

HMSNEWS

Historical Metallurgy Society

52 Winter 2002

Forthcoming Events

HMS Annual General Meeting 2003 will be held on Saturday 10th May at the Royal Armouries, Leeds. The associated Spring meeting will address research frameworks in archaeometallurgy. There will also be an opportunity to visit behind the scenes in the conservation and scientific sections at the Royal Armouries.

Roman Archaeology Conference (and TRAC) University of Leicester 3rd to 6th April 2003. Includes a session on Roman landscapes and Mining See Website <http://www.le.ac.uk/ar/rac>

HMS Annual Conference 2003 (12–14 September) will be held on Exmoor. The focus of the conference will be on metal production landscapes and field visits will include non-ferrous mining and smelting from the Late Iron Age to the 19th century. In particular, it is hoped that participants will be shown newly emerging evidence for a significant Roman iron production industry in the area.

Society for Post-Medieval weekend visit to Blaenavon World Heritage Site 5th–7th September 2003. Will be housed at Hill House, Abergavenny. It was a focus for early post-medieval industrial activity, including iron ore extraction from the 1670s, ironworking from the 1780s, and steelmaking (including the Basic process, 1878) and coalmining until the 20th c. Contact Martin Locock, Glam. Gwent. Archaeological Trust, Heathfield House, Heathfield, Swansea. SA1 6EL; Tel. 01792-655208

APPLICATIONS FOR GRANTS are invited to the R.F.Tylecote Travel Fund and the Coghlan Fund. Application forms may be obtained from Michael Cowell, Hon. Treasurer, Little Gables, 17a Thorncote Road, Northill, Beds.SG18 9AQ. Forms should be submitted by February 12th 2003.

E-mail mcowell@britishmuseum.ac.uk, Forms are also on the HMS web site. Please note the Web site for HMS has been changed and is now hist-met-org.

This year we have awarded grants from the Coghlan fund to Paula Campo, Constantina Vlachou and Christopher Carey. Grants towards travelling expenses have been awarded to Alan Williams and Albertine Malham from the Tylecote fund.

IRON ON THE WEALD A very successful HMS Conference was held in September based on Seaford on the South Coast. Our base, overlooking the sea, gave members the opportunity for a coastal walk before breakfast if they were

actively inclined. Ever since its inception HMS has taken a great interest in Wealden iron and last met in the area in 1979.

Jeremy Hodgkinson, chairman of the Wealden Iron Research Group gave a masterly introduction to the subject. Its densely wooded country lying between the North and South Downs contained as many as eight layers of iron ore; where within the Wealden Beds lenses of clay held nodules of iron ore. It has been worked for the mineral since before Roman times. The Direct Bloomery process was used from the 2nd century BC to the 15th century AD. Using free standing furnaces (shaft furnaces) it was an important area of production during the Roman occupation, when there was some working on a vast scale. It has been estimated that there was 30,000 tons of ironworking waste accumulated at the Beauport Park site, over a period of around a hundred and thirty years.

After the Roman period the industry rapidly declined. A *ferraria* at East Grinstead was mentioned in Domesday and during the Middle Ages many arrows and horse shoes were made, especially at Horsham.

Some water power began to be used in the 14th and 15th centuries, and excavations are currently going on at Crawley. There was an Ironworks at Newbridge on Crown Land c 1496 and Brian Awty has discovered that efforts had been made to start one at Queenstock, in Buxted, on the Archbishop of Canterbury's Manor before 1500.

Many French workers from the Pays de Bray had arrived in the Weald by 1540, no doubt bringing their expertise with them.

Chingley and Pippingford blast furnaces had been built in 1565 and 1696 with base dimensions of 5m and 8m respectively.

By 1574 there were fifty blast furnaces working in the Weald and landed gentry, like Sir Thomas Gresham, were beginning to take an interest in the iron industry. In the years following fire-backs and cannon were being cast in quantity.

In 1710 the equivalent of the entire output of the Gloucester furnace for the year was used to make the cast iron railings around St. Paul's Cathedral at the incredibly high price of £11,000.

Many guns were cast for coastal defences and others exported all over the world. The industry in the Weald did decline, however, in the early 17th century as other parts of the country developed. Naval expansion though meant that more guns were continually needed and the Weald concentrated on ordnance so that by 1756 almost all the furnaces were sending guns to the South coast ports. Lord Ashbumham and Ambrose Crowley are well-known names connected with the Ashbumham furnace which occupies the same valley as the earlier Panningridge furnace.

Sarah Paynter (English Heritage) spoke about excavations on a Romano-British settlement at Westhawk Farm, Kent. An area of about 6 ha. was excavated and an area of about 10ha. was preserved in situ. In all 1.65 tons of iron-working waste were recovered. Within the excavated area there were two enclosures where iron working had taken place; the waste was concentrated round them, and more than half of it was iron-

smelting slag and but there was a small proportion of smithing slag and a deposit of hammer scale. The latter was found in a workshop context and indicated that some primary smithing had taken place. The activity around one enclosure preceded that of the second but there were strong similarities between the organisation of the workshops, and the technologies and materials used in each, suggesting that the work continued uninterrupted from the early second century to the mid third century.

