Newsletter 80 Autumn 2024

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The editor wishes to draw your attention to the short article from Richard Williams on page 8 of this newsletter. He understates his status and achievements which include significant improvements in our understanding of the success of Abraham Darby 1st's coke smelting enterprise. Anyone who can add to the samples he seeks would be making their own valuable contribution.

In this issue:

WINTER MEETING 2025

Advance Notice

The Wealden Iron Research Group's 2025 Winter Meeting will be held at Nutley War Memorial Hall on Saturday 25th January. 2.30 pm.

The speaker will be Dr Andrew Richardson, director of Isle Heritage, who will speak on the Lossenham Project: Settlement and ironworking in the Rother Valley.

Getting in touch with WIRG:

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Similarities between Germany's Harz Mountains Mines and mining on the Weald

By Tim Smith

Located in the Harz Mountains of Lower Saxony, Eastern Germany, near the town of Goslar, was the world's largest deposit of copper ore, along with ores of zinc and lead, as well as native silver and gold. Mining started here in the early 11th Century. It was where Georg Agricola (1494-1555) was born – famous for his treatise on mining and ore processing, 'De Re Metallica' written in Latin and translated into English in 1912 by mining engineer, Herbert Clark Hoover – later to become President of the USA - and his wife, Lou Hoover.

