WEALDEN IRON RESEARCH GROUP

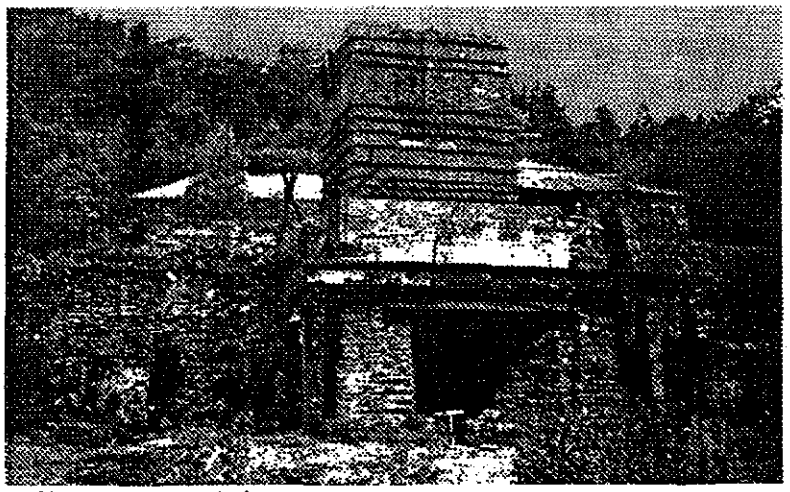
NEWSLETTER

Spring 1994 Number 19

Backbarrow

John Marshall gives a brief resume of the life of this last of the charcoal furnaces.

The Backbarrow ironworks site was one of two established in Furness in 1711, the other enterprise being at Cunsey on the west bank of Windermere lake. Of seven iron furnaces which were erected in the same district in the eighteenth century, Backbarrow lasted the longest, and remained in use until 1966. In its closing years, it operated on coke fuel, but during more than 200 years it used charcoal, and its proprietors went to enormous trouble to obtain this woodland fuel in the vicinity. The hard high-carbon cast iron produced was much in demand by quarry men for the crowbars on which their lives could depend.



Backbarrow Furnace today

The record of Backbarrow's history is a very uneven one, well documented for the company's earliest years, especially 1713-15, and patchy for most of the remainder, with one qualification; a mass of documents relating to the furnace in the twentieth century, deposited by Mr. D.M. While, are at the Duke St. depository of the Barrow Record Office, and await full exploitation by experts.

The original Backbarrow Company was a largely Quaker enterprise, and three of its four partners were of that persuasion. Hence it is not surprising that the partners were in touch with Abraham Darby I, who is known, in 1712, to have offered details of the coke smelting process to William Rawlinson, the senior Quaker partner. But the Furness charcoal iron industry did not deviate from the use of charcoal, and Darby's generous offer was unavailing - indeed no coke appeared in local furnaces until about 1870, when the Newland Company, a few miles from Backbarrow, experimented with it.

Not surprisingly, then, the Furness charcoal iron industry is regarded as backward in its eighteenth century form; it is seen as having taken over from the Weald by exploiting, in a rather wasteful manner, the woodland resources of Furness. However, what we know of the organisation of the Backbarrow Company does not suggest backwardness, in terms of the locality in which it operated, and the company owned ships, mines, woodlands and a constellation of forges from which it produced worked or bar iron.

One of these early forges, at Stoney Hazel, near Rusland, was thoroughly investigated by industrial archaeologists between 1970 and 1986, and is one of the very few standing forge structures from that period. It appears to have worked between about 1719 and 1730. The rule for eighteenth century furnaces and forges in this area is that they were nearly always situated near woodlands and charcoal supplies, and that the iron ore and limestone flux were carted out to the point of production, with the result that the forges were widely scattered, three to six miles from supplies of pig. (This pattern will be a familiar one). The Furness area had plentiful

supplies of water power, and there were numerous becks and streams which could be used.

But to continue with the history of Backbarrow. It changed hands several times, remaining in the control of the Machel family of Penny Bridge from 1731, moving into the hands of the Newland Company (Harrison, Ainslie & Co) in 1818. It is clear that the entire complex of buildings at Backbarrow was rebuilt in the 19th century, probably in 1824, and the furnace stack was surrounded by buildings and chambers which have disappeared in more recent reconstructions; blowing chamber, casting house, refinery forge and so on.

