

# THE CRUCIBLE

**Historical Metallurgy Society**

**Issue 81**

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*Cupellation Experiment*

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## **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.*

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The **HISTORICAL METALLURGY** Society

50TH ANNIVERSARY

# INTRODUCING THE CRUCIBLE

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As many readers will be aware, the Historical Metallurgy Society has recently turned 50. While we prepare a birthday celebration with a major international conference to take place in London in 2013, a number of other initiatives are moving forward. One of them is in your hands.

**The Crucible** arrives a bit later than planned, but we hope the wait has been worthwhile. This issue marks the handover from the editorial team led by Roger Doonan at the University of Sheffield to a new team based at University College London. We will do our best to keep up the hard work that the Sheffield team has generously put into this project over the last few years, continuing to make the HMS Newsletter a key channel for the communication of news and events among those interested in archaeological and historical metallurgy. With the new name, we are embracing the popular logo that has served as the HMS brand for five decades. We believe that the crucible accurately encapsulates the melting pot of backgrounds, nationalities and interests represented in the membership of our Society. As such, one of our major ambitions will be to cater for that diversity, making sure that we provide information that is interesting and relevant to all of our readers. For this, however, we need your help: we are looking forward to receiving your news, conference reports, comments, questions and views on any subject relevant to our broad field. In particular, while our sister journal *Historical Metallurgy* continues to present a breadth of detailed academic papers on relatively completed projects, we are keen to report on work in progress for those who would like visibility and feedback relatively early on. We will also be happy to voice your views on news and policies that are relevant to our Society – as well as to listen to your suggestions as to how to make your Newsletter better.

The first issue of **The Crucible** comes with a few new sections, including a One Minute Interview with one of our members and a Meet your Council section. We hope that you will find these useful ways of getting to know the work and views of your fellow members and of those who represent you at Council. We are very grateful to Salvador Rovira Llorens and Tim Young for accepting our invitation to be the first colleagues to contribute to these new ventures. And if you are reading this in black and white but would rather see it in colour, digitally and with active hyperlinks, you may download your copy from the HMS website ([www.hist-met.org](http://www.hist-met.org)), where you can also find many other useful resources.

From our new virtual editorial office, we thank you for bearing with us while we settle into our new shoes and once again encourage you to get in touch. And if you like what you see, then share it! Let's not forget that HMS is a charitable organisation: this means that all of us work for free as a service to the broader community. Subscriptions rates start as low as £6 per year for students. Also, consider contributing to the HMS 50<sup>th</sup> Anniversary Appeal. Your donations will be used for funding research, conservation, education and outreach.

## *The Editorial Team*



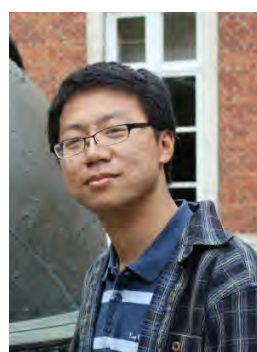
*Marcos Martínón-Torres*



*Loïc Boscher*



*Matt Phelps*



*Siran Liu*



*Miljana Radivojević*

We have made quite a spectacular start to the Anniversary Year, but have also made a couple of errors. So I shall begin by apologising to members for the non-appearance of the summer issue of the Newsletter, which was due to technical difficulties. The editorial baton has now passed from Roger Doonan and his team at the University of Sheffield to Marcos Martín-Torres and his team at UCL. I would like to thank Roger for all of his hard work during his years as Editor, and wish Marcos the best of luck in developing the Newsletter in the future.

You will already see some changes – including the new name **The Crucible** – in this issue. More changes in style and content are already in the pipeline. Please do let Marcos and his UCL team have your comments and any suggestions – and please don't forget to send in updates on your own research.

Two of the three 'Anniversary' meetings were held in 2012. The first was the Spring Meeting and AGM which was held in Birmingham in May. This saw nearly 50 delegates from eight countries enjoy some fascinating lectures and some interesting site visits in the English West Midlands.

The AGM approved the alteration of our Constitution to permit electronic communication with members. Many of you are keen to receive the Newsletter and other communications by email, and not only is this easier for you but it also reduces costs to the Society – so we can focus our resources in improving the service in other areas. (It also means we can use colour!).

The AGM also saw Eddie Birch elected as President, and David Crossley stepped down from this role after four years' exemplary service. I – and my predecessor as Chairman, Tim Young – have both been extremely grateful for David's support as President, and all members will be well aware of his substantial contribution to the work of the Society over many years.

The second 'Anniversary' meeting was held at the SS Great Britain in October. Again we had an excellent international attendance for this non-ferrous meeting, which provided a counterpoint to the firmly ferrous Spring Meeting.

Your Council has also made some changes to the structure and workload of our Committees. We have created a new Communications Committee (chaired by Vanessa Castagnino) which will effectively manage both the Newsletter and the website, ensuring that information is distributed quickly and efficiently.

On the publications side there have also been a few changes. Despite years of deteriorating eyesight Sam Murphy had continued his work as part of the Editorial team, but a recent heart problem means he has now reluctantly decided to step down. He has been responsible for typesetting Historical

Metallurgy since 1997, and many of the improvements in design and layout of the Journal since then have been due to him. On members' behalf I would like to extend a huge 'thank you' to Sam for his hard work over these many years, both on the Journal and with designing the 'Metals and Metalworking' Occasional Publication.

Most of you will be aware that we have slipped behind slightly in the production of the Journal, and our Editors are working flat out to ensure that we make up lost ground. You should have received both issues for 2011 by now, and Volume 46 Part 1 is 'in press' as I write.

It is worth mentioning that Justine Bayley and David Crossley undertake this work entirely unpaid and in their own time, and have done so since 1991. They – and the rest of the Publications Committee – continue to work extremely hard on the project for digitisation and online access to the Journal, as well as the day-to-day business of editing and producing it. As always we rely on the continuing efforts of members to solicit and contribute papers, and I urge everyone to consider submitting their research for publication with the Journal. We have some excellent issues in the pipeline, and I am also pleased to report that two further Occasional Publications will be published in the coming months.

Finally I must once again express my thanks to all of those active members of HMS Council who continue to ensure that we have a busy programme of meetings, an excellent Journal and Newsletter, and continue to move forward in many areas. If you are interested in helping the Society in any way then please do let us know – even if you are not a 'committee' person, then there are a whole range of jobs that need doing where many hands make light work. In particular it would be great to hear from international members who can help develop the Society's profile and membership in their own parts of the world.

I hope you enjoy this issue of the Newsletter, and the forthcoming issue of the Journal.



*Paul Belford*  
HMS Chairman

## IRON SMELTING IN THE WEALD: AN EXPERIMENTAL BLAST FURNACE

Members will be delighted to learn that charcoal iron smelting in a blast furnace is due to return to south-eastern England in the near future.

Gerald Baker and a team of volunteers have constructed a half-scale replica of a sixteenth century Wealden-style furnace at the Rural Life Centre near Farnham in Surrey. The furnace is constructed of a mixture of stone, brick, timber and concrete, and is lined with refractory firebricks from Stourbridge. Although the materials are modern, the overall plan and interior form of the furnace are accurately scaled from historical and archaeological evidence. The blast is provided by a pair of water-powered leather bellows – also made by volunteers at the Rural Life Centre.