Significant later inventions to improve mining included

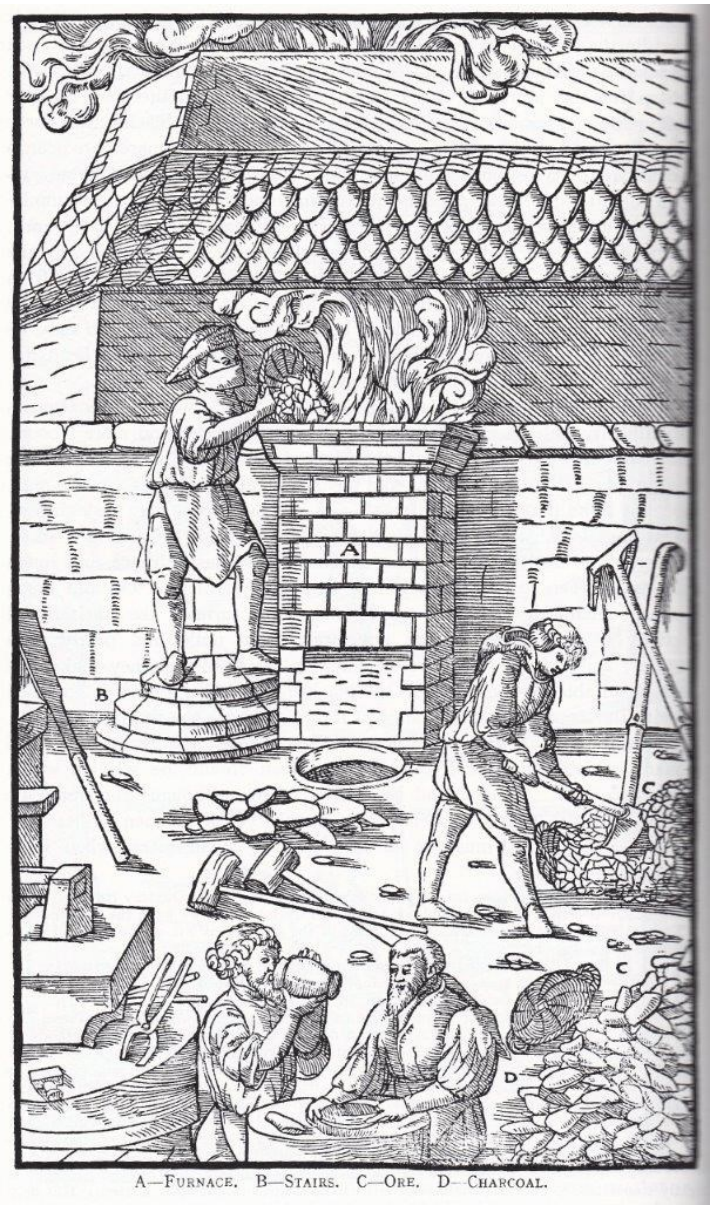


Illustration of a C16 iron smelting furnace by Agricola

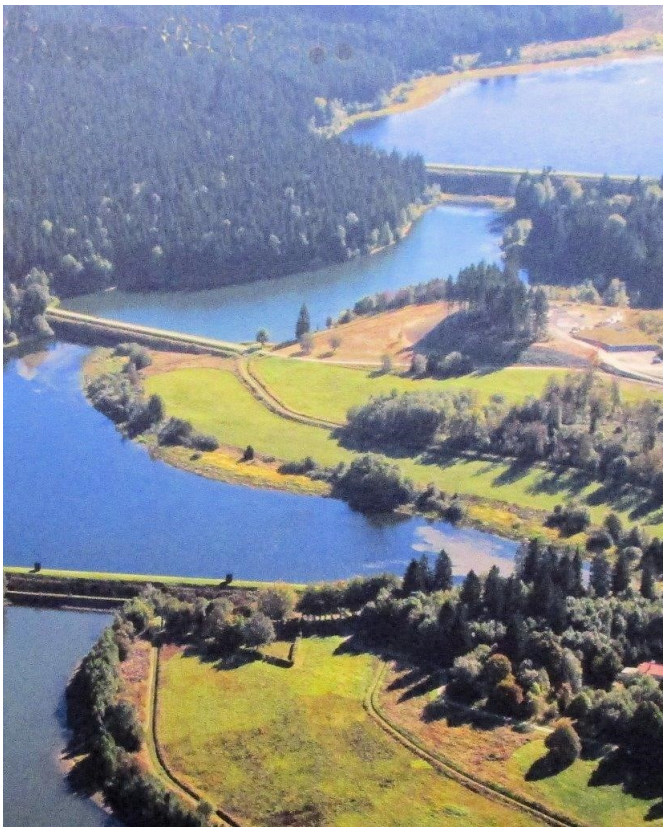
the 'Man Engine', in 1833. This consisted of a heavy reciprocating timber with platforms attached to it descending down a mine shaft. Additional fixed platforms were set into the shaft wall. Miner stepped between platforms at the point of rise and fall of the motion to be raised up or descend the shaft at a rate of 20m per minute, a three-fold saving in time compared with climbing ladders. This was a popular invention with miners who no longer had to climb hundreds of feet of ladders at the end of a tiring shift. Indeed, Agricola, prior to the invention of the Man Engine writes*: '… sometimes workmen slipping from the ladders into the shafts break their arms, legs, or necks, or fall into the sumps and are drowned; often indeed the negligence of the foreman is to blame, for it his special work both to fix the ladders firmly to the timbers that they cannot breakaway,….* The Man Engine was widely adopted in the mines of Cornwall, until a disastrous failure at the Levant Mine in 1919 which killed 31 men and injured many more.

Another significant invention leading to improved safety in mines was, in 1834, the wire rope for hoisting, which replaced hemp ropes, which were prone to rot in the damp of a mine shaft.

The largest mine of the area, Rammelsberg, ceased production in 1988 after 1000 years of activity. Agricola writes of subsidence in the Rammelsberg mine: *'… when in olden days Rammelsberg in Goslar , sank down, so many men were crushed in the ruins that in one day, the record tells us, about 400 women were robbed of their husbands….. therefore, miners should leave numerous arches under the mountains which need support, or provide underpinning'*

Recorded output of ores at Rammelsberg totaled 27Mt by its closure in 1988. Just prior to this, in 1986, ore production consisted of 35kt zinc, 10kt of lead, 2kt of copper and 15t of silver and 100kg of gold. The average grade of ore was 30% - a remarkably high figure for non-ferrous ores. The adjacent Erzbergwerk mine produced 19Mt of ore before its closure, and the last mine to close was Hilfe Gottes, in 1992.

