Friends of Killhope

President: Sir Kingsley Dunham, F.R.S.

FEBRUARY 1987

NEWSLETTER No. 7

The first snow of the winter covered the Killhope site in October and the risk of further falls continues until May which lends more than a little creadance to the dalesmen's wry observation that the area has nine months winter and three months bad weather! Not withstanding the Indian summer 1986 was yet another bad year for weather but the Killhope Centre is again able to report an increase in visitor numbers. The Friends can also look back on a successful season with membership encouragingly up on last year and a number of useful contributions to the development of Killhope.

Friends' Letters

The Newsletter is our chief means of keeping members informed about the activities of our organisation but it occurs to me that it should also provide a facility for Friends to express their views on appropriate subjects. I, therefore, invite you all to contribute to a "letters section." There is no need to wait for an invitation to comment on a particular subject as in the recent conservation/preservation debate. Feel free to initiate discussions on any subject in our field or perhaps simply comment or make observations. I hope this will become a popular and useful feature of our newsletter.

(B. Chambers, Newsletter Editor, Durham 68491.)
18 Cheveley Walk, Belmont, Durham DH1 2AU

MINING IN GLEN ESK

Roy Curry

Mining is a very old occupation in Scotland and was taking place in Glen Esk from at least the early 16th Century to the 18th Century. The minerals worked in this glen included silver, lead, iron, copper, zinc and gold. The locations range from above Loch Lee down to the Wood of Dalbog, close to Edzell.

In 1590 Sir David of Edzell decided to try to locate minerals on his land in Glen Esk although at the time all minerals were the property of the Crown. However, Sir David managed to have them transferred to himself.

Sir David and his brother, Lord Menmuir, began to employ miners to work the ore during 1594-5 and at the same time smelting houses were erected in various parts of the district. Since Germans were supposed to be the best engineers, Bernard Fechenburg was placed in charge of the workings and miners were brought in from Germany.

The mining operations seemed to have been profitable as on 12th October 1602 Sir David let to Hans Zeigler of Nuremberg and his companions, all the produce of lead and all other minerals within the Barony of Edzell and Glen Esk for a period of twenty years in return for twenty per cent of all minerals produced. From that period to the close of the 17th Century, the mines were worked steadily with at least partial success.

Editor's note: I understand that unfortunately there is little to be seen on the ground today.

MINING IN THE HUDESHOPE VALLEY

Colin Robinson

Hudeshope, to the north of Middleton-in-Teesdale has a long and impressive history as a lead mining centre. Many of the remains of this past activity are still visible on the surface with large spoil heaps, abandoned or ruined buildings and numerous shafts, levels and hushes. Coldberry Gutter, which cuts across the sky line from Coldberry Mine to Red Grooves is one of the most spectacular opencuts in the North Pennines and is visible from many points in the upper dale.

What may be seen on the surface, though, tells only part of the story for the underground workings are very extensive and in some cases go right through the hills from one valley to the next. The Coldberry Mine had four main working levels with connections to Lodge Sike, Low Skears, Red Grooves, Ravelin and Firestone Level. Rises and winzes from the horse levels gave access to many subsidiary drifts where stoping was carried out. Thus it can be seen that the maze of underground workings was far more extensive than may be imagined by anyone standing on the surface, although ore extraction would only be carried out in limited areas at any one time.

Galena was the mineral most sought after but the area has also produced small amounts of iron ore, barytes and fluorspar. Being in the transitional zone between Fluorine and Barium, as postulated by Dunham, it lacks the large fluorspar oreshoots of Weardale while the outer zone of Barytes, typified by Close House and Cow Green Mines lies to the south and west. It also differs from Weardale and Alston Moor in another important respect: the Great Limestone, the single most productive bed of the orefield, is here strangely unproductive, ore bearing ground being generally found in the sandstones and grits above the limestone. Metasomatic flats within the limestone are also rare, although some Barytes was got from a small flat in Snaisgill Mine. Having said all that, lead production figures are quite impressive and the Coldberry-Lodge Sike-Manorgill workings, the mainstay of the London Lead Company, were the only Teesdale mines to come anywhere near the great mines like Boltsburn, Burtree Pasture and Allenheads.

What follows is a list of the more important and recognisable sites, working north up the valley from Middleton. It is not meant to be exhaustive and there are bound to be features which others are aware of and which, for one reason or another, have been omitted. The thing to do is to go and see for yourself, always remembering that the places mentioned are on private land and permission should always be sought before venturing from the public rights of way.

Snaisgill Mine

As previously mentioned this mine worked a small flat for Barytes, 563 tons being the recorded production for 1887, although more was undoubtably produced. There is some confusion in the official statistics because this mine worked High Dyke vein and there are also figures for High Dyke Mine. If they are taken together the total Barytes production was over 2,300 tons. More than 1800 tons of limonitic iron ore was also recorded but lead production for the closing years of the last century was little more than a few tons per annum.

Little remains at the site which has been heavily afforested, but the small dumps of deads and tailings show limonite, quartz, barite, galena and yellow fluorite. The level itself is difficult to find and is rather wet. It is driven in shale below the great limestone and has some bad ground along its course.

Ironestone Level

This un-named level is situated not far south of Skears limekilns and is much wider than the normal lead levels. It is blocked by a serious fall a few metres from the portal and was probably driven to test an outcrop of limonitised limestone which may be seen in the vicinity.

Low Skears Level

On the west side of Hudeshope Beck near the entrance to Jack Scars there is another, possibly older level a little lower down and closer to the beck but this has collapsed. Low Skears level was a long crosscut drive at about the horizon of the great limestone, though due to the effects of faulting and the dip of the strata it passed through a number of beds. Dead straight for over three quarters of a mile to end in Hunt's Coldberry Vein it is now blocked before those workings are reached. As well as Hunt's vein it cut a series of veins, lettered 'B' to 'H' on the plans, and a number of cross fractures. Part of the drive was through the boulder clay of an old glacial channel and the level is completely unlined here, the clay being self-supporting. The workings are extensive though rather wet and there are numerous rises to higher horizons. Some of the ore from here was hoisted up through various levels to be dressed at Coldberry Mine, with which these workings once connected.

An old postcard shows a row of cottages close to the mine entrance but these can no longer be seen.

Firestone Level

The prominent dump from this level is a conspicuous feature just below the road from Aukside to Coldberry. It was driven in the Firestone Sill in order to test the same veins as were wrought in Low Skears but because the portal is further to the north-west, 'D' vein was the first to be cut. The level is now gated and locked due to a research programme being carried out there but the workings were at one time quite extensive and are virtually dry, all water draining down into the low level. Ore from here was dressed at Coldberry.

High Skears Mine

On the east side of the beck and south of Lodge Sike this compact site is in a relatively good state of preservation. The numerous hushes which run down from the road are of ancient date, as witnessed by the fact that the enclosure walls have been built across them. They are best observed from the roadside south of Coldberry when the sun is low in the sky and the gulleys are thrown into sharp relief.

Both within and without the high enclosure wall are the remains of dams and watercourses associated with hushing and the many small tailings heaps show that ore was dressed more or less where it was extracted. The main dressing floor has a wheel pit, trunk buddles, launders, bouse teams and numerous other features not so readily identifiable. Also still in existence is the mine shop, now reduced to a single storey barn and another small building. This other building is on the site of what the first edition six inch map marks as a crushing machine, in the period when the mine was worked by Backhouse and Company. When the London Lead Company took over in 1862 they re-arranged things to suit themselves so that there are now signs of the two periods of working. It would seem, however, that the mine was almost exhausted by then for the returns show a production of less than twenty tons for the Quaker Company's period of operation.

