000 feet resulted from a shift in the Lode to the east toward the hanging wall. As the shafts grew deeper and the tunnels longer, miners faced numerous and constant challenges in building the underground infrastructure. Rock formations changed, ranging from very hard (known as "country" rock and similar to what constituted the footwall) to soft, sugary porphyry, and interspersed with clay. It was not uncommon for a superintendent's weekly report on the progress inside the mine to describe on one day how miners were working in hard rock and on the next day how they were working in porphyry or clay. With experience miners became more adept at "reading" the rock structure with respect to location of ore, although their expectations were not always borne out. On the positive side, as the miners invaded the ground between 500 and 1,000 feet, they encountered less water than they had above 500 feet, but on the downside they had to contend with temperatures of 100 to 110 degrees.⁵ Puzzling though the Lode was for miners in the middle 1860s sufficient quantities of ore were being found or lifted to make the search worth the investment and the risk. It would be incorrect to assume that extractable ores ceased to exist below 500 feet (or thereabouts); rather extractable ores on the scale of the earliest bonanzas more or less terminated until the miners had made a necessary eastward shift in their explorations to locate the next bonanzas.

Reports by mining-company superintendents to their stockholders and quoted liberally by White illustrate what had to be done in the search for ore, a search that had no assurance of success. At Chollar Potosi Isaac Requa informed his directors and stockholders (June, 1868) that for the previous year work had been concentrated at 352 feet "from the surface."⁶ The area being worked was about 270 feet in length northeast to

Legislative Session (1869), 22-23.

⁵ "Biennial Report of the State Mineralogist...1867 and 1868" in *Senate Journal and Appendix* 4th Legislative Session (1869), 23-24.

⁶ Where work was being carried out underground can be confusing. Sometimes, as in this example, the reference was to the distance from the surface. In other examples the reference could be to a specific level, such as the 350-foot level, based on a measurement from a surface point (known as A) on top of Gould & Curry's mine. Since the Lode dropped by about 400 feet from Virginia City to Gold Hill, miners in the latter camp had several hundred fewer feet to work through in order to reach a comparable Gould & Curry

southwest and about 70 feet wide east to west. Equally important was the fact that from point where the rail had been installed at 352 feet the ore body extended *up* (not down) over 100 feet. As Comstock miners were quickly learning from experience, a body of ore did not always have uniform grades. The body described by Requa was richest in the center and less so on the edges. It was mined for 10 months and then abandoned in February 1867. From here to the southern boundary the company had 600 feet of unexplored ground. A drift to the southern boundary was cut, and cross-drifts about 140 long were also cut at various intervals. Unfortunately very little millable ore was found in this large quartz structure. The vertical shaft was extended until it was more than 800 feet below the surface where it crossed a vein about 3-foot thick. The vein dropped for about 40 feet and then disappeared. At the 850-foot level 700 test drillings were made with no positive results. The vertical shaft was dropped another 100 feet and from there an incline shaft was cut to the 1,000-foot level and then to the 1,100-foot level. Between the 850- and 1,100-foot levels the company had almost 250 feet of ground to prospect. His summary for the year (to June 1868) was that almost 5,500 feet of drifts and winzes had been cut and more than 500 feet had been added to the vertical and inclines shafts. “Without seeming to predict what may lie in the unexplored section to the east,” Requa was optimistic that the signs (without actually specifying them) pointed to major deposits at the depths now being explored.⁷ Sadly Chollar Potosi would find nothing at the 1,000-foot or 1,100 feet level or lower. In the course of a year after its only major ore body had been exhausted a few hundred feet from the surface, Chollar Potosi would add thousands of feet of underground works with barely anything to show for it.

Chollar Potosi’s neighbor, three properties to the north, Gould & Curry, did not fare much better. Its Bonner Shaft had reached 910 feet “from its mouth” or 1,100 feet “below the outcroppings” (the difference being explained by taking into account the grade from where the outcroppings were to where the shaft had been built). Most of the explorations during 1867 had occurred around the fourth station between the 400- and 500-foot levels. Drifts measuring hundreds of feet were constructed along the length and the width of the claim at this station quartz material through mixtures “of quartz and porphyry, without ore.” At deeper stations, the fifth and the sixth (at approximately 500 to 600 feet below the surface), Louis Janin jr., the superintendent, wrote: “No sign of ore was met with” and no trace of ore was found. Despite these less than promising prospects the company planned to explore the lower reaches much as they had explored the area

level: the 500-foot level at Gould & Curry was about 100 feet from the surface in Gold Hill. At 352 feet below the surface, as Requa reported, the level as measured from Gould & Curry would only be a few feet less. Unfortunately it is not always clear from the reports whether the reference is to distance from the surface or to the level in feet as measured at Gould & Curry. I have tried to maintain as much precision as I can when these references are used. When I refer to a level number hyphenated with foot, such as 500-foot level, I am referring to the measurement from the Gould & Curry Point A. When I use 500 feet, I am referring to the distance from the surface (often I add “from the surface”). The problem is that the sources that I have consulted, such as company records or Smith and Eliot or even the *Territorial Enterprise*, have to be interpreted at times as to whether the reference is from Point A or from the surface. The maps and surveys in Becker, *Atlas*, usually include both numbers, the Point A number appearing in brackets.

⁷ “Biennial Report of the State Mineralogist...1867 and 1868” in *Senate Journal and Appendix* 4th Legislative Session (1869), 25-26.

around the fourth station. What would eventually become obvious was that Gould & Curry was basically barren below 500 feet.⁸

FIGURE 1
VIEW INSIDE COMSTOCK MINE



White had good news to report from the southern end of the Comstock Lode. It had rich, abundant ores between the 500- and 900-foot levels (200 to 500 feet under the surface) and even richer deposits yet to be discovered between 1,000 and 2,000-foot levels. For the year ending 1868 Crown Point's Superintendent T. G. Taylor reported that the ore at 500-foot level "pinched out in porphyry: 76 feet above and 33 feet below that level. But then at the 600-foot level about 150 feet from the shaft the workers cut through clay to find a new ore body. It was as narrow as three inches and as wide as 14 feet and resided between the 500- and 700-foot levels. This was known as the "west body", and a few months later the "east body" was discovered between the 600-foot and 800-foot levels. In addition at the 800-foot level two seams about four feet thick of valuable ore were found between the east and west bodies. Taylor indicated that the extent of the discovery at the 800-foot level had not been fully ascertained. Actually this ore body would dip away into the adjoining property, Kentuck, and what Taylor did not yet know was that 200 feet deeper Crown Point would open a true bonanza. Whereas the reports of the companies above referred to the construction of long, expensive tunnels from their main shafts through largely barren ground between 500 and 1,000 feet, Crown Point by contrast found ore in almost every direction from the main shaft. Despite the knowledge gained about the structure of the Lode in a decade of mining finding the next bonanza was almost as much the work of the wizard as the expert.⁹

White summed up the structure of the Comstock, as then understood having reached depths of 1,000 feet. First the country rock of the west wall dipped with

⁸ "Biennial Report of the State Mineralogist...1867 and 1868" in *Senate Journal and Appendix* 4th Legislative Session (1869), 26-27.

⁹ "Biennial Report of the State Mineralogist...1867 and 1868" in *Senate Journal and Appendix* 4th Legislative Session (1869), 24-25. Other Gold Hill mines were also reporting favorable discoveries below the 1,000-foot level. Imperial had ore that yielded about \$40 per ton, and Yellow Jacket was lifting ore from a vein about 40 feet thick on the Lode eastern wall. A less favorable sign was that Imperial had also discovered a huge underground pool of water. (p. 31)

regularity at an angle of 45 degrees. Some low-grade ore lay against that wall. Second the propylite rock of the east wall dipped first 45 degrees to the east, and then at 400 feet became vertical and finally it turned eastward at 45 degree with the fissure at that point being about 125 feet wide between the west and east walls. It was now generally understood, according to White that the great ore bodies, if they existed, would be found along the east wall, sometimes with and sometimes without clay linings. Third the surface, while it had some rich outcroppings, was actually “split and covered” from rock slides and other seismic activities over time so that the outcroppings were episodic and would disappear into nearly barren quartz ground below. Finally he noted that the composition of the vein changed from the surface to the depths now being worked. Gold was more abundant on the surface than silver and then for 200 to 300 feet it virtually disappeared. At the depths discussed in the reports of the companies both gold and silver were becoming abundant again.¹⁰

