NEWSLETTER No.35 Spring 2002

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WINTER MEETING- 2nd February 2002

As usual the Winter meeting, held at Nutley Village Hall, was well attended. It was good to meet old friends and colleagues and to talk Wealden Iron to other interested folk.

Ann Callow has kindly written the following report of the talk which was the main feature of the afternoon:-

Paul Booth, of the Oxford Archaeological Unit, spoke about the excavation in 1998-9 of a Roman site at ~~White~~ West Hawk Farm, in Kingsnorth parish south of Ashford. This was a rescue dig prior to development for housing.

A preliminary investigation in 1996 had consisted of an extensive geophysical survey of the 20-hectare site. This showed the two roads meeting at a T-junction which is the focal area of a settlement with a large open space. The settlement extends some 400-500 metres mainly along the NW side of the Weald-Canterbury road. As a result of this survey the focal area was taken out of the development to be kept as an open space. The OAU excavation covered 6 hectares containing the area to the SW of the junction , which was then released for development, and the area north of the junction which was examined to see whether the road did continue northwards at this point. Interpretation of the results still continues, with a report due to be published in the second half of 2002.

White Hawk Farm lies at the junction of two Roman roads – one leading from Lympne to Maidstone and the other from the Weald to Canterbury. The site is fairly level and low-lying and not very well drained. It has been subjected to intensive agriculture and hence there is no stratigraphy. The topsoil was stripped and the top of the subsoil investigated. No surface material survived from the roads, which could only be defined by the ditches each side. This two-dimensional archaeology made the inter-relationships of the various linear features difficult to determine.

The site appears to date from early after the Roman Conquest, with nothing substantial pre-dating the Weald-Canterbury road. The main features found included a late 1st century temple, near the junction of the roads and, on the NW side of the road, several regular sized plots. Some of these contain structures characteristic of roadside buildings in small towns, built with their short axes facing the road.

Ironworking appears to have taken place in two areas, one adjacent to the temple. The area with the best evidence for iron production contained a Romano-British type building divided into two parts. The south-west end contained a row of smelting furnaces with evidence of smithing. Metal working remains enabled the identification of possibly two smithing hearths and the location of an anvil. There was a row of four furnaces which cover several phases of production, with at most two operating at the same time. It was unclear from the evidence whether these were within the building or just outside, although subsequent discussion suggested that they would not have been completely inside on safety grounds.

Extensive deposits containing slag were found, also evidence of large pots set into the ground, thought to be used for processing blooms. An iron billet 32cm long, of 75mm square section with tapered ends, was found within a circular building dating from the early 3rd century. The dating of use of the ironworking sites

is from the period 43-70AD, then again around 120-160AD, with a third period around 200AD. Domestic settlement of the site ceased in the middle of the 3rd century.

The excavation of the area north of the road junction failed to find any trace of the road from Lympne continuing towards Maidstone, but did reveal a cemetery bounded by a present-day hedge line and containing several burials and cremation urns. Artefacts included a copper alloy bracelet and beads made from jet and lignite.

This site appears to have been a major roadside settlement with varied functions regarding communications and agriculture. The connection with Wealden iron sites is unclear although the roads, leading from the Weald and from Lympne, hint at export of resources.

Ann Callow

UPDATE—THE WIRG WEB SITE

Jeremy Hodgkinson

I mentioned in my letter in last November's newsletter that Chris Broomfield was wishing to relinquish his role as Webmaster for the Group, and that we were seeking someone who would be willing to take it over. I am delighted to be able to report that Tony Singleton has stepped into the breach and has already stamped his mark on the site with a superficial redesign. The site is still accessible at the same address – www.wealdeniron.org.uk - but it is the committee's intention that the site should develop, so keep an eye on it from time to time as we hope there will be new features appearing in the near future. At present, among the pages are some interesting and relevant links to other iron-related web sites, details of the Group's annual programme, and the complete contents of the second series of the Group's annual Bulletin. The site has been very useful in making the Group known to a wider public, and we are keen to 'spread the word'.

MARGARET TEBBUTT

Margaret Tebbutt passed away on 20th December 2001 after an illness which had lasted for some months.

From the time that Margaret married Fred Tebbutt in the late '70s and moved to Sussex, she took a keen interest in the work of the Wealden Iron Research Group, of which he was then the chairman. This remained an important interest for the rest of her life.

At that time members were engaged in excavating an ancient ironworking site on Ashdown Forest. Margaret quickly became a valued digger and took a full part in this. Together with other members of the Group she spent many happy hours scraping away the accumulated debris of nearly two thousand years, to reveal the three iron smelting furnaces and their attendant forging hearths. About this time, she also learned another valuable skill, which was how to draw discovered artifacts sufficiently well for publication.

Margaret was an enthusiastic field walker and attended the winter forays whenever she could; she always helped to make new recruits to the field group feel welcome. She also enjoyed meeting old friends and colleagues each year at WIRG AGMs and Winter Meetings.

Before our book The Iron Industry of the Weald was published, Margaret and Fred undertook much behind-the-scenes checking and rechecking on sites and grid references for the proposed gazetteer. In addition, she indexed some early issues of the Group's annual bulletin. For a time she also edited the newsletter and was a valued member of the Committee.

Meanwhile, a small group of members, headed by Roger Adams, was conducting iron smelting experiments in the wood next to the Pheasantry, where Margaret and Fred lived. The iron smelters have happy memories of her visits to the site, often bringing cakes and tea and lending a hand with the various tasks. This happened again quite recently when experiments were re-started at Pippingford - I understand that when the site was being refurbished last year, she painted the roof covering!

After Fred passed away, Margaret's archaeological activity took an additional direction; she was asked by Fiona Marsden, the then curator of Barbican House Museum, to help in the identification of artefacts that were brought into the museum. She much enjoyed this work and continued to do it for some years, getting to know some of the metal detectorists who brought things to her and always writing a short report on what she had seen. I know that she much appreciated the help that Fiona gave to her and enjoyed the opportunity to learn about so many varied relics from the past.

