

THE CRUCIBLE

Historical Metallurgy Society News
Issue 97

Spring 2018

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The **HISTORICAL METALLURGY** Society

FROM THE CHAIR

This my final ‘from the Chair’ piece, as my term will end with the AGM in June. I have, in total, been Chair for eight out of the last ten years. It has been an honour and a privilege to serve HMS in this way for such a sizeable part of its history.

The role of Chair is really two-fold: to help to generate new ideas and directions, and then to manage the efforts of the team, so that the contribution of each individual member can have maximum effect. The result is that where the society has done well, the members of the team deserve all the credit – and I am very grateful to them all. Although the numbers of people involved in conducting the business of the society may seem quite small at any one time, over those ten years some forty-six people have served on Council, all giving freely of their time to support the Society in the furthering of the discipline. An even larger group has served on the various committees of the Society.

It has been a period with both ‘ups’ and ‘downs’. The biggest challenge has been trying to ensure the future of our valued journal, ‘Historical Metallurgy’. For various reasons, by a point several years ago the journal had slipped substantially behind its intended year of publication and this has had various serious knock-on effects. The most serious of these has been to delay the appearance of the journal in digital form. It has been our intention for many years to publish online as well as on paper, but that depended on us both being up-to-date with journal production and having a valid financial model for the journal. The latter has been achieved, but the catch-up in production has been slower than hoped. The good news is that, finally, this is now well on the way. Articles are now moving smoothly through the Editorial Board that was established at the end of 2016, so we can now assure authors of the rapid service they deserve; only two pre-2017 submissions now remain with the Editorial Board.

The Society’s other publication, ‘*The Crucible*’, has also been completely transformed over this period, from a drab newsletter, into the vibrant, informative, full-colour production that it is today. The HMS Facebook page is also now a well-established forum for more rapid communication. A completely revitalised HMS website is another major change from a decade ago, and further exciting changes are currently taking place. When these are complete, and the impact of GDPR evaluated, the next task will be to improve communication with members by email.

Of all the HMS activities of the last decade, the one that has probably given me most pleasure is the establishment of the ‘Research in Progress’ meeting series. This started with the meeting in National Museum Cardiff / Amgueddfa Genedlaethol Caerdydd that I organised in November 2008.

This series has gone from strength to strength, with meetings in Bradford 2009, UCL 2010, Sheffield 2011, Newcastle 2012, Exeter 2013, Oxford 2014, Brunel 2015, Birmingham 2016 and Liverpool 2017 – in each case having both a regional flavour and an increasing participation of speakers from outside the UK. As the demographic of the Society has changed from a predominance of enthusiasts of historical industries (often retired workers from those industries), to a membership dominated by student, academics and professional practitioners within the emerging discipline of archaeometallurgy (in its broadest sense), so RIP has effectively replaced the old-style annual conference (with its talks, field trips and informal members’ contributions) as the regular autumn HMS event. The addition of a regular HMS Prize for the best presentation at RIP by a recent or current student has made this series into the main focus of the society’s engagement with the upcoming generations of archaeo- and historical metallurgists. These meetings are always a wonderful reminder of the diversity both of the subject and of the means of investigation.

Increasing participation from outside the UK has also been a feature of the last decade more generally. Although the journal has always had a high proportion of contributions from outside the UK, there has been a great increase in the number of people travelling in person to attend, and to present at, HMS meetings, particularly following the highly successful Anniversary conference in 2013, which drew a large international audience. HMS has also started to award prizes for student presentations at international conferences outside the UK (Archaeometallurgy in Europe, Iron in Archaeology...). The simplification of subscriptions into a single rate, irrespective of location, is another facet of the society becoming more international, as is the diverse makeup of the current Editorial Board. Effective mechanisms for international participation in the work of Council remain, however, to be established.

I wish my successor well and I am confident that the Society will benefit from fresh ideas and energy!

Tim Young



*Other interests when not leading the Society
Tim experimenting with brazing*

OBITUARY

DAVID CROSSLEY

David Crossley's death on 3rd December 2017 marked the end of a very long association with the Historical Metallurgy Society, and before that the Historical Metallurgy Group.



At the Society's 50th Anniversary in 2012 he was one of only two surviving founder members and in that time he had served the Society as a council member and then as Assistant Secretary, Secretary, Chairman and President. Following Ronnie Tylecote's death in 1990 he then became Joint Editor, a role in which he continued until less than a year before he died.

Following a degree in history from Oxford, David went to Cardiff and established himself as an archaeologist, moving in the early 1960s to Sheffield University to join the Economic History Department. As an excavator of industrial sites where iron or glass were worked he produced a series of exemplary reports with commendable speed. His involvement with archaeology in and around Sheffield started with the excavation of the bloomery at Rockley Smithies, now beneath the M1 motorway. However, his better-known excavations of iron-working sites were in the Weald and culminated in a book, written jointly with Henry Cleere, *The iron industry of the Weald*. He is also well known for his excavation of glass-working sites such as those at Bagots Park, Rosedale and Kimmeridge.

Following closure of the Economic History Department, David moved to Continuing Education where, working jointly with members of one of his evening classes, he edited *Water Power on the Sheffield Rivers*. It used both historical documents and fieldwork on some of the rivers which formed the original basis of Sheffield's iron and steel industry. This interest in the history of local industries also meant involvement at Wortley, Shepherd Wheel and Abbeydale, sites which all became parts of the Sheffield Industrial Museums Trust, which David served as Vice Chairman.

David was also involved with societies other than HMS, acting as Treasurer for the Association for the History of Glass, and helped found both the Wealden Iron Research Group and the Society for Post-Medieval Archaeology, subsequently editing their journals for a number of years. The latter showed him the need for an accessible overview of the subject, so he wrote *Post-medieval archaeology in Britain* which was really the first book of its kind in the UK. His conscientious chairmanship of the English Heritage Industrial Archaeology Panel was widely appreciated, as was his championing of the application of scientific techniques to the investigation of archaeological sites and finds. He also served a term as a Commissioner of the RCAHMW and was a trustee of the Ironbridge Heritage Foundation. There, as in the many other areas where he was active, he will be sorely missed.

A future issue of *Historical Metallurgy* will include a series of brief recollections and appreciations of David's contributions to the history and archaeology of medieval and later industries. A one-day meeting to celebrate his life and work is also being planned for late May; it will be held at Kelham Island Museum in Sheffield. Any HMS members who would like to attend, or to contribute to the piece in *Historical Metallurgy*, are invited to contact me at editor@hist-met.org.

Justine Bayley

WANTED slag standards -

From the Archives and Collections Committee

Concern has been raised about the lack of XRF/EDX standards for bulk slag analysis. We are looking for suitable standards and if anybody knows of any, please contact the Honorary General Secretary of the HMS: secretary@hist-met.org

Vanessa Cheel

Submissions

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

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

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On Saturday 25 August, the trainees will carry out their first independent smelts. Other teams of seasoned smelters will be making blooms in a variety of furnaces. There are now around twenty smelters committed or strongly interested in participating which means ten to twelve furnaces will be blazing away.