Backbarrow, in common with other sites in this area, was organised on the principle of the furnace stack, usually of slate, being built near a bank, with the water supply running along the foot or side of the bank. Charcoal and ore stores were erected at the top of the bank on any shelving space available, and gravity used to feed the furnace. This arrangement can still be seen at the now rather overgrown Backbarrow site, and also at Dudden and Newland.

The future of Backbarrow is at present in the balance. It was surveyed some years ago by a team from the University of Lancaster, and there are moves afoot to attempt some form of restoration. A heritage centre has been mooted; no doubt the proximity of a still working railway line is a great attraction. But whatever its eventual fate Backbarrow will remain one of the more important names of the Furness iron industry.

Another system of water power in the Weald?

Brian reports on some research he undertook early in April this year.

One of our more interesting finds this season was the discovery of a possible blast-furnace site on the Surrey/Sussex/Kent border, TQ43504015, in the hamlet of Flairpool; an appropriate name for a water-powered site where the pond is still in water. The furnace structure could just be discerned below the bay, and this was corroborated by the metal detector. Beside the structure two depressions could be seen,indicating where two wheel pits were located, side by side, and about 3 feet apart; as if two water wheels were mounted on the same axle. Probing the area showed that the pits were sandstone lined and that the partition wall was solid sandstone. With such scanty evidence, what could be made of this new site?

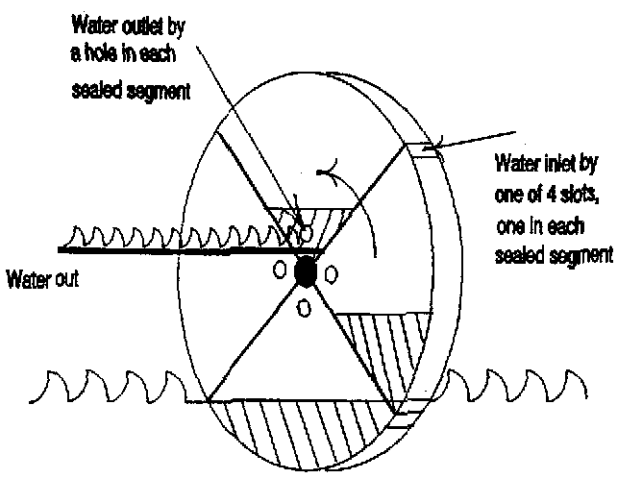
Q1) Why would it be necessary to mount two water-wheels on the same shaft?

A1) To obtain more power for driving a larger pair of bellows for a bigger furnace.

It is well known that bigger furnaces operated much more economically. One way of obtaining more power from an existing water supply is to use a wider water-wheel. However, two water-wheels placed side by side on the same axle would serve the same purpose; possibly wider water-wheels were beyond the technology of the period. Although a larger diameter water-wheel would also serve the same purpose, the height of the bay would have to be increased: a very large undertaking.

Q2) Perhaps two furnaces were operating side by side.

A2) It is known from documentary evidence that the blast furnace at Worth, in Sussex, was a twin structure.

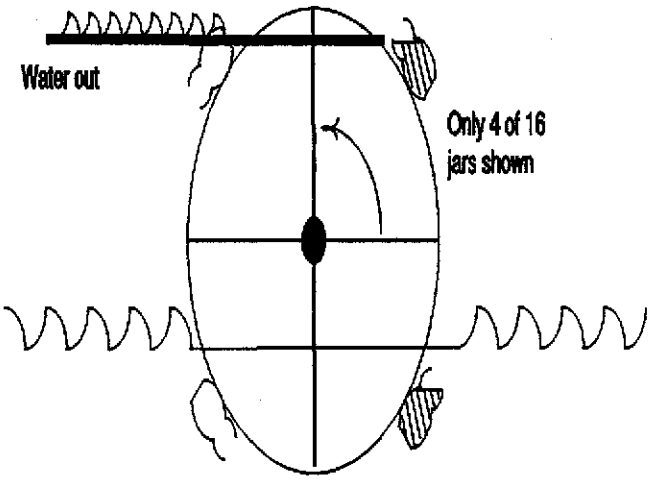


Twin furnaces were necessary when very large cannon were cast. It must be realised that an item produced in cast-iron must be "cast in one go", and that no significant time must elapse between running the iron from each of the twin furnaces. However, no evidence for twin furnaces could be found.