As members will realize, in the years since the book was published, the Group has continued to collect information. It became second nature to keep a look out for chance finds of iron slag and one day, whilst walking on Ashdown Forest, we noticed a small piece of slag on the footpath. However, we were unable to penetrate the dense gorse and heather cover for further searches. Two or three years later, Margaret heard

through her contacts with the Ashdown Forest Centre that there had been a fire on that area. We quickly searched and were able to discover further evidence. This site was subsequently excavated by the Group and proved to be one of the earliest so far found.

The Ashdown Forest Rangers were very helpful in reporting to Margaret any slag that they noticed in the course of their work on the Forest. As a result a number of further possible sites were discovered on an area which had previously been thought to be devoid of ironworks.

Her expert knowledge of the Forest was put to use when the Ashdown Study Group was formed. This was an attempt to link features on the Forest with documentary evidence. Margaret played a two-fold role here, joining in the field work and also helping to identify places which were mentioned in the medieval accounts.

All of us who worked with Margaret will remember her as a good friend and a kind, intelligent and knowledgeable colleague. We shall greatly miss her.

Dot Meades

EXPERIMENTAL IRONSMELTING

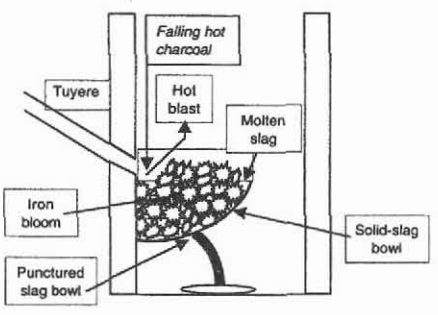
Due to the F & M outbreak in 2001, the smelting team decided to keep clear of Ashdown Forest until Sussex was "opened" again, thus only two smelts took place. A number of people from Jeremy Hodgkinson's evening class attended the smelt on October 14th and were invited to help with this labour- intensive pastime, some even volunteering to operate the bellows!

Although we can produce a bloom to order now, the tap slag produced is subtly different from that seen on Roman sites (see following comments by Gill Gibbs); the top surface of our slag is not so shiny and there are many small air-bells within the volume, although which gas created them is so far unknown. All the usual parameters were recorded, top and bottom burden temperature, airflow rate, time at which the charges were added, and all other relevant events. When later studying the resulting graph, the time at which extra charges were added, proved to be on a remarkably straight line; this is assumed to be due to keeping the measured temperature of the furnace nearly constant by regulating the pumping of the bellows. This is, psychologically, a very difficult task for the two people operating the bellows. It seems that the natural instinct is to pump as hard as possible, and when asked to "slow down", there is only a temporary lull before reverting back to the original speed. Nevertheless, the resulting bloom weighed in at an impressive 2Kg (4lb 7oz) from 20Kg of ore, an efficiency of 10%; no smithing was attempted, as it was getting too dark.

The 28th of December smelt, the fifteenth of the series, was even more successful with a 2.91Kg (6lb 6oz) bloom, from 20Kg of ore, an efficiency of 14.5%; but this was more by luck than judgment, as explained below. The object of this smelt was to measure the bloom's temperature, and then adjust the airflow to keep it constant at about 1150°C.

The group now owns a "disappearing filament" pyrometer; an instrument used to visually measure temperature by viewing a hot surface through its built-in telescope. Superimposed over this hot surface is a small filament lamp, whose brightness can be adjusted. By adjusting the brightness of this lamp to match the hot surface, the actual temperature may then be read out from a meter on the pyrometer. However, due to a misreading, we encouraged the pumpers to keep blowing hard, although we eventually saw the error of our ways. To add to this disaster, we discovered that it was not possible to measure the bloom's temperature due to pieces of hot charcoal passing across the bloom and obscuring the view; this happened each time a bellows started pumping.

An impressive event was the second slag tapping. Initially, on opening the slag-tapping arch, there was no sign of slag. However, on prodding the bottom of the bloom with a metal poker, a flow of liquid slag issued forth from the bloom, lasting some 2 minutes and weighing, (when cold of course) 2Kg.



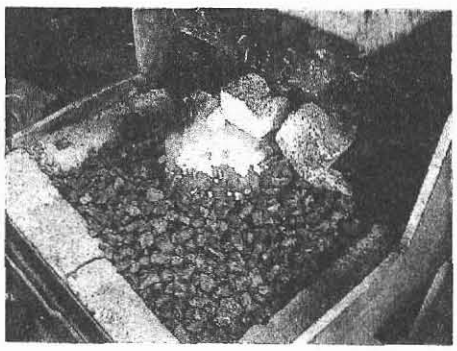
The diagram (not to scale) suggests what was happening during this second slag tapping.

When the very hot bloom was lifted out from the top of the furnace, it felt, through the tongs, exactly like a sponge, a term referred to in contemporary documents. The sponginess was also evident when it was squashed (consolidated) using a large wooden mallet, whereupon it reduced to half its height. This was as far as we took the smithing as, once again, it became too dark to see; also, it was still Christmas and there might be questions

asked in the house!

Attempts to forge part of the 15th bloom: On examination of the piece of bloom, it was noticed that it readily broke into two pieces. One piece was chosen for the first trials in February 2002.

The forging hearth used was rather small (330x230x100cm) (see photograph 1) and was fuelled with coke. It used a speed controlled electric fan and is quite capable of melting iron.
The fire was lit and quickly produced a good yellow heat. The chosen piece was placed on top of the pile of hot coke, as far away from the direct blast from the tuyere as possible, to minimize oxidation. Fresh coke was added on top, to surround the work for heating and protect it from easy access to oxygen. The work was brought to a sparking heat and quickly transferred to a wooden block. It was first pressed hard with another wooden block to try to compress it without hammering.