Prior to the mid 19th. Century, power was supplied



A cascade of ponds connected to water wheels by leats was developed

by water wheels, both above and below ground. The earliest water wheel dates from the 13 Century. To supply water to these wheels a cascade of ponds was constructed connected by least.

Recognizing the importance of this long history of mining in the district, UNESCO declared the area a World Heritage Site, the very first mining area to receive this accolade.

Evidence of mine pits in the Harz mountains

How does this hard rock underground mining compare with activities on the Weald? The water management system is similar in that a series of interconnecting ponds – Pen Ponds – were constructed on the Weald to drive water wheels to power the bellows of the blast furnaces and the bellows and hammers of forges.

ddition, much of the earlier method of winning the ore on the Herz was by sinking shafts, side by side. This is evidenced by subsidence at the surface, typically surviving in woodland, as is the case in the Weald.

Finally, in the 20th century, the management of wood supplies involved the planting of fast-growing spruce trees rather than native deciduous trees – mainly beech, maple, birch and ash. In recent years the spruce has been hit by the Rhizosphaera kalkhoffii fungus spread by bark beetles, an attack normally prevented by the resin of the tree, but a series of droughts and days of excessive heat have now made these non-native trees succumb to the fungi.

For further information on the mines of the area visit:

https://visitworldheritage.com/en/eu/mines-of-rammelsberg-historic-town-of-goslar-and-upper-harz-water-management-system-germany/cc602e5c-3d65-4c25-b6e9-d27ed6f54bf6

This article follows a recent visit to the Harz Mountains by the author.

WEALDEN IRON, WIRG Bulletin vol. 45, 2025

Articles are invited for next year's WIRG Bulletin.

The Editor, Jeremy Hodgkinson, would like to receive submissions by the end of April.

Send them to jshodgkinson@hodgers.com

An Invitation to attend the 5th Biennial

SOUTHEAST ENGLAND REGIONAL CONFERENCE

Saturday 30 November 2024 in Kings Church, Brooks Road, Lewes, BN7 2BY

Conference Organiser: anthony.brook27@btinternet.com

'People and Places'

9.00 Doors open and Registration

10.10 Welcome and Announcements

Programme

10.15-11.00 Lynn Cornwell (Hastings Archaeological Research Group)

'In Pursuit of the Classis Britannica: New Sites in the High Weald'

11.00-11.30 Coffee and Biscuits

11.30-12.15 Brian Short (University of Sussex) *'Walking and Writing on the Sussex Weald and Downs: the Legacy of Dr Peter Brandon'*

12.15-1.00 Geoffrey Mead (University of Sussex) *'Viscounts and Chicken Stubbers: Community Variation between the Downs and the High Weald'*

1.00-2.00 Lunch

2.00-2.45 Mike Benton (University of Bristol) *'Changing Ideas of Dinosaurs since William Buckland (1824) and Gideon Mantell (1825)'*

2.45-3.30 Ken Brooks (Hastings and District Geological Society) *'Teilhard de Chardin: Priest, Philosopher and Fossil-Hunter in the Hastings Area in the early 20th Century'*

3.30-4.00 Tea and Biscuits

4.00-4.45 Darren Clarke (The Charleston Trust) *'The Highly-influential Bloomsbury Group at Charleston Farmhouse in the Sussex Downs'*

