

# *Cornish Mining Technology in Eastern Pennsylvania: The Perkiomen and Wheatley Mines*

By  
R. Damian Nance

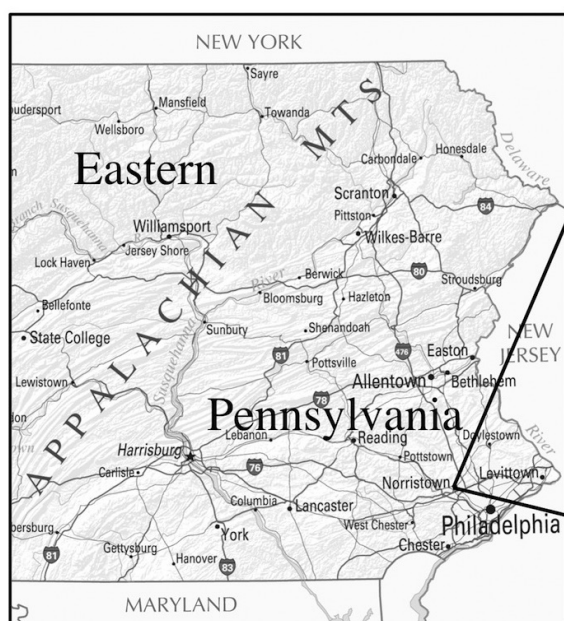
On either side of the Schuylkill River near Valley Forge, northwest of Philadelphia, two solitary Cornish stacks stand as lasting testaments to an important period of nineteenth century Cornish mining in eastern Pennsylvania. One chimney, at the northern end of the grounds of the John James Audubon Center at Mill Grove—the first home of America’s well-known artist-ornithologist in Audubon<sup>1</sup>—marks the former location of one of the Perkiomen copper mines. The other, in a copse beside the fifteenth green of the Pickering Valley Golf Club near Phoenixville, identifies the site of one of the Wheatley silver-lead mines.

Both groups of mines were essentially Cornish operations developed on the Cornish system by immigrant miners from Cornwall. But the man at the heart of their organization and productivity was a New Yorker by the name of Charles M. Wheatley. Born in Essex, England, in 1822, but raised from childhood in New York City, Wheatley was the manager of the Bristol copper mine near Hartford, Connecticut, when he accepted his employer’s invitation to manage the Perkiomen copper mine in Shannonville (now Audubon), Pennsylvania, in 1848.<sup>2</sup> This he proceeded to do with considerable success, but once there, he learned of the existence of rich lead ore across the river in Phoenixville, which he explored and later developed himself as the Wheatley mines.

## **The Perkiomen Mines**

The Perkiomen mines comprised a group of small copper, lead, and zinc mines on the east bank of Perkiomen Creek, a tributary of the Schuylkill River in Montgomery County. Hosted in red shales and arko-

# Perkiomen Mines Audubon, Pennsylvania



# Wheatley Mines Phoenixville, Pennsylvania



*Location of the Perkiomen and Wheatley mines in Audubon and Phoenixville, Pennsylvania, northwest of Philadelphia.*



*Two solitary Cornish stacks. A: The stack of the Ecton Mine's 20.5-inch, high-pressure pumping engine in the grounds of the John James Audubon Center at Mill Grove, in Audubon, Pennsylvania. The Ecton shaft lies out of the view to the right (east). B: The stack of the Brookdale Mine's 24-inch pumping engine stands beside Smith's engine shaft near Phoenixville, Pennsylvania. The flue hole at the base faced the house of the engine's single boiler.*

sic sandstones of the Newark Basin's Upper Triassic Stockton Formation,<sup>3</sup> the mines were most productive in the 1850s when they were worked by Cornish miners employing Cornish pumping technology.

Although knowledge of the presence of lead ore on the Mill Grove property dates to the eighteenth century—there is a tradition that many a Redcoat was laid low by Mill Grove lead during the American War of Independence<sup>4</sup>—the first records of mining activity date to late 1803 or early 1804, when the deposits were shown to young John James Audubon.<sup>5</sup> Audubon conveyed this

information to his father, Captain Jean Audubon, who sent a fellow Frenchman, Francis Dacosta, to manage the mine.<sup>6</sup>

In late 1804, the mine was described as having been “lately opened, and attended with great success” and that its lead “has proved to contain 2½ oz. fine silver to 100 [weight].”<sup>7</sup> In 1808, Dacosta established a company to work the (old) Perkiomen mine, and by 1809, the mine was thirteen fathoms deep and an adit sixty fathoms long had been driven in from nearby Perkiomen Creek.<sup>8</sup> A considerable quantity of lead ore and a little copper was reportedly raised, but little of this ore was



*Charles M. Wheatley. Photograph from Clegg's Underground Treasure: The Story of the Wheatley Mines.*

sold and, in 1810, the venture was abandoned.<sup>9</sup>

In 1813, the property was purchased for its lead deposits by Samuel Wetherill, Jr.,<sup>10</sup> as a means of supplementing the imported pig lead used to produce white lead at his paint works in Philadelphia, the supply of which had been interrupted by the War of 1812.<sup>11</sup>

In addition to developing the property, which became known as the Wetherill Mine, Wetherill used existing mills for mining purposes and was the first to employ Cornish miners. In 1820, for example, over one hundred tons of lead ore were raised by immigrant miners, most of whom were Cornish.<sup>12</sup> Wetherill also erected a smelting works in anticipation of processing the ore on-site and, in an 1826 presentation to the Philadelphia Academy of Natural Sciences, described the mine as being twenty-seven fathoms deep with three

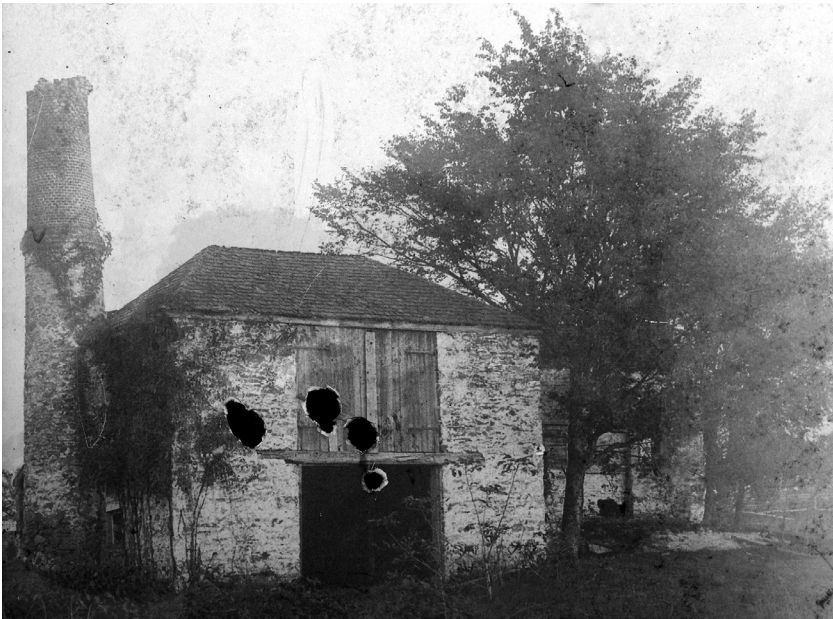
levels, and the ore as yielding 75 percent lead with traces of silver.<sup>13</sup> However, the ore proved difficult to smelt economically and soon after this the Wetherill Mine was abandoned.

Renewed interest, this time for copper, occurred in or about 1829 when two Cornish miners, John and Robert Rowe, sank shafts on the property.<sup>14</sup> But while they found copper ore of good quality, they failed to find it in sufficient quantity.

Over the next two decades, the mines changed hands several times, but an intermittent record of mining continues. In 1835, for example, copper from the Perkiomen Mine was alloyed with zinc from Franklin, New Jersey, to produce the first brass weights for the newly created U.S. Office of Standard Weights and Measures.<sup>15</sup>

The year 1848, however, saw a significant renewal of activity with the opening of two mines on either side of Mine Run, about half a mile north of the Wetherill Mine. On the north bank of the creek, the Perkiomen (or New Perkiomen) Mine was started by the Perkiomen Mining Association, while slightly later, on high ground a little over a third of a mile to the southwest, the Ecton Mine was opened by the Ecton Consolidated Mining Company.<sup>16</sup> Both mines produced copper and lead, although they were chiefly thought of as copper mines. Rich zinc ore was also found, but in the absence of a means of smelting it, the ore was never extracted.<sup>17</sup>

