Newsletter 74 Autumn 2021

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Visit Tudeley Ironworks on Saturday 30th October at 10am

Tudeley is one of the few Wealden ironworks from the medieval period with surviving documentary accounts. The unique collection of records offer a rare insight into the lives of its ironworks, their equipment, expenditure and associated woodland industries, in the mid-14th century. At a time when plague and population loss had led to considerable uncertainty across England, Tudeley along with its wood colliers and ore diggers, found itself in the middle of significant social changes.

The visit to Tudeley will initially head to the site identified by Straker in the

Northern part of the Tudeley Woods Nature Reserve which, in the last couple of years, has been the subject of a landscape and geophysical survey. After lunch, the southern section of the Reserve will be visited to look at the Devils Gill Bloomery (as yet undated) along with the mine pits and charcoal platforms that are located nearby.

Meeting location and lunch venue to be confirmed shortly.

Resistivity survey at Tudeley

A resistivity geophysical survey was carried out at Tudeley at the end of September, in the hope of identifying further archaeological features, in particular traces of a building that is described as having stood at the works during the 1350s. The identification of a building would add further evidence to support Ernest Straker's suggestion that this site on the bank of the Devils Gill stream, was Tudeley Ironworks. While the previous magnetometer survey revealed potential furnace sites and slag heaps, through changes to the soil's magnetism caused by burning, it was less likely to reveal features associated with structures, with the exception perhaps of hearths. Resistivity involves sending an electrical current into the soil and measuring the resistance the current encounters. A ditch for example, being more likely to retain water and organic deposits, will allow the current to pass more easily through it (low resistance) compared to material such as stone that exhibits a high resistance to the currents flow. The different readings can then be plotted, and any underlying features mapped. So far, the resistivity survey, which has focussed on the southern area of the site, has identified a possible east-west aligned ditch and high resistance anomalies likely to be compacted slag heaps or furnace bases. It is hoped that extending the survey north may show a continuation of features such as the return of the ditch, as well as pinpointing likely sites a building may have once stood. As can be seen in the photo below, the terrain made the surveying much more challenging than an open field. However, as the site is within ancient woodland and not a regularly cultivated field, the chances that underlying features have survived is far greater.

Jack Cranfield

Resistivity survey in progress

The Wealden Iron Industry as the "cutting edge" of the industrial revolution

The purpose of this note is to pour a little cold water on a cliché often attached to the Wealden Iron Industry in the period leading up to its final gasps in the early nineteenth century.

Whilst it is certainly true that the early blast furnaces of the Weald made a very significant contribution to the amount of cast and bar iron made in Britain until about 1640, there are some startling disconnects between those blast furnaces and what we now recognise as the "industrial revolution". These disconnects are of several types: in time, in scale, in scalability, in organisation and, most of all, in a signal failure to produce innovations that could be copied.

Although one may cherry-pick early examples of "modern" factory production from (say) Arkwright (e.g. Cromford 1771), the widespread adoption of factory production carried out by a wage-paid workforce belongs to a later period. Indeed, it was slow to catch on. As late as 1833 the *whole* of the factory workers in textiles (about 192,000) was still outnumbered by hand-loom weavers alone (See Thompson, E.P. *The Making of the English Working Class* 1963). In the Iron and Steel industries the "modern" system arrived later still (See Thompson, *ibid.*). Readers of this newsletter will know that the last Wealden furnace went out of use in 1813. A characteristic of labour in the industrial revolution was that wages were paid directly by the factory owner to his workers. This replaced a system of extensive sub-contracting. Such sub-contracting persisted in the Weald, as far as I can see, right to the end.

Whilst UK iron production enjoyed a period of exponential growth after 1750, production in the Weald shrank. Although even the most modern iron and steel plants were quite small-scale operations, it was competition from modernising pre-factory iron producers that delivered the *coup de grace* to the Wealden Industry. This competition was closely related to the increased use of coal, both in coke fed blast furnaces and in steam-powered bellows. The Weald has no significant coal, and the production of charcoal could not be scaled up. The streams that provided to power were also too small to allow significant scaling up. But the industry had been in decline since about 1640 (See King, P. *Economic History Review* 2005.), so there were other factors at work as well.

An example of major innovation that contributed to the development of high-pressure steam engines is boring cannon from the solid. This could have originated in the Weald, but did not. Instead, it is attributed to John Wilkinson.

In summary, the iron industry of the Weald was old fashioned and incapable of improvement *before* the industrial revolution. There is, nonetheless, one way in which what happened in the Weald was an integral part of the later industrial revolution. It partook in the accumulation of vast fortunes. In the early modern period rich became richer on the back of low paid labour at home and slavery abroad. John Fuller MP ("Mad Jack") had inherited some iron working interests, but, more importantly, two plantations and their slaves in the West Indies. Although he was to say the least eccentric, in his own times he was probably better known as a leading anti-abolitionist. Without such people its is difficult to imagine how railways, canals and cotton-works could have been financed at such a frantic rate. Jonathan Prus.