On the day after, Irish blacksmiths will be given the opportunity to get acquainted with home-grown bloomery iron. As opposed to the training part, the weekend events are open to the public.



After the event, the trainee smelters have committed to carrying out further smelts, at other events or on their own, and there are plans to make the Furnace Festival a recurring event.

If anybody is interested in attending or would like more information check our website www.furnaceproject.org or contact Paul Rondelez (prondelez@yahoo.com or 00353/851239550).

Paul Rondelez

FURNACE FESTIVAL WOODFORD, CO. GALWAY 20-26 AUGUST 2018

The Sliabh Aughty Furnace Project is this year holding its third Furnace Festival in Woodford, Co. Galway in Ireland. The idea of this year's Festival is to re-introduce bloomery iron smelting into Ireland. Woodford was the seat of blast furnace iron production from 1681 till 1780 and the event will take place in the field next to the bay which supplied water for the ironworks.

From Monday 20 to Friday 24 August, Lee Sauder will be training up six local(ish) Irish people, two groups of three, in the art of bloomery iron production. Lee, well known to many of the HMS members, has been smelting iron directly from the ore for twenty years and has over 200 smelts under his belt.

SHOCK, HORROR, THE DELHI PILLAR IS GOING RUSTY!

I have just returned from a trip to India to launch our monograph on the excavations of the early zinc smelting and other related metallurgical mines and smelters in Rajasthan (Early Metallurgy in India, Archetype Books, 2017), and whilst in Delhi paid my first visit in 30 years to the famous Delhi Iron Pillar, the ‘rustless wonder’. On my last visit it was a dark grey in colour, but on this visit it had a noticeable orange tinge, very suggestive of hematite or goethite formation - in common parlance, rust. The reasons for this are all too obvious, the all-pervading smog that now envelopes Delhi through much of the winter season.

This is well documented every day in the local media. Particulate matter level, where the acceptable limit is 60mgm per cubic metre is now typically between 300 and 600mgm, and the air quality index for chemical pollutants, where the acceptable level is 50mgm typically lies between 150 and 200mgm, and was actually 350mgm on the day of my visit (Sunday 3rd December). The pollution comes from a variety of sources, much of the particulate matter comes from the agricultural practice of burning off stubble from the fields at this time of year and the very dusty dry soil, combined with the urban pollution, not least from Delhi’s several million motor vehicles.

The various acidic oxides of nitrogen and sulphur in the air will be causing the chemical attack on the pillar, exposed in the open at the World Heritage Site at the Qutb Minar for many centuries and previously at Mathura, Uttar Pradesh or Udayagiri, Orissa. At these sites it remained largely rust free for the last 1600 years (although the base which was usually buried in the ground is quite heavily corroded).

The reasons for the apparent miraculous resistance to rust have excited comment and speculation for well over a century. Back in 1912 Sir Robert Hadfield’s chemical analysis established that the pillar was of a reasonably pure wrought iron with about 0.1% carbon and 0.25% phosphorus, and the more recent excellent studies by Balasubramaniam (2005) have gone a long way to explaining the mechanism by which the phosphorus inhibits corrosion. That, and Delhi’s reasonably dry and clean atmosphere throughout the centuries until the recent past.

To its credit this scientific explanation is now given on the Archaeological Survey of India’s noticeboard by the pillar. The causes of the present attack are clear, the solution is not. Iron is notoriously difficult to protect from corrosion once it has become established and any putative coating would be both impermanent and disfiguring. Perhaps the long term solution will have to be to remove the pillar to a protective environment indoors, such as has had to be done with the bronzes Horses of St Marks in Venice.

This would be a very drastic response and a terrible indictment of our abuse of the environment not just in Delhi but all over the world.

Paul Craddock

GREY MOTTLED CAST IRON IN THE EARLY CHINA

This short report describes fieldwork and analyses undertaken during October in 2017 is part of my PhD research project on “Iron and the Rise of the Qin Empire: An Exploration of the iron production industry in State of Qin and the dynamic interaction with its social context during the Warring States period (5th - 3rd century BC)”. The aim of the project is to use multi-disciplinary research methods to investigate iron smelting and manufacturing technology in the state of Qin during the period when it rises from a minor state into the first empire in the history of China.

The fieldwork was carried out in the Shaanxi Provincial Institute of Archaeology, which has a cooperation agreement with UCL Institute of Archaeology and USTB Institute of Historical metallurgy and Materials, Beijing. The Shaanxi Provincial Institute of Archaeology has been carrying out extensive excavations around the east Guanzhong Plain, where the State of Qin was based during the Warring States period. With the help of the staff of the Institute, archaeological materials from a few Qin cemeteries, located around Xi’an City have been investigated. All these cemeteries have a certain amount of iron objects excavated from tombs dated to late Warring States period.

With the permission from the institute, these iron objects were carefully examined (Fig. 1) and sampled. Samples were mainly taken from broken fragments or edges without unduly affecting the original condition of the objects. These samples were then taken to UCL Institute of Archaeology where they were mounted in resin and polished for metallography and SEM-EDS analysis.

The aim of analysis was to reveal the raw material as well as the manufacturing technique. The preliminary analytical results show that all samples taken from this fieldwork dated between late Warring States period to early Han dynasty, and were made of cast iron as the raw material. Swords and knives were then subjected to a decarburisation process, which removed most of the carbon, leaving characteristic slag inclusions with glassy morphology, and a distinctive chemical composition comparable with bloomery iron.

More interestingly, among the artefacts that were made by mould casting, grey/mottled cast iron (Fig. 2) was found more often than white cast iron, indicating a technological preference which will be explored further in the future research.

These results will complement to our current understanding of iron production technologies in early China, as well as contributing to more specific research questions such as the differentiation of direct and indirect products through slag inclusion analysis.

Liu Yaxiong



Fig. 1: Example of iron objects examined

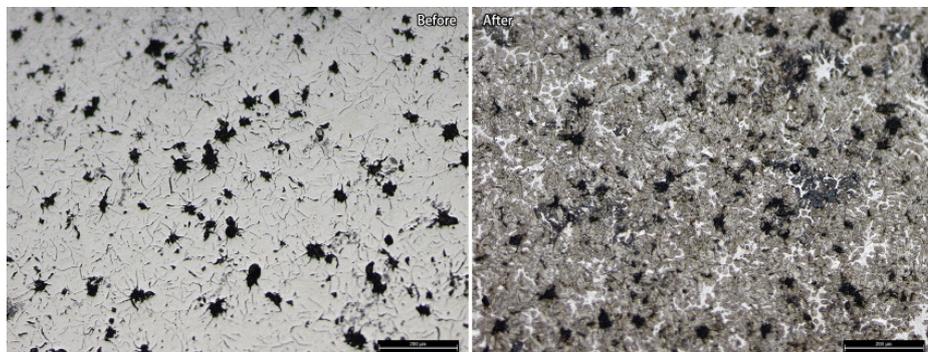


Fig. 2: Grey mottled cast iron before and after etching

TIN AND MERCURY IN SOUTHWEST CHINA

In December 2017, at the invitation of Prof Li Yingfu of Sichuan University, I joined a research trip to Southwest China. Prof Li, who is based in the School of History, Archaeology and Cultural Tourism at the University's main campus in Chengdu, is leading a major project to develop archaeometallurgical studies in Southwest China. It was not my first visit to Chengdu and Sichuan, but it was a first opportunity to travel more widely across the region and see sites in the field. Southwest China, made up of the provinces of Sichuan, Chongqing, Yunnan and Guizhou, is rich in mineral resources and is culturally significant in that it is distinct from the core Central Plains of China. However, it is not a part of the world that we often hear about in archaeometallurgy and the observations here give a taste of the potential of the region.