Groups of bloomery tapping furnaces were arranged at the edge of each workshop structure in each enclosure. They were round in plan, constructed from quartz-rich clay with an internal diameter of about 0.26m and a wall thickness of 0.17m; they probably faced away from the workshops. It seems likely that the workshops may have been open along one or more sides but the roof probably extended over the furnaces to provide overhead cover for the operators.

A number of bowl-shaped furnace bottom slags were found and one smithed billet of 4.5kg weight. The amount of refined iron produced over the lifetime of the site was estimated as a minimum of 2.7 tons (equivalent to 600 billets of 4.5kg each). It was an excellent example of archaeometallurgy using mainly slags to conjure up a convincing picture of past industrial activity

This was followed by **Brian Herbert** and **Tim Smith** giving a report on the WIRG experimental bloomery furnace. The project had been started twenty-five years ago and resuscitated some five or six years since. They found that it was easier to break up ore after it has been calcined which was carried out in a pit containing a wood fire. Corrugated iron was placed over the pit once the broken ore had been added, to contain pieces of ore that sometimes exploded. Charcoal was made from local hardwoods in 8ft dia. kilns and bought in for smelting.

An optical pyrometer and thermocouples were used to measure the temperature of the furnace and a charge of 1 kilo of ore to 1 kilo of charcoal generally employed. The resulting bloom was generally compact but on forging could disintegrate. A wooden mallet and anvil were used to consolidate it initially, followed by hammering with a steel hammer.

Tim compared the analysis of two different ores and the resultant slags. A high silica ore (26% SiO₂) did not produce a bloom but only a mass of viscous slag containing prills of iron. The ore normally used contains 9% SiO₂ and usually produces a bloom weighing one tenth that of the ore charged.

The experiments threw up differences in Roman slags with, in general, less iron oxide being present in the WIRG slags which, along with other phases, indicated that a higher blowing rate was being used in the WIRG experiments.

We had an excellent day out on the Saturday, with field notes provided by Tim Smith. We first visited the **Anne of Cleves Museum** in Lewes, which has an excellent gallery of ironwork with material bequeathed by the iron founder John Every in 1941. A large collection of fire-backs, including the famous one of Richard Lenard at his Brede furnace, commemorates one of the great outputs of the Weald; while cannon boring equipment recalls the other important production. The weather

was fine and enabled us to admire some rare trees in the small garden.

We visited the site of the **Newbridge furnace** and forge established in 1496 by Henry Fyner a goldsmith of Southwark to produce iron for the king's artillery on its Scottish campaign. The first batches of iron were sent off the following year and in April carriage was charged for iron shot taken to the Tower of London. The works were leased to a french worker Peter Roberts and nine months later he had a joint tenancy with Fyner who handled the iron in London. Roberts soon found himself in prison for failure to pay his debts to Fyner And the next tenant fared no better. He fell into arrears virtually from the start, and his debts appeared in the Duchy of Lancaster accounts for the next 30 years. He operated the typical 'Walloon' system. An inventory of 1509 shows that there was a blast furnace and two further hearths one for refining and the other for reheating the iron during forging under the hammer.

After Newbridge we went to the church of **St. Peter and St. Paul in Wadhurst** which is particularly rich in cast iron grave slabs, having the largest collection, 33, of any other church in the country. Members enjoyed some time looking at the them, mainly 17th and 18th century slabs. A full list, together with others around the country is available in the Bulletin of the Wealden Iron Research Group, second series No 8. 1988, p.12–47, ISSN 0266-4402 (£1 plus postage) from the Hon. Secretary Mrs S. Broomfield, 8 Woodview Crescent, Hildenborough, Tonbridge, Kent, IN11 9HD.

We ended the trip looking down into a valley at the site of the **Ashburnham Furnace**.

We had a wide variety of subjects presented by the Speakers on Saturday evening.

Jake Almond spoke on "William Strickland's steel furnaces". In 1825 William Strickland, Engineer, from Philadelphia USA, viewed engineering activities in Britain on behalf of sponsors. The North of England Open-Air Museum in 2000 paid £6000 for a manuscript version of Strickland's reports, published in 1826. Among the subjects on which he produced drawings and descriptions were the making of 'cast' and 'blistered' (cementation) steel. There is a suggestion that the information presented relates to the "Crowley's works on the Tyne", so confirmatory evidence would be useful. The cementation furnace pictured has a tall conical stack, unlike the extant Derwentcote structure and also, surprisingly, other illustrations published before 1830.

This supports the view that the drawings are based upon tangible objects. The Crowleys were associated with several sites in the Newcastle-upon-Tyne district so which, if any, in 1825 had on it the structures on which Strickland's drawings are based?

The speaker asked for members' advice and opinions concerning the value of this documentary source. (*During questions David Cranstone said that the Smallwell works in 1718 appeared to have conical chimneys*).

