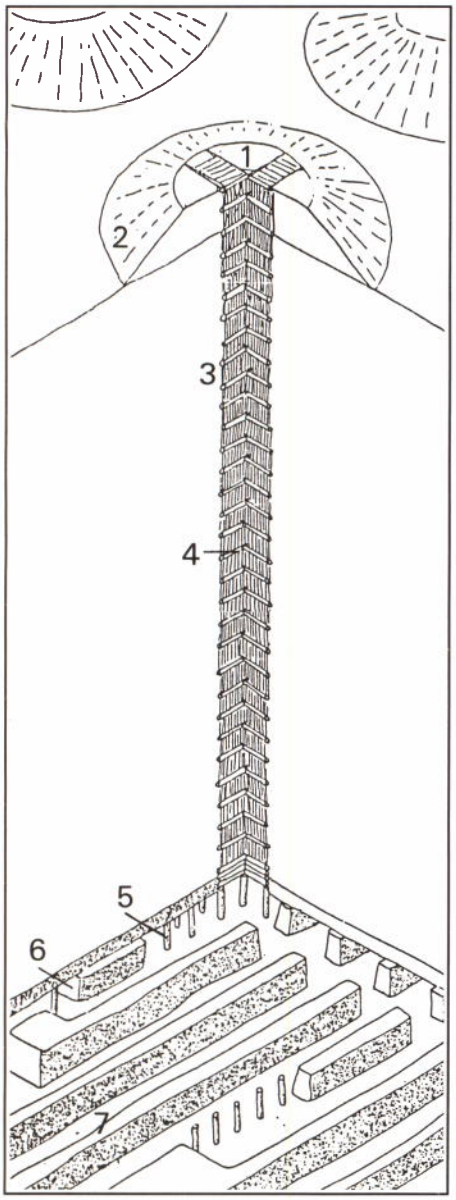
ASSOCIATION FOR INDUSTRIAL ARCHAEOLOGY

AIA BULLETIN

Volume 18 Number 4 1991



Medieval Lounge? A reconstruction of the mining remains dated to the mid 15th century at Lounge opencast, Leicestershire
1: Platform for winch to raise baskets of coal
2: Spoil heap produced by digging shaft
3: Shaft 100ft deep, 3ft square insdie timbers
4: Timber-lined shafts with jointed oak frames and birsh branch shuttering
5: Tree rings in oak pit-props give dating evidence
6: Main coal seam up to 9ft thick. Mine galleries are 4-5ft high, leaving coal in roof and floor
7: Systematic pillar-and-stall workings partly back-filled with slack

Drawing by R F Hartley

DIGGING DEEP IN MINING HISTORY

Stories have appeared in several national newspapers in recent months about the discovery of medieval coal workings at an opencast in Leicestershire. This find has important implications for British mining history, proving that sophisticated deep mining techniques were developed in England much earlier than was thought.

The investigators involved have provided for the AIA Bulletin the most detailed report on the site so far published, setting out their preliminary findings.

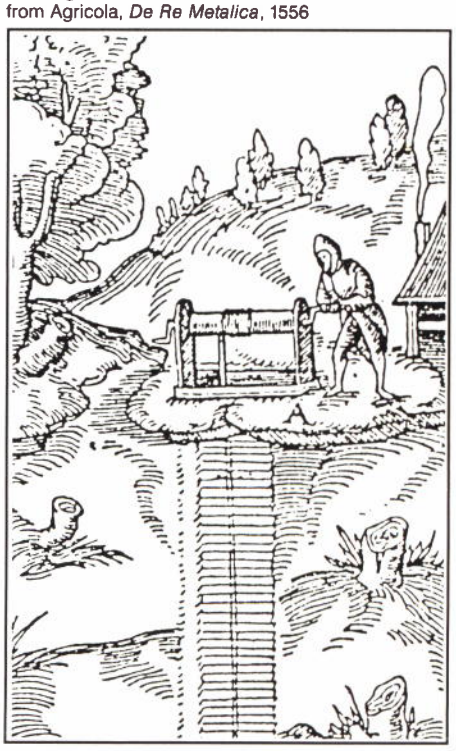
The biggest archaeological excavation in the world has just been undertaken in Leicestershire. What sounds like a gross exaggeration is probably quite true. During February 1991 staff of Leicestershire County Council's museums service were involved with an excavation of medieval mine working at British Coal's Lounge Opencast site near Coleorton. This investigated a rectangular timber-lined shaft with inside measurements ranging from 1.0m to 1.44m (39-56") by 1.36m to 1.57m (53-61") in a hole 1.29km square and about 100m (300') deep. Permission for the excavation was given by British Coal Opencast Executive, who provided valuable assistance throughout.

