DERBYSHIRE LEAD MINING IN THE 18TH AND 19TH CENTURIES

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Abstract: Four aspects of the industry are discussed: its prosperity and decline over the two centuries, its size, the control and management and the development of technology.

PROSPERITY TO DECLINE

In 1700 Britain was Europe's largest lead producer with Derbyshire still dominant but Wales and the North Pennines were coming-up quickly. Lead was probably the second-most important export, after wool, but was soon after overtaken by iron. Lead was an international trade with the price determined by the international market.

By 1780 or thereabouts the watershed was reached. Until then a reasonable portfolio of shares was likely to be consistently profitable; after then it was generally unprofitable. Portaway at Winster, for example worked for some 80 years without a single profitable year. Foreign competition was growing, especially Spain, whilst the North Pennines had become dominant in Britain. What might have been important water-power sites for deep drainage were taken over by the cotton industry which also diverted capital which might otherwise have gone into mining. The technical leadership Derbyshire had established was lost to Cornwall where Boulton and Watt's engines were being enthusiastically adopted.

Around 1830 the industry was at a nadir. Most mines were closed or near-closed, except at Alport and Crich. Desperate miners flitted to coal mining areas which were growing rapidly in importance. General depression and competition from Spain were the main causes: lead prices had fallen after the Napoleonic Wars but wages and many other prices were more "sticky".

Of several short-lived revivals, that of 1850 seemed the most promising, with outputs up to historically high levels (around 10,000 tons) again, but most mines proved unprofitable. William Wyatt, perhaps the then best known mine agent, retired from a career in which every mine he was involved with lost money.

The only important exception to all this was Millclose Mine at Darley Dale. Restarted in 1859-60 with Edward Wass the sole owner, it lost money for a decade on driving southwards from Watt's Shaft. The decision to turn northwards led to the discovery of the modern Millclose. Its lode was rich enough to withstand the competition from the United States and Australia, which, for example caused the collapse of Magpie and the ruination of its primary shareholder, John Fairburn, in 1885. The adoption of new methods of dressing c.1880 brought Millclose to the 20th century threshold.

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THE SIZE OF THE INDUSTRY

Peak outputs were probably about 10,000 tons of metal a year, with the average, over the two centuries and, perhaps, that preceeding, of about 5000 tons.

10,000 tons would need about 15-20,000 tons of concentrate with lower grades common in the 19th century. Visualise 20,000 tons as filling the Mining Museum at Matlock Bath. Perhaps four or five times this amount including ore and waste, was brought to surface (most waste was stored underground). Remembering that many mines (Masson, Golconda, Puttwell Hill for example) have been worked subsequently for spar (calcite, fluorite, barite), there is thus plenty of room for this output in the many miles of minuscule workings we explore.

Even "big" mines were small by modern standards, except for Millclose which mined something like 20% of all Derbyshire ore ever. Because the field was worked early, vertical access predominated, via thousands of shafts a short distance apart. In good times there were, perhaps, thirty or forty "big" mines operating, with the potential to produce a few hundred tons of lead per year. Biggest, except the later Millclose, were probably the short-lived mines at Winster and at Eyam, a few of which, in a few years, produced as much as 3000 tons of concentrate per annum.

Medium sized mines, in this scenario, produced tens of tons to a hundred tons or so annually. In good times there might have been up to two hundred such mines - a handful in each of the mining liberties, many operating for quite long periods.