After rendezvousing in Chengdu our first stop was in Kunming, the capital city of Yunnan, to visit the newly-opened state-of-the-art provincial museum which houses bronzes of the highly engaging Bronze Age Dian Culture (Front cover). Heading six hours south from Kunming, towards the Vietnam border, our destination was the city of Gejiu. Known in modern times as Tin City, Gejiu is the location of China's largest tin deposit and was from the 19th century until recently a major producer of tin. Our evening meal was taken in the converted early 20th century HQ building of the French company that constructed the Hanoi-Kunming railway for the purpose of accessing the tin of Gejiu. And on the outskirts of the city we visited the only remaining artisan producer of tin objects (Fig. 1).



Fig. 1: Tinsmiths at Ban's Tinworks, Gejiu, Yunnan

At 2000m elevation and with a lake at its centre, the city occupies a valley surrounded by low mountains and the evidence of mining in the form of vast open-cast workings is ubiquitous.

Our interests lay in the hills on the periphery of the city where we visited a small smelting site selected for future excavation, with little visible surface remains, but believed to be of possible Han date (206BC – 220AD). A preliminary assessment of slags from the site using pXRF showed them to be from tin smelting. From there we visited the nearby cemetery site of Heimajing. Excavated over several seasons, the well-known site has yielded both bronzes and bronze working evidence again dated to the Han period.

Back in the city museum of Gejiu, three display cases are given over to some of this local bronze working evidence, including a large copper ingot, spills of copper alloy and the curious lead objects in figure 3, retrieved from burials as grave goods.

Reflecting on the lead puddle, intriguingly cut-out like pastry with a biscuit-cutter, and the accompanying lead

“rounds”, I wonder if this represents an ingenious solution to ensuring some precision and regularity in alloy mixing in the bronze casters workshop, and whether other HMS members have observed anything like them. It would negate any need for weighing and measuring, and in this modular form could be scaled up in multiples depending on the size of the batch to be melted. Perhaps also the high surface area ratio would aid efficient melting and mixing.



Fig. 2: Early mercury-cinnabar mining galleries, Wanshan, Guizhou

Back to Kunming and then on by high-speed train (c. 300km/h) to Tongren in the east of Guizhou province.

The journey took us into an increasingly dramatic karst landscape of steep needle-like hills, which beyond Tongren are the setting of the mercury mining district of Wanshan.

Mercury is no longer mined at Wanshan and the vast 105km² area and over 900km of underground tunnels is now a National Mining Park, with the over ground workings, limited underground access and the Mao-era settlement being developed as a popular heritage destination. While the bulk of what is visible at Wanshan dates from modern times, mining here has early origins and exploited the mineral cinnabar as much for its use as the red pigment of traditional Chinese lacquer as for mercury. Slightly off the beaten track there is good evidence for fire-setting in small shallow galleries accessed from sheer-sided limestone cliffs (Fig. 2), while the regular tourist trail includes a glass-floored skywalk snaking around the escarpment (not for the faint-hearted!).

The final leg of our trip took us back to Guiyang, the capital of Guizhou, and another new state-of-the-art provincial museum, here focussing on the ethnography of the region which is home to the largest population of ethnic minorities in China. The new cultural awareness that is sweeping China is creating employment in heritage and driving new research which is reaching into technology and archaeometallurgy, and we are likely to hear much more about this important region.

Gill Juleff and Yuniu Li



Fig. 3: Lead ‘puddle’ and ‘rounds’ associated with bronze caster’s grave goods, Gejiu Museum, Yunnan



COPPER ALLOY SCULPTURE TECHNIQUES AND HISTORY: AN INTERNATIONAL INTERDISCIPLINARY GROUP

Bronze and other copper alloys have been used to produce sculpture all over the world since the fourth millennium BCE. Amongst the most costly and prestigious of sculptural media, bronze is often chosen for particularly prestigious and sacred works. The complex sequence of procedures required to create a bronze sculpture reflect the specific technologies and skills available at the time. Close technical study of the work can therefore play a crucial role in expanding our understanding of the artisans and/or culture that fostered its creation. The scholarship of bronze sculpture from all cultures and periods has benefited tremendously in the last decades from such studies. Due to the growing quantity and complexity of technical research, together with the diversity of experts involved, a greater standardization of vocabulary and methodologies has become increasingly important in order to facilitate fruitful and meaningful comparison, interpretation and dissemination of data.

Objectives:

The aim of the CAST:ING project is to create a framework of shared protocols and vocabulary for technical studies that will aid advances in the understanding of bronze sculpture. The overall goal is to allow experts in a variety of specializations to:

- communicate their knowledge about the materials and making of works of art made in copper alloys in a more accurate and consistent manner
- foster greater understanding of these works among allied professionals
- allow for a better synthesis of the rich amount of data that continues to be gathered than has been possible to date
- facilitate an increase in visual and information literacy of the museum-going public.

Outputs:

The key outputs of the CAST:ING project will be:

- An interactive set of Guidelines for Best Practice in Methods of Investigation and Reporting of Technical Data on Bronze Sculpture, to be published online by Getty Publications (Spring 2020)

- An open access website (cast-ing.org) to complement the publication that will serve as a much-needed forum for scholarly exchange of methods, data, and ideas related to the material study of bronze sculpture (e.g., production, conservation, and so on)

- A multilingual Glossary (initially in English, French, Italian, Spanish, German, Khmer, Chinese) for technical terms related to bronze sculpture.

This will be published in the Guidelines, as well as in an expanded and updatable format on the website. It aims to provide a critical foundation for clear reporting and sharing of information between collaborators across disciplines.

- A selection of well-illustrated and annotated studies will serve to model the interpretation of different technical features using the proposed terminology.

- A Bibliography will provide a powerful encyclopedic resource for all those interested in the topic.

Why?

The proposed standardization of methodologies and terminologies should help more consistent cataloguing, authentication, conservation and documentation of bronze sculpture, and is also critical for the development of a rigorous shared database model for the technical study of bronze sculpture.

For whom?

Foremost for a diverse professional audience, but ultimately for anyone interested in deepening their understanding and appreciation of bronze sculpture.

Who is contributing to the project?

An international team of conservators, scientists, curators, art historians, historians, archaeologists, metallurgists and craftspeople, who are studying bronze production of different eras and/or cultures. For more, see cast-ing.org

What is novel about the CAST:ING project?

A large scale interdisciplinary collaboration

Regularly updated resource for the interpretation of bronze sculpture

First global approach to reach agreed upon protocols for the technical study of bronze sculpture.