Justine Bayley's subject was precious metal refining in early Roman Chichester. Some flat-bottomed, oxidised-fired

crucibles that she had published (in 1983) as evidence for glass working had been re-analysed and shown to be parting vessels, used to separate silver from gold. Other crucibles contained opaque red glass that had initially been interpreted as deliberately-made enamel. Quantitative analysis showed the glass in the crucibles was very different from Roman enamel, and was in fact a copper-rich slag derived from silver refining.

David Cranstone entitled his talk “Mind the Gap” — he wished to point out some gaps in the MPP English Heritage programme for enhancing and documenting the Schedule of Ancient Monuments, in need of further research. It was a hard hitting lecture giving us plenty to think about.

The first gap is Medieval water-powered smelting. We are fairly familiar with unpowered Medieval bloomeries but the chronological and technological range of powered iron smelters is really not even characterised. How was iron smelted in the 15th century? Did the water-powered sites use power for blowing or hammering or both? When did the low open Stoney Hazel type hearth come into use? Were Gerry McDonnell's high-shaft furnaces, able to produce some cast iron, a normal type of smelter? Given the continental evidence for blast furnaces from the 12th–13th century, are we sure that Newbridge in 1496 was really the first in Britain, especially in low-phosphorus orefields? Rather than look for simplistic yes/no answers to these questions, we need to look far more closely at how smelting technology relates to ownership, social and economic factors, as well as technical factors such as phosphorus content.

The second gap is the archaeology of the finery/chafery forge from the 16th to the early 18th century. David Crossley's pioneering excavations have not been built on, and we have surprisingly limited site knowledge, and even few identified sites with field remains worthy of protection. The time is right - Peter King's historically-based forge lists now give the basis on which a field-based gazetteer can be built.

The third gap follows on directly — the development of pig-wrought iron conversion in the 18th century, from the traditional finery using charcoal-pig, via adaptations of coke pig, various attempts to break the monopoly of the finers, the need for charcoal fuel, and/or the need for water power, to the emergence of the fully fledged puddling and rolling process in the 1790s. Stamping and potting is the best known of these processes historically, but even then the field evidence, archaeology and archaeometallurgy are virtually unstudied, and I suspect that the documented processes and patents are the tip of an iceberg of experiment and innovation, some of it by working foremen who did not and often could not write it down, and whose contribution can only be rediscovered by archaeology. Again Peter King's work gives us a starting point, but most of the sites with good field preservation remain to be identified, let alone protected and studied.

Peter Crew's theme was “woodland management and charcoal processing at a late 14th century ironworks” in the northern part of Coed y Brenin, Merioneth. In 2001 it became possible to renew excavations at Llwyn Du. Further work was carried out on the furnace and two large trenches were opened to the west to locate the associated settlement and an area thought to be a charcoal burning platform was excavated. The following

year resulted in the discovery of another furnace and extensive refining/smithing debris and remarkable evidence for a cruck-built structure and a yoke.

The original furnace was about 2m by 1.50m overall, with a wall 20 to 40 cm thick. Mainly of clay it had an external ring of stakes, incorporating an arc of large stones. The lower part of the heavily slagged shaft survives to 50cm high. The slag-tapping channel was defined by a series of laid orthostatic slabs lined with clay and the arch was bridged by large flat slabs. Adjacent to the tapping bay was a large tank of sloping stones sealed with clay. This feature is not known from any other site in Britain. It seems unlikely to have been used simply for quenching tools and could possibly have been used for quenching glassy slags to recover prills of high-carbon iron.

In 2002 the well preserved remains of a second furnace was found. It appears to be of similar size and character to the first but awaits further excavation. Also to be examined are the remains of a timber building with smithing debris and areas of hammerscale. Charcoal burning was carried out on branch wood, and studies of the charcoal remains recovered continues. In the coming years it is hoped to reconstruct the buildings and furnaces as part of an interpretative trail linked to the Forest Centre at Maesgwm.

The charcoal on the ‘platform’ was up to 50cm deep with unburnt wood and stone at its base. It is estimated that some 90 tons of charcoal were used over a 3 to 4 years period of semi-continuous smelting. This is almost exactly the length of the final campaign of smelting by John and Roger Lyce and supports the hypothesis that the cruck-building was erected by them in 1395 and used as their charcoal store.

Martha Goodway (Smithsonian Institution) had been examining cable from the Wheeling bridge over the river Ohio. Built in 1849 it was the first all iron bridge in the U.S.A. It was 1008ft in length and the wrought iron cables for this suspension bridge were paid out down the town street by a team of oxen. Each longitudinal wire was closely wound round with finer wire which, apparently in America, is known as selvedging.

Jeremy Greenwood spoke on the Sowley Ironworks and its naval connections.

The Sowley ironworks were at Beaulieu, completed in the 1590s by the Earl of Southampton. It had a tenuous existence during the 17th century, but with the rapid expansion of Portsmouth dockyard the works were taken over by Henry Corbett a specialist blacksmith from London who set up a forge at Beaulieu in conjunction with Sowley. He was financed by Edmund Dummer ; a former surveyor of the Navy , and naval contracts for wrought iron followed. Corbett died in 1708 and Dummer continued the business until 1712 when his brother Thomas (an ex-navy purser) continued to supply the navy until 1716. Miles Troughton in association with some Forest of Dean manufacturers refurbished the works in 1722 and his grandson Philip Troughton Sone supplied round shot and naval guns to the Board of Ordnance, through the 2nd Duke of Montague who was master of the Board.