The hearth, fired up

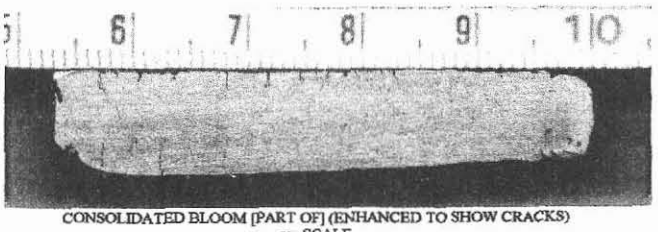
The piece of bloom was rather small, which caused it to lose heat quickly and it had to be returned to the hearth to be reheated to sparking temperature, before the next attempt. A hammering action between the two pieces of wood was used after initial consolidation, but even this careful tapping caused some small pieces to break away. The heat and consolidation work cycle continued, gradually introducing the use of a small hammer above a hard insulating board below, thermally insulating the workpiece from the anvil. It was decided that since the remaining piece was becoming 'bar' shaped, this form should be pursued.

By now the piece was looking and responding like proper iron, so it was finally finished between hammer and anvil, rotating it to 'square' the 'bar' over its length. A few blows were made on the end of the 'bar' in an effort to close some of the visible 'cracks' which ran across its length.

It was allowed to cool naturally and was filed on two sides so that the consolidation could be assessed and a simple grinding spark test seemed to suggest that it had a carbon content of around 0.5%.

Another attempt was made on the other piece of the 15th bloom, trying to get to a cube shape. This was not so successful and the attempt was abandoned after trying to recover the situation by applying borax as a flux (the temperature was too low to use silver sand).

An earlier attempt to forge the bloom using charcoal rather than coke had been abandoned for safety reasons as the charcoal proved too reactive producing a large quantity of sparks.



CONSOLIDATED BLOOM [PART OF] (ENHANCED TO SHOW CRACKS)
cm SCALE

Five observations:

1. *A forged rectangle of iron was successfully produced weighing 32g and measuring approximately 48x8x8mm. This contained some fine cracks at right angles to the long axis (see above photograph). Attempts to forge a cube from the bloom were less successful. A cube weighing 28g and measuring 18x14x15mm was produced but this contained large fissures within it. This observation ties in with the descriptions of techniques used by early smiths where the bloom was 'drawn' under the hammer to form a bar. If heavier sections were required, the bar was cut and sections piled together to be reheated and further forged under the hammer.*
2. *The size of the piece of bloom that had been tried so far was rather small which meant that it lost heat very quickly. This may not have allowed enough time for consolidation to take place before the 'critical' temperature to expel the slag and weld the iron, was lost.*
3. *The 'cracks'/'fissures' in the bloom were randomly distributed i.e. sometimes at right angles to each other. Applying a force (squeezed or hammered) in one direction at a time tended to cause the bloom to break up in the other, hence reducing the useful mass to a lot of small unusable pieces. This suggests that a useful consolidation force should be applied in all directions at once, i.e. drive the piece into a thermally insulated hollow cone shaped die.*
4. *Could it be that if the bloom was maintained at sparking heat while being consolidated it would not break up?*
5. *Are some of the 'cracks'/'fissures' already oxidised, which would cause resistance to consolidation?*

Brian Herbert, John Baillie & Tim Smith

ANALYSIS OF EXPERIMENTAL SLAGS AND IRON

Following the production of a successful iron bloom in October 2000 by the WIRG smelting team, a sample of the forged bloom (approximately 25mm cube) and some slag tapped from the furnace, were sent to the University of Surrey at Guildford for examination by scanning electron microscopy. The electron beam microscope enables us to see very fine detail on the surface of a specimen that cannot be seen by naked eye. It can provide a much higher magnification than an optical microscope and, if equipped with an X-ray detector, can also be used to identify the elements present in the specimen. This technique allows us to perform a chemical analysis of the features seen and to identify the mineral slag inclusions. It was hoped that these results would help confirm the working temperature of the furnace. Also, imaging the microstructures within the bloom enables an estimate of the carbon content of the iron from the amount of iron carbide present.

In order to examine the specimens and obtain an accurate chemical analysis, a flat polished surface was essential and therefore some preparation was necessary. Both the iron and tap slag samples were encased in thermo-plastic for ease of handling and the surface vacuum impregnated with resin to prevent fragments breaking off during preparation (which can otherwise damage the polishing equipment). The samples were ground flat and finally polished with diamond paste to a mirror finish. The iron was etched with a 3% solution of nitric acid in alcohol (nital) to enhance specific microstructure detail.

Figure 1 is an electron micrograph showing a typical slag inclusion in the bloom with microstructures showing the following mineral constituents identified from the chemical analysis:- White - Wustite (approx. FeO); light grey lathes Fayalite ($2FeO.SiO_2$); darker grey areas – Anorthite (glassy) ($CaO.Al_2O_3.2SiO_2$) Black (porosity & charcoal). The scale bar length is 0.1mm.

