

# THE CRUCIBLE

**Historical Metallurgy Society News**  
**Issue 93**

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*SEM image of an engraving on a Roman gold ring from the Colchester Hoard*

## INSIDE THE CRUCIBLE

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### Submissions

*Submissions to **The Crucible** are welcome at any time, but deadlines for each issue are 1<sup>st</sup> March, 1<sup>st</sup> July and 1<sup>st</sup> November every year. Contributions can be sent in any format, but we prefer digital if possible.*

### *The Crucible*

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The **HISTORICAL  
METALLURGY**  
Society

In the summer issue of **The Crucible** I announced that the management of the production of *Historical Metallurgy* was to be thoroughly overhauled. I am delighted to be able to announce the results of that process and give details of the new management structure. This structure is intended to allow the journal to provide a first-class service both to authors and to our membership.

The day-to-day smooth running of the editorial system will be in the hands of a new post, the Managing Editor. I am delighted to say that Kay Smith has accepted this position, and all new submissions for the journal should be sent to her (email: [submissions@hist-met.org](mailto:submissions@hist-met.org)). The work of the existing editorial team is now also to be enhanced, with the creation of an Editorial Board. Editorial board members will be invited to serve for a three-year term, with the possibility of subsequent re-appointment. The initial Editorial Board comprises nine members (in addition to the Society's Honorary Editors). The full new editorial team is listed below. Further appointments will be made to board in the coming years, both to ensure continuity and in response to any needs prompted by submissions in areas of our discipline not covered by the expertise of existing members.

We are enormously grateful to those who have agreed to give their time in support of *Historical Metallurgy*. These developments are an important part of the roadmap to place the journal back at the forefront of publishing in our subject and to make the journal fit-for-purpose in the changing environment of modern academic publishing.

## Honorary Editors

*Dr Justine Bayley FSA*: [Editor-in-chief] has jointly edited *Historical Metallurgy* since 1990. She has wide-ranging experience but her research focusses on Roman and medieval non-ferrous metallurgy in northern Europe. She was formerly head of the Technology team at English Heritage.

*David Crossley FSA*: [Editor] has jointly edited *Historical Metallurgy* since 1990. He is an historian and archaeologist, with experience mainly of ferrous metallurgy of the medieval and later periods.

*Dr Tim Young FSA FGS*: [Production Editor] commercial archaeometallurgist and geologist with wide-ranging interests, particularly in ferrous metallurgy. He has been production editor for *Historical Metallurgy* since 2012.

## Managing Editor

*Kay Smith FSA*: formerly Head of Conservation at the Royal Armouries. Her main interests are the development, manufacture and construction of arms and armour, especially artillery. She is a former Chair of HMS.

## Editorial Board Members

*Dr David Bourgarit*: an archaeometallurgist at C2RMF in Paris and member of Préhistoire et Technologie, UMR 7055, CNRS-University Paris10. He has a wide experience of many metals and periods, but is specialised in copper metallurgy, mainly European.

*Duncan Hook CChem*: archaeometallurgist/analyst in the Department of Scientific Research at the British Museum. Works mainly with non-ferrous metals of all periods and from all parts of the world. He has jointly edited many conference proceedings.

*Dr Jianjun Mei*: Director of the Needham Research Institute, Cambridge and Fellow of Churchill College, University of Cambridge. His research interests include the origins and role of bronze metallurgy in early China, and cultural and technological interactions between China and the West.

*Susan La Niece FSA*: archaeometallurgist in the Department of Scientific Research at the British Museum. She works mainly with precious metals of all periods and from all parts of the world, with particular interest in colouring, plating and patination of metal. She has jointly edited many conference proceedings and also the journal *Jewellery Studies*.

*Dr Janet Lang CEng MIMMM, FSA*: formerly archaeometallurgist in the Department of Scientific Research at the British Museum, with specialisms in ferrous metallography, silver and X-radiography. She has edited the 'abstracts' for *Historical Metallurgy* for many years.

*Prof Marcos Martínón-Torres*: Professor of Archaeological Science at the UCL Institute of Archaeology, London, he is an archaeometallurgist with wide-ranging interests, including non-ferrous metals, technical ceramics and alchemy.

*Dr Ignacio Montero Ruiz*: archaeological scientist at the Instituto de Historia-CSIC, Madrid, he works with many metals and periods, with particular interest in non-ferrous prehistoric metals and alloys. He is a former editor of *Trabajos de Prehistoria*.

*Dr Colin Phillips*: historian with interests in post-medieval ferrous metallurgy, mainly in the British Isles. Formerly Head of, and now Honorary Research Fellow in the Department of History at the University of Manchester. He is a former President of HMS.

*Prof Vincent Serneels*: Professor in Archaeometry at the University of Fribourg, Switzerland. He is a geologist and archaeometallurgist with wide experience in ferrous archaeometallurgy and in other materials, with research both in Europe and west Africa.

*Tim Young*

## HELPING TO FUND HISTORICAL METALLURGY INTO THE FUTURE

Readers of **The Crucible** will know that their Society supports research and conservation through grant aid. Grants may be made for a wide range of activities including assistance with the costs of travel for research and conferences (particularly for young researchers), as well contributing towards the cost of research and publication. The importance of Society grants is heightened in these times of austerity; public funding for conservation and research has shrivelled and times seem set to get harder.

The Society would like to be able to maintain and expand its financial support, but the resources so to do are very limited. The value of past bequests to HMS has been eroded by inflation and returns on investments have decreased. The 50th anniversary of HMS in 2013 gave the occasion for HMS to create the Anniversary Fund (<http://hist-met.org/about-hms/anniversary-fund.html>), to which members have been invited to contribute. Donations to this fund are tax-efficient (they attract Gift Aid if the donor signs a declaration that they are UK resident for tax purposes) and grants have already been made from this fund to support many valuable activities. That fund remains open for donations, but we must plan for the long term and so we would like to remind members of opportunities to support our work other than by donation, which may be appropriate to you, according to personal circumstances.

The most straightforward way to make a bequest is to add a codicil to an existing will. The Society cannot offer advice about wills, but can explain how to get professional advice and for what to ask your advisor.

It is not, however, always cheap or pleasant to make or alter a will, but recent rule changes in the UK mean that it is possible, for some pension-holders, to make a disposal of some (or all) of their un-drawn pension funds without making or changing their will. Details vary between different professional pensioner-trustees and between pension fund types, but all should provide a form with a title such as "Death Benefit Nomination Form" which allows the pension holder to say who should receive the money from the residual fund in due course. In principle, this can be as many persons or charities as you want in any proportion. This applies to pensions such as Small Self-Administered Schemes and Self Invested Pension Plans schemes where no annuity has been purchased (it does not apply to public sector pensions or to annuitised final salary schemes). It is very tax efficient, since the value of the fund does not form part of the donor's estate for Inheritance Tax purposes, and charitable recipients pay no tax on the incoming money. You, rather than the taxman, decide what happens to an important slice of money.