More about the project at cast-ing.org.

David Bourgarit

DOCTORAL STUDENTSHIP

THE MEDIEVAL IRON INDUSTRY IN THE WEALD

A generous bequest to the Wealden Iron Research Group in 2011 has enabled the group to undertake a number of projects that it would not have been able to contemplate in other circumstances. The boldest of these has been the co-sponsorship of a PhD Studentship in collaboration with the University of Exeter. Such sponsorships have generally been either philanthropic, by a major charity, or collaborative with other institutions such as museums. That a small, voluntary group such as WIRG should propose such a venture was a rarity, if not unique. WIRG's principal aim is 'to promote investigation ... concerning the Wealden iron industry', and thus to enable an individual, financially, to devote three years to research an aspect of the industry fulfils that aim. The first studentship began in 2015, and focused on Roman iron production. The successful applicant has already amply demonstrated, through his presentations to the group and his involvement of members in his fieldwork, the success of the project. So it was not difficult for the committee to agree to a second studentship, building on the productive collaboration established with the archaeology department at Exeter and with Dr Gill Juleff as supervisor.

This time the focus will be on the iron industry in the Weald in the Middle Ages. In many ways this will be a more challenging research project: the field evidence is less abundant than that of the Roman period; documentary evidence exists but requires specialised skills to read and interpret it; and previous study of iron-making in the period has been disappointingly scarce. There are some fundamental questions that need to be answered, of which the most pressing, perhaps, is, what are the distinctive characteristics of medieval iron-making in the Weald, in terms of processes and residues? A major site at Roffey, between Crawley and Horsham, has received little attention. The medieval heart of Crawley has been revealing significant evidence of iron production, but where else was production taking place on a similar scale to have satisfied the documented demands placed on the region by the Crown, say, in the 13th century? And were water-powered bloomeries a significant element in production?

The closing date for applicants to this second studentship is 30th April 2018. Full details can be seen via this link to Exeter University: <http://www.exeter.ac.uk/studying/funding/award/?id=3042> *Jeremy Hodgkinson*

Can anyone identify this tool sent to us by **JOHN GABB**? It was probably used in a foundry and is an exhibit in the Hayle Heritage Centre in Cornwall. Any suggestions, please let the Crucible editors know.





SUSAN LA NIECE

After graduating in archaeology and ancient history from Manchester University, I started my working life as a field archaeologist, excavating in Syria, Iran and Europe. I realised after a time that the contribution of science to archaeology was becoming more and more important so did a Masters in Archaeological Science at Bradford University, but instead of going back into the field as I had intended, I got hooked on the science, with an internship at the Oxford RLAHA lab, working at Harwell radiocarbon lab and studying metallurgy at John Cass college. In 1977 I joined the team of scientists at the British Museum Research Lab and have never wished to move from there.

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

SUSAN LA NIECE: My career, from its beginnings in field archaeology and the subsequent years at the British Museum has been a continual learning curve across the wide spectrum of archaeometallurgy. The range of material at the British Museum has given me the opportunity which is not open to many outside the museum environment of researching technologies from cultures of all periods across the world.

THE CRUCIBLE: What is your most memorable professional moment?

SUSAN LA NIECE: It has been both memorable and a privilege to handle and study unique metalwork such as the shoulder clasps from the Sutton Hoo ship burial, the inlaid brass 'Blacas' ewer from Mosul, Iraq, pre-Columbian castings, the Iron Age Winchester Hoard and the metalwork from the 'Amesbury Archer' Beaker burial, to name just a few.

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

SUSAN LA NIECE: I have learned much from all my colleagues, both scientists and curators, but if I am to name one I would pick Paul Craddock, for his extensive knowledge, keenness to share it and infectious enthusiasm.

THE CRUCIBLE: What is your main current project?

SUSAN LA NIECE: I am a contributor to the 'CAST:ING project' which is working to publish a framework to facilitate advances in the understanding of bronze sculpture <http://www.cast-ing.org/>. The project is bringing together a wide range of specialists from Europe and the USA to pool and share knowledge of the different aspects of bronze sculpture.

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

SUSAN LA NIECE: Museums hold extensive collections of metal artefacts with research potential for the understanding of ancient technologies world-wide. The escalating financial difficulties which museums find themselves in today is cutting deeply into the resources for scientific or, for that matter any other, research into the collections. I would love to have the resources to set up and fund for the long term a team of archaeometallurgists within a major museum to develop training and research in metal technology using the artefacts in the collection.



THE CRUCIBLE: Which publication should every HMS member read?

SUSAN LA NIECE: There are so many specialist books we should all read, many of which have been listed in previous 60 second interviews. I would like to suggest reading broadly around the subject – books by metal craftsmen, by art historians, by scientists etc.

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

SUSAN LA NIECE: Develop skills in writing good publication standard work and always get as many people as you can to read it critically before you send it off.

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

SUSAN LA NIECE: It would be presumptuous for me to pronounce on anything to the readers of *The Crucible*.

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.



The poster for the CultTech Summer School 2018 features a central blue circle with the text "CultTech Summer School 2018" in orange and white. Above the circle, the text "Summer School in Cultural Heritage Materials & Technologies" is displayed in blue, accompanied by the CultTech logo and a circular seal. Below the circle, the date "DATE: 8-21 July" and location "KALAMATA, GREECE" are listed. The poster is divided into two columns: "ORGANISATION" on the left and "PROGRAMME STRUCTURE" on the right. The bottom section contains contact information: "APPLY BY 15/06/2018", "CALL NOW FOR MORE INFO (+30) 27210 65145", and "REGISTER NOW AT WWW.CULTTECH.UOP.GR" with the email "Email: culttech@uop.gr". A row of five small images at the top shows various scenes from the school, including a modern interior, an ancient amphitheater, a group of people, a stone relief, and a coastal view.

ORGANISATION
The program operates within the advanced natural and cultural environment of the Peloponnese and offers a creative mixing of archaeological science, archaeometry and Cultural Heritage technologies. It is oriented from the Department of History, Archaeology and Cultural Resources Management, University of the Peloponnese in collaboration with the Demokritos National Center for Scientific Research and the National Observatory of Athens.

PROGRAMME STRUCTURE
The program consists by a lecturing part (3 first days) on Archaeology and Cultural Heritage Technologies, field archaeology by visiting the Ancient Thouria excavation (4 days) a field-trip stay and practice to Pylos (4 days) and guided educational tours to historical sites, museums, monuments and leisure time at the city of Kalamata and nearby sites.

APPLY BY 15/06/2018
CALL NOW FOR MORE INFO
(+30) 27210 65145
REGISTER NOW AT WWW.CULTTECH.UOP.GR
Email: culttech@uop.gr

ELISA GRASSI

I was born in Milan (Italy) in 1976, and have been fascinated by archaeology for as long as I can remember. As a teenager, I avidly read of the endeavours of the great archaeologists of the past - from Schliemann to Carter, to Evans - and I was adamant I was to follow in their footsteps.



