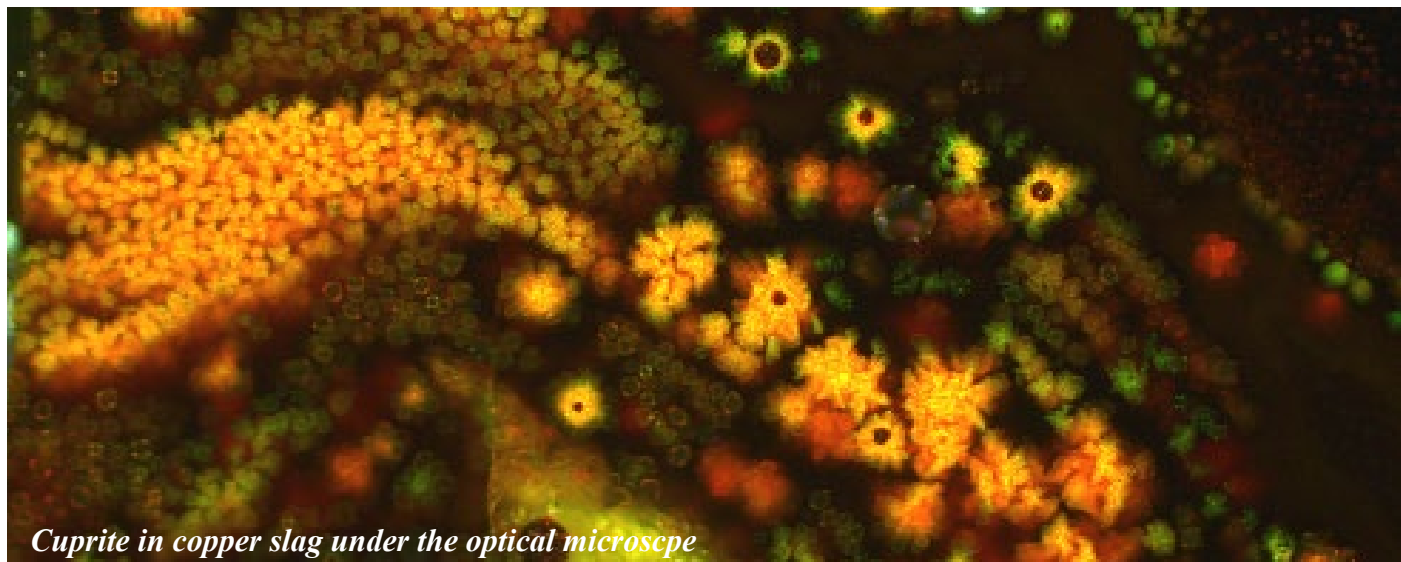


THE CRUCIBLE

Historical Metallurgy Society News

Issue 95

Summer 2017



Cuprite in copper slag under the optical microscope

INSIDE THE CRUCIBLE

Co-editors

Gill Juleff

Lorna Anguilano

Assistant Editors

Loïc Boscher

Carlotta Gardner

Matt Phelps

María Teresa Plaza

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.*

The Crucible

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The **HISTORICAL
METALLURGY**
Society

FROM THE CHAIRMAN'S DESK

The cycle of Society life means that we lose and gain members from Council every year, but the amount of change fluctuates. The recent AGM saw a particularly large number of personnel changes. Amongst those leaving Council, I would particularly like to note the retirement of David Crossley as one of the Joint Editors. David has had an enormous impact on the Society, as a founder-member and particularly as a Joint Editor ever since the death of Ronnie Tylecote in 1990. Council has awarded David an Honorary Membership in recognition of his services and we thank him deeply.

Also leaving Council this year was Marcos Martín-Torres, under whose editorship the Society newsletter has been completely transformed, first from HMS News into *The Crucible* (2012) and then into full colour (2014). Gill Juleff and Lorna Anguilano become the new editors of what has grown into being such an important organ of HMS. Our Communications Officer, Vanessa Castagnino has also retired from Council; under her charge the Society's website has been totally renewed, particularly with the creation of the online shop and it has become a truly vital element in the life of the Society. Another person leaving an important post is David Cranstone, who is retiring as Honorary General Secretary (a post he has held admirably since 2008), but who remains on Council as an ordinary member. Jonathan Prus is taking up the reins as Hon. General Secretary, with Peter Northover in a supporting role, to field general archaeometallurgical enquiries, another task formerly undertaken with great enthusiasm by David Cranstone. Finally, David Bourgarit has also left Council. To all of these, I would like to offer my personal thanks for all their hard work and dedication to the Society.

I am, however, delighted to welcome Bill Hawkes, Matt Phelps and Sophie Adams onto Council for 2017/18, and to welcome back Eddie Birch. The three 'new faces' both broaden the areas of expertise and interest on Council and simultaneously reduce drastically the average age of Council! Bill is a practicing conservator and jeweller, Matt has been one of *The Crucible's* production team from its inception, and Sophie is an archaeologist with a particular interest in later prehistoric non-ferrous metalworking, but no doubt they will all introduce themselves more fully in future 'Meet your Council' articles.

In my piece in *The Crucible* of November last year, I outlined the makeup of the initial core of the Editorial Board of Historical Metallurgy. This was to be supplemented with additional members as gaps in expertise became apparent. Recent months have revealed a need for strengthening the team in the area of post-medieval industry; Prof. Chris Evans and Dr Barrie Trinder have now joined the Board to provide that additional specialist input. The other change within the publications team is that Kay Smith, managing editor for Historical Metallurgy, has formally been appointed as one of the Joint Honorary Editors of the Society.

The Editorial Board has now been active for around 8 months and they are working hard to bring a large number of articles to fruition, which will enable the publication of volumes 50 and 51 of Historical Metallurgy as soon as possible. Although the Board has not yet been in place for long enough to effect the 'catch-up' in journal production, they are on track to achieve that later this year and the time-to-publication for new submissions should also now be back a reasonable interval. Volume 49 part 2 has recently been published but, once again, I have to apologise for the delay in receipt for many members; I hope that by the time this issue of *The Crucible* arrives you will all have received it. We are working to reduce delivery times for the journal, but it appears that the improvements we were promised last year only produced a typical reduction from 13 weeks to 11 for overseas members. New arrangements will be in place before volume 50/1 is dispatched.

I am looking forward very much to working with the new team, both in Council and on the Editorial Board, over the coming year.

Tim Young

Some readers may have noticed that the names listed as Editors on the cover of this issue are different from the one signing this editorial. This is a time of transition, and this issue of **The Crucible** has been edited jointly by the old and the new team, to facilitate the handover.

I was beginning this last editorial piece writing about how sad it is to say goodbye to the people and things that you like... but frankly, there is no need to be dramatic. I am standing down from my position in the HMS Council and my role as editor of **The Crucible**, but my shoes have already been filled by extremely capable individuals who will no doubt do a better job. Furthermore, I of course remain a member of the Society who will continue to benefit from the many perks and opportunities it offers, and will stay on the Editorial Board of Historical Metallurgy. I should therefore have plenty of opportunities to keep seeing many friends and colleagues, and enjoying the contacts, information and events channelled through HMS.

This is, however, a good moment to reflect briefly on my last six years in the HMS Council, and to say thank you. My main reflection has to be on the selflessness of all the Council members, and many others in the Society, who generously commit their time, knowledge and enthusiasm to HMS for the sheer pleasure of doing something good. I have enjoyed being a part of this community but also been inspired by those who gain satisfaction from doing things for others. As for my thanks... they are numerous, indeed too many to name. I am very grateful to all Council members, past and present, with whom I've had a chance to collaborate and enjoy myself in the last few years. I will single out the two Chairpersons I have served under, Paul Belford and Tim Young, for trusting me and also for steering the Society with much vision, hard work and diplomacy. I also take with me great memories with, and appreciation towards, quite a few others in Council – I hope you know who you are!