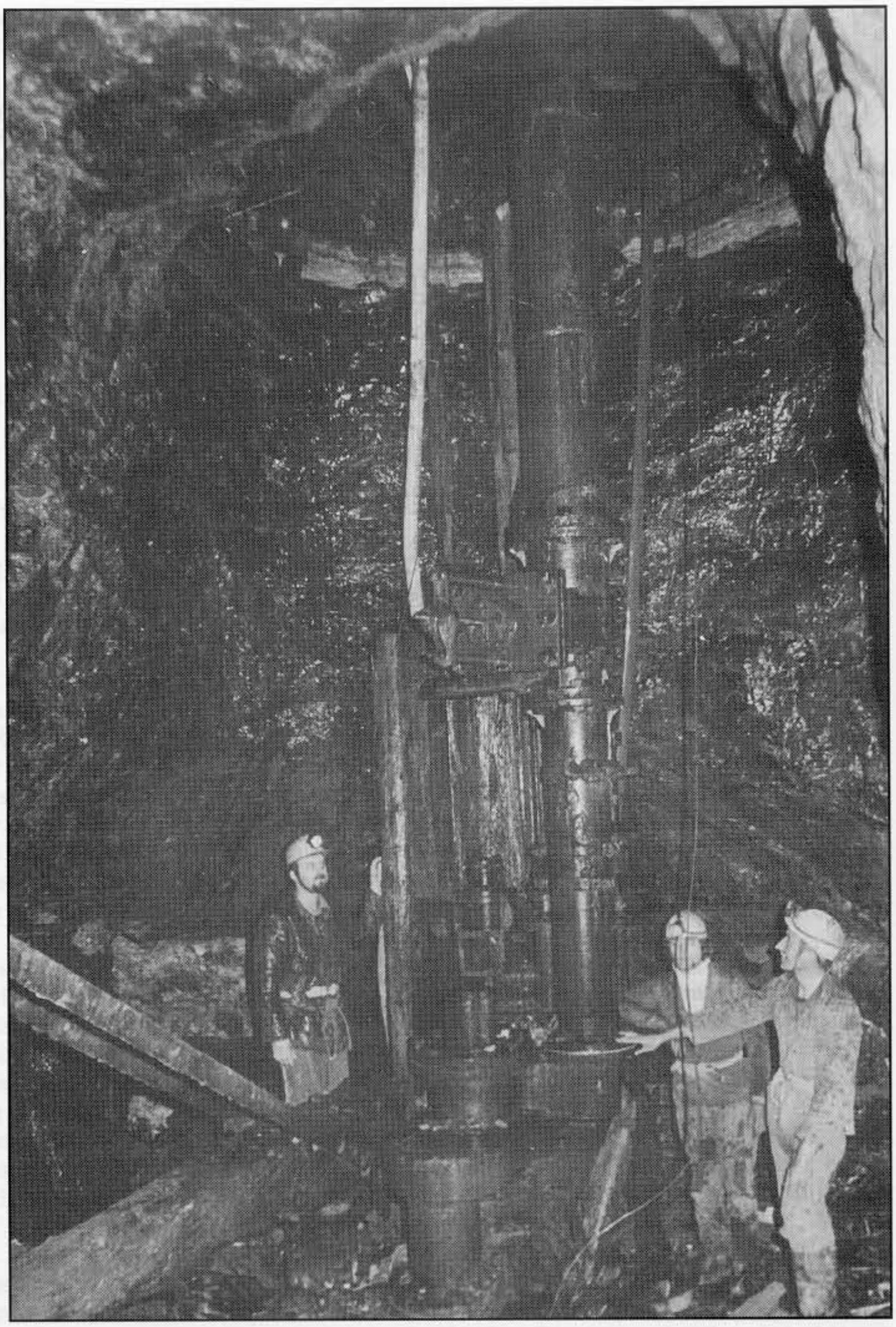
Small mines existed in their thousands, spasmodically worked by very small groups of miners, either in hope of finding large deposits - Magpie was a good (and rare) example of such success - or as a supplementary income done in conjunction with work at a larger mine or hand-in-hand with farming. Closure of the large Placket Mine at Winster in the 1790s gave rise to about 18 small mines reopened by out-of-work miners and it is clear that small-scale mining was often little more than an informal and respectable form of poor relief. Output was very small - a few dishes - a few hundredweights at each measuring at six and seven week intervals but was probably enough to encourage continuance.

In the early 18th century, if each man averaged an output of one hundredweight (50 kg.) of ore and waste a day, then the 100,000 tons or so brought to surface annually would require a workforce of about 6700 miners - not too inconsistent with David Kearnon's 20,000 people dependent on the industry in the 1640s, including those dressing, in carriage, smelting, woodcutting etc. Improvements in technology - use of powder, stoping, haulage and winding probably tripled the output per man by the late 19th century.