In 1753 Sone spoke of making 10 tons of shot in his new air furnace and of hoping to re-bore a large stock of guns, refused

by the navy, to make them suitable for foreign markets. There were appallingly high proof failure rates in 1758, and this was the end of the direct naval connection.

Sowley was leased by James Stairs of Titchfield who was also lessee of Funtley ironmill; both of these works were later taken over by Henry Cort.

Llynn Willies took as his subject “Mining by Bellpits (or where the Weald went wrong!)”. He described how Bell pits were a suitable way of working clay ironstone in Derbyshire. A vertical shaft was sunk and then opened out towards the bottom, piling waste in the centre.

There were a lot of advantages because the shape was stable, there was daylight and it was fairly self ventilating. A lot could be done at once, the waste was stowed and there was no need to find a place to put it. There was no horizontal haulage underground and the mineral was loaded directly with buckets in the shaft. Only a low capital outlay was needed and the work was easily supervised. The method was used in the 13th and 14th centuries and even up to 1700. These pits would be 40’ or even 100 or 120’ in depth. Straker (p 101) describes Bell or Mine pits in the Weald, speaking of 6’ across and 20’ in depth. However, the title of this talk seemed to be a rather obscure joke —since there did not seem to be much difference in the type of Bell pits in the two areas at all.

David Starley spoke about a gun he had examined. It was of white cast iron now entirely penetrated by corrosion. It had been on the Mary Rose and was one of the earliest cast iron one-piece guns from the Weald, dated to 1545 or before.

The columnar grains extending from the outer surface of the gun, indicated outer pouring temperature and a mould of high thermal conductivity. These results were parallel to those of cast iron shot made by William Levet in 1543. It appeared that metal moulds had been used for casting both shot and gun. The making of such moulds for shot is described by Biringuccio in the *Pirotechnia* (Smith & Gnudi 1943, p. 319–321).

The use of such a technique for manufacturing guns has not been previously identified. The gun was known as a ‘Hail Shot Piece’ and was probably not a very successful weapon.

The evening ended with the Chairman **Jill Juleff** telling us about excavations on Exmoor at Sherracombe Forge, whetting our appetites for next year’s conference.

The subject of Sunday morning’s lectures took us “Beyond the Weald”. **Peter Crew** (Plas Tan y Bwlch Centre, North Wales) began with a brilliant talk telling us about ironworking in an 18th century water-powered bloomery in the Basque country, near San Sebastian. The high quality ore in the area had been worked by the Romans and was much imported into Britain during the 13th to 17th centuries; cut blooms were also imported into Britain in vast quantities. They had the advantages of rich low-phosphorus ore, large quantities of wood and abundant water power.

Experiments were begun at a reconstructed ironworks at Agorregi some twelve years ago, and Peter described experimental smelts made in 1994, 1995, and 1999. Historical

evidence suggests that such a small Catalan furnace could make 4 to 6 smelts a day, producing half a ton of refined bloom iron each day. The experimental results with the present installation did not even begin to approach the historical quantities given by available records. It took six hours to produce a bloom of about 35 kilos, which was levered out of the Catalan forge aided by the inclined sides; a 450 lb hammer was used to consolidate the bloom. Much was learnt about the methods of working the furnace.

It was felt that these on-going experiments had considerable value as an important archaeological-historical project, to recover and demonstrate the traditional skills of Basque iron workers; to recover crucial information and to produce educational materials for the illustration of the heritage of the Basque country.

Ruth Brown talked on Iron and bronze cannon. Bronze guns were very much more expensive than those made of iron and gradually the latter took over. In 1603 forty five ships were using 8 bronze cannon to 1 of iron — 1012 bronze guns and 127 of iron. By 1699 there was a complete reversal 114 ships (two thirds of the fleet) contained 296 bronze guns to 8027 of iron.

The morning ended with **Peter King** on the “Output of the U.K. iron industry in the 16th to 18 centuries”, using modern technology, very effectively, to assist the audience in viewing his passion for figures and graphs. He concerned himself with production and consumption.

A knowledge of imports helped to define general consumption but as far as output was concerned it was difficult, if not impossible, to obtain the figures for the tonnage furnaces were making yearly, especially as they were not always in operation.

England had been largely self-sufficient in iron before the Armada, but by 1640 there was an increase in Bar iron imports of Sweden iron.

In the Weald iron production declined to almost nothing after 1700 and they produced only a little for their own use. Imports from Spain were coming in through Hull, Bristol, the South East, the North West, the South West and London. In 1717 an embargo was imposed on iron coming from Sweden which resulted in a shortage of iron and the price shot up. People built new ironworks and the embargo came off as prices fell. In 1720 a large quantity of Russian ironwork was being imported. In 1746 Sweden imposed an embargo on what was exported; but throughout the 50s the price increased as did output from the fineries.