Apart from the horse level, which is blocked by a bad fall a couple of hundred metres in, there are four other levels associated with this mine. A high level just below the Snaisgill/Lodge Sike road is driven a considerable distance in shale and beautifully lined with stone arching for part of its length. The craftsmanship is superb and as this level is not marked on earlier O.S. maps it is undoubtably the work of the London Lead Company. What inducement there was to drive it can not be ascertained as no mineralisation is evident either on the dump or in the accessible parts of the level. A north east branch is, however, blocked by a shale fall some way short of one of the old hushes so there may have been workings in the vein below the hush.

Marlbeck Mine

This connects with and is really part of the Lodge Sike complex. The mine-shop is intact and the level is open but apart from that there is little to see. Old reports state that the veins were very rich in the great limestone which is unusual for this area.

Lodge Sike Mine

With its huge spreads of waste this site presents a picture of industrial despoilation. It has to be admitted though that it didn't look half as bad until recent work to remove the slimes and tailings for fluorspar extraction re-opened the scars. Aesthetics aside, this work has also obliterated much that would have been of interest to the archaeologist and researcher. The demolition of the mineshop, blocking of the high level entrance and use of the low level as a water supply mean that there is very little left to see except rock waste and rotting timber. Some old bouse teams are visible near the site of the mineshop and there are a few remains further to the south towards Marlbeck which have escaped the bulldozers but it is now impossible to get a good overview of the whole site.

Pikestone Brow Mine

Just west of Lodge Sike is an old mine which worked the Lodge Sike - Manorgill vein. The level is open though inaccessible due to its being used as a water supply for the house nearby, but the workings are known to connect with those from Hudeshope level to the north west. Of interest here are the noticeable amounts of secondary copper ores present on the dumps, which also show the more usual gangue minerals. Small heaps of gravel tailings indicate that some ore was dressed here, probably before the main dressing floors at Coldberry and Lodge Sike were operational.

Coldberry Mine

At the eastern end of the large opencast, this was the last lead mine to work in Teesdale, an oreshoot being developed prior to the second world war and worked until 1953. Dressing floors extended down the hillside from the mine shop to Hudeshope Beck and although much has been obliterated by the removal of tailings there is still plenty to be seen including buildings, waterways, reservoirs, levels, shafts and a water balance incline, one of two in Teesdale. There were four main levels at Coldberry Mine itself and further workings higher up at Slate Sill Mine. These connected with drifts from Ravelin, Red Grooves and Skears Mine to form what must have been an incredible complex of underground tunnels.

In later years the mine was infamous for the bad air in some of the lower workings and an old retired miner told me of men having to be rescued from the bottom of a climbing shaft, having been asphyxiated by accumulations of carbon dioxide. The report produced by Anthony Wilson of Keswick and Mr. Green, Manager of the Weardale Lead Company and presented in 1944 indicates that the miners were unhappy about working in some parts of the mine and that extra ventilation would have to be provided prior to the extraction of the the remaining lead ore.

Water power was extremely important at this mine, being used not only for dressing operations but in the ingenious water balance used for raising ore up a vertical shaft. Old large scale ordnance survey maps give a good indication of the dams and watercourses and at one time there are said to have been five waterwheels working on the various dressing floors.

As with the rest of the area the oreshoots were generally above the Great Limestone although ore was extracted from this strata. There is also some evidence of replacement of the limestone but this was probably just alteration of the wall rock of the veins rather than the development of flats.

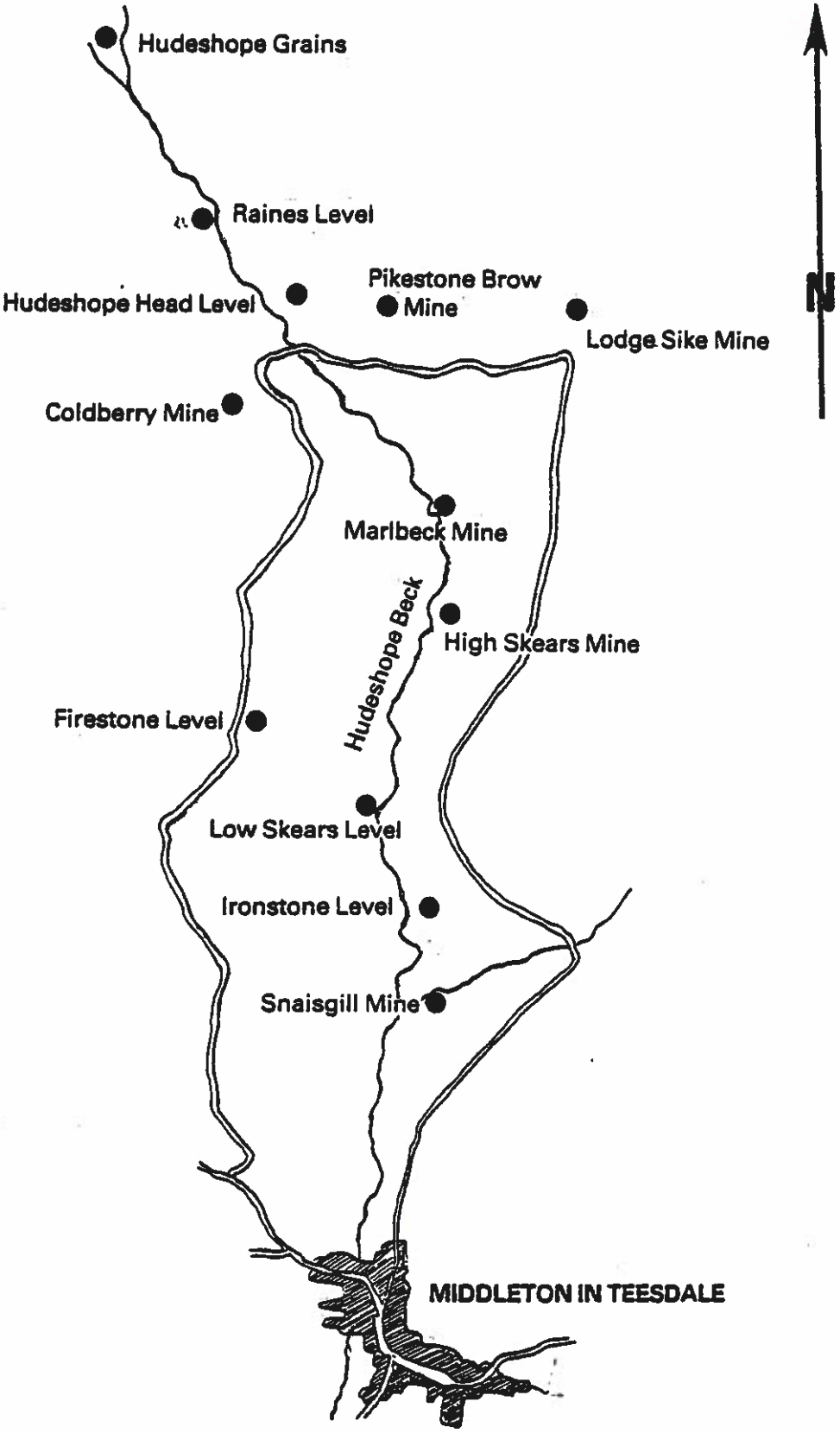
North of here there is little of note. Hudeshope or Hudeshope Head level has a fine stone walled portal but this is suffering a little from the ravages of time. There are some deads and gravel tailings outside the level which is driven in shale below the Great Limestone.