At this stage it was decided to call in the self-confessed expert on funny water sources (non-standard that is) for Wealden ironworks.

On a further visit it was noticed that the tail-race ran from only one of the two wheel-pits, so how did the water escape from the other one? Perhaps through the partition wall, 5 feet down in the infill! A very dangerous undertaking.

It is unusual for the pen stock controlling water to the water-wheel to remain, usually because it is easily removable or else the wooden structure has rotted away. On this site, however, an unusual sandstone "trough", that is to say, two troughs side by side, were found in the vegetation, both running across the top of the bay, and each one in-line with a wheel-pit. Even more curious was the fact that each trough sloped in opposite directions; one towards a wheel-pit, the other towards the pond.



From this merge evidence, it would appear that the pond water was being used to operate one water-wheel, in the usual way, and that the second water-wheel was being used to lift water back into the pond. Although there is no evidence for this type of water conservation in the Weald, the Darbys' of Coalbrookdale did use steam power to pump used water back into the supply pond in times of drought.

There are references to water-lifting water-wheels in "A History of Engineering in Classical and medieval Times" by Donald Hill, Croom and Helm; two possible types are named the "tympanium" and the "noria". The former can only raise water to just above axle level; not high enough for this task, but the latter will lift water to almost the diameter of the wheel.

The diagrams show conjectured apparatus for this source of waterpower, where some of the water used for powering the bellows is returned to the pond by a water-lifting wheel attached to the same shaft.

On leaving the site via the tail-race, a length of cast-iron plate was found. It was curved to suggest that it was one of several "side boards" for a water-wheel having a diameter of about 12 feet. More interestingly, it had the name "Llafipoor" cast onto one the side, suggesting that this site may be connected with the one of the Wealden Iron masters who moved his operations to south Wales.

Should the evidence for a water-powered perpetual motion machine cum blast-furnace be confirmed, the site will be surveyed and written-up for the next Bulletin.

B.K. Herbert 1st April 1994

Monarchs of all we survey???

As an occasional, and always mystified, member of Reg's small band of spear carriers I prevailed upon him to explain the black art of surveying. Is it really as simple as this.....?

There seem to be more site surveys than usual going on these days, now that the electronic grid of the resistivity survey needs to be tied into ground features. Members may like to know what is going on as they measure this and that distance or move range rods about.

The first part of any survey operation is to assess the site: what is the actual area?, what features need recording?, Where is the resistivity grid to run?. Each site has its own particular problems.

Next a sketch plan of the site must be drawn up. This is the basis for recording all notes and dimensions taken, and as such, must be reasonably accurate, at least in the relationship of the main features to each other.

Finally a 'framework' must be set up on the ground to which all these features must be dimensionally related. This, when set up to scale on the drawing board, will enable the whole site plan to be drawn.

Clearly one cannot simply dash onto a site and start measuring straight away.

There are three basic 'frameworks':

1. Triangulation

This is the simplest method, and, as its name implies, is a series of triangles. By setting up two ranging rods, A & B, at a known distance apart, the position of any other adjacent point, C, can be accurately determined by measuring A to C and then B to C. These distances can easily be transferred to paper by means of compass arcs. Point C can be any feature from a mine pit to a gate post, and, of course, point C could be used in conjunction with A or B to form another base line to locate another point altogether, point D.

The great thing to remember with triangulation is that dimensions from **two** known points are needed to find a third, unknown, point. It is only too easy to find at the drawing board that point B is six feet from A, but in an unknown direction.....

2. Offsets

This is a simple method for recording lineal features such as hedges, banks, or ditches. A base line is set up roughly parallel to the feature, and at measured intervals a right angled offset is taken and the distance from line to feature measured. It is often difficult to decide at what point and individual item is at right angles to the base line and it is usually easier to locate this type of feature by triangulation.