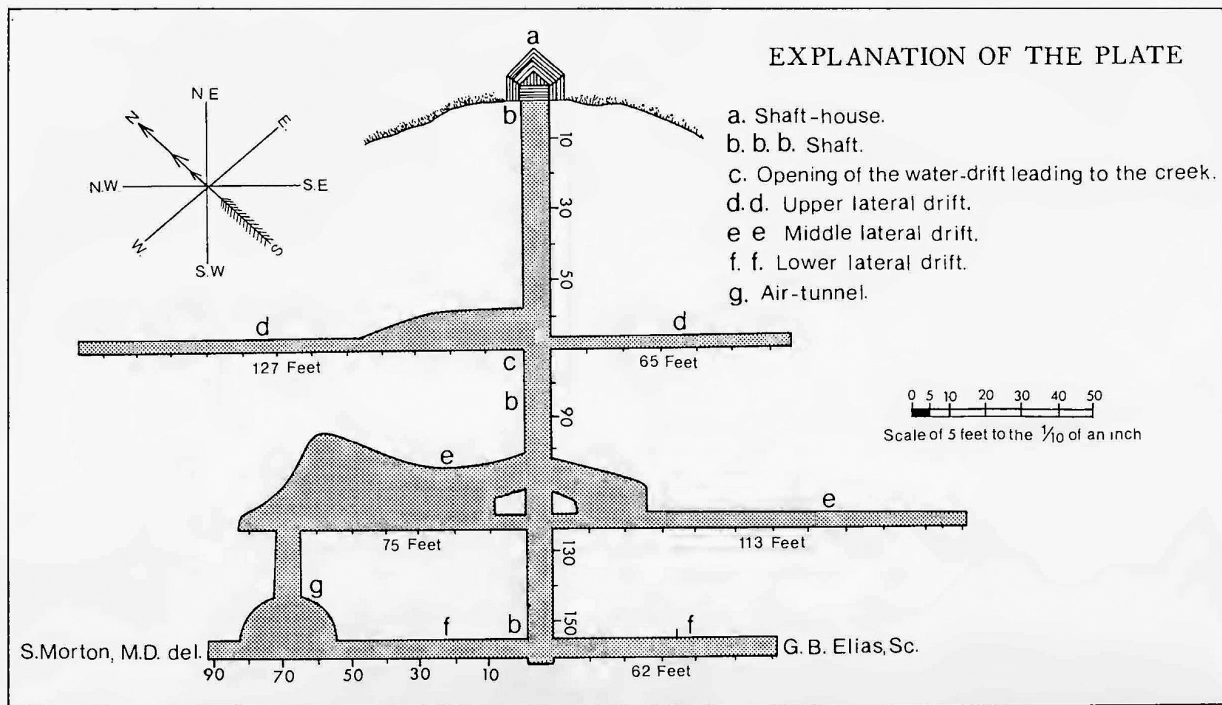
By 1848, in which year the two mines were purchased by a New York firm of metal brokers, both companies had imported copper miners from Cornwall and had erected rows of frame houses for their use.<sup>18</sup> Although no trace of these buildings survives, F. Harold Evans suggests in



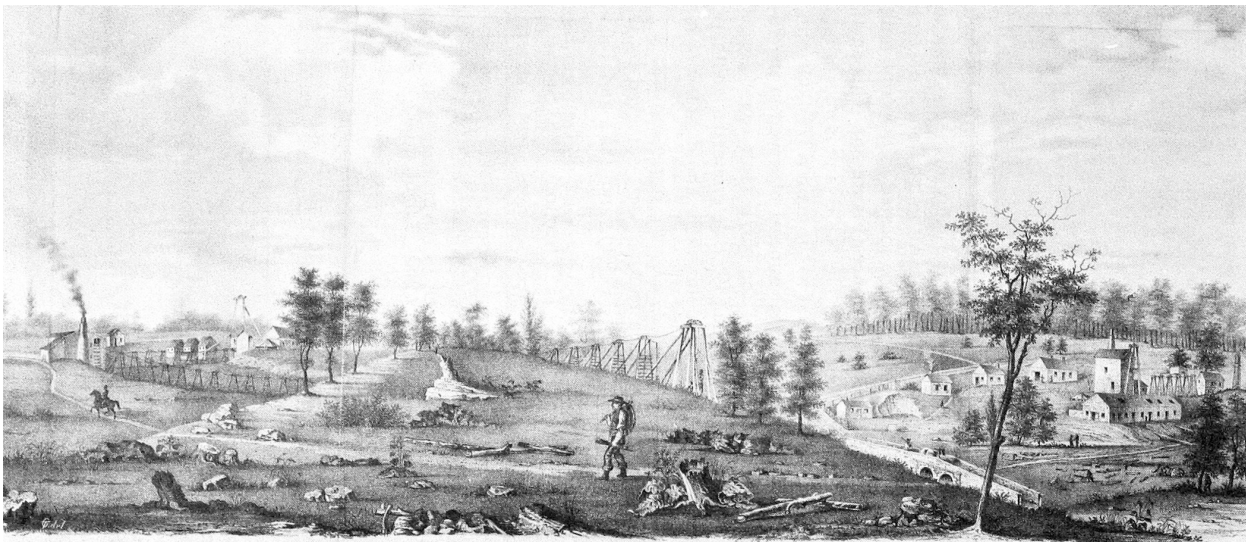
*An undated nineteenth-century photograph of the buildings surrounding the Ecton shaft just out of view to the right. The engine house is visible behind the trees to the right. The boiler house likely lay behind the building to which the stack is attached, the function of which is uncertain. Photograph from one of the mine-site information boards at the John James Audubon Center at Mill Grove.*



*The engine house, with its large brick-arched opening, and the surviving separate stack at the Ecton mine, taken from the mouth of Ecton shaft (foreground) sometime prior to 1905. Photograph by William H. Richardson from Williams' Copper Mines at Shannonville, following p. 223.*



*Cross section of the Wetherill Mine in 1827. From Smith's, Zinc and Lead Occurrences in Pennsylvania, 258; republished from an original in Wetherill's, Observations on the Geology, Mineralogy, etc. of the Perkiomen Lead Mine," 315.*



*The Perkiomen Consolidated Mines (looking north) from an 1851 engraving, showing the 50-inch Cornish pumping engine on Perkiomen shaft (right) and the 20.5-inch high-pressure engine on Ecton shaft (left). The headgear (center) is that of Whim shaft. From Smith's, Zinc and Lead Occurrences in Pennsylvania, 254, courtesy of Allen V. Heyl, U.S. Geological Survey, Denver.*

his book on mining in Montgomery County that they likely comprised “the most complete copy of a Cornish mining village ever built in the United States.”<sup>19</sup>

Both companies also erected pumping engines to keep the mines free of water. A 50-inch Cornish engine of 100 horse power capable of an annual load of 65 million foot pounds and valued at \$10,200 was erected at the Perkiomen Mine, and a 20-inch, high-pressure engine capable of an annual load of 18 million foot pounds and valued at \$9,000 was erected at the Ecton Mine.<sup>20</sup> Both mines also possessed whim engines and crushers.<sup>21</sup>

The illustration to the left shows the engine on the Perkiomen shaft (right) was a Cornish pumping engine. However, little is known of its provenance, although it is said to have been imported and was quite possibly built in Cornwall. The nature of the Ecton engine (left), where the surviving stack now stands, is uncertain and existing photographs of the engine house are not particularly informative. But it was likely to have been an all-enclosed, entablature rotative engine that pumped from the nearby Ecton shaft by way of a short run of flat rods.

Neither building survives but masonry loadings for a balance bob can still be seen on the west side the shaft crater, to the kingpost of which the flat rods would have been attached. The pit for the balance box can also be discerned between the shaft and the site of the engine house, and a depression on the north side of the building to which the stack was originally attached may mark the site of the engine’s single boiler.

It was in 1849 that the new owners sent Charles M. Wheatley, then a young mining engineer and mineralogist, to Shannonville to act as mine manager. Wheatley had previously served successfully as manager of the Bristol copper mine near Hartford, Connecticut, owned by the same New York firm, which hoped that he might likewise put the two Shannonville mines on a profitable footing.<sup>22</sup> This he attempted to do and, when

the Perkiomen shaft had been sunk to forty fathoms and the Ecton shaft reached a depth of fifty-five fathoms, a new level 1,800 feet in length was driven between the two to connect them.<sup>23</sup> An adit was also driven into the Ecton shaft, the portal of which can still be seen close to the mouth of Mine Run.

As a further economy, it was decided to consolidate the two mines into a single enterprise and, on 15 February 1851, a charter was granted to the Perkiomen Consolidated Mining Company “for the purpose of mining, selling and smelting copper and lead ores, and erecting the necessary buildings and machinery for such purposes, and as such, shall have power to lease or purchase the Perkiomen and Ecton mines, and certain other mines and mining lands, situated in the counties of Montgomery and Chester.”<sup>24</sup> For the purchase of the real estate, mines, machinery, and other property, the new company paid the Perkiomen Mining Association \$109,000 and the Ecton Consolidated Mining Company \$111,000.<sup>25</sup>

The new company carried out extensive mining operations and the same year Wheatley is quoted as saying that “all persons acquainted with mining operations that have examined the workings at Perkiomen have expressed astonishment at the regularity, size, strength and productiveness of the veins, and the high percentage of copper ore obtained from them. The Perkiomen is the first regular copper lode opened in this country, and bears a true resemblance to the Cornish system.”<sup>26</sup>

At the end of April 1851, Captain Joseph Vivian, a Cornishman associated with the new company as an expert,<sup>27</sup> submitted a favorable report, and between August 1851 and April 1852, the new mine raised 525 tons of copper ore that ranged from 7 to 25.7 percent copper and was sold to the Baltimore Copper Smelting Company for \$30,575.<sup>28</sup>

About two hundred men were employed, most of whom worked on a tribute system, like that used in Cornwall, under which groups of

miners would agree to extend a level or stope a given distance for a certain sum.<sup>29</sup> The illustration on page 9 is a cross section of the mine workings as they appeared in 1852 and 1863, and shows a strong influence of Cornish mining methods in the mine's underground layout with vertical shafts and levels driven at intervals of ten fathoms.