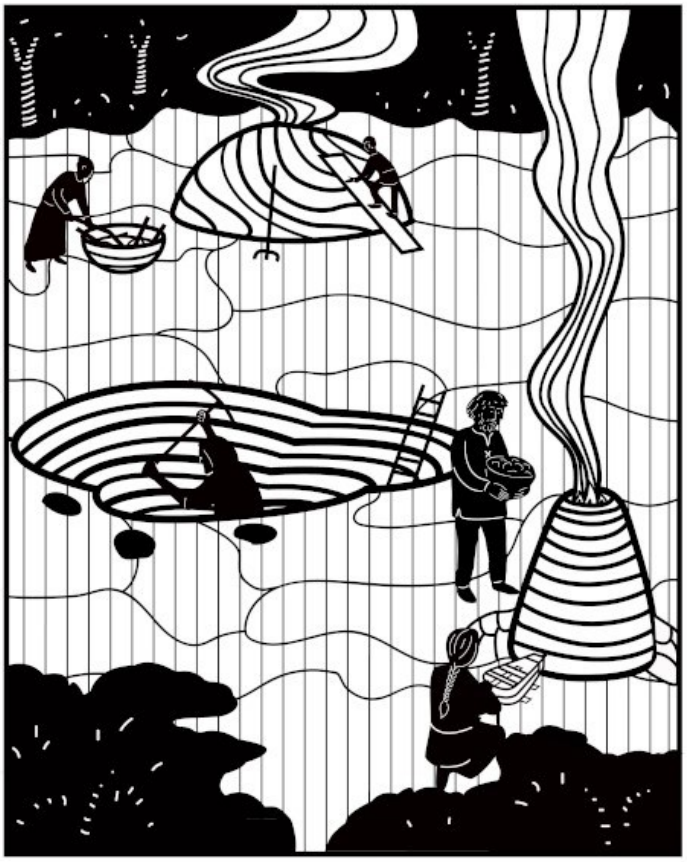
To Register for SERC24, please forward your Name, Address, Tel. No. and email to the Conference Organiser (anthony.brook27@btinternet.com); and also remit the Conference Fee of £35 per person, by Direct Bank Transfer, including your name as the reference, to Anthony Brook Sort Code 40-47-25 Account No. 4179153

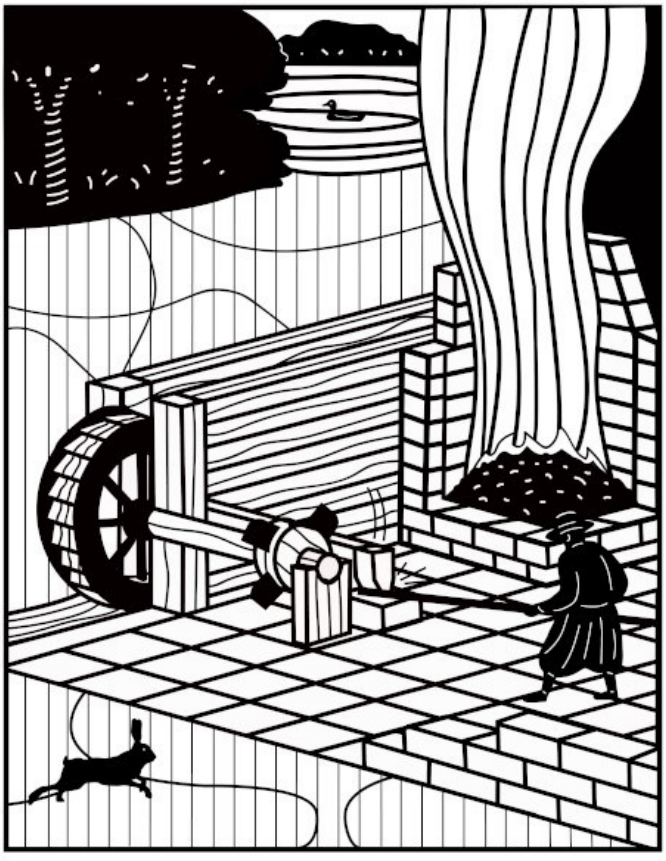
If it is easier for you, please forward a cheque for the Conference Fee to 15, Cambourne Court, Shelley Road. Worthing, West Sussex, BN11 4BQ

The Wealden iron industry is the theme of a new set of gates that front the Amelia Scott, the new arts heritage and culture hub at Mount Pleasant Road in Tunbridge Wells. Crafted from mild steel, the gates ingeniously depict the various stages of the iron industry from bloomeries to blast furnaces and forges, including the railings around St Paul's Cathedral that were made at nearby Lamberhurst. Artist Alex Fox consulted WIRG about what symbolised the various aspects of the industry and created a design of six openwork panels that made use of narrow vertical bars onto which and into which outline images could be placed in a way not dissimilar to stained glass construction (Figs.). The gates were forged by Rhys Harlin of the Darenth Valley Forge at Eynsford.