After considering and summarizing various company reports White added an interesting comment concerning a new discovery. He reported that “about a mile and a half or a little more east of Virginia City” (more precisely east of Gold Hill) “a ledge crops out in places and is parallel with the Comstock.” The most important mine was Occidental (which appears on later surveys and maps), and the ores both gold and silver yields profits of \$6 to \$8 per ton. To find an ore ledge that far away from the Comstock Lode was what many Comstockians had dreamed of if not begged for. The venture came to naught. Occidental (which included a mill) will appear in the public record from time to time, but the potential of a second ledge soon passed from public view.¹¹

The reserved but modestly upbeat evaluation of White in 1869 assumed more positive tones at the hand of the new mineralogist, Henry R. Whitehill, a Republican first elected to the office in 1871. And for good reason. Whitehill could legitimately record that the Comstock had given birth since 1869 to several true bonanzas, unlike anything experienced before. And this simply brightened the prospects for the future. Following a format developed by his predecessor Whitehill described general economic and demographic conditions county by county before turning his attention to the state of mining. Most counties had some mining, but Storey County was certainly the heart of Nevada’s mining sector. Even the counties surrounding Storey benefited from the Comstock mines. His description of deep Comstock geology was understandably more detailed than White’s because more was known by the time he was writing. When he was preparing his report, presumably in late 1872, some mines had already reached 1,700 feet. He likened the fissure to a channel filled with ore bodies shaped like eggshells and while they were not continuous they could still be massive wherever they were found. He explained that during the volcanic period in which the Lode was formed hundreds of vents within the fissure spewed forth “solfataras”, hot vapors and sulfurous gases that eventually filled the area with metal-bearing quartz. Other events combined to introduce

¹⁰ “Biennial Report of the State Mineralogist...1867 and 1868” in *Senate Journal and Appendix* 4th Legislative Session (1869), 27-28.

¹¹ “Biennial Report of the State Mineralogist...1867 and 1868” in *Senate Journal and Appendix* 4th Legislative Session (1869), 32. These comments were contained in a section dealing with “Diagrams of the Mines...” White underscored the importance of the surveys being prepared by Clarence King with the assistance of White’s predecessor, Richard Stretch.

metallic materials and then to solidify and crush the quartz. The solfatara process eventually came to a close. That miners had encountered hot water at the lower depth suggested that “at no very great depth, a considerable temperature is still maintained... but...only a faint relic of a once intense action.” The western (foot) wall dipped to the east, as others had reported, but at varying angles of 35 to 53 degrees, according to Whitehill. The east wall (hanging), although ill defined in structure, dipped west for several hundred feet and then both walls dipped east at 45 degrees. The space between the two walls collapses to a few feet and expands to several hundred feet. In these spaces, of course, resided the ore bodies. The fissure that contained the vein consisted of billions of cubic feet, and although much of it was barren of ore still tens of millions of cubic feet of ores.¹²

Whitehall made note of the fact that the earliest shafts were driven through the outcroppings near the footwall on the assumption that the vein below inclined toward the west. That was true for several hundred feet after which the vein dipped east, as noted earlier. At about 400 or 500 feet these shafts ran into the west wall that was hard sienite rock and actually below the vein at that level. (Sienite [syenite] is a hard, crystalline rock, allied with granite and composed mainly of hornblende and feldspar with or without quartz.) The presence of the sienite was convincing evidence to the miners that the structure was different from the soft material that had surrounded the ore veins closer to the surface. Within a few years Ophir Mining Company ran out of profitable ore under the original outcroppings on the Lode’s western slope. At 300 feet the vein began to grow narrower and shorter and soon disappeared into worthless porphyry.¹³ But even before the demise of Ophir’s bonanza the Gould & Curry Company, a half-dozen properties to the south of Ophir, had made a discovery that would shape the future of Comstock mining. Gold & Curry under its new San Francisco-based owners, who were unimpressed with poor results and limited prospects at its western outcroppings, decided to move 1,000 feet away from the west wall. At about 100 feet below the surface the new Gould & Curry ran into a rich ore body. What they had dug was more of an adit or tunnel rather than a shaft. It was driven into the side of the eastern slope of the Comstock Lode, but like rest of the companies it too eventually had to drop a vertical shaft. Many of these early shafts were sunk along D Street in Virginia City itself. Gould & Curry’s discovery of an ore body along the eastern slope had long-term implications for accessing and exploring the Lode as well as how the city grew. The future lay not in further explorations of the western slope but in expanded explorations of the eastern slope.¹⁴

The Comstock underground grew into a honeycomb of horizontal and vertical structure. How many miles of shafts, tunnels, drifts, winzes, etc. were eventually constructed will probably never be accurately known, but surely the total was in the hundreds. Even as the miners became better acquainted with the Lode basic outline, they could not predict very well the location of the profitable ores. Thus, much of the underground system was built for exploration rather than exploitation of the ore bodies.

¹² “Biennial Report of the State Mineralogist...1871 and 1872” in *Appendix to Journal of the Senate*, 6th Legislative Session (1873), 122, 124-125.

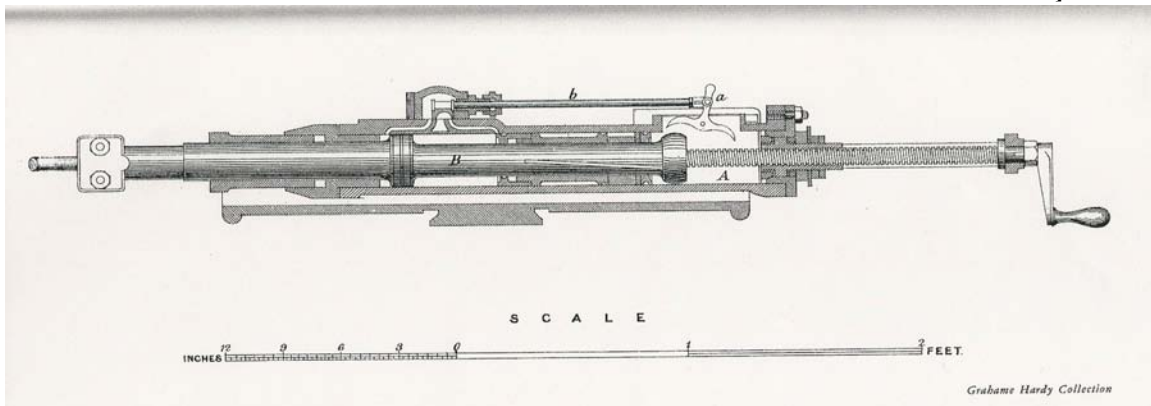
¹³ Smith, *The Comstock Lode*, 81.

¹⁴ “Biennial Report of the State Mineralogist...1871 and 1872” in *Appendix to Journal of the Senate*, 6th Legislative Session (1873), 124-125; Smith, *The Comstock Lode*, 84.

And that of course raised the cost of deep, underground mining. Once ore bodies were located even at the shallower depths of several hundred feet their size and composition posed immediate problems. The ore as well as the surrounding materials such as porphyry and clay could be soft and incapable of carrying the weight of the ground above these giant cavities. In Spanish America natural pillars fashioned from the ore bodies themselves were common. On the Comstock the workings were so large that natural supports failed. So too did early wooden props. Timbers spliced together to hold up the ceilings or hold back the walls were bent or crushed under the weight. The invention of the square-set framing system by the German engineer and California miner, Philipp Deidesheimer in 1860 more or less saved the day for Comstock mining. These were squares of timbers, approximately 6 feet by 6 feet that could be placed on top of each other or side by side for any reasonable distance. This system was introduced in the Ophir Mine and soon spread to other mines. The arrangement of the frames helped to spread the weight across the entire structure.¹⁵ Even the square-set system could fail, and companies had to be vigilant in how the frames were constructed both as the depth of the shafts and the size of the cavities increased. Supporting the ever-deepening shafts posed problems that the square-set frames could not solve. Since shafts passed through soft ground, that ground could cause the shafts to expand and contract to such a degree that hoisting operations had to be stopped until repairs could be made. Some shafts were so inappropriately located or badly constructed that they had to be abandoned and replaced.