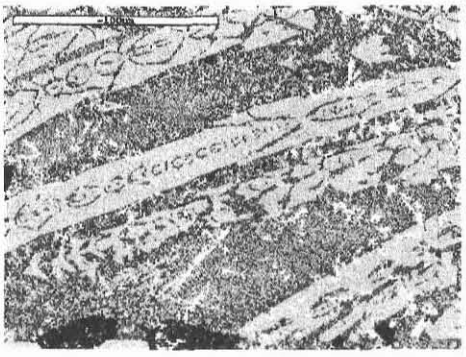


Fig.1

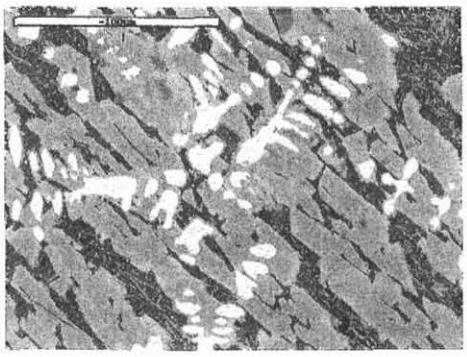


Fig2

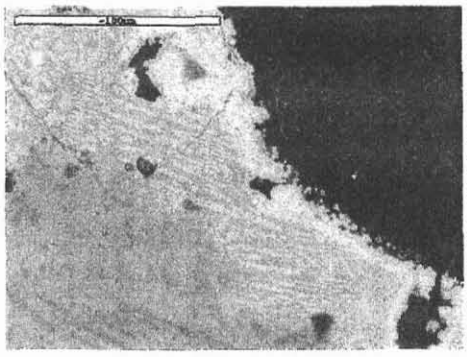


Fig 3

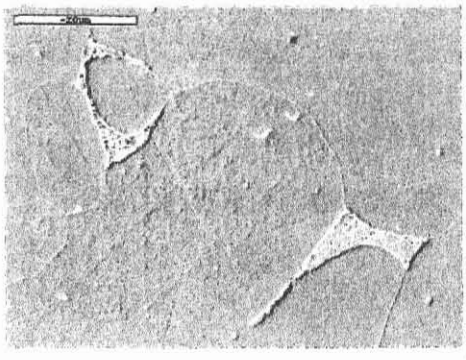


Fig 4

Bloomery slags have been studied extensively and reported in the literature. Identifying the minerals wustite, anorthite and fayalite, and their distribution, together with the relative amounts, should enable us to determine the melting temperature of the slag. However, by using previously published temperature versus composition graphs, known as ternary phase diagrams, this has proved difficult as these minerals rarely occur in the pure form. The quantitative chemical analysis results cannot be fitted exactly to the ternary diagram and this is a problem we need to investigate further.

Figure 2 illustrates a sample of historic tap slag from Tudely in Kent, (a site not yet dated) photographed at the same magnification as Figure 1, for comparison. The same minerals are present but the wustite (white) has amassed into larger areas, indicating a different cooling regime. A statistical analysis over a number of different regions shows there is almost twice as much wustite (white areas) in the Tudely slag as in the experimental slag, the respective proportions being 6.9% and 4.2%. However, the comparison here is between tap slag in the case of Tudely and slag trapped within the bloom in the case of the experimental material.

Figure 2 Historical tap slag from Tudely in Kent at same magnification as Fig 1

Figure 3 shows the fayalite areas located around the edges in the silica tap slag collected during the experimental smelt at the same degree of magnification as figures 1 and 2. The fayalite lathes are much finer than in

the bloom slag. No wustite was detected in this slag.

All these features are typical microstructures also found in Roman iron and slag but the relative proportions are somewhat different – samples of ancient tap slag showing a much higher proportion of wustite. From these results we can conclude that the smelting team is having success in producing iron but are not yet producing tap slag typical of that found on Roman bloomery furnace site.

The micrograph in **figure 4** shows regions of iron carbide as 'pearlite' in the bloom. (*pearlite* is an intimate mixture of iron carbide and almost pure iron in a layered structure – it was named by early metallographers because of its similarity in appearance under the optical microscope to 'Mother of Pearl'). These are the two lighter regions around the edges of iron grains (ie crystals – the boundaries are the thin lines running between the areas of pearlite). The proportion of pearlite present provides a guide to the total carbon content of the iron. The iron will contain 100% pearlite when the carbon content is 0.8%, and no pearlite if it is free of carbon. Thus, a sample containing, say, 0.4%C would be 50% pearlite and 50% pure iron (ferrite). By examining several areas of the sample, we can estimate the average amount of pearlite present to be about 12% and so the carbon content of the bloom is calculated to be approximately 0.1 wt%.

Of course it must be remembered that only a small sample of the bloom has been examined here. The blooms are very inhomogeneous and hence the microstructures could be very different in specimen taken from elsewhere.

Finally, the team have continued to produce more iron and slag that will also be analysed on the electron microscope. In my first year of membership of WIRG. I have enjoyed learning about iron and slag production and I hope to update the team regularly with results. Maybe this will give them an insight into the smelting procedures that they may need to adopt to reach their objective of producing a slag similar to that found in the field. ***Gill Gibbs University of Surrey 2001***

Account of Radio Science Unit production: "Unearthing Mysteries 4"

Two WIRG members requested a report on this programme, which was broadcast on 20/11/01. This is a précis of the transcript with comments at the end by Brian Herbert.

The program was presented by Aubrey Manning, with contributions from :-

Richard Lowe, production manager for Wilkinson Sword; **Paul Craddock**, head of metals research at the British Museum; **Gerry McDonnell & Ivan Mack**, Bradford University; **Dave Killick**, associate professor of anthropology at the University of Arizona.

The program was initially concerned with the Wilkinson Sword factory in London, the only sword maker in Britain, where they still make up to 2000 swords a year, mostly for ceremonial and fencing purposes. They are made from a special Sheffield Steel containing 1% carbon (to within 0.01%) and also other minor elements. A sword starts its life as a heated steel rod that is passed between a pair of, hand operated, shaped rollers, this a squeezing process repeated several times. Finally, a grindstone is used to remove the flashing and then shaped for its required purpose. At a later stage the cutting-edge-to-be is heat-treated to harden the surface so that, even after sharpening, the edge will not be damaged during use (in the past, the owner would sharpen his own sword). The bulk of the sword material is not heat-treated thereby keeping it tough and flexible.

The program went on to consider how steel might have been made in the past. It would seem that steel[1] has been known from the earliest times [2]. Another method was to heat low-carbon iron in conjunction with a carbonaceous material, the carbon chemically permeating the wrought iron for a few tenths of a millimetre[3]. This process would be practical providing the workpiece (sword say) was not sharpened too many times[4].

It was not until the 1740s that Benjamin Huntsman, a clock maker from Doncaster who moved to Sheffield, worked out another method of making steel suitable for reliable springs for his clocks. Basically, the problem was the variable carbon content of the steel of that time, with its inherent slag, that caused the springs to fail. He argued that if he could melt the case hardened steel that he was using, the slag would rise to the top and could then be skimmed off, whilst the underlying "wrought iron" with its "case hardened" steel surface, would homogenize when the mass became liquid. This process was carried out in a sealed container, called a crucible, to retain the original average carbon content[5]. Due to the high temperature necessary for this process, around 1600C°, most crucible materials would have disintegrated; his initial choice were crucibles made of graphite, as used by gold-workers[6]. He was eventually successful and made a consistent steel containing 1 to 1.5% of carbon suitable for making reliable springs for his clocks and, surprisingly, the steel was also found useful, and cheap enough, for knife blades [7].