CONTROL AND MANAGEMENT

By 1700 the direct influence of most local gentry in the industry as mine or smelting operators was declining. Single ownership or two or three gentry acting in concert had largely already ended, as for instance Vermuyden at Dovegang or, in 1700-1705, the Duke of Rutland at Haddon, though Wass was later to reverse the trend and in copper mining the Duke of Devonshire remained sole proprietor throughout the 18th century at Ecton.

Instead the "managing agency system" developed. In this (usually) a lead smelter held shares on behalf of a group of "friends" or clients. The smelter attended the sometimes frequent meetings at mines (or convenient hostelries) paying calls and receiving dividends. At the end of the quarter or year an account was rendered to each friend with the loss or profit on the portfolio. The cost was the right for the smelter to acquire the fraction of ore controlled by himself and friends. This was a sophisticated system, very efficient at raising capital, which was as early or earlier than occurred in most areas and, indeed industries. This, and the effective limited liability granted by the laws and customs helps account for the success of the local industry in raising capital for capital intensive projects such as soughing and the use of steam power. The system began to break down when profitability declined after 1780 and when alternative investments, such as in cotton, became available. It still, however, remained an important element in the industry, despite astonishing losses in some cases, for almost a further century.



Cornish Technology in Derbyshire. The Trevithick-type water pressure engine of 1819 at Wills Founder, Winster, discovered by members of the North Staffordshire Mining Club.

Medium and large mines were, almost invariably, controlled by two or three such managing agents, who appointed the mine agents and so directed affairs at the mines. Barkers, who were involved as two branches of the same family for nearly 150 years controlled holdings in mines, at their peak, amounting , perhaps to a third the total output.

The change can also be seen in the numbers of smelting sites - perhaps a hundred or so of the old-type smelting hearths up to the 1730s, reducing to less than a score of cupola-type works a half-century later. The change is particularly nicely seen at Olda Mill at Totley, briefly operated by that arch-villain Archibald Grant of Monymusk but given up first to the Twigg Family and then the Barkers by 1750 who, as exponents of the managing agency system, introduced the new methods widely.
It was naturally in the interest of the smelter to ensure his ore supply continued. The virtual monopoly of smelting kept prices of ore low and an ever-widening circle of credulous shareholders allowed many mines to remain in operation far longer than they realistically should. There was a much smaller incentive too, to rationalise mines into more economic groups.

TECHNOLOGICAL DEVELOPMENT

Drainage, the principal problem, was largely solved by the driving of ever longer soughs - Meerbrook, Yatestoop, Hillcarr and Stoke were mid-late 18th century examples - and by the introduction of the steam engine of the Newcomen type. The first of these was in operation by 1717 at Yatestoop Mine and later improved versions culminated in the Cornish Engine which established that County's technical supremacy by the 19th century. Use of water-power was limited by the general lack of surface water and later by competition from cotton mills taking over sites just as deep level-driving from the River Derwent became feasible. Water-power was significant, however, at Alport with the use of both wheels and hydraulic engines, in Lathkilldale and in mines adjacent to the Matlock Gorge.

In sinking and driving the use of gun or black-powder became cheaper and more common by the mid 18th century, replacing techniques such as pick and wedge and firesetting. Pneumatic drilling and dynamite was only used in a significant way at Magpie Sough (pre 1884) and at Millclose was still seen as somewhat odd even in the early 20th century. Larger shafts and tunnels were made possible by better excavation methods and were necessary for improved haulage and winding needs using horse gins and later, steam power, and the use of rails (1770s onwards) underground. These ended the dominance of up-and-down burrowings and the series of small sumps close to nearby shafts, and led to more systematic use of deep shafts and levels and organised stoping methods. Magpie was a good example of the changes. A few haulage levels were driven from the surface, such as the Newcastle Way at Brightside and in the Via Gellia such as at Good Luck, but the topography, small mines, hard rock and thousands of existing shafts mitigated against widespread use of levels as seen in more northerly mining fields. Use of wire rope, first used for winding at Magpie about 1840, was a mixed blessing. Combined with the use of cages by about 1870 it was the cause of a number of shaft fatalities, hitherto relatively rare incidents.

Ventilation depended largely on natural forces. Fans and a water-blast were used in the driving of Hillcarr Sough (1766 onwards) and bellows were occasionally used elsewhere. Magpie Sough was assisted by air from the pneumatic drills, but only Millclose ever seems to have installed a steam-driven fan.