HMS cannot provide you with advice on this issue but if

you are interested it can provide some helpful suggestions. Please contact us by email at '[appeals@hist-met.org](mailto:appeals@hist-met.org)'. Should you wish to add to a specific HMS fund, or if you wish to explore the possibilities, we can send you details of these funds and of the various options (as an example, you could specify that money should be added to the general fund, but that your preference would be to support outreach to schools for instance).

*Jonathan Prus & Eddie Birch*

## IRAN; THE LAND OF ARCHAEOMETALLURGICAL SURPRISES

There is a long tradition for archaeometallurgical expeditions through the Iranian Plateau. The most important areas, where the mining activity was concentrated, are located around the central Iranian Desert and along the Zagros Orogeny. The ancient copper mine of Sheikh-Ali is located 250 km south of Kerman Province. Geologically speaking, this outcrop belongs to the ophiolitic zone of metal enrichment in the southern section of the Zagros Orogeny. Sheikh-Ali is characterized as sulfide-volcanogenic Cyprus Cu-type. The main host rock bearing economic minerals are basaltic intrusions in association with donite, harzburgite and serpentinite which contains high enrichments of Cr, Cu, Zn, Mn. Economic mineral paragenesis in Sheikh-Ali is chalcopyrite-sphalerite-covellite-bornite.

The huge amount of slag, mines and metallurgical remains, as well as two unexcavated settlements, are among the considerable remains in this region. The dating of metallurgical remains unknown. The slag showed different external textures, the microscopic investigation characterized the material as copper smelting slag. Sheikh-Ali is an important region for discovering high lights about metallurgical evidences unrenowned triangle of Jiroft, Tal-e Eblis and Shahdad.

*Mohammadamin Emami*



## X-RAY FLUORESCENCE: THE BASICS

X-Ray Fluorescence (XRF) is very widely used in Archaeology, art and conservation and particularly in the analysis of metals. Whilst with modern hand held XRF instruments it is possible to “point and shoot” and get numbers, what do they really mean? Where is the signal coming from? Can I believe the results?

All XRF instruments, whether 4kW floor standing or 1W hand held, obey the same laws of physics. The primary excitation from the X-Ray tube causes inner shell electrons to be ejected from orbit and the resultant vacancies are filled from higher shells. The energy difference between the shells is what is emitted as an X-Ray photon characteristic of the element. For hand held units it is possible to analyse from Na through to U in the periodic table though not necessarily all at the same time.

Where does the signal come from? The primary X-Ray beam can easily pass right through your sample but the resultant fluorescent signal only comes from the surface. The rule of thumb is the lighter the element in the periodic table and the denser the base material then the thinner the analytical depth. See table below.

Analyte	Base Material	Analytical Depth microns (approx)
Mg	Al	13
Mg	Fe	0.6
Mn	Cu	21
Cu	Cu	50
Ag	Cu	100
Sn	Cu	140
Au	Au	10
Zr	SiO <sub>2</sub>	1000

Understanding your sample and where the signal emanates from is the key to understanding XRF. With a clean, flat homogeneous metal surface it is possible to get an accurate analysis. How many times with old metal samples are they flat, clean and homogenous?

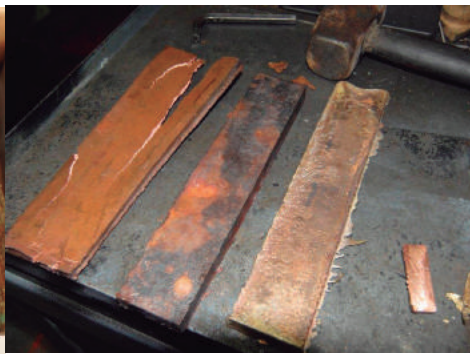
Same applies to slag, rocks and ores. The instrument spot size is around 6mm in diameter and analytical depth a few microns so, you are only analysing a few mgs of sample.



Copper drive bands.



Removed from shells.



Cast and rolled.

Ideally samples ground to “flour fine” will give the best results.

Having said all this hand held XRF is still a very powerful analytical technique. Even without quantification you can always work with the spectra. I have my own hand held XRF system and am willing to discuss possible projects with other HMS members. There would be no charge for the work. The following case study on one recent project gives an idea of the sort of work which might be attempted.

### Case Study: Making bugles from world war one shells’ copper “drive bands”

Talk about wrong place wrong time! Whilst doing some of my own melting work in a foundry in Birmingham the owner asked me why the copper he had melted was cracking on rolling. Turns out that the project was to re-melt “copper drive bands” salvaged from world war one shells from the Somme and make a set of bugles to be played in 2018 in the celebrations of the end of the war.

XRF analysis of the material suggested an alloy type of CDA110 or CDA172. The composition indicated around 0.1% As plus traces of Zn Sn and Ag in each of the samples.

Name	Ni	Cu	Zn	As	Ag	Sn	Sb	Bi
bugle 1		99.31	0.06	0.10	0.06	0.09	0.03	0.01
bugle 2		99.41	0.07	0.13	0.08	0.09	0.03	0.02
bugle 3	0.02	99.33	0.07	0.04	0.03	0.10	0.03	0.03

TMB Art Metal, who is leading this project, had 3 genuine 1<sup>st</sup> World War bugles at their London branch which we also analysed by portable XRF.

So is this small amount of As there as a de-oxidant? Any thoughts? The copper metal was re-cast then annealed between each roll to produce sheet of the required dimensions. Bugles are currently in production.

Mike Dobby

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## WEALDEN IRON

A summary of the 2016 volume

For the first time this year's annual Bulletin of the Wealden Iron Research Group (second series 36) has been split into two parts but issued at the same time. Some pages are also in colour.

Part I starts with a round-up of field notes: notice of a second carbon date for charcoal excavated at a bloomery in Broke's Wood, Southborough, near Tunbridge Wells, confirming the Middle Iron Age dating; a report on the discovery of two undated bloomeries in Brede, East Sussex; notes on an undated bloomery and iron ore extraction workings of probably later date in Waldron parish, East Sussex; a summary of investigations at a site at Crowborough, East Sussex, where evidence of Iron Age and Medieval ironworking were found; the discovery, during archaeological evaluation in advance of building development, of a Middle Iron Age bloomery hearth north of Haywards Heath, West Sussex, the first in that area; and a reinterpretation of pond bays associated with East Lynden furnace, a probable 16th century site near Ticehurst, in East Sussex.

When Cleere and Crossley published their book, *The Iron Industry of the Weald*, in 1985 the physical details of sites was based on fieldwork by Ernest Straker revisited and sometimes reinterpreted by WIRG. Henly Lower Furnace in East Sussex was one site that was included on the basis of such reinterpretation. An article challenges WIRG's interpretation, and Straker's original location for Riverhall Furnace is reasserted.