Rapid growth in iron production started in 1785 with the widespread adoption of the Wright and Jessen process in the midlands.

We are indebted to Jeremy Hodgkinson and Tim Smith for organising such an enjoyable conference; and also to Steel Times for so kindly providing wine for dinner.

Amina Chatwin

Archaeometallurgy

Historic iron and steel plant scheduled

Keith Webb has forwarded the excellent news that the Darkhill Ironworks site in Gloucestershire, featured in Archaeometallurgy column of HMSNews 51 has been scheduled as an Ancient Monument (28878) by the Secretary of State for Culture, media and Sport, under Section 1 of the Ancient Monuments and Archaeological Areas Act 1979. The plant is, perhaps, most famous as the site where Robert Mushet conducted his pioneering work on the production of alloy steels.

Medieval bloomery site in West Yorkshire

Evelyne Godfrey has sent details of a newly discovered medieval iron bloomery smelting and processing site at Myers Wood, Kirkheaton, Huddersfield, West Yorkshire which has been excavated jointly by the Huddersfield and District Archaeological Society and the Ancient Metallurgy Research Group of Bradford University. The area investigated during September 2002 encompassed at least one furnace structure and six large slagheaps. Post-excavation analysis is currently under way at Bradford. Archaeomagnetic and radiocarbon dating will be carried out to refine the 13th to 15th century AD date suggested by pottery finds. Initial analytical results of metal and slag (both smelting and smithing remains) from the site indicate a range of products from ferritic iron through to high carbon steel, with several examples of liquid steel 'gromps'. At least half of the iron and steel samples are highly phosphoric. It is believed that the ore smelted at the site was local Coal Measures siderite.

The geophysical survey data, magnetic susceptibility measurements, dating results, and metallurgical /mineralogical analyses will be discussed in a future publication. It is planned that further limited excavation will be carried out at the site in the Spring of 2003. The Myers Wood project has been financed the Heritage Lottery Fund's Local Heritage Initiative. Long-term proposals have been submitted for the interpretation, conservation, and presentation of the site to the public.

Prehistoric mines of the Timna Valley, South Israel

As part of the Mining Park Project in the Timna Valley, further excavations were undertaken in the Chalcolithic mine, Mine T, directed by Beno Rothenberg and Alexandra Drenka, in collaboration with C. Tim Shaw. Originally partly excavated in 1976 by Rothenberg's Arabah Expedition and the German Mining Museum Bochum, a number of major problems had been left unsolved: Firstly the Chalcolithic workings - reworked by Egyptian miners of the New Kingdom - are very widespread, but there seemed to be indications that the prehistoric miners sunk rough shafts into the mineralized sandstone and worked around these openings without planning proper, extensive shaft-and-gallery systems. Secondly ventilation of these workings had remained an enigma.

The recent excavations, which cleared a large additional part of the total area of the previously excavated Mine T (3–5m below surface), helped to solve these problems: There are indeed shafts which had rough steps to make the movement of the miners more convenient, these are in addition to shafts which are just holes in the roof of the mine, obviously for ventilation

and perhaps transport of ore. The Chalcolithic mines were not planned as large systems, but following the mineralization the ancient miners created quite large scale Shafts-and-gallery workings, though not according to any plan. Creating quite extensive, mostly very narrow, openings by following the ore pockets, the miners soon reached a point where breathing was almost impossible. Since this situation was actually encountered during the excavation of the sand-filled workings, an attempt was made to open what looked like an ancient ventilation shaft by clearing the hard sand upwards. This proved impossible. The problem of locating and clearing a shaft from the surface above was solved by knocking at the ceiling of the gallery underground and listening to this sound at the surface above. By this method it was found possible to establish the location of ventilation shafts sunk in Chalcolithic times. Five such ancient shafts were located and cleared - which solved the problem of ventilation of the Chalcolithic mines - and perhaps also of later periods. The present excavators would be interested to find partners in further excavations in the Timna mines. Please contact: Beno Rothenberg IAMS - University College, London

A hobby furnace fuelled on peat

David Cranstone and Paul Belford have recently undertaken an archaeological assessment of a site at Wilson House, near Lindale in Cumbria, claimed (on the basis of Stockdale, an often-unreliable 19th century historian) to have had a blast furnace operated by Isaac and John Wilkinson. Both Wilkinsons were important figures in the 18th century iron industry. Isaac (the father) was responsible for important advances in foundry and furnace blowing technology. John Wilkinson (active from the 1760s to his death in 1808) was also responsible for important technological developments. These included a machine for accurately boring-out cylinders and cannon, and the cupola for remelting pig iron in the foundry. He also became, perhaps the leading ironmaster of his day, with major works at Bradley in the West Midlands, Willey in Shropshire, and Bersham and later Brymbo in North Wales. It was Wilkinson's boring machine and precision casting that made the Boulton and Watt steam engine technically possible.