Where the feature being measured turns sharply as, for instance, the hedge at the corner of a field, the base line will turn also, with a rod marking the corner. By marking out a point on each line at a measured distance from the corner and taking a dimension between them across the corner the angle may be determined.

3. Bearing and distance

This is a rather special technique and works beat on large open sites. A dumpy level or theodolite is set up in the approximate centre of the site with 0 degrees on its bering ring set to magnetic north. Before starting all points or features to be recorded are marked with letters or figures on the site plan. One person, the Marker, holds the level staff on each of these points in turn while the readings are being taken.

The Observer, sighting through the theodolite, is able to calculate the distance with reasonable accuracy by counting the divisions on the staff visible between the crossbars in the telescope, and he also reads the angle of the bearing. Standing next to the Observer, the Recorder notes the position number or letter together with distance and bearing. It is essential that Marker and Recorder keep in touch to ensure that the point being marked is always that which is being recorded.....

The whole survey must now be tied back dimensionally to the site by triangulating two ends of a base line to permanent features so that any point on the site plan can, at any future date, be relocated on the ground. This is especially important in the case of a resistivity grid. Telegraph poles, corners of buildings and nails in trees have all been used for this purpose. Brian has just developed a method of burying metal discs below the ground surface to be relocated with a metal detector. The triangulation lines, dimensions and details of the site features used will then be set out on the final plan.

In practical work on a site a combination of methods 1 and 2 will give best results. And all this is putting it simply. If you come along to lend a hand you will soon find out that there are plenty of other problems, not the least of which is the big crunch when I get to the drawing board and try to put everything together. But that's another story!

Sheffield's Heritage Preserved

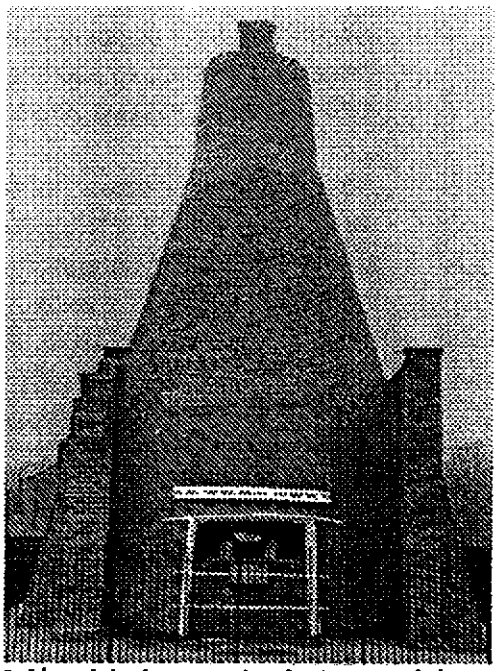
Tim Smith reports on a worthy preservation project. I am obliged to Steel Times for permission to use this article, which was printed in their edition of July 1993.

What is believed to be one of only two remaining cementation furnaces in the world has been preserved in Sheffield.

The furnace, located on Doncaster Street, in the NW corner of the City, is the last of some 56 cementation furnaces which operated in Sheffield in

the first half of the 19th century. Annual output at that time was around 12 000t of 'blister iron', each furnace carburising about 10t of wrought iron in a process which typically took 16-18 days.

The process, which was introduced to Sheffield in 1709 from Germany, consisted of heating wrought iron bars to a temperature of 900 - 1000 °C in sealed 'coffins' packed with charcoal. This enabled carbon to diffuse into the, almost carbon free, wrought iron resulting in a stronger, but brittle, product. The preferred source of the wrought iron was Sweden, since its low sulphur and phosphorus content accelerated diffusion. More carbon diffuses into the surface region, raising the carbon content here to around 1%, so producing an inhomogeneous structure.



Believed to be one of only two remaining cementation furnaces, this 'two coffin' furnace was built c1830.