The furnace was completed last year and has been fired with wood. The bellows have also been tested, but not yet attached to the furnace stack. The water wheel also powers a trip hammer – again half-scale.

A video is available on YouTube at [http://www.youtube.com/watch?v=EOVgTi\\_y40](http://www.youtube.com/watch?v=EOVgTi_y40).

Regrettably it has not yet been possible to undertake a smelt. As we have learnt from numerous papers on ironworks of all periods in *Historical Metallurgy*, once the capital investment has been made in plant, the other two constraining factors are raw materials and labour. Approximately four tons of charcoal and a ton of ore are needed for a week-long campaign. Volunteers at the Rural Life Centre have been zealously making charcoal in their clamp, and Gerald is confident he has a source of ore. This will need to be roasted (probably in open pits) before smelting. Moreover this likely is to be purer than Wealden ore, so there will need to be some pre-campaign discussion about fluxing and charging ratios. It is also likely that a day or so of pre-heating will be needed, which will have some effect on charcoal supplies during the rest of the campaign.

Since materials are in hand, the principal issue is the supply of labour. Some members of the Wealden Iron Research Group have been assisting Gerald in the design and construction of the furnace, and two have also volunteered to help with smelting. At the moment about half a dozen HMS members (including your Chairman) have also volunteered to assist. However once the furnace is blown in, it will be running 24 hours a day for a week. Therefore if any more HMS members are interested in lending a hand – ideally for the whole campaign – then please do let me know.

The timing of the smelt is yet to be decided – a lot depends on the supply of ore and labour – but it is hoped that



*Photograph of the blast furnace taken during the construction of the new cover building.*



*Photograph of the bellows taken during the construction of the new cover building; the new build means that the bellows and other parts of the furnace are protected by tarpaulin.*

a smelt can be undertaken within the next six months. This will be the first charcoal iron produced by a water-powered blast furnace in the Weald since Ashburnham Furnace (TQ 6860 1710) closed in 1813 – a hiatus of just under 200 years in a continuing tradition of over half a millennium.

*Paul Belford*



*The furnace house at Ashburnham, Sussex - probably originally built as part of the boring mill.*

## WEALDEN IRON RESEARCH GROUP DIGEST 2012

The latest volume of the Group's annual Bulletin (Second series no. 32) was published in July 2012. Reports of fieldwork are confined to the discovery of a small bloomery iron smelting site in Burwash parish in East Sussex, but no dating evidence has been found.

In a region where more than 180 water powered furnaces and forges have been identified, it is somewhat of a surprise when a new site is discovered. Such is the case, however, with the mid 16th-century forge at Crowhurst in Surrey. In operation from about 1550 until sometime in the 1560s, it may have had one of the shortest working periods of any ironworks in the Weald. It was built by Thomas Gaynesford and leased to a group of local men, none of whom are known to have had prior connections with the industry, which may explain its failure. The identity of the site remains somewhat uncertain, the location of a subsequent mill with an unusual water supply system being the likely candidate.

Later ironworks in the Weald were in operation in the early years of English newspapers, and the availability of some of these journals on-line has enabled a selection of notices relating to such works to be published for the details they give about their management and ownership. Of interest are references to a small number of wire mills, and the repeated failure to find tenants for some works in a period of decline for the industry in the region.

The development of the railway network in the Weald in the 19th century led to the destruction of the surviving

features of a number of historic ironworking sites. One such site was thought to have been that of Etchingam Forge in East Sussex. Painstaking fieldwork, however, has shown that the site of the forge survived and an article describes the location and the former water management system.



*A furnace arch lintel from Lamberhurst Furnace, Kent, now in the kitchen of a nearby farmhouse.*

Surviving accounts of the gun-founding trade in the Weald largely consist of lists of output, expenditure on raw materials and income from sales. Little attention has been paid to understanding the relationship between the factors of production and the influences that affected financial performance. A novel approach is to be found in an article that attempts to model the business performance of a gunfounder in the 18<sup>th</sup> century.

*Jeremy Hodgkinson*

## BELL MOULD FROM EAST BRIDGFORD CHURCH, NOTTINGHAMSHIRE

During investigations, by Archaeological Project Services, at St. Peter's church, East Bridgford, Nottinghamshire, a fragment of bell mould was recovered from a deposit of 16<sup>th</sup>-18<sup>th</sup> century tile, apparently used as hardcore.

Heavily encrusted with copper alloy slag, the fragment is part of a cope (outer) mould for a bell. The shape and splay of the piece suggest it is approaching the bell mouth, though the actual lip of the mould does not survive, and at the widest point indicated by the mould the bell would have had a diameter of about 44cm. There is a slight suggestion of a groove for a moulding wire (a ridge that went around the circumference of a bell to increase the strength of the wall).

Although isolated the piece of bell mould indicates the casting, or re-casting, of bells at the site. Bells often were cast at ecclesiastical sites for several reasons of ease, including that the raw material, frequently old bells needing to be re-cast, was available on site, and also because it obviated the need for transporting heavy bells from centralised foundries to the churches where they would be used.

The oldest bell currently in East Bridgford church is marked with the date 1631, and the church has had a peal of 6 bells since 1649. Three of the bells, the second, fifth and sixth, were re-cast when the tower was rebuilt in 1778. The fifth was re-cast again in 1844 and another, the fourth, in 1870. Both of these 19<sup>th</sup> century re-castings took place at Taylor's foundries in Loughborough (pers comm G. Dawson, assistant archivist, John Taylor Bellfounders). It therefore seems likely that the recovered piece of bell mould was from the re-castings at the church in 1778, or perhaps the original castings in the 17<sup>th</sup> century.

*Gary Taylor*

### HISTORICAL METALLURGY SOCIETY 50<sup>TH</sup> ANNIVERSARY CONFERENCE

12<sup>TH</sup> TO 14<sup>TH</sup> JUNE 2013

FRIENDS HOUSE, LONDON

SEE BACK PAGE FOR DETAILS

OR

[WWW.HIST-MET.ORG](http://WWW.HIST-MET.ORG)



## HAFOD REGENERATION PROJECT

The Hafod Copper Works Regeneration Project is an ongoing project that may well become a benchmark for the conservation and regeneration of historic metallurgical sites. The Copper works site in Swansea has recently been allocated £35,000 to fund an implantation place for the regeneration of the area. What is so important about the scheme is that this is not the conservation and development of a heritage resource in isolation but more the development and regeneration of a whole area with public amenities and housing including in the scheme.

In addition to the copper works, the Glyn Vivian Art Gallery is also currently undergoing redevelopment, having received £6.7m of funding. Together these facilities have the potential to become top class attractions in Swansea, and will benefit the local community both by providing leisure and educational opportunities as well as business and job opportunities.



*The riverside at the Hafod Copper Works.*

The entire riverside area will be developed and it should be of interest to those involved in the conservation of our metallurgical heritage. The project demonstrates clearly how industrial sites can form the focus for redevelopment through acknowledging the role of such sites and critically the communities which formed and endured around them. The project involves a collaboration between Swansea Council and the University and should result in an environment where people live, work, and visit a site that, in terms of its industrial heritage, is widely acknowledged as being of major international importance. It is an exciting project and one which HMS will follow closely.