The assessment found no evidence for a furnace in Isaac Wilkinson's day (though he did live there at one point, and kept ownership). However, to my great surprise, it produced clear evidence, from the Boulton and Watt papers, that John Wilkinson built a peat-fuelled, steam-powered blast furnace in 1778 — this used the second blowing engine designed by Boulton and Watt, which like the furnace, was fuelled on peat. Wilkinson used the furnace for experiments on various fluxes (including, to judge by the field evidence, copper ore!), and it was probably more a 'hobby furnace' than a serious producer - it does not appear in any of the late 18th century furnace lists compiled by Boulton and Watt, and may only have been used in 1778. What appears to be the furnace complex is shown, together with an adjacent model farm, on several maps from 1807 and before, relating to the Enclosure of the parish. The site evidence shows that several buildings from Wilkinson's time survive, including two open-sided buildings supported by cast-iron columns (one in the farm complex, the other perhaps a peat store for the furnace), and perhaps part of the casting house of the furnace. A number of cast iron waterpipes (some marked 'Wilkinson 1784') are also used as supports for Dutch barns and other buildings, but so far these all seem to come

from post-1807 contexts. No slags have been located so far, but there are a few fragments of iron incorporated into later walls, one of them with copper staining weathering out; the pipes and columns may have been produced on site, but may have been imported from of Wilkinson's other works. The metallurgy of peat-smelted iron, and of iron smelted using copper ore as a flux, is intriguing!

Access2Archives

David Cranstone would like to draw to the attention of members interested in historical research the 'Access to Archives' (A2A) project being developed by the Public Record Office, British Library, and Historical Manuscripts Commission. This website contains a searchable database of archives in County Record Offices and other repositories, at catalogue level of detail. The archive can be searched by name (person or place), date, repository, or region. Data is being entered under the auspices of a number of specific projects; some are already completed, and others are in progress.

Potentially this is an enormous aid to finding one's way through the mass of archival material available in Record Offices, libraries etc, and already it can save a great deal of time, and throw up material in unpredictable locations where only luck or extreme diligence would otherwise reveal them. However, at present it comes with three health warnings. Firstly, the entries are catalogues, and mostly created by inputting pre-existing paper catalogues (inevitably of variable quality) — so a name search will only identify the document if the name is included in the catalogue entry. Secondly, the search will only look for the name as spelled, so for older records a bit of ingenuity is needed to search under all the possible spellings! Thirdly, at present the database is far from complete, so many Record Office holdings are not yet on it; for example, a search under 'Duddon' threw up a number of Lancashire Quarter Sessions entries relating to Duddon Bridge (which would otherwise have taken a trip to Preston and several hours of catalogue searching to identify), but not the Duddon Furnace accounts which are also in Lancashire Record Office. The database is therefore an invaluable timesaver for searching those archives that are in it, and a quick way of identifying material in locations where it could never have been predicted; but it is not yet any substitute for the old-fashioned legwork of contacting all the Record Offices where relevant material might be expected, and trawling through the catalogues!

Access2Archives can be found on the Web at <http://www.pro.gov.uk/archives/A2A>

Industrial remains at Whitby Abbey

An article by **Martin Wainwright** in the Guardian reported on unexpected discoveries at Whitby Abbey on the North Yorkshire coast. Far from being a site of peaceful seclusion, the Abbey was the scene of large-scale industrial activity. A 34-strong team of archaeologists has uncovered lead-smelting furnaces, iron-working slagheaps and glassmaking workshops close to the remains of the Anglo-Saxon abbey's walls. An entirely unexpected prehistoric round house, dating back to the second century BC, also suggested that the windblown site had been a thriving, partly industrialised community for centuries before the Northumbrian saints arrived.

Portable iron re-melting furnaces sought

J.L. Frusha is trying to locate information and pictures of the design, construction and operation of the remelt furnaces used by Tinker-Molders', of England. His goal is to make and use one of these furnaces which were apparently used from the mid 1700s and into the 1800s, until the cupola became widely available. The only known reference is 'History of the Metalcasting Industry' by Bruce Simpson (p. 156).

The description states they were about 24 inches high and 9 inches in diameter, made in two sections and the entire furnace was tilted to pour. The entire outfit may have been light enough to transport in a wheelbarrow. Scraps of iron and steel were used for some castings, but the majority of the metal would have been from the item to be re-cast. His understanding is that they were fired with charcoal. It is assumed that the units were constructed of fire clay, possibly externally reinforced with iron bands (as were the small experimental converters used in the development of the Kelly/Bessemer process). If anyone can help, please contact: J.L. Frusha, #22 Branding Iron, Commerce, Texas 75428 <phrogjlf@netscape.net>

Any contributions to next issue by 23rd February to:

David Starley, Royal Armouries, Armouries Drive, Leeds, LS10 1LT. UK. Tel. (0113) 220 1919, Fax (0113) 220 1917, email david.starley@armouries.org.uk

NEWS FROM HMS COMMITTEES

HMS Archaeology Committee News

At the most recent HMS Council it was suggested that this newsletter could provide the membership with details of the activities of individual committees. The Archaeology Committee is an active group comprising members with a particular interest in early metallurgy. The current membership includes field archaeologists, those who investigate or conserve artefacts in museums or for government bodies and university-based academics with a special interest in archaeometallurgy.

