

THE CRUCIBLE

Historical Metallurgy Society News
Issue 100

Spring 2019

Celebrating 100 issues



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The **HISTORICAL
METALLURGY**
Society

FROM THE EDITORS

When we took over as co-editors our learning curve was so steep that our eyes were focused on the next steps so we didn't see Issue 100 ahead of us, and now it's here! It feels an honour and responsibility to be editing this issue but it is, of course, chance that we are holding the baton as we reach this milestone. It is the contributions of members over the years and the efforts of past editors that has made the newsletter a success and got us to this point. We've included a longer piece on the newsletter over the years but this is still a superficial browse. It would be an interesting to do a more in-depth study that charted the history of HMS through its newsletter. Perhaps something for a master's project?

Looking back over the last 100 issues the gradual and inevitable shift into a post-industrial environment, where research and interest in historical and ancient metallurgy is increasingly found within academic institutions rather than coming from those in industry, is evident. While we may mourn the passing of our industries, the upside of the change is that academic institutions are full of young people with curiosity and energy. It is the Society's role now to nurture and support these new researchers. Looking forward to the next 100 issues is both exciting and daunting. Inevitably we will, someday, want to debate whether we should be an online newsletter, but for the moment members seem to enjoy our print version. The critical element is ensuring members contributions so, as ever, we encourage all to send in material, a call reiterated by Jeremy Hodgkinson, one of the newsletter's most prolific contributors, in his one-minute interview.

Finally, and also to highlight one of the constraints we face, this issue is reaching you after some delay in production. Compiling and editing *The Crucible* in its glossy extended format has become the task of a team of volunteers, spread across two locations, all of whom have their own jobs and research projects. It is inevitable that scheduling time and availability to work on *The Crucible* as a team presents logistical and technical issues that are sometimes difficult to resolve, which has been the case with this issue. However, despite the delay, we all hope that you enjoy reading *The Crucible* at 100.

Gill and Lorna

FROM THE CHAIR

I would just shortly want to congratulate and thank *the Crucible* editorial team for their continued hard work in delivering this publication to our members. And to ask the members to keep sending them your reports, findings and notifications and keep *the Crucible* as the melting pot it is and which it is meant to be. Best wishes,

Paul

FUTURE INTERVIEWS

*Who would you like us to interview for the next issue of **The Crucible**?*

Please let us know at thecrucible@hist-met.org

FUTURE COVER IMAGES

*Do you have any interesting pictures that you like to share with the community on the front of **The Crucible**?*

Please send them to us at thecrucible@hist-met.org

FUTURE NEWS/MYSTERY OBJECTS

Are you working on an intriguing, amazing, or just downright confusing metal object that you would like to share with the HMS community?

Please let us know at thecrucible@hist-met.org

Submissions

Submissions to *The Crucible* are welcome at any time, but deadlines for each issue are 1st March, 1st July and 1st November every year. Contributions can be sent in any format, but we prefer digital if possible. Images should be sent as high resolution jpeg or tiff files.

For consistency, we tend to use contributor's names without affiliations and email contacts. Anyone wishing to contact a contributor not known to them is welcome to forward a message in the first instance to the editors who will facilitate the contact.

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JAKE ALMOND



John Kenneth Almond, universally known as Jake, died on 13 December 2018 aged 90. Jake was a long time HMS member, having joined in the early 1970s, and first served on Council from 1982 until 1987, with the last two years as Chairman. During his chairmanship the influential Archaeology Committee was launched. He was re-elected to Council in 1990, served on the Conservation Committee and as President from 1994 to 1996.

After school Jake had served two years' National Service (1947 to 1949) in the RAF, he became a Leading Aircraftsman wireless fitter and enjoyed the experience. Jake then studied Metallurgy at the Royal School of Mines in London, including vacation work at the Eyre Smelting Company and Fry's Metal Foundries. His first degree was followed by a PhD with his thesis on "Applications of high frequency vibrations in mineral dressing".

Jake's early career was abroad, first in Gambia with Gambian Minerals Ltd (a subsidiary of British Titan Products), then from 1957 to 1960 in India, returning to Africa in 1960 with the Government of Uganda Geological Survey and Mines Department, in charge of their laboratory unit. In 1968 Jake returned to the UK, and took a one-year course of technical-teacher training. In 1970 he was appointed lecturer and very shortly senior lecturer in extractive metallurgy at Teesside Polytechnic, a post he held until retirement in 1994. Outside the Polytechnic Jake taught for the Open University for over 25 years. Jake studied part-time at Durham University for a Master of Education degree, awarded in 1982 for his thesis "Factors influencing education in metallurgy in England and Wales, 1851 to 1950". By then he was involved in industrial archaeology becoming a committee member of the Cleveland Industrial Archaeology Society and chairman in 1973.

He remained on their Editorial Board for the rest of his life. He was also involved with the Newcomen Society, Cleveland Institute of Engineers, the Association for Industrial Archaeology, and the Teesside Ships Society, among numerous others.

Jake's wife Honor died in 2002, they had no children. The collection of books, papers and manuscript notes Jake had amassed will form the basis of a J K Almond archive at the Materials Processing Institute, Middlesbrough. The breadth of Jake's interests was legendary, we have lost a gentle and generous man with encyclopaedic knowledge of the history of metallurgical industries.

Eddie Birch, with acknowledgements to Dr F. W. Smith

KEITH MORGAN



We have recently learnt of the passing last year of HMS member Keith Morgan. Keith joined the HMS in 2000 and, in retirement was curator of the Trostre Works Cottage & Industrial Museum, Llanethlli, South Wales where he made visitors most welcome and discussed the collection with great enthusiasm. HMS News 71, has an article written by Keith on the museum.

Keith joined the steel industry in 1957 spending much of his career in the former British Steel Corporation Packaging Plus Division, later Corus, (and now Tata Steel TKS Europe) specialising in tinplate production.

He was a prolific writer and photographer and was always on the lookout for historical artefacts to salvage and display at either Trostre or the Kidwelly Industrial Museum. He had a particular fascination for embossed tinplate ceiling tiles (HMS News 49). One of his lasting achievements was the preservation of archive film by copying it to DVD, making it more widely accessible and ensuring a record of tinplate production in one of the last pack-mill producers in Wales as well as early continuous hot strip rolling.

Our condolences to all who met him and benefitted from his enthusiasm to preserve the heritage of the tinplate industry of South Wales.

Tim Smith

ACC: WHO WE ARE AND WHAT WE DO

The Archives and Collections Committee has been in existence for 10 years. It was established to manage the various archives and collections held by HMS, with a remit now extended to keeping track of the whereabouts of other metallurgical items where possible. The archives and collections are mainly housed at the Ironbridge Gorge Museum under an arrangement with the Ironbridge Gorge Museum Trust (IGMT).

We are a group of about 20 enthusiastic people from a variety of disciplines, divided into committee members and corresponding members (effectively retired committee members). All contribute much in experience, enthusiasm and support. Corresponding enables overseas members to participate in committees, when possible electronically. There are 3 face-to-face meetings every year in various parts of England and frequent lively, electronic exchanges. The variety of backgrounds and skills brought to the ACC is its strength and new members would be welcome. At present we have responsibility for the HMS archive, the Tylecote papers, the Tylecote metallurgical sample collection, which includes other small sample collections, the Tylecote Portal, the HMS library and slag collections which form part of the National Slag collection. The IGMT owns and homes the National Slag Collection, and Oxford University's Research Laboratory for Archaeology and History of Art houses the Tylecote metallurgical collection on behalf of the HMS.

The Tylecote Portal, named after Professor Ronnie Tylecote who was instrumental in founding HMS, will appear on the HMS website. The Portal will make available the library catalogue, archives, the slag collection databases, the metallurgical samples data, Tylecote's notebooks and micrographs. This will grow over time to include material available for anyone from researchers to students to the professional curator or the serious hobbyist or the just plain interested. The information will take the form of documents, analytical data, images, a glossary of technical terms and information about courses relevant to archeometallurgy.

Part of managing the various archives and collections is presenting the contents as public resources. Information on techniques ancient and modern, processes and data will also form part of our archives. The collections, both paper and material, are available for use and can be accessed by contacting the chairman of the ACC at ACCchair@hist-met.org. Projects undertaken using the collections have to result in reports on the HMS website. We also have a few study days per year which may be attended by HMS members with an interest in sorting, cataloguing, identifying, labelling, curating the contents of the collections we hold.

These usually take place at Ironbridge, but the opportunity exists for material to be signed out for work to take place elsewhere and there is plenty of work to be done on the collections we hold. As time goes by, more collections will become available in need of archiving and another task of the ACC is to consider how to deal with them.

It is our intention, over time, to make the HMS the 'go-to' place for all things historical metallurgical.

Vanessa Cheel

HISTORICAL METALLURGY SOCIETY 2019 AGM

POWER AND CONTROL OVER METALLURGY PRODUCTION

Saturday the 8th June 2019, Waterhouse Chamber, Reading Town Hall

This meeting will explore how metal production was controlled in different societies, in the UK and further afield. The plan is to explore control in a range of periods, including how the Roman military controlled iron production in the UK and beyond, elite control and use of precious metals in Anglo-Saxon workshops and even exploring Chinese control over iron production during the Warring States period.