Although I have tried to contribute to other areas of HMS activity, **The Crucible** is the most visible one, and the one that has required more thought and dedication. I am keen to thank sincerely those of you who have allowed us to make **The Crucible** possible by sending us reports, reviews, news, questions and announcements, or responding to our requests for interviews. I should also thank our many readers, who make our efforts worthwhile and keep us on our toes by sending compliments, suggestions and corrections. Above all, however, I have to express my huge debt of gratitude and admiration for the unsung heroes who, under the umbrella name of 'Assistant Editors', have tirelessly shared ideas, sought contributions, chased events, interviewed people, typeset drafts and generally made **The Crucible** better, and my role more manageable, fun and rewarding – all of this, while keeping up with their

own PhD or postdoctoral projects. Since the reinvention of the HMS Newsletter in 2012, this team has included Loic Boscher, Carlotta Gardner, Siran Liu, Matt Phelps, Tere Plaza and Miljana Radivojevic. I have learned something from each of them, and I look forward to seeing the many good things they will continue to offer to HMS, and to historical and archaeological metallurgy more generally.

I leave **The Crucible** in the good hands of Gill and Lorna, rather intrigued about how it will feel to receive it in the post without knowing its contents!

Thank you all, and see you around.

Marcos Martín-Torres





AN IRON AND CRUCIBLE STEEL PRODUCTION LANDSCAPE: PEOPLE AND TECHNOLOGY

Telangana is a new state in central India, formed from the north-western half of former Andhra Pradesh. It lies in the rural heartland of India, remote from the coast and hosting a climate of hot dry summers relieved by vital but sometimes catastrophic monsoon rains. The landscape is one of scattered villages and pockets of rich agriculture alongside large tracts of forest within the typical Deccan Plateau geology of boulder-strewn rocky hillocks. The Godavari river runs through its northern districts of Karimnagar and Adilabad and connects them with the Bay of Bengal. In historical times the region fell within the Dominions of the Nizam of Hyderabad and its productivity contributed to the fabulous wealth of the Nizams. A part of that productivity derived from the making and trading of crucible steel. We know this from the first-hand accounts of early European travellers, notably, but not exclusively, H.W. Voysey, who in the 1820s, recorded the process of crucible steel-making in the village of Konasamudram. We know it also from the inclusion of ingots of steel in the cargo records of the Dutch East India Company plying the Bay of Bengal, and it is implied in earlier descriptions of Indian steel in Islamic literature on sword-making. Most importantly, we know it from the fieldwork of Thelma Lowe in the 1980s and later of S Jaikishan, both of whom demonstrated that crucible steel-making was not confined to Konasamudram alone but was one facet of an extensive production landscape comprising hundreds of primary iron smelting sites that were the technological foundation of the crucible steel industry.

Against this backdrop, the Exeter-NIAS (National Institute of Advanced Studies, Bangalore) Pioneering Metallurgy project, initiated by Gill Juleff and Sharada Srinivasan, carried out a survey of known sites in northern Telangana.

Of 245 locations recorded by the first 2010 survey, 183 related to metal-working. Out of the initial fieldwork two distinct research projects grew. These have recently reached their conclusions and here we report some of their findings.

People

One of these projects, conducted by Tathagata Neogi, studied the ethnometallurgy of iron-working of the region. In the first two months of the three-season long study, 95 villages were visited in an area of c.120km diameter. In 54 of these villages older members of the community demonstrated some degree of knowledge of the erstwhile iron-smelting industry. Either they had participated directly in smelting, or they had seen the process in their childhood (Fig. 2). The continuing study then focussed on these 54 villages.

The research followed two interconnected trajectories: the first explored the dynamic relationship between iron-smelting, iron-smelter and landscape, and the second focused on the seismic socio-cultural and economic changes within the smelting and blacksmithing communities with the decline of smelting, and the advent of modern market economies and mechanization of agriculture in the last 120 years. The study both records the social character of iron-working in northern Telangana and provides a nuanced analogical model for the study of a craft in decline, and how craft-specialists negotiate decline. The methods used included semi-structured and unstructured ethnographic interactions, and guided explorations of smelting sites with former smelters to record their interpretations of intra- and inter-site spatial relationships and organisation. The study also included detailed archival research of 18th-20th century colonial documents on iron-smelting in the region.



Figure 1: Large slag heaps in Ellampally forest, Adilabad district.

From the ethnographic interviews conducted during our 2010 survey it was not clear whether smelters and blacksmiths constituted the same or separate social communities. This ambiguity also characterized the early days of this research. Initially, it appeared that the iron-smelters were an offshoot of the kammari, the village blacksmith community. However, with sustained interaction with the communities and gradual earning of trust it became clear that the smelters were originally an endogamous community distinct from the kammari. Known as the mudda kammari (lump iron makers), the smelters were on the fringes of the local caste hierarchy, far below the kammari. The low status mudda kammari followed the system of first-cousin marriage and detailed genealogies collated during the research revealed that this had gone on for long enough to make each mudda kammari household connected to the others by a definable kinship term. However, with the decline in iron-smelting since the early 1900s, the mudda kammari consciously began projecting themselves as kammari, both by taking up

blacksmithing and by adopting the semiotics of kammari identity.

The study area falls into two distinct geographical areas. The north remains densely forested with low magnetite-rich hills, while the south is dominated by agrarian villages. The difference in landscape character resulted in two distinct practices in terms of organization of production. Without going into the fallacy of environmental determinism, it is sufficient to say that the differences in these two types of landscape were diligently used by the mudda kammari to economise energy and economic investment in smelting, and determined who was involved in the process.

In both areas smelting was a male-only activity. However, in the densely-forested north (Adilabad), all aspects of smelting were exclusively carried out by mudda kammari community members only. The smelters here were dispersed along the forest boundaries in small itinerant kin-groups, who moved through the forest tracts to collect magnetite sediments, deposited by monsoon rain, from seasonal streams that criss-cross the forest. This seasonal source of ore obviated the need of intrusive mining or trekking uphill to collect in-situ ores. Timber from the *Acacia catechu*, known locally as sandra, was used for charcoal, which was prepared inside the forest. The smelting kin-groups knew the location of sandra groves and moved between groves on a 10-15 year cycle to allow regrowth. Despite problems of accessibility, the study was able to locate and record a temporary settlement with adjacent smelting site inside the forest, and the existence of other abandoned settlements were reported by the mudda kammari (Fig. 1). Smelting started at midnight, in a 5-7' tall furnace and was over after eight hours of continuous blowing using buffalo skin bellows with wooden base. Each smelt was followed by refining when the mudda (bloom) was repeatedly beaten into a lappa (bar) using a smaller furnace to squeeze out the remaining slag. The bar was then divided among the adult smelters who sold a part of it for cash to the Sahukar (middlemen) and other itinerant trading communities who



Figure 2: (L-R) Kuchanapally Rajaram, Yemnuri Bodanna and Kuchanapally Kondaiah: three seniors of the mudda kammari smelter community.

made it available in regional markets. The remaining part was sold directly to a handful of (mostly tribal) farmer clients who had the mudda kammari forge agricultural tools for them.

