Newsletter 71 Spring 2020

Editor: Jonathan Prus email jonathan@avens.co.uk

Phone 01435 830155

Postponement of Summer Meeting and AGM

For the obvious reason the AGM and Summer meetings of the Wealden Iron Research Group are cancelled. Other scheduled activities are postponed.

It is, of course, not possible to predict when things will get back to normal, but we hope it will be soon.

The Chairman and Committee wish all members the best of health and a comfortable passage through the Covid-19 pandemic.

A WILLIAM BENGE CANNON IN NEWFOUNDLAND

By J. S. Hodgkinson

My article in the Autumn 2019 Newsletter on the guns at Fort Prince of Wales on Hudson's Bay in Canada once again drew attention to Wealden guns wherever there was a British colonial presence, and previous notes in the Newsletter have illustrated guns found on West Indian and Greek islands. So it should be no surprise that a gun has turned up on the south-east coast of Newfoundland. On Bois Island, offshore from the small port of Ferryland, four batteries were eventually established to defend the port from possible attack by the French during the 18th century, and fourteen cannon remain there. Excavations during research for an

The 1702 demi-culverin on Bois Island, Newfoundland.

MA dissertation by Simon Newcombe at the Memorial University of Newfoundland have uncovered a gun of particular interest as the mark on the right trunnion had not been previously recorded. Although no details are available of the dimensions of the gun, a photograph (Fig. 1) shows that it is of the Rose and Crown type made between about 1690 and 1715, so it was already at least 40 years old when it was installed at Bois Island. Although not particularly clear in Figure 2, the maker's mark shows a W joined to a rather badly formed B (Fig. 3). The only gunfounder active in the period with those initials was William Benge, who cast ordnance at the Gloucester Furnace, Lamberhurst from 1696 until bankruptcy in 1705. An indistinct number, 14346, engraved behind the rose and crown identifies the gun in the survey of military stores at the Tower of London undertaken by Colonel George Brown in the early-18th century, and shows that it is a culverin (18-pounder) of 9ft. and was indeed cast by William Benge in 1702. Trunnion marks denoting the founder were only made a requirement in 1703 so Benge was already marking his products before the regulation came into force.

With thanks to Charles Trollope for telling me about this cannon and forwarding the details. The photographs are by Art Clausnitzer.

Jeremy Hodgkinson

Initials WB on the right trunnion.

A tracing of William Benge's trunnion mark. The 1702 demi-culverin on Bois Island, Newfoundland.

MICHAEL J. LEPPARD, MA

1937-2019

It is with sadness that we report the death of Michael Leppard, a long-standing member of the group. Michael's principal interest was in the history of East Grinstead, the subject of his two published books, where he was well-known as the founder and, for 20 years, the first curator of the town's museum. A former secondary school master, he also wrote on ecclesiastical history, on place-names and on the early history of settlements in Sussex. He contributed two articles for the Bulletin and several notes in the newsletter.

Pippingford furnace under threat

The winter winds put the Pippingford experimental furnace under threat with a group of three, long ago coppiced, sweet Chestnut trees leaning precariously over the furnace site.

Once again, the chain (saw) gang, Victor and Stephen came to the rescue to undertake the task of removing the threat without damaging the furnace. Careful evaluation of the compressive and tensile forces in the wood was needed to ensure saws did not bind or branches swipe back. Initial tension was relieved by the prudent use of Tim's pole saw.

Following felling, logs were cut and split so we have a plentiful supply of firewood for future smelts.

WIRG will be building a furnace and conducting a smelt at the Historical Metallurgy Society 'Accidental & Experimental Archaeometallurgy 2.0' event, now postponed to June 4-6th. 2021 at the Ancient Technology Centre, Cranborne, Dorset. Anyone who wishes to help prepare for the event or attend the event, please contact Tim at secretary@wealdeniron.org.uk or Tel 01403 710148

How did the ancients select the best ore: a testable hypothesis

I have wondered how the master smelters of old managed to select Wealden ore that would actually smelt. Alan Davies has been kind enough to point out the probable answer. And that answer has been staring me in the face.

In my very first days of walking up streams looking for ore and slag I was told "you can feel that its heavier than the sandstone". I suppose I got used to this and began concentrating on features such as the rock's relative smoothness, or shellyness or colour etc.