The whole sequence of panels, together with a short video of the artist talking about this project can be found on the Visit Tunbridge Wells website: https://visittunbridgewells.com/discover-the-iron-heart-of-the-weald/

IRON-THEMED GATES





WIRG displays 2024

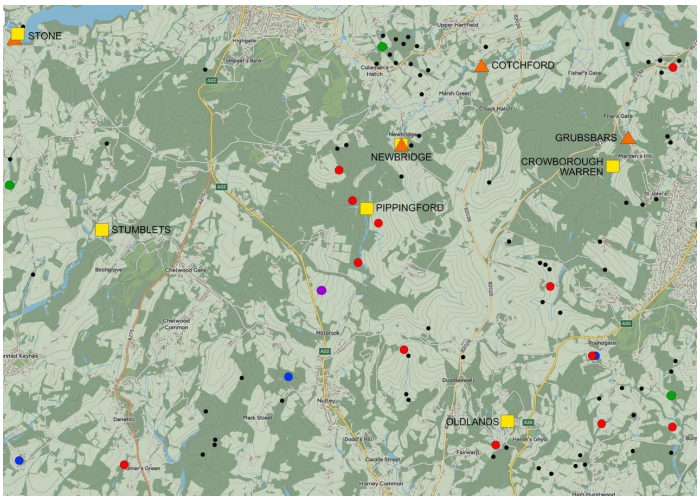
Part of WIRG's *raison d'être* is to disseminate knowledge of the Wealden iron industry to the public. One of the means of achieving this has been to attend various events with a stand consisting of posters and examples of finds.

On August 3, WIRG set up a stand at the Ashdown Forest Visitor's Centre, located on Coleman's Hatch Road between Wych Cross and Coleman's Hatch. The Visitor's Centre does house a small permanent display of iron industry finds. The Centre was dedicating separate days to the industries of the Forest and we were representing iron production. The display illustrated finds dating from the bloomery period to the blast furnace featuring raw materials and field finds as well as the WIRG display boards.

The WIRG display boards can be borrowed if you have an indoor event about the iron industry

New to the display was a demonstration of the use of bellows to blow air into a bloomery furnace at a constant rate.

Children (and adults) had to operate the bellows to float a ping-pong ball up a transparent tube and maintain its position at a constant level marked on the tube.



Iron sites in the vicinity of the Ashdown Forest Visitor's Centre Key Yellow -BF, Orange Forges, Bloomeries - Black undated, Blue Iron Age, Purple Saxon, Red Roman, Green medieval

On the Heritage weekend 14 & 15 September, WIRG attended the Fernhurst Furnace open days, an annual event which WIRG has been invited to display at for a number of years. Located in the west of the Weald, the event attracts a large number of visitors with stands exhibiting local crafts as well as an enactment of Civil War battle techniques by the Sealed Knott Society with plenty of 'bangs' as muskets and field guns are discharged. Remains of the foundations of the furnace – strictly North Park Furnace which operated from 1614 t0 1777 - are now the best preserved on the Weald after extensive renovation work has been completed.

Good weather brought in a near record crowd with plenty of interest from attendees attracted to the WIRG stand with some youngsters having to be hauled off the bellows by parents wishing to move on.

AN ELIZABETHAN CANNON IN BRAZIL

Christopher Sellars has communicated information about a Tudor cannon he came upon at the 16th century Fortaleza de Santa Catarina which used to guard the mouth of the Paraiba do Norte River north of Cabedelo in the state of Paraiba. There are, he writes, several English guns at the fort, some dating to the Georgian period, and therefore probably also of Wealden origin. However, of greatest interest perhaps, is this gun (Fig. 1), which bears the date 1590 and these marks (Fig. 2): ER, with a rose and crown, 33 3 0, being the weight of 33 cwt and 3 quarters, and T I, which are almost certainly the initials of Thomas Johnson, the Queen's gunfounder from 1587 to 1596, who was casting guns at Horsmonden Furnace during that period. Another of Johnson's guns, at Sluis in the Netherlands, was noted in Newsletter 62, and there is a demi-culverin of his among the guns that fortified Londonderry in Northern Ireland. The gun has an approximate bore of 5 inches indicating that it was a culverin or 18-pounder. A search on the internet has failed to provide an answer as to how or why English guns came to be mounted in this former Portuguese fort.