The existence of a forge on the site of Mayfield Furnace in East Sussex has been postulated for more than 30 years but its location has been problematic. An article proposes a controversial solution involving reuse of the water from the furnace and boring mill tailraces and the overflow from the furnace spillway.

Stream Mill, at Chiddingly, East Sussex, has been a forge, a furnace and a boring mill. The site has been revisited and a report on the locations of the three operations described.

The availability of early newspapers through their digitisation has facilitated access to 18th century notices of the lease or sale of ironworks, providing useful details of sites and their equipment. A further compilation of such advertisements is the subject of a short article.

The final piece in the Part I concerns the activities of the Prickett family who had earlier been involved in ironmaking in the west of England but who in the second half of the 18th century, and contrary to the trend at the time, moved to the Weald and London and had roles in the declining iron industry in the region.

Part II comprises three articles. WIRG has been excavating

the site of a bloomery in Salehurst parish, East Sussex, and an interim report outlines what was found. Both Iron Age and medieval pottery have been found and radiocarbon dating is awaited to confirm in which period the site was worked. An examination of the slags found at the site and on other sites in the Weald points to two differing processes.

Experimental iron smelting carried out by WIRG in an on-going programme is the subject of two articles. In the first, the relationship between the bloom yield and the loss of furnace clay into the smelt for three separate experimental smelts is analysed. And in the second article the yields of the same three smelts are analysed to understand the influences of the different aspects of the smelting process.

*Jeremy Hodgkinson*

## A SMALL CAST PIG

In *The Crucible* 90 we described briefly a remarkable cast iron 'bloom' weighing some 90kg found on a water-powered ironworks in southern Cumbria. A magnetometer survey of the site has now been carried out which shows some well-defined dipolar anomalies which may help to date the site. During the survey other finds were recovered including another complete cast-iron 'bloom', but of only 15kg, and a broken fragment of a cast iron pig with lettering, possibly WG or WO..., or even ...OW... This is much smaller and more carefully cast than normal (later?) cast iron pigs and any information about possible parallels would be gratefully received. It is now rather beginning to seem that cast iron may have been deliberately produced at this site.

*Peter Crew & Jack Procter*



Cast-iron pig fragment.  
Length 72mm max,  
width 57mm, max.  
depth 46mm max.  
Weight 1170g,  
density c. 7.8g/cc.  
Scale: 50mm.



## JIANJUN MEI

As an archaeometallurgist, Professor Jianjun Mei has focused his research on the origins and role of metallurgy in Early China and cultural interactions between China and the West. During the 1980s, he studied Physical Chemistry in Metallurgical Processes and History of Science and Technology at the University of Science and Technology Beijing (USTB). His work in Cambridge started in 1994, as a Li Foundation Scholar working at the Needham Research Institute; and a year later, he began his PhD study in archaeology at the University of Cambridge with a scholarship offered by the East Asian History of Science Foundation, Hong Kong. After postdoctoral work in Tokyo and Cambridge he returned to China in 2004 as a professor at the USTB and Director of the Institute of Historical Metallurgy and Materials. In recent years he has been a leading member of the team formed to write the volume on non-ferrous metallurgy for the Science and Civilization in China series, founded by the great British sinologist and historian of science Joseph Needham (1900-1995). He is active in a number of international research groups, and is currently President of the International Society for the History of East Asian Science, Technology and Medicine. In January 2014, he joined the Needham Research Institute as its Director.

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

**JIANJUN MEI:** I became interested in ancient metallurgy in the early 1980s when I was an undergraduate specialising in the Physical Chemistry in Metallurgical Process. After graduation,

I began my postgraduate study in the history of science and technology under the supervision of Professor Tsun Ko at the USTB and completed a thesis on the smelting technology of Paktong (Cu-Ni-Zn alloys) in ancient China. I then joined the Archaeometallurgy Group at USTB and worked there for seven years before I went to the Needham Research Institute in Cambridge as a visiting scholar. In 1995, with a generous fellowship awarded by the East Asian History of Science Foundation, Hong Kong, I was admitted to the University of Cambridge to study at the Department of Archaeology for my PhD degree. I obtained my PhD in early 2000 with a dissertation offering a pioneering exploration of copper and bronze metallurgy in late prehistoric Xinjiang. Having carried out postdoctoral studies in Cambridge and Tokyo over four years, I returned to the USTB in 2004 and later became Director and Professor of the Institute of Historical Metallurgy and Materials (IHMM). I stayed with the IHMM for ten years, witnessing the significant and rapid growth of the study of ancient metallurgy in China. In January 2014 I became Director of the Needham Research Institute in Cambridge, and I have been working there since then.

**THE CRUCIBLE:** What is your most memorable professional moment?

**JIANJUN MEI:** That has to be the moment when I received a fax from Hong Kong informing me that I had been awarded a fellowship to support my PhD study at the University of Cambridge.

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

**JIANJUN MEI:** That colleague should be Professor Jessica Rawson of Oxford University. She has taught me many things, but the most important one is to look at China from the perspective of an outsider.

**THE CRUCIBLE:** What is your main current project?

**JIANJUN MEI:** My students and I are working on a project which focuses on the development of forging technology in China during the first millennium BC.

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

**JIANJUN MEI:** I don't have that ambition now. If I were to develop such a project, then I would like to further examine the relationship between the use of metals and the growth of civilisations across the world.

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

**JIANJUN MEI:** It has to be Dr. Donald Wagner's Science and Civilization in China volume on ferrous metallurgy, which provides an excellent overview of the development of iron and steel technology in ancient China, strikingly different from what happened in the west. (<http://www.nri.cam.ac.uk/science.html>) [Editors Note: It is the second time this volume is recommended to our readers! David Killick suggested the same in our [issue 82](#). You can read an interview with Donald Wagner in [issue 88](#)]



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

**JIANJUN MEI:** Always keep your curiosity about history and ask questions. Whenever possible, visit archaeological sites and see things with your own eyes.

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

**JIANJUN MEI:** Go to China and catch glimpses of a great civilisation very different to the one you are familiar with.



## 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).*

# MEET YOUR COUNCIL

## PETER HALKON

My first encounter with ancient metal working was on my father's farm at Hasholme Hall, Holme on Spalding Moor in East Yorkshire, where my dad and the farmworkers found what they referred to as "Nosmun". This turned out to be iron slag, present in considerable quantities on the sandy rises close to the river Foulness, together with much Roman pottery. As a small boy I used to love wandering down to what became known as "Pot field" to explore these remains. In the early 1970s the East Riding Archaeological Society (ERAS) undertook an excavation there in which I participated. Discoveries included three Roman pottery kilns and a small furnace. A star find was a Roman iron anvil. Underlying Roman activity were the enclosure ditches of an Iron Age settlement, with ditch fills full of large pieces of iron slag and much hand thrown pottery, typical of the East Yorkshire region.