Alan's assertion was that more iron-rich ores had a higher density. This seemed a bit much like an over-generalisation to me, so I went back to basics and looked up the known densities of the constituents of the sideritic ore we find in the Weald. The principal iron compound is, of course, Iron (II) carbonate. This is about 48.3% iron and, in its pure form has a density of about 3900 kgm^{-3} (in old money this means an SG of 3.9).

I was sceptical about any direct relationship between composition and density and iron content so turned to the other likely constituents, These are primarily oxygen, silicon and aluminium. The ore has a clay matrix holding the siderite, so we expect that these will be in the form of a variety of aluminium silicates (densities between 2300 and 2500 kgm^{-3}). We might also expect a little free silicon dioxide (or "sand") (density 2650 kgm^{-3}).

Thus one should be able to pick out the "good stuff" by feeling for its density.

The rub is that perception of sizes and weights in rocks of different sizes and shapes may lead to poor selection.

I propose an experiment: pre-measure the iron contents and densities of a selection of ore samples and see how accurate the selections that people make can be.

An interesting twist in the bloomery experiments: the effect of addition calcium in the smelting mix

For some years we have been aware that there is considerable variation in the amount of calcium found in bloomery slags in the Weald, and also in the local ores. There are limestones, calcium minerals, found closely associated with the local iron ores. These are typically hard. The most obvious source of limestone is, however, the chalk which is altogether softer. As obvious as the chalk is in the landscapes bounding the Weald, there is no evidence that it was used in the bloomery furnace period.

In every case of bloomery smelting the most likely sources of calcium in the slag are the ore and the fuel-ash. Ash from oak charcoal (to take one example) is typically about 50% calcium carbonate. (This, of course, varies between trees from different areas.)

There has been comparatively little work done on the deliberate use of calcium in bloomery smelting, the most important being that of Peter Crew. Hitherto there has been no suggestion that limestone or wood-ash was deliberately added to bloomery smelting charges in the Weald, but in at least one case (Cullinghurst Wood site 5, see wirgdata.org) the calcium content of the slag is much higher than one would expect from the associated ore. It is also much higher than one would expect from an unplanned addition of wood ash.

What, then, is the significance of having calcium in the smelting mix? First, it tends to make the slag runny at lower temperatures. Second, it may increase the yield of iron from the ore. This may need further explanation: a bloomery works by “sacrificial fluxing”. That is to say that some of the iron in the ore combines with the impurities present to for the slag, which runs away. In the Weald most slags are dominated by a family of minerals called “fayalite”. Typically this is an iron-silicon compound, but other metals, including calcium, may substitute for the iron. So maybe more-calcium-in means more-iron-out.

This perception prompted WIRG experimental smelt 16. The report that follows is the work of Alan Davies. Some parts of the original have been omitted from this version.

Report:
Objectives, smelt 16 October 20 2019:

Following the results of the previous Smelt 15 which, even with burden liming using natural chalk, produced neither a tap slag nor bloom iron. Several possible causes were identified including small sized charcoal limiting air flow through the furnace, furnace temperatures slightly too low, burden bridging in the shaft affecting gas flows and a low hearth temperature preventing flow of any tap slag present. To remedy these the following were implemented for this Smelt 16:

1) To use a new source of lumpier charcoal
2) Chalk still to be added as a flux to aid slag flow and increase iron yield
3) To use a new and more powerful blower.

Also, following this smelt and outcomes, answers are sought for the following questions:

What is the effect of chalk additions on slags?
Is the resulting tap Slag of wüstite composition?

Smelting Results

Details of preplanning activities, furnace pre-heating and smelting details are provided by the smelting team. Extracts of process details, smelting outputs, photographs of slags and bloom plus slags and bloom mineral and metallurgical analyses are included in this note.

The slag running

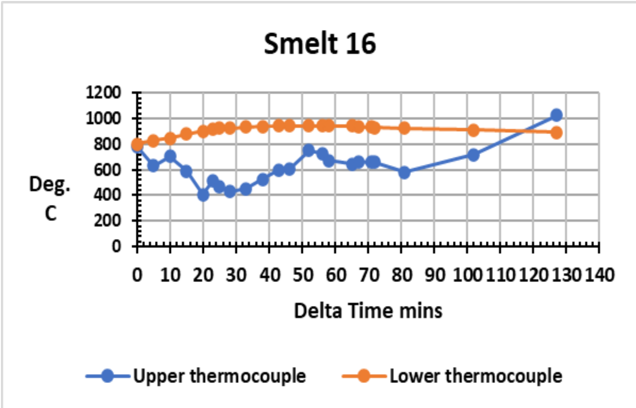
Smelting Process Details

The following details, shown in Table 1, are provided either from smelt records or calculated from operating data:

