THE CRUCIBLE

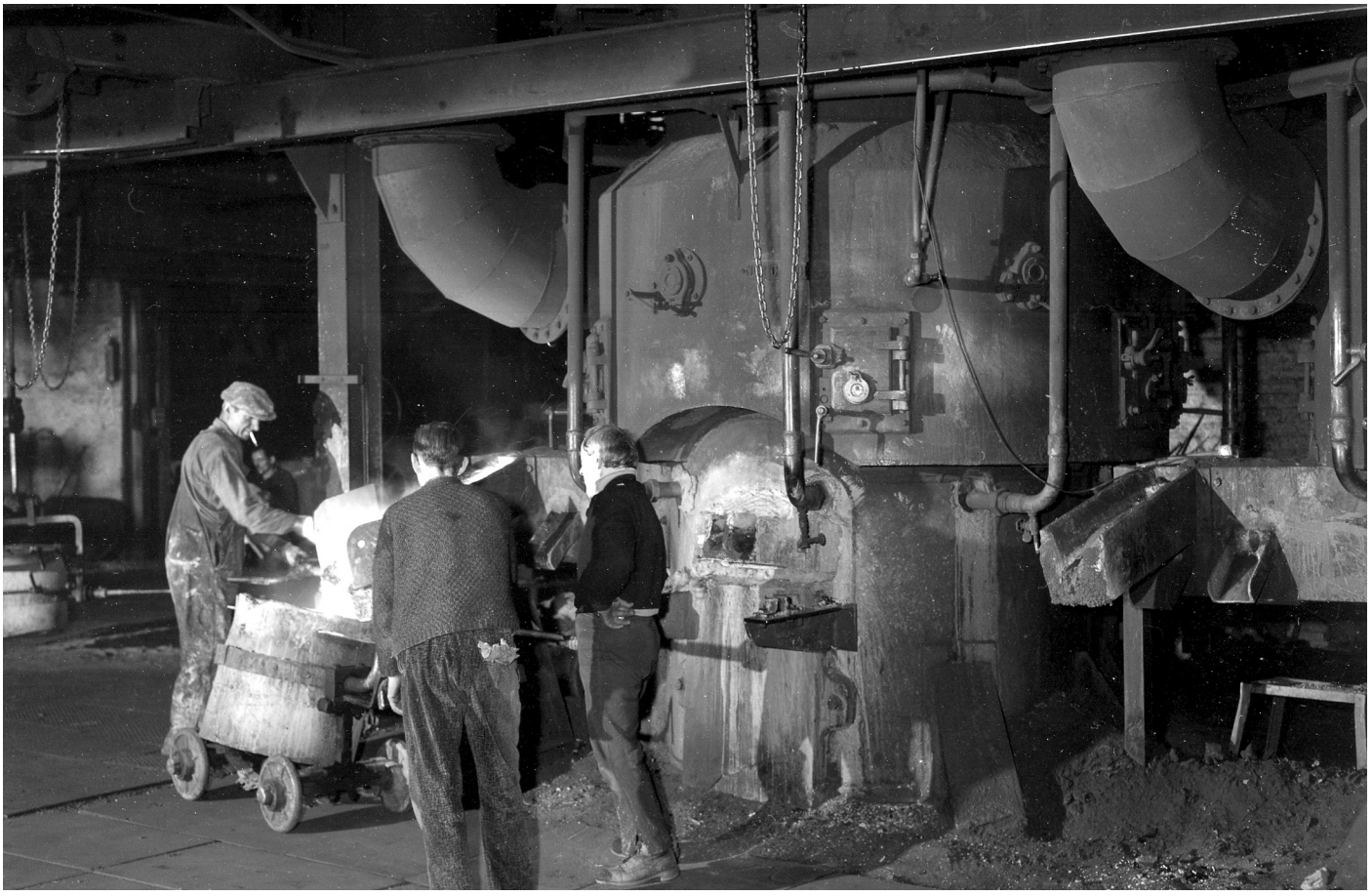
Historical Metallurgy Society News
Issue 113 **Summer 2026**

Inside The Crucible

The HISTORICAL METALLURGY Society

Above: reconstructing early modern silver assaying cupellation. The formation of lead oxide (litharge) in the base of the cupel (photo: M. Straßburger). See page 12.

Below: Pre-War, solid bottom cupolas used at the Grahamston Iron Company. See page 8.



From the Editor

Dear all, welcome to our Summer edition of ***The Crucible***. We were saddened to hear of the death of Peter Crew and our thoughts are with his family and friends. Peter was a very active member of HMS for many years and regularly wrote articles for ***The Crucible***. Justine Bayley has kindly put together a series of memories of Peter from HMS members which can be found on page three. If members have further memories they would like to share, we will publish these in the next edition.

HMS have a number of exciting events planned for the coming months that include a trip to the Brescia region in Northern Italy organised by Paul Rondelez, and our annual HMS Research in Progress conference towards the end of the year (date tbc). Further details of events can be found on page sixteen.

I would also like to welcome Bart Cornelis to ***The Crucible*** editing team. Bart has recently become a member of the HMS Council and has very kindly volunteered to help with editing the future editions of ***The Crucible.***

I am hoping for the next edition of the Crucible to bring back a few old favourite sections including the One Minute Interview and Book Review. If you would like to volunteer for either of these, please get in touch. As always we love hearing about places you have visited or objects relating to metallurgy you have come across in the Out and About section - a brief paragraph and photograph will be plenty and it doesn't matter how random it is!