Thus, I followed what in Italy was the “standard” course of studies for those willing to engage with the study of the past: I graduated in Classics, and then took a three-year postgraduate degree in Archaeology. Since the second year as an undergraduate I started participating in archaeological excavations and fieldwork. I instantly loved it, and at the same time realised that I wasn’t that interested in the art-historical approach to Roman archaeology that was still so common. What really enthralled me was the material culture, the “life behind everyday objects”. During the post-grad degree, my supervisor asked me if I was interested in studying some intriguing (and somewhat puzzling) metalworking evidence from a Roman-age site she was investigating. I said yes, but we both knew that I needed to acquire specific knowledge regarding these materials, and to seek guidance. Therefore, I applied for a scholarship to spend a few months abroad, and choose to follow two terms of the Artefact Studies MA at UCL. There, I encountered a completely new approach to the study of archaeological materials, and tried my best to assimilate it. In the following couple of years I was back in London several times, and the people I met there, Thilo Rehren above all, helped me in many ways with their knowledge, kindness, and technical support.

In 2006, I started a PhD at the Catholic University in Milan, with a project dealing with Roman-age metalworking in two cities of northern Italy. The project was challenging,

and once again I knew I needed help. I was lucky enough to get a Marie Curie EST fellowship, and spent three months at UCL performing scientific analyses, but most importantly being guided and trained by the staff there, and trying to attain the scientific fundamentals I knew I lacked. The best thing of those months was the opportunity to be constantly among people researching similar topics, but with different backgrounds and very diverse approaches: this was exceedingly stimulating for me, coming from a small, Humanities-only University. Back in Italy, I strived to keep in touch with the researchers I met there, and to create a network. After my PhD, I worked at the University in Milan for a few years doing a lot of fieldwork in Italy, Malta and Turkey, and lecturing Archaeological Methods and Theory. All the while, I never stopped “looking at slags”, cooperating with universities, superintendences and museums in the assessment and study of metalworking and other artisanal evidence. In a few cases, when I found particularly meaningful assemblages, I worked to create larger research projects in collaboration with other colleagues. Lorna Anguilano is the one with whom I have been working more in the past years, I have been at Brunel University – where I am honorary research fellow – several times, working on the materials coming from different Italian sites.

A few months ago, I left the university and became curator of the National Archaeological Museum in Parma. This is a new challenge for me: I am still trying to familiarise myself with the museum, but whenever I wander through the enormous amount of materials held in the storerooms I can’t help thinking about future projects, people to involve, research topics to pursue... There is a lot to do there (and a lot of interesting metals): the next years look really promising!

**FORGOTTEN COINS OF THE NORTH
AMERICAN COLONIES -25TH
ANNIVERSARY EDITION BY JOHN
LORENZO (2017)**

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We have been sent information on this publication, including the full preface. We thought that it would be of interest to some readers and have taken the liberty of editing the preface to give you a flavour of what is covered in the book. Editors

**FORGOTTEN COINS
OF THE NORTH AMERICAN COLONIES**

25TH ANNIVERSARY EDITION



This book is dedicated to my good friend Bill Anton. I first met Bill during my early days of collecting New Jersey State Coppers and he lived close by to me so we did see each other often and did discuss various topics of colonial coin collecting. This eventually led of course to the collecting of contemporary counterfeits. Since the initial book on the Forgotten Coins of the North American Colonies was published in 1992 by Krause Publications there has been much advancement of these contemporary counterfeits by American & Foreign collectors.

This book is not so much a research exercise into new areas of contemporary counterfeit collecting but a tribute to an individual who started many people in collecting these coins when, at this time in 1992, few if any collectors thought of collecting contemporary counterfeit.

Today most collectors of any advanced collecting interest have associated contemporary counterfeits in their collection. The purpose of this book will be to discuss certain areas that the author is familiar with and to bring this information to its current level of understanding.

A good definition is that which we used for the Counterfeit Eight Reales book released in September 2014 by Amazon Books. A Contemporary Counterfeit is defined as a spurious coin made to circulate alongside originals in day to day commerce at the same value, regardless of face value or design type. Specifically, discussed are the Canadian Blacksmiths, Spanish/American counterfeits (i.e., Kleeberg Two Reales and the Gurney/Nichols/Lorenzo Eight Reales), English and Irish Halfpence/Farthing contemporary counterfeits. The book also addresses all the Anton-Kesse Plate coins and brings their cataloguing into modern thinking such as incorporating certain pieces into now accepted counterfeit families such as the Long-Neck Family of counterfeit British Halfpence.

It was Byron Weston of Pennsylvania who initially coined the phrase “linked fingerprints” which establishes relationships between similar contemporary counterfeits having the same dies and who also linked the British Halfpence counterfeits to another series called the Evasions addressed first by Atkins in the late 19th Century and then further advanced by Cobwright. These relationships are what the contemporary counterfeit collectors call today as the study of these “Families” which have similar characteristics. The link fingerprint consist of three basic elements as initially described by Weston: die sharing, punch linkage and design style. Since this time there has been some controversy on which pieces belong to which Family and what to call these Families.

This book is really a comprehensive learning tool for the new collector not so much the seasoned specialist wanting to venture into contemporaries. The Anton Family have financially supported this publication and the author hopes you enjoy this edition and as Bill Anton so appropriately mentioned in his 1992 book “It is hoped that other collectors and students of the series will endeavor to correct and expand upon this effort.”

John Lorenzo

ROME WASN'T CAST IN A DAY: A SURVEY OF THE RECENT FINDINGS OF METALWORKING STRUCTURES IN THE CAPUT MUNDI

The past few years have yielded a series of discoveries of ancient metalworking structures in Rome, which can be considered remarkable both for their quantity and their importance. These came both from planned research, and from rescue excavations, allowing us to gain a new perspective on the topic, and to start reassessing some old questions. What is given here is a brief overview of the finds of the recent past, from which we will try to examine general features and outline possible research perspectives.

The very first discovery in chronological order dates back at least to the VIIth century BC: on top of the **Capitoline Hill**, where the majestic Temple of Iuppiter Optimus Maximus would later stand, the remains of a metalworking plant where both copper alloy and iron seem to have been worked were brought to light; the structures consist of a group of circular pits, which served as furnaces, and other production indicators such as fragments of crucibles and slags. The presence of such a structure in this location attests to the development of a specialised production on a bigger scale than that of mere autoconsumption: it is likely that there could have been more than one workshop, and the choice of the place itself was probably not casual, given that the position on the hilltop could have been useful in dispersing the noxious fumes deriving from the metallurgical operations. In the same period, at the foot of the hill, on the site of the future Forum of Caesar, another small furnace was documented. From the debris recovered, it was dedicated to bloomery smelting and refining, probably intended for the domestic use of the product.

A later workshop, dating to the 5th century BC, has been detected on the north-eastern slopes of the **Palatine hill**, within the perimeter of the Curiae Veteres sanctuary (Fig. 1): it is a small sub-circular pit, characterized by the alternation of layers of clay, fragments of large storage jars (dolia) and slags, probably used for making tools and nails during a phase of renovation of the sanctuary.



