HMSNEWS

Historical Metallurgy Society
76 Autmn 2010

From the Chariman

The twelve months since my last 'Chairman's Letter' have seen steady progress in all areas of the Society's activities. The events organised by HMS over the last year included the **Research in Progress 2009 (RIP09)** event, which was integrated with the archaeometallurgy conference held in Bradford last November, the Archaeology Committee's **Prehistoric Archaeometallurgy in Scotland**, held just before Easter, the **HMS Spring Meeting** in Cumbria in May, the **HMS Annual Conference** at West Dean in September and, most recently, the **Research in Progress 2010 (RIP10)** meeting held at UCL on November 10th. All of these meetings, which have been reported on in detail elsewhere in the newsletter, proved to be enjoyable and very stimulating.

The changes to the committee structure which started two years ago are now essentially completed and in many cases have now taken strong root.

The **Archives & Collections Committee** has been particularly busy with online publication of the National Slag Collection, the archiving of the Tylecote paper archive, progress towards finding a more permanent home for the Tylecote metallographic specimen collection and, currently, the cataloguing of the Society's book collection.

As announced last year, the **Archaeology Committee** is currently engaged on an ambitious programme of updating and expanding the range of 'datasheets', which provide practical advice in many areas of archaeometallurgy. The committee has also published a short introduction to archaeometallurgy in archaeological projects on the BAJR website (www.bajr.org).

The **History & Recent Metals Committee** is still in the process of finding its feet, but will be playing a leading role in the organisation of the Society's annual conference in September 2011, which will engage with various aspects of the iron and steel industry in South Wales, but with an emphasis on the 20th century. Further details of this exciting meeting will be available shortly.

The **Publications Committee** are now in the satisfying position of having several 'Special Publications' arising from recent conferences in the process of editing and production.

The **Membership, Publicity and Programme Committee** is actively developing the programme for several years ahead, including events to mark the forthcoming 50th anniversary of a foundation that evolved into HMS.

It is particularly pleasing to see the involvement of some of the younger members of HMS on the MPP Committee. The moves made by the Society to involve the younger generation also include the continuation of the annual Research in Progress meeting series with postgraduate student organisers and the award at that meeting of an annual prize from HMS for the best presentation by a current or recent student.

The first recipient of the prize, as previously reported in the newsletter, was Jui-Lien Fang, for her presentation at RIP09 on the colour of copper alloys. Younger members were also very much in evidence at the West Dean Conference, where the success of the programme of experiments was very much due to the efforts and energy of the students. Here too the vitality of the research undertaken by younger members was clearly in evidence.

The development of the Society, however, does not only rest with the recruitment of new faces, but also with expanding our range of collaborative activities. Alongside the rebirth of the History & Recent Metals Committee, we are seeking to re-establish links with IOM3 (the Institute of Materials, Minerals and Mining), with whom we not only have historical connections but much overlap of interest. It was gratifying that Hilda Kaune was able to come to West Dean on behalf of IOM3 and I hope the development of links will be of benefit to both organisations. HMS is also hoping that the 2011 Annual Conference will include some joint sessions with the Historical Committee of the VDEh (Verein Deutsche Eisenhüttenleute).

The coming year has a strong programme of events which looks set to be exciting as well as diverse. As always, however, the more we do, the more support we need and anyone who feels they have something to offer to any of our activities and committees is encouraged to get in touch. This will be last of my annual letters as Chairman (my four years will end with the AGM in Helmsley next June) and I would like to extend my personal thanks to all those who have dedicated so much time and effort to HMS over that period.

Tim Young

Spring Meeting 2011 and AGM

Royalty, Religion and Rust!

4th-5th June 2011
Helmsley, North Yorkshire

A meeting on the metallurgy of
. Royalty and High Status sites/artefacts
. Ecclesiastical or Religious sites/artefacts

For more information see http://hist-met.org/agm2011.html

Includes a guided field trip to nearby Rievaulx Abbey and Helmsley Castle, with a particular focus on the production and use of metals at the sites.

The next edition of the HMS Newsletter will be published in March 2011. Contributions are welcome and should be

Sourcing Lead used in the Peak District during Prehistory.

Prehistoric lead objects are rare in Britain. However two are known from the Peak District both dating to the Iron Age. The first, shaped like a bronze axe, was found at Mam Tor during archaeological excavations in the 1960s (Combes and Thompson 1979; Guilbert 1996). The other is a uniquely designed lead object, which may be one terminal of a torc, found in the late 1990s in a pit in the centre of the site of a large Early Iron Age house on Gardom's Edge, during excavations that to date have only been reported in summary (Barnatt *et al.* 2002).