And finally, in the last issue of ***The Crucible*** (112) there was an error with the figure caption on page seven. Figure 1 should have said *'Bacon Lane bridge over the canal'*. My apologies to Eddie.

Editor: *Jack Cranfield*

Submissions
Submissions to ***The Crucible*** are welcome at any time, but deadlines for each issue are 1st March and 1st September each 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. We accept a maximum of Five Harvard-style references per article only.

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.

The Crucible
crucible@historicalmetallurgy.org

HMS visit to the Brescia region, N. Italy

The Historical Metallurgy Society will visit the region of Brescia in Northern Italy in late September 2026. The region was home to the fascinating and unique Brescian iron-making technology. We will visit its best-preserved blast furnace and hammermills, and see a wonderful collection of the products made. Also on the programme are Roman to modern zinc mines, the world-famous Roman 'Winged Victory' bronze statue, and a series of presentations by local researchers. All this while savouring the beautiful landscape and the local gastronomy.

The Programme includes:

Friday 25 September

- Arrival at Diana Hotel, Darfo Boario

Saturday 26 September

- Roman to modern lead/zinc mines of Gorno. Museum and site visit
- Hammer mills of Bienno, the main place where the 'Brescian iron' was processed during Medieval and Renaissance times. Museum and a guided tour in the town
- Presentation by local researchers. presentation tbc
- Dinner at Hotel Dianna

Sunday 27 September

- Preserved 15th-century 'Brescian' blast furnace at Tavernole
- Brescia
  - Castel Museum: products of the Brescian iron industry
  - Capitolium: 2m-high 'Winged Victory', one of the most famous bronze statues of Antiquity

For prices and booking information please see the HMS Website at: https://historicalmetallurgy.org/events/hms-visit-to-the-brescia-n-italy-region/

Peter Crew 1942-2025
Memories and recollections

Figure 1: Peter consolidating a bloom at Plas.

Peter Crew passed away at home on 7th August 2025 after a short illness. He was 83 yeas old. Following his early successes as a rock climber, he then changed direction and served as archaeologist to the Snowdonia National Park, excavating a number of important ancient and historic ironworking sites in North Wales. This led him to develop a particular expertise in experiments attempting to replicate and understand the archaeological iron-working evidence he found. HMS has lost not one but two valued members as his death follows that of Susan, his wife and collaborator, less than a year earlier. An event to mark their contributions to archaeometallurgy is planned for 2026.

Peter's involvement with HMS included serving on Council and making major contributions to its committees and their work, organising two weekend conferences for HMS (in 1987 and 1998) based at Plas Tan y Bwlch, the Snowdonia National Park study centre, and hosting at least one of the early HMS 'Slag Days' there. He and Susan also ran many other archaeometallurgical conferences and pursued a lengthy campaign of iron smelting and smithing experiments at Plas, based on the discoveries from their archaeological excavations in the surrounding area (Fig. 1).

Though best known for his work in Wales, Peter also undertook fieldwork in other parts of Europe and had many good friends and collaborators from Spain to Scandinavia. He was a prolific author, publishing not only his excavations and experimental work but also related historical research. Knowing the problems in finding pre-digital publications he thoughtfully digitised many of his reports and conference presentations which are available at https://independent.academia.edu/PeterCrew. Of these he said: "If nothing else, this selection of papers records a development of ideas and concepts, during a period of rapidly increasing appreciation of the subtleties of bloomery iron working, especially in relation to the interpretation of the slags and other residues found on archaeological sites and the consequent quantification of the processes involved. None of this is put forward as 'the last word' – ideas are continually changing and interpretation improving – and long may they continue to do so." (Fig. 2).

Justine Bayley

Figure 2: Susan explaining what's happening to the UCL students helping with smelt X92. © Mike Charlton.

I first met Peter Crew and his wife Susan at the start of the 1980s, when they were working on the excavation of Bryn y Castell. Their warm welcome and hospitality, their laughter too, left an impression that has stayed with me through the years. As someone who detests excavation, I was drawn in by the attention to the detailed recovery of ironworking debris, its identification and the interpretation of the 'snail' structure. From this site, Peter went on to study ironworking in the area around Plas Tan y Bwlch, conducting excavations at the Crawcwellt settlement complex, moving on to the late medieval bloomery of Llwyn Du, then to the Dol y Clochydd and Dolgun blast furnaces. He participated in a study of the diaries of the Quaker, John Kelsall, who managed the ironworks at Dolgun, and later became clerk to the ironworks at Bersham. These were owned by Isaac

Remembering Peter Crew

Figure 3: Peter and Susan working on the HMS slag collection at Ironbridge

Wilkinson, father of 'Iron Mad' John Wilkinson who invented the machine that produced the first true-bored cannon. Peter knew of my interest in Bersham because of the connection between the products of Wilkinson's foundry and the cannon in the City of Derry/Londonderry, and with typical generosity sent me a draft of the Kelsall book.