Ironworkers' songs and songs about Ironworkers?

Paula Nicholson writes:

I have tried with unrelenting failure to trace any songs or music that were associated with the Wealden iron industry and wonder if your members have any ideas.

Whilst I appreciate that the noise and smoke of the furnaces etc. would have hardly been conducive to work songs or singing anything, I find it difficult to believe that there was no musical entertainment that referenced the work and hardships of those in the industry.

I have also sought the advice of people interested in the folk music of Sussex and the English Folk Dance and Song Society and again come up with a blank but they encourage me to keep searching.

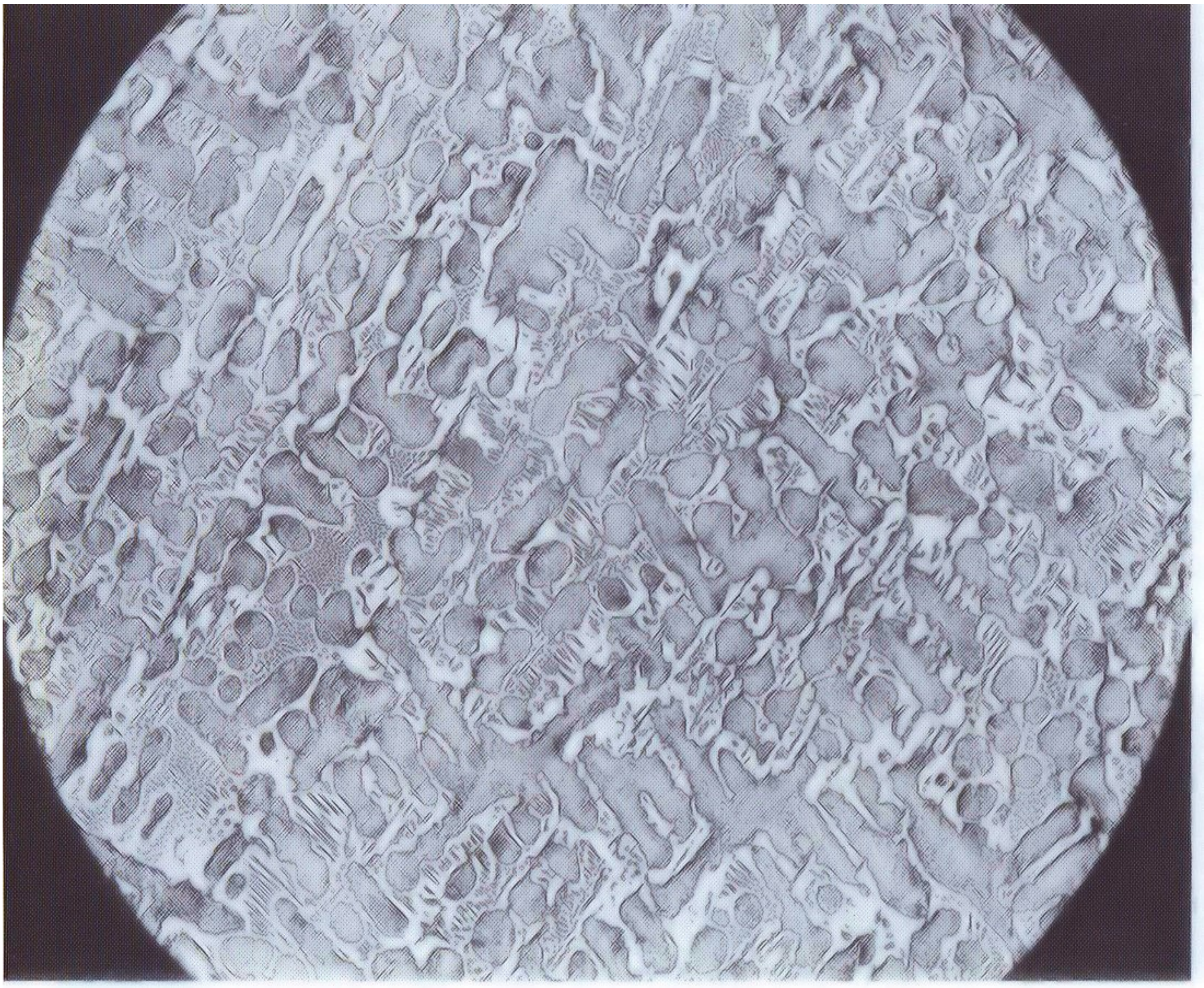
All you need to know about refining

A most excellent paper by Richard Williams published in the current issue of '*Historical Metallurgy*', the journal of the Historical Metallurgy Society, covers the fining of blast furnace iron into malleable wrought iron from the various methods employed in charcoal hearths to the puddling process which began to predominate by 1791.