To add to growing lead isotope data which can potentially help source the metal used, samples were taken from both objects and analysed by Jane Evans at BGS (for technical details of the method employed see Pashley and Evans) and kindly paid for by the Cultural Heritage Team at the Peak District National Park Authority.

The results show that the lead is likely to derive from either the Southern Pennines or the Mendips but not the Northern Pennines nor Ireland. Given that both objects were found within only 1 to 4 km of their nearest local ore sources and that the limestone plateau of the Peak District is one of the main lead orefields in Britain, it seem most probable that ores mined here were used, although this cannot be currently demonstrated from the lead isotope data.

For the benefit of future researchers who analyse further samples, the details of our results are:

Mam Tor (batch P470:10):

Pb^{206}/Pb^{204} – 18.4718 (2σ – 0.011)
Pb^{207}/Pb^{204} – 15.6469 (2σ – 0.013)
Pb^{208}/Pb^{204} – 38.4619 (2σ – 0.021)
Pb^{207}/Pb^{206} – 0.84707 (2σ – 0.003)
Pb^{208}/Pb^{206} – 2.08219 (2σ – 0.011)

Gardoms Edge (batch P470:9):

Pb^{206}/Pb^{204} – 18.4880 (2σ – 0.011)
Pb^{207}/Pb^{204} – 15.6434 (2σ – 0.013)
Pb^{208}/Pb^{204} – 38.4599 (2σ – 0.022)
Pb^{207}/Pb^{206} – 0.84614 (2σ – 0.003)
Pb^{208}/Pb^{206} – 2.08025 (2σ – 0.012)

References

Barnatt, J., Bevan, B. and Edmonds, M. 2002 Gardom's Edge: a landscape through time. *Antiquity* 76, pp. 50-56.

Combes, D. and Thompson, H. 1979 Excavation of the hill fort of Mam Tor, Derbyshire, 19650-69. *Derbyshire Archaeological Journal* 99, pp. 7-51.

Guilbert, G. 1996 The oldest artefact of lead in the Peak; new evidence from Mam Tor. *Mining History* 13.1, pp. 12-18.

Pashley, V. and Evans J. A. n.d. The Lead isotope composition of artefacts from the Peak District and Cu alloy from Greece. NIGL Report Number R239.

John Barnatt and Roger Doonan

Cast iron from Brunel's Paddington bridge

Isambard Kingdom Brunel's bridge at Paddington was recently saved from destruction (see HMS News 56). This was Brunel's first iron bridge and carried the approach road to Paddington station over the Grand Union canal. Brunel's bridge was obscured by brick work added at the beginning of the 20th century. Although plans were made to reconstruct the bridge a few hundred metres down the canal as a foot bridge, the remains of the bridge remain in storage at Fort Cumberland in Portsmouth (where they resemble an enormous meccano set).

Cast iron was used for the construction of bridges from the late 18th century until the end of the 19th century. A series of disastrous railway bridge collapses (the Dee bridge in 1847, the Tay bridge in 1879 and the Norwood junction bridge in 1891) led to the abandonment of cast iron for bridge construction. With hindsight it can be seen that many of the bridge collapses were due to inappropriate designs. Cast iron has excellent physical properties when under compression but too many 19th-century bridges used cast iron in situations where it was under tension. The survival of Brunel's bridge at Paddington owes much to the design in which almost all parts of the bridge were under compression.

Figure 1. Philip Davies (left) and Dr Steven Brindle of English Heritage inspecting Brunel's bridge in 2004

Inevitably some of the bridge components were damaged during dismantling and this has provided an opportunity to undertake metallographic examination. Samples have been taken from three identical cast iron components of the bridge (Figure 1, the lateral reinforcing sections). The samples were mounted in resin, ground and polished and finally etched with nital. The samples are all clearly grey cast iron with abundant pearlite and graphite (Figure 2). In two cases the microstructures are identical, while the third shows slightly smaller graphite flakes which are usually present as distinct clusters (Figure 3). In all three components examined the metal is generally of a similar chemical composition (Table 1) and it is likely that the observed differences in microstructure result from different rates of cooling.

Like all grey cast irons, these samples have sufficient silicon content to encourage the formation of graphitic carbon and sup-

Si P S Ti V Mn

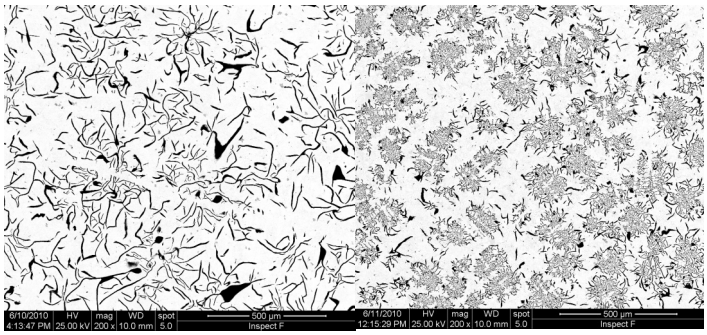

Figure 2. Sample of cast iron from Brunel's bridge at Paddington (M9A/10A). SEM-BSD