The principal ores were chalcopyrite and, to a lesser extent, malachite, but were mixed with zinc blende (sphalerite) that was mechanically separated as much as possible on site, but which made treatment of the ore difficult.<sup>30</sup> In addition, the mine's operation was necessarily expensive because of its location, the ore having to be wagon hauled to the Schuylkill Canal and sent on to the nearest smelters in New York and Baltimore by way of Philadelphia.<sup>31</sup>

In 1852, Wheatley resigned his position with the consolidated venture and started work on the Wheatley mines,<sup>32</sup> a group of small silver-lead mines several miles to the west, near Phoenixville, that he had personally opened a year or two earlier (see below). With his departure, the mine's productivity declined, and in 1853 only 143 tons of ore were raised, which sold for \$9,989.<sup>33</sup>

The Perkiomen Consolidated Mining Company officially closed in 1854, but the mine continued to be operated on a co-operative basis<sup>34</sup> and, in 1858, there is a record of 151 tons of copper ore being shipped both to Baltimore and to England and six tons of lead ore being sent to the Bay View Smelting Works on New York's Staten Island.<sup>35</sup> However, the operation was clearly unprofitable and, unable to raise enough ore to meet running costs, the mine finally closed later the same year.<sup>36</sup> At time of the mine's closure, the Perkiomen shaft was over eighty fathoms deep and the Ecton shaft had reached a depth of over one hundred fathoms.<sup>37</sup>

Renewed interest in the two mines accompanied the increased demand for lead with the outbreak of the American Civil War. In 1863, a prospectus was issued by the Perkiomen Mining Company to raise capital to reopen the mine.<sup>38</sup>

After selling some stock, an inaugural ceremony was held in November 1863, when the machinery is said to have been put in motion and a small amount of previously mined ore brought to the surface.<sup>39</sup> However, the venture was soon abandoned, although in 1865, during the reworking of his silver-lead mines southwest of Phoenixville, the burrows (mine dumps) were briefly worked at a profit by Charles Wheatley in partnership with a Captain Cooking from Cornwall.<sup>40</sup>

The Ecton Mine was briefly re-opened in 1901, when as many as thirty men were employed in the extraction of lead and zinc ore.<sup>41</sup> The final episodes of activity occurred during the Second World War, when the U.S. government surveyed the mines because of the need for copper,<sup>42</sup> and from March until June 1948, when a five-hole diamond drilling program was carried out by the U.S. Bureau of Mines.<sup>43</sup> But no further work was done and there has been no interest in the mines since that time.

### The Wheatley Group of Mines

The Wheatley mines comprised a group of small silver-lead workings in the valley of Pickering Creek between Charlestown and Phoenixville in Chester County. Largely hosted in Precambrian granitic gneiss of the Appalachian Piedmont,<sup>44</sup> the first discovery of mineralized veins in the vicinity of Phoenixville is attributed to Charles Pickering soon after his arrival in America with William Penn in 1682.<sup>45</sup> But the land was first leased for mining in 1850 by Charles M. Wheatley, then mine manager at the Perkiomen Mine, just five miles to the east.<sup>46</sup>

Worked largely by Cornish miners and served by several small pumping engines, the workings included the Wheatley and Brookdale mines and the smaller Phoenix Mine, all sunk on the same northeast-trending lode, as well as the nearby Charlestown Mine, sunk on a parallel lode to the northwest. Although the mineral veins contain lead, zinc, and copper, as is the case in Montgom-

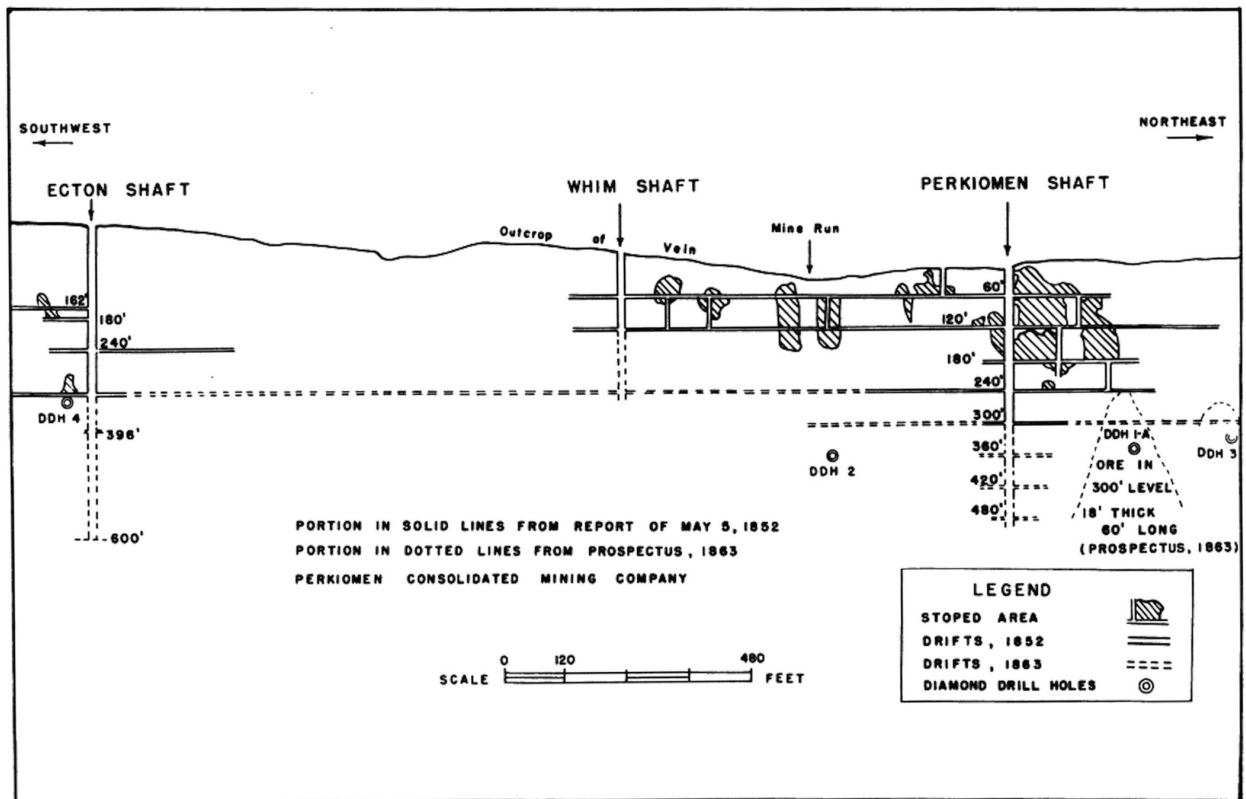
ery County, they were worked for silver-lead, the principal ore minerals being galena, pyromorphite, anglesite, and cerusite.<sup>47</sup>

That the mines were essentially Cornish operations is evident from the following quotation taken from a special report to the British House of Commons by Edinburgh University professor John Wilson in February 1854 regarding the Exhibition of the Industry of All Nations, a World's Fair that had opened in New York the previous year: "At Phoenixville, the mines under the able direction of Mr. C. M. Wheatley, are carried on perfectly upon the Cornish system, Mr. Wheatley having availed himself to the fullest extent, not only of the experience of our mining practices, but also of the practical skill of our men. The captains, as well as most of the miners, are from Cornwall."<sup>48</sup>