Committee members are currently involved in producing a Research Framework. This aims to provide an overview of the extent of our knowledge of sites of archaeometallurgical importance and to provide guidance to those involved in planning process, whereby further sites, if threatened, can be protected or investigated appropriately. Other areas where committee members have been involved to promote a better understanding of archaeometallurgy include: arranging meetings, such as the recent Ironbridge event; running courses, for example, "slag days" and the production and distribution of a series of data sheets.

The Committee has recently reviewed its membership rules. This will restrict its size to 12, and the period of service to two years, renewable to a maximum of four, before an enforced break of one year. It is hoped these changes will ensure that the group remains enthusiastic and productive. The changes also provides a regular opportunity for new members to join. Membership is by invitation of the committee and endorsement by council. Anyone who feels they would like to contribute to the work of the committee should contact the chair, David Starley (see Archaeometallurgy column) or Secretary, Vanessa

Fell (English Heritage Centre for Archaeology, Fort Cumberland, Eastney, Portsmouth PO4 9LD).

MORE ON COALBROOKDALE

IN HMSNews 51 we published a report on the Meeting at Coalbrookdale. I should like to apologise to the Senior Archaeologist at the Ironbridge Gorge Museum Trust — Mr **PAUL BELFORD** who was referred to as Paul Bedford

(Editor)

Correspondence

Members may like to know that I received a most interesting letter from member Alan Batty M.B.E. from Yarm Cleveland, following this report:

(Editor)

“Your comments on the early days of Coalbrookdale and some of the early stalwarts of the HMS and on Reg Morton, who did so much for the museum, bring back many memories for me. Many years ago we had our meeting at the Bilston Steelworks and we also saw the Blast Furnace.

After the meeting I gave Reg a lift home and we arranged that we would take me into the Tar Tunnel when I came down for a meeting at Ironbridge two weeks later. When I rang him up a few days before the visit I was most distressed when his wife answered the phone to tell me that he had died and the funeral had taken place that day. She told me that he had a severe heart condition and had to make a decision, either to become an invalid or to carry on doing what he loved doing with the possibility that he could go at any time. A lovely man and greatly missed.

I also have many happy memories of meetings and visits with the many contemporaries of mine whom you mentioned, sadly only a few of them are still with us. I still have in my archives, the original letter from Ronnie Tylecote inviting me to join the new Society being formed, which became the HMS, for an annual subscription of 5/- per year! I look back on the many splendid conferences we shared over the years. I am sorry not to be able to attend the meetings and conferences as at 87 I am not as mobile as I used to be but miss my many HMS friends.”

Alan Batty MBE

Sir James Hope and his travels abroad looking at metallurgical processes

At the back of the Fieldnotes for the Conference were printed an appendix about the diary of Sir James Hope from the Scottish Historical Society 3rd Vol ‘L’ Miscellany (9th Vol) 1958 p. 127–197.— this describes the Bardown Furnace in the Weald and its working. **Richard Deveria** of Lindisfame House, Corbenic Camphill Community, Trochry, Dunkeld, Perthshire Scotland PH8 ODY has been kind enough to send further notes on Sir James Hope.

Sir James Hope, a Scottish metallurgist, was born in 1614 into a family of lawyers and graduated from Edinburgh University in 1635. In 1638 he married Anna Foulis, who had inherited the lead mines at Leadhills, Lanarkshire from her father. Hope actively developed the property, and his visit to the Netherlands was in connection with a five year contract to export lead ore.

En route through Kent he visited Bardown furnace, Tonbridge, and his description of the iron furnace is widely quoted in Henry Cleere and David Crossley, "The Iron Industry of the Weald", 1995, Chaps. 8-10. At the end of his visit (11th March 1646) he placed an order with John Brown,

“maister of the foresaid yron milnes, to cause to make to me tuo yron plaites of forestones for my leid furnaces, each of them tuo inches thicke, 24 inches long and 20 inches broad, which he promised to have in reddiness for me at London against my return”

During his time in Holland Sir James observed and recorded a wide variety of enterprises, but of metallurgical interest is his meeting in Amsterdam, on 8 April, with Peter Hexe, a German metal refiner. Hexe had been given by Jacob Scott, a Dutchman of Scottish parentage, and several other Dutchmen, a piece of lead ore which had been discovered near Cologne, for assay. Hexe claimed that the ore contained ‘12 lottes’ (6 oz) silver in 721b weight, i.e. 1 part in 192. Hope was given a piece of the ore to test and assayed it as follows: -

“I took tuyce 6 deniers (24 deniers = 1oz) weighing above a quarter oz the peace, and passes them upon tuo severall copelles in ane assay furnace which was there, of the which came tuo small graines of silver, which being compared together weighed exactlie alyke, and together did weigh the one eighth part of one of the assay grains whereof I had taken 12 deniers (24 grains = 1 denier)

That is, 1 in 8x24x12 or 1 in 2304. As Sir James concludes:- “so that by his report it should hold preceislie twelve tymes more than I found it”

Considering there are 576 grains to the ounce, this corresponds to 20.34 grains to the gram or 1 grain= approx. 48 milligrams. To weigh one eighth grain accurately, as Sir James did, that is only 6 milligrams, indicates the availability of remarkably accurate scales in 17th century Holland.