A little further up and on the west side of the beck is Raine's level. This was originally a lead prospect but was driven on in search of fluorspar in the 1970s when SAMUK were working the area. It follows a sinuous course along an east-west vein which shows some fluorspar, quartz and galena, though not in appreciable quantities. A couple of short rises were presumably to test for flats in the upper part of the great limestone but appear to have found nothing. Over the last few years the site has been badly vandalised, the bait cabin and another small building having been wrecked.

Still further north a number of prospecting levels have been driven from the sides of the beck including two high up at Hudeshope Grains. Little mineralisation was found, although one of the levels stopped short of Westernhope Cross Vein which could carry some ore shoots.

That then is an outline of mining in the Hudeshope Valley. All the machinery is now silent and the landscape returning to a more natural state. The mineral leases are still held by a modern mining company but it is highly unlikely that any work will ever be done here again. The only real possibility is that ore bodies exist at depth below the Great Limestone, though to test for them would require very expensive development work which could hardly be justified on economic grounds.

Lead-mining sites in the Hudeshope Valley



MR. WESTGARTH'S STATIC ENGINE

Ian Forbes

Hydraulic engines were used extensively in lead mines to pump water from depth; we had one at Killhope.

Very simply the hydraulic engine worked rather like a steam engine, but used the pressure of a column of water rather than steam as its motive power.

It is widely known that William Westgarth, who was an innovative agent for the Blacketts, pioneered the development and use of the hydraulic engine at Coalcleugh in the 1760s.

Coalcleugh, although now a desolate spot with only two houses still standing was, in the late 18th Century, Blackett's richest mine, so it was natural that new technology should be introduced there.

Thus, Westgarth not only experimented with hydraulic engines; he also developed long horse-drawn waggonways in mines. One level near Coalcleugh was a mile long by 1769.

This kind of development enabled a systematic and planned exploitation of mining ground to take place.

A friend of William Westgarth's was Thomas Smeaton, the famous engineer. Best known nationally for his Eddystone lighthouse, Smeaton worked as engineer and surveyor for the Greenwich Hospital on Alston Moor. He was involved in planning an even longer level than Westgarth's - the Nent Force Level from Alston to Nenthead.

Perhaps Smeaton picked up ideas from his friend; certainly he was instrumental in bringing Westgarth's hydraulic engine before a wider public by persuading him to present a model and plan of his invention to the Society of Arts in 1769. The Society showed its appreciation by voting Westgarth a "bounty" of fifty guineas.

With Westgarth's model came a letter of recommendation from Smeaton, who wrote:

> "Independent of the various draughts, experiments and essays on models, which, as I am informed, Mr. Westgarth had in hand, for years, prior to his attempting a Machine in large; I had the pleasure of seeing the first complete Machine of this kind at work, for draining or unwatering a Lead Mine, belonging to Sir Walter Blackett, at Colecleugh..... in the summer of the year 1765..... He has now erected four others in the different mines of that neighbourhood, one of which I have seen and all attended with equal success....."

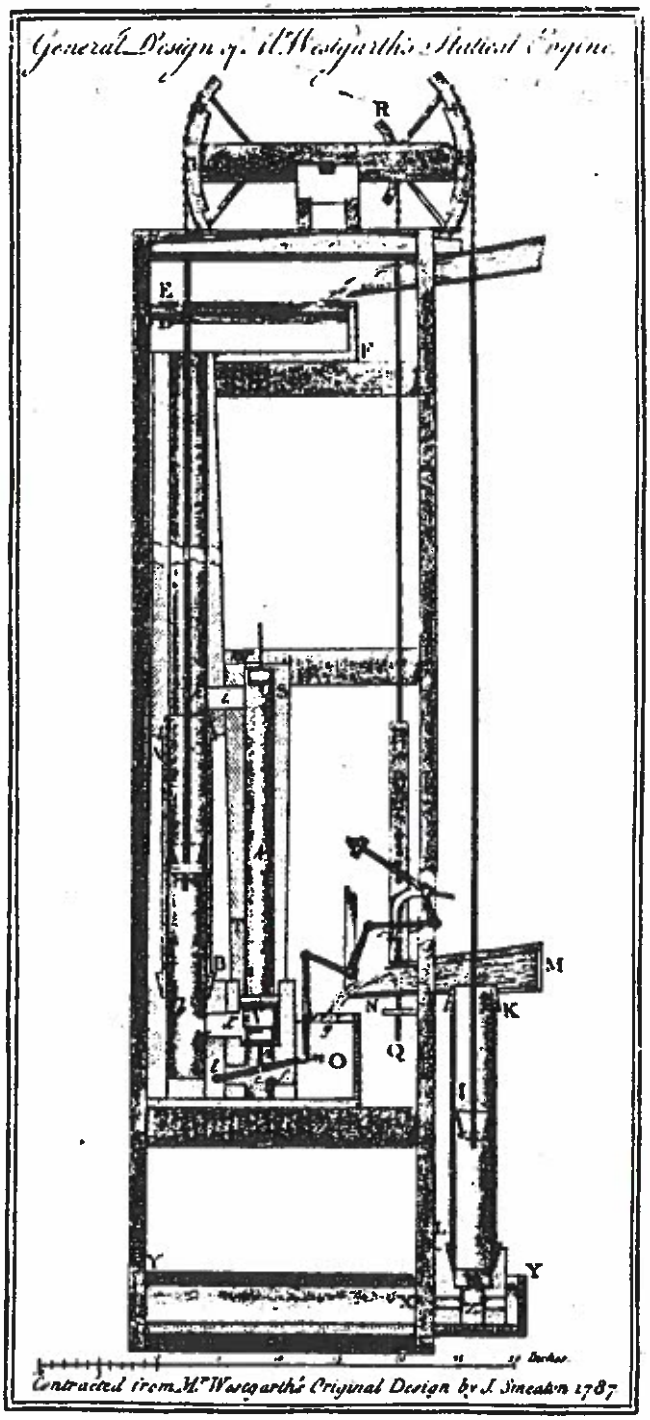
So, Westgarth built five hydraulic engines between 1765 and 1769.

In the mid 18th Century Killhope was a prosperous and extensive mining ground, with a whole series of veins upstream from the present Lead Mining Centre, being actively worked by about 50 mines. The most important vein was Killhopehead vein and it is now apparent that one of William Westgarth's hydraulic engines was employed here.

The evidence for this comes from a much later document. In 1813 Beaumont's agent planned a low level, to run towards Killhopehead vein and drain the lower workings in that vein. However, disappointment was in store when the level reached Killhopehead after eight long years.

In September 1821 the agent wrote:-

> "We have got the low level up to Killhopehead vein which has drained the old workings and are commencing to open out the old works in search of ore, but I am apprehensive it has been very much worked, as there was a water engine in this vein in the late Mr. Westgarth's time when at Coalcleugh."



THE WILLIAM BRUNTONS AND THEIR BUDDLE

Colin C. Short

Ian Forbes in Newsletter 3 asked the question, "Who was William Brunton?" Herein now some answers and comments on 'the buddle.'

There were two Wm. Bruntons, father and son. Father was born at Dalkeith near Edinburgh on 26th May 1777, son of a watch and clock maker Robert and grandson of a collier viewer. Apprenticeship in the fitting shops of the New Lanark cotton mills was followed by engagement in 1796 with Boulton and Watt at their Soho, Birmingham works.

At Soho Birmingham, Brunton rose to become superintendent of the engine manufactory. He remained a close friend of James Watt until Watt's death in 1819.