BWS1 Ore Kg. (18 Charges of 1Kg.)	18
Charcoal Kg. (Smelt+Burndown)	18 + 3 = 21
Chalk Kg. (Charge 5+, each 170gm.))	2.38
Outputs	
Furnace Slag Kg.	11.42
Tap Slag Kg.	5.87
Bloom Kg.	3.1
Iron Yield %	35%
Process	
Smelt Time Hrs. (incl. burn down)	2.25
Burn Down Hrs. (Natural draught)	1.08
Blowing Rate Litres/sec.	15
Iron Drop Rate (Avg. Gms./Min.)	24
Internal Hearth Diam. (Approx. Oval)	70cm x 60cm
Hearth Flow Rate Litres/Min/cm^2.	0.27
Furnace Shaft Diameter	27cm
Tuyere Internal Diameter	27mm
Tuyere Declination	20 Deg.
Height (Above slagging arch sill)	23 cm

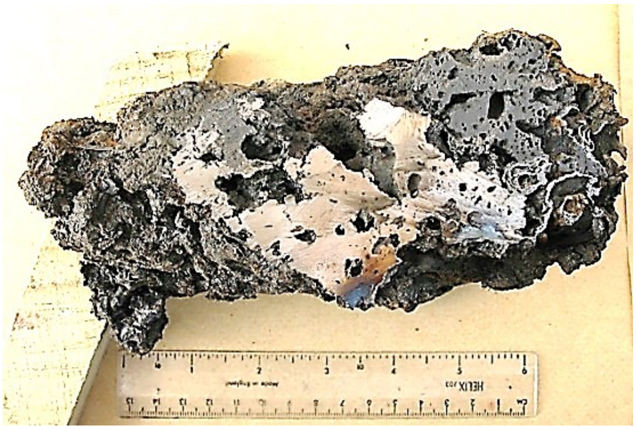
Table 1.

A much higher blowing air flow rate was used into the hearth zone during the pre-heat and charging period. Natural draft was used during burndown with the two side tuyeres, main front tuyere and secondary lower front tuyere open. However, for smelting the air rate through the 'plane surface area' of the internal hearth zone is 0.27 Litres/min./cm^2. [This compares with earlier values of 0.42, 0.41 and 0.33 Litres/min./per cm^2 (Smelts 8, 9 & 10 respectively, Page 30, Bulletin Vol. 36, Pt.2, 2016)]. Average liming rate = 132 Gm. chalk/ Kg. Ore. (Smelt 15 Rate = 170 Gm. chalk/Kg. Ore).



Smelting Temperatures

Figure 1– Furnace Smelting Temperature Profiles



The bloom, showing the section cut.

This record shows good consistency in maintaining overall smelting hearth zone temperature during the smelt and burn down.

Furness Slag

Bloom Slag

Chemical Analysis of Slags

Samples of Upper Furnace Slag, Lower Furnace Slag, Tap Slag and a small section of Bloom Iron were provided for microscopic and chemical analyses. Table 2 gives the main mineral percentages found for each of the three slag types.

Slags main Mineral Percentage Contents, Basicity and Flow Temperatures

The Upper Furnace Slag is mostly silica with only a small amount of iron giving an 'immeasurable' flow temperature. Unlike previous smelt 15, no magnesia is found in any of the slags. Whilst usually of low content, it does contribute to higher slag basicity. Basicity values are lower in this smelt causing a higher free flow temperature of 1268°C for the Lower Furnace Slag compared with 1156°C for the same slag from smelt 15. Whilst seemingly smelting the same ore, this absence of magnesia may be from the change in wood type charred by the different charcoal supplier.

