Lead Mining - Methods used

by Alastair Laws

There were five main methods of mining lead

Digging – by following the vein along the surface and digging it out, much in the way of open cast coal mining.

Firing – where a roaring fire was built up against the rocks, allowed to cool and then doused with vinegar and water, which split the rocks. Wedges were hammered in and then it was a case of picks and shovels being used to collect the broken rocks containing the ore.

Hushing – where there was a stream, an earth dam was constructed high up. This was then allowed to fill up to form a small lake. This water was then released allowing it to pour down the hillside carrying away the surface peat and soil to expose the ore containing rock dislodged by the torrent of water. This was called ‘Shoad Ore’

Bell Pits – A shaft some twenty to thirty feet deep was sunk and then miners would descend and commence working around the base, similar to the coal bell pits. They worked until the bottom was bell shaped and the ore was collected and brought to the surface by a ‘Jack Roller’ or Windlass. The pit was worked on and the bowse extracted until water penetration caused cave-ins and it was unsafe to continue. Then the next bell pit was commenced with the debris being used to fill in the first one and so they continued.

All these methods proved uneconomic due to inclement weather and difficulty in transporting the bowse from the site, so they had to come up with a different method of extracting the ore.
**Mines** – Two methods were used in mining. The first was a continuation of the Bell Pit where a shaft was sunk and then tunnels dug horizontally from the bottom until they dug and reached the ore-bearing rock, which, as in the case of the Bell Pit was brought to the surface from the shaft bottom. The only problem was water and ventilation, so they proceeded to the second method. This was by digging into the bottom of a hillside and driving a level with a slight gradient, the entrance of which was called an adit, and this solved the problem of drainage. They drove the level until they reached the vein of ore and proceeded to excavate it, following the vein upwards. When out of reach they constructed a platform of wooden beams and continued upwards, which was called stoping. They could continue like this until they broke through to the surface, thus solving the ventilation problem. They could turn sideways from the main level then upwards again following the veins of ore. A wooden railed wagon-way was constructed on the bottom level and the bowse hauled out in tubs by ponies to the adit. Rocks that contained no ore were used for packing tunnels where the ore ran out or were left piled on the staging. These were aptly named ‘deads’.

In the early days the method used to get the lead bearing ore was for one man to hold a steel bar called a ‘jumper’, which he turned while his companion hit the end repeatedly, drilling a hole that was then packed with explosives. This was all done by candlelight and later by carbide lamps. The miners worked in small groups of two to twelve men called partnerships. They would speculate from knowledge and experience and strike a bargain with the mine agent to raise ore from a certain part for a period of three months. The year consisted of four quarters with new bargains made at the start of each quarter. The price was agreed at so much per ‘bing’ of ore. Many aspects on both sides had to be considered before fixing a price such as the market price of lead, difficulty of extraction, and the quality of the ore. Bargains therefore varied from one quarter to the next. The extraction of ore once it was brought out of the mine was placed in a ‘Bowsestead’ or ‘Bowseteam’, each partnership having their own. The ore was now ready for the next stage – the processing procedure.
Young boys and women carried out the processing. The bowse was rested on a knocking stone and hit by a ‘buckler’ breaking the brittle bowse down into smaller pieces so the galena could be separated from the waste stone and other minerals surrounding it. It was then sieved in a tub of water called a ‘Hotching Tub’, the heavier galena sinking to the bottom and the lighter waste washed away at the top. The ore was then crushed and washed again in more vigorous water by the young washer boys and women. This was cold, wet and tedious work as it took place outdoors with initially no overhead shelter. Later mechanisation improved this task. Crushing mills at Killhope c.1860 were basic. This was where a large water wheel drove a series of grinding wheels. The bowse was dropped between these from a hopper, not unlike a coffee grinder. The ore was then washed mechanically by complex machines called ‘buddles’.

Boys aged nine to eleven were employed to pick out stones from the ore before crushing. They graduated to various mechanical separators after about three years. After some seven years and now more familiar with the different minerals, they progressed to master-man washers or became part of a partnership and commenced work in the mine, usually with family. The young washer boys were sent to school in winter when the water driving the wheel froze. Commissioners of Greenwich Hospital through the London Lead Company provided schools, housing, libraries, reading rooms and hospitals before they were available to most other working classes.

Once the ore was treated and purified it was then ready for smelting whereby the chemical constituents were separated and the purified lead obtained.

**Smelting** – The ore was smelted by heating it to the required temperature in specially designed hearths, the resultant fumes being carried off in a flue underground covered by turf to stop the escape of poisonous gases to a chimney set on high ground, sometimes over a mile away from the smelt hearths. Once a year the chimney and flue were scraped and the resulting fumes providing a cash crop of lead.
The smelting was a two-stage process: roasting and reducing. The galena (lead sulphide) was heated to burn off sulphur. Coke was then added combining with the sulphur, forming a fused sinter or dinker, which was easily removed. The lead combined with oxygen in the air to form the compound lead oxide. This was reduced when lead oxide was burned to remove the oxygen leaving molten lead. This still had a certain amount of impurities but if kept above boiling point in a large container, then stirring will bring the dross (impurities) to the surface. It used to be stirred in a dross kettle and the surface skimmed to leave pure lead.

Smelting was a specialised skill. There were relatively few smelters, usually retaining their skills in the family. They were provided with better housing, as at Nenthead, and often they were given land as an added inducement to continue working for a company.

The molten lead was poured into ‘pigs’ and was then ready for transporting to the east coast by teams of carriers who used strong galloways for the task. Each horse carried two pigs of lead in specially constructed bags, one on each side, each pig weighing one hundredweight. The team of horses between twelve and twenty were led by a raker or bell-horse making their way across the treacherous moors on well trodden trails which in winter became impossible to cross.

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