At this point, the discussion moved to the excavation of the 8th & 9th Century Saxon town of Hamwic, near Southampton, where steel-edged tools have been found in and around a large blacksmithing area. Here, it is argued, they were making steel by removing some of the carbon from cast iron, which perhaps contained 3 to 4% carbon; this process was some 900 years ahead of Sheffield steel [8]. By starting with a cast iron, with its low melting temperature easily accomplished with bellows and a charcoal hearth, the excess carbon could be "burnt off" using an oxidising flame at the tuyere [Ref.9]. It was noted that no crucibles have been found at Hamwic. The only skill needed was knowing when to stop the process!

Analysis of some Hamwic blades, using small sections and viewing them through an optical microscope, has shown that there was a minimum amount of high quality steel used along the cutting edge, the remainder being a wrought iron.

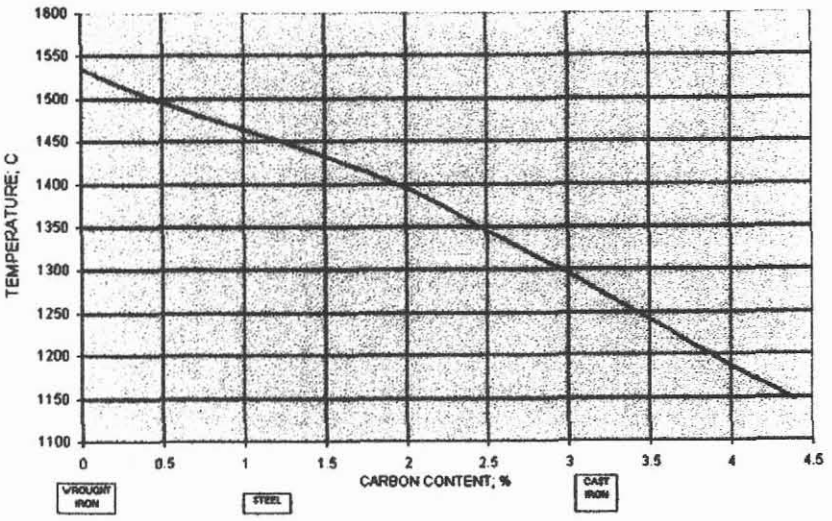
To counter the above argument, it was suggested that steel could be made in a bloomery furnace operating under the correct conditions. It was also suggested that the bloomery furnace was capable of operating under remarkably varied conditions to produce any desired iron, from wrought iron, to steel, to cast iron, and that it was possible to visually detect the difference between the different types of iron, straight from the furnace.

It was generally agreed that more evidence, on both sides, was necessary before the problem could be resolved.

1. *The WIRG experimental bloomery furnace is capable of producing a steel with about 0.5% carbon.*
2. *Iron with about 1% of carbon.*
3. *Leather or horn was used, and heating took many days, a process called "cementation"; the product was then called "case-hardened" or "blister" steel.*
4. *A Wealden cannon boring bar, found at "Stream Furnace" in Sussex, contained four steel cutting bits, each produced by welding together many shims of steel. If steel is heated to red heat and cooled quickly in water, say, it will become very hard but brittle: if now it is heated again to some 500C° and allowed to cool slowly, it then becomes tough.*
5. *A sealed container was necessary to stop sulphur from entering the iron from the coal used for long heating process.*
6. *Huntsman later developed a "fire clay" which was cheaper than graphite.*
7. *Because the steel that Huntsman put into his crucibles was a case hardened wrought iron, a very high temperature of 1600 C° was necessary to melt both types of iron, see graph below.*
8. *But where did their cast iron come from?*
9. *This is similar to the method used at the conversion forges in the Weald.] So, as the carbon was burnt off, so the viscosity of the molten iron increased, but was overcome by increasing its temperature, and so the iron was eventually converted into steel [but would still have contained a certain amount of slag.*

Brian Herbert

MELTING TEMPERATURE OF IRON VERSUS CARBON CONTENT



NB A number of speculative, not to say controversial ideas have apparently been put forward in this programme,, which are not necessarily backed up by archaeological evidence. However, these could be the basis for an interesting discussion. Comments welcome for the next newsletter. Dot Meades

REVIEWS

N. Aldridge, 'Little Farningham Farm, Cranbrook, revisited', *Archaeologia Cantiana*, 121 (2001), 135-156.

The *Classis Britannica* site at Little Farningham Farm suffered the fate of many sites in the Weald. Investigated by interested amateurs, but only to a limited extent, scheduled to protect it from further intrusion, it is a site with enormous potential, which remains tantalis-

ingly enigmatic. The dig which the late Cecily Lebon conducted in the 1950s revealed enough to suggest that there was at least one substantial building, that there was *Classis Britannica* involvement, evidenced by the finding of several stamped tiles, and that the main purpose of the site was concerned with iron production. The stop that was put on the work then has meant that the site has remained fenced off and liable to root damage from the trees that have subsequently grown over it.

Neil Aldridge's account reviews Miss Lebon's work in the light of more up to date work at other sites, as well as the under-investigated Roman site at Bodiam (also connected with the *Classis Britannica*), and adds some recent excavation of a trench beyond the present scheduled area. Following a resistivity survey, which does not appear in this paper, the new trench dug in 2000 confirmed a suspected realignment of the Hastings-Rochester Roman road, slightly further west than had been postulated by Margary; it hinted at the existence of the foundations of a timber building, and revealed four smelting hearths. Evidence of actual smelting had been absent from the earlier excavation, although slag had been found.

In a discussion of the finds from the latest excavation, the author draws attention to the pottery fabrics found, particularly the grog-tempered Patchgrove ware, which bears many common features with East Sussex ware, found on many sites that WIRG has investigated. That the two are possibly one and the same, with a continuity of use in the Weald that extends from the late Iron Age and into the Roman period, is commented on, with the suggestion that they should both be referred to as East Sussex ware.

Neil Aldridge's paper is useful in that it draws attention to a neglected site, and reveals a few more tantalising features. The resistivity survey, which would have been helpful were it included, could only have indicated a limited amount. From the standpoint of research into the iron industry, a magnetometer survey would probably reveal more. ***JSH***

Gunfounding in the Weald *Jeremy S Hodgkinson, Journal of the Ordnance Society 12 (2000)*

The main content of this article is a short but comprehensive account of the history of gunfounding in the Weald of Kent, Sussex and Surrey. It concludes with a brief description of the furnaces and gun boring. The author, using a wide variety of sources from Public Record Offices together with published literature has linked together a brief account of their contents. The result is an excellent account of the build up of the Wealden industry, the type of ordnance made at various furnaces, dates of operation, names of gunfounders and how fluctuation of demand affected the industry.