In 1808 Brunton joined the Butterley Ironworks at Ripley in Derbyshire and by erecting fitting shops established that company as an engine manufacturer. His connection with Birmingham was not entirely severed though, for in October 1810 he married Anne Elizabeth Button of Summer Hill, Birmingham.

While at Butterley on 22nd May 1813, Brunton registered the first of his nine patents (No. 3700.) This was the patent for the famous 'walking' railway locomotive. The first such locomotives worked at Crich in Derbyshire and a second for what was called the 'Hetton Railway' serving Newbottle Colliery near Houghton-le-Spring. This second locomotive blew up in 1815. Other work at Butterley included an underground steam winding engine at the Clayton Mine in Staffordshire and early applications of steam power to marine navigation, including the first steam Mersey Ferry.

Leaving Butterley in 1815, Brunton returned to Birmingham as a partner in the Eagle Foundry. The next ten years are a little vague, although it is clear that the Eagle Foundry was well regarded and did extensive work for the West Country mines. Several 'sons of the industry' were apprenticed at the Eagle Foundry.

In 1824 Brunton snr. was the engineer for the Redruth and Chasewater Railway in Cornwall. This was a 4' gauge mineral railway and is the only railway engineering yet attributable to William snr.

During this period Brunton patented an automatic stoker for boilers (No. 4685; 26.6.22.)

After ten years Brunton left the Eagle Foundry and from 1825 to 1835 he was in practice as a civil engineer in London. In this period he registered several patents. Most notable is 5621 of 21st February 1828, for an ore calciner, later extensively used in Cornwall for calcining arseneous ores. A line drawing appears in B.Earl's 'Cornish Mining, The Techniques ..... ' (1968.) Page 92.

Moving to South Wales in 1835, Brunton became a partner in the Cwm Avon tin works of Vigurs & Co., at Port Talbot. There he erected the copper smelting furnaces and rolling mills in a complex that was to become a major force in both tin and copper cartels of the 1840s. Brunton's inventiveness appears in this period in work improving mine ventilation and iron founding.

In 1838 Brunton relinquished his interest in Cwm Avon and became the major shareholder in a brewery in Neath. When the business collapsed, Brunton lost almost everything and being then over 60, he retired from regular engineering practice. His wife died at Neath in 1845.

In the latter years of his life, Brunton took out the first of his patents concerning ore dressing. Of 2nd November 1841, patent 9135 dealt with 'Dressing Ores and separating Metals or Minerals from other substances.' An identically named second patent followed on 19th May 1842, No. 9351. It is now clear that neither of these are the Brunton Buddle and they have not been investigated. From the information about his wife's death we may presume Brunton was still resident in South Wales at this time.

Wm Brunton snr. died at the home of Wm Brunton jnr. in Camborne, Cornwall on 5th October 1851, aged 74.

There were at least three sons, Robert, Johnand William jnr. We know that William Jnr. was the third son, born at Birmingham on 3rd April 1817. After early apprenticeship in England, still aged only 17, William jnr. went to the United States in early 1835. There eventually, he became Locomotive Superintendent of the New Orleans & Pontchartrain Railway. Four years after leaving England, Brunton began a roving career, becoming the engineer on a New Orleans sugar plantation, returning to England to work on the Manchester & Leeds Railway (opened throughout in 1841) and in the States again, on the Red River Canal. In 1844 he was at Pool in Cornwall and in 1847 he returned to the area as resident engineer of the West Cornwall Railway. After nine years Brunton moved again to become Chief Engineer of the Punjab Railway in India, moving on to the Public Works Department of the Indian Government. A spell sheep farming in New Zealand followed before taking over in 1871, District Engineer duties for the railways in Southland, New Zealand. Further engineering duties in N.Z. followed until resignation enforced by ill health in 1880. He died unexpectedly in June 1881 at Wellington N.Z.

In the period 1844-56 William Brunton jnr's interests were directed to the metal mining and processing industries. Most of this period he was resident at Pool in Cornwall - and from there in 1844 and 1847 registered two patents No. 10378 of 2nd November 1844 deals with 'Apparatus for dressing Ores.' The second patent, No. 11967 of 16th November 1847 deals with 'Apparatus for dressing Ore of Minerals.' The first of these covers the invention for which William jnr. is now best known - the Brunton Buddle. The 1847 invention is a type of automatic jig.

Brunton describes his invention thus.....

> .... an improved method of submitting ores, or materials containing ores, to the action of a stream of water, by distributing the ores or materials upon an inclined table moveable either continuously or occasionally upward against the stream, whereby the waste is (as in ordinary methods practised) washed off at the bottom of the incline, whilst the clean or dressed ore, by its superior gravity settles on the moving table, and with it is carried upwards beyond the influence of the washing stream, and ultimately deposited into a separate vessel.

This is our Brunton Buddle - see Newsletter 3. A primitive sketch accompanies the 1844 patent. The illustration shows what it shows with annotations in Brunton's words.

As such the invention is indicative of the attempts being made in this era to turn industrial operations into continuous processes. The capacity limitations of the old batch-processing styles, exemplified by the hotching tub, were felt when increased outputs were being demanded. It was natural then to seek continuous operations with their inherent higher handling capacities. William Brunton snr's automatic stoker and calciner arose from similar considerations, as did William jnr's 1847 patent.

In 'Cornish Mining' B. Earl refers (P89) to Brunton's belt in use in 1844 at Devon Great Consols copper mine in the Tamar Valley. The description of the unit is clearly a Brunton Buddle, but no further reference is given. An article 'Ore dressing in Cornwall 1600-1900' by F.B. Michell (Journal Trevithick Society No. 6 1978) gives no significant place to the Brunton Buddle. My observation is that they were not extensively used in Cornwall. Here the date 1844 may be an error as Devon Great Consols was only begun that year and no ore was sold until 1845. It might again though indicate early or even unsuccessful trials.

A. Raistrick & B. Jennings ('A History of Lead Mining in the Pennines' 1965 and 1983, p.237) claim Brunton invented and patented the continuous cloth separator at Allenheads in 1847. Purchase of the patent by the London Lead Company followed, which company made extensive use of the buddle. References are given to 'Catalogue of the Science Museum "Mining and Ore Dressing" (1920) 87 No. 254' and 'Hunt "British Mining" 2 editions 1884 and 1887, p771.' This claim, repeated by subsequent authors, can now be seen to be erroneous, but it is possible that Sopwith introduced the Brunton Buddle to the North Pennines in 1847. Its use seems to have been centred on the North Pennines thereafter.

During his time in Cornwall William jnr. also developed a machine for the production of a safety fuse, although this was never patented (possibly because William Bickford's 1831 patent was quite comprehensive.) This was a market with considerable competition, five or six different fuse companies operating within a few miles of Redruth. One of these was William Brunton & Co., whose Safety Fuse Factory was at Pool. This was still operating in 1881, along with another factory in North Wales. A William Brunton - most possibly the younger - was also the inventor of a compressed air hammer for driving mining drills. It was only half-way to the complete compressed air drill and was never widely employed.

Finally, a personal recollection. In the Particle Mechanics course of my Chemical Engineering degree, over twenty years ago, we tackled a class problem of separation on a Brunton Buddle. Details from one example in a twenty-year-ago course are now hard to recall, especially as I never had to use any Particle Mechanics in my career! I do recollect though that of the three main operating variables - the speed of the belt, the angle of the belt and the flowrate of water onto the belt behind the slurry feed - the most critical was the angle of the belt. This became even more critical with a less dense material than lead. If the Buddle was used at Devon Great Consols (a copper mine) this may be the reason for non adoption.

I would guess that on ore treating floors skill and experience solved the angle problem rather than our modern maths! Even then, maintaining belt speed would need careful control of the water wheel.