Fig 1. Rome, north-eastern slopes of the Palatine hill. The small 5th century BC workshop viewed from South

For what concerns the **Imperial period**, no new data were retrieved so far, but evidence for metalworking activity in the Campus Martius - the heart of the city - is provided by at least two different objects. One is a beautifully carved funerary altar dedicated to the memory of the bronze worker Aufidius Aprilis, “corintharius de Theatro Balbi” and a bronze ladle signed “...in Circo Flaminio”, showing us a lively productive panorama, together with an ample commercial circuit, whose direction is Rome outwards (a singular circumstance, given that we are generally used to think of Rome as an “attractor” of trade goods/as the ultimate destination of trade goods, rather than a manufacturing centre itself).

The **Late Antique period** opens with a series of dramatic political and economic changes, leading to a progressive decrease in the population of Rome, and the consequent abandonment of large sectors of the ancient city. A well-documented phenomenon of reoccupation of spaces takes place, where some buildings located in the most central part of the city seem to lose their original function, to be systematically converted into workshops.

Starting from the 4th century AD, the **Basilica Hilariana**, a former meeting place for the collegium of the Dendrofori, was turned in a manufacturing facility, which comprised colour fabrication, among the different activities. Also metalworking is documented by the presence of utensils, such as tongs and fragments of crucibles, together with a great number of bronze working debris.

The north-eastern slopes of the **Palatine hill** have also yielded considerable evidence for metalworking for the Late Antique period. By the end of the 4th century AD, one of the vaulted rooms of the monumental complex of the Curiae Veteres sanctuary is transformed into a metalworking facility (Fig. 2): a series of pits, most of which are circular were dug into the spoiled floor, showing clear signs of heating. Two phases of activity were investigated, together with a certain amount of coins and slags, while amid the debris which filled two other rooms nearby were found many unfinished objects, waste and scrap, probably connected with the activity of this workshop. Signs of bone and glass working were also detected, even though no associated structures have been found.



Fig. 2. Rome, north-eastern slopes of the Palatine hill. View of the pits from the Late Antique metalworking facility (4th-5th century AD)

During the first half of the 5th century AD, inside one of the tabernae (shops) which flanked the square in the **Forum of Caesar**, the floor was spoiled and a large circular pit was dug to set up a metalworking structure, probably meant for recycling the bronze clamps of the Forum itself. It is worth mentioning that in the same room some evidence related to bone working was also recovered, following what seems to have been a quite common pattern at the time. The space was likely to have been set up as a proper workshop, given the fact that a probable gate or fence was built at the entrance.

This phenomenon is documented not only for public abandoned areas, but also for private spaces. Between the 4th and the 7th century AD, the **Insula Volusiana**, an ancient “apartment building”, located between the river Tiber and the Capitoline Hill, nearby the important sacred area of s. Omobono, seems to have hosted a metalworking activity, testified by clear signs of intense heat on the floors and the walls of three different rooms, and by the presence of a great quantity of charcoal and slag. Together with the above-mentioned Basilica Hilariana, this is one of the private buildings in which we have evidence of reoccupation – or at least, of a change in the original function - for productive purposes. Excavation is still in progress.

Another example is the workshop found along the ancient **via Lata** (the urban stretch of the via Flaminia), where the metalworking structures were dug in the floor of a taberna (Fig. 3): it featured two different phases, each one of which consisted of two circular pits, identified as shaft furnaces. The presence of debris, semi-finished objects and a small ingot allowed identification of the workshop as specifically devoted to copper alloys. Another small, S-shaped pit that yielded no debris at all has been identified as the place for the anvil.

Common features and differences

The analysis of these finds is showing a very interesting panorama, from which we can try to outline some common features. First of all, the time span seems to range approximately from the 4th to 7th century AD. 1) Most of these workshops is set inside former (?) public buildings in central places of the city, while only three belong to private spaces. 2) Their structure is more or less the same: a series of (mostly) circular pits, often – but not always -ensuing each other. 3) Multiple phases of activity 4) Presence of an unusual quantity of coins, probably hoarded for recycling. 5) The manufacturing of metals is often associated with those of other materials, such as glass and bone.

The general, quite homogeneous, pattern of reoccupation and reuse for productive purposes so far outlined includes two other cases, which nonetheless stand out for their dimensions and particular features, both located in the Campus Martius almost in the same time span.

A LETTER FROM ... ROME

At the site of the **Crypta Balbi**, during the most important urban archaeology excavation carried out in Rome, hundreds of unfinished objects in different materials were found, allowing the reconstruction, albeit hypothetical, of the activity of a highly skilled manufacturing centre, specializing in luxury goods, many of which were probably exported throughout Italy and beyond. A recent resume of investigations has brought to light an articulated metalworking plant featuring a reverberatory furnace and a smaller structure, together with many other production indicators (crucible fragments, bronze spillages, part of a bronze circular ingot), dated between the middle 6th and the early 7th century. The specific characteristics of this workshop make it more similar to an industrial plant rather than a small-scale production unit: the same can be said for another recent discovery: that of an extensive workshop located inside the former **Athenaeum** built by the emperor Hadrian in 135 AD. In the middle of the 6th century AD the building was turned into a copper alloy working plant, featuring diverse kinds of furnaces (shaft furnace, reverberatory furnace, bowl furnace, and Catalan furnace) which were used to transform semi-products, probably still imported from the outside (Fig. 4). The scale and productive volume of this workshop seems to point at a very complex organisation, aimed at a specific kind of manufacturing, which could have included the production of preparatory materials for striking superficially silvered coins. If this would be the case, then an involvement of a superior authority in the supply of materials and specialised workforce is very likely to have happened.