Much of the reputation associated with Sheffield steelmaking arose from the skill of the craftsmen in forging this inhomogeneous blister iron into a tougher banded composite of high and low carbon steel (shear iron) suitable for such items as knives and sheep shears. An alternative was to melt the blister iron with a flux in a crucible, holding about 50kg. This process, developed in 1740 by Huntsman, a Sheffield watchmaker in search of improved steel for clock springs, gave rise to the Crucible melting furnace, still in use for certain tool steels into the 20th century.

The preserved cementation furnace, built in about 1830, was still in commercial production during World War II. Its final firing was as late as 1951, but this was for the purposes of making a film to record the operation. This film can be viewed by arrangement with the Kelham Island Industrial Museum, which also holds a key for visitors to gain closer access to the furnace.

The Iron Cannon

Bob Smith offers a beginner's guide to the identification of iron cannon

This short note is intended as an introduction to the identification of cast-iron cannon. It is not meant to be exhaustive nor comprehensive but merely offers basic information on what to look for on a gun to enable it to be identified and dated.

Nomenclature

First is naming of parts. As in all subjects the parts of a cannon have all acquired their own peculiar names which are shown on the diagram, figure 1 (overleaf). This only gives the names of the basic, useful, parts which are needed in most everyday work. Of these the most important are the trunnions, the cascable, base ring, muzzle and the first reinforce.

Length

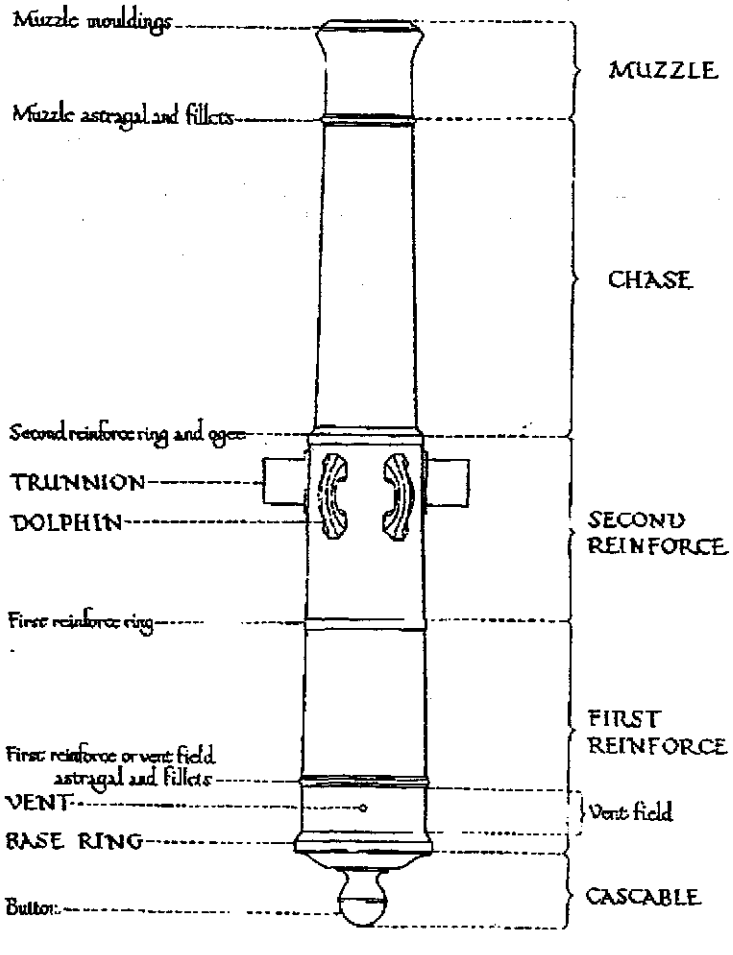
The first important measurement is the length. Two lengths should be taken: the first and more important is from the rear edge of the base ring to the front of the muzzle; the second is the overall length from end to end. A quoted gun length will always be the former, the length to base ring. For example a 9 footer will be 9ft from base ring to muzzle. Although it is useful to have the overall length it is far less important. You will find that the length will be not exact to the foot or half foot, for example, 9 feet 1/2 inch. It is important to know the exact size but for most purposes the length to the nearest foot, 6 inch or 9 inch is normally quoted.