Figure 3. Sample of cast iron from Brunel's bridge at Paddington (N4A/15A). SEM-BSD

press the formation of cementite (Higgins 1993, 356). The matrix is composed mostly of pearlite with some ferrite — usually adjacent to graphite flakes (Figure 4, cf. Rollason 1949, Fig 117). These samples also contain small amounts of phosphorus which is mostly present as iron phosphide (Figure 4). The chemical composition of the iron phosphide is close Fe_3P (84.4wt% iron and 15.6wt% phosphorus). The slightly low phosphorus content is possibly due to the presence of some steadite (ferrite-iron phosphide eutectic). Phosphorus lowers the mechanical strength of cast iron, but increases the hardness and lowers the melting temperature. Phosphorus has been seen as beneficial to cast iron used for complex and thin-walled castings because it increases the fluidity of the molten alloy (Carmen 1949, 207). Nevertheless, the presence of phosphorus in most early cast iron is simply a reflection of the presence of phosphorus in the ore used (Percy 1864).

Sample	C	Si	P	S	Ti	V	Mn	Fe
M9A/10A	4.0	1.1	0.7	0.2	<0.1	<0.1	0.7	91.3
VW64/7A	3.7	1.0	0.8	0.3	<0.1	<0.1	0.6	93.5
N4A/15A	3.8	1.4	0.8	0.2	0.2	<0.1	0.7	91.8

Table 1. Analysis of the three samples of cast iron from Brunel's bridge

Sample	Si	P	S	Ti	V	Mn	Fe
M9A/10A	<0.1	14.7	<0.1	<0.1	<0.1	1.0	86.6
VW64/7A	<0.1	14.4	<0.1	<0.1	0.1	0.3	85.0
N4A-15A	0.2	14.3	<0.1	<0.1	<0.1	1.1	84.2

Table 2. Analysis of phosphide inclusions in cast iron from Brunel's bridge

The Brunel bridge cast iron samples also contain manganese and sulphur, and both elements are usually present as discrete manganese sulphide crystals (Figure 4). Analysis of the manganese sulphide inclusions shows that the composition is very close to MnS, with a small substitution of Fe for Mn (Table 3). Manganese is deliberately added to many modern ferrous alloys precisely to form manganese sulphides (Carmen 1949, 207). In the absence of manganese, sulphur will tend to form iron sulphides and these tend to reduce the strength of the iron alloy.

Overall the proportion of manganese in these cast irons is close to that required to avoid the formation of any iron sulphides and it is possible that the manganese was deliberately added to achieve this end. Manganese had been discovered in the late 18th century and by the early 19th century its beneficial effects on iron alloys had been discovered and various patents issued to cover its use in this way. Manganese is, however, a common impurity in iron ores and much of the cast iron produced in the 19th century contains manganese from this source (Percy 1864).

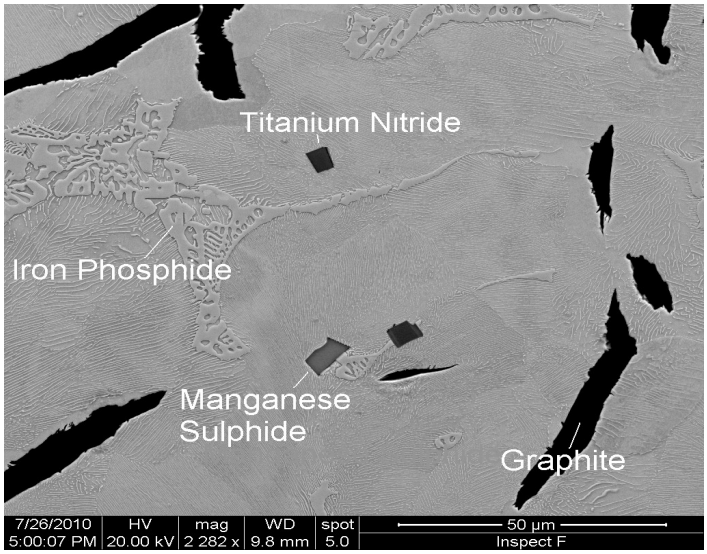

Figure 4. Sample of cast iron from Brunel's bridge at Paddington (VW6A/7A). SEM image back-scattered electron detector.