The registration fee is £35 for members and £45 for non-HMS members and includes all tea/coffee breaks and lunch (£25 for students). A booking form can be found enclosed with the newsletter, and online bookings will be either open when you receive this newsletter, or will be shortly.

The HMS AGM is being held at 1pm and is free for all members, but please contact the organiser below in advance. General enquiries can be directed to Eleanor Blakelock at events@hist-met.org and for our online booking service, the latest news and updates please visit the HMS website.

A GAZETTEER OF THE BRITISH IRON INDUSTRY, 1490-1815

HMS has provided Peter King with a grant to fund Eleanor Blakelock to produce maps to go with his *Gazetteer of the British Iron Industry, 1490-1815*. The map for his chapter on Northeast England appears below (Fig. 1). The book is now nearing completion, after several years' further work recently on historical sources that were not readily available in the 1990s, when he did much of his detailed research. The starting point for his research was contemporary lists of ironworks and such internal records of ironworks as survive, such as accounts, letterbooks, and diaries. Records of sales of pig iron in these provided information on other ironmasters, few of whose records survive. Investigation of less well-recorded ironworks involved reading large numbers of old title deeds, rentals and surveys, Land Tax records. Additional material, recently located, has mainly come from various searchable archives of newspapers, Chancery proceedings now identifiable from the digitisation of manuscript calendars in the National Archives, as well as some other archives that were not (or less) available then. He hopes to have this work published in the BAR British Series. He expects this historical work to be in two volumes amounting to over 600 pages.

In the course of his research, he has found some surprises. For example, A.S. Davies' pre-war work (*Montgomeryshire Collections*) on the industry in Montgomeryshire placed Adrian Duval at Pool Quay, at the head of navigation on the river Severn. Davies correctly his death in 1724 and thought he was an employee of the Duke of Powys. In fact, Powys Castle rentals (in National Library of Wales) show him to have been the Duke's tenant at Mathrafal Forge, followed by his widow Lucy. This is confirmed by probate inventories of both their deaths. The rentals give no hint of the existence of Pool Quay Forge at that time. There is however evidence of lead smelting, using coal brought up the Severn to smelt lead ore mined on the estate. The first indication of the existence of Pool Quay Forge was payment of rent in 1757 by the Shropshire ironmaster Francis Dorset. In Surrey, there is a similar case of confusion with some of the history of Ham Haw Mill near Weybridge being confused with that of the nearby Coxes Lock Mill on an artificial stretch of the Wey Navigation. The (or a) main function of the iron mills in that area seems to have been slit bar iron to produce iron hoops for barrels for example for the Victualling Board. In Yorkshire, Seacroft Furnace (near Leeds), claimed to have been operated by the Spencer Partnership, is wholly absent from any reference in their accounts. Smeaton designed a blowing engine for it in 1779 (*Smeaton's Reports*) and it is probable that the furnace was in fact built shortly after that. Also in Yorkshire, the surviving furnace at Low Mill in Silkstone seems to derive from the 1820s.

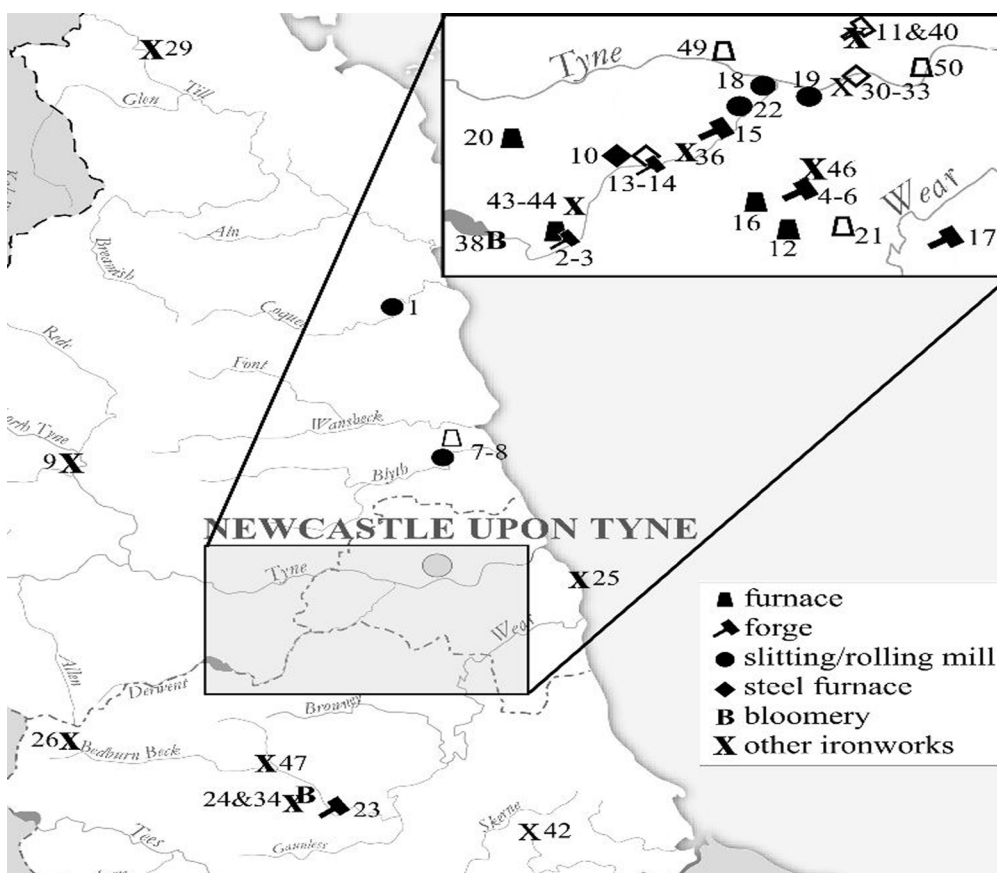


Fig. 1. Northeast England gazetteer map. Example of the maps produced with support from HMS

On the other hand, Exchequer proceedings, alleging the illegal use of timber in ironmaking, enable furnaces on the North Yorkshire Moors to be dated, both to the 1580s and 1590s. The furnace identified at Hartoft was in fact at Spiers (the other side of a boundary beck) and that at Great Fryup is recalled by a farm name. There must have been forges to go with these, but they remain to be identified. The ironworks at Mathafarn near the Dovey estuary can be dated to c.1630 from the shipment from Gloucester to Aberdovey of 'raw iron in sows', recorded in the *Gloucester Port Books*. Some further progress has been made relating to the Weald, where there are still a few sites that are known only from archaeology. Elsewhere, few remain for which no documentary has been found, but many remain ill-documented.

HMSNEWS/*THE CRUCIBLE*

I'm sure it hasn't gone unnoticed by members that this is issue No. 100 of our newsletter. For a relatively small society run by volunteers we can be proud of our record of sending out newsletters at a more or less regular rate of three per year since 1983. The world has seen many developments since 1983 so it is reassuring that **HMSNEWS/*The Crucible*** has been cautious and measured in adopting change, relying on tried and tested formulas – keeping members informed and often entertained with a traditional print newsletter.

My own set of **HMSNEWS/*The Crucible*** is complete back to No. 23 so I'm grateful to Justine Bailey who has a full set back to the first issue, compiled by Roy Day (Fig. 1). The opening sentence of issue No. 1, however, clearly indicates that there was an earlier occasional Newsletter, also compiled by Roy Day. Number one of this first Newsletter appeared in August 1976 and continued in a series of 12 issues until 1981. However, there were concerns that the Newsletter was becoming unwieldy, having grown in five years from 4 to 12 pages, and needed to be constrained to a consistent 8 pages. In 1985 (No. 4) Amina Chatwin took over as editor of the new **HMSNEWS**, a role she held until No. 52 in 2002, and, apart from occasional 12-page issues, successfully kept to the 8-page format. But it's not all about the number of pages! I would say that, wouldn't I, editing a newsletter that now regularly reaches 24 pages.

Thumbing through my back issues several themes emerge, one of which is technology. We all know how the development of digital technology and the internet has changed all our lives and we can see this reflected in the production of our newsletter. Back in 1994 (No. 28) contributions on disc are first invited, suitable for 'Apple Mac, Amstrad or Ascii', and email addresses only begin to appear in the late 1990s. One reason why it was possible to produce a consistent 8 pages was because illustrations were limited to simple line drawings, with black and white photographs being few and far between until about 2004. With improvements in image resolution, a growing number of photographs inevitably led to an expanding newsletter, and in 2012, the Society's 50th anniversary year, **HMSNEWS** transformed into ***The Crucible*** and reached 20 pages. Under the editorship of the UCL team led by Marcos Martín-Torres ***The Crucible*** flourished and full colour was introduced in 2014.

But the history of our newsletter is not just one of developing technology. Again, thumbing through back copies, news about the Society's activities are a mainstay. In particular, reports of Annual General Meetings and Conferences make entertaining reading, especially when they include accounts of hearty meals and convivial evenings after long days exploring metallurgical sites in remote and less remote parts of the British Isles. The tradition is set on the very first page of the very first newsletter (Fig. 2). In this case a day-long meeting in London began at 9.15 with a visit to the Whitechapel Bell Foundry. By 11.30 the action had moved to the Science Museum where the business of the AGM was conducted in double-quick time to ensure members got their lunch in the museum restaurant, which then fortified them for an afternoon either at the British Museum or the Percy Collection, with the day over by 4pm! I wonder if it would be possible to cover the same ground in the same time today?