Bore

Next it is important to know the bore. This should be very carefully measured, preferably with callipers and, if possible just down the bore from the muzzle face in order to prevent errors due to corrosion. It is also a good idea to measure the bore in two directions at right angles to each other to eliminate errors. The bore should be measured as accurately as possible, at least to the nearest 1/8

inch. This measurement can then be used to find out the calibre or poundage of the gun. The size of guns is referred to by the weight of the solid cast-iron ball the gun fired, for example a 24 pounder fired a 24 pound ball. The following table can be used to find out the size of your gun. It is worth pointing out that a small error in measurement can result in mistakes in the size as there is only a small difference in bore between some sizes.

Calibre inches		Poundage
3.6	35/8	6
4.2	41/4	9
4.6	45/8	12
5.2	51/4	18
5.8	53/4	24
6.3	63/8	32
7	7	42



Marks

The next part in the process is finding and reading the marks on the gun itself. There are a whole variety of different marks to be found on guns but I will only be dealing with those which are most frequently encountered.

First is the area of the top of the first reinforce. Here will be found either the Royal cypher, for example GR, or the rose and crown. The more common royal cyphers to be found are those for the Georges, GR. The four kings were distinguished by the use of a number intertwined with the main part of the letter G. George I of course is just GR (not common), George II has the number 2 (not too common), George III, the number 3 (most common) and George IV, the number 4 (not common). The only other common cypher is that of Victoria, VR.

The rose and crown was used on guns up to about 1727.

There may also be incised arrows (the Government ownership mark), or incised numbers in this area as well and these should be recorded.

Next is the area just in front of the touch hole. here should be found a series of incised numbers. These are the weight of the gun in hundredweights (cwt), quarters (quarters of a cwt, 28lbs, qr) and pounds (lbs). For example 15-3-18 is the weight 15cwt, 3qt, 18lbs. It is worth remembering that there can only be 0-3 quarters, and 0-27 lbs. This is useful as often the numbers are not easy to read due to corrosion or other damage. Where numbers are unclear it is worth having a stab at reading them but enclosing the number in brackets (or adding a ?) to indicate that there was some uncertainty.

It is rare that English guns are not marked with a weight but on some guns and in some periods they were placed in other areas. If no weight mark can be found just in front of the touch hole the next place to look is the lower face of the cascable.

On either side of the cascable they may be an incised line with associated numbers. This is mainly found on later guns and was used as an aid for sighting the gun. It is worth recording that these are present but they are of less importance in the identification of the piece.

Next the end faces of the trunnions should be inspected. Here may be found letters and/or numbers, either incised or raised. These should be recorded. The letters refer to the foundery where the gun was made or the founder of the gun (or sometimes both). Their decipherment has caused some confusion in the past but new work is now making it clear what they mean. There is far too great a variety to list here but further information can be found in the following: 'The Woolwich

proof registers 1780-1781' by Ruth R Brown in the Journal of Nautical Archaeology, 1988, vol. 17, number 1, pp. 105-111; 'Identifying 18th century trunnion marks on British iron guns: a discussion', by Ruth Brown in the Journal of Nautical Archaeology, 1989, vol. 18, number 4, pp. 321-32. (offprints of both of these articles are available from WIRG). In addition later in 1994 Ruth will be publishing a short book on the whole range of marks found on British iron guns. Finally it is a good idea to look over the entire gun looking for any other marks.

Identification and dating

Once you have recorded all the dimensions and marks on the gun an identification and/or dating can be attempted. The problem with a short article such as this is that, although there are a number of common types and patterns, there is a great variety of guns and it will just not be possible to list them here. If the gun has a cypher then it can, of course, be dated to the reign of that particular monarch. If it has the Rose and Crown mark then it must date from before about 1727.

To pinpoint the date of a gun closely is quite difficult and outside the scope of this short note. If you do want to go further the two best books which deal with the subject are The Armouries of the Tower of London. 1 Ordnance by H L Blackmore, London, 1976; An introduction to British artillery in North America by J S Gooding, Museum Restoration Service, Bloomfield, Canada, 1965. Both of these are available from the Royal Armouries.