There are two British Coal opencasts in Leicestershire: Coalfield North near Heather, and Lounge near Coleorton. Museum staff had kept a watching brief through regular visits to both sites since their creation in the mid 1980s. They have exposed a variety of workings dating from the mid fifteenth century through to the 1940s. Over the past four years a large number of mining artifacts and workings have been found. These include underground sledges, tools, a complete 1930s coalface, a miner's woollen shirt probably dating from before 1800, an 1880s Evans Cornish steam pump, and a complete 1870s underground stable. But the most significant finds were a series of oak pit props.

These pit props average about 1.5m (5 feet) in length and are cut from the natural shape of a tree trunk. Their significance was recognised after the museum had a selection dated dendrochronologically. They were sent to Nottingham University, and findings based on matching the tree rings visible to statistics for mean growing seasons of oak over a long period have shown that the trees from which they were hewn were felled between 1450 and 1463. These are therefore the earliest accurately dated coal mining finds in Britain and have blown-open our previous understanding of medieval mining.

Associated with the props were pillar and stall workings and a series of timber lined mine shafts all of the late fifteenth century. The patterns of working exposed and recorded were contrary to what was expected from the period. The shafts were 91cm (3 feet) square with timber frames set at vertical intervals of also about 3 feet. The frames were morticed and tenoned with an opposing 'Y' bracing. Major longitudinal timbers were cut into the wall of the shaft and packed with loose material to secure the frame. The shaft timbers were on average 10cm (4") square. Between the shaft walls and the frame was a double layer of brushwood and twigs, laid horizontally against the earth of the shaft wall and vertically between that and the frame. The shafts went to a depth of 27m (89 feet) and were distributed an average distance of 14m (45 feet) apart. Many shafts showed evidence of being back-filled and had no framing, possibly indicating that the frames were removed and re-used. At the bottom of the main pit investigated, the final shaft frame was resting on two 'L' shaped

Winding at a German mineshaft,, from Agricola, *De Re Metalica*, 1556



pillars of coal with a roadway crossing the pit bottom. There were instances, however, of single exits from the bit bottoms. The pits led into an extensive series of pillar and stall workings extending over an area of about 2.59 kilometres square (1.6 miles). In some instances more coal was removed than the roof alone could support, which necessitated the use of the oak pit props.

The coal in these workings comprised of two seams, the Higher Main and the Upper Main, which at this depth had converged. The Higher Main which the miners struck first is 1.5m (5 feet) thick and is split into two equal leaves, the upper leaf being very poor quality coal. This was left to form the roof, with the bottom leaf of the Higher Main and most of the 1.2m (4 feet) thick Upper Main being worked. This resulted in coal workings about 1.5m (5 feet) high. Evidence of 'V' cut drainage channels was found in major roadways but as yet no drainage sump at pit bottom has been identified. All coalfaces were linked to main roadways which gave adequate ventilation and pit bottom were linked, giving an average working radius of about 6m (20 feet) from each shaft. There was also evidence of old faces and roads being backfilled with coal slack. Artifacts found in these workings included leather boots contemporary with the workings and three wooden shovels.