I went on to read Ancient and Mediaeval History in Archaeology at Liverpool University, followed by a Postgraduate Certificate in Education at the College of Ripon and York St John, and was appointed to a teaching job at a large comprehensive school in Hull. Whilst teaching I maintained close interest in archaeology and helped form a field studies group of ERAS. Although my father had left the farm some years before, I maintained contact with the area and decided to begin a programme of field walking with the society to find out more about Iron Age and Romano British activity along the river Foulness. Early results showed considerable activity, extending backwards into the Mesolithic, including a significant iron industry mainly concentrated on the sandy hills close to the river.

In 1982 I was introduced to a newly appointed lecturer at Durham University, Martin Millett, who was looking for a relatively unexplored region of northern Roman Britain to research. Thus began a collaboration which lasted for over 30 years. Martin is now a Cambridge University Professor and one of the foremost experts on this period. Our work, combining the forces of local volunteers and students from a range of universities has been most fruitful. Further Roman pottery kilns were excavated at Bursea House, a mile to the west of Hasholme along with further evidence for early iron working. In 1984 we made the find of a lifetime, the Hasholme log boat, its parent tree cut down between 321 and 277 BC. At 12.5 m in length the vessel had sunk in a tidal creek of the Humber estuary, just below the sandy rise on which I had picked up those pottery sherds all those years before.

The following year further field walking to provide material for my part-time MA supervised by Martin Millett at Durham, resulted in the discovery of a large heap of iron slag at Moors Farm, Welhambridge, on a slight rise close to the Foulness. After subsequent excavation, this turned



out to be one of the largest ever found in Britain, dating from the middle Iron Age contemporary with the log boat and perhaps more significantly, the Iron Age Arras culture with its chariot burials. I had not initially realised the significance of the Moors Farm discovery until I met Peter Crew, who was very excited about this find and organised an HMS visit to the region and invited me to participate in Early Iron in Europe, a major conference held in 1995 at Plas tan Y Bwlch in the Snowdonia National Park, in which Moors Farm appeared at the top of the slag heap league table in his lecture! I owe an enormous debt of gratitude to Peter and Susan for all their help and encouragement over many years.

After a number of career changes, including teaching history and archaeology at Sixth Form colleges in Hull, a two and a half year spell as Education Officer for the Council for British Archaeology and York Archaeological Trust, I eventually got a job at the University of Hull, where I am now a Senior Lecturer in Archaeology. One of my main research interests is early iron production, particularly in terms of its relationship to the landscape, and the possible connection between the iron production centres of the Foulness Valley and the valley of the River Hull and the large Iron Age cemeteries. In 2013, during unseasonable March blizzards, myself and my then PhD student Yvonne Inall organised a most enjoyable HMS visit to this region. I am currently supervising Zech Jinks-Fredrick, who is undertaking a PhD researching iron objects in non-burial contexts across the British Isles and am keen to supervise other research students.

I am also keen to explore the origins of iron production and thanks to a grant from the European Science Foundation in 2010, I organised conference on the subject in London collaborating with Prof Vincent Serneels in which over 19 European countries were represented. I also organised a session involving many of the same participants at the European Association of Archaeologists annual conference at Pilsen in 2013. In my role as an archaeologist on the HMS Council, I am eager to extend and embed this network and shed further light on the origin of iron production.



## IAMS ARCHAOMETALLURGY SUMMER SCHOOL 2016

This year, the Institute for Archaeo-Metallurgical Studies' annual summer school, coordinated by Prof. Marcos Martín-Torres and Dr. Jane Humphris, was held in the last two weeks of June and featured lectures from a whole host of researchers from different institutions, backgrounds and specialties. This was followed by a three day smelting expedition to Dorset, expertly run by Jake Keen. This review will cover the lectures in the second week, which this year was focussed on gold and silver.

The lectures, were diverse in nature and broad in scope, covering numerous aspects of gold and silver mining and metallurgy in the past. They comprised an introduction concerning silver and lead mining by Prof. Martín-Torres; Roman and medieval silver mining in Austria and Iberia by Dr. Brigitte Cech; prehistoric mining in Iberia by Dr. Mercedes Murillo-Barroso; and the study of the Staffordshire hoard by Dr. Eleanor Blakelock. The series was rounded out with lectures by Prof. Martín-Torres concerning Precolumbian and colonial metallurgy in the New World.

The first lecture series, given by Prof. Marcos Martín-Torres, concerned itself with three distinct but closely-linked topics. These were namely the history of and evidence for past silver, gold and lead extraction; how and why these metals were used; and finally, why these three metals are so closely associated in our understanding of past metallurgy. While all individually interesting, it was the investigation of these three in tandem that proved to be most enlightening. Thanks to how the day was structured, beginning with a lecture on the fundamentals of metal element and ore properties and reactions, everyone was able to begin appreciating some of the more dynamic material relationships that complicate the archaeological record. To give one example, how lead was able to attain value through its use in the secondary extraction of more valuable materials, in this case silver and gold, and not just from its own uses in object manufacture.

Dr. Brigitte Cech outlined her studies of Roman mining in present-day Austria and Spain, specifically her investigations of its organization at various levels, from overall planning to surveying and sourcing, then to the individual technologies and tools used in the entire process. These were seen in both the textual and archaeological record and comparing the two allowed for the contrast between theory and practice in the world of Roman mining. Of particular interest was the site in Las Medulas, which demonstrated the unforgettable technique of *ruina montium* as attested to by Pliny, where a nearby



*Jake attending the iron smelting furnace.*

river would be dammed up, and channels connected to the dam dug through a hill, with the fury of the river unleashed in a single, terrible, moment, utterly smashing the hill into millions of fragments (hence, “ruining the mountain”) and revealing the ore therein. Some of the tools involved were represented in the British Museum, and we saw these during our tour there. Dr. Cech also studied the organization and execution of medieval mining in Austria, and the high status of miners as seen in the literary record helped to explain the layout of the apparently lush quarters, and aspects seen in illustrations explicated certain tools and objects seen, such as wild-boar hides used as sleds to move ore down snowy slopes.

This was followed by a talk concerning prehistoric gold and silver metallurgy in Iberia by Dr. Mercedes Murillo-Barroso, from the technologies involved such as beaten sheets, lost-wax casting, and filigree, and the ideology and symbolism involved in the artefacts produced, to the relative abundances of gold and silver per time period. She also discussed the analytic techniques used to study the corpus of material, and the differences in the capabilities and limitations of scanning electron microscopes, X-ray fluorescence, particle-induced X-ray emission and inductively coupled plasma mass spectrometry. The potential involved in isotope provenancing, which has reached a zenith in studies of human bone, was discussed concerning lead inclusions and their concentrations in the metal artefacts of Argaric society.