Due to its more settled nature, smelting in Karimnagar in the south was organized on a comparatively smaller scale by mudda kammari families permanently based within in different villages. The area also has low hills with banded magnetite outcrops. Streams from these hills act as irrigation canals, bringing rainwater to large reservoirs (many dating from the medieval period), which were in turn connect to smaller village tanks in a disperse pattern. The evidence for iron-smelting here is also dispersed and is found in the villages clustered around these low hills. Smelting evidence is most often found near the village tanks on the boundaries of the village, attesting the location of the mudda kammari on the fringes of village hierarchy in social space. Since the heavy magnetite sediment would settle readily it had to be collected from the streams immediately after coming down from the hill and before entering the reservoir. As Thelma Lowe reports, and as our ethnographic interactions suggest, this was done by placing granite rifles in the streams as they drained into the reservoir. Because the locations where sediments could be collected and timber for charcoal grew were distant from the village, the mudda kammari community here took help from other fringe communities. These tribal labourers were engaged in transporting magnetite sand and charcoal over long distances and then also worked as bellows operators during smelting.

Technology

Returning to the first survey of 2010, the majority of the metallurgical locations recorded were dominated by evidence for primary smelting. However, 22 locations

also had evidence for crucible steel-making. Samples of representative surface metallurgical waste were collected from each site and this body of material formed the subject of the second of the two research projects, conducted by Brice Girbal.

All too often crucible steel-making is studied as a stand-alone technology in isolation from locally-related technologies. Crucible steel-making is a refining process and can't be divorced from the primary processes that produced the raw material for refining. Studying crucible steel-making within the wider context of iron production in northern Telangana was thus the aim of this project.

To assess the scale and diversity of metallurgical technologies, 1.61 tonnes of metallurgical residue from the field survey was visually characterised. The material comprised slag, technical ceramics and geological material. The assemblage proved very complex, with 56 material sub-types identified. The first observation was the unequivocal dominance of iron smelting, which not only made up the bulk of the material but was present on almost all sites, including the 22 with evidence of crucible steel production. By assessing the co-occurrence of materials it was possible to identify 9 smelting variants and 3 crucible steel technological groups.

All the smelting technology groups, although differing in furnace construction, were consistent with the solid state reduction analogous with 'bloomery' smelting. Smelting occurred in small shaft-type slag tapping furnaces, varying in diameter from 20-60cm. The co-occurrence of different technological groups on some sites suggests a progression or development of technological processes at site-level. Despite the degree of variation, one technology was dominant in the core research area, suggesting that at one point iron smelting became relatively standardised.



Figure 3 Examples of typical crucible fragments. Type 3 crucible body (left) and type 2 crucible body (right).



Figure 4: Fragment of coil-built furnace wall (left) and purpose-made stone furnace base (used) (right).

Fragments of used crucibles were the primary evidence for crucible steel-making. Variations in crucible size and form enabled three technological groups to be identified (Fig. 3). On sites associated with crucible steel there was evidence for the use of coil-built furnaces with diameters of 40-50+cm, and a shaped stone base on one site suggested at least some furnaces were built on stone platforms (Fig. 4). Differences in crucible size and morphology aside, the construction, use and waste associated with steel-making was similar across all sites with crucibles.

Having identified the major technological groups present, the second step was to assess their spatial distribution. By mapping the technological groupings across the sites it became apparent that technologies were geographically distinct, particularly the crucible steel groups, suggesting that different communities developed their own technological practices or that technology developed over time. It was not possible within the scope of the study to assess temporal trends and this is a priority for future work.

Site specialisation was apparent in that sites with crucible groups 1 and 3 are larger and are dominated by crucible waste, they are preferentially located within villages and have bigger crucibles. Conversely, sites with group 2 crucibles have smaller crucible sizes, a greater abundance of smelting waste, and are primarily located in more rural settings. Thus, it can be argued that crucible group 1 and 3 sites were centralised and specialised, producing steel ingots on a larger scale intended for trade, while crucible group 2 sites were localised enterprises, producing fewer ingots, perhaps for local markets. These ingots were also smaller, perhaps better suited for everyday cutting edges, whereas ingots from the larger, type 1 and 3 crucibles would have favoured the weaponry market where more bulk material was required for the manufacture of swords.

Physically mixed smelting and crucible waste suggested that smelting and crucible steel-making operated simultaneously. It was also observed that there was little difference between the smelting debris on crucible sites and debris on smelting-only sites. Overall the evidence demonstrated that crucible steel-making was very much embedded within the larger metallurgical traditions of Northern Telangana and that the crucible feedstock was apparently produced on site.

Despite a distinctive Telangana crucible form, similarities in fabrics and associated waste with other southern Indian and Sri Lanka crucible steel sites indicates a strong degree of regional technological contact. Telangana forms part of a South Asian tradition of crucible steel manufacture, distinct from counterpart traditions in Central Asia.

Brice Girbal

Gill Juleff

Tathagata Neogi

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The discovery of the Zn furnaces at Zawar Mala. 15 minutes after it was realised that an intact furnace lay buried beneath the spoil tip. Paul Craddock's photo.

PAUL CRADDOCK

Ranging from the Bronze Age Near East to twentieth century China and from cast iron to precious metals, Paul Craddock's published work has made significant contributions to many aspects of archaeometallurgy, yet he has still found time for productive sidelines in flint provenancing and the identification of fakes and forgeries. Datasets such as that on the copper alloys of the classical Mediterranean, field-based projects such as that on the medieval zinc smelting industry in India and substantive reviews such as the book "Early Metal Mining and Production", give just a flavour of his rich and diverse output. Paul's strong background in chemistry, his encyclopaedic knowledge of archaeology and the past, and his base in the research labs of the British Museum, have been exploited to produce a body of work which continues to grow, well into its fifth decade.

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

PAUL CRADDOCK: Hired by the British Museum in 1966 as an analytical chemist and stayed ever since. The composition of synthetic materials seem to offer more scope than natural materials and began to concentrate on metallurgy.

THE CRUCIBLE: What is your most memorable professional moment?

PAUL CRADDOCK: Realising that the heap of retort debris we were investigating at Zawar in India concealed an intact zinc distillation furnace.

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

PAUL CRADDOCK: Henry Hodges and Joseph Needham. Henry Hodge's excellent lectures on early technology at the Institute of Archaeology got me interested in the subject and Joseph Needham's magisterial work on Science and Civilisation in China showed both what could be achieved in the study of ancient technology and science and also that it was possible to write very erudite material but still be eminently readable and even entertaining.

THE CRUCIBLE: What is your main current project?

PAUL CRADDOCK: Now that the Indian project is published I can return to other many and varied other interests. These include publishing a corpus of analyses of Roman copper alloy metalwork together, working with Alessandra



GiumliaMair, with a revaluation on Pliny's many and variously mistranslated comments on metals in general. I am also still continuing my researches into the development of indirect hollow lost wax casting in Egypt and its influence on Classical casting technology. Following the identification of manganese dioxide flux in some 18th century crucible steel crucibles from Sheffield I am again interested in the very varied involvement of manganese and its compounds in ferrous metallurgy from antiquity to the present.

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

PAUL CRADDOCK: Recording the fast changing indigenous technical processes around the world, not just as a record of past technology but how they change and why they change.

THE CRUCIBLE: Which publication should every HMS member read?

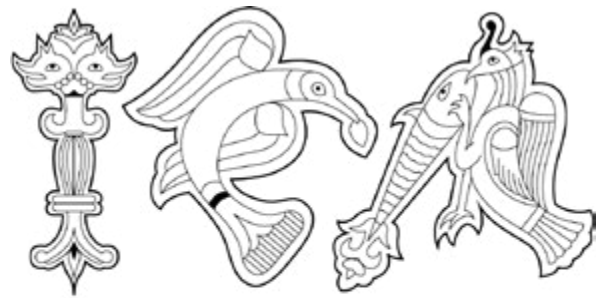
PAUL CRADDOCK: Agricola's *De re Metallica* edited by the Hoover's. Both original text and Hoover's extensive footnotes are full of good things.