Figure 2 shows how these mineral components evolve during the smelting process:

Figure 2 – Slags Minerals Composition Changes

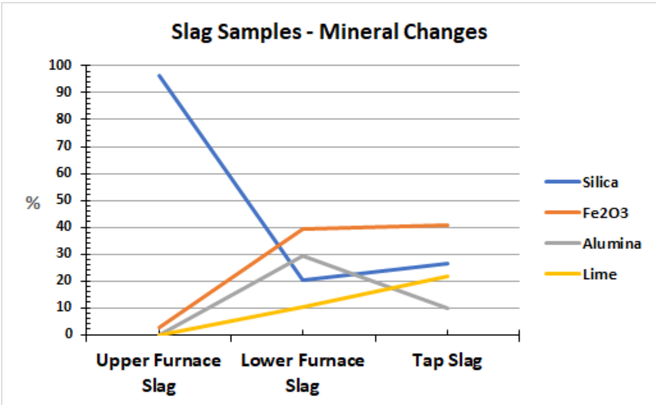
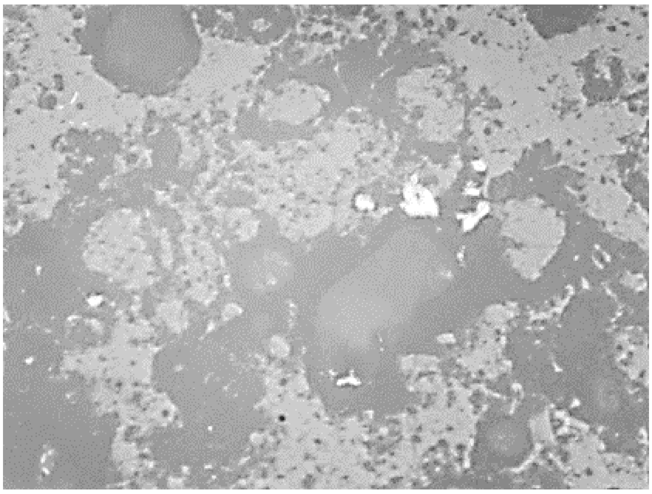


Table 2			
Mineral %	**Upper Furnace Slag**	**Lower Furnace Slag**	**Tap Slag**
Silica	96.35	20.47	26.67
Equivalent Fe_2O_3	2.60	39.48	40.94
Alumina	0	29.27	9.78
Lime	0	10.24	21.74
Magnesia	0	0	0
Sub Total % =	**98.95**	**99.46**	**99.13**
Fe^{2+}	1.21	23.61	17.08
Fe^{3+}	0.61	4.02	11.57
Total Iron	1.82	27.63	28.65
Slag Basicity	0	0.17	0.32
Free Flow Temperature (5000mPas)	'High Value'	1268°C	1244°C
Free Flow Temperature with solid Iron excluded	-	1414°C	-

The fall in silica content and rise in iron equivalent oxide content of slags is shown as slag forms and descends in the furnace shaft. As before, the slag lime content rises progressively as slags are formed. Even with different smelt liming rates, lime reaches similar levels in the Lower Furnace Slags and between the Bloom Slag in Smelt 15 and the Tap Slag in this smelt. A higher up-take of alumina by the Lower Furnace Slag in this smelt may be an effect of the increased blowing rate and higher temperature and so more furnace wall losses to this slag.



Slag Matrix (x100)

Examination of Slags. 1 Upper furnace slag

Upper Furnace slag

Surface boundary (x400)

The greyish exterior surface is fused in places with streaks of a shiny black phase. The interior is a compact mass of greyish particles.

The macrograph (above) shows small light and dark brown/black particles in a fused greyish matrix containing many small voids and vesicles.

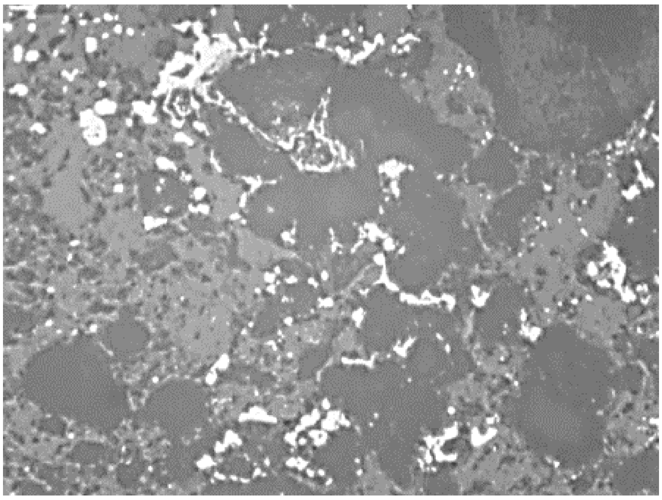
Closer examination, above right (1), shows granular ore particles set in a grey micro-porous partly fused matrix. Above , right (2), shows the cross section of the thin shiny black surface phase as a layer of early formed wüstite dendrites in fayalite.