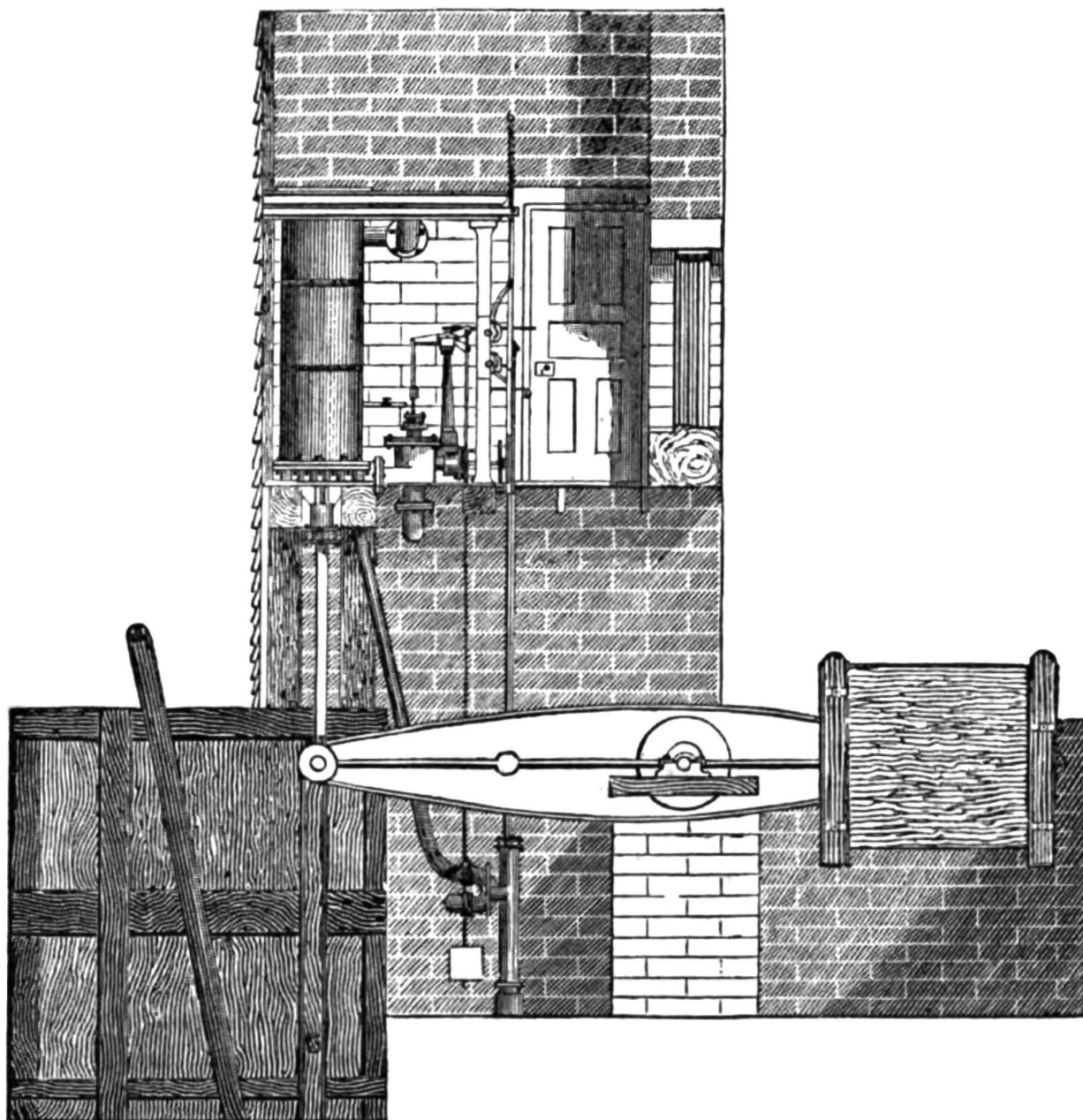
### The Wheatley Mine

Work at the Wheatley Mine, the largest of the group, began early in 1851 with a small pumping engine of about fifty horsepower.<sup>49</sup> Only eleven tons of silver-lead ore were raised that year and by January 1852, at which time Cooking's engine (pumping) shaft had reached a depth of twenty-two fathoms, the engine was proving inadequate. To raise capital for a larger one, Wheatley formed the Wheatley Mining Company in February with two of the owners of the Perkiomen mine.<sup>50</sup>

The engine the new company purchased was a twenty-four-inch, high-pressure, single-acting Bull engine with a six-foot stroke. At sixty horsepower, the engine could raise thirty-six gallons of water per stroke at ten strokes per minute.<sup>51</sup> An agreement with the neighboring Chester County



*A Longitudinal profile of the Perkiomen Consolidation copper mine in 1852. The diamond drill holes are those of an investigation of the deposit by the U.S. Bureau of Mines in 1948. From Earl's Investigation of Perkiomen Creek Copper Deposits, Figure 3.*



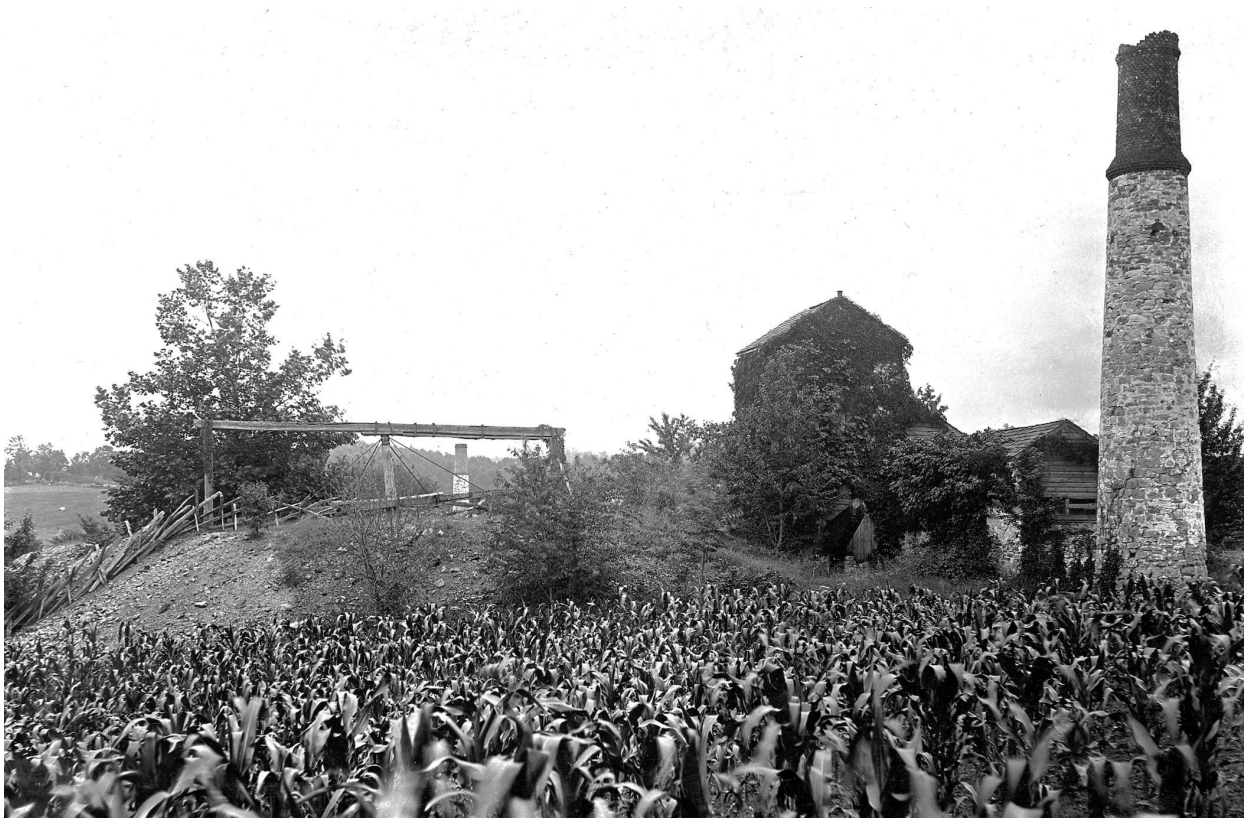
*The 24-inch Bull engine erected on Cooking's engine shaft at the Wheatley Mine in 1852. An elevation engraved for the Exhibition of the Industry of All Nations, a World's Fair held in New York in 1853. From Silliman and Goodrich's World of Science, Art and Industry from Examples in the New York Exhibition, 57.*

Mining Company, allowing the Wheatley to share the Chester's adit, lightened the pumping load by draining the mine to the ten fathom level.<sup>52</sup>

The engraving (left) shows that the engine's underbeam was counterbalanced and functioned as a surface balance bob, as well as giving movement to both the plug rod that operated the valve gear in the engine house and the boiler feed pump positioned beneath the beam. As with all Bull engines, the cylinder was inverted and the steam drove the piston upwards, with the valve chest and steam inlet at the base. In this way, the engine occupied just a single floor. But in the absence of an illustrated condenser, the position of the exhaust, normally at the top of the cylinder, is unclear. It is possible that the pipe shown at the cylinder top is

an eduction pipe leading to a hidden condenser in the roof. However, neither an exhaust valve nor a means of operating it are evident, so it is equally possible that the engine was non-condensing. The engine house faced south-southeast with the boiler house (for a single boiler) to the rear, served by a separate stack.