These workings bear no resemblance to the bell pits expected of the period. They were organised 'deep' mines with, one must assume, a division of labour between faceworkers, haulagemen, onsetters, banksmen, and shaftmen. What we do not know, however, is how the miners got down the shafts as no ladder securings on the shaft timbers have been found. Did they climb down the frame or were they hauled up and down on a rope? We also have little knowledge of how the pit tops were organised as these had been destroyed before any survey could be carried out. Agricola's ***De Re Metallica***, published in 1556, shows German mines and shafts very similar to those excavated, with simple winding mechanisms over the shafts. However, the Leicestershire mines date from a century before Agricola, casting some doubt on the conventional assumption that European miners brought their techniques to Britain at about this time. As yet there are no clear answers. Much more research is needed into the organisation of these English medieval pits.

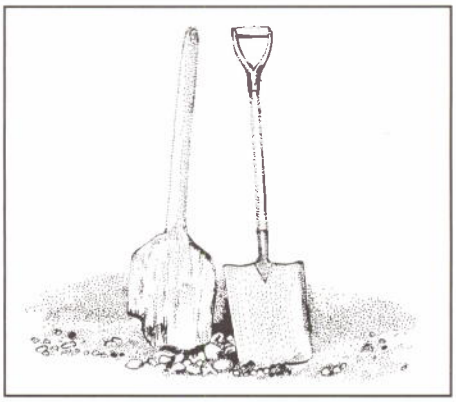
The excavation of one of the shafts was only made possible by the support and assistance of British Coal Opencast Executive and the coaling contractors, Budge Mining. For four weeks British Coal and Budge altered their work practices and extracted the coal around the shaft, thus allowing the Museum to carry out a controlled removal of seven frames. After careful recording and photography each frame was lifted with the areas around and between the frames removed by 'backfill' bucket excavators. This was a nerve racking experience, to see an excavator working in a relatively delicate excavation, but our fears were soon laid to rest when we realised that, if challenged to do so, the drivers could probably have peeled a hard boiled egg with their buckets. Not only were they masters with their machines, the operation was only feasible in this, rather than by having to dig a hole nearly 25 feet deep by hand!

At each stage it became evident that the timber frames had been subjected to side thrusts of strata movement over the years which had caused many of the timbers to be forced out of position and even break. An interesting feature was discovered on our fourth frame to be exposed, about 24m (79 feet) below original ground level. At this point it was obvious that most of the frame had broken while in service and a simple but efficient shaft repair had been carried out, by fitting a new frame over the broken section.

As the timbers were removed they were taken to Snibston, Leicestershire County Council's new museum of science and industry at Coalville, where they were submerged in baths of water awaiting PEG treatment and eventual vacuum freeze drying. It is the Museum's aim to display about 6m (20 feet) of shaft in the new Snibston Museum when it opens next summer.

Robert York and Stuart Warburton
Leicestershire Museums

The authors would like to thank Mr P Blood, Site Manager of British Coal Lounge Opencast Site, and Mr T Hassell, Quarry Agent, Budge Mining for their assistance during the investigation.



Above: The old and the new: on the left a 15th century wooden shovel probably used for shovelling coal slack at the Lounge mine shaft
Below left: Lounge opencast mine workings; medieval pillar and stall workings about 45m NW of the excavated mine shaft. The large open area was worked during the 15th century and evidence of pit props could be found
Below centre: The medieval mine shaft during excavation with a medieval repair to the broken frame
Below right: Bob York working on the medieval mine shaft between layer 5 and 6

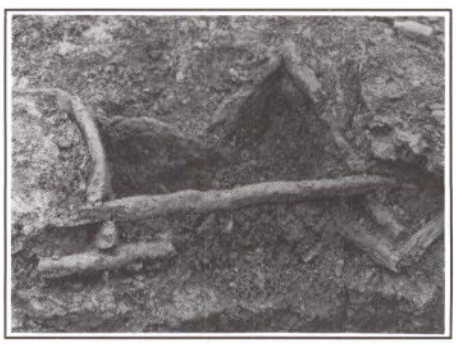
THE RISE AND FALL OF THE INDUSTRIAL CHIMNEY

Even remote hill farmers in Wales realise, from the eerie glow of their sheep, that the development of new technology can produce unpleasant side-effects. This was as true of steam power in the last century as it is of nuclear power today.