**FIGURE 2
BURLEIGH DRILL**

**[DEBATE ABOUT WHEN FIRST INTRODUCED; WIDE-SPREAD USE BY THE MID-1870S.
MODIFICATIONS OVER TIME. OPERATED WITH COMPRESSED-AIR UNIT]**



By the 1870s, however, Comstock mining benefited from other late-nineteenth-century technological revolution. Such improvements as Cornish Pumps, Burleigh Drills, wire ropes, metal hoisting cages and of course dynamite all entered the miners' arsenal for conquering the depths of the Comstock. The engines that drove the cages in the shafts or pumps in the mines reached horsepower of several thousand, and each required scores of cords of pine and fir each day. These engine also operated the compressors that drove the power drill that could triple the amount of rock and ore to be excavated in a single

¹⁵ Lord, *Comstock Mining and Miners*, 89-90; Smith, *The Comstock Lode*, 23-24.

days.¹⁶ All of this came at some cost, not only to purchase the equipment but also to install, operate and maintain it. Without mechanization deep mining along the Comstock would have developed more slowly if at all. An attribute of the technological and industrial revolution in late-nineteenth-century America was that bigger and faster machines were simply a matter of time and application. In his 1875 legislative report included a reprint from the *Virginia Enterprise* with the heading of “Going for the Bottomless Pit”. The Savage Mining Company had ordered steel-wire ropes from John A. Reehling’s Sons in Trenton, New Jersey, and engines to raise and lower the rope from Booth and Company of the Union Iron Works in San Francisco in order to reach the 4000-foot level, twice the depth that current machinery was servicing. Other mining companies – Crown Point, Hale & Norcross, Consolidated Virginia and Ophir – were also preparing to launch similar assaults with bigger and faster machines. Notwithstanding the fact that barren ground characterized much of what was being explored at the 2,000-foot level, even for the bonanza mines, the *Virginia Enterprise* could not resist a rhetorical flourish: these companies “will at once plunge down into the great unknown ‘depths profound,’ in which lie hidden the silver roots of the Comstock.”¹⁷

Over time through trial and error miners had developed certain underground procedures for opening, managing and securing underground operations. Nothing could be done to neutralize absolutely the risks. Whitehall was impressed with some of the efficiencies that had evolved. Extractions were easier if ores lay above the tunnel. An upraise could be dig to the wall of ore above and then as workers cut their way through the wall they could drop the ore and the residue onto the floor or into cars below. The cars were then placed on a platform, usually surrounded by a cage and lifted to the surface. From there the cars were directed to ore bins or to waste dumps. The cars could carry up to a ton of ore or waste. Tunnels connected to the shafts every few hundred feet and usually tunnels were designated in the foreman’s journals or the company’s account by their depths such as the “1,000-foot level” or the 1,500-foot level”. The tunnels themselves could snake for hundreds of feet underground, and tunnels on different levels were connected by upraises and winzes. Some tunnels were abandoned because they lacked profitable ore or encountered unstable ground, while others in use for years were routinely retimbered, enlarged and refurbished to accommodate more workers and machines. In addition, of course, other tunnels had to be dug to provide air and remove water. Water, often very hot water, was a constant threat. It often lurked behind a clay wall that separated ore bodies or marked the terminus of a vein and could be breached in the course of following the vein. Greater depths meant higher temperatures (110-120° F), and tons of ice had to be transported to the lowest levels every day and administered to the workers. This is but a general description of the Comstock’s underground city. More will be revealed as we examine individual companies. The business of mining, deep mining as it were in the case of the Comstock, involved construction and maintenance on a grand scale in order to extract the wealth that was being sought.

¹⁶ Lord, *Comstock Mining and Miners*, 335-337, especially footnote 3; Smith, *The Comstock Lode*, 46.

¹⁷ “Biennial Report of the State Mineralogist...1873 and 1874” in *Appendix to Journals of Senate and Assembly*, 7th Legislative Session (1875), 124.

Above ground another mechanized world was emerging. The heart of it was in the municipality of Virginia City, the seat of government and commerce, and for a while one of Nevada's largest cities. In addition to offices, stores and homes, though, Virginia City was becoming an industrial city. Ore had to be processed and treated before it became gold and silver bullion. Two basic processes existed: smelting in which the impurities were cooked away and amalgamation in which mercury was combined with the ore to draw out the metals. Bartolomé de Medina had invented amalgamation in Mexico in the middle of the sixteenth century. The composition of New World ores including those found in Nevada made amalgamation the preferred refining method. By the nineteenth century the mill or refinery had evolved from a simple operation that had the appearance of an outdoor patio to a mechanized process inside what was a factory. As the boom unfolded along the Comstock companies spent millions in building ever-larger mills to process what was thought to be a never-ending supply of ore. Some contained the latest technology imported from European mining centers. Mills were scattered throughout the county and in the adjoining counties. But within the boundaries of the city itself some of the largest and most mechanized would be built. The ore had to be ground and treated before being combined with the mercury and other chemicals. After being "amalgamated" for a period of time the mercury had to be evaporated (cooked off), the metals fashioned into ingots and prepared for shipment to the mint. Photographs from the last quarter of the nineteenth century reveal a city in the mountain desert with a fashionable opera house, grand mansions and huge mills. Like an Escher print the structure has a flow from the harshness and severity of the underground natural world to the triumph of progress and order above ground.

While mining was the engine that drove the local economy, commerce, finance and transportation were fuel lines that feed the engine. The Comstock was virtually inaccessible until roads and then a railroad were constructed. Almost everything had to be imported: timber for the mines, water for the mills, food for the citizens, finery to dress the opera-goers and capital to find and process the ores. Mining centers throughout Latin American had a similar hustle and bustle arising from a less than permanent foundation. Story County, as more than one public official had reported, had nothing to recommend it for settlement, not even a supply of water except for the Truckee River on its northern edge. One could have said the same thing about Potosí in Bolivia and Zacatecas in Mexico. Location made travel and transportation to and from the Comstock unpredictable until the Geiger Road was finished and perhaps more importantly the Virginia & Truckee Railroad. With nothing being produced locally everything to maintain the life and business of the city and county had to be imported. Even the water was piped in from higher ranges around Lake Tahoe. The completion of V&T Railroad, known as the "crookedest railway in the United States", that first connected Virginia City with Carson City and later with Reno was hailed as both a technological triumph and an economic necessity. Although it cost about \$100,000 a mile to build, financed largely by Story and Lyon County bonds and mining company contributions, V&TRR soon justified its cost at least with respect to local commerce. The tracks apparently on some days handled between 30 and 40 trips per day, but that seems high for an everyday occurrence given the technology. Certainly the route was well used. Trains might carry as much as 1,000 tons of ore from the Comstock to the mills and mints and as much as 5,000 cords of wood

to the city. The trains also featured luxury accommodations for travelers and visitors, such as President Ulysses S Grant in 1878.¹⁸ Some nearby counties lacked huge ore deposits and the instant wealth that they engendered, but if they had land that could be farmed or other natural resources such as forests that could be harvested they too could participate in the Comstock boom.

The decade of the 1860s chalked up some major discoveries, but none of these had the makings of a true bonanza. Close to \$90 million worth of ore had been pulled out of the Comstock with the mines on the center of the Comstock – Chollar Potosi, Savage and Gould & Curry – having produced about half of the total. Some sections of the Lode had high-yielding ores, say \$30 per ton and above, but much of what had been assayed was of moderate or poor quality. Although mining officials and stock speculators continued to portray the Comstock in the most positive terms – that rich ore bodies were within reach – the decade was one of many unfulfilled promises. Extraction costs were on the rise, and reduction costs even with more efficient mills remained high. The great blank underground spaces were hardly encouraging. (And companies' extravagances plus speculators' manipulations only further clouded the financial viability of Comstock mining.) The Comstock could become a footnote rather than a headline in Western mining history.

A major discovery on the Lode's southern end kept the Comstock in the headlines. It was in Gold Hill where the early placer miners had been so active. As prospectors had tramped around Gold Cañon, north of Silver City, they had recognized the possibility that a "yellow hill" about "60 feet in height and nearly 500 feet long" in the upper Gold Cañon might be worth investigating. The "yellow hill" was not lost on James Finney, a long-time prospector who despite his bluster was as skilled a placer miner as anyone. In January 1859, Finney and his friends began to prospect on the hill, and they found gold worth about 15 cents a pan, "a fair prospect". They made placer claims of 50 feet long and 400 feet across, and they named the area Gold Hill. Days later another group including Henry Comstock laid claim to adjoining land. In the spring after the snow had receded the placer miners had discovered a quartz vein about 10 feet below the surface. This can be treated as the "official" discovery of the Comstock Lode, although writers over the years have offered variations on the theme of who discovered "what and where". This quartz discovery on the Comstock's lower end in contrast to the quartz discovery on the upper end in June, discussed earlier, was that the Gold Hill discovery remained a placer claim. In any event these discoveries by placer miners that yielded about \$20 per day were soon overshadowed by events on the Comstock's upper end.¹⁹ As we enter the Comstock's second decade the action will return to the southern end with the bonanzas at Belcher and Crown Point, two neighboring mines.