*Roger Doonan*

## HENRY BESSEMER BICENTENARY

The 19<sup>th</sup> January 2013 marks the bicentenary of the birth of Sir Henry Bessemer.

Born in the village of Charlton, near Hitchin in Hertfordshire, UK in 1813 he is best known as the inventor of the Bessemer Converter, which was arguably the first pneumatic bulk steelmaking process (Kelly in USA also laid claim to a pneumatic process at this time but it was never commercialised). Bessemer published his invention in 1856 and the first commercial application was seen in 1858. The process was still in operation worldwide well into the 1950s.



Henry Bessemer. From Meyer's Encyclopedia, 1906.

Bessemer persevered to overcome major difficulties in commercialising the process, first to overcome porosity in the cast ingots - which he did following the suggestion of Robert Mushet to add spiegeleisen (Fe-Mn) to deoxidise the steel - and later in recognising that the process was only suitable for the treatment of acid ores - low in phosphorus - as Bessemer used a silica lining in his converter which was attacked if the recognised process of adding lime was used to remove the phosphorus which embrittled the steel on cold working. (Sidney Gilchrist Thomas overcame this problem in 1878 by using a basic lining of burnt dolomite and pitch in the converter rather than Bessemer's silica lining).

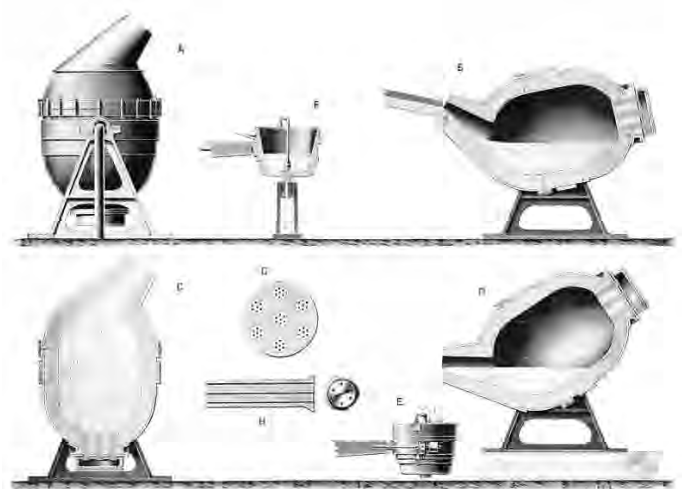
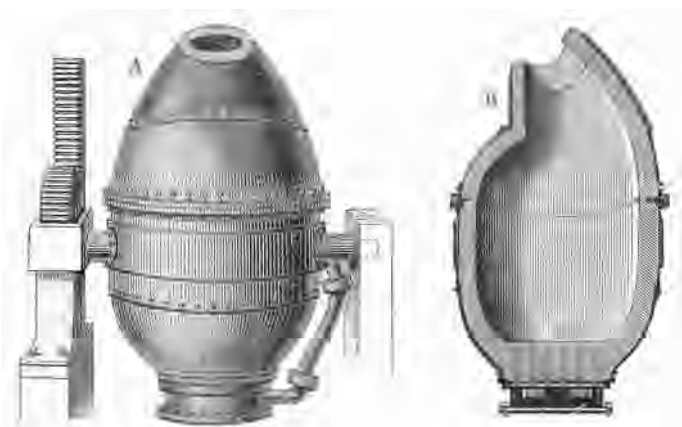


FIG. 111. THE PNEUMATIC CONVERTER (BESSEMER'S FORM).



Prints of the Bessemer Process from 1867 (top) and of a Bessemer converter from 1900 (bottom)

Bessemer was a prolific inventor with 117 patents to his name. Fortunately one invention on the production of 'gold' leaf for artists was so profitable that it enabled him to persevere to overcome the problems he first experienced with converter steelmaking.

To celebrate the anniversary of his birth, the Friends of Charlton Village - a hamlet on the southern edge of Hitchin - are holding a party in the local pub (the Windmill) on the evening of the 19 January and have arranged an exhibition on Bessemer's life at the British School of Invention in Hitchin running from February to 18 May which will close with a Victorian Fair on 18 May.

In addition, the IoM3 in London are organising an exhibition at their headquarters, 1 Carlton House Terrace, from 19<sup>th</sup> January for three to four months as well as publishing an article by a descendant of Bessemer in the January issue of 'Materials World'.

Tim Smith

## MES AYNAK'S ANCIENT COPPER MINES (AFGHANISTAN)

Mes Aynak is an ancient copper mine and Buddhist centre in modern Afghanistan dating to the Kushan and Sassanid periods (AD 103-651). Geological exploration has revealed the site is located directly above the second largest known copper ore deposit in the world. An open cast copper mine is planned to extract the copper ore and archaeological excavations are currently attempting to record this important archaeological site before it is destroyed. The work has been an ongoing joint project, since 2009, between the government of Afghanistan and DAFA (Délégation Archéologie Français en Afghanistan).

Until recently little was known about the ancient copper extraction methods at Mes Aynak but current work has started to shed some light on this aspect of the project. So far we have looked at three locations extending up the side of the east side copper bearing mountain. We have identified three features that could potentially be copper furnaces, or related structures, and a further 25 remnants of features that could either be related to metalworking or



*Map showing the location of Mes Aynak in Afghanistan.*

from another process such as kilns for ceramic production, lime for plaster, charcoal or simple ovens.

The photograph below is one of two furnaces found in area MA 051. It is located near the top of the mountain,



*Looking southwards across Mes Aynak. The settlement is in the foreground and on the right is the mountain containing the copper ore and the location of the furnace structures.*



approximately 2500m above sea-level, within layers that seem to be mine working tailings. As can be seen the walls are made of large slag blocks, which is common to the three furnaces we have attributed to copper smelting. We have also found some slag fragments that seem to have had ceramic lining material applied to them suggesting these structures had a ceramic furnace lining.

At the base of the mountain, in area MA018, apart from finding one further example of a furnace structure



*Furnace 18, south face section, area MA 051 (scale 0.5 m).*

built of slag blocks, we have also recorded buried working surfaces and buried structures within numerous overlapping slag heaps. Much of what we have found at Mes Aynak dates to the Kushan (AD 103-225) and Sassanid (AD 226-651) periods but the presence of these buried structures could indicate earlier phases of copper extraction and settlement.

Work within the settlement area of Mes Aynak has also uncovered evidence of metallurgical activity. A small quantity of crucible fragments have been found and in separate location a potential metalworking area. However, the most significant find has been a room in building that contained 300 copper-alloy coins and a fragment of copper-alloy bar (approx. 10 mm diameter). Excavation is ongoing but this structure could potentially be a coinage mint and would therefore be significant for

understanding coinage production and circulation.

Little investigation has currently been done on the mines themselves due to limited resources and expertise in this area but there are at least two examples of mineral seams showing tool marks and at least six places where machining has uncovered tunnels. There is also a large underground gallery/chamber that extends for 10-15 m near the top of the mountain. An ancient wall and steps had been built into the entrance of this chamber, which is heavily silted. This chamber is approximately 1 m below the ground surface upon which numerous structures are situated.