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

PAUL CRADDOCK: Try and develop your projects.

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

PAUL CRADDOCK: I don't do mission statements.



56° CONGRESO
INTERNACIONAL DE AMERICANISTAS
SALAMANCA 2018

ICA 2018, CALL FOR PAPERS

Symposium: "Archaeology and History of Mining in the Old and New World: potential contributions in the analysis of American and urban colonial contexts"

Mining has been pointed out as the engine of Andean economy during colonial time. It has also defined social relationships between diverse historical agents, directly related to the social configuration of the future American national states and the development of industrial capitalism in Europe. This session aims to promote the debate about the context of colonial mining in colonial and urban sites, and also gather researchers who study American and European historical and archaeological contexts related to colonial mining. Therefore, we invite to submit proposals that contribute to theoretical and methodological debates around the specificity of mining in colonial and urban contexts; history of mining in the Old and New World; changes and continuities in mining, arts and crafts; techniques and technologies; tensions between agents and agencies involved; environmental impact, daily life, power relationships, and the identification of the diversity of sites, archaeological and historical evidences.

56th International Congress of Americanists (ICA), 15-20 July 2018. Salamanca, Spain. Deadline for abstracts, the 20th October 2017. Organisers: M. Florencia Becerra (florenciabecerra@gmail.com) and Luana Campos (luanacampos@insod.org)

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.

MEET YOUR COUNCIL

PAUL RONDELEZ

My name is Paul Rondelez and I was born in Belgium about a half a century ago. My early enthusiasm for all things of natural beauty was ‘crystalized’ when my father took up the hobby of mineral collecting. From then on, three to four holidays a year, and many weekends in between, were spent conveniently close to old and working mines and quarries. When I started my university studies in Ghent, I choose history as my subject and later specialized in archaeology. The subject of my Master’s thesis was quickly found: iron mining and production in Iron Age and Roman Belgium (1992).

After some interesting detours, including risky factory jobs and equally dangerous secondary school teaching, I reached the shores of Ireland in the year 2000 to work in commercial archaeology. My interest in metallurgy was alive and well and I always succeeded in ending up excavating the metalworking features on the various sites. When, in 2009, the recession hit Ireland and the archaeological work dissipated, Ewelina, my wife, convinced me to apply for a PhD position at UCC. A brief talk with Prof. William O’Brien, of early Irish copper mining fame, concluded that the subject was to be Late Medieval iron production in Ireland. In the four following years a synthesis was made of the available sources on the subject, archaeological and historical, which was then placed in its larger European context. This thesis was successfully concluded in 2014.



During my PhD research, I came across many references to blast furnace iron production in 17th- and 18th-century Ireland, a topic barely studied up to then. Many weekends were spent crisscrossing the country to located these furnaces and long evenings dedicated to deciphering relevant manuscripts. This culminated in setting up the Sliabh Aughty Furnace Project, aiming at studying the history and preserving the remains of the iron industry in east Counties Clare and Galway. In April 2014, I organized a field trip for the Historical Metallurgy Society to the ironworks there and others built by the East India Company at Dundaniel, close to Cork. Up to now, two Furnace

Festivals have been organized in the Sliabh Aughty area, with a third coming up in 2018, to spread the word on our research. In 2015, we received a generous grant from the Heritage Council to compose Conservation Management Plans on all four of the upstanding blast furnace remains in the Sliabh Aughty area. Also, a first publication is in the works on detailed correspondence of the agents of one of the iron masters there in the 1690s.



In the meantime, I have started publishing parts of my PhD research, as well on non-ferrous mining in Ireland, and have composed about 30 specialist reports on metalworking remains excavated in Ireland. I can still get very excited when a package arrives with slag and other goodies! Since a few years, I am a proud member of Council of the Historical Metallurgy Society as well a director of the Mining Heritage Trust of Ireland. In the future, I hope, Providence permitting, to continue publishing parts of the vast body of material, both archaeological and historical, relating to early mining and ironworking in Ireland currently on my Desktop.

I was asked to add some views for the readership, but was not sure, seeing my rather unorthodox career path, I currently work for Apple Inc. by the way, that I am best placed to offer much advice. Then I realized that many of the researchers of early metalworking which I know have got to where they are via equally tortuous routes. I guess at some point, our hearts got captured by early metalworking, be it by unlocking the chemical composition of artefacts, trawling through 18th-century mining accounts or studying the intricacies of iron smelting slag. And then, we met, or are still to meet, in this wonderful organization known as the Historical Metallurgy Society.

LINKS:

The PhD: <https://cora.ucc.ie/handle/10468/1944>

My website on metalworking reports: www.slslag.ie

The Sliabh Aughty Furnace Project website: www.furnaceproject.org

And the Facebook page of the same: <https://www.facebook.com/FurnaceProject/>

EARLY HIGH TECHNOLOGY CERAMICS MEETING

27th April 2017, London, UK

This year, the Early High Technology Ceramics meeting, which took place in April 2017, was hosted in the Institute of Archaeology at UCL. The meeting proved to be a wonderful opportunity to learn in a friendly atmosphere, about recent and ongoing research on a range of topics related to glazed materials, porcelain, cobalt used as pigment, faience beads, early glass production and crucibles. Here, we would like to comment on the last session of the day, composed of three papers focusing on the use and properties of crucibles.



The first talk was given by Marcos Martín-Torres, who presented the study of five crucibles from Santa Cruz de Mompo in Colombia, a colonial village chosen by the Spaniards to tax the gold that was sent to Spain. Based on the composition of the fabrics and shapes of the technical ceramics, the authors proposed that four of them were most likely imported from Europe; whereas one of them showed different characteristics pointing to a local manufacture. The characteristics of the local crucible however, are different from the indigenous crucibles found in Colombia so far, which means that this finding is the first locally-made crucible found in a colonial site, where local and European traditions are combined. The analysis of the metallurgical remains also revealed both continuity and change of the old traditions. For example, some crucibles were used to melt alluvial gold, extensively used before the European contact. But melting silver was also identified, which represents a new technology spread with the Spaniards.

A second presentation by Justine Bayley focussed on the question of "What shape is a good crucible?" The author showed how factors such as their manipulation, the types of hearth used, the amount of metal produced and the control of the redox conditions can explain different shapes of crucibles. The shape is also determined by the fabrics used, which may determine the wall thickness and

the size of the vessels; and by the form of domestic vessels that in many cases were used as crucibles. Overall, a large variability in crucible shapes is observed in the same sites or areas, at the same time. For Bayley, the diverse shapes do not necessarily represent different traditions or vessels imported from different places; it means, most likely, that a good crucible can be any shape. Therefore, as far as it works and resist the task for what is needed, any shape can be used.

The last speaker Carlotta Gardner, presented a study on the mechanical properties of Roman crucibles that were modified adding an extra outer layer of clay. Her experiments consist on testing the transverse rupture strength and compressive strength of a series of ceramic bars. Her results showed that by themselves, the different clays did not resist much pressure at high temperatures, but when they were used together the resistance increased notably. This means that the addition of an extra layer of clay on Roman crucibles did actually improve the performance of the crucibles, making them more resistant to heavy weights and high temperatures. It is very likely that roman metalworkers were aware of the potential of combining the different clays, using them to avoid the collapsing and fracture of the crucibles.

Overall, the meeting was a complete success. The variety of topics and the quality of the presentations make this a great event to catch up on what is going on in the high technology ceramics world.