On 11 April Hope met Jean Meinershagen, a master of lead works at Cologne and they discussed the mining and furnace operation. The furnaces were 7 or 8 feet high, 2 and a half feet broad and 3 feet long. The back and sides were built 3 - 4 feet thick, and the furnace would last a year.

The furnace was charged from the top and the metal and slag emerged from a single taphole at the base. The two phases passed through two sumps in series and any slag which contained metal was recirculated to the furnace.

By 25 April Hope had proceeded south to Liege where he gave a description of an iron rolling and cutting mill:-

“Then they had yron of about ane inch thicke and four inches broad cut into peeces of three foott longe, which being made varie hole in an oven aire founace, one man takes them out of the fomace, a second passes them thorow the rowers (rollers), and so reduces them to the desyred thickness and breadth. A third receaves from that, and enters them into the cutters, where they passes thorow, and in the passing are cutt into 13 strings, where a fourth receaves them and lays them by in ordor”

Outside Liege (28 April) Sir James visited and described plants for the manufacture of sulphur and ferrous sulphate. He later visited an alum works and a refinery for cast iron. He returned to England on 10 May.

Sir James Hope later acquired the silver mines at Hilderston and, in 1659, the Airthrey copper mines near Stirling, but died in 1661, shortly after another visit to the Low Countries. The fortune he made from lead mining later went to finance the construction of Hopetoun House, South Queensferry, Edinburgh.

He lies in Cramond Kirk, Edinburgh; his bust is situated on the wall of the nave and from the epitaph on his gravestone we may quote the following lines:-

He was and by ingenious art could pry
In nature's deepest secrets and discrye
Where earth the massive treasures had conceai'd
Which in her frozen entrails had congealed
Great mineral works he always did maintaine
Which was his countries honour and its gaine
And all the riche endowments of his mind
Were still for publick peace and wealth combin'd"

Richard Devera.

(Hopetoun House designed by Sir William Bruce with an Adam front and side wings has a fine contemporary wrought iron "back" stairs by William Aitkin; and a gate is illustrated in Bayley S Murphy. Editor)

ANNIVERSARY OF THE THOMAS CONVERTER

The archivist at Thiessen Krupp Steel is looking for a speaker on the Thomas Process in England for a conference being organised in Germany in the Spring to commemorate the 125th anniversary of the adoption of the process.

If anyone has first hand knowledge of Thomas Converter steelmaking, or knows of anyone with such a background, could you please contact Tim Smith on Tel (0)1403 710148 (h) or by E-mail to tjsmith@waitrose.com.

HONOUR FOR AMINA

On Oct. 3rd at the Painter Stainer's Hall in the City Amina Chatwin was made a Companion of the Worshipful Company of Blacksmiths, for services to Blacksmithing. She is the first woman to receive this honour. The Company, which was incorporated in 1325, did much to regulate the trade in the past and continues to work closely with blacksmiths.

WEALDEN IRON RESEARCH GROUP

The group's latest annual Bulletin, Wealden Iron, (2nd series, volume 22) contains important new evidence of 15th century iron working in Buxted. References in manorial documents and in the records of the commissioners of sewers suggest that a blast furnace and forge were being operated before 1500 on the site known as Iron Plat. It is possible that this site may pre-date the one at Newbridge, hitherto the earliest documented example in England.

Other articles deal with two medieval bloomeries associated with settlement sites in south Surrey; with the re-dating, to between October 1570 and November 1571, of a document containing a list of furnaces and forges in Framfield manor; and with the recording of a cast iron graveslab, additional to the existing catalogue, in the churchyard at Foots Cray, Kent. An unusual ledger stone with a wrought iron cross, at the redundant church at East Peckham, is also noted. The Penkhurst family's involvement in the iron industry is elaborated in another short article.

Ironmaking in the Weald in the 18th century is the subject of two articles. In the first, the working life of forges and their production in the early part of the century is described. In the second article, the factors of production — location, transport, raw materials, technology and labour — of furnaces in the middle of the century are discussed in some detail.

Field notes record the discovery of bloomery sites in Beckley, Brightling, Burwash and Hartfield in East Sussex, and in Kirdford, West Sussex.

Jeremy Hodgkinson

FORTHCOMING NEWS

I am sorry you will have to get out your magnifying glass for this issue, but glad to be having such a good input from members. Thank you all for your contributions. Some items have had to be held over to the next news; these will include an article by Christopher Morley on Worley Top Forge and one on the examination of a Crucible Steel Mirror in the British Museum by Paul Craddock and Janet Lang.

The Hon. Editor Amina Chatwin, The Coach House, Parabola Close, Cheltenham GL50 SAN. Tel 01242 525086 Welcomes contributions for HMSNews by, the end of February, June 11th, and November 5th. If possible on ascii.

Membership Secretary, Mrs Lesley Cowell "Little Gables" 17a Thorncote, Northill, Beds, SG18 9AQ. Direct e-mail address is: lesley@mcowell.flyer.co.uk.

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