The Brunel bridge samples also contain rare titanium nitride inclusions (Figure 4), although the small size of these inclusions and the overlap between titanium L (0.45keV) and nitrogen K (0.39keV) lines made their quantitative analysis impossible. Titanium nitride is widely used in modern industries due to its wear resistance properties and biocompatibility. Its presence in steels has been noted and exploited; it precipitates at very high temperatures and so can be used to reduce grain growth. The presence of titanium nitride in the Brunel bridge cast iron is unlikely to be deliberate. The air passing through a blast furnace would be rich in nitrogen and most ores used would contain small amounts of titanium.

The metallographic examination of three samples from Brunel's bridge at Paddington provides information on the nature of cast iron employed in 1838 for a major construction project. The three samples examined are all grey cast irons with only small differences between each sample. The samples all contained small amounts of silicon, phosphorus, manganese and sulphur at concentrations that are typical for grey cast irons. The cast iron for the bridge was produced by Gordon's of Deptford; any information about this company would be wel-

Sample	Si	P	S	Ti	V	Mn	Fe
M9A/10A	<0.1	<0.1	35.4	0.1	<0.1	63.5	3.3
VW64/7A	<0.1	<0.1	33.6	0.1	<0.1	60.3	3.3
N4A-15A	<0.1	<0.1	34.8	0.1	<0.1	62.9	2.4

Table 3. Chemical composition of manganese sulphide inclusions in three samples of cast iron from Brunel's bridge.

References

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David Dungworth

The origins of the Historical Metallurgy Society

The 50th anniversary of the Society is looming, and we will be celebrating this at our conference in 2012. A special committee is being established to help organize this special event, which will provide a good opportunity to look back at some of the achievements of the Society – as well as looking forward to the next 50 years.

In some ways 2012 is an unusual date, for there was no formal organisation until the 'Historical Metallurgy Group' produced its first Bulletin in April 1963. However 1962 was a pivotal year in the history of archaeometallurgy, when several strands of interest in the subject came together. The resulting synergy was the beginning of our Society.

Interest in the historical development of metalworking can of course be traced back to the mid-nineteenth century; Percy's seminal work on *Iron and Steel* contains a great deal of anthropological information and speculation. The formation of the Iron and Steel Institute (ISI) in 1869 provided a forum for information-sharing about the modern industry, but increasingly articles appeared in its *Journal* dealing with historical aspects. The ISI rapidly developed into one of the leading learned societies, and gained its Royal Charter in 1899. In 1908 another learned society, the Institute of Metals, was established to cover non-ferrous metals. Many active industrialists developed interests in the histories of their particular branches of industry. Meanwhile academic historians were also beginning to look at the origins of industrialisation. In 1920 a group of engineers in industry and curators from the Science Museum formed the Newcomen Society to 'promote, encourage and co-ordinate the study of the history of engineering, industry, and technology'. Several important papers on early metallurgical processes and sites were published in the Newcomen *Transactions* in the first few years, including work by T. S. Ashton, H. H. Coghlan, W. K. V. Gale and R. A. Mott. In 1924 Ashton published his study of *Iron and Steel in the Industrial Revolution*, a pioneering work of metallurgical industrial economic history.

Whilst the ISI, the Newcomen Society and others were developing approaches rooted in technological and economic history, archaeologists and others were also looking at metallurgical developments over wider tracts of time and space. The Ancient Mining and Metallurgy Committee of the Royal Anthropological Institute (RAI) had its first meeting on 8th May 1946 which was chaired by H. H. Coghlan. The Committee met infrequently during the 1950s, and its existence was marked by turbulent relationships both internally and with the RAI Council. For instance in 1956 C. F. C. Hawkes was nominated to the Committee apparently without Coghlan's approval. Coghlan wrote to the RAI on 9th November stating that the Committee was already too large and that this situation was leading to personal difficulties, and asked specifically for 'prior information of proposed appointments' (RAI Archive A89/14). Further personal issues seem to have dogged activities, and matters reached a head in 1959 with the resignation of Mary Lamb. Coghlan successfully urged Lamb to stay on, but was prompted to seek a meeting with Marian Smith, then the RAI Secretary, to inform her of 'all that is going on' (RAI Archive A89/24-29). The meeting did not materialise until the following year.

However by the end of 1960 the situation had stabilised, with the Committee's remit and membership being approved by the RAI Council. Smith supported Coghlan's ambition for the Committee to become the centre for the 'metallurgical background of Far and Near Eastern archaeology', and in December R. F. Tylecote was put forward as one of three new Committee members (RAI Archive A89/32-35).