¹⁸ "Biennial Report of the State Mineralogist...1873 and 1874" in *Appendix to Journals of Senate and Assembly*, 7th Legislative Session (1875), 80.

¹⁹ Smith, *The Comstock Lode*, 2-5, 13-14. As is well known, Finney's nickname "Old Virginny" for his home state of Virginia, became the basis for the place names of Virginia Hills and Virginia City, and Comstock, who apparently spent a lot of time riding a bedraggled mule around the countryside, will lend his name to the lode for reasons that were barely connected to mining at all. Regardless of how names got attached, Comstock mining to be understood got its start on the southern end of the lode in Gold Hill.

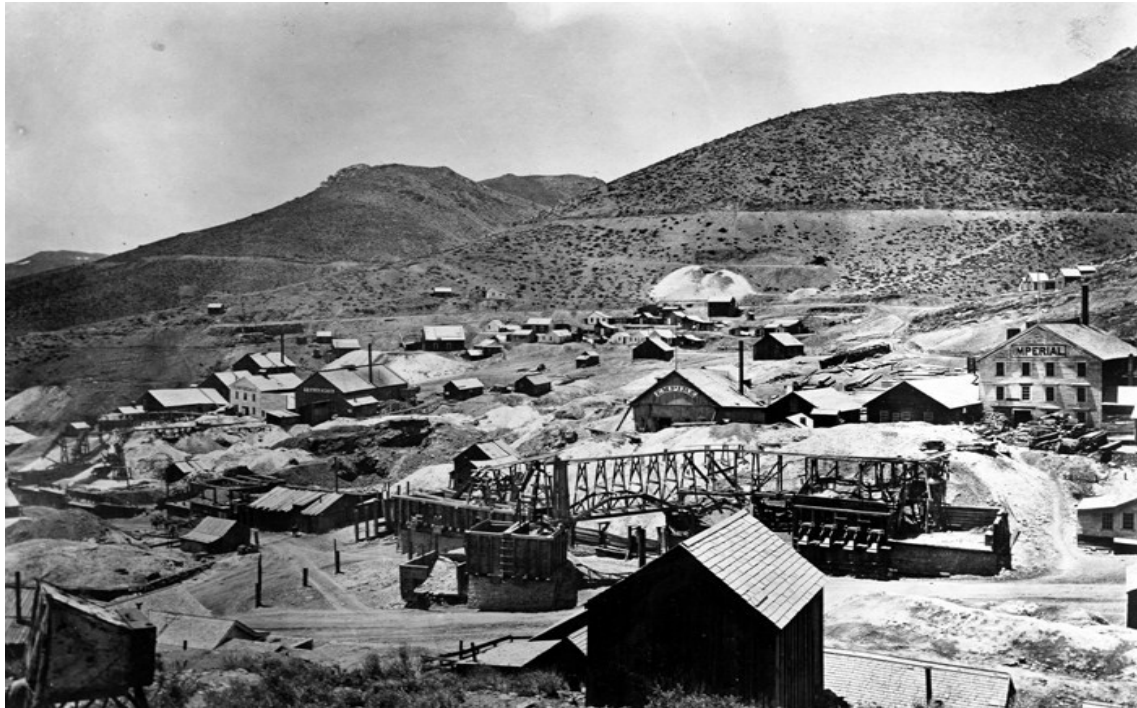
The southern end had not been devoid of activity in the 1860s. The Imperial mine had opened on a Gold Hill quartz claim in 1859, and for a few years it produced about \$2.5 to \$3.0 million dollars. In the early 1860s small to moderate ore bodies, more or less above 500 feet, had been exploited at Belcher, Crown Point, Kentuck, Yellow Jacket and one or two other properties. Belcher's operations began in 1863 and Crown Point's in 1864, and as operating mines they would continue with a few interruptions until 1884 (and beyond). But it was the discovery of a large and rich ore body, shared by the two claims, from the 1,000- to the 1,500-foot levels in 1870 that saved the Comstock from a premature death. Up to 1870 Belcher had worked a small vein of ore several hundred feet below the surface and worth about \$2 million, while Crown Point had worked two different bodies (which it shared with Yellow Jacket on the north) worth about \$4 million. Over the life of these two mines from the mid-1860s to the mid-1880s we can estimate the total tonnage from Belcher was in excess of 800,000 tons worth about \$35 million and from Crown Point over 900,000 worth about \$29.²⁰ The yields per ton were calculated at \$44 per ton for Belcher and \$32 per ton for Crown Point. If we look at the most productive years – 1871-1875 – Belcher's per-ton yield was \$55 on 547,000 tons worth \$30 million and Crown Point's per-ton yield was \$39 on 638,000 tons worth \$25 million. Prior to 1871 Belcher was regarded as virtually worthless having produced very little profitable ore. Crown Point in contrast had shown more promise yielding up several million dollars in bullion. After 1875, while both continued to register bullion through 1884, Belcher's yield per ton fell to \$22 on slightly more than a total of 200,000 tons and Crown Point's yield dropped more sharply to \$14 on similar tonnage.

At the aforementioned per-ton yields Belcher and Crown Point made money for their stockholders. From 1870 and 1878 Belcher paid out \$14.9 million or 47 percent in dividends and Crown Point \$5.3 million or 20 percent. As the dividends suggest Belcher was a far more productive mine than Crown Point. For the four best years Belcher's ore had a string of extraordinarily high yields: 1871 with \$65 per ton; 1872 with \$58; 1873 with \$70; and 1874 with \$55. In 1875 the boom was done as per ton years fell \$27 where it would languished for another decade. Crown Point had more tons but less valuable ores, although dividend payments were still substantial: 1871 with \$32 per ton; 1872 with \$41; 1873 with \$59; and 1874 with \$40. In 1875 the yield dropped to \$20 per ton, but then had a brief recovery to \$55 per ton on one-third of the volume of the previous half-decade. But the downward spiral resumed in 1877, and by 1884 yields settled in at about \$12 per ton²¹.

²⁰ My total estimates will differ somewhat from others quoted in various published works because I have used different sources and have chosen a longer time period. My sources for 1871 through 1884 are from the Story County Assessment Records. From 1876 through 1884 on microfilm in The County Records Microfilm Project, ST 67 Story County, Special Collections, Library, University of Nevada, Reno. For 1871 through 1875 I have relied on the Mineralogist's Reports found in the *Appendices to Journals of Senate and Assembly* for Legislative Sessions 6 (1873), 7 (1875) & 8 (1877). For the years prior to 1871 I have used data found in Grant Smith's Notebooks, NC229, Binder 1, Special Collections, Library, University of Nevada at Reno. Smith estimates from 1859-1882 are Belcher 738,000 tons worth \$34 million (\$46 per ton) and Crown Point 843,000 tons worth \$30 million (\$35 per ton). Smith, *The Comstock Lode*, 310-311. I have discussed these sources in previous chapters.

²¹ These yields were computed from the Mineralogist's Reports cited above.

FIGURE 3
CHALLENGE, CONFIDENCE, EMPIRE-IMPERIAL MINING OPERATIONS
[GOLD HILL, BARREN AFTER 1,000' (SURVEYOR'S POINT)]



As discussed in the previous chapter the per-ton-yield figures were only half of the equation. The other half was per-ton costs, which in many cases equaled or exceeded yields. Cost data are harder to verify, and yet for some companies such as Belcher and Crown Point several different sources can be compared to try to arrive at a reasonably sound estimate. Since both companies paid handsome dividends – a total of nearly \$24 million on output worth about \$58 million – they realized surpluses (receipts greater than expenses) at least during their bonanza years. What can be said as a general observation – and not particularly original – is that costs relative to receipts were high at the beginning of the bonanza in the early 1870s, fell sharply during the middle years when both mines came into their own, and then rose again during the late 1870s and early 1880s (and in fact during some years surpassed receipts). From the third quarter 1875 through the fourth quarter 1884 (without any interruption) Belcher costs were only \$1.83 per ton less than its receipts and Crown Point costs were \$1.41 per ton more than receipts. Since their bonanzas came to an end in late 1875 or early 1876, these figures do not represent the highly profitable years during the first half of the 1870s. Five surviving quarterly Abstract Statements, submitted by Story County to the State Controller, indicate how successful these mines were from 1871 to 1875. At Belcher after a losing first quarter 1871, per-ton yields rose and per-ton costs fell in each of the remaining four quarters. The best of these five quarters was the first quarter 1874 when yields reached \$65 per ton and costs came in at \$22 per ton, a difference of \$43 per ton. In the same five quarters Crown Point's performance was less impressive, in particular during the first quarter 1874 when it actually posted a \$2 loss per ton, but still undeniably strong. Its best quarter was the first quarter 1872 when it achieved \$54 per ton in receipts versus \$24 per ton in

expenses for a difference of \$30 per ton. Crown Point's costs remained in the mid twenties, but its yields declined into the mid thirties so that in terms of the ratio between receipts and costs Crown Point was less valuable than Belcher. A comparison of financial statement for slightly different period – the calendar year 1873 and the fiscal year June 1873-May 1874 – reveal mining and milling costs that did not differ significantly. Belcher removed 155,000 tons that cost \$8.51 per ton to mine and \$12.10 to mill compared to Crown Point that removed 140,000 at \$9.24 per ton to mine \$11.85 to mill. The difference between the two operations lay in what they mined and milled. Belcher produced more gold – 53 percent of the total bullion – than Crown Point – 42 percent. The average yield of an ounce of gold and silver bullion was \$2.57 at Belcher and \$2.17 at Crown Point. Comstock gold was generally less fine than gold from other region like California and its silver was purer. Any mine that could produce more gold than silver gained an advantage in terms of yields, costs and profits.²²