Maria Teresa Plaza



IRON IN ARCHAEOLOGY: BLOOMERY SMELTERS AND BLACKSMITHS IN EUROPE AND BEYOND

30th May – 1st June 2017, Prague, Czech Republic

The Iron in Archaeology: Bloomery Smelters and Blacksmiths in Europe and Beyond conference was held 30th May – 1st June 2017 at the National Technical Museum in Prague (Czech Republic). The international conference marked the 50th year anniversary of the Comité Pour la Sidérurgie Ancienne/The Committee for Ancient Ironworking (CPSA) founded by Radomír Pleiner, to whom the conference was dedicated, after remaining secretary of the organisation for nearly 40 years. The event also marked the beginning of a new President of the committee, Vincent Serneels, taking over from Peter Crew, who devoted 15 years to the role.

The conference was opened by Philippe Dillman, who summarised over 15 years of collaborative work with his team of researchers at The Centre National de la Recherche Scientifique (CNRS). Not only did he provide an overview of the developments in iron provenancing over the last decade, but he pointed towards new directions of research relating to the technical performance of iron reinforcements in Medieval monuments in France.

The next three days proceeded with two morning sessions of oral presentations followed by lunch, an afternoon poster session and then finally two afternoon sessions of oral presentations, all broken up nicely by coffee breaks with a generous supply of open sandwiches, pastries and cake. The champagne arrival on the first day prior to the opening lecture was very well received, instilling a celebratory tone that was perpetuated throughout. The posters were spread between the conference hall and the museum reception area, which naturally enabled delegates to explore the well-chosen venue more fully during their breaks, inspecting some of the finest engineering exhibits from the Czech Republic. Most delegates ate out at lunch in Letna Park



(Letenské sady), just outside the museum overlooking the Vltava river. It was here also that the conference dinner was held on the second night at the Letenský zámeček restaurant, which provided an outstanding five-course silver-service menu in beautiful surroundings. It was in this warm atmosphere that delegates began taking turns holding the floor with their positive nostalgia, sharing personal and sometimes comic stories about Radomír Pleiner, whom they all endeared as a friend. Vincent Serneels, Alessandra Giunilia-Mair, Alan Williams and Gert Magnusson not only honoured Jiří Hošek for hosting a wonderful conference, but paid personal tribute and thanks to Radomír's wife, Ivana, and family who were special guests at the dinner. As now appears custom at these gatherings, Arne Espelund invoked a communal rendition of the miners' song *Glück auf* before we all retired to the Letna Park for more discussion and socialising.

For a three-day conference focussed entirely on iron, it was impressive in both scope and volume. The programme included 57 oral papers delivered over 11 sessions (each with allotted discussion time) and 27 posters presented across three poster sessions. Over 100 delegates from more than 20 countries came together to present and discuss their work, which was equally as diverse in terms of chronology and geography. The sessions were not specifically themed, but they were coherent, often grouping papers together of a similar nature. They encompassed both prehistoric and historic case studies of bloomery, as well as indirect iron production, from Europe, Africa and Asia.

Amongst the wealth of good presentations, which only occasionally ran over time, some particularly noteworthy 'inclusions' stood out as being novel in their approach. In his review of iron products from the Middle Ages in France, Maxime L'Héritier combined historical texts with metallographic analyses to tackle the issue of iron re-use and recycling, an area of study greatly in need of attention. Two papers on iron smelting from Wetzlar-Dalheim, presented by Andreas Schäfer and Guntram Gassmann,



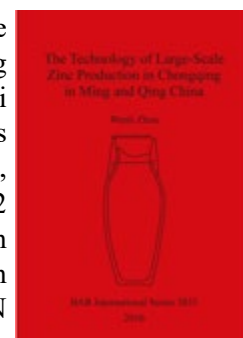
BOOK REVIEW

were perhaps the most significant of the conference. They succeeded in describing the problems of radiocarbon dating iron production slags (caused by calcium carbonate contributions from furnace lining material), and the need to review dated slags in light of their findings. The results had the whole delegation debating into the night at the conference, which Sylvain Bauvais described in his initial response as ‘polemic’. Stéphanie Leroy et al. showed the power of an integrated approach, demonstrating the value of combining metallography, chemical analysis and archaeology simultaneously. Adopting this holistic approach, Stéphanie presented an interpretation that furthered our understanding of Angkor (Cambodia), describing the organisation of iron networks and economy of the site. Amongst the highlights was a presentation by Yasuyuki Murakami on the development of iron production in Japan, including a sneak preview of the film hitting world cinema this year, ‘Tatara Samurai’. He urged delegates to see the film because it contains video footage of authentic Tatara steel making, one of the oldest surviving traditional iron production methods.

The conference concluded on Thursday 1st June, with earnestly-expressed thanks and appreciation to the National Technical Museum and the organisers. The finale included the awarding of two HMS student prizes. The first prize was awarded to Ragnar Saage for best student poster presentation on Late Medieval and Early Modern Smithy site of Kaku, Estonia, followed by the prize for best oral presentation to Kamila Brodowska for her talk entitled One of 150000 – How to ‘read’ furnace artifacts from Maszovian centre of metallurgy. The next day took delegates on an excursion to the Mining museum in Příbram, located 60km south-west of Prague on the Friday. The conference will result in a special issue of the peer-reviewed journal *Archeologické rozhledy* containing 30 papers, though delegates have also invited to submit their conference contributions in published form to *Archeologia Technica*.

Thomas Birch

The Technology of Large-Scale Zinc Production in Chongqing in Ming and Qing China, by Wenli Zhou, 2016, BAR International Series S2835, BAR Publishing, Oxford, UK, xvi+162 pages, 43 tables, 122 figures (62 in colour), 3 maps (1 in colour); illustrated throughout in colour and black & white, ISBN 9781407315515, £32.00



Wenli Zhou carried out the scientific study of the remains excavated at the Late Ming and Early Qing zinc-smelting sites at Fengdu and Shizhu in Chongqing, central China at UCL in London. This volume primarily records the results of this examination in some detail from which the main operating parameters of the process have been established.

However, this is much more than just a scientific report, excellent though it is, and seeks to set the Chinese industry in the broader context of the world-wide development of zinc production. The volume begins with a global historical over-view of brass and zinc before the in-depth study of the industry at Fengdu and Shizhu. The latter includes trying to establish how the industry began, the reasons for its location, including the more local distribution of the smelting plants in the context of the zinc and coal mines and transport, in which the Yangtze River was all important. The geo-politic and economic factors effecting production are also evaluated.

From this the discussion extends to the role of Chinese zinc in post medieval world trade, especially viz-a-viz Indian production. One of the surprising conclusions of this work is the rapidity and extent of the trade in Chinese zinc only a short time after its inception most likely in the 16th century. Soon Chinese zinc was supplanting Indian zinc, even within India itself. The international trade was almost exclusively in the hands, or more correctly the vessels, of the various European East India Companies.

The relatively small quantities of zinc brought to Europe from the East created considerable scientific curiosity, and finally commercial interest, when it was finally realised that the metal was made from the familiar calamine (smithsonite) zinc carbonate ores that had been used for centuries to make brass by the cementation process.

All in all this is a fascinating work, well written and produced, worthy to join the growing ranks of archaeo-metallurgical works produced by BAR Publishing. This is ancient technology as it should be studied; a full and lucid technical exposition is fully integrated into the broader social, economical and geographic contexts.