In the same year that the RAI Committee was established in London, a group from Birmingham visited the old furnace in Coalbrookdale at the request of the Shropshire Archaeological Society. Among them was W. K. V. Gale, who initially felt that 'it was too late for anything to be done' to save the recently-exposed furnace (letter of 1950, cited in Darby 2010). The Coalbrookdale Company meanwhile commissioned Arthur Raistrick to write a history, published in 1953, and as a result a concerted effort was made to 'restore' the furnace. This enthusiasm for the physical remains of the early iron industry was supported by a growing wave of academic output, such as Schubert's 1957 history and, later, work by Gale and others. This was part of the emergence of the wider study of 'industrial archaeology', a phrase first deployed by Michael Rix in 1955 who was then teaching with the Workers Educational Association at Birmingham University (Raistrick 1953; Rix 1955). Studies of canals by L. T. C. Rolt and Charles Hadfield in the 1940s and 1950s were followed by the monumental five-volume *Oxford History of Technology*, published between 1954 and 1958. Another key figure was G. R. ('Reg') Morton, then teaching at Wolverhampton Polytechnic, and later instrumental in developing the museum at Ironbridge (Cossons 1979). In 1959 the restored furnace at Coalbrookdale, and a small museum, was opened to the public. The opening was accompanied by a conference which included contributions from Gale and Raistrick, as well as T.S. Ashton, B.L.C. Johnson and R.A. Mott (Darby 2010). This academic interest was echoed by increasing public enthusiasm for the monuments of industrialisation generally, which was most prominently articulated by the ultimately unsuccessful campaign to save the Euston Arch, launched in 1959.

So by the early 1960s, three groups – with quite different backgrounds, but overlapping interests – had already begun to share the same path. Indeed many of the most active members in all groups were the same people: R. F. Tylecote, W. K. V. Gale, G. R. Morton and H. H. Coghlan, amongst others. These three strands: archaeology, history and industrial metallurgy still form the core of the Historical Metallurgy Society.

Two events took place in 1962 which were the catalyst for the formation of the Society. In March the RAI Ancient Mining and Metallurgy Committee decided to prepare a paper for the 6th International Congress of Prehistoric and Protohistoric Sciences, which was being held later that year in Rome (RAI Archive A89/48). The paper, on analytical research methods and the need for international collaboration, was published ahead of the Congress in the RAI Journal; its contributors included Coghlan, Tylecote, Leo Biek and Janet Butler (Coghlan *et al.* 1962). Meanwhile, in June, G. R. Morton published a paper in the *Journal of the Iron and Steel Institute* on the blast furnace at Duddon, in which he called for 'urgent action' to save the physical remains (Morton 1962). The following month a group including R. F. Tylecote, wrote to the ISI endorsing Morton's sentiments and arguing that 'something should be done'. The letter went on: 'It is high time that a group of interested people got together with the intention of producing a survey of all sites

… we obviously need … some sort of metallurgical preservation society' (cited in Doncaster 1989, 112). At the end of the summer Tylecote and Coghlan went to the Rome meeting, but they were disappointed with the outcome. Coghlan wrote to A. H. Christie (who had succeeded Smith as RAI Secretary) in September, stating that the Congress had not been a success: no conclusions had been reached on 'analysis and their correlation in respect of the non-ferrous ores and metals'. The RAI therefore decided to develop its own conference specifically on this issue for the following year, although the Committee was not able to discuss this until December (RAI Archive A89/50-51). At around the same time, 'Tylecote spoke to Henry F. Cleere (then at the Iron and Steel Institute)... about forming a [Historical Metallurgy] Group ... [which] came into existence between December 1962 and April 1963' (Doncaster 1989, 112 -113).

Cleere's ongoing excavation of a Roman bloomery at Wadhurst in Sussex was featured in the first Historical Metallurgy Group (HMG) *Bulletin*, edited by Tylecote and published in April 1963. The Bulletin also included a table of blast furnace sites. Meanwhile the RAI Committee, at that time still chaired by Coghlan, had been discussing their conference and had set a date in October. The conference, which had numerous overseas delegates – some from behind the 'iron curtain' – was clearly a success, and at its conclusion Coghlan stood down as the Chairman of the RAI Ancient Mining and Metallurgy Committee (RAI Archive A90/1-57). His replacement was Tylecote, who later that year was in discussion with Cleere about the composition of the Committee; he also wished to set up an iron subcommittee (RAI Archive A89/55-56). The December HMG *Bulletin* included further additions to the list of blast furnaces, as well as reports of excavations which had taken place in that year. It also noted the sad loss of Maryport blast furnace without record, although members of the Group had 'interrogated the demolition workers with not very successful results' (Tylecote 1964, 6).