The ore bodies that Belcher and Crown Point shared and developed on the Lode's southern end were in Smith's mind "ideal". They existed between 1,000 and 1,500 feet underground (between 1,450-foot and 1,950-foot levels). The length of the vein (across both properties) was nearly 800 feet, and at its widest the vein was 120 feet. Smith described the lay of the ore body between 1,200 and 1,300 feet "like a fish with two flat tails, one branch continuing down the footwall, the other descending at a slighter dip." By and large the ore was easily accessible, and lacking other base metals it was highly uniform in value. It took four years to extract the ore in this vein. At the outset of the bonanzas, as was true so frequently on the Comstock, hopes flew high. Crown Point's Superintendent, S. L. Jones, wrote in his (May) 1874 report after three years in which nearly \$20 million worth of bullion had been hoisted "in my judgment, there is more ore in sight in the mine today than there was at the time [May 1873] of the last annual report." Along side of the justifiable optimism – these were indeed very rich mines – was a sober note from Rossiter Raymond, a respected mining engineer who, as quoted by Smith, wrote in 1873: "Whoever believes that these mines have now at last entered upon solid and continuous body, extending indefinitely in depth, and precluding for the future the necessity of explorations, will find himself mistaken." as the companies sunk deeper shafts, their costs rose, their assessments increased and their profits vanished. Those underground cavities where the stopes were the thickest grew so large as the ores were being extracted that millions of feet of timber had to be installed to prevent interior collapse. After labor the highest 1873-1874 expense in both mines was the purchase of timber – almost a half million dollars for the two mines combined. By 1875 bullion yields had fallen by more than 50 percent, and more threatening was the evaporation of the margins (that is, gross profits) between receipts and costs. No ore was found below 1,600 feet even though their shafts had reached the equivalent of 3,000 feet.²³

²² "Biennial Report of the State Mineralogist...1873 and 1874" in *Appendix to Journals of Senate and Assembly*, 7th Legislative Session (1875). Crown Point's accounts appear on pp. 106-112 and Belcher's on pp.114-118.

²³ Smith, *The Comstock Lode*, 137-138. These depths measured from Gould & Curry were approximately from the 1,450-foot level to the 1,950-foot level. Smith reproduced a map with the fish tail from Becker, "Longitudinal Vertical Projection of the Comstock Lode..." *Atlas*, Sheet VII, in which the depth were given in both feet from the surface and feet as measured from Gould & Curry. Raymond's quotes by Smith was from his 1873 "U. S. Mines and Mining Report", no page given. Smith also reproduced a composite (p.

The bonanza at Belcher and Crown Point came after one of the “darkest” years in the history of the Comstock.²⁴ In 1870 all the mines were in trouble. At the 500-foot level ores had given out along the Comstock, and although several mines had reached the 1,000-foot level the prospects were not encouraging. From 1865 to 1870 Belcher had produced about 0.5 percent of the Comstock ore whereas Crown Point had produced between 8 and 9 percent and ranked sixth behind Savage, Yellow Jacket, Chollar Potosi, Kentuck and Hale & Norcross. Gould & Curry, the previous high flyer, witnessed the disappearance of the vein at the 500-foot level as the east and west walls permanently pinched together. Similarly at the 1,000-foot level Yellow Jacket, Hale & Norcross and Savage experienced the same pinching effect with the result that had less profitable ores and more underground flooding. And on top of these developments came the fire of 1869 on the southern end of the Comstock Lode that closed down part or all of the operations from Crown Point through Kentuck into Yellow Jacket. From 1865 to 1869 these three mines had produced more than a third of the ore on the Comstock. By 1869 all three of these mines plus a flooded Belcher to the south of Crown Point had come under the control of the flamboyant entrepreneur and politician, William Sharon and his associates. The loss of their best mines brought their Comstock Empire (which included mines, mills, a bank and a railroad) to the verge of collapse. In late 1870 Crown Point’s superintendent, J. P. Jones, an Englishman who was both politician and miner with a penchant for risk-taking (no one “better fitted to lead a forlorn hope”, wrote Lord) entered promising ground about 200 feet from the Belcher line, and because the seam lay against the angled footwall Jones assumed that it would extend south and eventually cross the boundary into Belcher property. Since Sharon *et al.* had controlling but not majority interest in these mines, Jones and Alvinza Hayward, one of Sharon’s business associates, began to buy up Crown Point stock. They eventually won control of Crown Point, much to the surprise and chagrin of Sharon. In response to their betrayal and to forestall any further losses Sharon began to accumulate Belcher stock that he did not already own. The two parties finally agreed to end the warfare and to reach a settlement. Sharon sold all his Crown Point stock to Jones and Hayward, and they in turn sold all of their Belcher stock to Sharon. The transaction, it was said, involved millions of dollars. It turned out to be a high-priced paper transfer that benefited both sides.²⁵

In the decade before the bonanza at Belcher and Crown Point, the latter mine had enjoyed greater success than the former. Crown Point had produced ore that had a value 10 times greater than its total assessments and had paid some dividends. Belcher, on the other hand, had assessment that were 2.5 times greater than its production and paid no dividends. When the Crown Point superintendent, T. G. Taylor, issued his report in May 1868, he acknowledged that the fiscal year (June 1867-May 1868) was one of uncertainty. To begin with, a “body of ore” at the 500-foot level (about 100 feet underground) gave out unexpectedly after an initial success. In the normal procedure of working up and down from the main tunnel carved out at 500 feet, the workers had

276) of several longitudinal vertical projections (Sheets X-XII) from Becker, *Atlas*.

²⁴ Smith, *The Comstock Lode*, 126.

²⁵ Smith, *The Comstock Lode*, 122-123, 126-131. Some of the data were found in Smith’s Notebooks, NC229, Binder 1, Special Collections, Library, University of Nevada at Reno. Quotes from Lord’s *Comstock Mining and Miners* will be found in pp. 280-282.

followed the vein up 76 feet and down 33 feet only to terminate in worthless porphyry. About 6,730 tons of ore worth more than \$220,000 had been removed. This part of the vein was thought to be richer, and that expectation had been noted enthusiastically in the previous report. Not all was lost, however. At the 600-foot level over 100 feet from the shaft in an eastward direction workers found dry quartz and a new ore deposit. It was as narrow as three inches and as wide as 14 feet, and it had been pursued to the 700-foot level and slightly beyond. Already 7,000 tons of ores had been extracted, worth between \$225,000 and \$250,000. Following that discovery another ore body was found at 700 feet, about 200 feet from the shaft, once again in an eastward direction. The seam was worked up to the 600-foot level with varying widths of two feet to 19 feet before it ceased. It was at the time of the report being followed down to 800 feet where more work remained to be done before its full value could be ascertained. Between the 600-foot and 800-foot levels workers ran into additional seams that measured about four feet wide. The disappointments at 500 feet were soon compensated for at the deeper levels. This report captured how quixotic the business of mining was. Ground that looked promising could become a dead-end, and ground that appeared to have limited prospects could lead to good deposits. Some of the ore between the 600-foot and 800-foot levels had extraordinary in-mine assays of \$296 per ton, but the average yield was only about \$33 per ton, higher than the average for the Comstock but nowhere near any record. Crown Point ore worth \$866,000 had been reduced at several mills during the fiscal year noted above. The calendar-year figures for 1867 and 1868 respectively will differ from the fiscal-year figures. They show that Crown Point produced nearly \$1 million worth of ore in 1867 and over \$1 million the next year. More telling perhaps was the fact that its stockholders were assessed \$150,000 but earned dividends of \$625,000. The excavations at the 800-foot and then at the 900-foot levels continued to yield good ores into 1869 when, as discussed earlier, the fire of April 1869 closed down Yellow Jacket, Kentuck and Crown Point. In 1869 Crown Point produced \$106,000 worth of ore but also assessed its stockholders \$150,000. Needless to say its dividends ceased.²⁶ At this point no one could have anticipated that Crown Point's future was to glow even more brightly.