By May 1853, the engine shaft had reached thirty-six fathoms, two whim shafts, numbered 1 and 2, had been sunk to depths of twenty-nine and seventeen fathoms,<sup>53</sup> respectively, and the mine had been equipped with two waterwheels. One of these was of thirty-foot diameter (two-foot breast) driving six heads of stamps and a crusher, and the other of ten-foot diameter (twenty-foot breast) working the dressing floors ("trunks and



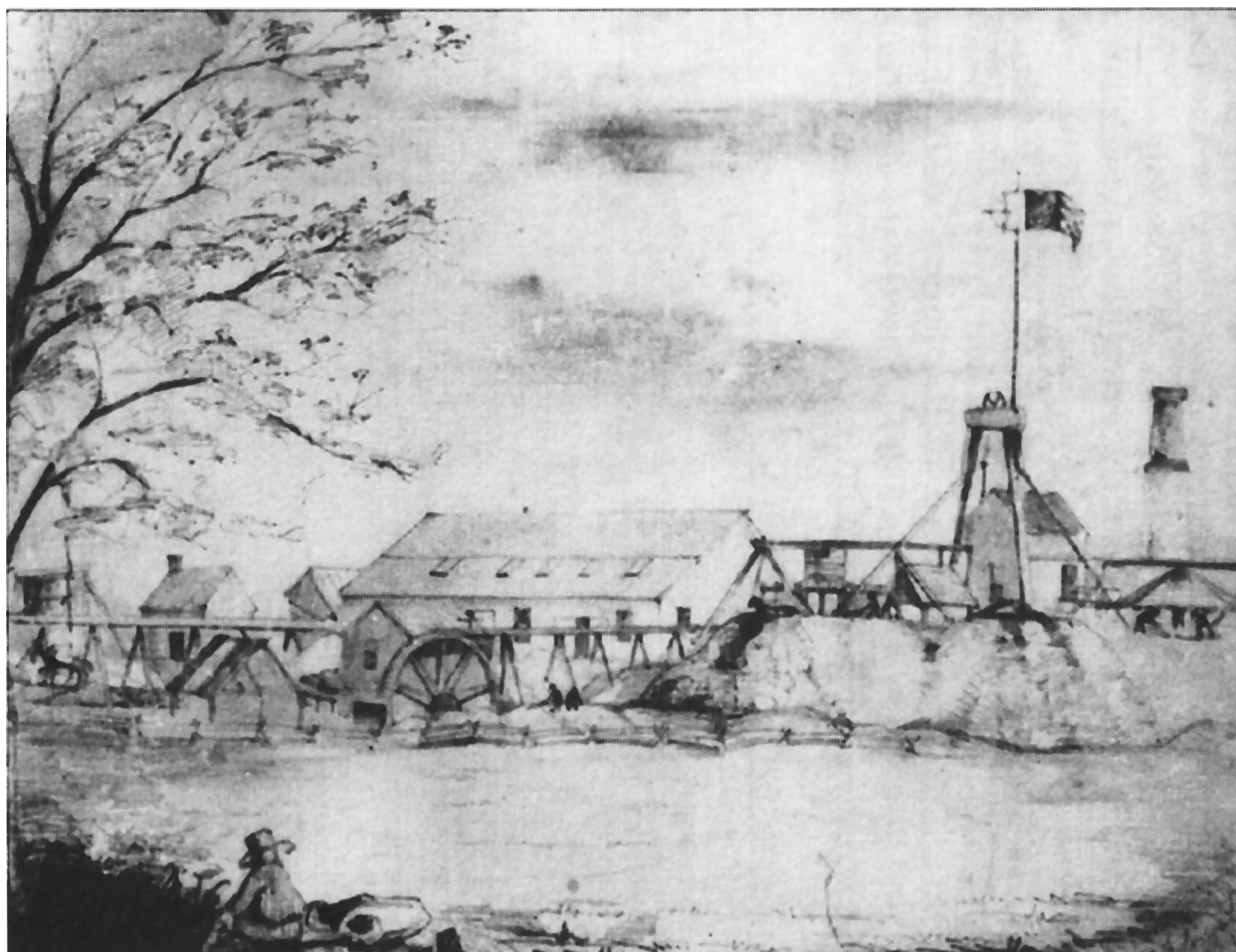
*The derelict engine house, boiler house, and separate stack of the Bull engine erected at the Wheatley mine in 1852, with burrow and horse whim to left. The stack of the 24-inch rotative engine re-erected at the Wheatley mine in 1864 can be seen beyond the whim. Photograph by E. B. Hardin (c. 1885), Geological Society of America, image no. 995.*

round [b]uddle"<sup>54</sup>).

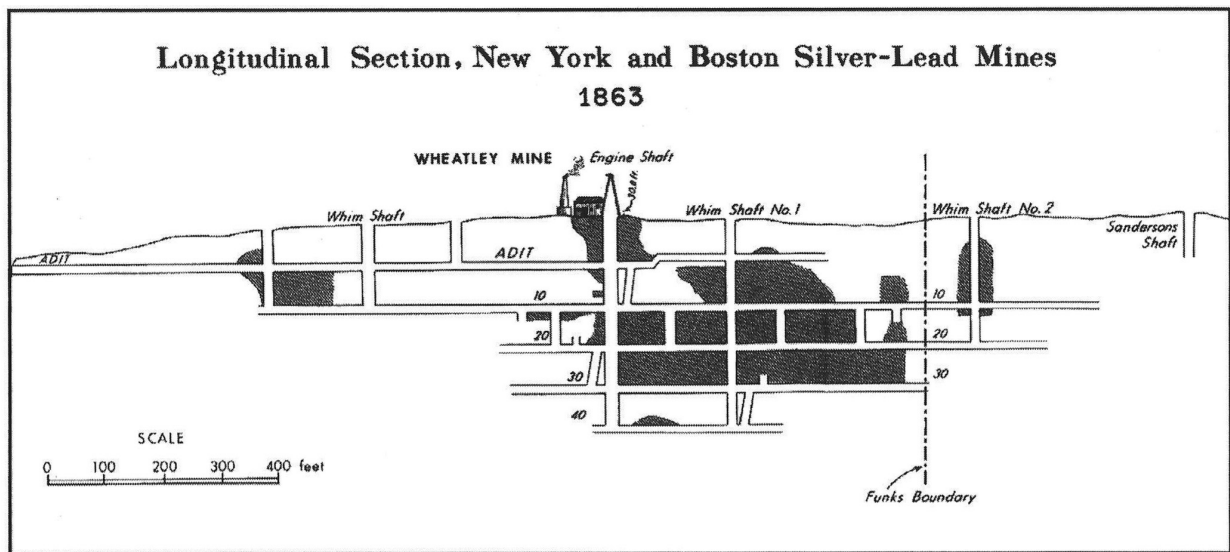
By August, the engine shaft had reached a depth of thirty-nine fathoms<sup>55</sup> and work had begun on a new shaft—named the Sanderson after Wheatley's business partner—sited halfway between Cooking's shaft and Smith's engine shaft at the nearby Brookdale Mine. The plan was to link the two mines underground and drain both from the new shaft by means of an eighty-inch Cornish pumping engine with a twelve-foot stroke.<sup>56</sup> But while an estimate of \$26,480<sup>57</sup> was drawn up for such an engine in April 1853, the engine was never purchased.

Nevertheless, by April 1854, Sanderson's en-

gine shaft had been sunk ten fathoms, Cooking's engine shaft had reached its final depth of fifty fathoms, and the two whim shafts were at depths of thirty-nine and twenty-nine fathoms, respectively.<sup>58</sup> By September 1854, five levels had been developed following Cornish mining methods, and the mine had raised in total 1,800 tons of ore averaging 60 percent lead—the galena averaging 70-85 percent lead with 15 to 120 ounces of silver per ton, while the pyromorphite averaged 66-72 percent lead and 5 ounces of silver per ton. Of this output, 1,400 tons had been sold to the nearby Chester County Mining Company for smelting at a price of 4.5 cents per pound.<sup>59</sup>



*A sketch of the Wheatley Mine drawn by G. F. Folingly in 1853, showing the 30-foot waterwheel (left) used to drive stamps and a crusher, and the engine house, shears, whim, and separate stack (right) of the 24-inch Bull engine. From Sloto's Mines and Minerals of Chester County, p.136; courtesy of the American Philosophical Society.*



*A cross section of the Wheatley Mine in 1863, prior to the mine's reworking by the New York and Boston Silver-Lead Company. From Slot's Mines and Minerals of Chester County, 135; republished from an original in Reports on the Properties of the New York and Boston Silver-Lead Company, Chester County, Pa (New York: George F. Nesbit and Company, 1864).*

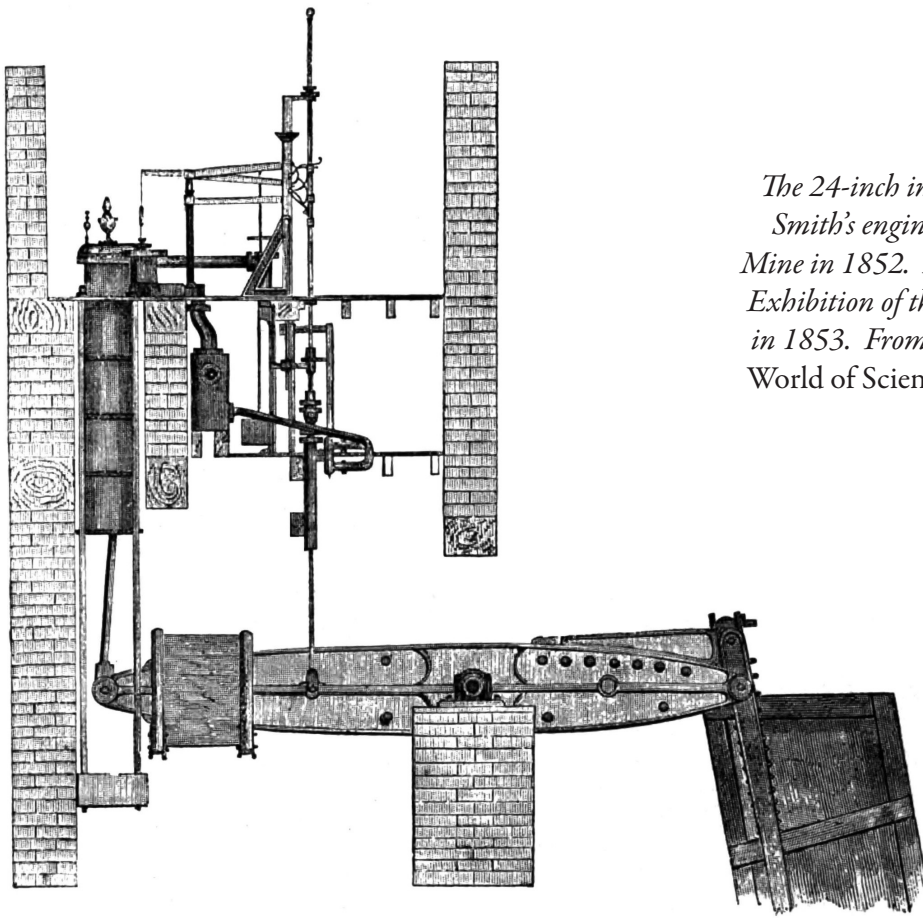
Mining was suspended in 1855 due to a crisis in the U.S. financial market in February, and in September 1855, in response to financial difficulties and the need to raise capital for the eighty-inch engine, the Wheatley, Brookdale, and Phoenix mines were merged to form the Pennsylvania Lead Company.<sup>60</sup> However, the new company never worked the mines and, having failed to raise the necessary capital, declared bankruptcy in 1857.