In the great extension of steam power which followed the expiry of James Watt's patents in 1800, tall, free-standing chimneys became widespread for the first time. Through the nineteenth century these grew in both size and number to become the most distinctive symbol of the industrial revolution, and a dramatic addition to the new industrial landscape. Writing in 1857, the chimney enthusiast Robert Rawlinson was worried about general standards of design and construction. In his ***Designs for Tall Chimney Shafts*** (1858) he wrote, 'A first vision of British chimneys as contemplated from our railways must, I fear, have caused many a nightmare to sensitive foreigners'. Sensitive locals had more cause for concern. One of the now forgotten aspects of industrial chimneys was their persistent tendency to fall down. Rawlinson went on to say: 'To be ugly is an evil, but chimneys are not only ugly, they are dangerous too.'

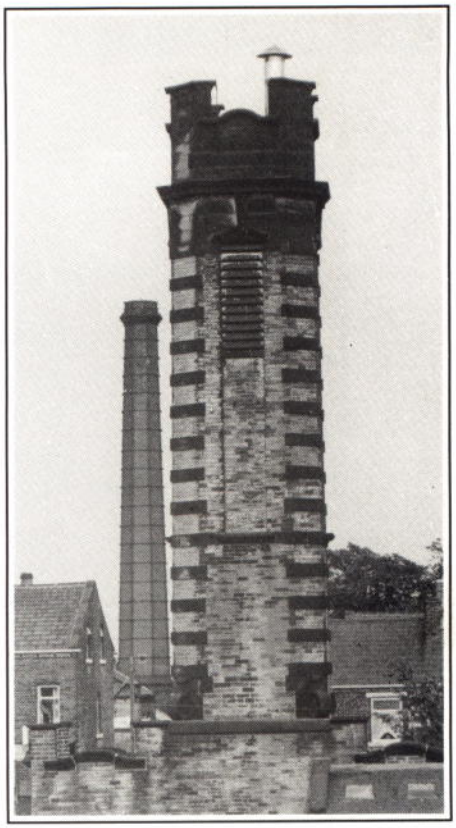
Much of this danger arose because of the generally miserable standards of nineteenth-century construction. We often tend to think today of such standards as very high, but we forget the huge proportion of poorly-made buildings which have been demolished or have fallen down. Victorian values did not usually extend to building materials, any more than they did to food, both of which were adulterated or reduced to the considerable detriment of the final product. Furthermore the men who built the chimneys were largely free to get the job done to self-imposed standards which related more to a chimney's drawing power than to its safety. Safety, as ever, tended to lag behind technical advance.

In 1800 chimney design had changed little in eighty years, since Newcomen's first steam engines. Engine houses were much like domestic dwellings, with the stack for the furnace rising a few feet above the pitch of the roof. In the succeeding decades chimneys rose steadily in height as increased demands were made on the steam-producing capacity of the boilers. They became emancipated, free-standing and self-supporting. To cope with the pressure of the wind, only the shorter stacks were made square, and anything over about 150 feet was made either octagonal or round in section. By the 1830s the tallest were over 200 feet, and by 1842 over 400 feet. In 1857 the new chimney at the St Rollox alkali plant near Glasgow became the world's fourth tallest building at a staggering 468 feet, and was as symbolic a structure to contemporaries as



Dean Clough Chimney, Halifax, 1857

The massive stack of Manningham Mill, Bradford, 1873



School incinerator chimney, Wyke, Bradford

All photos: James Douet

sky-scrapers are in American cities today.