Peter recorded one critic as describing his work at Plas as 'too parochial' but his contribution to the archaeometallurgy of iron and steel was far broader. What he observed and learned from his excavations was soon translated into a 25-year programme of experimental smelting and blacksmithing that was not only highly productive in terms of practical explanation of smelting processes and the manipulation of the product, but also thought-provoking. His publications on a variety of interrelated subjects, both solo and in collaboration, significantly influenced my thinking over the years. And while we agreed to disagree on the question of the bowl furnace as an early apparatus, it was an amicable discourse. I have recently returned to the subject and was hoping to present the early results of experimental work to Peter for comment. Sadly, I shall not now be able to enjoy – and profit from – his opinions.

In 1986, I was teaching a course module in Queen's University of Belfast's Department of Archaeology, on materials science in archaeology, and was able to invite Peter and Susan over to teach at a Summer School that the university organised. They came equipped with everything needed to run a demonstration smelt. It was a pleasure to observe the way in which their enthusiasm and easy way of communicating drew the students in and led them to enjoy the experience.

In the 'one-minute interview' he gave ***The Crucible***, his closing was 'Iron rules, OK?'. Peter was indeed a ruler! And he and Susan could properly be described as scholars and gentlefolk! (Fig. 3).

Brian G Scott

Peter Crew was already a leading authority in the archaeology of iron production before I began working in the sector. There was a resurgence of interest in the subject in the 1980s in Britain and Europe, but Peter's approach was slightly different. Unable to understand some of the smelting waste products he encountered in the field, he began experimenting with bloomery smelting himself at Plas Tan y Bwlch. I was fortunate enough to join Peter and Susan for a few days of iron smelting with colleagues in the 2000s and have happy memories of lively conversation gathered around the warm furnace on a cold night.

Peter was undoubtedly a very clever man, equally comfortable discussing geophysics, chemistry, geology or archaeology, and a perfectionist. Every paper, he would copy edit and produce proofs more polished than the journal's version. He was a big supporter of science in archaeology, and a great pleasure to collaborate with: knowledgeable, curious, reliable and honest. He was driven and uncompromising about his work, and that showed in the quantity and quality of his output, to the extent that he was still conferring with me and others, completing and uploading papers in his final months.

I believe Peter's impact was so considerable because he was a charismatic character and a good communicator. The conferences and working groups he organised I know inspired many others like me across Europe and helped lead to better provision for archaeometallurgical study in commercial archaeology as well. It is fitting that there is a photograph of smelting in his experimental furnace on the cover of the first Archaeometallurgy Guidelines produced by English Heritage, and another of Peter removing a glowing iron bloom from it overleaf. The datasheets and papers he produced remain a valuable resource for anyone working in the sector. Since his death I have enjoyed reading about his climbing exploits in the steady stream of fond tributes published online (https://www.ukclimbing.com/articles/features/pete_crew_triumph_of_the_will-16574). He was clearly greatly respected and will be missed by many of us.

Sarah Paynter

Peter Crew did more than anyone else in Britain to advance our understanding of how early iron smelting, more particularly the early bloomery process, actually worked. I remember the many conferences he organised at Plas Tan y Bwlch where his aim was to bring together European scholars to promote a common practical interest and 'pooling' of knowledge in the previously little-understood area of early iron making. They all involved visits to early ironworking sites across Snowdonia but also promoted iron smelting experiments (Fig. 4).

Peter's work on locating early iron working sites in Snowdonia involved the development of new techniques to pinpoint their exact position in the wider landscape, most notably topsoil magnetic susceptibility which is excellent for locating both smithing and smelting sites. Peter also developed magnetic susceptibility as a way of examining iron bloomery smelting furnaces so they yielded more detailed information.

He was also one of the very few researchers who really understood how to examine and interpret the complexities of the internal structure of early iron objects, generally focussing on technicalities of bloom technology or its products. A good example of this was the hoard of Iron Age currency bars from Coffinswell in Devon (Crew and Quinnell 2022). Peter and I worked on the structure of one of these iron bars to look at the homogeneity and identify the type(s) of iron used (new or recycled) and how these might have varied. One aim of our work was to counter the perception that iron is simple and that its detailed examination can't tell you much. We were experimenting with different varieties of etchant to look at ways to illustrate the subtleties of structure where the main alloying impurities (carbon and phosphorus) are only present at very low levels, as the illustrations in the publication show.

As with much of Peter's innovative work on iron, he was eager to advance our knowledge of the practical intricacies of early iron technology which ranged from the microscopic to landscape-scale approaches. He will be sorely missed.

Brian Gilmour

Peter's death, a few months after Susan's, is very sad and touched me deeply. I will always remember his interest in my research when I was a young researcher and his enthusiastic invitation to take part in the symposia on iron metallurgy that he organised at Plas Tan y Bwlch. These had a big impact on me. Since then, we have regularly exchanged views on a wide range of archaeometallurgical subjects, including P-iron. He will remain an important person for me in the field and personally.

Philippe Dillmann

Figure 4: Peter removing a bloom from one of his experimental furnaces

Peter was a figure of extraordinary importance for my training as an archaeometallurgist. When, in the late 1980s, I began to deal – almost by chance – with slags and furnaces in the Metal-bearing Hills (Colline Metallifere) of Southern Tuscany – I who had been dealing with ore deposits for twenty years – it was inevitable that I would meet Peter. His work (Crew 1991) opened the door to archaeometallurgical studies for me. I wrote to him for advice and to exchange ideas, and he, a scientific eminence of international renown, did not hesitate to reply to an unknown young Italian researcher. I personally met Peter and his wife Susan at an International Conference and could not help but confirm my judgment on his extraordinary scientific competence. But also, and perhaps above all, on his equally extraordinary generosity and humanity. Thank you Peter (and Susan!), your memory will accompany me forever.