By mid-1964 it was clear that the existence of the HMG as part of the ISI was detrimental to the continuation of the RAI Ancient Mining and Metallurgy Committee. In May 1964 Tylecote (in his capacity as chair of the RAI Committee) wrote to RAI Secretary A. H. Christie noting that the HMG was considering enlarging its activities, and that members of the RAI Committee had 'a sense of urgency about the future' (RAI Archive A89/57). Tylecote, Coghlan, Morton and others were of course well aware of the activities of the HMG. They had met 'over the Whitsun holidays' in 1964 and agreed a working committee to establish the Historical Metallurgy Group as a formal entity, with the first Annual General Meeting planned for Easter 1965. Tylecote was Secretary of the new group, G. R. Morton the Chairman, and Coghlan was the 'Southern Regional Secretary'.

Although the aim of the HMG was to 'encourage the study of the prehistory and history of metallurgy ... and to co-operate ... with other organisations working in the same field', there was evidently no room for the two organisations. Indeed Tylecote later remarked that the HMG had been created to replace the RAI Committee (RAI Archive A89/91). Whether intentional or not, the effect of the existence of the HMG meant that the RAI Committee never actually met after 1963, and, despite periodic efforts to revive it, was wound up in 1971 (RAI Archive A89/91-102).

The HMG on the other hand went from strength to strength, becoming the Historical Metallurgy Society in 1974. At this time the Iron and Steel Institute merged with the Institute of Metals (also absorbing the Institution of Metallurgists which had been founded in 1949); this created the Metals Society, which was the forerunner of the IoM3 with whom HMS remains affiliated.

This brief 'prehistory' of the Society no doubt contains errors; some members will still remember the events of those early days and many more will remember some of the participants. The definitive history of the Society is yet to be written, but at least the recent projects by the Archives and Collections Committee have resulted in a well-stored and fully catalogued archive so this subject can be explored in the future. The 2012 conference will of course provide opportunity for further discussion. '

Currently work is underway to compile a complete list of officers and committee chairs that have served the society since its early days. Whilst there is a plethora of paper evidence to glean this information from some information remains elusive especially in the early years of the society. To this end the author would welcome any information, memories or other sources of evidence which would help in establishing the history of our Society. If you do have any comments on the foregoing account, or other information relating to the Society's early days, then please email the author at paulbelford@ymail.com.

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Paul Belford

An Appeal From the Membership Secretary

Does anyone know the whereabouts of ***M. Florian Sarreste***, formally living in Tours, France?

If so could you please let the membership secretary have a contact email address or telephone number. Many thanks.

Please forward any information to
Membership Secretary, Mrs Lesley Cowell,
"Little Gables" 17a Thorncote, Northill, Beds, SG18 9AQ.
Email: lesley@mcowell.flyer.co.uk

Recent Conferences

'Polluting the environment in Antiquity'

University of Glasgow, September 7-8 2010

The organisers struck a chord with this conference theme. Hosted by Glasgow's Archaeology Department, the meeting saw 21 speakers from across Europe. The subject matter varied widely from developed case studies to analytical methodologies, but a clear common focus demonstrating that pollution-based research is very much an ascendant field and a timely addition to the wider heritage management disciplines. Metals-based studies constituted a substantial proportion of the papers offered but, as often pointed out, metallurgical industries can profitably be considered alongside their less pollution-prominent neighbours for a better understanding of the social context and spatial organisation of production.

Brendan Derham provided an introductory overview of the scope and potential of pollution archaeology, asking us to consider the ways that past human agricultural, industrial, and settlement activities may have left a detectable pollution signature within the landscape, but at the same time highlighting the amount of work that needs to be done to understand how these signals are diminished or modified by the passage of time. Sorina Spanou offered a local perspective with her report on the insights and challenges faced with the ongoing M74 roadworks cutting through the previously heavily industrialised districts of southern Glasgow. Effie Photos-Jones's spoke about how synergies can be found in the site evaluations of commercial archaeologists and Contaminated Land Consultants (CLCs).

Michael Given questioned the idea of 'pollution', pointing out that in Cyprus local informants felt that their discarded pot-sherds and slag tied them to their land and provided a sense of identity. Although difficult to extend into the past, he noted the significance afforded to the slag deposits in NW Cyprus.

Of particular interest to the readership, Andy Meharg's research on British tin exploitation using dated lead, tin, and copper pollution episodes in bog cores from Bodmin and Dartmoor. Significant peaks were detected for Roman and Saxon production but interestingly Meharg also provided a calibration of the pollution signal from historic records, indicating a lower threshold below which Bronze Age production could fall. Questions highlighted the issue that mining alone will not mobilise the heavy metals that result in atmospheric pollution, recognising that British tin ores could have been smelted elsewhere.

Further archaeometallurgical studies were offered by Roger Doonan and John Grattan. Doonan's paper concentrated on the efficacy of hand held XRF surveys to rapidly map elemental distributions at high resolution (<1m) across mining landscapes. Grattan's work in the archaeometallurgically renowned Faynan region of Jordan also used hand held XRF to provide highly economical assessment of the ongoing environmental impact of ancient metal production at scales ranging from the thousands of square kilometres to the process of modern food contamination with a Bedouin kitchen.