The full title of the paper *'Grey or white pig? The importance of the starting material whether fining iron in charcoal hearths, clay pots or puddling furnaces'* summarises the vast range this paper covers in its 20 pages drawing on 42 literature sources including WIRG's own Brian Awty.

The chemistry of pig iron is addressed from the perspective of whether a grey iron which contains free elemental carbon as graphite flakes or white iron in which the carbon is combined with iron as the carbide, cementite (FeC_3), is made in the furnace. The former is necessary for making castings as it has a small degree of ductility while the white iron is harder and more brittle and fractures readily, indeed the name 'white iron' is derived from the look of the fracture which is wholly crystalline and contrasts the duller appearance of a grey iron fracture.

White iron is the preferred form for fining, partly because the finer form of the cementite aids the speed of removal of carbon, but more importantly because it melts over a range of temperatures producing a mushy mass in the hearth which can be manipulated with iron bars to provide oxygen to the bulk both from air blown



White iron. The darker areas are an intimate layered structure of ferrite iron (αFe) and cementite, known as pearlite, and the lighter areas are cementite (FeC_3) Micrograph x 66

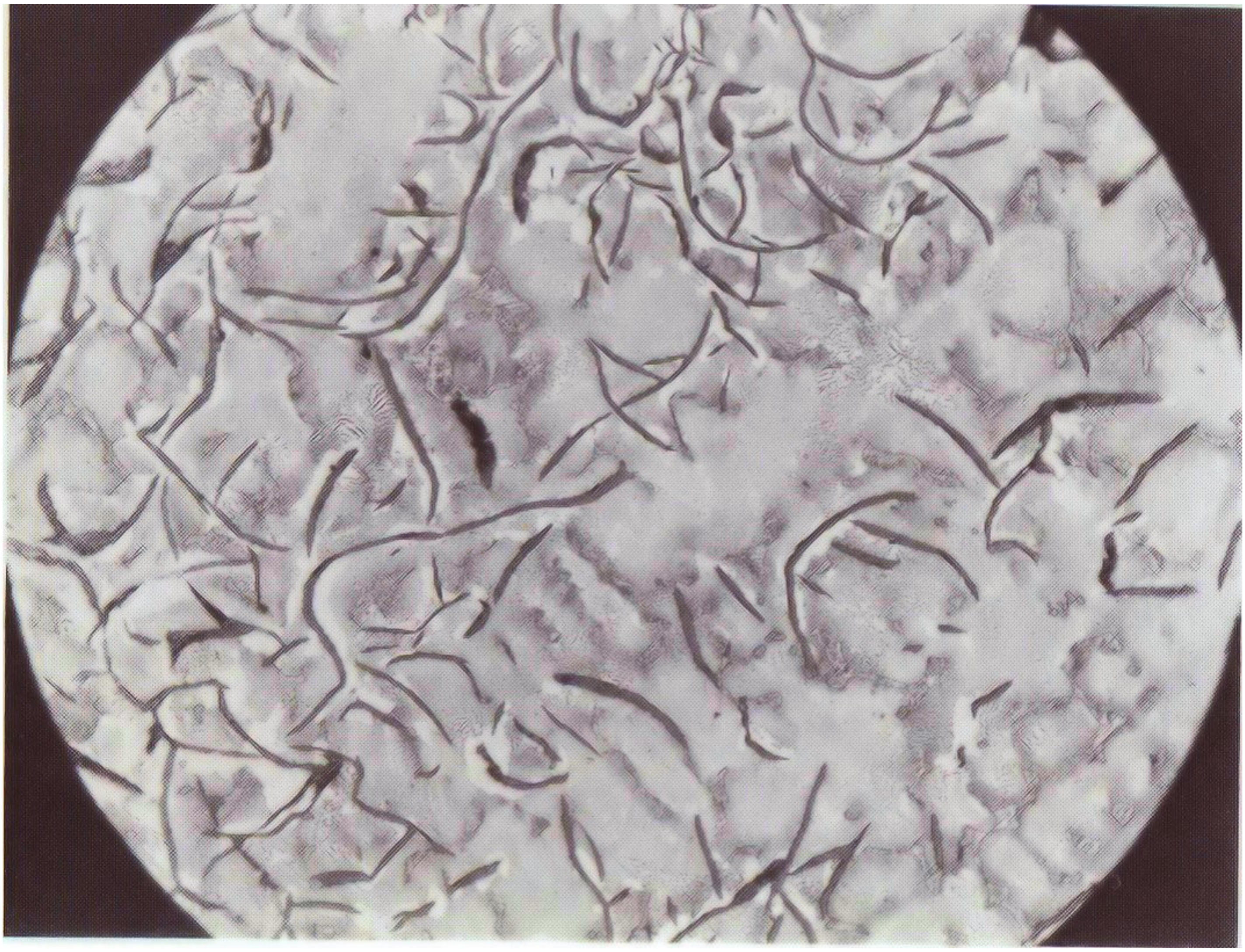
through a tuyere and by the addition of iron oxide in the form of slag, hammer scale or rich ore. As more and more carbon is removed the melting point of the mass increases and it can be removed from the hearth as a lump (loop) and consolidated under a hammer.