In 1999 (No. 43) the Annual Conference was held in Cumbria, with a long day out and about in the fresh air, including a packed lunch taken seated on the foundations of a furnace, returning to the conference venue for 'a quick drink and another soporific dinner'. In 1995 (No. 30) the Spring Meeting was held in Leeds and included a visit to the Armley Museum in a 'fleet of taxis' and a narrow boat trip (with buffet lunch) to the partially completed Royal Armouries. The Annual Conference of 2006 (No. 64) took the society to The Forest of Dean and the Wye Valley when dinner included an 85th birthday toast to Robson Davies, one of the longest surviving members of the Society. Cornwall was the venue for the 2007 Spring Meeting (No. 66) and included not only an obligatory Cornish pasty but a boat trip on the Fal and a conference dinner at the Pandora Inn, and 'subjects metallurgical ... discussed over drinks until late'. The pattern persists and members reading this will be transported back to many memorable evenings, such as the 2005 Conference



Fig. 1. First page, first paragraph, first issue of **HMSNEWS** in 1983

in North Yorkshire when ‘after a conference dinner ... younger members headed for a well deserved pint after a tiring but enjoyable day’. Especially memorable for many would be the Early Ironworking in Europe conference at Plas Tan y Bwlch in 2007 (No. 67) that celebrated the contribution to archaeometallurgy of Peter Crew when, ‘after a night which witnessed the establishment of exemplary Anglo-Franco-Germano-Swiss-Dutch friendships during the early hours, breakfast on the last day was slightly less tempting for some’.

In case I’m in danger of distorting the picture, there is much more to the newsletter than happy memories of social events. Looking back, the newsletter has been hugely enhanced by a number of regular contributors who have unfailingly shared a rich platter of knowledge, investigation, debate and curiosity. For example, Tim Smith has brought us a myriad of close observations on industrial archaeology and metallurgy and Paul Craddock can be relied on to reflect an international perspective on early metallurgy. All editors of the newsletter have been grateful to Jeremy Hodgkinson for his diligence over many years in reporting the activities of the Wealden Iron Research Group to members of HMS.

Another feature of the newsletter is its international coverage. While we tend to think of this as a more recent development, a glance through past issues reveals a wealth of information from all corners of the globe. Across two pages in the winter issue of 2001/2 (No. 49) there were short articles on Persian steel from the Tanavoli Collection; a sword in the stone in Tuscany; new research in Bulgaria; pre-Hispanic metallurgy in Argentina; Geevor mine in Cornwall and iron metallurgy in Sudan. And the newsletter also keeps pace with new discoveries. On a single page in 1998 (No. 38) we have reports on the discovery of gold coins and tin ingots off the coast of South Devon; the poor quality of rivets in the hull of the Titanic; the copper axe of the Ice-man and the discovery of a copper smelting site on the Great Orme. Browsing through back issues has entertaining moments. I came across a short note on archaeodentistry, describing the discovery of 8 first millennium AD gold teeth in Halin, Upper Burma (No. 53). There are also the ‘mystery objects’ that appear from time to time which members are invited to help identify. In older issues such objects were often represented by rather enigmatic line drawings but with colour photography these mysteries have become easier to solve. Thinking about how the use of colour has enhanced the newsletter and looking at more recent issues, there is no denying that experimental smelting and colour photography is a match made in heaven. The same can’t always be said for the grey-black lumps of slag that we hold so dear!

Perhaps the most poignant development is the gradually increasing number of obituaries in recent years as, one by one, members of the group of pioneers from industry and academia who envisaged and created the Society pass away. We remember them with fondness and gratitude for their contributions to our discipline. Happily, continuity across generations in the Society is dynamic and we now have many short ‘Out and About’ contributions from new researchers publicising their projects. Looking back over 100 issues, the newsletter in its various manifestations is by its members and for its members. As editors we depend on members’ contributions so please keep them coming in.

Gill Juleff

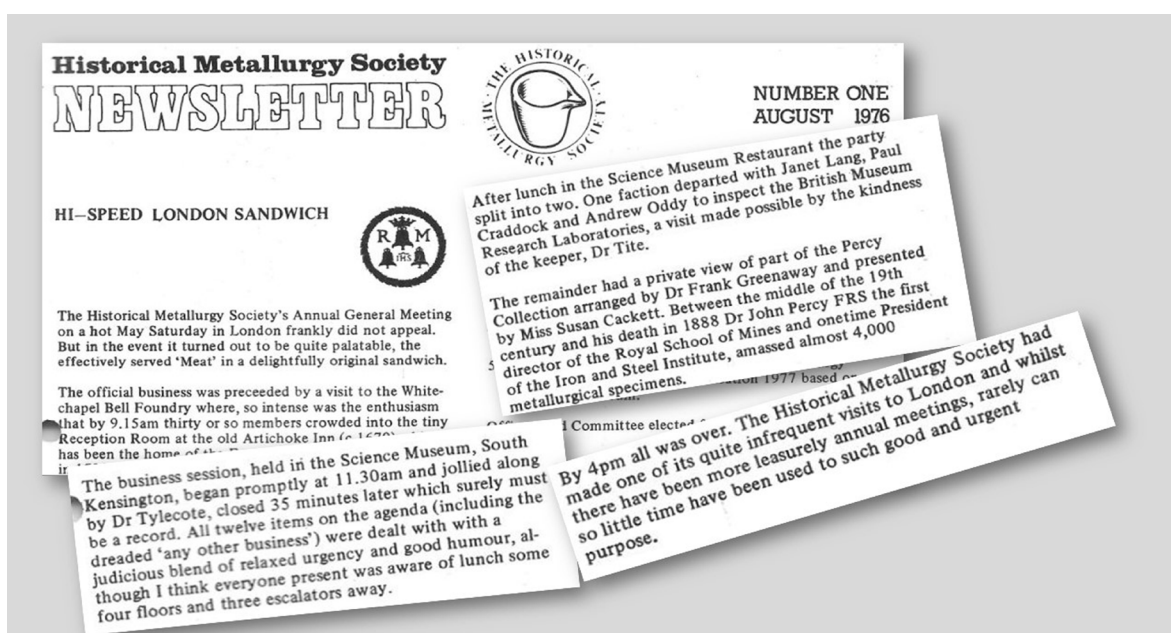


Fig. 2. A case of extreme AGM!

OBJECT HIGHLIGHT

THE RENDLESHAM SWORD PYRAMID - AN ODDITY

One of the objects analysed as part of the Rendlesham project is a sword pyramid (Fig. 1), while research is still ongoing I thought I would share some initial results and thoughts.

While all Anglo-Saxon objects are unique, this one is particularly unusual. The shape is fairly consistent being a pyramid shape with a flattened top with a garnet inset and incorporating garnets or filigree decoration. In this example the gold decoration covers a silver core. However, there are many unusual aspects to this pyramid.

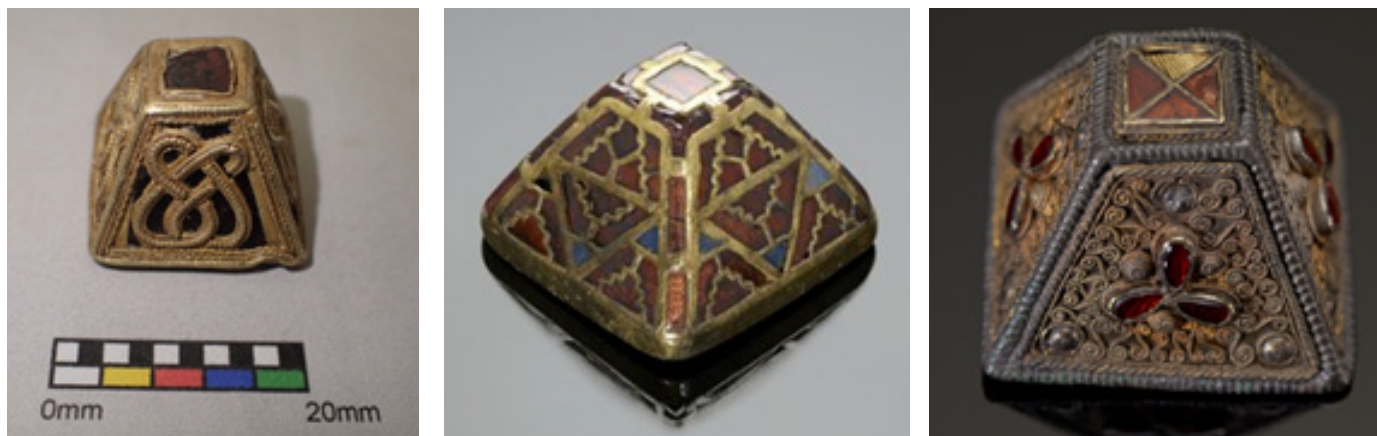


Fig. 1. Pyramid from Rendlesham (left, © Ipswich Museum) compared to two designs from the Staffordshire Hoard (© Birmingham Museums Trust)

The first major difference between this piece and most other Anglo-Saxon work is that no textured gold foils have been placed behind the red inlay (Fig. 2). These foils are usually there to help the garnets shine, and the result is that the inlays appear dark and dull.