In addition to sources noted above, information has been gleaned from the following:-

Dictionary National Biography VII p148f

Obituaries in Institn. Civil Engineers Minutes of Procedings, Vols 11,64,67 (by courtesy, Archivist, I.C.E.)

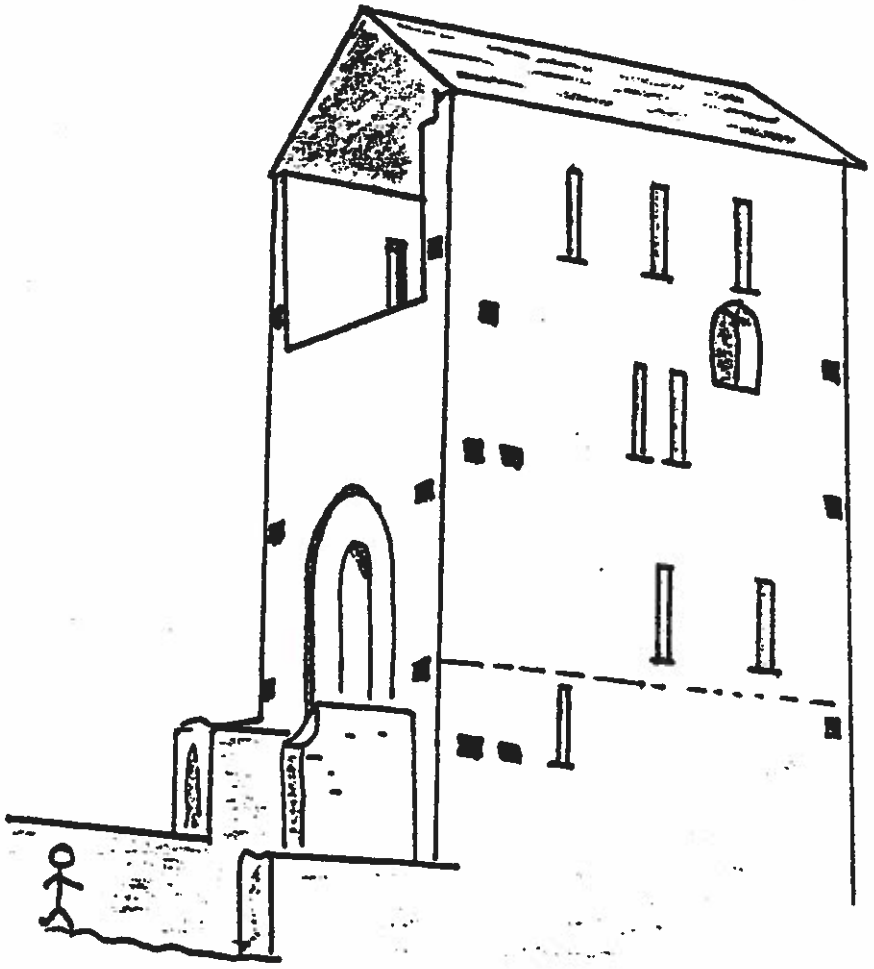
B. Woodcroft 'Alphabetical Index of Patentees of Inventions, 1617-1852' (1854; 1969) P77f

P. Nixon 'Industrial Archaeology of Derbyshire' (1969) p154f

J.A. Robey & L. Porter 'The Copper & Lead Mines of Ecton Hill in Staffordshire' (1972) p40

A.C. Todd & P. Laws 'Industrial Archaeology of Cornwall' (1972) pp26,202f.

Readers will recall Colin Short's item on Lead Mining in Devon and Cornwall and his reference to this engine house which still stands near Newquay.

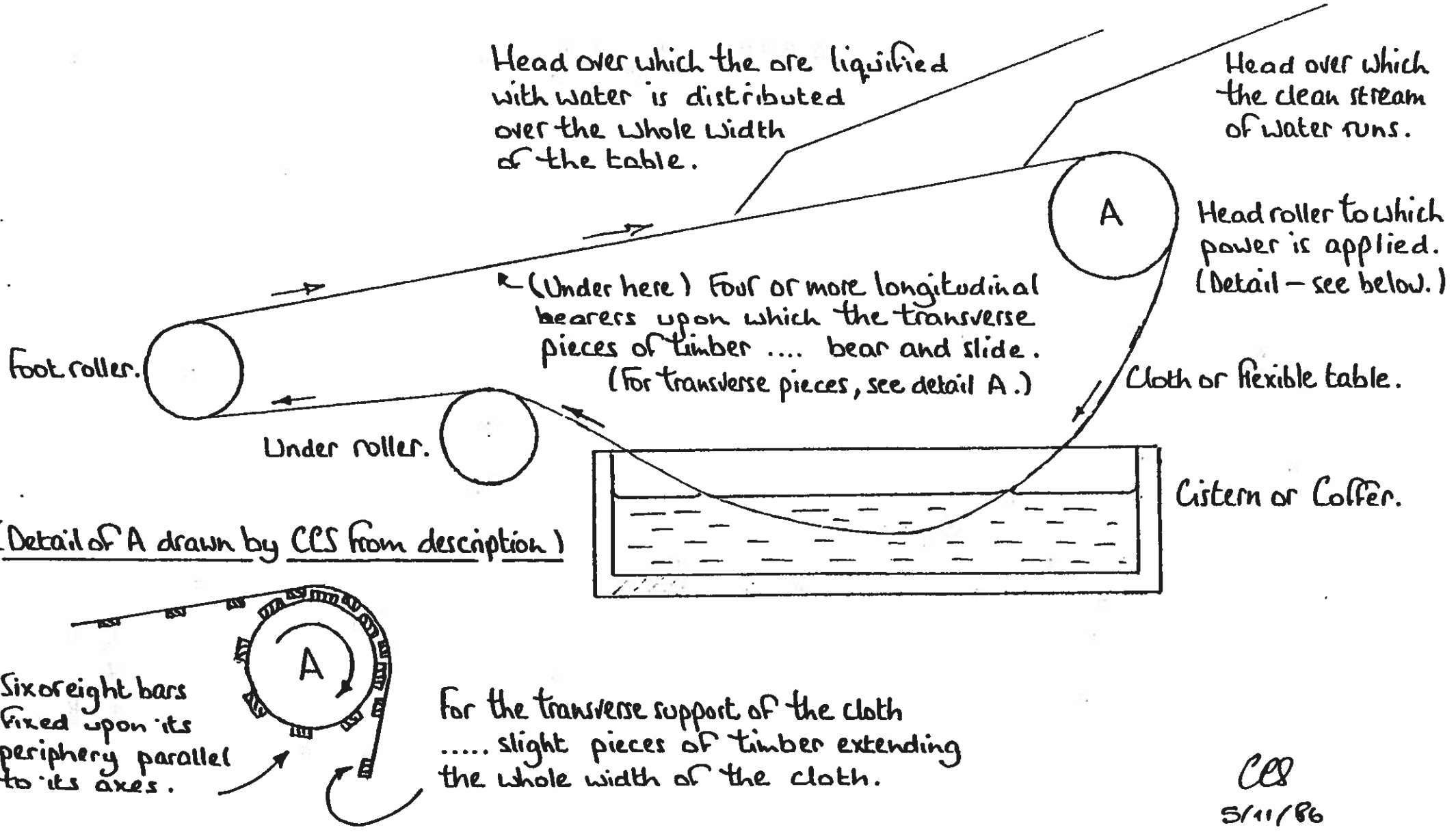


East Wheal Rose 60' engine house — with adult human figure for scale.