Most people in Britain will be familiar with the distinctive trappings of Anglo-Saxon material culture from their days in school or university, as well as from museum

visits. However, nothing quite compares to having an expert sharing their own insights, especially someone as knowledgeable on the subject as Dr. Eleanor Blakelock. In both her lectures concerning her own work on the Staffordshire hoard and the visit to the Sutton Hoo exhibit at the British Museum, the focus was set squarely on the human dimension. Not only were the objects and the craftsmen who made them investigated in this way, but also how the modern-day hoard was divided between the various vying institutions that claimed some kind of cultural connection to it. Being shown all the small microscopic imperfections in the gold filigree where an apprentice has attempted to correct a mistake, or having all the hallmarks of a famed smith be pointed out across multiple assemblages provided a refreshingly different perspective on these famous objects, and one far removed from the technology-oriented, often detached, way that archaeological metal is often viewed.

On the final day of the course, Prof. Martín-Torres provided one final nugget of technical information, specifically how specific alloys can differ in colour and how to ascertain these from ternary plots. After this brief lecture, he proceeded to introduce us to a wide range of case studies from the Americas, varying from the Muisca votive figurines of Colombia, to the impact of European brass on the Tainos of Cuba. These were followed by an overview of the metallurgical remains recovered from settlement-era Jamestown and La Isabela, both of which evidenced poor attempts at the craft by untrained settlers expecting unimaginably rich yields. These examples helped to reinforce both the technical and humanistic information we had been taught across the two weeks of practical hands-on work and lectures.

We entered this summer school actually having completed a course on archaeometallurgy also run by Prof. Martín-Torres, and while there was a certain repetition of content in terms of the fundamentals and certain case studies, this was totally understandable given that the participants of the school were from varied backgrounds and had different understandings of metallurgy and its study. The new case studies did much to reinforce our knowledge whilst also revealing new perspectives by dint of the various researchers and institutions involved. The selection of lectures proved accessible to participants of all levels, and the lecturers readily clarified any points of doubt or any technical questions.

Overall, we would strongly recommend this course to anyone interested in archaeometallurgy, and although each year features a set theme, the points learned concerning archaeometallurgical studies and their conclusions have relevance regardless of the specific metals or alloys being

studied. That said, we hope that in the future, the less celebrated metals such as lead and brass may be covered and be subject to such diverse studies as we have seen for gold and silver during these lectures.

*Alasdair Chi and Tumi Markan*



## HMS RESEARCH IN PROGRESS MEETINGS ABROAD

Since 2008 the Historical Metallurgy Society has successfully been organising Research in Progress meetings. These have become an increasingly popular meeting with contributors coming from far and wide, and from a variety of different walks of life. There is deliberately no theme which means that any new or ongoing research can be presented, be it the results from archaeological sites, scientific analysis, historical research or a new interpretations of existing data. The audience is made up of interested parties and the atmosphere is friendly, so they are a great place for a student's first outing.

This format has been such a success that it could easily be taken, adapted and run by other groups in other countries. The meetings are often run by students mostly using university facilities and are therefore cheap to run, and not labour intensive. If anyone is interested in using the Research in Progress format feel free to get in touch and I can provide you with any guidance, support and example forms that you may like ([Eleanor.blakelock@blueyonder.co.uk](mailto:Eleanor.blakelock@blueyonder.co.uk)). HMS will gladly advertise the event on our website and we may also be able to provide funding for a prize for the Best Student Research.

The date and venue for the next meeting has been agreed. It will be held on Tuesday the 29<sup>th</sup> of November in the Department of Metallurgy and Materials, University of Birmingham. More details are available on the website. I look forward to seeing you there.

*Eleanor Blakelock*

## MeTOOLS CONFERENCE

MeTools, The metalworker and His Tools conference, was held 23-25 June 2016 at Queen's University, Belfast. The conference honoured Professor Barbara Armbruster for her pioneering work recreating ancient gold smithing techniques. Professor Armbruster gave the keynote speech on Thursday night, which was in actuality a four-hour master class in the history of research in metalworking techniques and her exploration of early technology, including her apprenticeship to a goldsmith in Mali.

The first session on Friday morning concerned stone in metalworking it focussed on stone tools used in mining and in the production of metal objects. Selina Delgado Raack (Universidad Autonoma de Barcelona, Spain) presented research that included examining use-wear to understand how stone hammers, anvils, and picks were altered through use. The tools were also analysed for traces of metal. While this paper used examples from across Europe, João Luis Cardoso (Centro de Estudios Arqueológicos de Oeiras, Portugal) focused on an assemblage of lithic tools used for metalwork found at a settlement in Outeiro Redondo, Portugal.

The second session began with a paper by Mechtid Freudenberg (Stiftung Schleswig-Holsteinische Landesmuseen, Germany) in which non-invasive chemical analysis of an axe found at Ahneby, Germany, was used to understand its manufacture and how the axe had been modified. SEM and Maxim XRD were used to show the crystalline structure of the axe, which distinguished between the parts of the axe that had been forged in contrast to the parts that remain as cast. Verena Leusch (Curt-Engelhorn Center for Archaeometry, Mannheim, Germany) and Miljana Radivojević University of Cambridge, UK) spoke about metal smithing in the Balkans and the evidence of a metalworking site that included tools and a clay-lined hearth where copper was smelted and gold was worked. Andreas Svensson (University of Lund, Sweden) discussed "multimetallurgy" in the Late Iron Age. The examination and analyses of selected sites in Scandinavia indicate that smiths were not specialised and that they worked in a variety of metals. The final paper of the session given by Elpidia G. Fregni (independent researcher) who presented a system of organising the chaîne opératoire of metal smithing tasks and using the framework to explore the tools used in metalworking, including those tools that are missing in the archaeological record.

The afternoon session began with an overview of Scottish metalworking tools and sites given by Trevor Cowie, who recently retired from the National Museum in Scotland. His paper was followed by Justine Vernet and Paolo Piccardo's (Università degli Studi di Genova, Italy) who

gave a presentation on the significance of different mould materials and their effect during casting. Experimental bronze ingots were cast in moulds of sand, clay, and modern steel in order to compare the cooling rates and the resulting microstructure. The resulting evidence provides a link between the microstructure and casting parameters that may be compared to ingots from the Bronze Age.

The first full day of the conference ended with a wine reception sponsored by the Prehistoric Society and the Ulster Archaeological Society. The highlight of the evening was the surprise presentation to Trevor Cowie of a replica bronze sword in honour of his work at the National Museum in Edinburgh.