The big strike came on November 1870 at the 1,100 feet below ground (about 1,450-foot level). The Mineralogist portrayed it as "the largest body of pay ore ever found in the Comstock lode...." In comparison to earlier discoveries it was indeed huge. It lay about 375 to 400 feet north of the southern boundary with Belcher, extended from the 900 feet to 1,300 feet, and reached widths of 125 feet. The value per ton was about \$45, about double the per-ton average for all companies across the whole period 1865-1885. The Mineralogist was mildly disturbed that the superintendents of both Crown Point and Belcher had not yet filed any reports, and therefore further details were scarce.²⁷ Several months after the Mineralogist had presented his report (and his criticism) to the Legislature Crown Point's superintendent, J. P. Jones, prepared a report for company stockholders. He acknowledged that he had not submitted any reports since

²⁶ "Biennial Report of the State Mineralogist...1867 and 1868" in *Senate Journal and Appendix* 4th Legislative Session (1869), 24-25. See also production data in Smith's Notebooks, NC229, Binder 1, Special Collections, Library, University of Nevada at Reno.

²⁷ "Biennial Report of the State Mineralogist...1871 and 1872" in *Appendix to Journal of Senate*, 6th Legislative Session (1873), 3 132.

1 May 1870 in large part because “Crown Point was yielding nothing”. He reminded the stockholders that the prospects were bleak:

There was no ore in sight of sufficient high grade to pay the cost of extraction and reduction. Nor was there any where in the mine any indication of a coming ore-body. The Company’s mill was leased at a very moderate monthly rental of \$1,000. The future prospects of the Company never looked as unpromising.

The fire had ruined most of the underground works to the north of the main shaft, but it did not stop operations to repair and extend the shaft and to explore ground to the east and south of the shaft. This had resulted in the aforementioned discovery at the 1,100-foot level. A drift following quartz seams had been cut for a long distance of 800 feet due east. The seams, however, were barren and ended up in porphyry. It was decided then to drive a new tunnel to the south at a point in the drift that was 360 feet from the shaft and 101 feet from the northern boundary. At about 240 feet a clay wall, running diagonally northeast by southwest, was pierced. At this juncture as the drift was turned eastward, it passed through some “soft whitish quartz, containing occasional spots of ore” and then for the next 10 feet through porphyry that was “somewhat decomposed and resembling soapstone in appearance”.²⁸ This was in fact the west wall of an ore body that “consisted of boulders encased in cement”, had a width of 1 foot and a yield of \$40 per ton, wrote Jones. Following the vein in a southeastward direction for about 38 feet, it grew in width to 14 feet, 20 feet and finally to 84 feet. The drift was driven to the southern boundary where it entered the property of Belcher. Crown Point’s had a future after all.²⁹

As was often the case the ore body resided across several levels in a wedge shape. Jones explained in considerable detail the work at each level and the quality of the ore. He then summarized these details:

the vein at 900 feet [from surface] or the “upper edge or apex” was 80 feet in length with an average width of 9 feet and a value of \$28 per ton;
at 1,000 feet it was 300 feet in length and on average 45 feet wide with a per-ton yield of \$32;
at 1,100 feet its length was 255 feet and its average width 58 feet and a yield of \$38 per ton;
at 1,200 feet it ran for 310 feet and averaged a width of 70 feet and yield \$45 per ton;

²⁸ Some of these phrases in an altered form appear in Lord, *Comstock Mining and Miners*, 282.

²⁹ Typescript, “Crown Point Bonanza (Report of the Superintendent J. P. Jones, May 1st, 1873, on the operation of the three years preceding)”, NC85/2, 1. A copy of the original document was typed at a later, unspecified date and deposited in the Crown Point company archives. It was more detailed than what appeared in Smith, Lord and other commentators. This was the report that preceded the annual report which the Mineralogist quoted from in his 1875 Legislative Report: “Biennial Report of the State Mineralogist...1873 and 1874” *Appendix to Journals of Senate and Assembly*, 7th Legislative Session (1875), 103-112.

finally at 1,300, the best level thus far, the length was 360 feet, the average width 90 feet and the per-ton yield \$75.

As it dropped from level to level it grew in length and breadth, and that meant of course exceedingly favorable extraction costs. Jones estimated that at 1,300 feet more than \$4 million worth of bullion had been extracted and another \$10 million may be awaiting extraction.³⁰ It was hoped and perhaps assumed that this great wedge would continue downward indefinitely. It did not. It ended between 1,500 and 1,600 feet. There were further explorations and investments but no evidence that future discoveries could be expected. The ground itself lacked what miners had come to regard as potential signs of yet-to-be-discovered deposits.³¹

Because of Crown Point's discovery in 1870 the focus of attention for explorations became the 1,500-foot level all across the Comstock. Only a handful of explorations proved profitable and most ventures lost money, but for better or for worse the search helped to revive the sagging local mining economy. Crown Point was obviously a beneficiary, and for four year it made money. By Comstock standards that was a reasonably lengthy bonanza. But despite great profitability it was not exempt from the limitations in the vicinity of the 2,000-foot level that characterized this cycle of bonanzas in the 1870s. In 1875 costs jumped to nearly twice its revenues, and while Crown Point remained active until 1885 (and beyond), it operated in the red for most of the second decade. What Crown Point found at 1,100 feet (1,450-foot level) was an "immense chimney", the phrase that Jones used in his 1873 report. Jones explained in the report how the chimney was exploited in the first two years. Only one-seventh of the ore had been removed from 900 to 1000 feet with the remainder being held in reserve in case revenue was needed to deal with cave-ins or other disruptions deeper in the mine. Four-fifth of the ore had been removed between 1,000 and 1,100 feet, and three-fourth between 1,100 and 1,200 feet. Only one-fourth had been extracted from area between 1,200 and 1,300 (to May 1873). Jones said some ore existed above 900 feet, although the wedge was at its narrowest at the top. With ground below 1,300 remaining to be mined Jones speculated what might be found. Since this wedge was actually made up of several chimneys separated mainly by walls of porphyry or clay, Jones speculated the chimneys would eventually unite into a single ore body of great depth and width and of course of great richness. It did eventually unite, not, as Jones had hoped, to launch a new, grand bonanza but to signal the termination of the vein.³²

In the final pages of his 1873 report Jones added more details about the impact of discovery and exploitation of the chimneys. He described the post-fire operation as prospecting, and when the discovery was made in 1870, the company had to make a

³⁰ See footnote above, pp. 5-6.

³¹ I believe that the depths given in the foregoing summary from the Superintendent's Report are measured from the surface and not from the Gould & Curry Point A. I have compared them to data in Becker, "Longitudinal Vertical Projection of the Comstock Lode..." *Atlas*, Sheets 7 & 11, and they fit more convincingly with calculations from the surface than from Gould & Curry Point A. I am not absolutely certain about this interpretation, and unfortunately the reports by the Superintendent and the Mineralogist were not helpful.

³² See footnote 29, above, pp. 6-7.

substantial investment to mine the body. Crown Point's shaft was small, and the hoisting and ventilating systems were inadequate. The shaft was enlarged down to 1,100 feet, and three hoisting cages were installed in the shaft. Swelling of the ground around the shaft caused the timbering to push inward. Removing two more feet of soil around the shaft eliminated that problem. Most of the shaft was retimbered. Not only were the engines for the hoisting cages new but also all the underground equipment – drills, compressors, pumps, fans – was new. Only then did a prospecting mine become an operating mine.³³