Finally, Richard Jones summarised the findings of pollution studies from across the Aegean to address issues surrounding the social organisation of production, and suggested possible avenues for future research in the region. A conference proceedings is in the offing and promises to be essential reading!

T. O. Pryce

Accidental and Experimental Archaeometallurgy

The HMS Annual Conference,
West Dean 2-3rd September 2010

This year's conference, held at the beautiful 19th century estate of West Dean College on the South Downs, was organised by David Dungworth of English Heritage and Roger Doonan of Sheffield University and brought together practitioners and academics involved in the field of experimental archaeometallurgy. The conference was arranged over two days, with oral papers on iron production and theoretical models on Thursday morning and non-ferrous metallurgy on Friday afternoon. Experimental work took place on Thursday afternoon and Friday morning.

Papers in the first session explored a number of concepts within experimental archaeometallurgy. David Dungworth discussed a variety of issues in modern experimental work, highlighting tensions in the relationship between the scientific methodologies adopted by researchers such as Tylecote, and the more experiential undertakings of more recent experimenters. Roger Doonan built on this by exploring how archaeologists can establish a theoretical framework in which to undertake experimental work, exploring the justifications for experiential approaches.

David Dungworth also raised the spectre of gender bias within the practice of experimental archaeometallurgy. Whilst a gender-gap was not particularly visible in the attendees at the conference, it was remarked that there were only a handful of female experimenters, none of whom were running their own projects. When David asked for responses as to why this might be, the rather predictable response of 'women aren't strong enough to undertake iron smelting' was given by a number of the attendees. Although contradicted by the active involvement of a number of female experimenters and volunteers, this statement indicates the continued survival of negative stereotypes in British experimental archaeology. Doubtless these attitudes contribute to the apparent hesitancy of women to get actively involved in British experimental archaeology, although judging by the attendees a shift to a more age and gender diverse, if not ethnically diverse demographic appears to be underway.

Figure One: The journal editor contemplating the fragmentation of gender in metal production?[ed]

Session two incorporated papers on iron metallurgy, with subjects from the Dogon smiths of Mali by Raphaëlle Soulignac of the University of Fribourg, to Anglo-Saxon pattern-welded swords by Tom Birch. Indeed all the contributors for session three – which focussed on bronzes, brasses and assaying - were drawn from beyond Britain, and were joined by attendees from

the Spain, Ireland, Switzerland, Denmark, the Netherlands and even the USA and Australia. The organisers should be praised for drawing such wide attendance, and the resulting community had a rich variety of experience, opinions and theories, access to which proved to be of considerable benefit to experimenters.
Rather than hosting experiments on a specific theme, the conference took the innovative approach of bringing together a variety of experiments on a wide range of topics within metallurgy. The organisers, in particular David Dungworth, worked hard to create the facilities necessary for the numerous and intensive experiments undertaken. In particular with both experimenters and a substantial number student volunteers welcome on site almost a week before the conference began, there was ample time for the construction of facilities and tools as well as the myriad of labours necessary to support the nine experimental groups operating during the conference.

Figure Two Lee Saunder stands in front of his furnace, photograph [David Dungworth]

The experiments were dominated by explorations of archaeologically inspired furnace structures and methods; these included a Romano-British modelled shaft furnace by Roger Doonan; Jake Keen's 4-5m chimney with a hay-packed slag pit developed from African traditions; the smelting copper oxide ores from Alderley Edge by Simon Timberlake; and Brice Girbal's exploration of the performance of different bowl furnaces. Also of note was Gerry McDonnell's experiment in creating cast iron in a bloomery furnace, which appeared to create liquid metal.

Lee Sauder, Shelton Browder and Stephen Mankowski from the US were among some of the most successful experimenters, creating iron blooms on the Wednesday and Thursday afternoons and providing an engaging and informative commentary to their audiences. They also demonstrated an extremely innovative technique for producing small quantities of steel within a very small high temperature enclosure, which has interesting implications for the creation of steel in pre-industrialised societies.
Participants commented on how the close proximity of so many experimenters contributed to an extremely constructive atmosphere and the question of why experimenters don't work together was repeatedly raised. Indeed it seemed quite clear that experimenters work better when together, able to draw on a gestalt of expertise, as well as access additional labour, tools and materials. A repeat of this conference, or a similar organised experimental event, could offer real benefits to experimenters, particularly those with limited experience.
Perhaps the only disadvantage of such a structure is that the experiments did occasionally run towards what David Dungworth identified as 'theatre'. This is perhaps the inescapable result of presenting 80 enthusiasts with the excitement of successful bloom smelting and smithing.
Despite this, it was clear that the conference facilitated experimental work that attendees would have had difficulty undertaking away from the financial and physical support of the conference. This sort of support and advice is vital if the flow of a younger and more diverse demographic into experimental archaeology is to continue, and the conference organisers should be congratulated on their efforts to encourage and incorporate students and early career researchers.