### *The Brookdale Mine*

The solitary stack at the Pickering Valley Golf Club stands beside the engine shaft of the Brookdale Mine and served as the separate stack of the mine's small pumping engine. Lying a little over a third of a mile to the southwest and on the same lode as the Wheatley Mine, the Brookdale Mine was opened in October 1852.<sup>61</sup> In December of that year, a high-pressure, single-acting engine capable of pumping 216 gallons per minute<sup>62</sup> was erected beside Smith's engine shaft.

The engine, set to work in March 1853,<sup>63</sup> was the same size (twenty-four-inch cylinder, sixty horsepower) as that at the Wheatley Mine, and of similar design. Both were "automatic or intermittent in their action, remaining inactive until a certain load of water has accumulated on the pumps, when 'a float' releases a lever communicating with the steam 'cut-off,' and a motion of the piston relieves the pumps of their burden, and the machinery is again quiet until a fresh accumulation."<sup>64</sup>

Rather than being a Bull engine, however, the Brookdale engine (p.14) was simply inverted, with a connecting rod attached to the indoor end of the underbeam, while the pump rods were worked from the outdoor end. Like the Wheatley engine, the underbeam gave movement to the plug rod operating the valve gear and boiler feed pump, but was counterweighted on the indoor end rather than the outdoor end, the curious adaption to which likely supported operation of the pump rods on the underlie. However, unlike the Wheatley engine, all the valves are positioned at the top of the cylinder, the base of which ap-



*The 24-inch inverted engine erected on Smith's engine shaft at the Brookdale Mine in 1852. Elevation engraved for the Exhibition of the Industry of All Nations in 1853. From Silliman and Goodrich's World of Science, Art and Industry, 58.*

pears to have been open with the connecting rod attached directly to the piston. If so, the steam must have driven the piston downwards. The engine also occupied two floors, a driving floor, from which the valve gear were operated, at the level of the cylinder top, and a basement housing the condenser, boiler feed pump, and cataracts. The engine house faced east with the boiler house for a single boiler to the rear, served by the surviving stack, the flue hole of which lies at the base of the eastern side.

The engine shaft was deepened from twelve to over eighteen fathoms between May and August 1853,<sup>65</sup> and by April 1854, it had reached thirty fathoms.<sup>66</sup> By this time, two levels had been developed below the adit level at five fathoms, the whim shaft had been sunk to nineteen fathoms, and about 150 tons of ore had been raised.<sup>67</sup>

Smith's engine shaft reached its final depth of thirty-two fathoms later that year. The shaft is presently capped, following the collapse of the seal in 1995, and is used as a water supply for the golf course.<sup>68</sup>

Mining activity at the Brookdale Mine ceased in 1855 in response to a court ruling that found Charles Wheatley, as mine manager, guilty of polluting and diverting the flow of a stream neighboring farmer John Chrisman used to water livestock. The summons was issued in December 1853 and the verdict announced the following month. Wheatley appealed the decision, which delayed its implementation until January 1855, when the court sided with Chrisman. Upheld by the Pennsylvania Supreme Court in June 1855, the decision forced mining operations to cease.<sup>69</sup>

### *The Phoenix Mine*

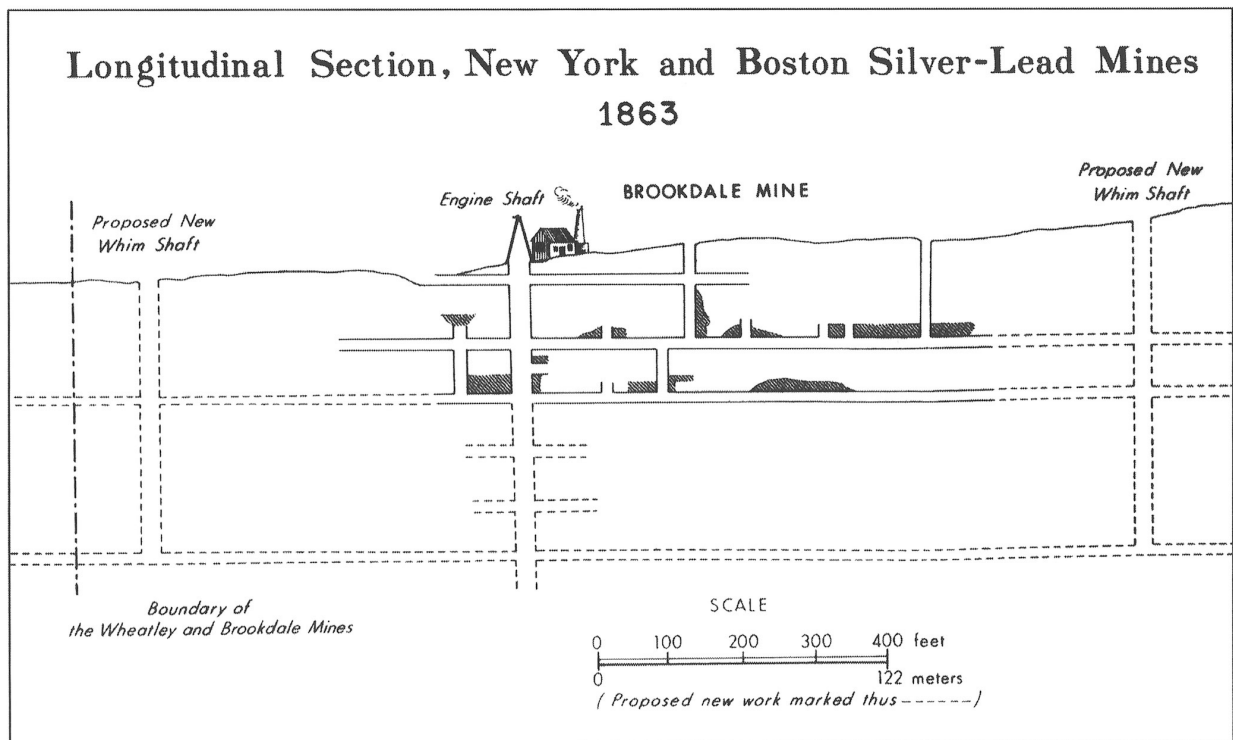
The Phoenix Mine, which lies a quarter of a mile southwest of the Brookdale Mine on the same lode, was likewise opened by Charles Wheatley in the early 1850s, but was a very small operation. A steam engine was erected here but no record of it exists and the engine shaft was only sunk to a depth of fifteen fathoms with a single level driven two hundred feet north and south at the bottom.<sup>70</sup> The mine was acquired by the Pennsylvania Lead Company in 1855 and the New York and Boston Silver-Lead Company in 1864 (see below), but no work was done by either of these concerns.

### *The Charlestown Mine*

The Charlestown Mine, a little under a mile northwest of the Brookdale and Wheatley mines,

was started in late 1850 or early 1851, and an act to incorporate the Charlestown Silver-Lead Mining Company read in February 1852 was passed by the Pennsylvania General Assembly in April of that year.<sup>71</sup> By early 1854, Wheatley's engine shaft had reached a depth of thirty fathoms and the mine had been equipped with a twenty-four-inch, low-pressure, rotative beam engine of sixty horsepower.<sup>72</sup>

Built by I. P. Morris and Company of Philadelphia from drawings furnished by John West of nearby Norristown, Pennsylvania, this single-column, entablature condensing engine (p.17) was used for both pumping and crushing the ore, which was raised with a horse whim.<sup>73</sup> The valve gear was worked from the beam by way of a plug rod and plug handles rather than by eccentrics driven off the crankshaft, the parallel motion was concentric, and the condenser cistern was placed



*A cross section of the Brookdale Mine in 1863, showing the extent of development in 1855 and the planned development under the New York and Boston Silver-Lead Company. From Slot's Mines and Minerals of Chester County, 155; republished from an original in Reports on the Properties of the New York and Boston Silver-Lead Company.*

“outdoors” between the neo-classical column and the flywheel.