It is perhaps worth noting that among the most common guns to be found are those cast by the Carron Company and those of Walker and Company. The former are marked with the name CARRON on one trunnion face and so are easy to recognise. Very commonly the other trunnion will bear the date of manufacture. Walker and Company guns are marked WCo on one trunnion face and though not normally dated were produced between 1775 and the mid 19th century.

Finally there are carronades. These short, fat guns were made, first by the Carron Company, and later by a wide range of makers, from 1778 until the mid 19th century. They are easily recognised as, apart from being so short, they have no trunnions but are mounted on a fitting beneath the barrel.

Finings

REVERSE ARCHAEOLOGY

A time capsule was buried at Philips Research Laboratories, Horley, Surrey, on the 10th. of September 1993, under what will be known as "J" building. Among the contents were records of the Laboratory's activities over the years, and personnel archives of both the youngest employee and the longest serving employee - the latter being Brian Herbert. Amongst his documents was a copy of the "The Field Walker's Guide and an Introduction to the Iron Industries of the Weald". Future archaeologists will have no excuse!

HISTORICAL METALLURGY SOCIETY NEWS.

David Cranstone is starting to investigate bloomery sites in Durham and Northumberland; some sites have been previously recorded by Denniss Coggins (in Teesdale) and Ronnie Tylecote, but large numbers of visible (and sometimes impressive) sites have never been recorded. The programme is, at present, limited to locating sites and preparing brief records for the County Sites and Monument records; no excavation is planned.

The work is at a very early stage, but it is already clear that bloomeries are common throughout the Durham Penines, typically, but not always, near streams. There is some variation in the site size and slag type, the bigger sites tend perhaps to be lower down the Dales than the smaller sites. Very little work has yet been done in Northumberland, but this has included the location of an enormous site, an order of magnitude larger than anything yet identified in Durham. In contrast, small, 'Durham type' sites have yet to be located in Northumberland, though they probably do exist. The majority of sites are likely to be medieval in date, though earlier sites are possible.

MAP REFERENCES MADE EASY.

Members who need to determine exact map references from 2.5" maps will know how difficult it is to estimate the fourth and eighth digits. Brian has produced a transparent scale to help take the agony out of the process. Available free on receipt of an SAE from B.K. Herbert, 1 Stirling Way, East Grinstead, RH19 3HG.

And Finally

Hugh Sawyer has the last word this month! Submissions are invited from readers whose extensive knowledge of the Wealden Iron industry will confer only a modest advantage; a not unreasonable bottle of claret awaits the winner! Send your entry (photocopy, if preferred) - by 30th June 1994 to:

Hugh Sawyer, 14, Springhead Way, CROWBOROUGH, Sussex, TN6 1LR

Name.....
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Address.....
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ACROSS

1 Car I let guru have for land improvement (11)
9 & 10 At it noisily with these tools? (6,3,5)
11 Return plaster (6)
12 A fishy place for iron extraction? (8)
13 Ray tours Ely annually (6)
15 Stunned by a morass caught in the act (8)
18 Explosive capacity for slowing down the burning? (8)
19 Merry prank (6)
21 & 23 Gun data may be mapped? (8,6)
26 In the end, rear-admiral is cheerless (6)
27 Adorn with shining spleen bag (9)
28 Some sea news of dread (11)

DOWN

1 Has a try aimed at smokers (7)
2 Italian Norman gives up an indefinite number (5)
3 Indented parapet (9)
4 Tale may lead to a mill (4)
5 A French bank with a grand newsman won't hold water! (8)
6 Highly praise the former backward lot (5)
7 Attempted to treat sad eyes (7)
8 Very unpleasant from down under (8)
14 Shortened a crossing to five hundred (8)
16 A true font turns auspicious (9)
17 I am able to accept a hundred in friendly spirit (8)
18 Watered to excess? (7)
20 A bashful quality (7)
22 Nothing right in the motoring organisation from the heart (5)
24 Five with a burning fever lacking distinction (5)
25 Eastern departure from loose Norwegian town (4)

Use Chambers 20th Century Dictionary