Jeremy Hodgkinson

Characterisation of bar/wrought iron made by different fining processes.

Call for help!

I have just started an MSc by research at the University of Warwick, with the aim of looking at the different microstructures, analyses and slag contents of indirect process irons used in England between 1500 and 1900 AD.

I identify five different fining processes, albeit with complications. The main issue is whether the pig iron fed into each process was high or low in silicon.

Simple Walloon/French charcoal fining of low silicon irons, without iron oxide additions.

The German fining process for pig iron with higher silicon contents, involving the addition of iron oxides (in some form or another).

Potting and stamping, where silicon was removed from high silicon coke pig in a prior treatment process.

Puddling, using a white pig iron, or a high silicon coke-iron that had been prior treated, in a 'refinery'.

The wet puddling process, where high silicon iron was fed in on top of an iron oxide- rich hearth.

The complications are chiefly that there were many half-way, hybrid, arrangements, where iron oxide additions were made during the operation in smaller quantities.

I will be looking at slag analyses, but also at slag quantities and the relationships between matrix and slag chemistry, ie the partitioning of elements between matrix and slag.

Malleable iron is an enormously variable material, within bars, between bars and from place to place, and I need as many samples of iron in each category to analyse as possible.

So my plea is for samples of iron with some provenance. This is not as difficult as may be thought perhaps. Any iron, in the form of any manufactured object or merchant bar, that can be dated to the 16th, 17th and 18th Centuries and was manufactured in England, will have almost certainly have been made using the Walloon process. The German process only became necessary in England after 1750, when coke iron first began to be used in the forges.

All puddling was a two stage process up until 1820 or so, thereafter wet and dry processes were used side by side.

Potting and stamping was only used in earnest between 1770 and 1800, and then in relatively few, well-known, places.

Imported iron is a complication, because Swedish irons were sometimes made using iron oxide additions, ie the German process, and sometimes not, when some variant of the Walloon one was used. It depended on whether the iron was made from torrsten ores or from quicksten ones, the former being a form of hematite with a high silica:lime ratio that naturally produced a grey iron. The strategy here will be to go back to source and try to obtain irons from areas where the particular ores were found. I have no strategy as yet for understanding the Russian irons that were imported in some quantity over the same period.

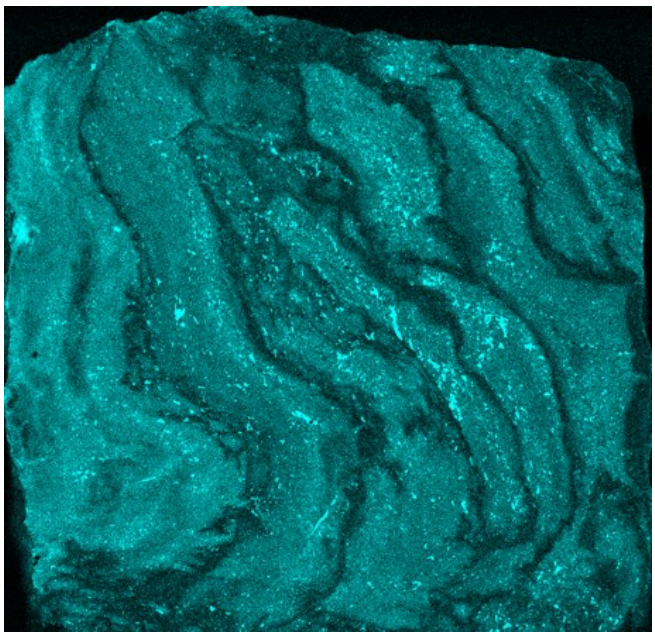


Fig 1. Micro XRF phosphorus map of a bar from New Willey, showing the individual 'stamped' pieces of iron that were placed in the crucible. Cross section approximately 50mm square.