Marco Benvenuti

I like to think that Peter and I contributed to the re-writing of the Victorian theories on Early Iron Age smelting and forging of iron. We first met at one of Alf Web's archaeology weekends. At the time Peter was involved in some research on Iron Age 'currency' bars. Peter asked me why I thought that the smelters were rolling one end of the bar round similar to a socket, and bending the other end over and welding it back into itself? My practical

forging of iron gave Peter the answer he was looking for; both were proof of the quality of the iron in the bar.

From this beginning we went on to smelt the iron and produce a replica bar of the period to prove the theory. This led on to many weekends of experimental work including the time we were on one of the excavated sites that had evidence of smelting and working iron. I was busy forging some of the iron on one of the stone anvils when to my horror the anvil split in half. To my relief Peter and everyone else in the team gathered round to see the broken anvil and were delighted that it now matched other pieces that were on the site.

It was always a pleasure and fun working with Peter and an honour to have known him.

Hector Cole

I only actually met Peter once, on a very wet and windy visit to the blast furnace at Dolgun, but there are probably more emails on my computer, from/to Peter than from any other person.

After we met, he saw a video of a talk that I gave to the Newcomen Society, about cast iron cooking pots amongst other things, and got in touch about a pot that he had found some time ago and had never really thought about. It was not long before we were cataloguing every single pot we could find, measuring capacities and dimensions. We quickly realised that the shape and manufacturing techniques used between the early 1700s and the mid 20th century were identical.

Peter instituted a study of all the pots in the Ironbridge Gorge Museum, which was pursued by his grandson Adam and myself, measuring, photographing, and recording names when they were there. The single greatest discovery of the whole exercise was that the trademark of the so-called Coalbrookdale company was Dale Co right up until the end of the 18th century, and the pots were only labelled C.B.Dale after then. Although there are numerous clues to this in the literature, it was total news to those running the museum.

What about composition and microstructure? I asked the Warwick Manufacturing Group of Warwick University if a student would like a historical project but, to cut a long story short, I was invited to do the work for myself. It turned out that compositions and microstructures of all our pots were also almost identical over the centuries, at least until the introduction of inoculants after 1950. Peter published his findings in ***The Crucible***, but I turned my success at Warwick into a part-time Masters by Research on the characteristics of 18th- and 19th-century wrought irons and it quickly took over my time. I must now publish my analysis work on the pots for Peter's sake.

But Peter knew a useful contact when he found one. He asked me to look at specimens from Dolgun, Dol y Clochydd and Cefn Coch – all of which I very happily did for him. We left one enigma unresolved. A pig that he found at Dol y Clochydd (blast furnace 1596-1604) turned out to have exactly the same structure and composition of an iron made with coal or coke. We never did find any ore in the area which might have mimicked, in an iron produced from it, the composition of one from a coke fired blast furnace. Twenty years before Dud Dudley! Peter knew there had to be an alternative explanation.

Richard Williams

Peter Crew was the teacher, mentor, and colleague who inspired me and countless others. I started my PhD at UCL in 2002 knowing only that it would involve the evolution of iron production technology. Peter Crew's work in north-west Wales was mentioned as one possibility for giving my theoretical project some much needed empirical life, though at the time I was only vaguely aware of Peter and his work. In spring 2003 a trip for MSc students to participate in one of Peter's experimental smelts included me. When we arrived at Plas the force that was Peter became almost instantly apparent. We had tasks assigned, a set of readings were provided, and an impalpable excitement grew about the next day's activity. Susan made us feel welcome and ready for the task ahead; she was also essential to the successful orchestration of the smelt.

Peter had initiated his famous series of experiments two decades earlier. Our student group benefitted greatly from his experience. He made the suite of tasks ahead seem like second nature and the meticulousness with which he planned and organised every aspect of the experiment was remarkable. Despite this, XP91 was a horrific failure due to the low iron content of the ore, only discovered in later analyses. But that first taste of smelting became intoxicating, fuelled as much by Peter's post mortem and what he thought the unfortunate result could tell us, as by the elegantly choreographed preparation that preceded it.

Only later in the weekend was I able to speak to Peter about his excavations, quizzing him on phases of production and other matters relevant to my research. It became clear that he maintained the archaeologist's eye for typology and context as well as the scientist's eye for the data hidden within slag, ore, and clay. He then invited me to spend a week excavating at the medieval bloomery at Llwyn Du and collecting samples. Soon after this he agreed to be my tertiary supervisor.

Working with Peter was an absolute joy. On site, he demanded close attention to detail and that discipline and assistance paid off in both beautiful sections and clear plans. Off site, Peter regularly challenged himself (and me) with new analytical problems stemming directly from his experiments, excavations or readings. Peter

valued knowledge (especially knowledge he did not already possess) and for him, addressing problems was far more important than the status of the person solving them. Peter used his mathematical mind to model mass balances, labour and materials costs of iron production, furnace signatures in geophysics, and chronology. Quantifying resource requirements and production yields occupied him and had to occupy his students' thoughts too.