The conditions to produce white iron are a low silica content in the metal and/or rapid cooling on casting. Grey iron is formed when the silicon content is higher – typically above 1.5%, and/or solidification on casting from the furnace is slow. On fining, it melts completely at 1150 deg C as it is the product of a eutectic reaction where melting of the solid goes directly to a liquid rather than via a two phase region of solid plus liquid as non-eutectic compositions do. Melting direct to a liquid prevents the manipulation of a mushy mass beneath the tuyere. In addition, the silicon burns off before the carbon as it has a greater affinity for oxygen which increases the time to refine the metal and requires more fuel – partly compensated by the burning off of the silicon which also provides heat.

Williams explains all these reactions clearly and the importance of silicon and other elements affecting the position of the eutectic point using the concept of 'Carbon Equivalent' defined as CE% = (C + Si/3 + P/3). Ideally, a metal for fining should have a CE of 3% in contrast to a grey iron which has 4.3% C, constrained to its eutectic point.

Normally, iron from charcoal fired furnaces is low in silicon and hence favours the production of white iron. In contrast, iron from coke fired furnaces is high in silicon and thus favours the formation of grey iron.

Williams' describes the two hearth process of the Walloon forge and its evolution into a single hearth process to save charcoal. Also, how the large sows, known as 'gueuse' on the Continent, and weighing as much as a ton, were re-



Grey iron. Random graphite flakes in a matrix of pearlite Micrograph x66

placed over time by smaller pigs easier to manipulate. He describes various methods of fining with charcoal including the fining to steel containing some carbon, rather than wrought iron of minimal carbon content. Fining to steel was more common on the Continent than in UK where cementation to return carbon to wrought iron, became the preferred method. He describes the Lancashire hearth, developed in South Wales and largely used in Sweden, as the ultimate charcoal refining method because of its enclosed nature improving thermal efficiency.

With the advent of coal as a cheaper fuel than charcoal for fining he addresses some of the methods of preparing grey iron prior to refining such as potting and stamping.

Variants of the puddling process were developed by a number of workers, first using a silica lined hearth (dry puddling) but better results were achieved by assisting oxidation by using an iron bottom lined with a refractory layer rich in iron oxide such as the tap slag drawn off during puddling mixed with old furnace bottoms. This was the eventual basis of Cort's method and was known as wet puddling. Following the oxidation of silicon from the iron, oxidation of the carbon started, the resulting CO agitating the slag assisting the migration of phosphorus from the iron into the FeO rich slag. The evolved CO bubbled to the surface where it burn off as 'blue candles' as it reached the air. This was termed the 'carbon boil' and enabled grey irons to be puddled directly without pre-treatment.

Cort's puddling process required considerable skill in preparing the hearth and manipulating the iron and first became successful in 1791. Here, a key point was the use of a reverberatory furnace in which the coal burns in a separate chamber to the iron being refined thus preventing sulphur from the coal contaminating the puddled iron which would result in brittleness at temperature (hot short).

The final four pages address the removal of phosphorus when fining iron, an element that causes embrittlement when worked cold, known as cold short. Low phosphorus iron was necessary to produce a ductile iron able to resist impact and was in much demand by the navy for anchors and chains. Charcoal hearths could only remove part of the phosphorus by using strongly oxidising conditions – placing the pig directly in front of the tuyere, but could not reach the low levels required for chains, instead producing a hard iron destined for such applications as nails. Neither could Potting and stamping or other pre-treatments remove sufficient phosphorus to make wrought iron resistant to impact.

European ores are generally high in phosphorus, except Swedish Dannemora ore, hence, expensive low phosphorus Swedish Oregrund bar iron was imported in large quantities to make chains and anchors. But Cort's puddling process removed phosphorus so effectively that it could match the Swedish Oregrund iron. Unlike the 'modern' process of using a basic slag to remove phosphorus, developed by Sydney Thomas in 1877 by the replacement of the silica lining of Bessemer converter with a basic (alkaline) lining of ground limestone and magnesia mixed with pitch, it was the relatively low temperature of puddling and the FeO rich slag that enabled the removal of phosphorus. Indeed, the advent of puddling caused demand for Swedish Oregrund iron to drop dramatically.