Also included is a small map showing furnace locations and a list of 40 furnace names, their National Grid references and the associated gunfounders.

The dearth of contemporary descriptions of furnaces and gun boring is an ongoing problem with this aspect of gunfounding in the Weald. The author has rightly made good use of excavation results of various sites plus some contemporary data to describe the furnaces and gun boring techniques. Many aspects of the latter, as used in the Weald, have of necessity to be speculative.

A comprehensive list of notes and references is included at the end of the article.

David Butler

FORAY NEWS

October 2001—Park Wood near Etchingham

I was contacted by Mike Tebbett, the tenant of Park Wood, following a visit to the wood by Martin Brown, the Assistant County Archaeologist for East Sussex. They had come across a small quantity of bloomery slag, and Mike had suggested I come and see. The small quantity they had found turned out to be a fairly dense scatter along about 70 yards of the east bank of a northerly-flowing gill in the wood, which on later examination was also found to extend to a small part of the west bank as well. The Field Group booked it in as its first foray of the 2001-2 season, and duly dug a trial trench into the slag heap. After a lot of effort, what appeared to be two sherds of pottery were found, although somewhat disconcertingly close to the surface. These were passed to David Rudling, of the UCL Field Unit, at Ditchling, who pronounced one of them as early-modern, and the other as not pottery at all. So, a disappointing start to the season, especially as some effort had been made during the foray to collect samples of slag, furnace lining and ore, for analysis, should the pottery have turned out to be Romano-British; such sampling being required for the analysis to be undertaken by Irene Schrüfer-Kolb at Leicester as part of her Tebbutt Fund-supported project. I daresay the Field Group will want to try again with this site next season.

JSH

November 2001—Heathfield Study Area

We started at Bodell's Farm east of Heathfield, and progressed down to the stream. The only significant find of the day was a small patch of bloomery slag at

about TQ58882265, but this remains to be confirmed as there seemed to be several tracks across the stream at this point. We progressed downstream on the Ashdown Sand, with a smear of Wadhurst Clay on the hilltops to either side where several pits are shown on the 2.5inch map, thus indicating a possible source of iron ore. However no more sites were found up to about TQ5923. ***BH***

December 2001-The field group returned in December to Stumbleholm Bloomery site in Ifield, Sussex, TQ23023706; Straker p458. A previous visit to the area found a great deal of forge cinder in the nearby fields, presumably from Ifield Forge, but could not pinpoint the bloomery site The source of ore in the weald clay peters out at this point and there are many mine pits to the north-east.

An exploratory trench was dug in the field at TQ23023706, on the edge of the highest slag density, according to the metal detector. Although a few pieces of slag and several nodules of roasted ore were found, no pottery was forthcoming. Eventually, having dug down to the subsoil at about 300mm, the metal detector was still active, whereupon it was noticed that this was due to roasted ore fines. It was decided that there may have been an ore-roasting site close by; but not where we were digging as the subsoil colouring showed that no heating had taken place. The trench was extended in two directions, without any further discoveries, save for the fact that the subsoil seemed to be covered with a very thin layer of charcoal fines. A plan of the site was made to enable it to be re-found should another visit be planned.

In the field to the south, where the source of ore would have reached the surface, many pieces of dark-brown ore with squared corners were found, not at all like the usual limonite weathering. This is similar to the geological "puddingstone" found locally which is called "chevick".

There is definitely a bloomery site here somewhere as several substantial pieces of tap slag have been found close by. Also, the field names Cinder Platt Mead, Little Cinder Platt & Great Cinder Platt would seem to indicate a bloomery site.

The site will probably be destroyed when a new road is built to enable the Horsham traffic to bypass Crawley.
BH

January 2002– Blackham
For the first foray of 2002 the Field Group returned to the area around Blackham where, when first visited in November and December 2000, three new bloomery sites were found and one investigated. Activity at that time was concentrated at Tollhurst Farm situated at the eastern end of a block of land lying just north of the East Grinstead to Tunbridge Wells Road. (A264) on a north-facing slope. The latest foray took place at the western end of the block, some 1250 metres from the previous sites, lying, strictly speaking, within the parish of Cowden.

The location chosen for the foray was a triangular shaped piece of land with its base, the southern end, being the A264; its sides two heavily wooded streams lying in gullies - the western, adjacent to the Hartfield Road, (B2026) and the eastern forming a field boundary some six-hundred metres away. The triangle, having an area of about one hundred acres, lay with its apex to the south of Hethe Place (47973972), the enclosed ground being divided roughly between woodland, (for the most part Cullinghurst Wood) and pasture, (part of Hethe Place Farm).

The main block of woodland, on average, some 300 metres in depth from north to south, was found to contain a considerable number of mine–pits of uncertain age and of varying depths and surface areas together with indications of trackways running generally north/ south through the wood. It was noticeable that the southern limit of the pits formed a line roughly parallel to the road and about 150 metres from it, corresponding to the boundary of the Ashdown Formation in that area as determined by The Geological Survey,

Whilst no evidence of ore processing or smelting was found within the main body of woodland, traces of bloomery slag were discovered at its edge, at a point (TQ48253950) on the stream system leading to the eastern-most gully. Some 70 metres north of this location along this gully (TQ48153953) a number of large pieces of slag were found partially buried in the stream bank and lying partly below the water level at the time. The cluster included one piece 40 cm x 47 cm x 22cm thick. Nearby, on the opposite bank, a piece of slag-like material, curved in plan and about 20 cm long, thought to be part of a furnace bottom, was discovered and removed for further examination. Similar pieces, perhaps from a separate source, were found a further 50 metres along the stream at TQ48003965.