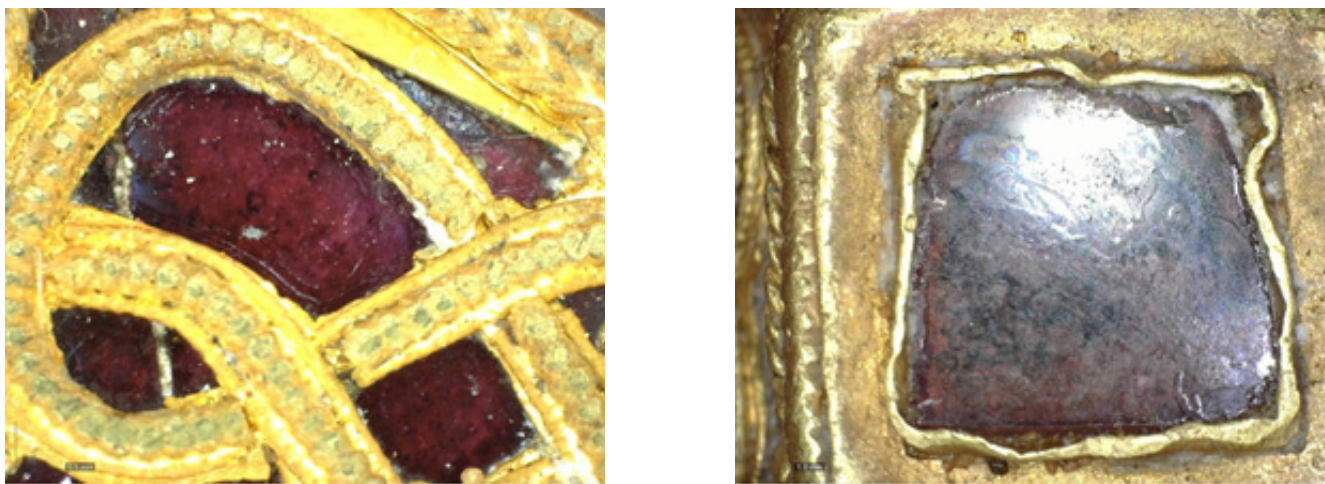


Fig. 2. Showing no foils behind the insets

At first glance it looks like a fairly typical gold and garnet cloisonné piece, but on closer inspection there are major differences in its construction. Normally cloisonné consists of small cut garnets which are inserted into walled cells, but here the filigree decoration has been soldered suspended above the very large inset (which may be a red glass rather than garnet due to its size). It appears that the beaded wires have been soldered onto a backing sheet of gold, and then this has been roughly cut out and haphazardly soldered on to the base (Fig. 3). The cut filigree decoration may suggest that it was originally from a different object, which was cut and re-used in this piece.

The unusual construction of this piece needs further research and debate, the lack of usual elements in Anglo-Saxon goldwork and haphazard construction is intriguing. Especially considering the site of Sutton Hoo with its incredible cloisonné shoulder clasps and weapon fittings is just down the road.

Eleanor Blakelock

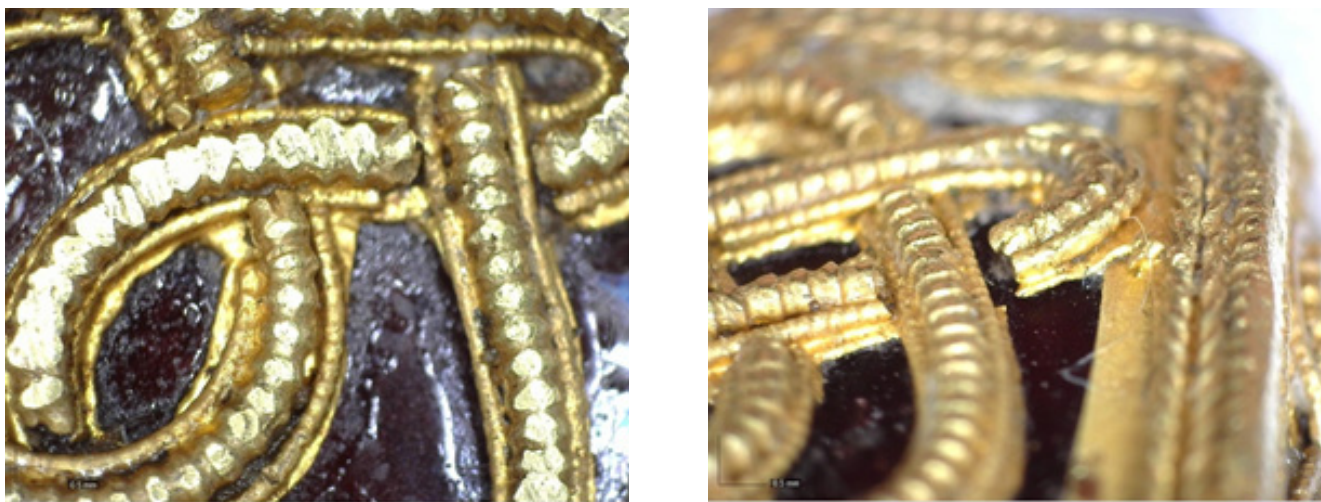


Fig. 3. Showing the filigree decoration cut and soldered onto the base

METALWORKING AT ANGLO-SAXON RENDLESHAM

Work started in June last year to examine the assemblage of metalworking residues and metal finds from the site of Rendlesham which lies on the east side of the River Deben in south-east Suffolk, and is located just 6km north-east of the Anglo-Saxon burial ground of Sutton Hoo. Fieldwork at Rendlesham has identified a major central place complex of the early–middle Anglo-Saxon period. This has particular significance in the light of Bede’s eighth-century reference to a ‘royal settlement’ at Rendlesham and the princely burial site at nearby Sutton Hoo.

The main survey of the area consisted of a systematic surface collection with metal detectors, which has led to a rather skewed assemblage, mostly consisting of metal objects and debris, rather than the typical metalworking sites with their crucibles and moulds. However just from looking at the assemblage it is quite clear that casting was being carried out at the site, as we have sprues, unfinished or failed objects as well as their complete counterparts (Fig. 1). As well as clear evidence for copper alloy work there is a reasonable amount of scrap metal, spills and coin blanks to suggest precious metal working.

The research being carried out at UCL is aiming to assess the assemblage morphologically but also look at the chemical compositions, through a combination of optical microscope, XRF, SEM-EDX and ICP-MS work. The aim is to investigate the workshop at Rendlesham, and compare this to other Anglo-Saxon sites and objects.

If this has peaked your interest there will be a talk giving the preliminary results from the work on the 8th of June at the HMS AGM in Reading.

Eleanor Blakelock



Fig. 1. A badly cast pin, misaligned as well as flashing; B: Failed cast of another buckle; C: Double sprue with flashing; D: Failed cast of a buckle

LEAD ISOTOPE ANALYSIS OF ROMAN PERIOD ANCHOR STOCKS FROM CATALONIA COAST, SPAIN

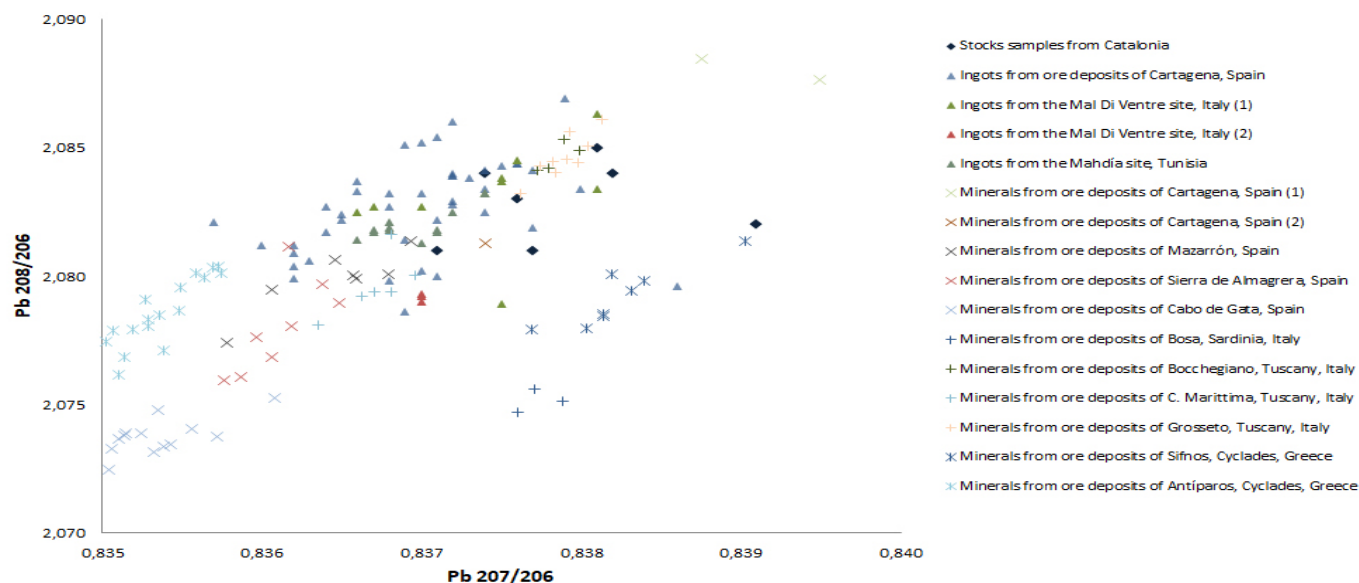


Fig. 1. Comparison between the isotopic ratios of the analyzed samples with those of other archaeological artifacts and minerals from the Mediterranean region. Reference data were retrieved from published works of the Isotrace Laboratory (Oxford) and other research papers (e.g. Stos-Gale et al. 1995, 1996; Trincherini et al. 2010; Clemenza et al. 2017)