The chimney depended for its stability on the mass of brick or stonework in its walls. The lime mortar with which they were built was slow to achieve much cohesive strength, so stacks were particularly vulnerable when newly finished. Too much stiffness was eschewed anyway, in the false belief that a degree of flexibility was an asset. A propensity to oscillate, common to many chimneys, was therefore little warning of an impending fall.

Falls there were, and in great number. A bad storm might bring down several in one night. After violent gales in Sheffield in 1873, the citizens awoke to find at least nine of the city's chimneys stretched out on the ground. Following further falls that winter, the Times of London smugly concluded that 'life must be especially insecure in Sheffield.'

In the same year a 175 feet chimney fell in Northfleet, near Gravesend. It has been designed by James Cubitt and collapsed just as the topping-out ceremony was about to begin. Without warning, it suddenly bulged in the middle, bringing down the cast-iron coping and the three bricklayers on top.

The worst fall of all, in terms of loss of life, occurred at Newland's Mill, Bradford, in 1882. The 20 year old shaft had twice been straightened, by making cuts in the side to bring it back to the vertical. In the weeks preceding the disaster, the builders were called in again to correct a bulge developing in one side, which they set about cutting out. Despite the obvious danger, work carried on in the adjacent mill, so that when the 250 feet chimney duly fell, more than fifty people lost their lives. Characteristically, the inquest attached no blame, least of all to the owner, who had insisted the stack be built on the top of an old pit-shaft to economise of the expense of piling.

A further danger to which chimneys were exposed was that of lightning. Though poorly understood, great precautions were taken to guard against 'the atrocities of the electric fluid'. Professor Faraday himself (he of the new £20 note) advised on a suitable conductor for the 300 feet chimney at the Edinburgh gas works in 1850. In one case, a bolt of lightning passed straight down the shaft, bursting open the brickwork, went out through a metal damper, through the boiler, and finally to earth through the stoker, who was standing patiently by the fire door.

Following the mid-century high in chimney construction, there was a move away from tall, sublime towers toward more decorative, picturesque designs, usually based on some historical analogy such as a campanile. This trend was in line with a more uncertain attitude toward industrialisation itself, and a desire to ameliorate its worst effects. New methods and materials, moreover, in conjunction with tighter building regulations, contributed to a much less haphazard approach to construction. Preformed concrete and steel chimneys gradually replaced the old hand-built stacks of brick and stone. Finally, the development of practical electrical supply meant the end of the pre-eminence of steam as the universal power source, and with it the heroic age of the chimney builder.

In the twentieth century the chimney is no longer the proof of work and prosperity it once was. It has wilted, like a sailor's tattoo, from a symbol of industrial masculinity to an embarrassing monument to decline and old age.

Most chimneys were demolished, as what were known as the 'smoke-stack industries' went into recession. Today, the value of the survivors is increasingly appreciated. Writing in 1979, in ***Satanic Mills***, Marcus Binney of SAVE Britain's Heritage suggested that chimneys were 'an essential element in the landscape' and gave the mill towns of the North 'an identity which is unmistakable'. A few examples around the country are cherished, like the ventilation furnace chimney for the Golden Valley coal pit in Bristol which was recently repaired and the steam engine stack at Westonzoyland lately rebuilt (see ***Bulletin*** 16.2). Many around the country are now being listed or scheduled, but these are lone monuments to a once great enterprise. The difficulties of maintaining such structures, which always had their problems, are acute now that they have no industrial use. As more and more chimneys crumble and decay, the landscape of stacks and smoke has already passed.

James Douet

A book by James Douet on the history of the industrial chimney, entitled 'Going up in Smoke', is published by the Victorian Society and available from them at 1 Priory Gardens, Bedford Park, London, price £4.00 inc. P&P.

Drawing: Susan Isaac