Peter was amongst the first of the true archaeometallurgists in Henry Cleere's (1987) sense of the term. He was equally comfortable working with data from materials science and archaeology but he also contributed to geophysics and environmental archaeology, both on his own and through his carefully crafted networks of specialists. The genius of his planning and recording was inspiring and has been adapted and carried forward by many others. More important to me, as a student, was his unending generosity and support that extended into the decades following my PhD. That is how I will remember Peter most.

Mike Charlton

References

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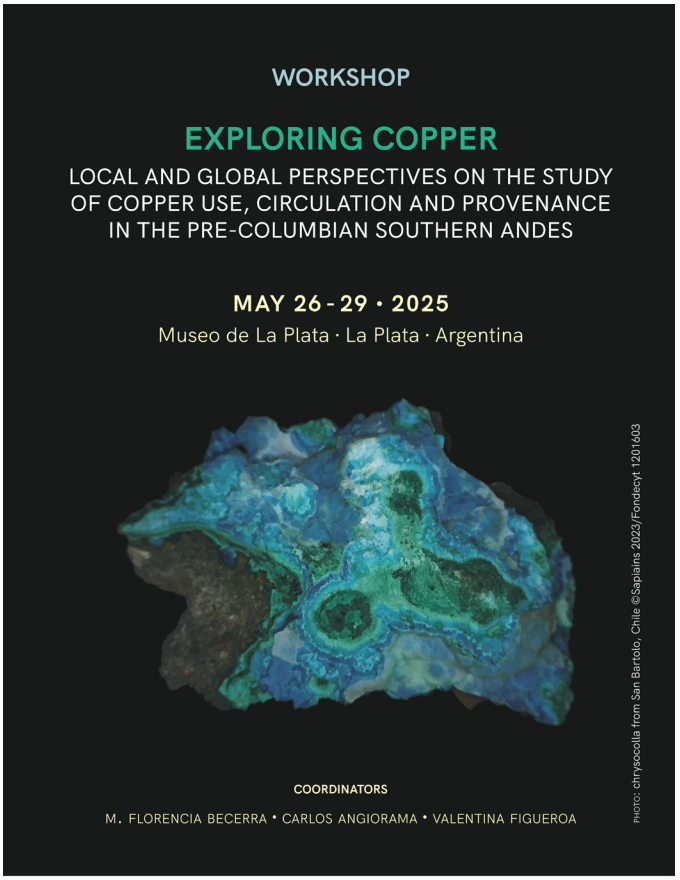
Workshop Internacional: Exploring Copper.

Local and Global perspectives on the study of copper use, circulation and provenance in the pre-Columbian Southern Andes

Between May 26 and 29, 2025, an international workshop called E*xploring Copper. Local and Global Perspectives on the Study of Copper Use, Circulation and Provenance in the pre-Columbian Southern Andes* was held at the Museo de La Plata, La Plata, Argentina. The event was funded by the Wenner-Gren Foundation and it brought together around thirty researchers from Argentina, Chile, Brazil, Ecuador, the United States, Germany, and France.

Over four days, 24 oral presentations were delivered, thematically organised along the copper operational sequence, ranging from studies of pre-Hispanic mining contexts to the analysis of finished metal objects. Each presentation was followed by questions and discussions that fostered a rich exchange among specialists from diverse disciplines and academic backgrounds (archaeology, anthropology, geology, geochemistry).

The workshop was conceived as a relaxed and interactive academic space, distinct from the dynamics of large conferences. A highlight was the visit to the archaeological collections of the Division of Archaeology in the Museum, where participants had the opportunity to examine various pre-Hispanic metal objects from Northwestern Argentina. This introductory activity helped contextualise the debates for those not so familiar with the region.



Discussion sessions addressed the challenges of provenance studies of copper ore sources in the Southern Andes, the development of a global isotopic database, and the need to harmonise analytical criteria. The importance of local research was emphasised, as well as the limitations in infrastructure and access to advanced techniques, underscoring the value of international collaborations.

As a result of the workshop, participants agreed to organise a second edition in 2027, and to publish the presented papers in a special issue of the Revista del Museo de Antropología, an Argentinean archaeological journal. This publication will be in English, with the aim of enhancing the international visibility of studies on copper use, circulation, and provenance in this region.

This workshop marked an important step toward consolidating a regional and international network in archaeometallurgy and archaeomineralogy for Southern Andes, as well as strengthening collaborative projects.

María Florencia Becerra

Organisers

María Florencia Becerra - *CONICET-División Arqueología, Facultad de Ciencias Naturales y Museo (Universidad Nacional de La Plata)*

Carlos I. Angiorama – *Instituto de Arqueología y Museo (Universidad Nacional de Tucumán); Instituto Superior de Estudios Sociales (Universidad Nacional de Tucumán – CONICET)*

Valentina Figueroa – *Instituto de Investigaciones Arqueológicas y Museo (Universidad Católica del Norte)*

GRAHAMSTON IRON COMPANY, POROUS PLUG INSTALLATION AND SOME GENERAL FOUNDRY DETAILS

Although information regarding the porous plug is now freely available over the Internet, this was not the case in the 1970's. Even today information regarding its use for the continuous treatment of metal seems to be sparse.