Lead isotopes analysis is a valuable means for assessing provenance of raw material used in artifacts from antiquity, and results with archaeological remains are increasingly encouraging. Available databases on isotopic signatures of Roman period artifacts (e.g. lead ingots from shipwrecks) and samples from lead sources used at that time constitute an outstanding frame of reference to develop these studies. Based on this information and epigraphic evidence, seven lead anchor stocks recovered decades ago from the Catalonian coast are under examination by archaeologists from the Catalan Centre of Underwater Archaeology, in Gerona, Spain, with the collaboration of the Archaeometallurgy Group, University of Buenos Aires, and the Mass Spectrometry Laboratory of the National Atomic Energy Commission from Argentina. Isotope data were obtained by analytical chemists from the latter institution, using a thermal ionization mass spectrometer Finnigan MAT 262 (Thermo Fisher Scientific, Bremen, Germany); results were corrected for mass fractionation measuring the common lead isotopic standard NIST-SRM 981. The preliminary comparison of the results with a database of more than a thousand samples collected from the Mediterranean and Western Europe regions suggests that six of the seven pieces were manufactured with lead from ore deposits of Cartagena, Spain (Fig. 1). The aim of this study is to contribute to knowledge of the uses of lead sources in the Mediterranean for naval purposes.

References

- Clemenza, M. et al., 2017. Development of a multi-analytical approach for the characterization of ancient Roman lead ingots. *Journal of Radioanalytical and Nuclear Chemistry* 311 (2): 1495-1501.
- Stos-Gale, Z. A. et al., 1995. Lead isotope data from the Isotrace Laboratory, Oxford: Archaeometry data base 1, ores from the western Mediterranean. *Archaeometry* 37 (2): 407-415.
- Stos-Gale, Z. A. et al., 1996. Lead isotope data from the Isotrace Laboratory, Oxford: Archaeometry data base 3, ores from the Aegean, part 1. *Archaeometry* 38 (2): 381-390.
- Trincherini, P. R. et al., 2010. The identification of lead ingots from the Roman mines of Cartagena (Murcia, Spain): the role of lead isotope analysis. *Journal of Roman Archaeology* 22: 123-145.
- Nicolás C. Ciarlo^a, Erica Zubillaga, Mauricio Fernandez, Marta Bavio, Rut Geli and Eduardo Gautier^a CONICET, nciarlo@conicet.gov.ar

DOLGUN BLAST FURNACE

300TH ANNIVERSARY

March 21st 2019 will be the 300th anniversary of this furnace being blown-in. The furnace was planned by Abraham Darby not long before his death and was initially managed by John Kelsall, the well-known Quaker preacher. Kelsall's diaries, now preserved in the library of Friend's House, give a precise chronology for the construction of the furnace and for the first campaign in 1719, followed by a detailed account of the operation of the furnace from 1729 to 1736, providing an unique archive for an early 18th century charcoal blast furnace. In 1982-85 Dolgun was cleared of collapsed rubble and consolidated by a team from Plas Tan y Bwlch, the Snowdonia National Park Study Centre. This showed that the furnace was well-preserved, with structural details of the lining and hearth, which cannot be seen so easily at a contemporary furnace elsewhere in Britain. From the 1980's until 2007 the site was managed and maintained by the Snowdonia National Park, but after my retirement the management resources of the archaeology section were diverted to the Roman complex at Tomen y Mur and no work has been done at Dolgun since then.

The approaching anniversary has been the stimulus for a project to recover and excavate the site. It had been overcome by a vigorous bramble and sapling growth, making it difficult to see and to visit. The furnace has now been cleared and a series of drone photographs have been taken by Mark Walters of SkyWest Surveys, kindly funded by the Cambrian Archaeological Association (Figs. 1 and 2) and gradiometer surveys have been carried out by Ian Brooks, Engineering Archaeological Services (Fig. 3).



Fig. 1. A perspective view from a height of about 4m, looking over the furnace pillar, with the blowing arch on the left and the tapping arch on the right. Scale rods 2m. Inset: Detail of the tapping arch excavated in 1984. The tapered opening in the sandstone blocks, which would be blocked during use, gave access to the crucible for repairs to the lining. Scale rod 1m

The upper ranging rod on Fig. 1 is against the original facing stones of the tapered square shaft, with the upper lining of flagstone blocks resting on a step in the casing. Much of the crucible survived as heavily vitrified sandstone blocks, repaired with firebricks. The boshes would have been rather higher and the junction with the upper flagstone lining is marked by curving lines of vitrification. On the each side of the blowing arch are the lower courses of a slate-block arch, which would have supported the front wall of the shaft casing. Part of the shaped hole for the tuyeres survived in the sandstone lining at a lower level.



Fig. 2. A vertical view from a height of 10m. The upper lining of the shaft is shown clearly by the reddened burnt flagstone blocks, which is 2.15m square at the level of the boshes. The charging platform, in sunlight on the right, still has the original paving. The site of the wheel-pit is indicated top left

During the 1729 to 1734 period, when the furnace was owned by the Payton family, the pig iron was shipped to the forge at Llanrhead, now Glanfraid, south of the Dovey Estuary, for refining to bar iron. There is little evidence for the furnace continuing in use beyond Kelsall's departure in 1734 but recent research has recovered considerable detail about the later Dolgun Forge, which was probably built in 1757 and continued into the early years of the 19th century. The forge is recorded in 1763 and in the 1790 list (King 2011 and King forthcoming), as having two fineries and a chafery. This implies that the forge had four water-wheels, one each for the hearths and one for a hammer, which would have been driven by a complex arrangement of launders from the high level leat. There are several records for the pig iron being purchased, from Horsehay in 1759-61 and from Backbarrow in 1787. Early 19th century shipping records mention pig iron coming into Pwllheli and bar iron being shipped out from Barmouth.

The location of the forge has now been established, by a high resolution gradiometer survey, on the east end of the level shelf below the furnace (Fig. 3). The massive negative anomaly on the east and the line of positive anomalies on the north are the remains of old iron fencing.

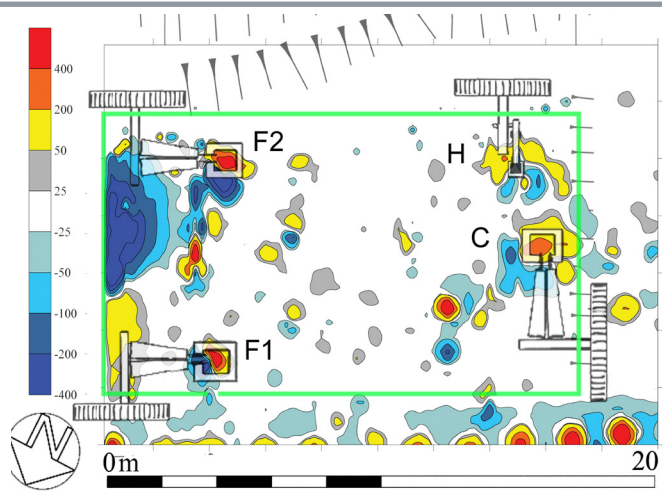


Fig. 3. Gradiometer survey with readings at 0.25m spacing, colour-filled contour plot, positive readings in red and yellow, negative readings in blue, with a non-linear scale. The overlay indicates a putative layout of the building (green), about 17m x 10m, with three hearths, the hammer and wheel locations

There are four main dipolar anomalies each with a northerly orientation, indicating material burned *in situ*. F1 and F2 are probably the finery hearths and C the chafery hearth. The arc of low positive readings at H is characteristic of a spread of forging debris, indicating the location of the hammer, which would have been driven by a wheel on the south of the building. The orientation of the dipoles, to the east of north, is indicative of a late 18th century date, when the secular curve for Britain is historically recorded. A resistivity survey will be carried out to try and confirm the location of the wheel-pits.

In the spring of 2019 a full EDM survey will be carried out and the access and safety fencing improved, funded by the National Park. The tapping arch, blowing arch and wheel-pit will then be excavated to the original floor levels. Selective excavation will also be carried out on the site of the forge. The samples recovered, together with the finds from 1982-85, will be subject to a programme of scientific work on the ores, slags, firebricks and iron, forming a crucial part of the publication.

For the 300th anniversary a new interpretation board and pamphlet will be produced and there will be a celebratory occasion, organised by Peter Crew and Tomos Jones, the current Archaeology Officer of the National Park, which will be held on the 27th April, when the excavations will have been completed. There will be a series of talks, with an introduction by Michael Darby, followed by a tour of the site.

A brief report on the excavations will be produced for a future issue of *The Crucible*. Publication of different aspects of the project is planned for *Archaeologia Cambrensis*, *Historical Metallurgy* and the *Journal of the Merioneth Historical Society*.

In the longer term a fully illustrated monograph will be prepared, covering the work at Dolgun and at the nearby late 16th century blast furnace at Dol y Clochydd, also excavated by the team from Plas Tan y Bwlch. Further details of the project and updates on progress can be obtained from crew.peter.susan@gmail.com.