It remains to be seen how much further work will be possible at Mes Aynak due the planned opencast mining operations. What we have discovered, so far, is a small snapshot of a complicated and significant copper mining landscape that was part of a wider social and economic within the Kushan and Sassanid empires and beyond via the Silk Road.

*Tom Ely*

## HMS REMINDERS

### E-MAILS

We feel honoured that many of you have been members of HMS for a long time – so long, that you didn't have an email address when you joined. We are now trying to update our records to include email addresses for everyone. So please, take a minute and email our Subscriptions Secretary, Lesley-Ann Cowell, with an update of your contact details at: [lesley@mcowell.flyer.co.uk](mailto:lesley@mcowell.flyer.co.uk). Please note if you are happy for us to use this as the primary means to contact you. You'll help us save time and trees.

### WEBSITE

We would like to remind all of those who perhaps haven't visited the website ([www.hist-met.org](http://www.hist-met.org)) in some time that a number of reference works are freely available online. This includes the *Metal and Metalworking* framework for archaeometallurgical studies in the UK, all past issues of the *HMS Newsletter*, and a number of relevant datasheets on various sub-topics of archaeometallurgy.

# MEET YOUR COUNCIL

## TIM YOUNG

I have been a member of the Society for about 15 years. I was first elected to Council in 2002-06, was Chairman 2007-11 and am now back on Council as an ordinary member. As Chairman I was ex-officio member of the various HMS committees and I have since continued an active role in the Membership, Publicity and Programme Committee as well as the Archaeology Committee. In recent months, I have also taken over the task of typesetting the HMS journal *Historical Metallurgy*.

Archaeometallurgy is my profession but, like many, my route into the discipline was an indirect one. As a teenager most of my spare time was spent volunteering on archaeological excavation, and my first forays into archaeological science were in environmental bioarchaeology. At university I studied geology, but in subsequent years I steered my academic research on the geology of iron ores back towards archaeological applications. In 1997 I left academic geology to establish a business providing analytical and interpretational services to archaeologists. My day's work may involve

anything from field survey, geophysics or excavation through to laboratory analysis of materials ranging from Bronze Age moulds to parts of Victorian steel furnaces. When the society was first conceived fifty years ago, that there would one day be private sector contractors providing such services would have been almost unimaginable! That they do so, is in no small regard a direct result of the promotion of historical and archaeometallurgy by HMS.

However, we should not rest on those laurels. Encouraging the study of past metallurgical activities, ensuring that the remains of those activities are both preserved and better understood, promoting best practice and training the future practitioners, all remain 'work in progress'. HMS is uniquely placed to provide a focus and means for the further development of our discipline, in all its diverse forms, to the next level; exciting things are afoot at the society. These are tasks well worth taking time out of the day job to support...

*Tim Young*



*Tim Young recording industrial ironwork at Ffos y fran.*

## THE MEMBERS, PUBLICITY AND PROGRAMMES COMMITTEE REPORT

The Historical Metallurgy Society is now celebrating its 50<sup>th</sup> anniversary, and because there was no definite start date for the society we decided that we should have a year long celebration.

After the success of the first two anniversary conference; Birmingham conference 'Furnaces, Foundries and Forges: Ironmaking Heritage Revisited' and the non-ferrous based meeting 'Not so much Gold, Silver, Bronze - more Copper, Zinc and Brass' held on the 6<sup>th</sup> of October. The Historical Metallurgy Society will finish our anniversary year with a bang, and are planning a large conference in London in June. There has been a slight change of dates and a change of venue, which will allow us to offer far better value for money while times are tough. The new date for your diary is the 14<sup>th</sup>-16<sup>th</sup> of June 2013, there will be wine, cake, a range of talks and a poster session. The call for papers and booking form are enclosed with the newsletter, but also keep your eyes peeled on the website.

In addition to these special anniversary events on the 22<sup>nd</sup> to 24<sup>th</sup> of March 2013 there will also be a field trip based meeting organised by Peter Halkon ([A.P.Halkon@hull.ac.uk](mailto:A.P.Halkon@hull.ac.uk)) and the archaeology committee which will explore iron working in and around East Yorkshire. Later in the year on October the 19<sup>th</sup>-20<sup>th</sup> 2013 the Historical Metallurgy Society will return to Sheffield to celebrate the 100<sup>th</sup> year of stainless steel with a meeting based at the Cutlers' Hall.

MPP is also trying out a new type of informal meeting, the HMS regional groups. These will meet on a fairly regular basis allowing members to catch up on the latest news. The first group to be established will be in London, so if you are a London based member please let me know by email and I will add you to the contact list, and will be in touch with news on the first meeting.

So whatever your interest there is something happening around the country for our members. As always MPP are keen to hear from members about meetings you would like to see happen, so just get in touch. HMS and MPP is also happy to assist members who are interested in setting up their own Historical Metallurgy meetings or conferences.

HMS Council and the various committees are treating this anniversary year as a good excuse to evaluate what we are currently offering members, and to continue to add new benefits to members. The membership, publicity and programmes committee believe that the 50<sup>th</sup> anniversary is also the perfect time for a celebration of historical and archaeological metallurgy. MPP is currently concentrating on publicity and raising

awareness of HMS both nationally and internationally. MPP jointly with the new communications committee are considering an emailed newsletter so please send your email addresses to the membership secretary at [lesley@mcowell.flyer.co.uk](mailto:lesley@mcowell.flyer.co.uk).

If you think you may be able to help MPP in any way please get in touch as we are always looking for enthusiastic members to help. If you can't dedicate any of your time to HMS but feel there is something we are not doing that we should be please let us know. We would particularly like to hear from historians and/or those in the modern metallurgy industry

*Eleanor Blakelock*

## ARCHIVES AND SLAG COLLECTIONS

### OPEN DAY

**Saturday 27<sup>th</sup> April 2013**

The Archives and Collections Committee (ACC) is organising an open day at the Long Warehouse, Ironbridge Gorge Museum Trust, Coalbrookdale, TF8 7DQ, on Saturday 27<sup>th</sup> April 2013. HMS Members are welcome and invited to attend to gain an insight into the work of the ACC.

After a brief introduction, it is intended that workshop sessions on the management of the collections will be held. These will be "hands on" and will achieve useful progress in cataloguing and protecting the collections rather than just be set piece "exercises".

Sessions will cover both the paper archives and the slag collections. We hope that participants will choose to split their time between the two, but if necessary it will be possible to select either one or the other.

Tea, coffee and lunch will be provided. For those requiring accommodation, this may be available at a small discount at the nearby Youth Hostel.

Complete the form enclosed with this issue of the Newsletter or book your place through:

Eddie Birch (Tel 01226 370331)

Louise Bacon ([lbacon@horniman.ac.uk](mailto:lbacon@horniman.ac.uk))



## SALVADOR ROVIRA

Salvador Rovira Llorens deserves much credit for turning Spanish archaeometallurgy into a distinct field of study recognised internationally. His numerous publications on metallurgical technologies of all Iberian regions and periods are essential works of reference, as are his other projects ranging from South America to Central Asia. Most notably, however, Salvador is widely esteemed as generous and supportive teacher and collaborator.