Paul Craddock

13TH MEETING OF HISTORIANS IN LATIN AMERICAN MINING

4th - 7th April 2017, Buenos Aires, Argentina

The 13th Meeting of Historians in Latin American Mining (MHLM) "Interdisciplinary dialogues and challenges around past and present Latin American mining" was held from 4th to 7th April, in Buenos Aires, Argentina. The event was organized by the Ethnohistory Section of the Institute of Anthropology from the University of Buenos Aires. The Organizing Committee was formed by M. Florencia Becerra, Dolores Estruch, Lorena Rodríguez, M. Victoria Staricco and Carlos Zanolli. The MHLM is a periodic meeting that has been organized since 1990 in Mexico, Peru, Bolivia, Chile and the United States of America. The 13th edition was the first one held in Argentina and welcomed over 100 participants from different countries (Argentina, Chile, Bolivia, Peru, Colombia, Brazil, Mexico, United States of America, Holland, France, Scotland and Spain). See www.13reunionmineria.wordpress.com for more information.



The congress had six sessions that covered various disciplinary approaches and problematics related to mining and its study, considering cases from different periods and regions in Latin America. The first session covered the analysis of mining agents (workers, small, medium and large-scale entrepreneurs, authorities, etc.) in pre-Columbian and colonial Mexico (Queretaro by Pérez Campos, San Luis Potosí by Povea Moreno, Guanajuato by Guevara Sanginés and Michoacán by Serrano), in Bolivia (Potosí by Zagalsky as well as by Barragán, Carangas by Gil Montero), in Peru (Huancavelica by Brown) and in Argentina (La Rioja by Staricco and Catamarca by Rodríguez) The session also presented three papers on mining in Mexico during 19 and 20th centuries (Gamez and Mendez Reyes, Uribe Salas, Ortega and Liceaga Carrasco).

The second session was dedicated to conflicts and tensions around mining. Most of the papers discussed present-day cases where open-mine projects are generating opposition in local communities (Jofré Luna, Espósito, Gómez, Schiaffini, Yeckting Vilela, Costa), affecting archaeological heritage or reconfiguring territories (Godfrid). Others

focused on the strategies of Mexican miner unions (Zapata) and the conflicts and projects in the late colonial period in La Rioja, Argentina (Staricco and Boixados).

The third session was on impact and construction of mining landscapes and jurisdictional territories. The first set of papers covered different cases of colonial mining areas in the North of Argentina from archaeological and historical evidences (Quiroga; Mignone; Angiorama, Becerra, Giusta and Pérez Pieroni; Garcés). A second set of presentations addressed mining and company towns in Chile (Artaza Barrios, Méndez Díaz) and Catamarca, Argentina (Meléndez and Quesada) during 19th and 20th centuries. A third group was on territories, justice and politics, in colonial (García Mendoza, Gavira Márquez) and present-day Mexico (Schiaffini), as well as in Jujuy, Argentina in 1880-1930 (Fandos and Bovi).

Sources, scales and theoretical-methodological approaches were addressed in the fourth session. The history of medium and low scale mining enterprises in La Rioja, Argentina (Bedini; Hünicken and Crovara) and in Mexico (Navarrete) were presented as well as alternative sources for approaching mining activity: colonial iconography and cartography in the Andes (Barragán, Scott), 20th century's photography (Gluzman), technical books (Bigelow) and technology (Herrera), social networks, blogs and audiovisual records for ethnographical research (Estruch) and social memory (Soto Flores and Ortega Morel, Herrera Muñoz).

The fifth session focused on mining technologies and technical operations. Firstly, it approached mining of non-metalliferous minerals for making stone tools in La Pampa (Beron and Carrera Aizpitarte) and in Córdoba, Argentina (Sario, Costantino and Salvatore). It also included a paper on clay mining in pre-Columbian times in Catamarca, Argentina (Orgaz and Ratto) and a presentation on turquoise mining developed during Inka times in Salta, Argentina (López, Coloca, Solá and Rosenbusch). Both of them highlighted the sacred and religious dimension of the extractive activities. Regarding metalliferous minerals, the session presented papers on pre-Columbian copper extraction and smelting in North of Chile (Figuroa, Mille, Salazar and Berenguer; Sapiains, Menzies, Figuroa, Mille and Berenguer) and on silver exploitation in colonial times in Oruro (Cruz and Téreygeol) and Aullagas (Casanovas, Nicolas and Quisbert), both in present-day Bolivia. Hydraulic technology in Mexico (García Mendoza) and reverberatory furnaces in the Andes (Téreygeol and Cruz) were also addressed in the session. Finally, there were two papers on the study of evidences of mineral processing (crucibles, moulds and stone grinding tools) found in Calchaquí Valley, Argentina (Gluzman and Gál; Castellanos and Williams).

IAMS ARCHAEOMETALLURGY SUMMER SCHOOL

12th - 23rd June, London, UK

The IAMS archaeometallurgy summer schools have been running successfully for 20 years. Targeting professionals, academics, students and enthusiasts, they cover a range of topics (from mining and beneficiation to metal production, experimental reconstruction and analysis), presented by leading researchers. Scheduled for June 12-23, participants claim the 2017 archaeometallurgy summer school was interesting, engaging and highly beneficial to their work and research. The 2017 summer school attracted around 15 participants from across the globe (UK, USA, Hungary, Spain, Italy, India, China, and Australia). Whilst the majority of the participants had archaeological backgrounds, the group also consisted of an isotopic analyst, geologist and an undergraduate chemist/archaeologist. All participants shared one commonality, they work with ancient metals.

The 2017 programme comprised of seven days of classroom based activities, including artefact handling sessions, visits to the British Museum (figure 1) and UCL analytical archaeology laboratories; and a three day experimental iron smelting workshop in Monton Up Wimborne, Dorset, UK.



Figure 1: Participants visit the “Roman Water Wheel” at the British Museum (Photograph courtesy of C Livingston).



The last session was dedicated to economy, population distribution and socio-environmental impacts of mining activities. The first paper addressed colonial economy in the south of Bolivia during early 17th century (Palomeque). Two papers on Mexico in the 19th century were focused on British investments in Guanajuato (Parra) and the company towns in Baja California (González Cruz and Rivas Hernández). Mining and its environmental impacts in Brazil was addressed from archaeological perspective (Guimaraes and Fernandes de Moraes) and present-day narratives (Scotto). There was also a paper on mercury pollution in Querétaro, Mexico (Herrera Muñoz, Mejía Pérez Campos and Herrera Mejía) and on environmental history of gold mining in Antioquia, Colombia in the 19th and 20th centuries (Campuzano Duque).

The meeting also had five keynote presentations, regarding the history of the meetings (Alma Parra, INAH, Mexico), the archaeology of mining in Southern Andes (Diego Salazar, Universidad de Chile), mining and population in Charcas -Bolivia- during colonial times (Raquel Gil Montero, CONICET, Argentina), the Taki Unquy movement and the mercury pollution in the Andes (Lydia Fossa, ESAN, Lima) and the mercury in silver mining in the 19th century (Tristan Platt, University of St. Andrews, Scotland). Besides these activities, participants enjoyed the presentation of three related films: Potosí’s temptation (La Tentación de Potosí, by Crnogorac and Absi), Women of the mine (Mujeres de la Mina, by Unamuno and Bystrowicz) and Exhalation of the Earth (La exhalación de la tierra, by Farjat and Swiderski).

The meeting fully met our expectations with the participation of researchers from different disciplines and countries, gathered by the common interest in the history of mining in Latin America. The 14th Meeting will be held in Santiago de Chile in two years. I hope more colleagues from Europe studying mining in Latin America can join us in the fruitful debates and presentations.

María Florencia Becerra



Figure 2: Participants divided into work groups: fore centre- crushing ore; back left- making clay; far back right of centre- cutting wood (Photograph courtesy of C. Farci).