References:

- Blick, C. 1984. 'Early Blast Furnace News', *Historical Metallurgy* 18, 47-48.
- Crew, P. and Williams, M. 1983. 'Dolgun Blast Furnace', *Archaeology in Wales* 23, 70-72
- Crew, P. 2009. Iron Working in Merioneth from prehistory to the 18th century – Merfyn Williams memorial lecture, 2009 (Maentwrog: Snowdonia National Park and Plas Tan y Bwlch), 28-32.
- Cranstone, D. 1989. 'Early Coke Ovens', *Historical Metallurgy* 23, 120-122.
- King, P. 2011, 'Iron in 1790: production statistics 1787-96 and the arrival of puddling' *Historical Metallurgy* 45.2, 102-133.
- King, P. forthcoming, *A Gazetteer of the British Iron Industry, 1490 – 1815*, (BAR British Series).

Peter Crew

THE HMS DOLGUN FUND APPEAL FOR CONTRIBUTIONS

HMS Council has agreed to set up a temporary fund to support the programme of works and research to be carried out at the Dolgun Blast Furnace and Forge during 2019-2020.

£1500 has already been pledged to the Fund and further contributions will be gratefully accepted. Gift Aid will be claimed on contributions when it is applicable. Any surplus in the Fund on its closure will be added to the HMS Anniversary Fund, for the support of other grant applications within the aims and objectives of HMS.

Contributions should be sent, payable to the Historical Metallurgy Society, to the Treasurer Peter King at 49 Stourbridge Road, Hagley, Stourbridge, West Midlands, DY9 0QS.

Paul Rondelez, Chairman HMS

ANOTHER MYSTERY OBJECT

Dear HMS members,

My team is currently processing the finds from an early colonial historical archaeological excavation in Australia (c.1794 – 1816) and are hoping you might be able to shed some light on this shattered cast iron object?

It was recovered from fill deposits associated with a subsurface brick barrel drainage system, constructed in 1816. It is unlikely, but remotely possible, that it post-dates this time and has been introduced to the matrix at a later date. It is almost 4 kilograms in weight and if spherical/hollow would have had a diameter of between 200 and 250mm. It seems unlikely to me that it could form part of a smelting pot or crucible for a number of reasons, however we hoped you might share your opinion on the possibility? Prior to c.1830 no iron casting was carried out in Australia on any commercial scale and metalworking was essentially confined to the blacksmiths trade, so this would be an imported object and have to relate to more basic forge activities.

Our best guess at this stage, unlikely as it may be in this colonial context, is that it actually forms a souvenired or ballast-related portion of an exploded mortar shell of the period, with the aperture forming part of a fuse hole. Any thoughts on the mystery would be greatly appreciated!

Many thanks,

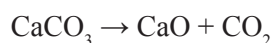
James McGuinness
Austral Archaeology
jim@australarchaeology.com.au



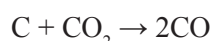
A FAILED ATTEMPT TO REVIVE IRONMAKING IN THE WEALD OF SOUTHERN ENGLAND

The Weald of Southern England extends 100km East-West between the North and South Downs and was the birthplace of blast furnace technology in Britain. Walloon furnaces and forges were first introduced from the Low Countries of present day Belgium and France in 1490 and the region prospered for 330 years. During this time 113 furnaces are known to have been in operation at various times and 109 fining forges. The last furnace to close was Ashburnham Furnace which survived until 1813. The final campaign was not uneventful as, according to a later newspaper report, the four men and two boys employed were drunk on contraband gin which was regularly smuggled from Holland, landing at various secluded places along the south coast. This led to a lack of care in charging the correct portions to the furnace resulting in a failure to run metal on the final day.

Sixty-one years after the closure of this furnace the Brighton Guardian newspaper of 4th November 1874 reported on the setting up of a company to exploit the remaining ore bodies on the Weald, estimated to extend over 1000 square miles. A letter by a Mr W Figg, a surveyor by profession, argued that the conditions that led to the ending of ironmaking in the Weald were; ‘of a past period and now have totally disappeared’. He continues: ‘Sussex fuel was formerly confined to the charcoal from surrounding forests, and all carriage was by water, as no real roads existed passable by other than bullock waggons, and then only with light loads.’ The advent of railways from the 1840s opened up the region, enabling coal to be brought in and offering the possibility of making coke iron. Figg argued that improvements in furnace design had reduced the amount of coal required per ton of iron from nine tons in 1781, to five tons in 1851 and just 1.1 tons in 1871. Further, Figg claimed coal consumption could be reduced as low as five to six cwt (0.25-0.30 ton) by the substitution of coke by gas as fuel – a remarkable claim bettering the performance of modern blast furnaces. The gas required, he says, ‘is produced abundantly from chalk, by the use of the waste gases of the furnaces. Nine tons of chalk and one ton of carbon suffices for the production of four tons of iron; and it is estimated, and fairly so, that the lime produced will pay for the carbonic acid gas.’ Chalk is readily available on the Weald from the South Downs. The 19th century term ‘carbonic acid gas’ refers to carbon dioxide (1) which is produced by the calcination reaction of chalk at about 800°C:



At a more elevated temperature around 1000°C, in the presence of carbon, the CO₂ can be reduced to carbon monoxide by the reaction:



Carbon monoxide acts both as a fuel and a reducing agent and was named ‘Carbonic Oxide’ at this time. The above reactions readily take place at the upper and mid-levels respectively of the blast furnace shaft, but Figg is evidently advocating the production of additional CO₂ in a separate furnace since he comments that the lime produced would be a valuable by-product, and that the heat can be supplied from the blast furnace off-gas. Indeed, such shaft furnaces utilising the furnace waste gases, were a common feature of Swedish blast furnaces at this time, but for calcining ore.

Figg evidently proposes to inject the CO₂ produced into the blast furnace. Technologically, this is unfeasible. The reaction for the reduction of CO₂ to CO is endothermic and the addition of excess CO₂ as proposed would not only chill the furnace but also require the addition of more carbon, thereby negating the claimed fuel savings. Indeed, if his proposal could work, the modern steel industry would solve its CO₂ emissions by recirculating top-gas and could offer to import CO₂ from other emitters such as power stations to reduce global warming.



Fig. 1. Graffiti in the short lived Snape iron ore mine in East Sussex

Figg describes the local ore as containing 36-42% iron content (a figure confirmed by other analysis) and says that for the most part the ores are in shallow deposits avoiding the expense of underground mining making extraction half the cost of mining as practiced in the North of England. He also mysteriously claims that the ores are suitable for making malleable iron and cast steel direct from the ore, thus doing away with refining the furnace iron as, for example, in the then recently established Bessemer converter. Indeed, the production of malleable iron, direct from the ore, is a much sought after technology, still unsolved today.

Figg's enthusiasm in reviving the iron industry was no doubt sparked by an attempt to revive local ore extraction with the formation of the Wadhurst Ironstone Mining Company around 1857. A supposedly rich seam of ore had been found during the construction of an extension to the South Eastern Railway branch line to Wadhurst in 1851-2. The Weald's only underground iron ore mine commenced in Snape Wood in August 1857, the plan being to send the extracted ore to Shropshire for smelting via the railway (Figs 1 and 2). However, frequent faults in the ore bed and the lack of a railway siding to load the ore resulted in a short lived attempt, the mine closing just a year later in September 1858. The quality of ore was also questionable, being low in iron and high in silica. A study in 1908 to consider reopening the mine gave a negative report and again, during WWI, re-opening was investigated but considered unviable.

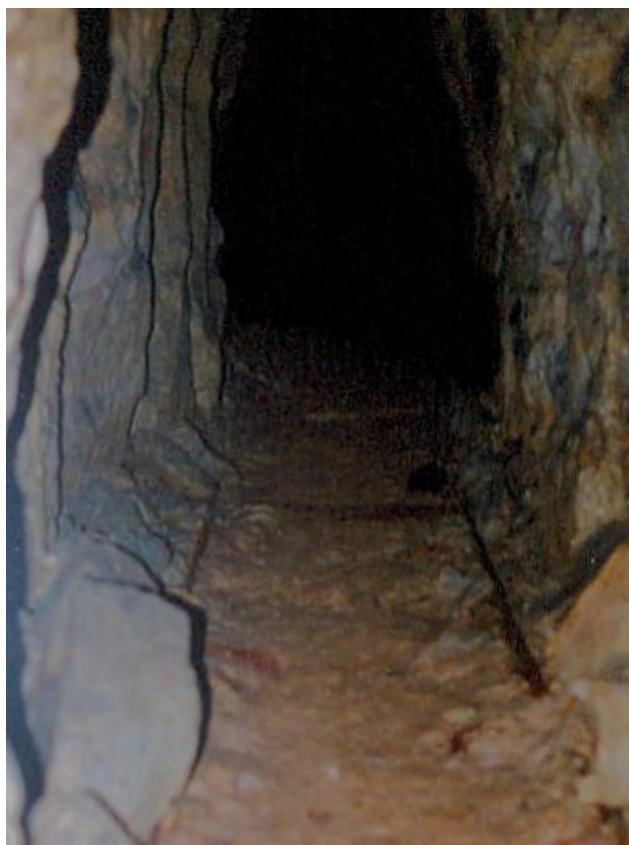


Fig. 2. One of two galleries in the short lived Snape Mine

Should anyone have come across other references to this unlikely proposal to inject Carbonic Acid Gas into the blast furnace please contact me at secretary@wealdeniron.org.uk