Born and raised in a Mediterranean city surrounded by prehistoric sites, he inherited an early interest in archaeology from a school teacher, but his initial formal education was in the field of Electronics. After years of attachment to the Spanish Association of Friends of Archaeology, he decided to shift his studies and become an archaeologist. Since he had always been interested in the technological aspects of material culture, he endeavoured to connect archaeology with materials science.

After a few years working at the Institute for the Conservation of Works of Art and Archaeology, he joined the Spanish Corps of Museum Conservators, first to work at the Museum of America and soon after, at the National Archaeological Museum. At the same time, he was Visiting Professor at the Universidad Autónoma of Madrid. He retired formally in 2009 but, as he tells **The Crucible**, he remains as active as ever.

**THE CRUCIBLE:** Can you summarise your career in a couple of sentences?

**SALVADOR ROVIRA:** It's hard to summarise some thirty years of dedication to archaeometallurgy in just a few sentences. Even though my initial training was that of an archaeologist, I had always been interested in questions of prehistoric technology. A decisive step in my career was joining the Spanish National Corps of Museum Conservators, and subsequently directing the Conservation Departments of important museums such as the Museum of America or the National Museum of Archaeology. This allowed me to institutionally join many national and international research projects

**THE CRUCIBLE:** What's your most memorable professional moment?

**SALVADOR ROVIRA:** I would have to mention two. The first one, the meeting that my dear friends at the Spanish Superior Council of Scientific Research (CSIC), led by Ignacio Montero, organised in my honour as I retired in 2009. This was the memorable "TESME, Archaeometallurgy: Technological, economic and social perspectives in Late Prehistoric Europe". These days were unforgettable not only because of the quality of the work presented but also, very especially, because of the many colleagues from around Europe who came. I had never imagined that I had so many good friends in the profession.

The second one, no doubt more personal, was the award of the Order of Civil Merit by His Majesty the King Juan Carlos in 2010, in recognition of my research career.

**THE CRUCIBLE:** Who's been your most influential colleague, and why?

**SALVADOR ROVIRA:** This question requires two answers too. Paul T. Craddock has been, and continues to be, one of the colleagues whose work have taught me, and continues to teach me, the most. For a few years I was particularly interested in studying the chemical composition of metallic objects – and Craddock's works (often written jointly with other colleagues) were essential references. I met him in person at a congress in Madrid in 1985 and since then we have continued to meet at various events, I'd say that almost every year. There is a mutual rapport that has grown over the years.

In the early 1990s my scientific interests drifted towards prehistoric metallurgical slag. This was a gap in Spanish research that had to be filled. The orientation I received from Andreas Hauptmann, both through his publications and innumerable conversations, was fundamental. I met him in 1985 too, at the same congress where I met Craddock. We have a close friendship.

**THE CRUCIBLE:** What's your main current project?

**SALVADOR ROVIRA:** The project that has taken up most of my professional life is "Archaeometallurgy of the Iberian Peninsula". We launched it in 1982 with a Kevex 7000 XRF spectrometer and a Reichert MeF metallographic microscope. Since then, we have managed to keep a steady stream of funding to keep developing the research and the laboratory instruments. The project's coordination has been, successively, in the hands of Manuel Fernández-Miranda (the initiator), Germán Delibes and, currently, Ignacio Montero. From the project's start until my retirement I was in charge of the laboratory analyses, in collaboration with Susana Consuegra and Ignacio Montero. The project currently has what probably constitutes one of the largest databases in Europe, with over 20,000 chemical analyses including objects, slags and minerals, and some 4,000 metallographic analyses.

**THE CRUCIBLE:** What multi-million project would you like to develop?

**SALVADOR ROVIRA:** Without a doubt, the characterisation of the mineralisations of the Iberian Peninsula by lead isotope analysis. The most recent works in this area carried out within our project are providing many unexpected surprises regarding the mobility of metals and minerals.

**THE CRUCIBLE:** Which publication should every HMS member read?

**SALVADOR ROVIRA:** One of the greatest assets of HMS is the variety of professionals and interests it hosts. A browse through the indexes of the Society's journal *Historical Metallurgy* suffices to demonstrate that. As such, I don't think there is a single modern publication about metallurgy that is of interest to everyone. However, for those interested in the prehistoric metallurgy of copper and its alloys (which is the topic I work on), I believe that Andreas Hauptmann's 2007 *Archaeo-Metallurgy of Copper* is a fundamental work of reference.

If I have to mention a publication in which I am involved, then I would recommend the three volumes of the project that appeared in 1997, 1999 and 2003 under the generic title *Las primeras etapas metalúrgicas en la Península Ibérica*. These cover from the Chalcolithic to the Middle Bronze Age. But I ought to say that, in our case, the best work is yet to appear: we are currently working on a book to be entitled *Arqueometalurgia de la Península Ibérica y Baleares*, covering from the earliest stages until the Late Middle Ages.

**THE CRUCIBLE:** Have you got any advice for young students interested in archaeological and historical metallurgy?

**SALVADOR ROVIRA:** Absolutely yes: In archaeometallurgy, the number of unknown or understudied topics is far higher than the number of those that have received a convincing answer. This means that a lot of work remains to be done, and that we need to increase the number of researchers.

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

**SALVADOR ROVIRA:** What you are holding in your hands is a fast and efficacious instrument of communication. We should all collaborate with our own contributions, to make sure it continues this way.

## FUTURE INTERVIEWS

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

*Would you like any additional question added to our standard list?*

*Please let us know at [thecrucible@hist-met.org](mailto:thecrucible@hist-met.org).*

## AFRICAN ARCHAEOLOGICAL SLAGS - WHAT THEY CAN AND CANNOT TELL US

Imagine Morton and Wingrove, Ron Tylecote and Cyril Stanley Smith were to read 21<sup>st</sup> century publications on archaeological slags. What would they think? Has the discipline advanced or stagnated? Is there anything new?

Slags, the near imperishable waste products of smelting, contain significant technical and cultural information about the societies that produced them. Typical handbooks on archaeological slags indicate that slag studies illuminate raw materials used in smelting (the ores, the clay, and the fuel), the temperatures that were reached in the furnaces and the liquid and solid state reactions that occurred in the extant furnaces. Furthermore, the amount of metal oxide left in the slags is essential for demonstrating the efficiency of reduction. These parameters were clearly established when the discipline of archaeometallurgy started in the 20th century. So what basically is different between then and now?

Especially since the late 1980s, the development of anthropological approaches in archaeology has seen gravitation towards the need to extract both technical and cultural information from technological studies. The anthropology of technology, social constructionism, chaîne opératoire and the now fashionable materiality are some of the theories used to access human beings in technological studies. This is perhaps one thing that the founders of archaeometallurgy might see as an additional dimension but Cyril Stanley Smith would argue that since the early 80s he had figured out that the beginning of metallurgy was all about materiality.