Grahamston Iron Company of Falkirk was founded in 1868 by Wm. Thompson Mitchell. Due to the reduction in the market for the type of castings it produced and competition, the company went into Liquation in 1990.

In the late 1970's Grahamston Iron Company commissioned a pair of modern cupolas, installed by Roper's of Keighley, Yorkshire. These cupolas, fitted with hand loaded mechanical charging, twin row tuyeres with oxygen enrichment and a continuous porous plug facility for the carburisation of iron, delivered metal to a 10 ton mains frequency holding receiver. They replaced a pair of solid bottomed pre-war cupolas and by having a higher melting efficiency and eliminating pig iron from the cupola charge reduced the cost of molten metal (See cover image and Figs 2-3).

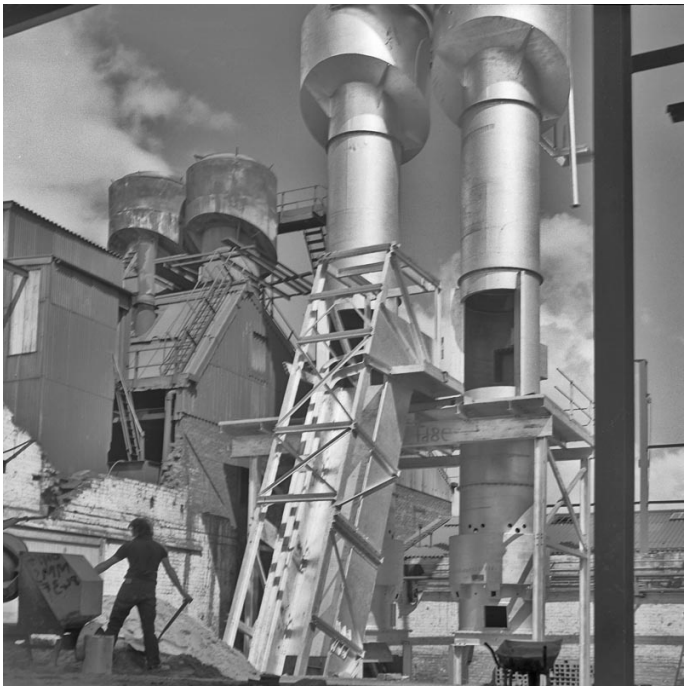


Figure 2: Erection of New Cupolas

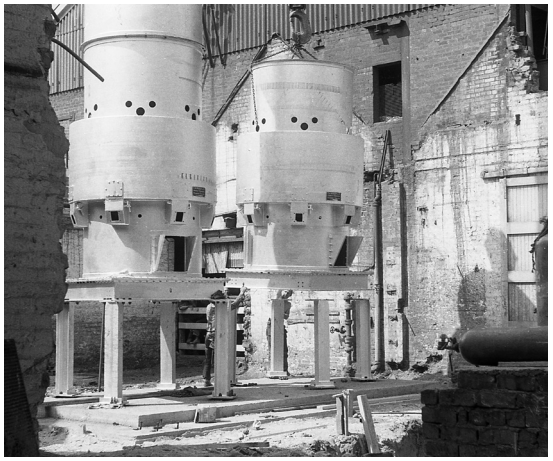


Figure 3: Erection of New Cupolas

Description of the Porous Plug

The plug consists of two main components, manufactured by Morgan Crucible Ltd (Figs 4-5).

1) A hollow female truncated cone, rammed firmly into the ladle lining.

2) A male truncated cone fitting closely into (1), with a co-axial core of porous ceramic.

In Grahamston, Nitrogen was the preferred gas.

Recarburising in the porous plug ladle using high purity graphite enabled the use of a 100% extremely low quality scrap metal charge.

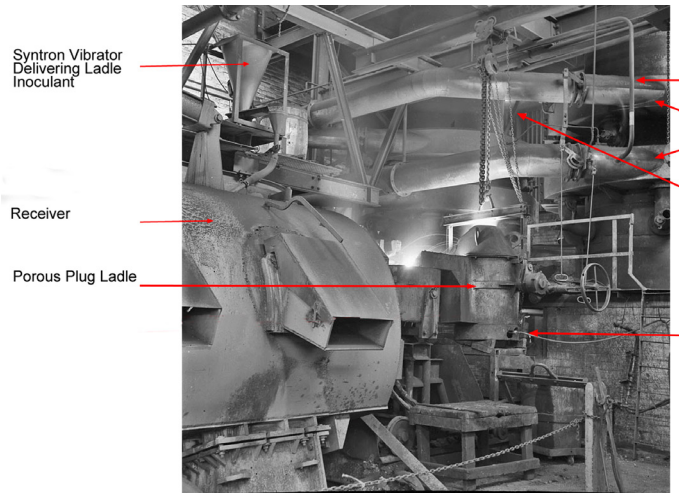


Figure 4: Porous Plug Installation

The metal was then held in a 10-ton mains frequency receiver when, after ladle inoculation with the appropriate amount of Silicon/Manganese/Zirconium (SMZ) ferro-alloy added by means of a Syntron Vibrator, delivered to the casting stations using either 10cwt. two or four wheeled bogies or 5-10 cwt monorail slung ladles.

SMZ was the inoculant chosen as it was found to reduce build-up of ladle slag.

The treated metal was suitable for domestic casting, pipe fittings and road furniture, etc., although due to the grade of scrap used, Phosphorous levels ranged from about 0.8% to 1.2%. This severely limited its suitability in producing engineering castings.