Saturday's presentations began with a session on tools and workshops. Brian Clark, an independent researcher from Wicklow, Ireland, who has mastered Bronze Age forging and forming techniques gave a presentation about how he recreated ribbon and flanged torcs, lunulae, and beaded wire using Bronze Age tools and technology. Later in the day he brought out examples of his work and displayed the tools he used to make them. Next Barbara Armbruster spoke in more detail about ancient tools and workshops, along with the contexts in which tools are found throughout Europe. This was also combined with her ethnographic work in Mali that provided new insights about the structure of early workshops. Maria Lowe Fri (Stockholm University, Sweden) presented examples of how chisels and axes change with use, challenging standard typologies of the tools. The next paper, by Silvie Cousseran-Néré (Institut National de Recherches Archéologiques Préventives (INRAP) France), was delivered in French, but the PowerPoint was clear enough to allow non-French speakers to be able to follow her report on a Bronze Age smith's workshop in Montélimar, France. The site had over 100 bronze objects and 20 tools that included hammerstones, stone anvils, and whetstones, the remains of crucibles and moulds, along with bronze pins, bracelet fragments, and arrowheads.

The following session also began with a paper delivered in French. The research was done by a team at INRAP and was delivered by Linda Boutoille. The team examined objects from 14 metalworking sites and two hoards in order to define the type of work performed at different sites and if there was a preference for locating places for metalworking. A paper on ferrous metalworking in Iron Age Britain and Ireland was presented by Sophia Adams (University of Bristol). In her talk she presented research from 252 Early Iron Age metalworking sites where non-ferrous metalworking was practiced, often alongside ferrous metalworking. Her paper examined where metalworking occurred in the context of settlements and

addressed questions about depositions. The next paper continued the theme of Early Iron Age Workshops. Emilie Dubrequcq (Université Toulouse le Mirail) explored the craft and technology practiced in the West Hallstatt territories. The final paper of the session was presented in French by Maxence Pieters (Centre ardennais de recherche archéologique, France) who discussed Bronze Age anvils.

The session continued after lunch with another paper in French on Hallstatt workshops given by Patric Clerc and Florent Jodry, both of INRAP. Axes and tools were examined, as well as analyses of slag and hammerscale. Of interest was the round pit furnace used for a forge with a tuyere, hammerstones, and slag. Leo Webley (University of Bristol) followed with a presentation on moulds in the Late Bronze Age and their significance in depositions in Britain. Another paper that explored aspects of depositions was given by Davide Delfino (Universidade de Coimbra, Portugal), who spoke about different explanations for the deposition of objects in hoards and emphasised empirical proofs over theoretical interpretations. The final paper was given by Elpidia Fregni who used examples of tool hoards in Britain as a means for interpreting assemblages.

The final session began with a paper given by Bianka Nessel on the interpretation of the deposition of metalworking tools in hoards and graves with a focus on Carpathian and Scandinavian contexts. That theme was continued with Rebecca Peake's (Université de Bourgogne, France) on metalworking tools found in tombs in France and Germany. Thibault Le Cozanet and Gérard Bataille (Université de Bourgogne, France) spoke on the deposition of metalworking tools in wet environments. The final paper of the conference, given by Thibault Lachenal (Université Paul Valéry, France), gave an overview of the different types of tuyeres that have been found in Europe and how the modifications could have been for specific functions.

Several posters were also presented at the conference. Bridget Schorer (Landesmuseum Württemberg, Germany) presented a poster on embossing gold objects in the Early Iron Age. Alessandro Armigliato (University of Bologna, Italy) presented the results of experimental bronze casting pits. Jaroslav Peška (Palacky University, Czech Republic) and Jindřich Štelcl (Masaryk University, Czech Republic) performed micrometallographic analysis on metalworking tools found in Beaker burials. Linda Boutoille (Queen's University, Belfast) and Kewin Peché-Quilichini (Université Paul Valéry, France) examined the stone tools used for forming copper alloy metals of the site at Cucurpula during the Late Bronze and Early Iron Ages. Katja Martin (Universität Halle-Wittenberg, Germany) explored the symbolism of metalworking tools in burials. Nikolai Shcherbakov, Miljana Radivojević, Iia Shuteleva, and Tatiana Leonova presented a poster on Late

Bronze Age copper mining on the Eurasian Steppe. Linda Boutoille (Queen's University, Belfast) reported on the metalworking tools from Upton Lovell.

The conference was successful in its global approach to the subject with both theoretical and analytical approaches to studying the materials. It was wonderful to see so many people from different countries presenting their research in a supportive and welcoming atmosphere. The presenters were congratulated by the conference chairs for their systematic approaches and experimental work. The various contributions have gathered and circulated much information about the role of the metalsmith in Bronze Age societies and the use of metalsmithing tools in both workshop and ritual contexts. A publication of the papers is planned. For more information please contact Linda Boutoille ([metools@sciencesconf.org](mailto:metools@sciencesconf.org)).

*Giovanna Fregni*

## ARCHIVES AND COLLECTIONS COMMITTEE

After our successful request, in the last issue of **The Crucible**, for volunteers to transcribe the Ronnie Tylecote note books we are once again looking for help. We are looking for volunteers to help with the cataloguing of Tylecote's photomicrographs, and matching them up with the catalogue of his metallographic specimens. The collection is held at Ironbridge and the work would of necessity have to take place there.

If you are interested please contact Louise Bacon email: [louise.bacon@btopenworld.com](mailto:louise.bacon@btopenworld.com).

## AMINA CHATWIN (1927-2016)

Amina was born in 1927 in Cheltenham, where she was brought up and lived for much of her life. She died earlier this year and at her memorial service her many enthusiasms and wide range of interests were remembered by a large group of her friends.



In her youth she was a champion ballroom dancer, made and performed with large marionette puppets, attended art school and travelled widely throughout Europe. From the 1960s she owned and ran a dress shop in Cheltenham but also developed the interests that were to bring her to HMS. She joined the Bristol and Gloucestershire Archaeological Society, and the Gloucestershire Society for Industrial Archaeology, eventually becoming its President in 1994.

By 1969 she had joined HMS and was first elected to its Council in 1979. She was Chairman from 1981-2 and edited HMS News, the predecessor of *The Crucible*, for 18 years from 1985-2002 during which time it developed from an occasional news sheet to a more substantial regularly-produced newsletter. She was a regular attendee at HMS conferences, often driving herself to them in an MG Midget which she bought new for £800 in the 1960s and continued to use until about 10 years before her death – when she reputedly sold it for £7000!

Outside HMS Amina had other metallurgical interests. She was a great champion of historic architectural ironwork which was the subject of her first book, *Cheltenham's Ornamental Ironwork: A Guide and History*, which she published in 1975. She was also a keen supporter of modern blacksmiths and worked with both the British and American Artist Blacksmiths Associations; in 2002 she was the first woman to be elected a Companion of the Worshipful Company of Blacksmiths. Her second book, *Into the New Iron Age: Modern British Blacksmiths*, which she wrote, designed and self-published in 1995, is now regarded as a seminal work.