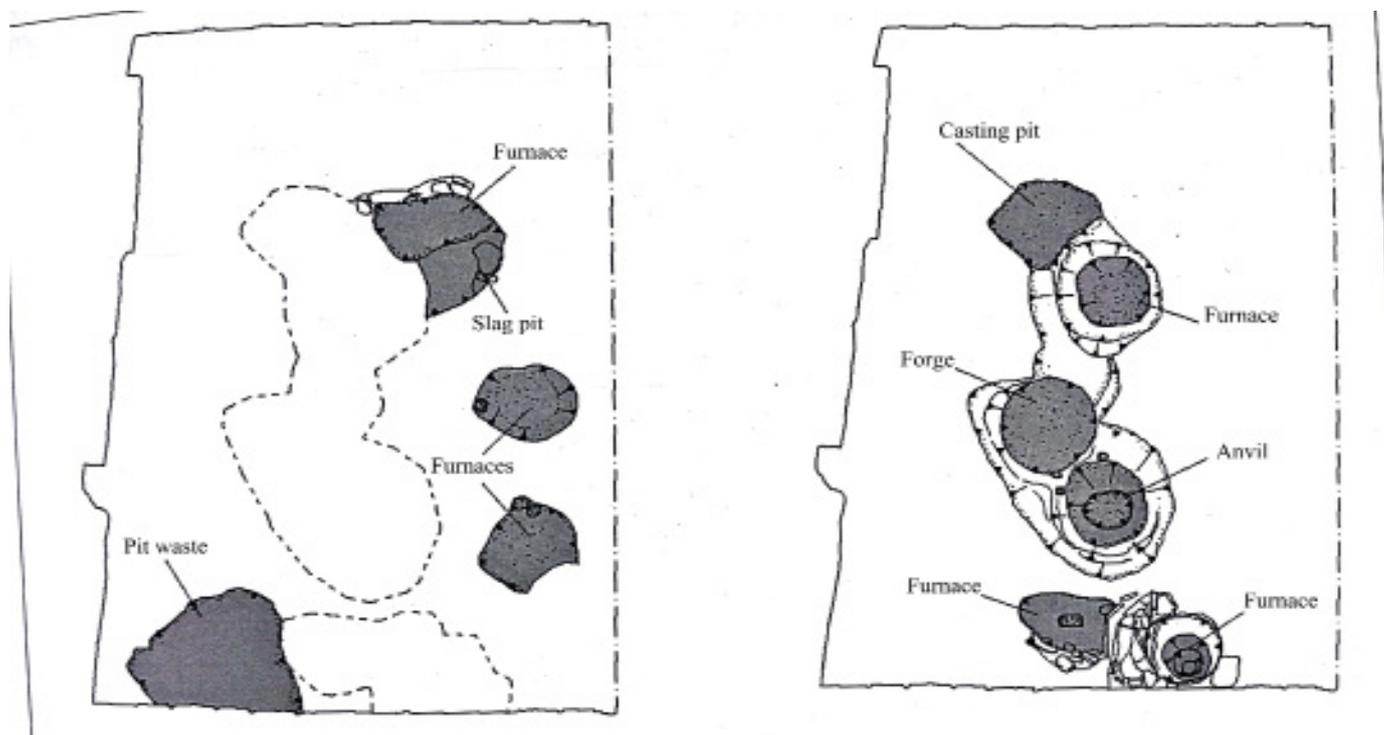


Fig. 3. The two different phases (first on the left, second on the right) of the copper alloy workshop found along the via Lata (6th century AD)

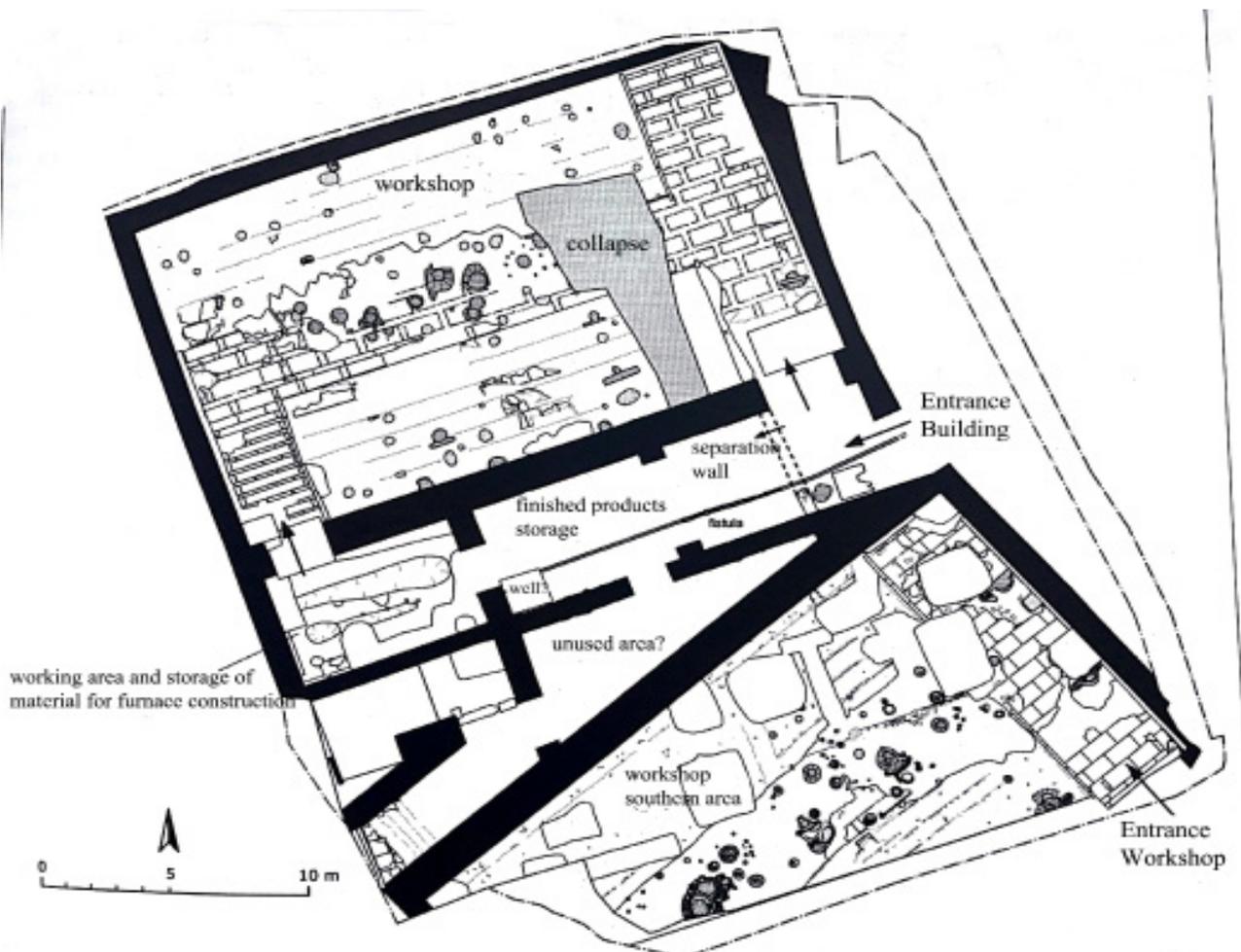


Fig 4. The extensive workshop located inside the former Athenaeum (6th- 7th century AD)

Conclusions

All these new findings have considerably enriched our knowledge about the places and the ways in which metals were worked in Late Antique Rome, adding fresh data which allow a new – and partly different – assessment of what we knew so far. Another, important topic concerns the sources of supplying of raw material: in the case of the earliest workshops detected on the Capitoline Hill and in the Forum of Caesar, analyses could give a contribution in clarifying the question of supply channels and technological skills, helping to refine our knowledge of the period's economic and social phenomena.

The scale and methods of supply of materials remain the main question also for what concerns the Late Antique period. On the one hand, there is a high probability that the main aim of all these activities could have been the recovery of raw material through the recycling of metals, mostly spoiled from abandoned public monuments and pagan temples; on the other, in cases such as that of the workshop located at the Crypta Balbi, or the workshop discovered at the nearby Athenaeum, the very nature and the scale of the activity which took place there may hint at a different kind of supplying. It is worth remembering how, even in its darkest hour, Rome always conserved some kind of central authority, which must have consequently approved of these activities, or even played an active role in fostering them.