An émigré from Cornwall, John West was the nephew of the celebrated Cornish engineer William West, and went on to design several engines, including the largest beam engine ever built in North America. Known as “The President,” this 110-inch, twin-beam pumping engine was set to work at the Lehigh Zinc Company’s Ueberroth mine in the Saucon Valley, thirty miles to the north of Phoenixville, in January 1872.<sup>74</sup>

By April 1854, the engine shaft at the Charlestown was down to thirty-seven fathoms and about one hundred tons of ore had been raised.<sup>75</sup> The mine was also equipped with two gigging machines, and the miners, of whom there were eleven and one boy, were being paid thirty to thirty-five dollars per month.<sup>76</sup> The lode, however, proved poor and the mine was abandoned as unproductive in 1855.<sup>77</sup> In 1864, the mine was acquired but not worked by the New York and Boston Silver-Lead Company and the beam engine was moved to the Wheatley Mine (see below).

### **The New York and Boston Silver-Lead Company**

In 1864, following almost a decade of inactivity, the increased demand for lead brought on by the American Civil War led Wheatley to re-purchase all four mines and their machinery, and to form the New York and Boston Silver-Lead Company to which he promptly sold the property.<sup>78</sup> According to the company’s first annual report,<sup>79</sup> work at the Wheatley Mine began in April 1864, at which time the Bull engine was cleaned and repaired for a period of about six weeks before being set to work. The engine proving of inadequate power to drain the mine to the ten-fathom level, a second adit was driven for almost six hundred feet at the eight-fathom level.

In addition, the Charlestown engine, described as “a Cornish beam, whim and crusher,” was re-erected in an all-enclosed house with an at-

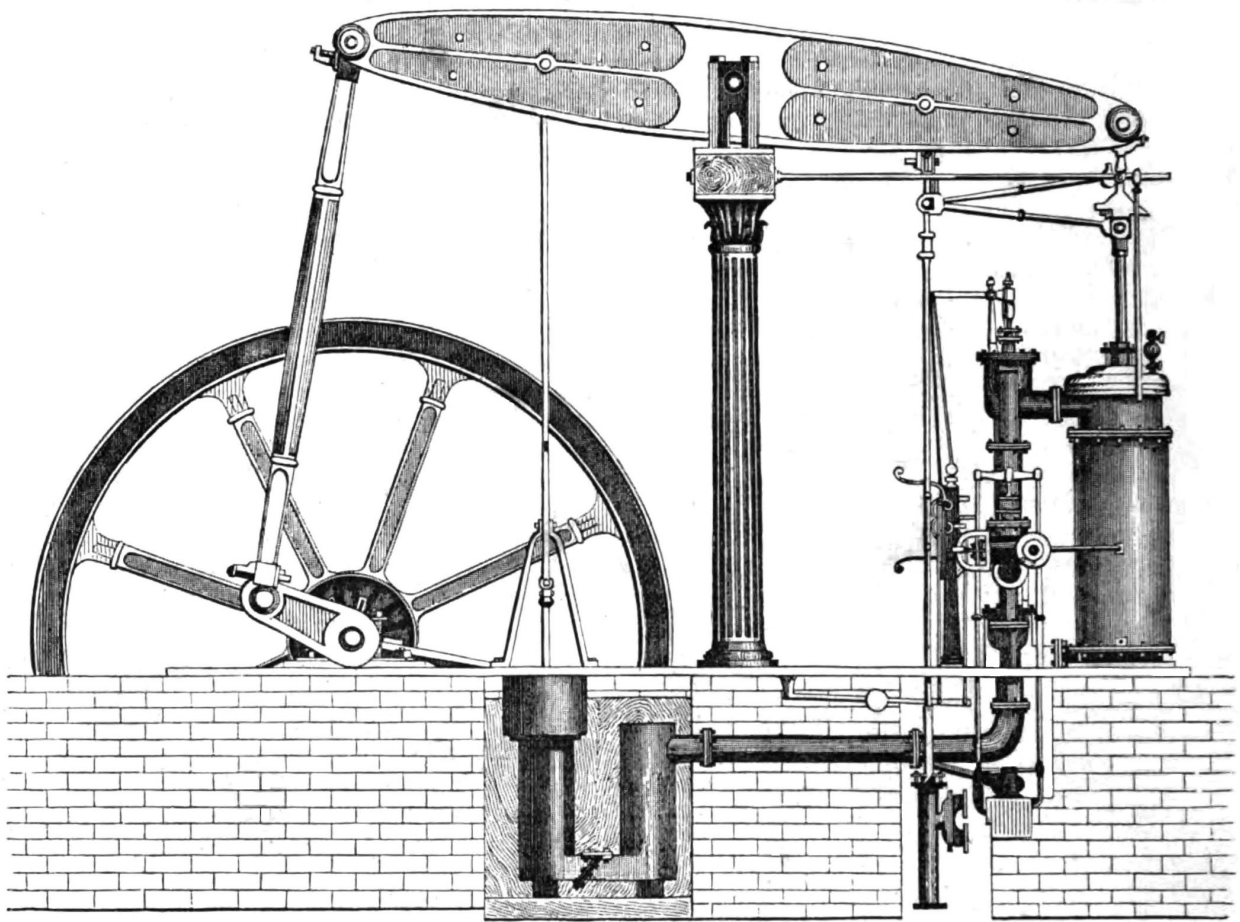
tached stack and lean-to boiler house alongside, “at a convenient point” between the Wheatley and Brookdale engine shafts. From there it could work the Wheatley Mine by way of flat rods and also be used for hoisting and crushing.

In this way, the mine was successfully dewatered and, by March 1865, had been cleared and re-timbered, and significant underground development had taken place. New dressing floors and crushers were installed, with the stopes yielding, on average, five hundred pounds of dressed ore per fathom, of which twenty-five tons had been shipped and a further sixty-five to seventy tons of lead ore and twelve tons of zinc ore had been raised.

At the same time, work was also underway on the Brookdale engine, with the expectation that pumping would commence within two weeks. Exploration at adit level was yielding four hundred to five hundred pounds of dressed ore per fathom.<sup>80</sup> To what extent the Brookdale Mine was dewatered, however, is unknown, since records of the activity of the New York and Boston Silver-Lead Company cease at this point. However, all mining had likely ceased by 1870, when Charles Wheatley was taken ill and hospitalized.<sup>81</sup> The company went bankrupt in 1873.

### **Later Activity**

No further work was carried out on the Wheatley Mine until January 1917, when it was reopened by the Eastern Mining and Milling Company. Mining was forced to stop on account of a coal shortage but resumed in November 1918 and, by August 1919, about five hundred tons of lead and zinc ore had been raised. Production, however, was limited and operations ceased for the final time in 1920.<sup>82</sup> In 1923, the Pennsylvania Lead and Zinc Company and the Great Eastern Mining and Manufacturing Company made an attempt to raise capital to resume mining operations, but it was unsuccessful.<sup>83</sup>



*The 24-inch multipurpose rotative beam engine designed by John West of Norrisville, Pennsylvania, and erected on Wheatley's engine shaft at the Charlestown Mine in 1852 or 53. An elevation engraved for the Exhibition of the Industry of All Nations, from Silliman and Goodrich's World of Science, Art and Industry, 58.*

*R. Damian Nance is a distinguished professor emeritus of geology at Ohio University and a visiting fellow at Yale. In addition to having published over two hundred papers and sixteen books in geology, he has written over forty papers on aspects of Cornish mining history and his*

*Complete Guide to the Engine Houses of West Cornwall (2014), Mid-Cornwall (2019), and East Cornwall and Devon (2020) with Lightmoor Press (U.K.) reflect his life-long interest in the Cornish beam engine.*



*The derelict all-enclosed engine house, boiler house, and attached stack of the 24-inch rotative beam engine, first erected at the Charlestown Mine in 1852, following its removal to the Wheatley Mine in 1864. Photograph by E. B. Hardin (c. 1885), Geological Society of America, image no. 997.*

### Notes:

1. Henry W. Kraiz, "Audubon and his Achievements," in: *Historical Sketches* (Norristown, PA: Historical Society of Montgomery County, Pennsylvania, 1905), v. III, 233-41; Francis H. Herrick, *Audubon the Naturalist: A History of His Life and Time* (New York: D. Appleton and Co., 1917), v. I; Rebecca Anne Hunt, "'Blessed Spot' along the Perkiomen: An Historical Analysis of Mill Grove" (master's thesis, University of Pennsylvania, 1994).
2. James Grant Wilson and John Fiske (eds.), *Appletons' Cyclopaedia of American Biography* (New York: Appleton and Co., 1889), VI (Sunderland-Zubita), 450; Wendell E. Wilson, "Charles M. Wheatley (1822-1882)," Mineralogical Record Biographical Archive, 2015 (<https://mineralogicalrecord.com/labels.asp?colid=710>).
3. Kenneth M. Earl, *Investigation of Perkiomen Creek Copper Deposits, Montgomery County, Pennsylvania* (Washington, DC: U.S. Bureau of Mines, 1950), Report of Investigations 4666, 4; T. M. Berg, W. E. Edmunds, A. R. Geyer, et al. (comp.) 1980, "Geologic Map of Pennsylvania" (Pennsylvania Geological Survey, 4th ser., 1980), Map 1, scale 1:250,000; "Bedrock Geology of Pennsylvania" (Pennsylvania Bureau of Topographic and Geologic Survey, 2001), digital map.
4. Herrick, *Audubon the Naturalist*, 1:103; Hunt, "'Blessed Spot,'" 54; John H. Barnes and Robert C. Smith, II, *The Nonfuel Mineral Resources of Pennsylvania* (Harrisburg: Pennsylvania Geological Survey, 2001), 4th Series, Educational Series 12, 20.
5. Herrick, *Audubon the Naturalist*, 1:113.
6. Kraiz, "Audubon and his Achievements," III: 237.
7. *New York Herald*, 17 Nov. 1804, 3; Herrick, *Audubon the Naturalist*, 1:114.
8. Benjamin LeRoy Miller, *Lead and Zinc Ores near Phoenixville, Chester County, Pennsylvania* (Harrisburg: Pennsylvania Geological Survey, 1923), 4th Series,