Trials to reduce phosphorous by the incorporation of steel in the form of bales of unwashed salvaged cans from the local Council incinerator were successful but had to cease due to the extremely unpleasant working conditions created by the use of the unclean bales.

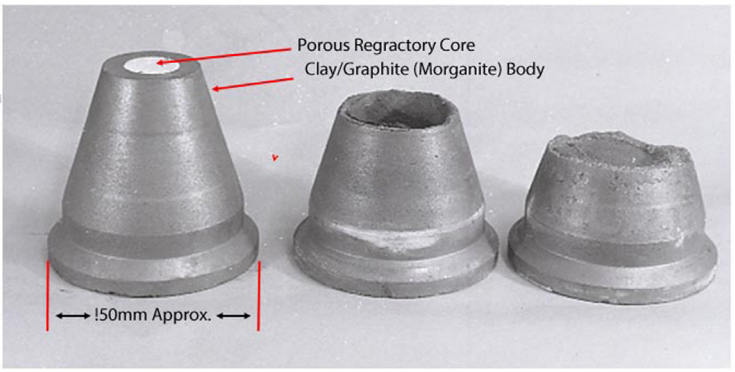


Figure 5: Unused and used male porous plugs after approximately eight hours of semi-continuous use. Approximately 50 tons of cupola melted cast iron had been created, in this case increasing the total carbon by 0.5% by the addition of high purity graphite. Trials of desulphurisation using a mixture of calcium oxide/calcium fluoride gave a sulphur level below detectable limits.

Grahamston had no facility for chemical analysis. For quality control purposes ASTM A367 chill and wedge test pieces were regularly cast (Fig. 6).

Andrew Simpson

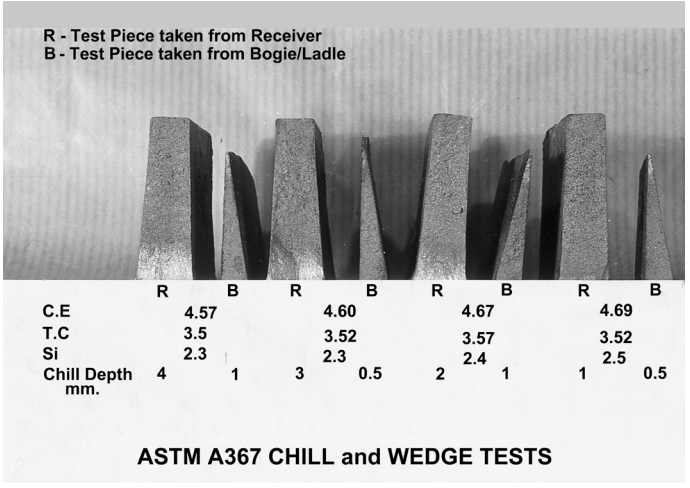


Figure 6: Chill and Wedge test pieces

CAROLINGIAN SILVER MINES IN MELLE, FRANCE

Figure 1: Galley in the Carolingian Silver Mines, Melle (France). The wood pile indicates how wood might have been placed in the past for fire setting. Photo: "AMIP-Melle-16-18" (https://www.flickr.com/photos/35275580@N07/26739131443) by Jacques Bodin, licensed under CC BY 2.0.

Participation in the 2025 experimental archaeology season on the premises of the Carolingian silver mines in Melle was a more than welcome opportunity to visit them. Located in the south of the picturesque small town of Melle, about 30 km west of Poitiers, they were rediscovered in 1830 by quarrying activities. Today, they are a world heritage site and the oldest publicly accessible silver mines in the world.

The mines were extensively excavated with more than 20 km of documented shafts and galleys, of which 350 meters are nowadays publicly accessible in guided tours. The mines are located at the shallowest part of a larger Mississippi Valley Type deposit and feature silver-rich galena in carbonate rock. According to radiocarbon dates, mining activities date between AD 602 and 995, while numismatic evidence indicates that the mint in Melle, supplied with silver from the mines, was active from AD 768 to 1189, making Melle the largest silver mine of the Carolingian Empire.

From an archaeometallurgical perspective, the mines are particularly outstanding for the complete absence of any later reworking because their existence was completely forgotten after mining activities ceased. The visitor can see perfectly preserved evidence for mining by fire-setting – a technique particularly effective on carbonate rocks – and other mining techniques. The layout of the shafts and galleys further allowed reconstructing how mining activities progressed into the deposit.

Since 2007, the premises are also a hotspot for experimental archaeology with special focus on metallurgy. Furnaces built for long-term experiments can be visited all year round as part of the guided tour. And every summer, many experimental archaeometallurgists and archaeologists gather for a couple of weeks to conduct their experiments, creating a faint impression on the scale of the past smelting activities with the sound of their bellows and the smell of burning charcoal.

Thomas Rose

Figure 2 (right): Calcrete covering dumped material under a shaft i in the Carolingian Silver Mines, Melle (France). Photo: "AMIP-Melle-16-05" (https://www.flickr.com/photos/35275580@N07/26739111773) by Jacques Bodin, licensed under CC BY 2.0.