(Copies of *Historical Metallurgy* No 53 Part 2 2019 are available for £20 from Jonathan Prus (jonathan@avens.co.uk)

TIP – If you wish to identify if a piece of cast iron is white or grey without breaking it, see if it 'rings' when hit. White iron will, grey will give a dull note.

A Fireback with a Tudor Artillery Connection

(Fig 1) This fireback is in a house near Rolvenden in Kent. It is undated, and while the initials 'ER' in all probability refer to either King Edward VI or his sister, Queen Elizabeth, there is no clue as to who was represented by the initials IC, which are likely to be of the founder or the person for whom the fireback was cast. The crowned rose within a Garter (Fig 2)that was impressed into the sand mould three times to decorate the fireback, however, bears a striking resemblance to the badges that adorned early bronze, and some iron, naval guns. Notable examples are those recovered from the wreck of the Mary Rose which sank so dramatically off Portsmouth in 1545. An example is shown here (Fig 3).

Curious as to whether the identical Rose and Crown badge had appeared on a piece of ordnance, the writer visited the collections at the Tower of London and at Fort Nelson, near Fareham, to compare the dimensions and design of the badge on the fireback with those on some Tudor artillery pieces. Having a son who works at the National Army Museum in Chelsea, it was possible to obtain details of a gun in its collection too. What was immediately apparent were two things: firstly the badges on the eight guns examined were all different though nevertheless of similar design; and secondly, the type of gun with the size of badges that most closely matched the badge on the fireback was the saker. These are medium calibre weapons that fired a shot weighing around five pounds. My assumption is that the badge on the fireback was a re-use of a pattern or model that had originally been made to decorate a gun. Evidently gun founders used a different pattern for each of the guns they made.

The French founder, Peter Baude, the Arcanus family from Cesena in Italy, and the Owen and Mayo brothers from England all made bronze guns for the navy in the Tudor period. Because the badges on the guns are unique, the chances of finding a gun with the identical rose and crown are remote but, were it to happen, it would establish a link between the founder of that gun and the iron industry in the Weald.

Fig 1 Iron fireback from Rolvenden with Rose and Crown

In a paper in the *Sussex Archaeological Collections* (vol. 125, 1987, 'A Cast-iron Cannon of the 1540s), the late Brian Awty argued convincingly that an iron cannon preserved at Prideaux Place, near Padstow in Cornwall, had been made at a Wealden furnace by a member of the Arcanus family of bronze founders. Is the appearance of a Rose and Crown badge, characteristic of those found on Tudor bronze guns further evidence of a possible link between bronze cannon founders and Wealden ironworks?

Jeremy Hodgkinson

www.hodgers.com/firebacks

Fig 2 The Rose and Crown badge on the fireback

Fig 3 Rose and Crown badge on a saker made by the Owen Brothers, 1538 (in the National Army Museum)

Big holes, little holes and spoil

In the Weald there are shaft pits and open-cast quarries that were used to mine iron ore. Shaft pits (little holes) are usually considered to be medieval or post- medieval and the open -cast quarries (big holes) to be Romano-British, in particular from the period of maximum production between 70 AD and 250 AD.

Shaft pits did not give rise to spoil left above ground as they were backfilled, to varying degrees of perfection, with spoil from an adjacent pit. Open-cast quarries have observed depths of 5 to 10 metres, say an average of 7.5 metres, and at the time of use would have been deeper. However, iron ore in the Weald occurs in thin bands and in a typical pit only a depth of between 30cm and 50cm would have been iron ore, see the chapter by Worssam in Cleere and Crossley. Hence after removing the iron ore, taken as being 50cm in depth, each square metre of a typical quarry would have yielded 7.0 cubic metres of spoil. Where has this material gone? It is often suggested that spoil was removed for marling. This is possible but raises questions. Was marling widely practised in the Romano-British era in the Weald? Did the Wealden landscape at that time have a sufficient area of arable fields easily accessible from the quarries?

The uncertainty concerning the removal of spoil requires consideration of whether spoil was dumped near to the quarries. Slag and other debris were dumped in gills and other areas downhill of bloomeries and spoil could have been treated similarly. Would spoil dumped in this way be recognisable some 1800 years later after gravity and rainfall had acted on it? Some quarries are found in flattish areas and downslope dumping would not have been feasible. In these locations spoil could have spread across nearby flat areas. As spreading would have involved carts and barrows and shovelling or tipping the spoil heap would not have been high but would have required an extensive area. For example, a quarry 50m by 30m by 7.0m would produce 10,500cu.m of spoil which if evenly spread 50cm deep would cover an area of 2.1 hectares. Would an area of spoil of this extent be recognisable today, especially if it were in woodland?