Giulia Bison

Italian Ministry of Cultural Heritage - National Etruscan Museum of Villa Giulia

BASTIAN ASMUS writes: Within the last decades experimental archaeology and archaeometallurgical studies have considerably broadened our understanding of the production processes of our forebears. However, coming from a craft and production background to archaeometallurgy in particular and archaeology in general, I feel that the current state of affairs concerning the reconstruction of production processes needs a more applied approach. We need long term experimental series, so that, for the manual production so essential experience can be gained and deepen our understanding what a craft process actually is. It is more than a mere recipe. I am sure all of us have felt this, when watching a master craftsman at work. There is no time for contemplation of how to proceed with the production. “You just know or feel what to do” or “the material provides feedback of what may be possible to achieve and what does not”. It is exactly this hard to define element in the manual production processes that I am interested in and try to convey to archaeologists, art historians



and historians that it is pivotal to understand the “how”. Likewise it is crucial to convey to crafts-persons that the archaeology and history of crafts processes is not a mere side-remark in the endeavour to reconstruct past technological processes. Simply put: “Common sense or good judgement is essential but just not enough to reconstruct an ancient production process.”

In order to foster understanding between the various factions shaping our understanding of the past - be it experimental archaeology, be it re-enactment or living history or the historically informed crafts-person - I started a long-term project and I expect it to go on for the next decades or so. It is concerned with the history of casting. It is as such divided into the fields of first, large scale casting, such as bells, cannon and statuary bronzes, second, the understanding of the moulding materials and third, the examination of the melting technology and furnace designs.

More tangibly, this can be experienced in April 24-29, where I will cast a Carolingian bell at the Campus Galli open air museum in Germany.

I have been asked by the Metropolitankapitel of the Hohe Dom to make an 11th century beehive bell for their 11th century Bartholomäus chapel. From June 25 to July 27, I will be performing the complete reconstructed process of 11th century bell casting publicly in Paderborn, Germany.

ALEXANDER AGOSTINI writes: The awarding of the ERC Horizon 2020 Excellent Science Grant for the project nEU Med – Origins of a New Economic Union (7th to 12th centuries – Resources, Landscapes, and Political Strategies in a Mediterranean Region), to the Dipartimento of Scienze Storiche e dei Beni Culturali of the University of Siena has allowed for new fieldwork research, expanding the multidisciplinary approach adopted in past years by the Department. Within this program, excavation activities are being conducted at the site of Vetricella (Scarolino, Tuscany), a fortified tower structure dating between the 9th and 11th centuries AD. Since 2005 these excavations have yielded over 1000 iron objects, some in various stages of production, alongside evidence of in situ metallurgical activities. My current research grant project is focused on a systematic examination of the finds from both a technological and functional perspective, while at the same time considering the manufacturing processes adopted in the Carolingian and Ottonian periods for localized production and distribution of tooling equipment.



Aerial photograph of the site of Vetricella following the 2017 excavation campaign (from www.neu-med.unisi.it)

The aim is to provide a clearer picture of the metalworking traditions, innovations and economic choices that invested the region during those centuries through archaeometric analysis of selected materials from the site as well as other contemporary assemblages from the developing urban centers of nearby Pisa and Lucca.

MAHIR HRNJIC from Centre for Urban Network Evolutions (UrbNet), Aarhus University writes: The goal of my PhD research is to study the provenance of Viking-age silver found in south Scandinavia. Silver objects, mainly found in hoards, reflect long-distance trade and contacts between the Baltic region and Asia. Objects made of silver — such as Islamic coins, Perm'/Glazov and Duesminde rings — show an intensive economic interaction with the Islamic caliphate and communities between Northern Europe and the Middle East. The aim of my PhD project is to understand the dynamics of the long-distance trading network in the 8th and 9th century, by studying the elemental composition (μ XRF) and lead isotope signatures (MC-ICP-MS) of silver rings and coins.



FORTHCOMING EVENTS

Conference, Date and Location	Description	Website, Email and Prices
Rehabend 15th – 18th May 2018 Spain	This major international conference is oriented to construction and cultural heritage management. Some interesting topics are “Conservation of industrial heritage” and “Restoration of artworks and archaeological materials”.	http://www.rehabend.unican.es/index.html
BushFire Forge – Demonstrations and Lectures 18th – 20th May 2018 Kent, UK	Bush is hosting three days of lectures, practical demonstrations and forging in May 2018. Forge-In is a friendly international event, a great opportunity to meet some of the worlds best Bladesmiths and tap into a wealth of information that you would be hard pushed to find elsewhere on the planet.	http://owenbush.co.uk/forge-in-may-6th-7th-8th-2016/
Archaeometry 20th – 26th May 2018 Mexico	The International Symposium on Archaeometry (ISA) is a specialized forum for research and applications of Archaeometry and Archaeological Sciences that covers the full spectrum of topics, materials, techniques, chronologies and regions.	http://isa2018.mx/
International Conference on Contemporary Cast Iron Art 28th May – 3rd June 2018 Pennsylvania	The mission of the International Conference on Contemporary Cast Iron Art is to create an international platform for the exploration and practice of contemporary cast iron sculpture and to inspire global participation in the aesthetic, conceptual, cultural, historical, and technical dialogue on contemporary cast iron art.	https://www.iccica.com/
National Heritage Ironwork Group 14th – 17th June 2018 Bath, UK	The NHIG has organised a series of events revolving around iron metallurgy.	https://nhig.org.uk/events/event
HMS AGM Meeting 16th June 2018 London, UK	One day conference and the Society’s AGM on the topic of the archaeology, conservation, analysis, and/or presentation of metallurgical heritage.	http://hist-met.org/meetings/agm-2018-what-is-mined-is-yours.html
Metallography and Microstructure Course 2nd – 6th July 2018 Hastings, UK	This week-long course is designed to introduce or further develop knowledge of the microstructure of ancient metals and the practical application of metallography.	dascott@ucla.edu
56th International Congress of Americanists (with Sessions on Metallurgy) 15th – 20th July 2018 Spain	Under the motto “Universality and particularism in the Americas,” this edition of the ICA invites us to reflect on the relationship between universality and particularism in the production of knowledge.	http://ica2018.es/home/
International Committee for History of Technology 17th – 21st July 2018 France	Our 45th annual meeting will take place Saint-Étienne, France, on 17-21 July 2018. We will be celebrating the 50th ICOHTEC Anniversary.	http://www.icohtec.org/annual-meeting-2018.html
Furnace Festival 25th – 26th August 2018 Ireland	Smelters from around the world will meet for this 2 days furnace festival.	prondelez@yahoo.com
Association for Industrial Archaeology (AIA) Conference 31st August – 4th September 2018 Nottingham	This year’s AIA Annual Conference will be held in Nottingham from 31st August to 4th September, starting with a Seminar on ‘Revised Research Frameworks in Industrial Archaeology’, then the conference from Friday evening to Sunday lunchtime, and afterwards with coach visits from Sunday afternoon to Tuesday or Wednesday (which will include colliery sites, railway viaducts, steam engines, canals and bell founding).	https://industrial-archaeology.org/aia-annual-conference-2018-nottingham/
EAA Conference 5th – 8th September 2018 Spain	The Annual meeting of the European Archaeologists Association is a space for updates and debates on all the aspect of the discipline.	https://eaa.klinkhamergroup.com/eaa2018/