A search of the western gully revealed two deposits of slag, again along the bed of the stream. The first at 47753960 (but with the possibility of it having been moved to that position by earth slip or land drainage works in the adjacent field) and the second at 47653935 at the confluence of the main and a subsidiary stream to

which point a man-made water course had, at sometime been constructed. ***Peter Goodall***

February 2002 This was a continuation of the November foray down stream to the mill at TQ58782440. Although increasing signs of bloomery slag were found when walking upstream at about TQ591232, a recent dam across the valley has resulted in the pond silting-up, the steep-sided valley in the Ashdown Sand no doubt accounting for this. Later, the landowner confirmed the existence of a bloomery site just above the dam and probably now submerged under the silt. It is hoped to revisit this area to see if it is possible to pin-point this site. A very small bloomery site was definitely found, some 8 feet up on the vertical west bank at TQ59132332. Very little was left of this site, due to erosion and it will probably not be possible to date it. The possible mine pits were found, on the east and west hilltops, as expected. There is documentary evidence of the pit at TQ595235 being used for extracting clay for brick making, and the position of the "updraft kiln" is still visible on the south-east corner. However, the pit may be too large to have been just used for brick making and is likely to have been a source of ore as well. Work by Molly Beswick shows, also, that another pit further north made tiles for a blast furnace.

It had been hoped to view, from a distance, Old Mill Blast Furnace, given as TQ588245, however, this site proved to be an unlikely situation because the working area was not low enough. It is thought that the correct map reference is at TQ58902442, a little further south and on an unmarked stream. It also seems likely that the map reference for Bungehurst Blast Furnace is wrong; TQ600244 further north seems more likely. It is proposed to have a foray to these two sites next season to sort out these anomalies.

WIRG would like to thank David Smith of "The Mount", Heathfield, for organizing these forays so well (despite not being a member). We hope he enjoyed the day as much as we did. BH

FORTHCOMING EVENTS

WIRG AGM 20th July 2002 At Rotherfield Village Hall. Details to follow

Historical Metallurgy AGM 11th May at Ironbridge. Subject: Structural Metalwork. Two day event with presentations on the Saturday and field trips on the Sunday. Contact Paul Bedford, Ironbridge Gorge Museum Trust (Tel 01942 432141).

HMS Annual Conference 2002 13-15 September (starting Friday evening) Details on page 12 of this newsletter.

West Virginia University Institute for the History of Technology 26-28 April 2002 Conference on the iron industry and tour of Buckeye and Vinto furnaces to be held at Athens, Ohio. Information from Lee Madox by phone (304) 293-3829, email:Lmaddex@wwu or by mail at the Institute for the History of Technology 1535 Mileground, Morgantown, WV 26505.

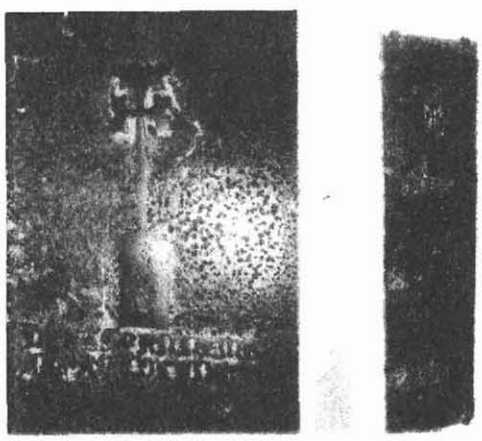
International seminar on the Conservation and restoration, care and technology of arms and armour. Organized by the Royal Armouries, Leeds and Malta Centre for Restoration, Malta, in collaboration with The Palace Armour, Valetta. Details from Robert Smith, Royal Armouries, Armouries Drive, Leeds, LS10 1LT. Tel 0113 2201920 email robert.smith@armouries.org.uk

CORRECTION to AN AGE OF CONCERN

(WIRG Autumn Newsletter 2001)

Many apologies to Dr Tim Smith. Tim sent me two versions of his article on grave slabs and I mistakenly reproduced the first instead of the amended and fuller second version. There was also confusion (mine) over the photographs. Tim has asked me to print the following corrections:

The illustration reproduced on page 5 of the Autumn Newsletter which refers to the Lombardic inscription on the iron grave slab in Burwash church in fact shows the grave slabs in Wadhurst church, referred to later in the article. The illustration of the Burwash grave slab is shown on below:



The text used was an incomplete version of the article and omits a further piece of evidence that the slab dates at around 1525. This is the use of the words of the inscription which translate from the Latin as 'Pray for the soul of ……, which is a common imploration on monumental brasses of the period 1440-1540.

A reference to the gazetteer of iron grave slabs com-

piled by Rosalind Willatts which was published in the WIRG Bulletin Second Series No 8 1988 should have been included. *DMM*

NEWS FROM ELSEWHERE

A Sword in a Stone
We're all familiar with the story of King Arthur but, alas, his sword was conveniently returned to the lake, so no metallographic investigations can be made.

HMS Newsletter Winter 2002/2, however, has a report from Italy, where "a series of scientific investigations are being made into the sword of St Galgano, an apparently genuine 12th century sword allegedly thrust into the rock when the saint abandoned his life of war and violence to become a hermit." Apparently the hilt of the blade had been broken and replaced in 1960 and there was also some concrete capping... "this was removed so that the broken hilt of the sword could be released and about one inch of the embedded blade revealed, protruding from the stone." Samples have been analysed by Atomic Absorption Spectroscopy and Neutron Activation Analysis and X radiography will be used to look for inscriptions on the blade. No doubt in due time we shall have an explanation of this intriguing blade. So we'll lose our magic to science. I don't know what Thor will say—he'll probably send a thunderbolt!

Iron metallurgy in the Sudan
Members will remember that a few years ago we had a very interesting talk at one of our public meetings, about some furnaces in Sri Lanka. These had an elongated layout and were situated on hills facing the prevailing wind so that they were wind and not bellows blown. They apparently produced both malleable and cast iron.

Thilo Rehren reports in the HMS Newsletter that there is now evidence of similar structures in the Sudan. It appears from local place name tradition that these furnaces were used for iron smelting. Links are being sought between structures in these two areas as well as other instances of wind powered furnaces.