Given the greater difficulties of finding and working economic deposits in what was an old and largely exhausted field, it is likely that most significant productivity improvements came from better stoping methods, whether overhand or underhand, in which ore was run directly from the stope into waggons - an improvement probably linked to John Taylor's introduction of Cornish mining techniques about 1840.

At surface there were significant improvements in washing ores, notably in buddling low-grade ores. The techniques used here were introduced by a Derbyshire man to Cornwall about 1780 and it is apparent in duty accounts that the improved practices were important by then, especially at Longstone Edge. Horse driven crushers, such as that at Odin Mine at Castleton and the jigging hutch became common after about 1820 and in the following decades displaced women from what was previously a female-dominated occupation.

Steam-driven crushers and systematic layouts of dressing floors, such as at Eyam Mines in the 1850s was not generally applied across the bulk of less successful mines. The more typical remains at Winster Pitts of small-scale buddles and crude techniques of ore washing, do reveal one new development, the use of slimes dams for disposal instead of ponds.

In smelting the coal-fired cupola furnace was introduced by 1735, first at Ashover, and had totally replaced the older ore-hearth by 1780. By that same time, improved slag and low grade ore smelting was possible to cope with the buddled outputs. Further improvements to slag smelting took place around 1830 with multiple tuyeres and with the steam-powered Spanish slag hearth about 1850. This latter could cope with very low grade material and helps account for the increase in production at that time. The use of long flues particularly came about with the higher temperatures of the slag hearths and metal vaporisation and pollution.

General improvements in external transport - roads, canals and then railways benefited the industry. Smelting moved to better located sites - near the Cromford Canal for example by and after 1800. Gregory Mine at Ashover was associated with the new road to Swanwick for its coal supplies and both the Chesterfield Canal and the High Peak Railway promoted themselves as being important to lead mining. On a smaller scale, at places such as Winster, miners' paths were made, using gritstone pavors, to facilitate miners crossing wet areas en route to work.

MILLCLOSE - WAS IT THE ONLY MAJOR DEPOSIT?

There can be little doubt that the main part of the mining field was economically and technically exhausted by the late 19th century and possibly even earlier. Economically because the mining of deposits using modern methods at Linares in Spain on mines untouched since the Romans, or on huge virgin deposits in Wisconsin and the Tri-State district of America, or the waste lead of the Broken Hill silver deposit in Australia were all vastly cheaper to work. International trade meant these were all competing as well as cheaper producers, and Britain was a major market and re-exporter of lead from all these. There was, perhaps a slight local advantage, supplying the several lead manufactures in Bonsall and Brough, Derby and Sheffield, but over longer distances the price difference was too large to be ignored. Technologically the field was down to or beneath valley levels so that continuous pumping was necessary to dewater Alport Mines, worked very spiritedly by John Taylor between 1839 and 1850. Despite the great advantage of water power, the profitable working of the field proved impossible even with large scale operation. How much less successful would steam power have been?

Modern research also suggests the deposits are essentially shallow. The most likely deposits left were under the shales. Experience of pursuing these, at Eyam and Ashover and Winster, for example, showed a strong decline in lead content as such veins were pursued. Gregory Mine at Ashover spent some £20,000 unsuccessfully - broadly equivalent to the previous profits - though the composition of the partnership had changed. Others such as William Wyatt - with his luckless attempt to mine deep at High Rake at Hucklow (on a volcanic plug) and John Taylor with his belief of a "virgin field" at depth fared no better. Explorations at Winster by Allied Chemicals in the 1970s found zinc replaced lead as the veins were pursued under the shales (as also was found at Millclose) - which was probably the reason for the abandonment of Yatestoop and lack of later reworking after 1785. Edward Miller Wass, therefore, went against received wisdom when he finally drove northwards about 1870, ignoring the dismal record built-up by others, and made a fortune. No one else did.

In size Millclose was less exceptional than it may seem. Before the middle of the 19th century a similar sized area would have been exploited with many separate mines. Had Eyam Edge or Winster been exploited as single entities it is possible they would have been almost as large. Had the mining field been developed in the late 19th century, it is likely something like a dozen or score of mines could have exploited the whole area and may well have done the job more efficiently.

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