If spoil dumping were widely practised the miners would have had to locate the dumps carefully so they did not cover areas that they would want to mine in future. Little holes alongside big holes may have played a role in defining limits of the areas in which spoil could be dumped.

Big holes, little holes and spoil present a dilemma. We know that marling occurred in the Weald until the 19th century and for this period the documentary and archaeological evidence is that iron ore was obtained from little holes that were backfilled. The marl must have been obtained from different pits than those dug for iron ore. The big holes of the Romano-British period and the absence of obvious spoil heaps require explanation. Removal of material for marling is a possible explanation. Another explanation is that spoil heaps have not been recognised in the field because they were initially low and unobtrusive and have subsequently been degraded. The familiar conical spoil heaps found in association with 19th and 20th century mines are the creations of powered equipment not of men and horses with carts and shovels.

Bob Turgoose

Newsletter Editor's hobbyhorse: Marling

Effective marling, a key to the agricultural revolution in Britain, means adding material rich in calcium carbonate to acid soils. The practice *was* known in Roman Britain: Pliny refers to it specifically as a practice in Britain He refers to marl as a white and unctuous soil that was applied to the fields: unctuous can only mean clayey. Calcium Carbonate is white.

However, there is a paradox. Almost no marl occurs in the weald, but, oddly, some tenant farmers' leases obliged them to dig and apply marl in places where none occurred.

The most probable explanation of these leases is the abysmal ignorance of some absentee landlords. The leases may provide a partial explanation of the missing spoil around *some* orepits. Although spreading burnt lime is chemically equivalent to marling, it is the clay that has gone missing.

Big holes, little holes and little holes next to big holes.

A fundamental problem with the archaeology of holes is that, by definition, most of the evidence has been removed. I wish to discuss one aspect of the archaeology of Wealden ore-pits that presents tricky but interesting problems. Dating holes is virtually impossible. The nearest, usually, that one can get is to say that the hole must be older than the oldest tree growing in its bottom. This is rarely of any use in the Weald for two reasons: first, the Weald was largely clear-felled in the early 20th. Century – WW1 etc. Second, the dominant tree species rarely live long enough to date a hole to within the iron-making periods. The only exception of which I am aware is extra-large girth stools of hornbeam coppice. These are rare.

A common opinion about ore-pits in the Weald is that the larger "open cast" quarry type pits belong to the Romano-British period whilst smaller shaft types are either mediaeval or early-modern. This is reasonable. Vast swarms of small shafts are associated with some blast furnaces and some Romano-British sites are associated with large open pits. The best studied shaft workings in the Weald (those at Sharpthorne) are securely dated to the high mediaeval period. However, we need to examine the contexts to make sense of this.

Before considering the issues of context, please allow me some *a priori* reasoning about ore mining in the Weald. I

A small pit on the upper edge of a large pit at Beauport Park

Very large ore-pit close to Warbleton Priory Blast Furnace

believe that miners would take the most visible ore outcrop with the thickest seams before seeking out deeply buried seams that do not outcrop. Secondly, I would guess that drainage was a major issue. A big hole on a shallow slope will drain naturally: most of the big ore pits have a point of egress for water at their lowest points. My conjecture is this: iron age and Romano-British ore miners would have chosen the most obvious ore in the most convenient places and that big, well drained, holes are more strongly associated with earlier working.

Context(s)

First, the sideritic clay ironstone that was the basic feedstock of the Wealden iron industries often occurs in clay that is pretty impervious to water. The rainfall in the area is, typically, just over 600 mm. per year. Thus, a big pit taking some years to dig out *must* have natural drainage. Otherwise it becomes a pond. A shaft can, however, be dug and back-filled in a fortnight. Given luck with the weather one could mine all summer and lose little to the rain.

Second, the ore does not occur in continuous strata and the strata that exist do not always occur in the same order. The implication of the picture from the Fuller *mss*. (Cleere and Crossley, 1995. P. 23) seems to be that the Wealden strata are in some sense a fixed series. This is false. The clay ironstones formed in lacustrine and estuarine environments where *similar* geological events were repeated many times in many places over several million years. There does not seem to have been any single event which resulted on ore formation across the whole of the relevant area. On the contrary, the evidence of the shapes of large iron ore workings suggests that the deposition of ore was localised to irregularly shaped patches.