*Justine Bayley*

## URSULA FRANKLIN (1921-2016)

Dr Ursula Martius Franklin, one of the true pioneers in the field of archaeometry, died on July 22, 2016, at the age of 94. Dr Franklin was born in Munich in 1921, where her father was an archaeologist and her mother an art historian. She spent the last several years of the war interned in a forced labour camp, where she suffered frostbite that led to constant pain in her legs for the rest of her life. After the war, she attended the Technical University Berlin receiving in 1948 a doctorate in experimental physics. She came to Canada as a post-doctoral student at the University of Toronto in 1949, and Toronto was her home base for the rest of her life.

Following her postdoctoral studies she was employed for 15 years at the Ontario Research Foundation, and then joined the Department of Metallurgy and Materials Science of the University of Toronto as an Associate, then Full Professor. At U of T, she became known as an inspirational teacher and a mentor to countless students and colleagues. She carried out research in such “conventional” areas as materials characterization by X-ray diffraction and X-ray microradiography. However, it was in the application of materials characterization techniques to ancient and historic materials, both metallic and non-metallic, that her work has had the greatest scientific impact. One of her more important accomplishments was as creator and director of the Collegium Archaeometricum, a group of colleagues in a wide range of disciplines from the University of Toronto and other universities in Southern Ontario as well as the Royal Ontario Museum. The Collegium, which included metallurgists, physicists, chemists, mineralogists, anthropologists, statisticians and museum conservators, acted as a stimulus for collaborative research as well as for the teaching of Archaeometry, with courses at both the graduate and undergraduate levels. She considered interdisciplinary studies to being equivalent to going fishing with friends in that someone brings the boat, someone knows where the fish are, someone knows what equipment to recommend, someone knows how to cook the fish, and all are friends. One of her favourite metaphors was to liken scientific collaboration to a potluck supper where everybody contributes what he or she can do best.

In 1984, she was awarded the title of University Professor (as distinct from Professor in a specific department), the highest honour given by the University to a faculty member, and was the first woman at U of T to be accorded this honour. She was active in the international archaeometric community, including the International Symposia on Archaeometry. She was known (and perhaps feared) for her penetrating and incisive questions and comments in discussions following seminars and conference presentations. For the last part of her academic life, she was a Senior Fellow at Massey College, the University of

Toronto's interdisciplinary graduate college, and a Fellow of the Ontario Institute for Studies in Education. She also served for a time as director of the U of T's Museum Studies programme.



In addition to her scholarly life, Ursula Franklin, a lifelong practicing Quaker, participated in an incredible number of public activities related to peace, international understanding and the role of women in society. She worked tirelessly to bring a humanitarian and feminist voice to the world of science, and the world in general. In the 1960s, she used her analytical expertise to help investigate the levels of strontium-90 - present in radioactive fallout from nuclear weapons testing - in children's teeth. This work was instrumental in discussions about stopping nuclear weapons testing in the atmosphere, and was a factor in her deep scepticism towards nuclear energy production in Canada.

She was active in encouraging young women to seek careers in science, working for peace and justice, and considerations of the social impacts of science and technology. She felt that women's perspectives are often different from those of their male counterparts - that they are more likely to create a spirit of cooperation, and allow them to connect knowledge gained with its impact on communities rather than its economic impact.

She gave much consideration to how science and technology shape our society and how they are, in turn, shaped by the demands that society makes of them. She encouraged people to become "citizen scientists", to gain a general knowledge of science and technology in order to understand issues and become activists if necessary to influence and even reverse the directions of change. She drew a distinction between holistic technology as illustrated by the creative work of artisans, and prescriptive technology of corporations and bureaucracies which require a division of labour, with operations carried out in a series of steps, thereby requiring a need for bosses or managers and creating a culture of compliance and, if

necessary, enforcement. She once said that she liked the monarchy because it represented "defanged power."

She wrote and co-produced numerous radio programmes on science, technology and public policy. These included a number for Ideas, the prestigious CBC radio series, with titles such as "Technology, Democracy and Freedom", "Nuclear Peace", "Complexity and Management", and "Size and Scale in Technology". Books she authored included *Every Tool Shapes the Task: Communities and the Information Highway* (Lazara 1996), *The Real World of Technology* (Anansi, rev. ed. 1999), *The Ursula Franklin Reader: Pacifism as a Map* (*Between the Lines*, 2006), and *Ursula Franklin Speaks: Thoughts and Afterthoughts* (McGill-Queens, 2014).

She received many honours throughout her life including being named a Companion of the Order of Canada, a Fellow of the Royal Society of Canada and a Member of the Order of Ontario. She was awarded numerous other honours notably the Pearson Medal of Peace for her work in advancing human rights, a Governor General's Award for promoting the equality of girls and women in Canada and honorary degrees from many Canadian universities. With her keen interest in education at all levels, she was deeply pleased when the school authorities in Toronto named a new high school "The Ursula Franklin Academy." She took a deep interest in the school, played a major role in its academic planning and curriculum, and made frequent visits. She believed that the appropriate metaphor for education was a garden, not a production line, and this philosophy infuses the Academy. This was very much along the lines of what she called her "earthworm hypothesis": many tiny moves and achievements of individuals prepare the soil in which progress grows.

As one of her admirers and friends succinctly put it, "A giant tree has fallen". However from this tree many new shoots have sprung, pushing science and humane thinking ahead. In these troubling times, Ursula's voice calling for peace and justice and the absence of fear, and her clear determination to fight for dignity and humanity are sorely missing. Let us hope that somebody as forceful and determined as Ursula Martius Franklin will take up the torch that she had to drop.

Ursula is survived by her husband of more than 60 years, a son, a daughter and four grandchildren. In addition, in many communities throughout the world there are people who admired her and were strongly influenced by her. For many she was a mentor, a colleague, a role model, a friend. She lived her convictions in a very passionate way, and always defended with incredible determination and admirable strength what she felt was important and just. She will be deeply missed but not forgotten.

*R. B. Heimann, V. Vitali and M.L. Wayman*

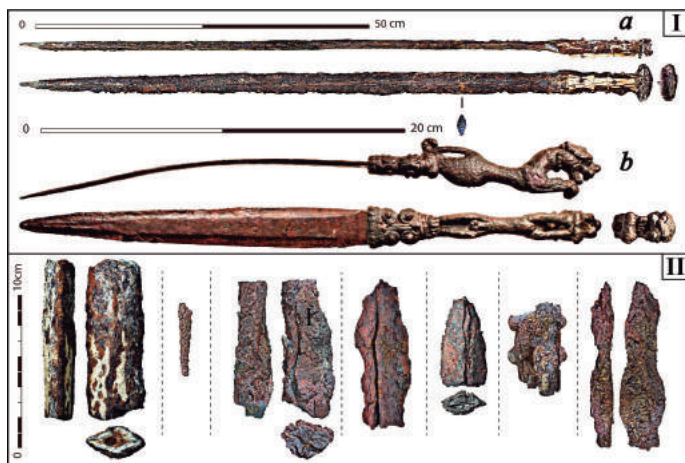


**LOUISE BACON:** Visiting a train graveyard in Uyuni, Bolivia. Uyuni was once a major rail centre for the mineral mines. The British built the railroad, but both American and English trains were used. The locomotives were designed by Robert Stirling, Locomotive Superintendent of the Anglo-Chilean Nitrate & Railway Company. Kitson Meyer of Leeds further developed his idea and supplied most of the trains. The line fell into disuse in the 1940's. The trains are gently disintegrating on the Bolivian plateau, most damage being caused by the salt air, tourists and graffiti artists. Any manufacturing plaques have long since disappeared.