CEP Nov 1986

From William Brunton's sketch of his apparatus

(All words without brackets are Brunton's.)



(Detail of A drawn by CCS from description)

Six or eight bars fixed upon its periphery parallel to its axes.

For the transverse support of the cloth ..... slight pieces of timber extending the whole width of the cloth.

CCS
5/11/86

VISIT TO ELSWICK WORKS OF COOKSONS INDUSTRIAL MATERIALS Duncan MacCallum

Below is the concluding part of Duncan MacCallum's comprehensive report on the visit to Cooksons Industries last year.

Next stop on the tour was the melting plant stockyard where the lead and rubber from the battery crusher is stored together with other lead residues and iron swarf. Here the raw materials for the smelting process are weighed out in a series of charges onto a covered conveyor belt. Sodium carbonate which is used in conjunction with the iron as a flux is added from a silo to the rest of the charge which then passes into the melting plant building.

Indoors we saw the 25 tonne capacity rotary furnace in which the crude lead metal is recovered. The furnace was not in operation at the time of our visit due to the weekend break. However, this permitted us to have a close look at the oil burners which are used to provide the bulk of heat for melting. We also saw the waste gas flues along which the fumes from the furnace are sent, after cooling, to the bag filter house where the particulate matter is removed from the gasses before it is released to the atmosphere.

Under the reducing conditions of the rotary furnace the lead metal from the scrap is melted and any lead oxide reduced to lead. Non metallic impurities pass into the iron oxide based slag. After approximately 4/5 hours reduction the metal at 600 deg. C is cast through a taphole at the end of the furnace into ladles and transferred to the refinery. The slag is either descarded or retained for further processing if it contains sufficient lead.

The next part of the works which we visited was the refinery, consisting of twelve 100 tonne capacity gas fired furnaces called kettles. At this point in the process route there is a large element of flexibility with regard to materials, plant and process metallurgy depending on the end product for which the lead is required. Consequently some of the kettles had been adapted with ancillary equipment for special operational or metallurgical processes. In all cases the progress of the refining operations is monitored by taking samples of lead from the kettles and sending them to the laboratory for chemical analysis to see if the required levels of copper, tin, zinc, antimony and arsenic have been obtained.

In one process route, the impure molten lead from the reduction furnace is refined to reduce the copper, tin, zinc, antimony and arsenic to desirable levels. This is done by adding various chemicals to the kettles which remove specific impurities from the lead, the process being assisted by vigorous stirring of the lead by paddles mounted in the lid of the kettle.

The removal of copper is carried out just above the freezing point of lead, 320°C by the addition of sulphur sticks.

Tin is removed at 540°C by the controlled injection of chlorine gas. The resulting tin dross which floats on top of the lead is removed by a motor driven rabble, the introduction of this machine being responsible for removal of the arduous manual work which was required in the past.

Antimony is removed by injection of air into the lead. In the alternative route scrap lead sheet, pipe and cable sheathing and uprising lead scrap is remelted directly in a kettle to recover the lead, smelting in the rotary furnace not being necessary. Any iron, steel or copper which may be present with the lead scrap floats on top of the lead bath and is removed with a large draining spoon.

After the removal of impurities any necessary alloying additions are then made. The lead is then transferred to the casting bays by pumping it through cast iron pipes.

On our tour of the works we first visited the automatic casting machine where 25kg ingots are cast on an automatic rotary casting machine. These ingots are automatically stacked into 1 tonne bundles and strapped on pallets ready for shipment.

Our next stop was to see the alternative casting route where much larger 11 tonne slabs are cast. After cooling the slabs are rolled into 2 metre wide thin sheet in a very modern highly automated mill with facilities for automatic gauge control, automatic coiling and handling. The sheets are either sold as rolled or slit into smaller width coils ready for use by the building trades.

Further along the process line we saw machines which punched sheet into shapes ready made for battery plates.

By way of contrast we also saw an old fashioned sheet mill about 50 years old, which other than the motor required for the roll drives was devoid of mechanisation. Hard manual labour was required to feed sheet to the rolls and double over the sheet when the length became too long for the run out tables.

Our tour of the works over we returned to the offices, removed our safety gear and were entertained with coffee and biscuits. We also had an opportunity to ask more questions and peruse through a selection of literature stretching from Percy's Metallurgy to the Cooksons Materials Division sales brochures.

My lasting impression of Elswick Works was that of a site with a long history and tradition of lead smelting but one which had adapted its plant and technology to the needs of modern industry.

A READER'S LETTER - a less serious item.

A Killhope Friend, Mr. George Pickin sent the following extract from an old trade journal.

STEEL TIMES JUNE 4th 1965

seventy-five years ago

A REMARKABLE PHENOMENON.—The Dufton Fells Lead Mining Company (Limited), being desirous of ascertaining fresh facts relating to the minerals of the fells, called in the services of the boy Francis Rodwell, whose "magnetic powers", it was said, had enabled him to make some wonderful discoveries in the same direction, in other parts of the country. The result is said to have caused great surprise among the mining experts of the district.

The manager of the company, Mr. W. Gibson, communicates the following account of the experiment:—"Mineral veins and water have very strong magnetic attraction for the boy, who is fifteen years of age and of ordinary weight. If he stands in a small quantity of water, it takes a very strong man to lift him. It is not at all necessary for him to carry a stick. All he requires to do is walk over the ground with his hands clasped, and he can immediately tell you if he steps upon a vein. He can give the direction of the vein, and say whether it is weak or strong. He can also, simply by walking over it, say whether another vein crosses it or comes into it. When he came here we were all sceptical, so we took him onto a portion of the hills where we knew veins to exist, but where no outside traces of them were visible, and he correctly gave us the direction of each.

"In his researches, he came upon a very large and strong vein, which was quite unknown to us. He gave us its direction and strength, and as we have since put a shaft down into this vein we have proved that he was exactly right as to its position. He does not profess to tell whether the vein carries lead ore or not; and all he can do is find the vein and tell you what size and strength it is. In the vein he found for us we have not yet come upon lead ore, but it carries rich mineral soil and promises well."

Rodwell is accompanied by a medical man, whose services are frequently required, as the work of discovery proceeds, in consequence of repeated magnetic shocks which he receives from contact with minerals or water.—*The Iron and Coal Trades Review*, June 6, 1890.

Mr. Pickin asks:-

1. Does anyone know of similar occurrences?
2. Could it be that the Projects Officer is a latter day Rodwell with the ability to detect lumps of iron on Rotherhope Fell using only his magnetic personality?

Editor's note:. (2) is clearly a reference to the account of the retrieval of iron blocks and rollers given in the last Newsletter. Readers may recall this operation led by the Projects Officer, involved considerable physical effort in dreadful conditions and I, therefore, welcome comments but would remind members of the expedition of the existence of the laws of libel!

Project Officer's Report

Short cold winter days have seen Bobby the pony retire to his winter quarters at Langdon Beck, the hens to theirs at Nenthead and most Friends driven indoors to work on archives or catch up on things they didn't have time to do in the summer.

At Killhope our attention has switched from the late 19th century buildings to development in the woodland. The woodland trail, already developing into a most attractive walk will add a whole new dimension to Killhope with its displays of early mining and ore-dressing. Friends have been helping with research into 18th century leadmining.

The period around 1680-1730 was a fascinating era before the two major businesses - the Blacketts and the London Lead Co. imposed their authoritarian stamp on the industry.