A year later, 1874, a new superintendent S. L. [instead of J. P.] Jones made a much longer report, part of which was reproduced (verbatim) in the Mineralogist's 1875 Legislative Report. It included not only descriptive material but also accounts on revenues, costs and profits. Based on Jones's details the mineralogist concluded that Crown Point had been "worked with skill and economy, and no management of a mine in this district has ever given better satisfaction to the stockholders." And reading Jones's report can clearly leave that impression. It is filled with references to new buildings, bigger machines and perceived efficiencies. In general he referred to the year (May 1873 to May 1874) as one of considerable "dead works", which in mining parlance meant maintenance and repair. Several thousand feet of new timbering had been installed in the main shaft, the loading and unloading compartments at each level and in the tunnels themselves. Several thousand feet more of new drifts, raises, winzes and crosscuts had been dug. A large and much improved carpenter and machine shop had been constructed at the top of the shaft. The water supply, mainly for fire prevention, had been improved. Jones was especially proud of the new hoisting facilities, which would soon be ready to operate. After describing such things as the number of anchor bolts (two to two and one-quarter inches) and the size and strength of the hoisting reel, he compared the old and new hoisting capabilities. Under the current system the car and the rope combined weighed 11,000 pounds. To hoist 500 tons of ore per day, a goal of the company, 250 trips with two tons of ore per trip would be required. Under the new system with a bigger car and stronger rope with a combined weight of 18,000 pounds 500 tons could be hoisted in 42 trips at 12 tons per trip. Fewer trips, it was anticipated, meant savings of tens of thousands of dollars per year. The cost of the new machinery plus freight and installation was estimated to be \$50,000. Jones concluded that within several years the new machinery would pay for itself based on predicted savings. But in fact during the year fewer than 400 tons on average were lifted each day, and the number 500 appeared to be an unrealizable goal. The assumed savings to pay off the capital improvements and to enhance the bottom line did not materialize to the degree predicted by Jones.³⁴

Even though some goals were not realized by the end of the fiscal year, production and revenue figures between May 1873 and May 1873 bore out Jones's upbeat assessment. Crown Point clearly made a handsome profit. His figures showed that on 140,000 tons of ore the company realized a yield of \$7.1 to 7.4 million or about \$52 per ton. [Numbers in report do not always agree so I have used approximations.] Because the company carried over a cash balance of \$1.9 million on 1 May 1873 and had other

³³ See footnote 29, above, pp. 7-8.

³⁴ "Biennial Report of the State Mineralogist...1873 and 1874" in *Appendix to Journals of Senate and Assembly*, 7th Legislative Session (1875), 103-105.

receipts from 1873 to 1874, total revenues equaled \$9.3 million. Based strictly on the value of the bullion extraction costs of \$1.5 million including extensions, repairs, operations plus new machinery (which probably should have been amortized) and reduction costs of \$1.6 million including expenses and repairs at its own mill, Rhode Island, and contracts with 10 other mills the total was about \$3.1 million or \$21 per ton. The “gross operating” profits were about \$4.0 to 4.3 million or about \$30 per ton. The company reported another \$400,000 in administrative, legal, assay and freight charges so that profits were reduced to between \$3.5 and 4.0 million. The company paid dividends of \$5.3, an amount greater than the surplus for the year. The cash on hand made up the difference. Thus at the end of 1873-1874 fiscal year Crown Point still had on hand a half million dollars.³⁵

On the basis of mining operations in 1873-1874 it was not hard to be optimistic and generous about the future. The hopes, however, would be dashed. The wedge or chimney that seemed unending quit at the 2,000-foot level or about 1,600 to 1,700 feet underground. To keep the company going for the next few years assessments had to be re-instituted, but an ore body that might have justified the expense was never found. In August 1875 a letter from Jones to the President of Crown Point, J. D. Fry, revealed how quickly the prospects had deteriorated. At 1,700 feet after pushing the drift 160 feet east it was still in hard rock with temperatures reaching 120 degrees. Workers were being furloughed and expenses cut because the ore grades were so low - from \$4 to 10 per ton – that the value of the bullion did not cover the costs. Even though the wedge had given out in early 1876 Jones and his engineers remained preoccupied with trying to figure out where it might reappear. They had driven as deep as 2,000 feet. Three drifts – north, south and east – were being dug in hopes of intercepting a continuation of the wedge from above or of finding a new vein. Actually quartz was found at 2,000 feet, but it was even lower in grade, \$2 to 4 per ton, than what was found at 1,700 feet. The new problem was water, extremely hot water. Behind the porphyry were not deposits of ore, as was often the case, but pools of water. The main pumps did not extend beyond 1,700 feet, and special pumps had to be installed at 2,000 feet to remove the water to 1,700 feet before the main pumps could be activated. And the temperature of the water adversely affected the interior ambiance throughout the mine. A year later in 1877 the water problem had been solved by making a connection with Belcher, but while the tunnels were dry, the rock was hard and more importantly the ore was absent! Not even enough ore was being produced to keep the mill (Rhode Island) running, and it had been leased for \$1,500 a month to Mackay and Fair’s Pacific Mill and Mining Company. And the Story County commissioners were contemplating a lien on the company’s property in lieu of unpaid taxes, although the taxes were eventually paid. This was not the end of mining at Crown Point. It continued to register ores until 1885 but in amounts that were a fraction of its earlier success. It certainly ceased making money and paying dividends.³⁶

³⁵ “Biennial Report of the State Mineralogist...1873 and 1874” in *Appendix to Journals of Senate and Assembly*, 7th Legislative Session (1875), 106-112.

³⁶ Crown Point Gold and Silver Mining Company Letterpress Book, Feb 1875-Jul 1877, NC85/3, Special Collections, Library, University of Nevada at Reno. Information cited from following: Letter from S. L. Jones, Supt., to J. D. Fry, Pres., 20 Aug 1875, recto 68 (page in Letterpress); Letter from S. L. Jones, Supt., to C. E. Eliot, Sec., 8 April 1876, recto 137, verso 139; Letters from W. P. Holmes to F. B. Taylor & Co, 19 July 1877, recto 294 and S. L. Jones, Supt., to Col. P. L. Weller or Miller, Pres., 19 July 1877, recto 274-

The Belcher Mine on Crown Point's southern boundary shared the ore bodies described above. Indeed in 1873 the Crown Point directors agreed to accept a payment of \$275,000 from Belcher because the latter had crossed the boundary and extracted ore from Crown Point's side. The agreement called for a payment of \$137,500 in gold and a note for the remainder payable in 60 days at a rather usurious rate of 1 percent per month. The Crown Point accounts showed the receipt of \$2,750 in interest from Belcher, the amount equal to two months at 1 percent per month. Apparently the boundary was clearly enough marked to avoid future disputes. And in the course of the next few years Belcher would in fact out-produce Crown Point. Already noted was how control of Crown Point passed from Sharon to Jones and Hayward and control of Belcher from Hayward to Sharon. In the end Sharon, as the principal owner of Belcher, would realize a somewhat larger fortune than Haywood, the principal owner of Crown Point. It was almost axiomatic in mining societies that fortunes were made to be lost. They were lost because owners did not know when to abandon unproductive works and because they could also spend endless hours speculating in stocks. Serious investors who seldom speculated made and lost fortunes; and serious speculators who could be serious investors also made and lost fortunes. Buying up cheap mining stocks even if done with speculation in mind could actually have positive results if the purchasers made some effort to recover the mines. In short the role of speculation in mining (like speculation in "dot.coms") did not necessarily spell disaster for the business of mining. In the case of Crown Point and, as we shall see, in Belcher and other mines what happened at the site away from the stock markets was the more important consideration.³⁷

Because they shared an ore body the work in Belcher to find and exploit the ore will not be so different from what we have described in Crown Point. In the 1860s Belcher's output could not even pay for its assessments. Belcher barely figured in the Mineralogist's Reports before 1871. At the 1,000 feet (1,400-foot level according to Gould & Curry) after the strike in Crown Point a vein about 400 feet long and 100 feet wide was found in Belcher. Its full depth was not yet known, but it was thought to be several hundred feet. In early 1871 Belcher's main works were at 100 to 200 feet underground (400-foot level) in an ore body probably discovered in the early 1860s.

275 [folios not numbered correctly, pages also torn out]. The distances discussed in these letters appears to be feet from the surface rather than feet from Gould & Curry Point A. Such an interpretation would coincide with figures shown in Becker, "Longitudinal Vertical Projection of the Comstock Lode...", *Atlas*, Sheets VII & IX. A comment about Letterpresses. Scores of Letterpress Books for mining companies survive in varying conditions. Instructions for copying a single-sheet letter or as many as 10 to 20 single sheets were given on the fly page of the letterpress book. La Belle Copying Book and Ink was one company that sold these copying devices. Basically after the letter was written and allowed to dry for a few minutes, it was placed on a heavy "pasteboard" written-side up. A leaf of the copying paper was placed over the ink-written letter (La Belle also provided the ink) and then rubbed "rather hard with the ends of your fingers on the copying paper." Apparently the ink for the original "seeped" through the copying paper to create a copy of the original. The letterpress books sold by Le Belle had from 300 to 1,000 pages. By using a Copying Press provided by the vendor more than one letter could be copied at a time. Most of the letterpress books in Special Collections were 300 to 500 pages, which cost \$2.75 to \$4.25 each. A half pint of ink was included.