Third, although the ore was deposited in a very flat environment, the later alpine orogeny crumpled the ore-bearing members so that there is a dip on almost all strata and flat bits are rare. This is less extreme in the Weald Clay areas to the east and to the west of the High Weald but still must have affected ore mining.

How to interpret a swarm of small shafts adjacent to a set of large open pits

A possible interpretation of many small pits next to a number of wider pits is that the former post-date the latter. This interpretation usually rests on the observation that big pits are often found with Romano-British bloomeries. However, the slope on the surface should be considered. Where the ground surface is relatively flat, drainage for big pits may have been impracticable, particularly where the dip of the strata runs in the opposite direction to the slope at the surface. Early miners may have decided that, however good the ore, it was harder to deepen the drainage than to start mining by shaft. Consider Holbean Wood, near Wadhurst as an example of a Romano-British site with mixed broad pits and many shafts. Consider the Great Iwood pit system (near Rushlake Green). This system is huge and probably fed the Warbleton Priory blast Furnace. Where the surface slopes, the pits are huge and connected by channels. Where the ground becomes level we find huge numbers of shaft pits.

How to interpret small pits surrounding large open pits

There are also systems of larger pits that have more isolated shaft pits around them. A good example is to be found at Beauport Park, Hastings, just south of the huge slag heaps. The shaft pits cannot reasonably be associated with any blast furnace, but do require interpretation. I would suggest that these are prospection pits, work that is carried out when a seam of ore is exhausted and the miners wish to know whether it is worth continuing a wide and deep pit in pursuit of ore that might (or might not) have petered out. Since there are large pits associated with blast furnaces (consider pits along Eatenden Lane, Mountfield) that have small pits near their edges we may infer that digging a prospection pit to relocate strata of ore was a method that spanned the ages.

Why shaft mining could never have been the method of first choice.

Although a shaft pit can be dug and backfilled in no more than a fortnight it is an inherently inefficient mining method. For many years no-one has seriously believed in the notion that the scars of shaft pits we observe are the top of "bell pits". It is just too dangerous to undercut clay down a shaft. One would have to leave, perhaps, 75% of the ore *in situ* to prevent cave-ins. *If* the ore is at a reasonable depth and *if* drainage can be arranged (two sides of the same coin!) open cast mining is preferable. If your object is prospection, then a shaft makes sense.

Jonathan Prus

WEBSITE NEWS

A new facility has been made available on the WIRG online database. It will now be possible to link to documents such as pdf, text and spreadsheet files relating to a site, where available, adding extra sources of information. Pdfs of the field notes compiled by WIRG members, mainly in the 1970s and 80s, are being added, and it is hoped that this facility will be extended to the People Database in due course.

Also recently added to the main website are brief accounts and photographs of Study Visits made by groups of WIRG members to sites of iron production outside the Weald. These include trips to the Pays de Bray and the Ardennes, as well as areas in Great Britain such as Furness, the Forest of Dean and South Wales.

Restoration work at North Park Furnace

Nearly 30 years ago a contractors' vehicle driving along the pond bay at North Park Furnace, near Fernhurst in the north-west corner of Sussex, caused the structure of the bay to begin to collapse. This necessitated emergency support in the form of timber braces to prevent the stone-work of the furnace's 18th century southern spillway from toppling over. In the intervening years repeated efforts have been made to raise the funds necessary for the re-pair of the structure of the bay and the stonework. This has largely fallen on the shoulders of Robin and Carla Barnes, the owners of the site, but has been supported by the Fernhurst Furnace Preservation Group and many local friends and agencies. Annual Open Weekends have been held in early September to raise funds and awareness of the project, and many WIRG members have visited. Exca-

Fig 1 North Park Furnace, Fernhurst; reconstruction work on the southern spillway

vations took place there in 1989 and 1990, and WIRG has twice visited Fernhurst for its AGM, in 1986 and 2007.

At last, the damaged pond bay and spillway are being re-paired (Fig 1), funded in part by Historic England and the Rural Payments Agency, and the opportunity is also being taken to alter the flow of water from the furnace pond so that it will run through the restored spillway instead of over the northern spillway that was built in the 20th cen-tury and which, during Winter storms, has resulted in huge volumes of water cascading over onto the remains of the furnace wheel-pits and gun-casting vault. Currently, water is being channelled past the remains in pipes (See Fig. on next page). North Park is one of the two best-preserved water-powered ironworking sites in the Weald (the other is Ashburnham Furnace), so it is particularly important that its remains are prevented from being damaged any further.