I already have some very interesting specimens to look at. Being sent a sample of bar iron found near John Wilkinson's New Willey works at Broseley was pivotal in my starting the project. It was very clearly made by potting and stamping, see Fig 1. Very quickly thereafter I was asked to look at some iron bars that had been found off the coast of Holland. They were well documented. They had been on their way from Finland via Stockholm when the boat sank, destined for a particular merchant in Birmingham, who was to receive them via Bristol. The registration of the particular stamp mark in the Jernkontoret noted the iron to be of second quality, specifically produced for the English market, see Fig 2

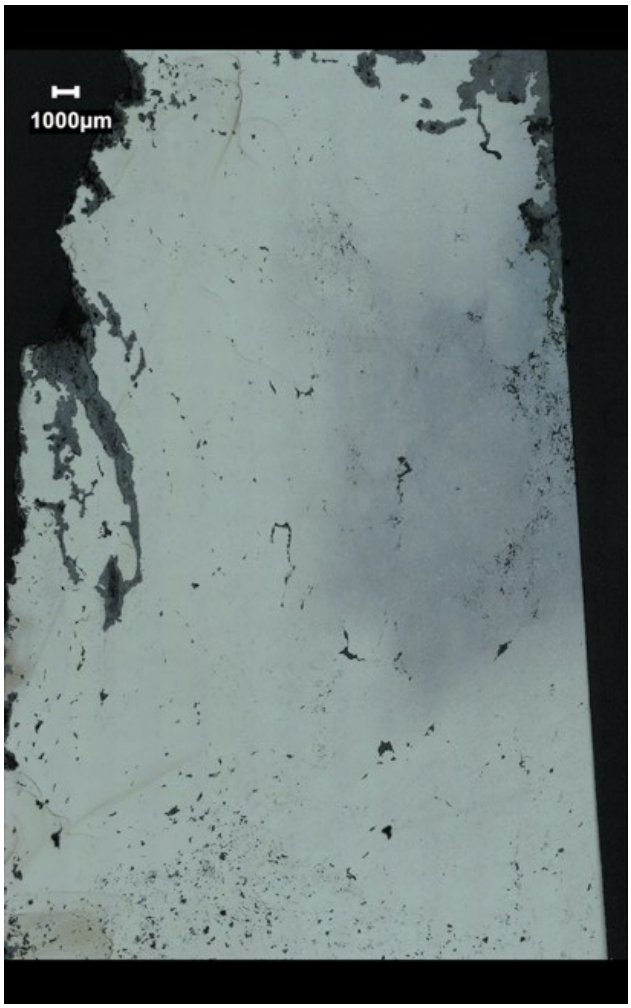


Fig 2. Optical microscopy of iron from Bjork Boda in Finland, 1770. Dark area is pearlitic, light areas ferritic. Note relatively small amount of slag.

I have since been given bar iron from the Weald (17th C) and from North Wales (late 16th C). I am making a random collection of 19th century irons looking to see if they can be filed into two groups. My surmise is that dry puddled iron should have less overall slag and lower phosphorus contents than wet puddled material.

Fig 3. Cross section of a nail from the Weald c 1650. Note the enormous amount of slag and the dark areas of high carbon content.

Can you help me? Do you have any early bar/ wrought iron samples at home that you would like to know the composition of, or know where some might be found? A classic location is dismantled old buildings, or, of course, finds in old industrial areas.

My research is a part-time project, destined to take three years, but I intend to report early findings at the HMS *Research in Progress* 'meeting' in November this year.