- Progress Report 67, 1; Earl, *Perkiomen Creek Copper Deposits*, 3; Edward W. Hocker, "Montgomery County History," *Bulletin of the Historical Society of Montgomery County* 12, no. 2 (Spr. 1960): 96; R. C. Smith, II, *Zinc and Lead Occurrences in Pennsylvania* (Harrisburg: Pennsylvania Geological Survey, 1977), 4th Series, Mineral Resource Report 72, 247-8. A fathom is six feet or 1.85 meters.
9. Herrick, *Audubon the Naturalist*, 1:199; Earl, *Perkiomen Creek Copper Deposits*, 3.
10. W. H. Reed, "Audubon: Its History, Traditions and Reminiscences," in: *Historical Sketches* (Norristown, PA: Historical Society of Montgomery County, Pennsylvania, 1905), v. III, 262.
11. Herrick, *Audubon the Naturalist*, 1:102.
12. Hocker, "Montgomery County History," 96.
13. John P. Wetherill, "Observations on the Geology, Mineralogy, etc. of the Perkiomen Lead Mine, in Pennsylvania," *Journal of the Academy of Natural Sciences of Philadelphia* 1st ser., 5, pt. 2 (1827): 305-16.
14. Theodore W. Bean (ed.), *History of Montgomery County, Pennsylvania* v. 1 (Philadelphia: Everts and Peck, 1884), 10; I. C. Williams, "The Copper Mines at Shannonville," in: *Historical Sketches* (Norristown, PA: Historical Society of Montgomery County, Pennsylvania, 1905), v. III, 222.
15. Miller, *Ores near Phoenixville*, 1; Barnes and Smith, *Nonfuel Mineral Resources*, 20.
16. Hocker, "Montgomery County History," 96.
17. Miriam Clegg, "Underground Treasure: The Story of the Wheatley Mines" (J. R. Ertell, ed.), *Newsletter of the Historical Society of the Phoenixville Area* 33, no. 3 (2010): 2.
18. Williams, "Copper Mines at Shannonville," 222.
19. F. Harold Evans, *Historical Sketches of Copper and Lead Mining in Montgomery County, Pennsylvania* (Special Publication no. 2, Friends of Mineralogy, Pennsylvania Chapter, 1980), 17.
20. Williams, "Copper Mines at Shannonville," 223; Bean, *History of Montgomery County*, 10.
21. Bean, *History of Montgomery County*, 10.
22. Clegg, "Story of the Wheatley Mines," 2.
23. Bean, *History of Montgomery County*, 10; Williams, "Copper Mines at Shannonville," 223.
24. Miller, *Ores near Phoenixville*, 2.
25. Bean, *History of Montgomery County*, 10; Williams, "Copper Mines at Shannonville," 223.
26. Bean, *History of Montgomery County*, 11.
27. Williams, "Copper Mines at Shannonville," 225.
28. Bean, *History of Montgomery County*, 11.
29. Bean, *History of Montgomery County*, 11.
30. Bean, *History of Montgomery County*, 11.
31. Bean, *History of Montgomery County*, 11; Williams, "Copper Mines at Shannonville," 224.
32. Clegg, "Story of the Wheatley Mines," 3; Charles M. Wheatley (1822-1882), Mineralogical Record Biographical Archive.
33. Bean, *History of Montgomery County*, 11.
34. Hocker, "Montgomery County History," 97.
35. Miller, *Ores near Phoenixville*, 7.
36. Bean, *History of Montgomery County*, 11.
37. Bean, *History of Montgomery County*, 11.
38. Hocker, "Montgomery County History," 97.
39. Hocker, "Montgomery County History," 97.
40. Bean, *History of Montgomery County*, 11.
41. Hocker, "Montgomery County History," 97.
42. Allan Gehret quoted in: Joseph S. Kennedy, "Mining the Memories on the Mill Grove Estate," *Philadelphia Inquirer*, 7 July 1994.
43. Earl, *Perkiomen Creek Copper Deposits*, 5.
44. Henry Darwin Rogers, *The Geology of Pennsylvania* v. 2 (Philadelphia: J. B. Lippincott and Co., 1858), 700; F. Bascom and G. W. Stose, *Geology and Mineral Resources of the Honeybrook and Phoenixville Quadrangles, Pennsylvania* (Washington, DC: U.S. Geological Survey, 1938), U.S.G.S. Bulletin 891, 124.
45. Samuel Whitaker Pennypacker, *Annals of Phoenixville and its Vicinity: From the Settlement to the Year 1871* (Philadelphia: Bavis and Pennypacker, 1872), 13-14.
46. Ronald A. Sloto, *The Mines and Minerals of Chester County, Pennsylvania* (Middletown, DE: Ronald A. Sloto, 2009), 131.
47. Bascom and Stose, *Resources of the Honeybrook and Phoenixville Quadrangles*, 124.
48. "Journal of Silver and Lead Mining Operations—The Wheatley Mining Company," *Mining Magazine* 4 (1855): 413.
49. "Journal of Silver and Lead Mining Operations," 411.
50. Sloto, *Mines and Minerals of Chester County*, 133.
51. B. Silliman, Jr., and C. E. Goodrich (eds.), *The World of Science, Art and Industry from Examples in the New York Exhibition, 1853-54* (New York, G. P. Putnam and Co., 1854), 59.
52. Sloto, *Mines and Minerals of Chester County*, 135.
53. Henry D. Rogers, "Report of the Wheatley and Brookdale Mines, Chester Co., Penn.," *Mining Magazine* 1, no. 4 (1853): 384-5.
54. Silliman and Goodrich, *World of Science, Art and Industry*, 27.
55. Rogers, "Wheatley and Brookdale Mines," 384.
56. Silliman and Goodrich, *World of Science, Art and Industry*, 58.
57. Sloto, *Mines and Minerals of Chester County*, 137.
58. Silliman and Goodrich, *World of Science, Art and Industry*, 26.
59. "Journal of Silver and Lead Mining Operations," 412; William P. Blake, "The Wheatley Silver-Lead Mines," *Mining Magazine and Journal of Geology* (2nd Series) 1 (1860): 414.
60. Sloto, *Mines and Minerals of Chester County*, 138.
61. "The Case of John Chrisman v. Charles M. Wheatley," *Mining Magazine* 5 (1855): 149.
62. Silliman and Goodrich, *World of Science, Art and Industry*, 59.

63. *Mining Magazine* 5 (1855): 150.
64. Silliman and Goodrich, *World of Science, Art and Industry*, 58.
65. Sloto, *Mines and Minerals of Chester County*, 153.
66. Silliman and Goodrich, *World of Science, Art and Industry*, 27.
67. Silliman and Goodrich, *World of Science, Art and Industry*, 27.
68. Sloto, *Mines and Minerals of Chester County*, 156.
69. "Diverting Water for Mining Purposes," *Mining Magazine* 5 (1855): 149-55.
70. "The Wheatley Silver Lead Mines," *Mining Magazine* (2nd Series) 1 (1860): 413.
71. *American Republican*, 6 Apr. 1852; Sloto, *Mines and Minerals of Chester County*, 19.
72. Silliman and Goodrich, *World of Science, Art and Industry*, 58.
73. L. Turnbull, "A Visit to the Lead and Copper Mines of Chester County, Pennsylvania," *Journal of the Franklin Institute* (3rd Series) 27 (1854): 53.
74. "Pumping Engine at the Lehigh Zinc-Works, Friedensville, PA," *Scientific American Supplement* 32 (1876): 504.
75. Silliman and Goodrich, *World of Science, Art and Industry*, 27.
76. Turnbull, "Lead and Copper Mines of Chester County," 53.
77. Charles Hoofstetten, "Report to the President and Directors of the Pennsylvania Lead Company," *Statement of the Pennsylvania Lead Company* (New York: Billin and Brother, 1855), 30.
78. Sloto, *Mines and Minerals of Chester County*, 138.
79. James Harvey, "Report," *First Annual Report of the New York and Boston Silver Lead Company 1865* (New York, A. A. Mosher, 1865), 5-8.
80. Harvey, "Report," 9-10.
81. Sloto, *Mines and Minerals of Chester County*, 138.
82. Bascom and Stose, *Resources of the Honeybrook and Phoenixville Quadrangles*, 125.
83. Sloto, *Mines and Minerals of Chester County*, 138.