At the same time as the work is going on to restore the

Fig 2 North Park Furnace, Fernhurst; gun-casting pit brick and timber lining

bay and spillways, the opportunity is being taken to consoli-date the surviving remains of the wheel-pits. A regulated amount of water will be allowed to continue to flow through them to prevent the wooden floors from drying out. One feature that was not excavated to any extent during the work that was undertaken in 1989-90 was the gun-casting vault. Only four of them have been discovered at Wealden gun-casting furnaces: Pippingford, Maynards Gate, Scarlets and Batsford (there is also one at Rockley Furnace in Yorkshire). The best-preserved, at Pippingford, included intact lining, a lead pipe for pumping water out and a complete, adjustable casting table. At North Park, renewed excavation has shown, so far, that the pit is brick and timber lined and also has a lead drainage pipe (Fig 2). The furnace was probably used for gun-casting as late as the 1770s so the contents of the pit there are likely to be the most recent of all those discovered so far.

Jeremy Hodgkinson

www.fernhurstfurnace.co.uk/

A view of the surviving remains North Park (Fernhurst) Furnace, labelled.

WIRG at Fernhurst Open Day

WIRG members, Robin and Carla Barnes, open the Fernhurst (North Park) furnace site, on the western edge of Sussex, to visitors each year on the National Heritage Days in September.

A variety of country crafts, displays of musketry and fighting skills by the Sealed Knot, birds of prey flying and a sheep roast attract some 1000 visitors to the free event over the week end.

Tours of the furnace site, currently undergoing conservation work, a display by The Fernhurst Furnace Preservation Group and a display by WIRG, serve to provide the history of the furnace and the wider importance of the past ironmaking heritage throughout the Weald.

The furnace was one of the last to operate on the Weald, the latest documentary evidence being its sale in 1777.

Showing the slag!

The WIRG tent at the Fernhurst Open Day

The earliest evidence is dated 1614 with its building recorded in the Shulbrede Court Roll and tenanted by William Shotter. By 1762, John Butler had begun casting ordnance at the furnace, making it one of only 38 furnaces on the Weald capable of undertaking this difficult task, for which a gun pit had been constructed.

Conservation work has unearthed some important artifacts including a rectangular bear measuring approximately 113 x 62 x 18-14cm thick illustrating the large size of the hearth and its rectangular shape rather than the circular hearths indicated by the bears found at several other Wealden sites.

Parts of three firebacks were also found, showing alternative, possibly earlier, products were cast as well as part of a large pig of iron, the remains approximating to 67 x 10 x 3-

4cm thick with a convex bottom. This was probably cast at a later stage of the furnace's life when it was recognized that smaller pigs were easier to carry to the forge for refining rather than the traditional Walloon sows weighing up to a ton. In addition, the more rapid cooling of a smaller pig favours the formation of a white iron in which the carbon is combined with the iron as cementite (FeC_3) rather than grey iron which contains free carbon as graphite. The former is preferred for fining as it melts to a slushy mass as the carbon is removed which can then be consolidated under the hammer. In contrast, grey iron, which is required for castings because of its higher (but still low) ductility, is difficult to refine as it tends to completely melt in the forge and also requires a longer time and thus charcoal use to refine. Readers who find this aspect of iron making interesting will probably like to read the review of Richard Williams' recent paper on page 4 of this Newsletter.

WIRG plan to visit the site at the 2022 Summer Meeting in July which will include a talk by George Anelay of West Sussex Archaeology who conducted excavations of the site. The next Heritage Open Day will be in September 2022. Keep up to date and read about the history and progress of conservation by visiting http://www.fernhurstfurnace.co.uk

Tim Smith

THE WIRG BULLETIN - Your contributions are sought

One of the Wealden Iron Research Group's most important aims is the publication of research - there is no virtue in 'unearthing' something that was not known of before and not passing your knowledge on to others. WIRG has gained a reputation for sustained publication of its research. A search on the group's website will reveal the extensive contribution that its members have made over the 52 years since its first Bulletin was printed, 17 issues in its first series and 41 so far in its second.

Writing for the Bulletin is not the preserve of a few, despite there being some pretty regular contributors (OK, I'll put my hand up) but when I submitted my first piece back in 1978 I had no particular experience or training. I and some friends were interested in an iron site near where we lived. I read what was known about it in Straker's book, I enquired at the local library and was put in touch with WIRG in the person of the late Brian Herbert who gave me a copy of the group's field notes about the site. What I had read in Straker pointed to some sources that I thought could reveal more and I wanted to see them for myself. One thing led to another.

My point is that all you need is a bit of curiosity about something and a desire to find out more (when I used to ask my father something his stock answer was "Look it up!"). If there is something iron-related you are curious about - a place name, a site, a reference in a book, for example - but are not sure how to set about finding out, I, as Editor, will be happy to help. This year's Bulletin was not the thinnest there has ever been but it would be good to have some more articles in volume 42. The closing date is 30 April 2022.

Jeremy Hodgkinson