³⁷ General discussion of Belcher in Smith, *The Comstock Lode*, 126-140; negotiations between Belcher and Crown Point in Crown Point Gold and Silver Mining Company, Minutes, Special Meeting, San Francisco, 17 December 1873, NC85/1, Record, 1859-May 1874, Special Collections, Library, University of Nevada at Reno.

Activity was also underway 700 to 800 feet underground (between 1,100- and 1,200-foot levels). Before the discoveries at Crown Point on the northern border the strategy in Belcher was to explore in a southern direction. After Crown Point's discoveries, however, the northern side of the Belcher claim looked more promising. At the end of January 1871 with the discovery of a 2-foot seam at these deeper levels ore samples jumped from \$7 to \$30 per ton to about \$100 per ton. By September 1871 the work along the northern border was paying off. At times yields were as high as \$75 per ton. This was reflected in company accounts that showed that bullion received from the mint and expenses to operate the mine had risen from a few thousand dollars per month earlier in the year to tens of thousands. The problem at the lower depths was water, although the former superintendent, Thomas Bowen, was confident that it could be successfully controlled. But the matter was still under debate and had not yet been resolved to everyone's satisfaction. Bowen's successor, W. P. Smith, believed that without a resolution the mine could not operate at an optimal level. A shaft had been dropped 800 feet but was still several hundred feet above the ore body for purposes of hoisting water. Other proposals were to construct a new shaft over the ore body or to construct an incline shaft to connect the ore body with the existing shaft. Smith did not believe a suitable location for a new shaft had been found. Sharon, who remained the company's dominant force, concluded that an incline shaft could be built more cheaply and quickly than cutting a new shaft. An incline shaft was planned from approximately the 700-foot level of the current shaft at an angle of 36° for 700 feet in order to reach the level of the ore body about 1,100 feet underground where a drift of at least 150 feet and perhaps as much as 500 feet would be constructed to intercept the ore. Smith estimated that the incline shaft could be completed in eight months (May 1872). In addition Smith proposed retimbering 400 feet of the existing shaft and purchasing and installing new machinery for hoisting the ore along the incline and through the shaft. By the time of the Mineralogist's Report in 1873, the superintendent's recommendations had been implemented and Belcher was becoming the biggest and richest operation on the Comstock. The Mineralogist was impressed with the skill of the effort and the "neatness" of the operation. He even urged Belcher's neighbors to "imitate" its model.³⁸

Plans for accessing new ore bodies did not always proceed smoothly. By June 1872 the incline had been driven 418 feet from a point 850 feet underground. New machines had to be installed, and that combined with the hardness of the rock slowed progress in sinking the incline. The original timetable could not be met. When the work reached 1,000 feet underground drifts were started in order to tap into the wall of ore (about 1,100 feet underground), and when the wall was penetrated the body of ore was said to be 65 to 70 feet in width, and far richer than expected. In addition to rich ore, however, the miners found unbearable working conditions. Because of the intensity of heat and the poorness of ventilation workers became exhausted after several hours and had to be replaced by a new shift. Hiring, training and managing a larger labor pool plus

³⁸ Letters from T. W. Bowen, Supt., to W. C. Kibble, Sec, 20 January 1871, recto 4; 24 January 1871, recto 4; 30 January 1871, recto 13; 19 Mar 1871, recto 66; Letter from T. W. Bowen to J. D. Fry, Pres., 25 Feb 1871, recto 41 & 42; Letters from W. H. Smith to J. D. Fry, Pres., 7 Sep 1871, rectos 199 & 200 with accounts attached; 11 Sep 1871, rectos 201 & 200 in Belcher Silver Mining Company, Gold Hill, Letters, NC92, Special Collections, Library, University of Nevada at Reno. "Biennial Report of the State Mineralogist...1871 and 1872" in *Appendix to Journal of Senate*, 6th Legislative Session (1873), 132.

frequent shift changes affected adversely the efficiency of the operation. And of course in order to work the wall of ore that was several hundred feet in depth the incline had to be extended and more drifts had to be opened with the attendant problems of heat and ventilation. (Shafts were more effective at circulating air than inclines or drifts.) In addition draining Belcher turned out to be complicated and cumbersome because the water had to be piped through a drift that passed through Crown Point to Yellow Jacket's shaft where it was hoisted to the surface. These were not permanent obstacles; rather they slowed progress, cost money and demanded attention. What distinguished the ore body residing in Belcher from that residing in Crown Point was the presence of gold. The time lost and the expense required, though greater than expected, soon paled in significance as ore yields reached historic highs. In 1872, when most of the letters and reports containing the foregoing information were written, extraction costs ranged from \$17 to \$24 per ton in three of the four quarters while total costs (including transportation and reduction) per ton ranged from \$27 to \$37 per ton. At the same time given its gold content the ore was so rich even with those cost it yielded bullion worth between \$50 and \$60 per ton. And as the obstacles were overcome with new drainage pumps and ventilation shafts the cost of extracting the ore declined. In one quarter during its most productive year 1874 extractions costs were reported to be under \$10 per ton as the yield reached \$65 per ton. These figures suggest that the operation of the mine became more efficient in spite of the need to construct and maintain a complex underground system. As the depths grew, however, there was some foreboding. The angles of the veins were shifting unexpectedly, not in accord with the surveys, and although not yet recognized for what it was it would become the beginning of the end. The ore body had a limit, and that limit had been reached in 1874.³⁹

In his 1875 biennial report (covering the two previous years) the State Mineralogist could barely contain his enthusiasm. He believed that Belcher was the most productive mine in the history of world, and that it surpassed even Potosí, Spanish America's legendary Andean mine. What impressed him was that Belcher produced almost as much as Potosí (in dollar values), but Potosí's production came from over 2,000 mines and 32 veins, not from a single mine and ore body. (The comparison was somewhat overdrawn because Potosí's production was more concentrated than these numbers suggest.) By 1873 Belcher had built four stations 100 feet apart between 1,000 and 1,400 feet. They produced a total of 156,000 tons of ore. The station at 1,300 feet was the most productive with 38 percent of the total followed by 26 percent from each station at 1,000 and 1,200 feet and 10 percent from 1,400 feet. When the Mineralogist prepared his report the incline shaft had reached the 1,300 feet and ore from the 1,400 feet was being removed through a drift connecting with Crown Point and perhaps Yellow Jacket. More new equipment was in evidence including a Burleigh air compressor and two Burleigh drills. In the mine itself 3,692 lineal feet of drifts and winzes had been excavated; 380 feet had been added to the incline; and 4,072 feet of track had been laid

³⁹ These points were drawn from handwritten copies of letters sent to company officers and from daily progress reports. They were not letterpress copies, although letterpress books exist for the Belcher. Letters from W. H. Smith, Supt., to J. D. Fry, Pres., 22 June 1872, p. 35 and 30 June 1872, p. 35, along with notes by Smith from daily reports in NC92/1/1, Special Collections, Library, University of Nevada at Reno. Quarterly costs from Abstracts Statements in Nevada State Archives. By 1877 extraction costs had risen to more than \$30 per ton, and the yields in the mid-\$20 range could not cover those costs.

and other repairs too numerous to be noted had been finished. Producing ore worth about \$11 million cost about \$4 million. The company paid dividends in the amount of nearly \$7 million and still had on hand at the end of the fiscal year \$1 million in cash. Having paid about \$1 per share Sharon and his partners realized astronomical returns.⁴⁰

Both Crown Point and Belcher remained active mining sites until 1885. After 1875 the mines made little or no money, and soon assessments exceeded the value of mineral output. The owners achieved some of the greatest depths on the Comstock, at least 3,000 vertical feet, without anything to show for it. The wedges that seemed unending when first discovered did not continue or reappear at these lower depths. Ore of such low grades found that it made more economic or financial sense to leave it in the ground than to hoist it. Belcher assay records from 1885 reveal that the value of extracted ore occasionally exceeded \$20 per ton but generally held around \$15 per ton.⁴¹ Speculation in Belcher stock occurred from time to time, but even the speculators eventually knew when enough was enough. The danger signals in what was transpiring at both mines in the second half of the 1870s was obscured in part by the even more astonishing success of The Firm's Consolidated Virginia and California mines at the other end of the Comstock.

⁴⁰ "Biennial Report of the State Mineralogist...1873 and 1874" in *Appendix to Journals of Senate and Assembly*, 7th Legislative Session (1875), 112-118.

⁴¹ Belcher Silver Mining Company, Record of Assays of Ores Milled, January 1885-Nov 1886, NC92/2, Special Collections, Library, University of Nevada at Reno.