Charcoal production in the Weald has traditionally made use of above-ground heaps, which required night and day tending for up to a week. However, WIRG member Roger Adams, who was responsible for the first series of experimental ironsmelting, made his charcoal in a pit, which allows air to be more easily excluded once the heap is alight and thus does not need such constant attention.

Dr Tom Gledhill reports in HMS Newsletter that similar pits have been discovered in County Durham in an area which is right in bloomery sites. They were first recognised by Dennis Coggins and Ken Fairless and are described as follows:

"The pits are visible as slight hollows about 2m in diameter and up to 0.4m deep. They are identifiable as charcoal pits because of the charcoal-rich soil brought up by animal disturbance. I am informed by Peter Crew that these are the first charcoal pits to be found in the UK, although they are well known in association with bloomery sites in Scandinavia. At the time of writing more than 30 pits have been identified." Another thing for WIRG forayers to look out for?

DMM

MEDIEVAL SHIPBUILDING NAILS

Iron fastenings which had been used in shipbuilding or repairing were found during the small archaeological excavation at the medieval shipyard of Smallhythe, Kent, in 1998, and historical records indicate that vessels varying from 40 tuns to 1000 tuns capacity were constructed or refitted there in the 15th century. Building accounts of ships of equivalent sizes built in the reign of Henry V quantify the weights of nails which were used. For example, the *Anne* of 120 tuns needed 135 cwt (almost 7,000 kg), and the king's largest ship the *Grace Dieu* of 1400 tuns used more than 467 cwt (*c.* 23,750 kg) in its construction.

This raises the question of whether the 15th-century Wealden iron industry could have supplied any or all of the iron necessary, or was the iron imported - 'Spanish iron'. Little work seems to have been done on the nails from medieval Wealden sites, and information from members on the capacity of Wealden medieval production in general, and details of nails in particular, would greatly help me in my research. I should be grateful for any help, which will be fully acknowledged.

Helen Clarke
hclarke6@netscapeonline.co.uk

EDITOR'S NOTE

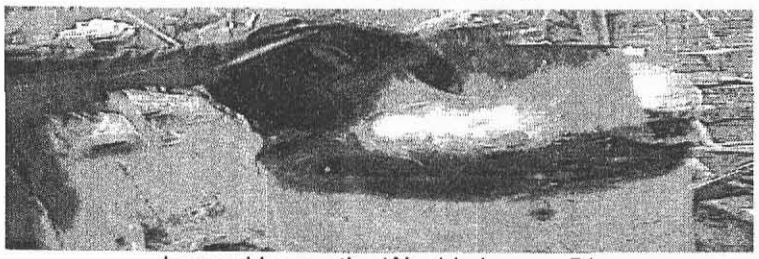
Once again, many thanks to all our contributors. If you are thinking of sending something in please try to get it to me by mid-October for the Autumn Newsletter or Mid-February for the Spring edition. I can take material on floppy disk with a hard copy, by email (meades@freeuk.com), typewritten or legibly handwritten (in order of preference!) Items should preferably be not more than 1 1/2 newsletter pages including any illustrations. For financial reasons the newsletter is limited to twelve pages in all. I should prefer any pictures on disk to be in JPEG format.

Finally, if you have access to the internet, don't miss our web site: www.wealdeniron.org.uk. *DMM*

HMS ANNUAL CONFERENCE 2002

IRON ON THE WEALD

13 - 15 SEPTEMBER



Ironmaking on the Weald circa ap 51

WIRG will be hosting this year's Annual Conference of the Historical Metallurgy Society.

The venue is to be Corsica Hall, in Seaford. Corsica Hall was originally built by the ironmaster, John Whitfield, in the 18th century, the house gaining its name when he presented George II with smuggled Corsican wine to escape the interests of the Revenue men. Later owned by Lord Napier, the house was the scene of a tragic shooting, as a result of which some claim it to be haunted. The house was later dismantled and rebuilt overlooking Seaford Harbour .

THE PROGRAMME

Registration will commence at 16-00 hours on Friday 13th, Dinner will be at 18-00 followed by presentations about the Weald. Jeremy Hodgkinson, will outline the bloomery and blast furnace activities that took place in the region, followed by a talk by Brian Herbert and Tim Smith on the operating experiences gained on the experimental bloomery furnace operated by WIRG. A demonstration smelt is planned for Sunday afternoon.

The bar will be open on Friday and Saturday evening, with a video available to show member's tapes.

On Saturday, a coach has been booked to take us on a 75-mile journey through the Weald. Jeremy will be our guide. The first stop will be the Anne of Cleves House in Lewes for a tour of the Iron Gallery which includes an example of the Brede fireback of 1636 - depicting a rare image of a Wealden blast furnace - and a cannon and reconstructed boring machine. We then travel north to Newbridge, the site of the earliest documented blast furnace in Britain. Next, we have a two hour stop at Wadhurst where we stop for a packed lunch in the church hall and visit the church which boasts 33 iron grave slabs, the earliest dated 1617. Our final visit of the day will be the site of Ashburnham blast furnace c1554.

Following Dinner, HMS and WIRG Members who wish to make presentations of about 10-15 minutes length will be given the floor.

Sunday morning will include papers of a more general kind, but will have two more about the Weald, the results of investigations of slag finds at Westhawk Farm, Kent, by Sarah Paynter of English Heritage, and a talk on the merits of cast iron cannon versus bronze, by Ruth Brown.

Following lunch, for those who have time, there will be a visit to the WIRG experimental bloomery furnace to partake in a smelt.

BOOKING

The cost of the conference including full board from Friday dinner to Sunday lunch and packed lunch, entry fees and transport on Saturday, will be £85 per person. For those who do not require residential accommodation, the charge is £8 per day (to cover meals excluding packed lunch) and transport on Sat.

If you are expecting to come, please complete the tear off sheet and mail to:

Tim Smith, 15 Hazelwood Road, Partridge Green, Horsham, W Sussex, RH13 8EX, UK Tel (0)1403 710148, or provide the information by e-mail to tjsmith@waitrose.com

Name.....Address.....

.....

Tel.....e-mail.....

Number places (Resident).....(or Day).....

Presenting paper Sat (Y/N).....Bloomery demo Sun (Y/N).....