Conference proceedings will be published in the future, and there is currently a call for videos and photographs from the conference to be sent in to HMS. In line with suggestions by Peter Crew, one of the presenters, it is hoped that an archive of experimental videos and recordings will be created at Ironbridge Museum, home of the national slag collection. HMS also plans to release a DVD of the experiments alongside the proceedings, which should describe those aspects of experimentation hard to express with text, as well as being a useful reference for those undertaking their own experimental work-

Figure Three: Brice Girbal with one of his experimental bowl furnaces, photograph courtesy of David Dungworth

Ruth Fillery-Travis

Wealdon Iron Research Group

WIRG continues to be a very active society with its Bulletin having a recent make-over. It continues to include the usual mixture of fieldwork discoveries and lengthier articles. Notices of no less than ten newly-discovered bloomery sites feature in the opening pages, all are in East Sussex. Of particular interest is a site in Hartfield parish which has produced a Saxon C14 date. Charcoal recovered during a trial excavation trench, has been countered by the discovery of late Iron Age or Romano-British native pottery from the same site. Further excavation will be undertaken to establish from which period the site dates.
Burwash Forge had an operating life from about 1523 until as late as 1810, making it the longest continuously working iron site of the post-medieval period in the Weald. The documentary evidence is detailed in an article, together with its literary connections. Rudyard Kipling lived nearby, and the activities of the Collins family who ran the forge and its associated furnace at Socknersh, appear in the celebrated author's book, *Puck of Pook's Hill*.
Pot founders were a skilled branch of the casting trade, and a number of them appear in the historical record in the Weald in the 16th and 17th centuries. Their identities and associations are outlined in a short article. The locations and descriptions of cast-iron graveslabs in Wealden churches receive periodic notice, and a recently discovered plate at Chailey, in East Sussex, is duly recorded in a short note.
Finally, the physics of waterpower are considered in an article which examines the power necessary to operate blast furnaces and forges. The dimensions of waterwheels, bellows and tuyeres are discussed with reference to archaeological and documentary evidence.
Further details of the Wealden Iron research Group, its publications and activities can be found at www.wealdeniron.org.uk.

Jeremy Hodgkinson

Archaeology Committee News.

The Archaeology Committee has had a busy year, keeping a watchful eye on new legislation and changes to policy and practice, and also continuing to provide a link between archaeologists and metallurgy.
The main work of the Committee has been in providing and publishing information for non-specialists dealing with archaeometallurgy. Lynne Keys prepared very comprehensive guidelines for dealing with ironworking slag and residues. Aimed at fieldworkers it is disseminated through the BAJR website (www.bajr.org). HMS Datasheets are also being revised with a total of 35 sheets, now divided into three broad categories which cover recovery and recording, production processes, and evidence for the development of specific metalworking processes. We aim to get revised datasheets online by spring.
Various regional, local and thematic research frameworks have also caught our attention. Most regional ones have been completed and the Welsh framework process has been revived, and publication of a framework for Exmoor National Park is imminent. NAMHO's research framework for mining in England continues, and the committee is in regular contact with NAMHO Project Officer, Dr. Phil Newman. .We are considering a meeting on upland lead/silver mining and working for Spring 2012. Committee membership can be seen on the HMS website.

Paul Belford

Help needed!

HMS member Alan Williams has asked if other members could help with an intriguing problem. He has come across a reference to a painting which is claimed to be the oldest painting of a blast-furnace and finery in Europe. Alan is keen to trace the provenance and detail of this picture for its historical value. It was published in a book by Marechal, J.R. ["Considerations sur la metallurgie prehistorique" (Lammersdorf, 1963) written in French, but published in Germany]. The picture is reproduced without any accreditation (see Figure One). It was there said to be by Patenier (sometimes spelt Patinir) but it does not appear in the standard textbooks about the works of that painter, who was himself the uncle of Herri met der Bles, another painter of furnaces. It does not appear in books about him either. Alan has tried the usual sources including the Courtauld Institute, Warburg Library and Ecole du Louvre, but without success. He believes it to be Flemish c.1500 in style and could well be what Marechal claimed it to be, but since the current location is unknown further details cannot be established. Any member with any insight please contact the Newsletter editor (see below)

Figure One: Do you know this painting?(see text for details)

Newsletter submissions are welcome at any time, but deadlines for each issue are

1st March, 1st July 1st November

Contributions can be sent in any format (hand-written, typed, email, floppy disk, CD-ROM, etc).

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