Professor Marcos Martín-Torres kicked off the programme on Monday June 12th with a ‘Foundations’ day. This provided a preview of what was to come, establishing participants’ relevant backgrounds, experience and interests. The classroom component included invaluable lectures and presentations by leading archaeometallurgy researchers: Dr. Miljana Radivojevic (Early metallurgy in the Balkans), Dr. Ignacio Montero-Ruiz (Early metallurgy in the Iberian Peninsula), Dr. Kunlong Chen (Early metallurgy in China), Professor Thilo Rehren (Non-ferrous metallurgy: mixed topics and foundations of iron smelting), Dr. Brigitte Cech (Fieldwork and excavation of metallurgical sites, iron smithing) and Dr. Eleanor Blakelock (Metallography and microstructure of iron objects).

Highly interactive, these lectures and presentations often incorporated activities to facilitate learning. Participants enjoyed the open- forum learning environment, flexibility of topics (endeavouring to meet their needs) and approachability of presenters. The programme concluded with the experimental iron smelting workshop.

The experimental iron smelting component was conducted on the last three days, with the majority of participants wishing it was longer. The first day provided an introduction to Jake Keen, an experienced iron smelter, and Dr Martin Green, the owner of Down Farm, as well as an orientation to the work area. With one medium sized bloomery furnace (Meroe) already running, the participants broke up into small work groups and began the necessary tasks that accompany smelting (crushing/separating ore; roasting ore; chopping wood; making clay; furnace repair; charcoal breaking/sorting) (figure 2 & 3).

An assaying furnace and crucibles were also constructed. The smelt on the first day produced a large quantity of slag, but no discernable bloom. On the second day work

continued in earnest. Participants rotated throughout the work groups gaining firsthand experience of the laborious nature of ancient smelting. The assaying furnace was running all day, yield many successful smelts under varying experimental conditions. These experiments were being conducted by one of the UCL MSc students, Andrea Frasca. Day two proved a long day, as participants agreed to an attempted smelt in the large bloomery furnace. In order to carry out this smelt, the large furnace first needed minor repairs, and enough charcoal and ore would need to be crushed and sorted into exact ‘charge’ weight bundles. Thus a medium bloomery furnace was in operation throughout the morning and the large bloomery furnace was in operation for the afternoon and evening (figure 4).

Large amounts of slag were produced again, but no discernable bloom formed in either the medium or large furnace smelts. However, upon examination of the cold contents of the furnaces the following morning an interesting phenomenon was discovered. Amidst the unconsumed remnants of charcoal was iron, paper thin and foil-like.



Figure 3: Participants crushing ore (Photograph courtesy of C. Farci).

In the late afternoon of day two participants were treated to a guided tour of Down Farmland Down Farm Museum by owner Dr Martin Green. The Down Farm landscape includes parts of the Dorset Cursus and Ackling Dyke, Bronze Age barrows, as well as Roman and Iron Age buildings. It is a rich, multi-period site in a wonderful setting, proving a refreshing break for participants from the arduous work at the smelt.

The final smelt on day three produced very similar results as those from day two. However, this time there was dense, iron-rich ‘slag’ pieces, resembling solidified drips/runs. Upon discussion it was hypothesized that these were possibly the phase just prior to a bloom forming, and had the smelt continued for approximately thirty minutes a bloom may have formed.

Participants of the 2017 IAMS summer school found the programme to be very valuable (Figure 5). They state that the theoretical components were extremely beneficial to their current work or research, and the practical component was not only very informative but a lot of fun. All participants found the facilitators and presenters very friendly and approachable. This is an excellent programme that they would recommend to others, with some even suggesting they would consider attending again in the future.



Figure 4: Large bloomery furnace in operation with four drum bellows (Photograph courtesy of C. Livingston).

Catherine Livingston



Figure 5: 2017 IAMS Archaeometallurgy Summer School group photo (Photograph courtesy of A. Gupta).

WHAT ARE YOU UP TO?



ETHAN GREENWOOD from University of Exeter reports: Together with the Wealden Iron Research Group we are undertaking excavations with the Hastings Area Archaeological Research Group on a Roman iron production site just outside of the village of Broad Oak, Brede, East Sussex. The site shows evidence of large scale production with a waste heap extending around 400m along a large stream. The site has been investigated using a variety of geophysical techniques including magnetometer, earth resistivity tomography, induced polarisation and electromagnetic surveys. This showed the site to have a number of enclosures and trackways along with eight large furnaces and working areas. The excavations being undertaken are looking at the whole site including quantifying the waste heap and exposing a furnace in its entirety.



JO AHMET, Kent FLO, reports: As is often the case with the day to day work of the Portable Antiquities Scheme interesting patterns and cases appear via the objects and treasure being reported. Of recent note is that increasing numbers of Bronze Age finds, including hoards and early gold objects, are beginning to suggest that an urgent re-assessment of the Bronze Age and its material in the county is necessary. Perhaps the most unusual of these finds is the Preston Plate hoard from near Canterbury (2016 T450) which consisted of 930 'plate' like fragments of copper-alloy contained in a pot of MBA-LBA date.

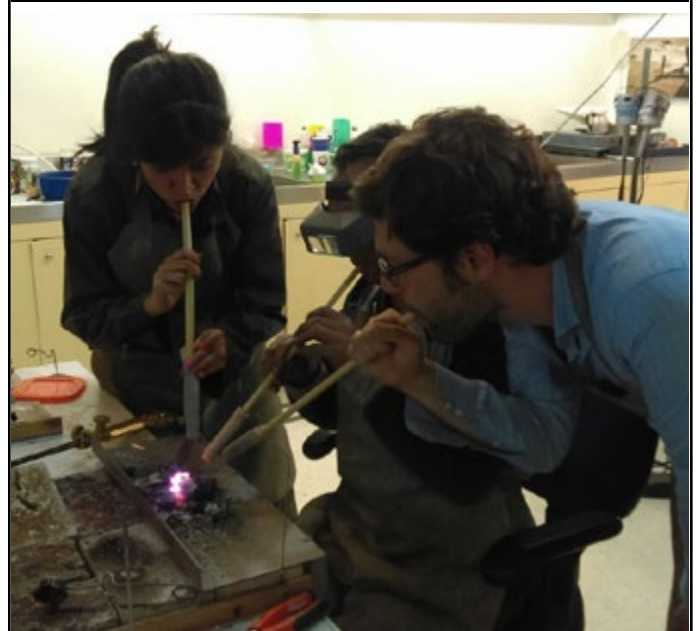
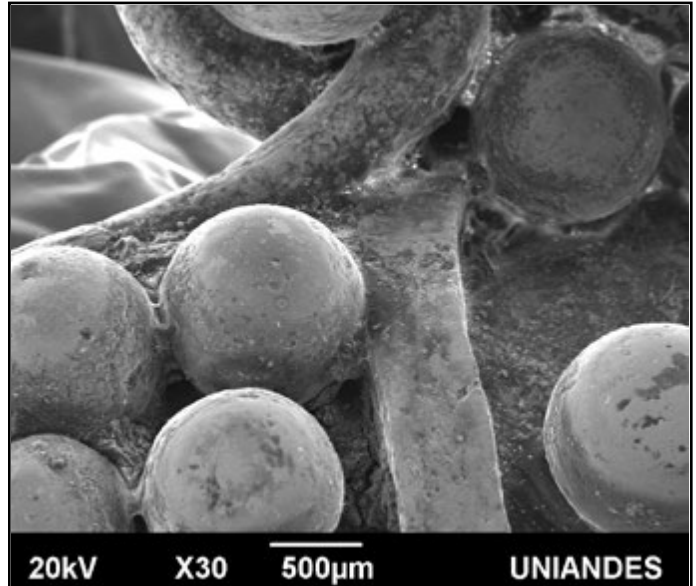
ELEANOR BLAKELOCK says: On the 2nd of July I started a six day archaeometallurgy course for the Sedgeford Historical and Archaeological Research Project (www.SHARP.org.uk). This course was almost entirely practical based, with teaching and discussions taking place as and when needed outside in the field. The seven students built both a casting hearth and a bloomery furnace. During the week we cast objects in pewter and copper alloys, using cuttlefish moulds which are quick and easy for the students to carve. On the Thursday evening we carried out a smelt using the local carstone from Snettisham Quarry (this is the same ore used by the Romans in nearby Snettisham). The smelt started in the morning, and continued well into the evening when everyone on camp came to join in on the bellows. The evening was made extra interesting by a thunderstorm which circled us in the late evening while leaving us mostly dry, the furnace gods were smiling on us that day!