The study of slags has progressed significantly and many researchers have joined the fray - we still document ore used, characterise technologies that produced the slag, infer ore sources, estimate furnace operating temperatures and can now compare the chemistry of slags produced since metallurgy began up to recent times. Great stuff. But, there is still some vital information that slags cannot tell us. Slags cannot tell us the name of the smelters, neither can they inform us about whether the smelts were successful or not. This detail may not be very important – but for Africa, as elsewhere, it seems that slags cannot tell us the furnace types that produced them. The ethnographic record of Africa is replete with numerous furnace types of staggering diversity. There are tall natural draught furnaces and the varieties of low shaft and bowl types. According to slag handbooks, these furnaces produced fayalitic slags, which are difficult to separate into groups physically and chemically. Archaeologically, neither is it easy to tease apart all these furnace types. The consequence is that while there is a great deal of furnace diversity ethnographically, archaeologically there is homogeneity as it is frequently impossible to identify furnaces used on the basis of available evidence, chemically or otherwise. Often, natural draught furnaces have tuyeres that fused in multiples – but can we always be sure?



*Natural draft low-shaft furnace with numerous tuyères (photo G.Celis).*

Therefore, the million dollar question is: can slags, often the best preserved remains from smelting, tell us about the furnaces that produced them? Many in the business of studying archaeological slags will balk at the idea – how can that be possible? Similar thermodynamic principles govern reduction such that bloomery slags have a more or less identical chemistry dominated by fayalite and wüstite irrespective of furnace type. Furthermore, the ores that were used were very diverse; some were high grade others low grade such that it is impossible to even dream of getting leads on macro variation from slags. This is all reasonable. But the frustration of failing to identify archaeological furnace types used in African prehistory persuaded me to experiment with slag compositional data from bowl, low shaft, and tall natural draught furnaces. This mammoth task involved gathering published data from numerous places across Africa. In the study, it was realised that there are so many sources of variation such as the local geology, the ore to fuel ratio used and so on and so forth but nevertheless bivariate and multivariate statistics were used in an experiment to link archaeological slags to furnace types. In any case, bloomery technologies mostly thrived on high grade ores and low grade ores were beneficiated to increase the amount of metal oxide sufficient for reduction and for partitioning into the slag. So, it is reasonable to assume that high grade ores were used across different geologies and cultures.

## “FURNACES, FOUNDRIES AND FORGES: IRONMAKING HERITAGE REVISITED”

### HMS SPRING CONFERENCE

25<sup>th</sup>-27<sup>th</sup> May 2012, Birmingham, UK

The first of the three HMS 50th anniversary conferences was held over a weekend in Birmingham at the beautifully landscaped grounds of the Woodbrooke Quaker Study Centre in the historic heart of the British iron industry.

Peter Crew began Friday's talks with a paper discussing the development of iron production seen through bloom sizes, production estimates, and raw material costs. Kate Biggs' paper 'Overlooking the Wye Project' discussed the importance of a holistic approach to heritage management, dealing with both the built and natural environments. Recent projects dealt with Abbey Furnace, Tintern, and Mushet's Whitecliffe furnace, Coleford, the latter of which is now being conserved. Ian Standing, who took an active part in Whitecliffe's preservation, was on hand to answer questions. Highlights from Saturday included Don Wagner's paper on 'Cast Iron in China'. He discussed such objects as 2<sup>nd</sup> century BC cast iron tomb doors and the Cangzhou lion (cast 953AD). The lion, which was largest cast iron object in the world until 1910, is now corroding badly due to mismanaged conservation. David Cranstone discussed the problems researching puddling caused by conflicting contemporary literature.



*Delegates by the waterwheel at Churchill Forge, Worcestershire.*

The fieldtrips were a high point of this conference, made all the better by the fantastic weather. At the Black Country Museum we witnessed chain making, brass casting, and wandered through industrial relics such as steam-hammers, a re-heating furnace and rolling mill. This was followed by a fascinating tour of the water-powered Churchill Forge, active for over 500 years, complete with an operational waterwheel. Sunday's tours were to Cinder Mill, a partially excavated water-bloomery site, and to the Stirchley Furnaces, Telford; an extremely impressive site built in the 1820s with a monumental chimney and the remnants of four blast furnaces. A knowledgeable tour of the site was provided by Paul Belford.

*Matt Phelps*

Initially, I also doubted the benefits of such an endeavour but the more I got my head into it, the more I realised that some useful information could be obtained. Ternary plots and both bivariate and multivariate statistics indicated that natural draught furnaces were more reducing when compared to other furnace types. It was however difficult to chemically separate bowl from low shaft slags, presumably because all had shorter durations of reduction and thus the slags were too heterogeneous. Mass balance calculations were computed to arrive at theoretical slag compositions for the three furnace types, using the different times that it would take to reduce iron. Of course, chemistry and statistics alone are not enough to identify archaeological furnaces, but chemical data when combined with archaeological signatures such as multiple fused tuyeres typical of natural draught furnaces may give studies of African archaeological slags into another dimension. There is good correspondence between ethnographic and archaeological cases to make this a worthwhile exercise. Indeed, experimental reconstructions are being carried out, with similar ores and similar variables and so on and so forth.

Yes, there are things that traditionally can be accessible through slags, and indeed for the African archaeological record furnace type may now be one of them. Of course, the tyranny of system driven constraints makes identifying furnace types on the basis of chemical data alone near impossible – the founding fathers of archaeometallurgy would say impossible, just like some archaeometallurgists of the 21<sup>st</sup> century. But regardless of massive doubts – natural draught furnaces were more reducing when compared to other furnace types. It maybe worthwhile to build on this lead. Who knows, the im- in impossible may give way to possible! Only experimentation can tell.

*Shadreck Chirikure*  
University of Cape Town

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## “INTRODUCTION TO THE ARCHAEOMETALLURGY OF CYPRUS” NARNIA COURSE



**NARNIA**

NEW ARCHAEOLOGICAL RESEARCH NETWORK FOR  
INTEGRATING APPROACHES TO ANCIENT MATERIAL STUDIES

7<sup>th</sup>-11<sup>th</sup> May 2012, Nicosia, Cyprus

In May, the University of Cyprus hosted a five-day “Introduction to the Archaeometallurgy of Cyprus” course sponsored by the EU-funded International Training Network NARNIA (<http://narnia-itn.eu/>).

The event was a huge success and attended by nearly one hundred participants and streamed live on the internet. The course was a combination of lectures by experts in Eastern Mediterranean archaeometallurgy, excursions to copper mines and production sites on the island, and experiential learning opportunities. Visits to ancient and modern mines offered insights to Cyprus landscapes highly altered by mining activities over millennia, and tours of archaeological production sites permitted participants to examine smelting remnants in situ rather than in a laboratory or classroom. Additionally, on the last day, the participants were given a chance to try smelting copper from ores at Skouriotissa, probably the world longest operating copper mine!



*NARNIA Director, Lina Kassianidou, directing delegates at one of the many site visits.*

Talks early in the program included James Muhly, who provided an overview of central issues in Cyprus archaeometallurgy over the last four decades. Muhly set up a dichotomy between “analysts” and “metallurgists” in the physiochemical study of metal artefacts, and proclaimed, “Never trust metal analyses.”. Edgar Peltenburg discussed early metallurgy on Cyprus, noting that beginnings are difficult to recognise in archaeology. He noted that various parts of the island may have had different relationships with the raw material as well as outside connections. Thus, early copper production on Cyprus might not be a single story but instead many stories with varied regional trajectories. He encouraged studies that explore links among pyrotechnologies and to not compartmentalise craft

production, citing possible links between copper and faience. Bernie Knapp considered Bronze-Age metal production and exchange, and he discussed, in part, alternative methods to consider lead isotope data that yield quite different results.