For more pictures of Snape Mine visit:

<http://www.subterraneanhistory.co.uk/2008/07/snape-mine-east-sussex.html>

(1) 'The Manufacture of Iron, in all its various branches' 2nd Ed By Frederick Overman pp 206-209 Publisher: Scholarly Publishing Office, University of Michigan Library (22 Dec. 2005) ISBN-10: 9781425556600 & ISBN-13: 978-1425556600

Tim Smith

THE SECOND INTERNATIONAL EARLY ENGINES CONFERENCE (IEEC2) - PRELIMINARY ANNOUNCEMENT AND CALL FOR PAPERS

Building on the success of IEEC 1 at The Ironworks, Elsecar in May 2017, we are delighted to announce that IEEC2 will be held at the Black Country Living Museum (BCLM), Dudley, West Midlands in Mid May 2020 (either 8/9/10 or 15/16/17 May)

The event will start at noon on Friday and finish at noon on Sunday and it is our intention that it runs concurrently with the BCLM's "Red by Night" event which involves many of the museums engines being in steam and working into the night. The format will be similar to that of IEEC1, including publication of the Transactions and we are determined that the event will again feel inclusive, friendly and non-elitist for everyone. The theme for IEEC2 is "A wider view of early engines and their operating context – beyond valve gear and famous engineers"

We already have a number of papers offered covering topics such as Curr's Attercliffe engines, the world's oldest B&W engine house and early engines around Swansea. Please let us have your proposals for papers as early as possible to admin@earlyengines.org

Costs and booking details will be announced during the summer and in the meantime do please contact us with any questions that you have.



JEREMY HODGKINSON

I am a retired primary school teacher and, for more than 30 years, have lectured, primarily about the Wealden iron industry, at conferences and to local societies and adult education audiences. I have contributed to various books and journals on the same subject and latterly on iron firebacks. I have also appeared occasionally in a specialist role on radio and television. I gained my MA in Regional and Local History from the University of Brighton in 1993. I am a Fellow of the Society of Antiquaries of London and am currently an Honorary Research Fellow of Exeter University. I was Chairman of the Wealden Iron Research Group for 24 years, subsequently its Vice-Chairman, President and currently the editor of its annual Bulletin. I have also served on the managing bodies of the Sussex Archaeological Society, the Historical Metallurgy Society and the Antique Metalware Society, and was founding Chairman of CBA South-East. I am the author of two books: *The Wealden Iron Industry*, published in 2008, and *British Cast-Iron Firebacks*, published in 2010, and have recently co-edited *Adventures in Iron* by the late Brian Awty.

Can you summarise your career in a couple of sentences?

I was a primary school teacher for 34 years, but from a historically metallurgical point of view I have been active in the study of the Wealden iron industry for over 40 years. Since retirement I have been able to devote more time to the latter, writing two books, lecturing and other distractions.

What is your most memorable professional amateur moment?

Discovering my first bloomery or water-powered site that had not been known of before.

Who has been your most influential colleague, and why?

Probably the late Fred Tebbutt, who was the Wealden Iron Research Group's (WIRG's) first President when I was asked, rather unexpectedly, to take on the role of Chairman. I had only been a member of the group for four years and on the committee for three. My learning curve was precipitously steep and he and his wife, Margaret, were generous and kindly mentors.

What is your main current project?

I have just completed five years of drawing together and co-editing *Adventure in Iron*, the late Brian Awty's monumental study of the development of the early Post-Medieval iron industry from its roots in the Meuse valley to France, England and beyond. Brian was an indefatigable researcher and he first showed me drafts of a chapter more than 20 years ago when we were reconnoitring a WIRG trip to the Pays de Bray in Normandy. He showed me a page from one of the French archives he was attempting to transcribe. To me it was incomprehensible, but he said it had taken him all day to work out what was written, and he worked on so much of the same sort of material, deciphering the lives of the families of ironworkers that migrated to work in the Weald. Who knows what will be next!

What multi-million project would you like to develop?

More than 20 years ago I was involved in a project to build a Historic Wealden Iron Centre, a visitor attraction that would incorporate full-size reconstructions of a furnace and forge. We got as far as planning permission - the first for a blast furnace in the Sussex Weald! - but the scheme faltered because of the intransigence of a landowner. It would be a great project to revive, but I don't think I would be the person to develop it.

Which publication should every HMS member read?

I think I have to pass on this question. The key to great understanding is to read widely, and no single publication can be essential to everyone's different interests.

Have you got any advice for young students interested in archaeological and historical metallurgy?

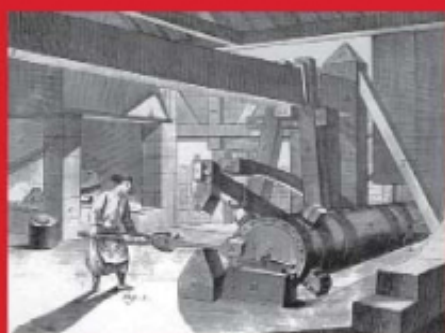
Don't specialise too early. Gain experience in a variety of situations. The pressure to accumulate qualifications impels students into narrowing their focus. Once upon a time a doctorate might result from a lifetime of study. Now it has to be accomplished in three years when perspective has rarely been acquired.

I would like to tell every reader of *The Crucible* that...

...they should consider contributing to it, so that its contents continue to be varied and interesting.

ADVENTURE IN IRON

BRIAN G. AWTY



PART ONE

ADVENTURE IN IRON

*The blast furnace and its spread
from Namur to northern France,
England and North America,
1450-1640; a technological,
political and genealogical
investigation*

by Brian G. Awty

ISBN 978-1-9160423-0-8; case bound in two parts; 977pp; 302mm x 216mm
37 black and white illustrations and maps of sites; two appendices;
detailed contents pages, footnotes and bibliography; general and names indexes.

Making extensive use of British and continental archival and published sources, many previously unexplored in this context, *Adventure in Iron* describes the way in which the early history of the indirect ironmaking process in England is integrated into the parallel story on the Continent, and provides a detailed biographical approach to the migration of ironmasters and workers from the Continent to South East England in this period.

'A major contribution to understanding the process of technological diffusion in early modern Europe. The book breaks out very successfully from the strongly Anglo-centric tradition in studies of the early modern iron industry in this country and puts England fully into a European context'. Philip Riden, Nottingham University

Published April 2019 in a limited edition of 350 copies
by the Wealden Iron Research Group

£45.00 + postage & packing.

Only available from
www.wealdeniron.org.uk



A MOST IMPORTANT BOOK ON THE METALLURGICAL ANALYSIS OF JAPANESE SWORDS

A great deal has been written about the making and using of Japanese swords. However, until recently, this was based upon a rather small body of metallurgical data. As long ago as 1936, Chikashige described the metallography of 11 swords, showing, by means of cross-sectional drawings, the joining of steel edges to iron cores; blades with steel edges and sides with iron cores, and even all-steel piled blades. Unfortunately, he did not include photomicrographs, nor microhardness results.

The pioneering metallurgical work was that of Kunichi Tawara. In 1936 a swordmaking laboratory was set up on the campus of Kyūshū University. Between 1936 and 1938 various research projects were carried out, with the participation of 10 swordsmiths, descendants of swordsmiths, representing different schools, and using metal made in a tataru.

The most extensive data that has been published on the metallurgy of Japanese swords is that by Tawara. He described the smelting forging, hardening and polishing processes in some detail. Most interestingly, he had three historic blades sectioned (each in several places) and studied by metallography as well as chemical analysis. Mechanical (destructive) tests were carried out on bending and impact strengths.

These results were reported in some detail, as well as the hardness data on ten blades and metallographic studies on another two swords and a dozen straight (perhaps Kofun period ?) blades. This work was not published until 1956, but since most of it had been written some years before, many now obsolete kanji were employed, which has made translation difficult, and the book remains available only in Japanese.

Tanimura discussed the tataru process in some detail. Tanimura paid tribute to his teacher, Professor Tawara, and expressed his own interest in this subject. But then he went on to say "...I have not had the heart to cut an old, precious sword..." So two replica swords made in his laboratory were tested to destruction.

There are several papers on isolated examples by Bain, O'Neill, Smith and others. Bain pointed out that a good deal of the working was evidently to homogenise the metal used. As well as the use of a high-carbon steel, the skill of some craftsmen included selective quenching so that only the cutting edge became martensitic and around 700 VPH while the core remained pearlitic.

O'Neill showed the section of a sword that he had had analysed but gave no data for the origin of the sword illustrated.

The section shown had steel edge and sides, and had been hardened to 724VPH (edge), 154-191VPH (core), and 309VPH (side).

Piaskowski described the sectioning of one sword; also of unspecified date, but probably later rather than earlier. Metallographic examination revealed a relatively high carbon steel of 0.6 to 0.8% carbon on the edge and sides, with a low carbon steel core of ~ 0.2% C. The steel layer had been wrapped round the core, and forge-welded to it. Then it had been quenched to give a bainitic microstructure and an edge hardness of 283 VPH (*sic*).