RACHEL CUBITT, at MOLA (Museum of London Archaeology) says: Medieval visitors to the area around Leadenhall Street in the City of London would have seen a hive of industrial activity. A group of metalworkers were casting copper alloys, making large open vessels such as cauldrons, skillets and perhaps bells. In fact nearby Billiter Street shares its name with the occupational name for a bell-founder. In 2013-15, MOLA excavated a site at 52-54 Lime Street (LED13) and found just over 17kgs of discarded mould material along with other evidence for casting such as crucibles and copper alloy waste. These objects are now being analysed in advance of publication by myself and other MOLA colleagues. We are very grateful to Justine Bayley for assisting us in identifying some of the more unusual mould fragments.

VANA ORFANOU, THOMAS BIRCH, SØREN SINDBÆK from Aarhus University report: The site of Ribe in the west coast of Jutland, Denmark, founded in the early 8th century AD is the earliest Viking urban centre and emporium in the region. Excavations revealed prolific evidence of in situ metallurgical activities, and a wealth of metal objects. Our project examines the copper-based evidence during the peak of activity in the 8th and 9th and includes crucible and mould fragments, metal bars/ingots and related objects. Most importantly, the material derives from a tightly stratified archaeological sequence consisting of roughly 20-year long phase intervals. Results will provide unique insight into the short-term development of technological choices relating to the different stages of the metallurgical cycle in an urban setting.



LINA CAMPOS-QUINTERO, at the Museo del Oro in Bogota reports: I am studying the granulation techniques employed to manufacture delicate gold ornaments from Colombian Pacific-region. The aim of my work is to understand the technological pathways developed for making and joining little spheres, wires and gold sheets in southwest Colombian metalwork cultures. Surprisingly, the first analyses made by SEM-EDS have shown that there is no interstitial copper between spheres, which might beget the possibility of an autogenous welding, a contrasting method to the ones described for Etruscan granulation, or for the 18th-century European pastiches. Confronting the possibility of a welding technique that does not use a filler metal, the project has started experimental work to prove, or disprove, the hypothesis of diverse welding preferences coexisting in space or, alternatively, changing along the time.

FORTHCOMING EVENTS

Conference, Date and Location	Description	Website, Email and Prices
23rd European Association of Archaeologists (EAA) Annual Meeting 30 th August - 3 rd September 2017 Maastricht, Netherlands	This year's EAA meeting has several themes that will cover various aspects of archaeology relevant to archaeometallurgists, including " <i>The 'Third Science Revolution' in Archaeology</i> ". One regional session in particular should be of interest to our readership: " <i>Early Mediterranean metallurgy: technological innovation and cross-craftsmanship</i> ".	https://www.klinkhamergroup.com/ea2017/
1st Workshop for Young Researchers in Archaeometry and Conservation Studies 11 th -12 th September 2017 Frankfurt, Germany	Young researchers from different institutions and educational backgrounds study and work in the fields of archaeometry and conservation studies. Due to the varying methodological and analytical approaches, mutual exchange and networking particularly among students and young researchers in general is rendered difficult. The workshop -held in the Institute of Geosciences at the Goethe University Frankfurt- invites all young researchers to present their work in a convenient/relaxed atmosphere and to discuss among peers. Contributions will focus on analytical studies of archaeological materials or on institutions carrying out research in archaeometry and/or conservation studies.	http://www.dmg-home.org/fileadmin/user_upload/Archeometrie/pdfs/cfp_english.pdf http://www.dmg-home.org/index.php?id=210
Recycling and the Ancient Economy Conference 22 nd -23 rd September, 2017 Oxford, UK	This conference to be held in the Old Library, All Souls College (Oxford), organised by The Oxford Roman Economy Project, will include presentations of interest to our readers such as "Coinage and Metals Recycling", "Large-Scale Modelling of Copper Alloy Recycling " and "Roman Merchant Ship Cargo of Scrap Metal and Raw Materials in Caesarea Harbour ", amongst others.	Chloe.Duckworth@ncl.ac.uk oxrep.classics.ox.ac.uk
9th International Conference on the Beginnings of the Use of Metals and Alloys (BUMA IX) 16 th - 19 th 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.	http://eng.kim.or.kr/Board/board.asp?b_code=3231&Action=content&GotoPage=1&B_CATE=BBS11
European industrial heritage associations and volunteers 20 th -22 nd October 2017 Barcelona, Spain	The X annual weekend of European industrial heritage associations and volunteers, organised by E-FAITH (European Federation of Associations of Industrial and Technical Heritage) will be held in and near Barcelona in October 2017. This meeting has become a tradition where volunteers, associations and professionals meet and share experiences. The draft programme, the call for papers and the registration forms are now available on the E-FAITH website. This year's themes are: "Industrial Heritage: exploring opportunities for education and lifelong learning" and "Preparing the position of industrial heritage for the 2018 European Cultural Heritage Year".	http://industrialheritage.eu/activities/industrial-heritage-weekend-2017
Later Prehistoric Finds Group meeting 27 th -28 nd October 2017 Edinburgh, UK	The LPFG are now accepting abstracts for the conference sections of their annual meeting, which will be held at the National Museum of Scotland, Edinburgh. Abstracts on any topic related to later prehistoric finds will be accepted, but those focusing on finds from Northern Britain are particularly encouraged. Abstracts of up to 250 words should be submitted by email to: laterprehistoricfindsgroup@gmail.com. The closing date for abstracts is the 31st of August 2017.	laterprehistoricfindsgroup@gmail.com https://sites.google.com/site/laterprehistoricfindsgroup/
Science of Ancient Egyptian Materials and Technologies Conference (SAEMT) 4 th - 6 th 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".	http://www.saemt.com/calling-paper.html submit@saemt.com
XX International Congress on Ancient Bronzes 17 th -21 st April 2018 Tübingen, Germany	The conference -to be held in University of Tübingen- will bring together experts from different backgrounds in order to develop further the study on ancient bronzes, may it be sculpture, tool, or weapon. The aim of the conference is to explore questions concerning bronze(s) as resource, on their reconstruction, the motives and subjects represented, and on the function of bronzes in society.	2018AncientBronzes@klassarch.uni-tuebingen.de uni-tuebingen.de/ancient-bronze-congress-2018
56th International Congress of Americanists (ICA) 15 th -20 th July 2018 Salamanca, Spain	The 56th ICA, to be held in the University of Salamanca, Spain, we will be conducting the symposium "Metallurgy as an axis for the understanding of the political, social and economic changes of pre-Columbian and Colonial societies in America" and "Archaeology and History of Mining in the Old and New World". The topics include: "Metals across time", "Processes and technologies", "Pre-Hispanic and colonial mining" and "Aesthetic and symbolic dimensions". The deadline for proposals is the 20th of October 2017.	http://ica2018.es/home/ luchivetter@hotmail.com