Lina Kassianidou gave an overview of Bronze Age of copper smelting technologies in Cyprus, and Cemal Pulak and Andreas Hauptmann both discussed the Uluburun shipwreck. Pulak discussed the copper and tin ingots and proposed a route for the vessel that Knapp thought “perverse” during questioning. Hauptmann focused on the production techniques of the copper ingots found in the wreckage. George Papasavvas wrapped up the Late Bronze Age session. Lina Kassianidou contributed further papers on copper smelting looking at the Iron Age and Roman periods. Erez Ben Yosef gave an interesting talk on the direct dating of copper slag deposits using the magnetic signatures. He demonstrated that different metallurgical practices existed side-by-side on different scales, challenging evolutionary models. Roger Doonan spoke about the science and practice of copper sulphide smelting whilst David Bourgarit covered experimental approaches to sulphide smelting.



*NARNIA participants smelting copper at Skouriotissa mine.*

The fifth day included a special event at Skouriotissa mine, where smelting experiments were conducted. The participants were challenged to think about what they had learned in the air-conditioned lecture hall and apply their learning in the field. Ultimately, it did not matter that only a small amount of metal was produced. The aim was to experience the sights, smells and sounds of copper smelting and to appreciate the techniques and effort required to work bellows with sufficient vigour to reach temperatures of 1200° C!

Overall this training course was a great success, it succeeded in bringing together a vast number of students, academics and professional in a location which has to be amongst the most interesting places in the world for those interested in the history of metals.

*Ellery Frahm*



## “NOT SO MUCH GOLD, SILVER, BRONZE – MORE COPPER, ZINC AND BRASS” HMS AUTUMN CONFERENCE

6<sup>th</sup>-7<sup>th</sup> October 2012, SS Great Britain, Bristol, UK

In a break from the Society’s recent iron-centered themes, this year’s annual HMS conference, entitled “Not so much Gold, Silver, Bronze – More Copper, Zinc and Brass”, focused on non-ferrous alloys, with brass taking centre stage.

This meeting was a tremendous success with over forty delegates from across the UK and Europe and clearly demonstrated that there is wide interest in non-ferrous metallurgy among the Society’s membership. The conference was held in Bristol’s city centre in view of the scenic SS Great Britain, which gave the proceedings an appropriately, although slightly anachronistic, historical backdrop. The event was excellently organized by Eleanor Blakelock and Matt Phelps and chaired by Paul Belford.

The conference was held over two days, with the Saturday dedicated to eight related papers presented by researchers and professionals from a broad range of backgrounds,

while the Sunday was reserved for tours of the Warmley Brass and Zinc Works and the Salford Brass Mill.

Saturday’s program included eight talks, roughly divided by theme. The conference included generous tea breaks and an excellent lunch that offered the perfect venues for discussion. After a brief introduction to the proceedings from Paul Belford, the first of two technical papers was presented by Jocelyn Baker from Durham University on quantifying colours using spectrophotometry and ED-XRF. This was combined with a study of historical records in order to understand how British Anglo-Saxons would have perceived the relationship between copper alloy and precious metal colour space. The Society then welcomed our German colleague Gerald Eisenblätter from Leipzig University who gave a talk on the use of X-ray computed tomography and its use in the investigation of the Roman copper coins. This paper, co-authored by Alexandra Franz and Gert Kloess, combined various imaging and archaeometric approaches to offer a versatile non-destructive method to characterize the composition of copper alloys.



*Conference delegates in front of the historic HMS Bristol.*

After a short but well deserved coffee break the lectures continued on a decidedly more international outlook. Cambridge Archaeological Unit's Simon Timberlake presented an overview of experimental mining and archaeometallurgical investigations at Sakdrissi in Georgia, in the Mitterberg region of Austria, and Rosia Montana in the Apuseni Mountains of Romania. This broad sweeping overview was followed by Wenli Zhou from UCL who gave a paper on China's zinc distillation process from the 14<sup>th</sup> to 20<sup>th</sup> centuries. This paper outlined the clear technological head start that Asia enjoyed over Europe in regards to zinc production and neatly led to the next series of paper which covered the more traditional brass cementation and later zinc distillation processes in Europe and Britain.

The next four papers had a more local flavour, outlining the rise and fall of the British brass industry. A fascinating paper by one of the premier scholars on the Bristol brass industry, Joan Day, was read by Tony Coverdale of the Salford Brass Mill Project on the historical and archaeological story of the Avon Valley copper and brass industry between 1700 and 1740. A paper covering the development of the rise of South Wales as the world's dominant copper smelting area in the 19th century and its impact on shipping technology and the copper industry was given by Keith E. Morgan, curator of the Trose Works Cottage & Industrial Museum. Keith also kindly shared some surprising insight into the family origins of Swansea Valley's famous actress Catherine Zeta-Jones. This was then followed by a review of recent salvage excavations at William Champion's pioneering but ultimately failed 18th century venture at the Warmley Brass and Zinc Works by David Etheridge of the Avon Archaeological Unit.

However my personal highlight was the last paper of the day, given by historian Chris Evans of the University of Glamorgan, who broadened the topic substantially by exploring the role of copper and brass objects in the transatlantic slave trade. This excellent exposé was the source of lively discussion and elegantly tied together the various strands of research of the day into the broader global context which illuminated much of the developments we saw on more local scales.

The Sunday programme of field tours proved to be equally captivating. The first visit was of the Warmley Brass and Zinc Works discussed the previous day by David Etheridge. This complex was the first to produce zinc metal through the distillation process to make high zinc brass in Britain starting in the 1740s. The walk through the patchy remains of William Champion's estate was very interesting although at times puzzling and mystifying. The

slag-block summer house, and slag-clad concrete statue of Neptune, and slag-lined grotto complete with industrially-warmed waterfall, were particularly inspiring! Following a delicious Sunday carvery lunch at the Riverside Inn, we continued the day's activities at the Salford Brass Mill where Tony Coverdale and Joan Day gave a riveting tour. This mill is a prime example of what would have been a complex of mills scattered throughout the region working brass ingots into sheets and then into the various hollow-ware vessels destined for export. The grounds are dominated by several watermills that were used to roll the ingots into sheets and to power large "battery" hammers.



*William Champion's slag-clad Neptune sculpture.*

The positive response we have received to this entirely non-ferrous meeting (with only the occasional reference to iron manhole covers) clearly shows that there is much appeal for alloy-specific themes amongst the Society's members. It has been particularly pleasing to attend this well-organised and cohesively themed conference. This gave the chance for all the delegates to engage in meaningful discussion, crossing both geographic and methodological barriers. Attendance to the conference by all sectors of archaeometallurgy, including academics, enthusiasts, historians, museum curators, metallurgical engineers, and commercial archaeologists, continues to highlight the strength of the Historical Metallurgy Society in bridging customarily segregated fields. I look forward to seeing the Society expand on these strengths and feel confident that our next meeting, the 50th Anniversary Conference and AGM in London will be just as engaging and successful as this one has been.