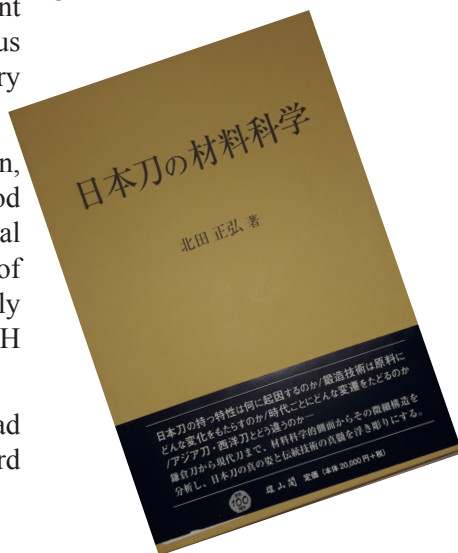
The great pioneer of archaeometallurgy, Cyril Stanley Smith, published metallurgical data on four swords ranging from the 16th to the 20th centuries, and then referred the reader to Tanimura and Tawara.

The relatively small number of analyses carried out is understandable since few owners of historical blades are willing to sacrifice them for sampling. However, Professor Masahiro Kitada has been able to sacrifice a considerable number of important blades, which has added considerably to our knowledge of their metallurgy. There have been several recent publications describing the analyses of historical swords by him. One gives details of the metallographic analysis and tensile testing of five Japanese swords, as well as other swords and fragments of armour.

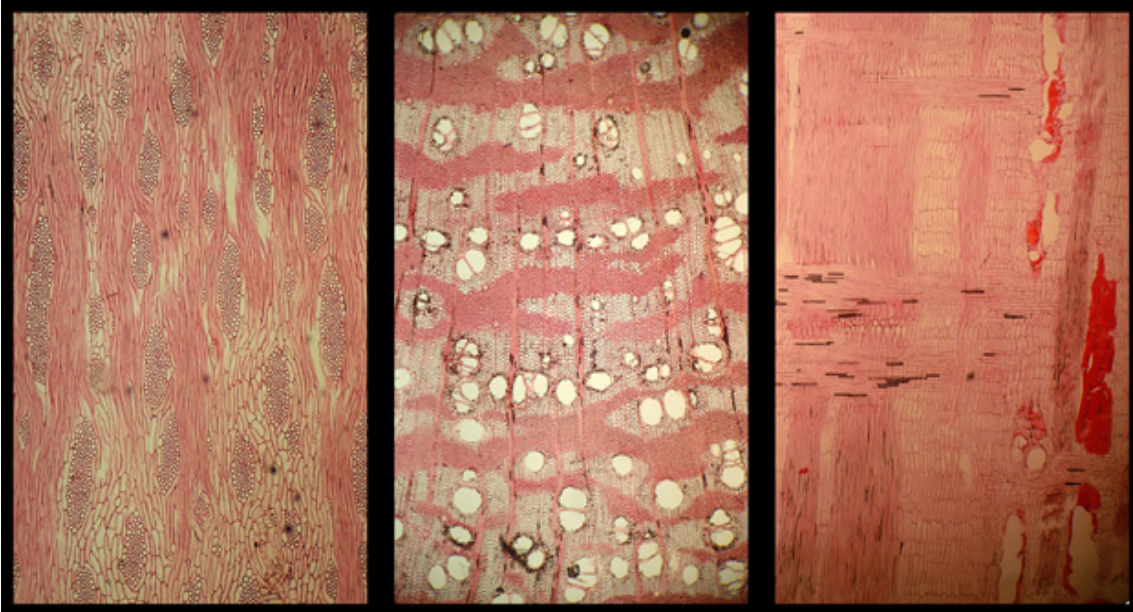
And recently, in 2017, a greatly expanded version has been published, with these and many more results, and with an abstract in English. He gives the microstructures (and detailed analyses) of no less than 27 historic swords.

One sword forged by Kanenaga in Kamakura Period (1288–1330); three from the Period of Northern & Southern Dynasties (1334-1393); seven from the Muromachi Period (1394-1595); seven from the Edo Period (1596-1867). As well as four swords made between the Muromachi to Edo periods, and five others (many the property of the author). Six Modern Japanese swords, 5 Japanese Spears, as well as a number of Chinese & other swords, a kris, a matchlock gun, and some armour are also described.

This most important book by Professor Masahiro Kitada is "*Nihontoo no Zairyoo kagaku*", (*The Material Science of Japanese Swords*) ISBN 978-4-639-02520-7 C3057. Yuzankaku publishing: Fujimi 2-6-9, Chiyoda, Tokyo, 102-0071 Japan, mail: info@yuzankaku.co.jp



Alan Williams



*Fig. 1. Microscopic sections (tangential, transverse, and radial) of the wood of *Vachellia (Acacia) tortilis*, the umbrella thorn acacia, an important desert tree endemic to Israel and one of the preferred (and only) fuel sources for the ancient metallurgical industries operating in the Timna Valley*

MARK CAVANAGH writes: since 2012, the Central Timna Valley Project (<http://archaeology.tau.ac.il/ben-yosef/CTV/>) has built upon the legacy of Beno Rothenberg in furthering our understanding of the ancient copper industries situated in the Timna Valley, Israel. As a member of staff on the project, I have been working towards developing our knowledge of the relationship between the ancient metallurgical communities and the unforgiving, hyper-arid desert environment, where the scarce vegetation was relied upon for fuel, food, and fodder. As part of my own PhD research, under the supervision of Dr. Dafna Langgut and Prof. Erez Ben-Yosef, I am using archaeobotanical proxies – namely wood, charcoal, and pollen, to scrutinize the resource management and sustainability practices employed over time. Starting with the earliest evidence of human activity in the region, to better understand how the industries survived (and perhaps didn't) in such a harsh landscape, and how that landscape was in turn, affected by these industries.

JACK CRANFIELD writes about new work in the Medieval Weald: Work on a new Ph.D. Project has begun with the aim of investigating the medieval iron industry of the Weald, an area of South East England between the North and South Downs, covering parts of Kent, Sussex and Surrey. The project is funded by the Wealden Iron Research Group and based at the University of Exeter in collaboration with the Wealden Iron Research Group and the Early Metals Research Trust. The Ph.D. seeks to understand the nature of medieval iron production within the Weald, how the industry operated economically during the medieval period and whether the idea of centres of iron production is truly valid. One of the most well-known bloomeries is the Tudeley Ironworks in Kent, important for its rare survival of documentary accounts from the first half of the 14th Century, something unprecedented in the Weald for this period. The location of the ironworks remains unconfirmed and much debated, and it is hoped that the site may be identified during the course of the project. Initial visits to the area have proved interesting, with the identification of possible earthworks and trackways. Tudeley will need to be looked at in relation to its wider landscape, if its exact location and economic importance are to be understood. It is hoped that further investigation can be carried out at Tudeley and other significant Wealden iron locations such as Hartfield (East Sussex), Crawley and Horsham (West Sussex). Further updates to follow!



Fig. 1. Bloomery iron slag recovered from the Weald

FORTHCOMING EVENTS

conference, date and locations	Description	websites, emails and prices
10/04/2019 - 14/04/2019 Albuquerque, USA	Society for American Archaeology	https://www.saa.org/annual-meeting
24/04/2019 - 26/04/2019 Manchester, UK	UKAS	
08/06/2019 Reading, UK	HMS AGM Meeting	http://hist-met.org/meetings/agm-2019.html
15/06/2019 - 06/07/2019 Melle, France	Archaeometallurgy experimental session on non-ferrous metallurgy	http://www.mines-argent.com/paleo-metallurgie.html ; tereygeol@cea.fr
19/06/2019-21/06/2019 Hungary	Archaeometallurgy in Europe	http://hist-met.org/meetings/archaeometallurgy-in-europe.html
28/07/2019 - 24/08/2019 Aulus-les-Bains, France	Archaeological excavations at Castel-Minier on medieval silver mines, iron workshop and ore mill. Volunteers are welcome, free of charge	tereygeol@cea.fr

CALL FOR CHAPTER PROPOSALS FOR EDITED VOLUME “GLOBAL HISTORY OF COPPER”

Copper has played a large role in human history. Being the first metal for making tools and equipment, the red-brown, malleable metal has made a mass-appearance in the modern world because of its high electrical and thermal conductivity. We welcome abstracts (maximum 400 words) by **22nd April**, to hans.otto.froland@ntnu.no and Robrecht.Declercq@Ugent.be. Selected contributors will be invited to a workshop at the NTNU in Trondheim (normally held in the week between 12/08 and 16/08, exact dates TBD). Please note that we may want to discuss potential revisions to proposals individually, as to streamline content and investigate opportunities for co-authorship.

Contributions in the following fields are welcomed (but not limited to):

- The political economy of copper and the underlying economic and political institutions in various epochs (colonization, informal empire, decolonization).
- Transnational, comparative and global perspectives on various facets of copper in modern history: ecologies, communities, industrial development, networks, political economy, extractivism.
- Copper as a curse or blessing: trajectories of national and regional economic development.
- Business history perspectives on the history of copper (extraction, trading, consumption).
- The socio-ecological transformation and impact of copper mining on specific mining frontiers in the world with attention for transnational contexts.
- The role of scientific expertise, networks and technological development in the global expansion of copper mining.
- Processes of “strategizing”: when did copper become strategic, and what implications did it have on the political economy of copper?

Contact Info:

Dr. Robrecht Declercq , Ghent University, Contact Email: Robrecht.Declercq@Ugent.be