**IVAN STEPANOV, LLOYD WEEKS, KRISTINA A. FRANKE, and PETER GRAVE:** As a part of the SHARP collaboration between the UNE and Dubai Municipality, we are investigating the abundant ferrous remains from the Iron Age (c. 1200-600 BC) site of Saruq al-Hadid (U.A.E.). Despite the fact that all our objects are completely corroded, ongoing scientific analyses (OM, SEM-EDS, LA-ICP-MS, neutron tomography) testify to significant variation within the site's ferrous remains in terms of manufacturing techniques, carburization, the overall quality of the metal, and the composition of its slag inclusions (and hence its possible provenance). Research continues on this unique assemblage, which provides the first opportunity to investigate the origins of iron technology and use in prehistoric Arabia.

**MARCOS MARTINÓN-TORRES and JUANITA SÁENZ-SAMPER:** We are adding the finishing touches to a review paper on the Prehispanic Nahuange goldwork from Colombia, to be published in *Antiquity*. Defying frequent generalisations about a preference for depletion gilding in South America, we show that most objects were deliberately gilded, but that at some point in their lives the gilding was removed by polishing, revealing the more orange colour of the bulk metal. Clearly, the history of Pre-Columbian metalwork needs to be contextualised in order to appreciate cultural variability, and we should pay more attention to the life-histories of the artefacts after manufacture.



**HELENA VAZ:** Dear colleagues, I'm an Archaeological Metals Conservator, and as usual, I'm working on several conservation projects. Right now I'm organizing the packaging of Roman iron artifacts from Beja (Portugal); dealing with the conservation treatment of copper alloys and iron objects from the pharmacy of the Convent of Christ, Tomar (Portugal); preparing the budget for the conservation of Roman metals from an archaeological site in Arganil (Portugal); and preparing a training on archaeological metals storage, to be presented in July, Ourique (Portugal). It was good to share. Thank you!

# FORTHCOMING EVENTS

Conference, Date and Location	Description	Website, Email and Prices
<b>HMS Research in Progress</b> 29 <sup>th</sup> November 2016 Birmingham, UK	This meeting is aimed at a wide variety of contributors, from historical and archaeological metallurgists to excavators, historians and economists. If you are working, or have just finished working, on a project related to archaeological or historical metallurgy, we would like to hear from you. We are particularly interested in bringing together contract and public sector archaeologists with academic researchers, and in fostering links between the different disciplines studying metallurgy and related activities. Whether you are a student, a researcher, an interested non-specialist, or a professional excavator, we invite you to meet others working in this field and present your research to an interested community.	<a href="http://hist-met.org/meetings/2016-research-in-progress-meeting.html">http://hist-met.org/meetings/2016-research-in-progress-meeting.html</a>
<b>2<sup>nd</sup> International Conference on Art &amp; Archaeology</b> 11 <sup>th</sup> -14 <sup>th</sup> December 2016 Jerusalem, Israel	This conference aims to bring together a range of scholars, specialists and experts in the fields of archaeology, art, preservation, restoration, cultural heritage, researchers of ancient structures and technologists. Focused mainly on analytical methods, it may be of interest of our readers the sections about “Non Invasive Spectroscopic Research and Analysis” or “Authentication vs. Detection of Forgery”	<a href="http://www.isas.co.il/art-archeology2016/">http://www.isas.co.il/art-archeology2016/</a>
<b>13<sup>th</sup> Meeting of Historians in Latin American Mining (MHLM)</b> 4 <sup>th</sup> - 7 <sup>th</sup> April 2017 Buenos Aires, Argentina	This meeting aims to gather various disciplinary approaches and problematics related to mining. Presentations are expected to consider technological and organizational dimensions of mining but also the religious-symbolic, spatial, economic and political aspects linked to these activities.	<a href="http://www.13reunionmineria.wordpress.com">http://www.13reunionmineria.wordpress.com</a>
<b>International Early Engines Conference</b> 11 <sup>th</sup> - 13 <sup>th</sup> May 2017 Elsecar , South Yorkshire, UK	Including visits and presentations, the inaugural International Early Engines Conference will provide a forum for presentation and discussion of new research into heat engines prior to 1812.	<a href="https://www.earlyengines.org/">https://www.earlyengines.org/</a>
<b>Iron in Archaeology: Bloomery Smelters in Europe and Beyond</b> 30 <sup>th</sup> May - 2 <sup>nd</sup> June 2017 Prague, Czech Republic	International conference in honour of the late Radomír Pleiner and to commemorate the 50 <sup>th</sup> anniversary of the founding of the Comité Pour la Sidérurgie Ancienne (CPSA).	<a href="http://www.arup.cas.cz/ia2017/index.html">http://www.arup.cas.cz/ia2017/index.html</a>
<b>9<sup>th</sup> International Conference on the Beginnings of the Use of Metals and Alloys (BUMA IX)</b> 16 <sup>th</sup> - 19 <sup>th</sup> October 2017 Busan, Korea	The main theme at the Busan Conference is “ <i>Cultural Interaction and the Use of Metals</i> ”. The Conference will provide a forum for discussion on the effects of metals on the culture and history with a special focus on Asian materials. Comparative studies and case studies on ancient and traditional metallurgy from other regions can illuminate the interactions between the Far East and the West through South Asia as well as Eurasia.	<a href="http://eng.kim.or.kr/Board/board.asp?b_code=3231&amp;Action=content&amp;GotoPage=1&amp;B_CATE=BBS11">http://eng.kim.or.kr/Board/board.asp?b_code=3231&amp;Action=content&amp;GotoPage=1&amp;B_CATE=BBS11</a>
<b>Science of Ancient Egyptian Materials and Technologies Conference (SAEMT)</b> 4 <sup>th</sup> -6 <sup>th</sup> November 2017 Cairo, Egypt	This conference is an opportunity for specialists working within Egypt and employing archaeological sciences to get together and present their research and exchange ideas. Topics of interest to our readers are “Mining and quarrying “ and “Pyro-technology”.	<a href="http://www.saemt.com/calling-paper.html">http://www.saemt.com/calling-paper.html</a> <a href="mailto:submit@saemt.com">submit@saemt.com</a>