Lower Furnace Slag

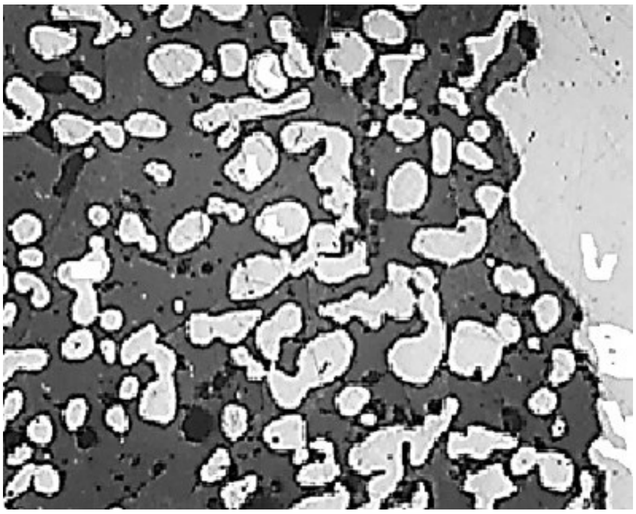
A vesicular slag with globules and stringers of free iron forming at or near many vesicle surfaces.

Free Iron = 6.07% of this total area but represents 15.62% of just the slag+iron area shown, and is equivalent to 22% iron by weight in slag. (See photomicrograph at the top of the next page, p. 8)

Analysed Total Iron in slag sample = 27.63% wt. Subtracting the 22% wt. solid iron leaves a balance of 5.63% iron weight in the residual slag. This value is equivalent to 7.24% weight FeO.

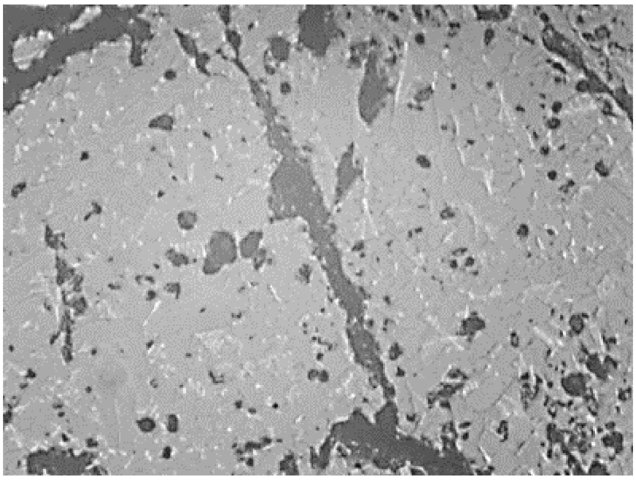


Iron forming in lower furnace slag



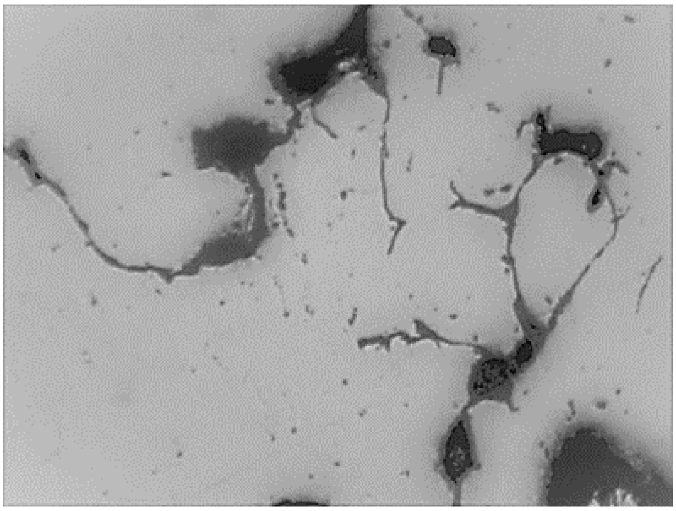
Aggregating Bloom Iron in Slag (x100)

The photomicrograph immediately above, shows an example of aggregating iron in slag fusing with a more solid section to right of image. The area of aggregating iron is 35.39% this is equivalent to a 50% total iron weight of slag weight.