Richard Williams

williams.hollies@btinternet.com

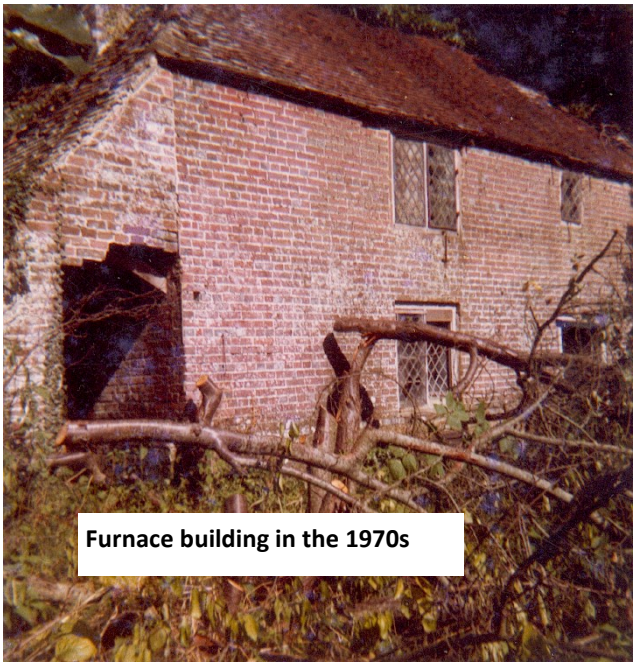
…

SUMMER MEETING – DALLINGTON – 27TH JULY 2024

Twenty members and eight guests met at the Old School, Dallington, which serves as its village hall, on a sunny Saturday morning. The first event of the day was an interesting talk by Philip Riden, the group's President, on London and the iron trade 1680-1830. London had not been a producer of iron, with most being made in the Weald and, increasingly, other parts of England and Wales, as well as being imported from Sweden and Russia, but with its expanding size and population it was a major, growing market. Philip delivered an absorbing account of London's changing role in the iron business over the long eighteenth century.

The group's annual general meeting was held following Philip's talk and he presided over the usual reports by the Chairman and the Treasurer. Election of officers and committee followed with Dr Ethan Greenwood, the first recipient of the group's two studentships at Exeter University, joining the committee now that he has returned to Sussex.

Lunch was taken in the hall or at the nearby Swan public house at Woods Corner before making the short journey to Ashburnham Furnace for the afternoon's visit, by kind permission of the Wallace family. The group had previously visited the site in 2006. Ashburnham was the last furnace to be blown out in the Weald, in early 1813, and it is one of the two best preserved although, like all of the ironworking sites in the Weald no standing structures have survived. However it is undoubtedly the one that best exemplifies the idea of the ironworking community with its surviving buildings including three workers' cottages and at least one working building dating back to when the furnace was active, and which the Wallaces have converted into their home since moving there in the 1970s.



Furnace building in the 1970s

Jeremy Hodgkinson guided the assembled members and friends around the site. It was noticeably overgrown and unfortunately an attempt to strim access to some of the parts of the site had only been undertaken at the last minute. However, it was possible to see the lower of two wheel pits – an eyewitness account written in the nineteenth century had referred to two furnaces, an upper and a lower one – as well as the tailrace running from it which was culverted beneath the Wallaces' house (indicating its former working function). The three cottages, two from the sixteenth century and the adjoining 'pay cottage' built in the eighteenth century, overlook the upper part of the site and we were able to access the spillway, or 'waterfall' as it is known locally and look down across where more than two centuries ago had been a bustling scene of men and horses, smoke and dirt, all now returned to rural peace. When we returned to where the cars had been parked it was possible to see the vestiges of the 2¾ mile-long leat that had been constructed to bring water from the former Penhurst Furnace to supplement the supply, perhaps when the second furnace or a boring mill needed to be powered.

The lower wheel pit

As well as visiting an ironworking site, the afternoon visit following the Summer meeting is an opportunity for members to talk about iron and to learn from each other. Following the visit Jeremy has compiled an illustrated description of the site at Ashburnham to explain some of the features that it was hard to see when we were there in July. It can be viewed on the WIRG website at https://www.wealdeniron.org.uk/ashburnham-furnace/.