Much work remains to be done here on the early leadmining entrepreneurs such as Alderman Ridley of Newcastle who worked a number of North Pennine leadmines including our own Hazely Hill hush at Killhope. But we have not just been trying to sort out the early history of Killhope; there have been more specific questions to answer. What did a mine entrance of c.1750 look like or a mine kibble c.1730?

The vocabulary of the older documents is rich and strange; mines are never so called, but are always "groves" and the agent is a "grove steward." (The term of course lingers in a number of place names - Groverake, Guinea Grove and so on.) Does anyone know of a glossary of these early terms or will we have to compile our own? I offer you "piggins" "stoprice" and "wimbles." And what about "vogue level" and how would you "sludge a level"?

Thanks to those who have helped with research, particularly Lawrence Barker, Alan Blackburn and the Peak District Mines Historical Society.

Sharing research done is the key to the advancement of knowledge; Friends are grateful to John Crompton and other members of Norpex for giving up two Sundays to show parties of Friends some of the unforgettable sights of Smallcleugh mine at Nenthead and to Peter Bowes and Arthur Roberts for their talks at Barnard Castle. Reports on these events will appear in the next Newsletter. Friends have also enjoyed three other meetings since the last Newsletter.

John Crompton showed a selection of his superb slides of old mines to a large audience at Stanhope and we had two outings. An evening meeting at the Northumberland Record Office enabled us to explore some of the large collection of documents held there, and, coming right up to date, we visited the Broadwood complex at Frosterley - a modern mineral separation plant where fluorspar is produced commercially. Thanks are due to Weardale Minerals Ltd. for the opportunity to visit Broadwood and to Stan Agar for giving up his time to show us round. We hope to publish an account of the operations at Broadwood shortly.

Rotherhope Fell near Alston holds a peculiar charm for Friends - the charm of being soaked through every time we go there! The weather forecast of the night before was appalling so I called the trip off, but the one in the morning was much better, so it was all systems go again. Well the first forecast was right, but by the time darkness had fallen a bedraggled group of dripping and shivering Friends was unloading at Killhope two very fine cast iron flange pipes which look great outside the mineshop.

A most impressive donation came from Dr. Jake Almond of Teesside Polytechnic; a lab-size jig which staff at Killhope will be able to use to explain jigging in the best possible way - by demonstrating the process. We also collected from Dr. Almond a home-made spiral classifier and a cyclone.

Donations to the library have continued. Dr. Frank Gilbert has generously given us his copy of "Future of non-ferrous mining in Great Britain and Ireland." Joanne Todd has allowed us to copy her thesis on "The London Lead Company in Teesdale - Philanthropic Paternalism or the Pursuit of Profit?" and the following articles have swelled our collection: "Origins and Early History of the Institution of Mining & Metallurgy 1892-1914" by Harvey and Press, "The Production of Galena and Associated Minerals in the Northern Pennines" by Sir K.C. Dunham (1944), "On the Methods Generally Adopted in Cornwall in Dressing Tin and Copper Ores" by James Henderson (1858) and "Ore Dressing in the 18th and early 19th Centuries" by Arthur Raistrick.

At Killhope the chaired rails we secured last year have been laid between the mine and the bouse teems and Russell Parkin has made a finger point to fit in the track to enable tubs to be switched to a small siding. These simple "kick across" points were widely used in lead-mines in the days of horse-pulled tubs. In the immediate future we intend to build at least one replica tub to be displayed on the railway at Killhope.

In the Spring we will be holding, with the W.E.A. a course on geology and the minerals of the North Pennines. This will be conducted by Dr. Senior and will be at Stanhope.

Anyone interested in helping with rebuilding work, in the course, or in helping with research should contact me.

Three dates for the diary; the Friends Barbecue will be on 17th May, the Open Quoits Championship on 14th June and the Annual General Meeting on 10th June. The A.G.M. promises to be special as Sir Kingsley Dunham and Mr. J.R. Foster-Smith have agreed to attend and answer questions from Friends. More details of these and other events will appear later.

Finally we are pleased to report a further contribution of £400 (an increase of £100 on last year) from Durham County Council, Environment Committee, towards the work of the Friends. This is of course especially welcome when we are faced with the cost of specialist services such as in the case of the Brunton buddle wheel.

(Ian Forbes, Fieldfare, Wearhead, Co. Durham - Telephone 0388 537470)

North Pennines Heritage Trust

Richard Turner

Take a walk or drive a car in any part of the North Pennines and you cannot fail to see evidence of the lead-mining industry which dominated the area for so many years. Spoil heaps, mine entrances, capped and uncapped shafts, mine buildings and, of course, the settlements in which people still live and work.

In recent years there has been growing and widespread concern that many of the remaining examples of our Industrial Heritage have fallen into disrepair and decay; of some, indeed, there is scarcely a trace. Within each of the counties (Cumbria, Durham, Northumberland) restoration projects have been discussed and, in Durham's case, put into operation. There is, perhaps, a new risk, the risk of duplication of effort and a proliferation of lead-mining museums, each competing with the others for the limited number of display materials and the same visitors. A recognition of this risk gave the impetus to a group of North Pennine residents, and others interested in the preservation of these remains, to look into the formation of an organisation which could do something to help people, residents and visitors alike, to understand and care for their environment, without concern for the county boundaries which artificially divide the North Pennines. Thus the North Pennine Heritage Trust came into being.

The North Pennines Heritage Trust was launched on Saturday 6th December, when over two hundred people attended a meeting in Samuel King's School, Alston. Richard Turner, chairman of the steering committee, outlined the aims of the Trust and asked for the support of residents and friends of the North Pennines. (Since that appeal was made, membership of the Trust has grown to over one hundred and applications from new members, along with letters of support and offers of assistance, are arriving daily.) Mr. John Burnet, Cumbria County Council's Director of Economic Development, spoke of Cumbria's intention to co-operate with the Trust in working towards the establishment of a Lead Mining Heritage Centre at Nenthead, based on the Smallcleugh/Rampgill Mining complex. Mr. Burnet stressed that Cumbria county Council sees this development as complementary to further work at nearby Killhope and recent proposals for neighbouring Allenheads. Already, therefore, signs of a co-ordinated programme to interpret the North Pennines heritage. Promise of support for the Trust was also given by Mr. Graham Coggins, Regional Director of the Countryside Commission.

The second half of the launch programme was provided by members of the NORPEX mining research group who, by the use of striking pictorial and documentary material, gave ample evidence of a heritage that is worth preserving.

Catch 22b (Section 5(iii) para 4(c).)

County Council Spokesman

Consider this; You own a Scheduled (Ancient) Monument which occupies half of your site. Scheduled Monument Consent (SMC for short) is required from the Department of the Environment before work may commence on a Scheduled Monument although not for your unscheduled half. So you start work on the unscheduled half. Now you know that the D.O.E. has been considering scheduling the unscheduled half for many years and that SMC takes 3/6 months to get (still with me?) But you cannot apply for SMC in advance because you don't know if or when the site is to be scheduled and if you apply after it is scheduled you've got to wait a long time for consent - thats catch 22b.