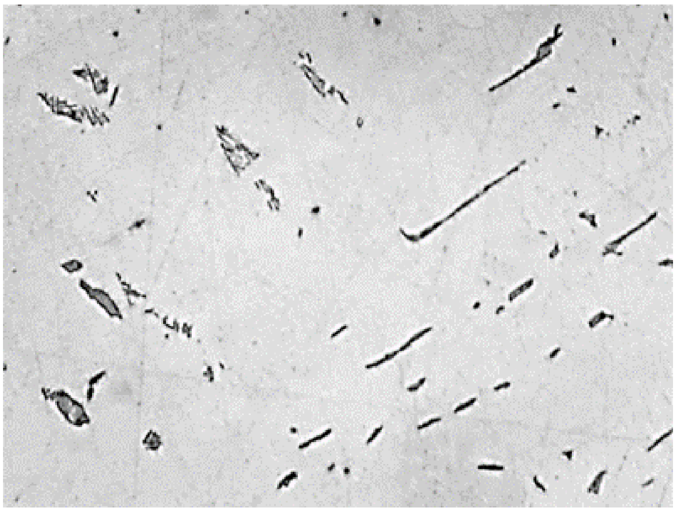
Tap Slag (x100)

The photomicrograph immediately below shows a small section of bloom iron illustrating local effects of initial hot consolidation of extracted bloom with partial fusion of aggregated iron, some residual porosity (black) and entrained surface oxide or slag (grey).



Section of consolidated Bloom Iron (x100)

Following partial bloom consolidation and etching with 2% Nital to highlight pearlite phase, the image below shows a typical low carbon iron structure. Analysis of four independent fields of view gives an average value of 3.8% of area as mostly fine pearlite at ferrite grain boundaries. Some pearlite fragmentation is likely from the consolidation and reheating cycle of a partially worked bloom.
Optical phase analysis, with confirmation using Iron-Carbon equilibrium diagram, shows this iron sample has an average of 0.032% carbon content.



Nital etched bloom

Summary Conclusions

Changes made in materials and procedures for Smelt 16 give a very much-improved outcome. These changes and effects include:

A higher input air blow rate to sustain lower furnace temperature, lumpier charcoal to improve furnace gases production and flows, keeping furnace closer to required operating temperatures, delaying early burden chalk additions to avoid short term furnace calcining cooling effects and sufficient burn down time to complete slag reduction for more bloom iron

These combined effects achieved a successful smelt producing a 3.1Kg. bloom of low carbon iron (0.032%C) with a 35% yield of iron from ore

Even with 'removal' of solid iron from the total Lower Furnace Slag composition, this residual slag is still close to the pre-set target composition following burden liming.

In response to the two questions:

What is the effect of chalk additions on slags?

Chalk additions on slags achieves better iron yield by forming preferentially calcium richer silica slags in place of wüstite in fayalite slag. This unused wüstite is reduced to give more iron for bloom formation within better flowing slags. Overall tap slag represents 5.87 Kg (34%) of the combined total furnace slag weight of 17.29 Kg produced from 18Kg of ore.

Both smelts 15 and 16 show how the quantity of burden chalk can be calculated (liming rate) to give a target slag composition and flow characteristics.

Is the Tap Slag of wüstite composition?

The detailed structures and chemical analysis of the Tap Slag shows no evidence for a 'wüstite' slag. Smelt 16 Tap Slag composition is close to that for a 'textbook' low viscosity fayalite slag.

Comments and possible future research

The most significant line in Alan Davies' report tells us that the addition of extra lime in the smelting charge "improves the outcome of the smelt". This improved outcome is in part reflected in the improved flow of slag (reduced viscosity) and is also evidenced in the presence of calcium in the fayalitic part of the slag.

The key questions arising are these:

> **If adding extra lime helps, why was the practice not universal during the bloomery period?**
> **With what frequency do high calcium bloomery slags occur?**

For the first of these questions experimental smelting may provide some insights: may it have to do with the qualities of the blooms produced? Alternatively, may we have mistaken the precision with which master-bloomers chose and discarded ore: certainly high-iron-low silica ores are easier to smelt and run at lower temperatures.

For the second question we must clearly analyse slag from more (and more various) sites.

BURIED UNDER IRON?

Wealden churches, particularly those in East Sussex, are known for their cast-iron memorials; many are associated with families involved in the iron industry. But the desire to be buried beneath an inscribed iron plate was not always fulfilled. Two different instances have come to light of people in the past whose wish to be buried under iron may have come to nought.