*Loïc Boscher*

## HMS RESEARCH IN PROGRESS 2012

6<sup>th</sup> November 2012, Newcastle, UK

Andrea Dolfini and Michael Smith organised and hosted an excellent Research in Progress meeting. It was held, and generously funded, by Newcastle University. As noted in the closing remarks, the research presented was ‘truly research in progress’, and the talks offered a fantastic overview of various research projects taking place within historical and archaeological metallurgy across the globe. The range of approaches taken was particularly interesting, with presentations of experimental studies, instrumental analyses and academic research in different combinations. Below are some of my personal highlights of the day.

Yvette Marks presented an excellent paper on Bronze Age perforated furnaces, discussing her field, laboratory and experimental work that has led to a re-assessment of the working parameters of these furnaces. Yvette proved that these perforated furnaces, originally thought to have been used in conjunction with ceramic pot bellows, were in fact powered naturally by the high winds that she recorded on site. Experiments proved that these winds would heat the furnaces to the required temperatures to smelt copper ore and that the heat was even across the furnace instead of being localised (which is common with bellows-driven furnaces). She developed her re-assessment in a very logical way and linked her findings back to key archaeological and social questions. Her paper, deservedly, won the HMS student prize.

Evidence of metal production in Scotland, specifically casting activity, was discussed by Daniel Sahlén. Daniel



*David Cranstone and Tim Young awarding Yvette Marks the Best Student Presentation Award.*

presented material (predominantly ceramic moulds and crucible fragments) found during recent excavations and compared it to assemblages found in a wider context. He developed his arguments by identifying a number of trends; for example material distribution on the excavated sites. Daniel also noticed that the ceramic fabrics of the moulds and crucibles were remarkably similar to each other; suggesting the raw materials used for both crucibles and moulds were from the same source. He concluded that evidence for

non-ferrous metal production is in-fact traceable in the archaeological record of Scotland from the late Bronze Age to early Historic Period. It is therefore important to record and analyse these production materials and not just rely on the finished products as tools for assessing non-ferrous production.

The final paper of the day, presented by Andrea Dolfini, presented an exciting interdisciplinary project that seeks to produce an online metadata archive documenting use-wear patterns on artefacts with cutting edges. This paper developed themes presented earlier in the day by Rachel Crellin, regarding the development of use-wear analysis for the study of Bronze Age axes. Andrea explained the key principles of the online archive and its intended purpose as a resource to assist and encourage future research. These types of interactive, online resources are current in many fields and are providing academics and students with valuable resources for research and a forum for specialist discussion. It was a wonderful opportunity to see the development of one of these online spaces and the ideas behind it.

These three papers are just some of the exciting research projects presented; the nine other papers by Laura Perucchetti (on Bronze Age transalpine relationships), Siran Liu (on gold and silver production in China), Heather Hopkins (on lead dying kettles from Pompeii) Carlotta Gardner (on a late-medieval foundry in Croatia), Abdullah Alzahrani (on a mining settlement in south-west Saudi-Arabia), Michael Smith (on the role of copper and brass in the Transatlantic Slave Trade), Peter Cloughton (on ore processing in Queensland), Tim Young (on the old term ‘Wolf’s Spit’), and David Cranstone (on the development of the cementation process in Britain) were equally as interesting and thought provoking. Siran Liu and Laura Perucchetti were runners up in the student prize. The audience, of around 25 people, were welcoming and contributed to the discussion by asking interesting questions and providing useful feedback.

During the lunch break there was an opportunity to visit the Great North Museum. The exhibitions reminded me of how rich the archaeology of the North East is. There were some beautiful examples of Roman metalworking and explanations of how some of the artefacts were made; crucibles and moulds were displayed in some of the cabinets.

The 2012 RIP was a superb opportunity to discuss research as it happens in a friendly environment with both early career and more established scholars. I would certainly recommend future RIPs to anyone interested in current developments in the field.

*Carlotta Gardner*

# UPCOMING EVENTS

Conference	Date	Location	Theme	Website/email
BANEA 2013 Conference: Metals and Colours	3-5 January 2013	Cambridge, UK	Although this conference broadly encompasses Near Eastern archaeology as a whole, this year's theme should be of interest to many in the Society.	<a href="http://www.banea.org/conference">http://www.banea.org/conference</a>
The 7 <sup>th</sup> UK Experimental Archaeology Conference	11-12 January 2013	Cardiff, UK	This conference covers various themes of experimental archaeology, but also usually includes a few papers on experimental archaeometallurgy.	<a href="http://experimentalarchaeology.org.uk">http://experimentalarchaeology.org.uk</a>
UK Archaeological Science and Association of Environmental Archaeology Spring Conference	11-14 April 2013	Cardiff, UK	The primary aim of this conference is to promote collaborate and dialogue between diverse archaeological scientists.	<a href="mailto:UKAS2013@cardiff.ac.uk">UKAS2013@cardiff.ac.uk</a>
Mining for Copper: Environment, Culture and Copper in Antiquity: In memory of Professor Beno Rothenberg	22-25 April 2013	Timna, Israel	The conference will consist of a series academic sessions on copper metallurgy and guided tours to both Timna and Feinan in Jordan.	<a href="mailto:microarchaeology@gmail.com">microarchaeology@gmail.com</a>
HMS 50 <sup>th</sup> Anniversary Conference and AGM	12-14 June 2013	London, UK	This international academic conference is the culmination of a series of events marking the 50th Anniversary of the Historical Metallurgy Society and will provide a high-level 'state of the art' profile of current and future developments in the various disciplines which HMS represents.	<a href="http://hist-met.org/agm2013.html">http://hist-met.org/agm2013.html</a>
Rust, Regeneration and Romance: Iron and Steel Landscapes and Cultures	10-14 July 2013	Coalbrookdale, UK	This conference seeks to engage in an open multi-disciplinary analysis of iron and steel landscapes and cultures, from the ancient to the modern.	<a href="http://ironandsteel2013.wordpress.com/">http://ironandsteel2013.wordpress.com/</a>
The 8 <sup>th</sup> International Conference on the Beginnings of the Use of Metals and Alloys.	10-15 September 2013	Nara, Japan	This international conference is an interdisciplinary gathering of scientists, engineers, archaeologists and historians with a focus on production and use of metals, with an emphasis on cultural interactions and evolutions over time and space, especially between the West and the Asian region.	<a href="http://buma8.wiki.fc2.com/">http://buma8.wiki.fc2.com/</a>
HMS 100th Anniversary of Stainless Steel	19-20 October 2013	Sheffield, UK	Celebrating Harry Brearley's first arc furnace cast of stainless steel 100 years ago, HMS is holding yet another anniversary conference!	<a href="http://hist-met.org">http://hist-met.org</a>
Ancient and Historic Metals: Technology, Microstructure, and Corrosion Workshop	22-26 August 2013	London, UK	This five-day course will act both as an introduction and a focus of more intensive study dealing with the examination, analysis, metallographic examination and corrosion of ancient and historic metals.	<a href="mailto:dascott@ucla.edu">dascott@ucla.edu</a>