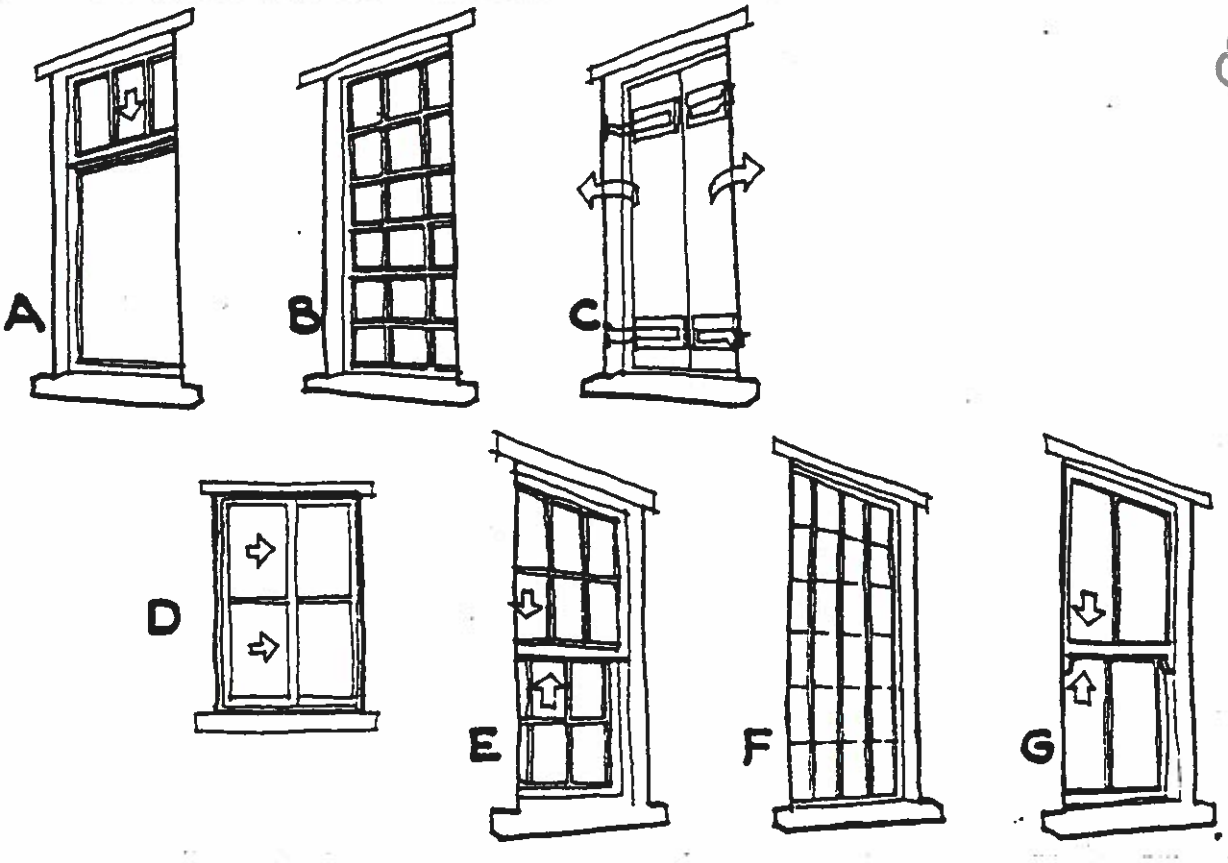
Applied to Killhope it worked like this. Archaeologists have been working on the dressing floor for three years without the need for S.M.C. because the floor was not scheduled. At the end of August the D.O.E. scheduled it. The planned archaeological work had to be postponed until S.M.C. was applied for and received - a process which normally takes several months. It caused us problems at the time but it must be said that both English Heritage and the D.O.E. pulled out all the stops to give us consent in weeks. That, I suppose, was the good news. The bad news came in the form of snow - lots of it.

David Cranstone the Archaeologist and a small team are due to return to Killhope in mid February - with or without snow. It is hoped that the dressing floor and the settling tanks will be properly documented to allow restoration work to proceed at last. All the restoration work will be agreed with and monitored by English Heritage.

Buddle House Windows

A great deal of consolidation work has been carried out on the Buddle House over the years. Now it is time for the big push - the reinstatement of the roof and the windows. Some people actually remember that the Buddle House had king post roof trusses. Nobody unfortunately, can recall the type of window that was used. There is no documentary evidence to suggest the design used and there is certainly no physical evidence on site.

Undaunted, we let our intrepid researcher loose on the problem. Many suggestions were put forward but the evidence from other W.B. sites points fairly firmly towards one particular window type. Which one would you consider to be authentic from A - top sash windows (fixed bottom), B - multi paned fixed windows, C - side hung shutters (like the mineshop) D - Yorkshire sliding sash (slides horizontally), E - 12 paned vertical sliding sash (or box window) with no horns, F - fixed window with vertical glazing bars and overlapping glass, or G - a double hung sash window with horns and 4 panes. (see next page for corporate view)



Window F - evidence from old photographs suggest that W.B. mines used this type of window at Boltsburn Jigger House and several other buildings. The Jigger House at Killhope has strong evidence to support this but unfortunately the Buddle House gives no clues at all.

Editor's Note: The foregoing gives some indication of the considerable lengths to which Durham County Council,are prepared to go to ensure restoration work is correct. Perhaps both sides of the conservation/ restoration debate can gain some comfort from this?

For those not familiar with the site, the Buddle House is the roofless building just to the east of the Jigger House which is the largest building at Killhope with the big wheel at its west end. Material from the Jigger House would be further refined in the Buddle House.

"Lead and Life at Killhope"

In March a new publication about lead mining will appear. "Lead and Life at Killhope" tells the story of lead mining in the North Pennines and particularly at Killhope. The 28 page booklet contains many illustrations, most of which are copies of old photographs from the Beamish collection, the Alston Moor Historical Society and Alan Blackburn. There are also some before and after photographs showing the recent changes to the site. The text concentrates on the nineteenth century history in order to explain Park Level and the crushing mill. However, recent investigations of eighteenth century lead mining in the North Pennines and Peter Bowes' talk at Barnard Castle on mediaeval lead mining in Weardale, show that there is plenty of material for follow-up publications to "Lead and Life."

It is aimed at a general readership, not just the lead mining enthusiast. Durham County Council, who produced the booklet, hope that it will provoke a greater interest in lead mining and in the North Pennines, as well as enticing more visitors to Killhope. The cost is £1.80. If you cannot get a copy at your nearest bookshop, complain until they start selling the booklet. Alternatively, get a copy when you next pop in to Killhope.

A New Visitor Centre for Killhope

Since the last Friends' Newsletter the County Council has approved the building of a new visitor centre. It is clear that the mineshop could not cope with the visitors that it was getting at peak periods in 1986. There needs to be much more space for everyone - school parties, the general public, the staff and Friends of Killhope. The new building will contain a shop, display space, a cafe with kitchen, a classroom, a small staff room and toilets. Most of the displays in the mineshop will be retained where they are, but there will be more space allowing it to operate more effectively. The reason for this development is to provide a better service to the customers but there are fringe benefits. The shop could act as a much-needed outlet for locally produced tourist souvenirs. The availability of refreshments should make Killhope and the area more interesting to tour operators. There should be space and a climate inside the new building to accommodate a small library for the use of researchers. Think of Friends' Activities Days when there is a purpose-built refreshment area and kitchen! The classroom will enable there to be evening meetings organised by the Friends at Killhope.

Killhope Staffing

In 1987 there will be more staff time available for looking after visitors. As from mid-November 1986 Ian Forbes has a full-time job, much of which is concerned with research at present. The four part-time assistants will be working, between them, an extra 100 days compared to last year.

Rowstie-Stowstie

The headgear over the shallow shaft on the woodland trail will be based on the 16th Century woodcut shown below. This kind of simple jack-roll has been used for hundreds of years. Joe Short has given us a photograph, taken in 1927 of himself and his father sinking a shaft onto a vein at Baxton Law near Hunstanworth. Over the shaft is a jack-roll. The late John Forster of Rookhope called this a "Rowstie-Stowstie"; we intend to keep this splendid term alive at Killhope.