The first concerns Jane Darby, the wife of William Darby of Sedlescombe. She died in 1680 and in her will in the National Archives (PROB 11/363/95) it is evident that Jane was thrice married: firstly to Thomas Baker of Bayham in Frant; then to Giles Waters of Brede; and finally to William Darby. The succession of her marriages and widowhood left Jane a woman of means and the list of beneficiaries was long. The implication in the will was that much of her property had been inherited from her first husband so perhaps it was not a surprise to William Darby that she asked him to see that she was buried in Wadhurst church near to Thomas Baker's grave. He had died in 1647 and an iron plate bearing his initials and the date is set into the floor in the north aisle of the church (Fig. 1), and Jane too asked her husband to 'lay upon my grave an iron plate'. However, no such plate can be identified among the 30 in Wadhurst, so did William default on Jane's request or did he resort to a cheaper solution and bury her beneath her first husband's graveslab? Unlike on some of the slabs in Wadhurst, where subsequent burials have been recorded with engraved dates and initials, so such markings are to be seen on Thomas Baker's plate.

Thomas Baker's iron graveslab in Wadhurst church.

In the instance of James Nicoll of Mountfield who died in 1731, we do not know whether his wish to be buried under iron was carried out. In his undated will in East Record Office (PBT 1/1/53/312) he set down in great detail his planned memorial:

'I desire I may be buried under the steps going up to my gallery in ye parish church of Mountfield which place I hereby Will and Desire may be made a convenient Buriall Place for the succeeding Possessors and Owners of ye Manor of Mountfield that shall hereafter Pleased to be buried therein and to the entrance of it I Desire a Cast Iron Plate made at Darwell Furnace may be sett my brickwork on which shall be these lines fixt in the ye casting of it as fair and legible as may be.

Here lyes ye Body of an Ironmaster

Who sought and wrought,

And dearly Bought,

Yet Still Escapt Disaster.

At Last was Blast,

Now lyes at Rest,

Till ye Great Trump is Sounded,

Then Hopes to Rise,

And Gain the Prize

With Angels all Surrounded

Whether the grandiose plans that Nicoll set down for his immortality were ever carried out seems to have been lost in the mists of time. All Saints' church, Mountfield underwent radical 'Victorianisation' in 1854 with what was described then as an ugly gallery, the one to which Nicoll's will refers, being moved to become the organ loft. One of the contributors to the improvement fund was Colonel Nicoll of the same family so, if James Nicoll's memorial had been installed, perhaps it was the pompous doggerel he had decreed for his epitaph that persuaded his family not to object to its removal.

With thanks to Patricia Jones and Peter Miles for expanding my knowledge of Mountfield.

The King's Gunfounder

By Tim Smith

A chance discussion following my talk on Wealden iron to the Sussex branch of the Association of Retired Professional Engineers, drew my attention to a painting on the walls of the former Brighton & Hove Grammar School (now the 6th Form College BHASVIC) entitled: *'Sussex Ironworking: Parliamentary Emissaries Question the King's Gunfounder'.* This is the seventh of a series of nine panels painted by Louis Ginnett (ROI) between 1913 and 1927 depicting 'Sussex Man' from pre-history to the 1926 excavations at Hollingbury Camp, just North of Brighton.

John Browne was the King's Gunfounder and, from the very start of the English Civil War, (1642-1651), Parliament sent two of its Members to summons him to appear before them so that his '*position*' could be made clear to him. Despite previously supplying the Royalist army under Charles Ist, John Brown had little choice but to now supply ordnance to the Parliamentary forces who held Kent and Sussex from an early stage. These counties were then the ironmaking centre of the country. However, following the victory of the Parliament forces at the battle of Naseby in June 1645, compromising letters were said to have been seized implying Browne was ready once again to supply the Royalists. As a consequence, he was imprisoned in the Tower of London, and witnesses claimed shortfalls in the quantities of ordnance supplied by him to Parliament. But Browne was the sole competent supplier of ordnance in the whole of Britain, so when the Parliamentary forces required guns to arm three new frigates they reluctantly released Browne after six-months. He accepted an undertaking to supply only Parliament and negotiated a lucrative contract to cast 86 guns of various sizes for the ships.

A regular supply of guns was an important factor in times of war as guns had a finite life requiring replacement at regular intervals. Straker, in his 1931 book, '*Wealden Iron'* (p160) suggests the life of a heavy gun was just 40 shots and lighter guns, 55, but his source for this is unknown. However, at each new war, the government placed orders for several thousand guns of varying sizes, indicating a need for regular replacement.

The Browne's were a dynasty of iron founders. Thomas Browne, John Browne's father, was the King's gunfounder, initially using a furnace at Chiddingstone, then moving to Ashurst and later Horsmonden, all located in Kent. He also operated Bayham forge, which was in Sussex until the late-18th century. Later, John Browne also leased Barden, Bedgebury and Cowden furnaces, all in Kent.

As the King's Founder, John Browne had the monopoly to supply ordnance and shot to the Government but not elsewhere. This led to a dispute with Sackville Crowe who had been given the exclusive licence for 12 years to supply guns to merchant shipping, an important market in times of peace, when demand for guns from the Government dried up. Also, John Browne expressed the need to be able to cast smaller guns, generally required by the Merchant Navy, prior to larger guns, as the furnace hearth needed to eroding sufficiently to hold enough iron to cast large guns.

By 1645, John Browne was operating three furnaces under the instructions of his father, Thomas, casting whole and demi-culverins. These were lighter than 'cannon' which, in the 17C, strictly applied only to guns firing 66 pound shot (Straker p159) and by the 18C 'cannon' referred to guns firing 42 lb shot – a gun not made on the Weald where the 32 lb demi-cannon was the largest guns cast. According to Straker (p160), listing the dimensions of guns cast at Heathfield from 1735 to 1742 and Warren Furnace in 1769, a culverin fired 18 pound shot and was 10' 11" long with a 5.2" bore and weighed around 4840 lb (2.19 tonne), whereas a demi-culverin fired 8 pound shot, had a 4" bore, a length a little over 10' and weighed around 3400 lb (1.54 tonne). The Browne's were also exporting guns to the Dutch and Italians, as well as casting some guns in bronze. Bronze enabled a lighter gun to be cast, a particular asset for ships' guns. Since the density of tin-bronze is 7.4-8.9g/cm^3 compared to 6.6g/cm^3 for grey (graphitic) cast iron, casting in bronze implies a thinner wall thickness and/or shorter gun, compared to an iron gun. The cost of bronze guns was some 270% more than cast iron, a high price for a lighter gun.

In an attempt to produce lighter guns in iron, John Browne developed the 'drake' in which the bore at the breech end was tapered to provide thicker metal where the greatest forces were experienced on igniting the charge. He also offered guns in which the surface had been machined on a lathe to impart superior strength. This is logical as, on firing, the gun experiences a tensile hoop stress around its circumference and this stress is greatly magnified at any sharp defects on the surface of the gun causing cracks to propagate. However, the additional cost of these guns did not warrant the increase in life obtained and soon the government declined to buy them. Some years later, in the 1670-80s, Prince Rupert – the nephew of the ill-fated Charles I - further advanced the process producing '*turned and neil'd*' guns in which not only was the outer skin removed on a lathe, but the whole gun was heated in a furnace for a month or more (annealed) to spherodise the internal flakes of graphite thereby removing them as internal stress raisers. This annealing would also relieve stresses built up during solidification of the casting. Again, because of the additional cost without producing significantly better guns, the process was discontinued.

In the third generation -John Browne died in 1651 - his son, George took over the business taking on the lease of Brede furnace in 1677 and Hamsell furnace in Rotherfield, both in Sussex. Here he cast guns and built a boring mill at Birchden forge.

Returning to the picture, evidently a little artistic licence was expressed in claiming John Browne, 'The King's Founder' as a man of Sussex.

And finally,

For those expecting an update on the very 15ArcRfb11=0promising excavation at Great Park Wood, there is, of course little to report: the early digging days of the season have had to be can-celled…

However, her is a picture of the most promising trench as it was at the end of December. There is no reason to suppose that the archaeology has been damaged, but the poor drainage properties of the fine Ashdown sand are plain to see.

WIRG contacts:

Chairman: Bob Turgoose. bobturgoose@yahoo.co.uk

Hon. Secretary: Tim Smith.

secretary@wealdeniron.org.uk

Treasurer: Shiela Broomfield. treasurer@wealdeniron.org.uk

Editor of **Wealden Iron, The Bulletin of the Wealden Iron Research Group:** *Jeremy Hodgkinson. jshodgkinson@hodgers.com*

Newsletter Editior: Jonathan Prus. jonathan@avens.co.uk