TERRALID METADATA PROFILE PUBLISHED AND GLOBALID DATABASE CONTINUES TO GROW

Together with the TerraLID Editors, we happily announce that the TerraLID metadata profile is now published (https://metadata.terralid.org). In addition, the current state of the GlobaLID database with more than 5700 entries is now citable as new version of the database archive (Westner et al. 2023). The over 1500 new entries extend the database's coverage to additional regions such as the Alps and Central America and improves it for many other regions (Fig. 1).

The metadata profile was jointly developed by the TerraLID Editors and the Core Team. It is the first major step towards TerraLID, the digital research data infrastructure (RDI) for lead isotope data (https://terralid.org/). While GlobaLID is restricted to ores (Klein et al. 2022), TerraLID will also include artefacts and provide more functionalities. It is envisioned to become the central hub for publishing, storing, and handling lead isotope data in archaeology.

TerraLID aims to overcome the limitations of static databases such as OXALID (Stos-Gale and Gale 2009), which outdate quickly due to the ever increasing number of data and are often hard to combine because of differences in their metadata. The TerraLID metadata profile provides a generalised way to describe lead isotope data and their associated contextual information. It combines core information about e.g. sites, objects, and analytical parameters with material-specific information. Its modular structure allows efficient storage of information while making it easily extendable to include new materials or additional analytical methods. Persistent identifiers link it to other specialised RDIs and facilitate data entry through the inclusion of information stored at these RDIs.

TerraLID is developed in a community-driven process. The TerraLID Editors are especially committed representatives of the lead isotope community who meet monthly to make sure that the development of TerraLID follows the needs and expectations of the community as close as possible. In addition, the entire community is invited to provide their feedback on drafts. For example, the community feedback phase for the TerraLID metadata profile ended in mid-October 2025.

Because the TerraLID metadata profile was developed in a community-driven process, it represents the consensus of the lead isotope community. Therefore, it provides a reference point for authors and reviewers alike for the information that should be included when publishing lead isotope data.

As a next step, the TerraLID database will be configured according to the metadata profile and a workflow for the (bulk) upload of data into the database developed. Subsequently, a web application and other services will be developed to make the data easily accessible. And while development activities shifted from GlobaLID to TerraLID, new data is added to the GlobaLID database until the release of TerraLID. New entries to the database become immediately available in the GlobaLID web application (GlobaLID Core Team 2025).

Visit **terralid.org** to learn more about TerraLID and contact us via terralid@bergbaumuseum.de if you want to become part of the team, have a question or you have a dataset you want to see included. We are looking forward to hearing from you!

Thomas Rose, Katrin Westner, Malte Kottmann, Helge Wiethoff and Sabine Klein

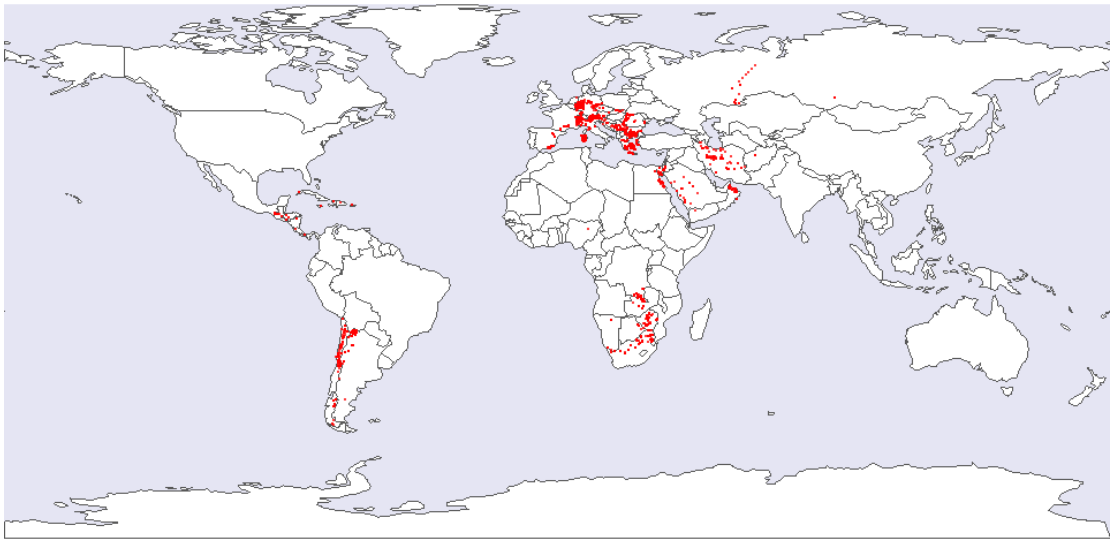


Figure 1: The spatial coverage of the more than 5700 entries (red points) in the GlobaLID database (August 2025).

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RECONSTRUCTING EARLY MODERN SILVER ASSAYING AFTER LAZARUS ERCKER

Quantitative analysis of silver-bearing materials was a cornerstone of Early Modern mining, metallurgy, and coinage. Decisions on ore processing, metal production, and monetary policy depended on the reliable determination of precious-metal content. Among the most influential authorities on this practice was Lazarus Ercker (c. 1530–1594), whose Probierbücher (assaying books) provide the most detailed contemporary descriptions of assaying techniques, particularly silver cupellation.

This article presents the experimental reconstruction of silver assaying ("Probieren") following L. Ercker's instructions, combining historical sources with hands-on experimentation. The aim was to test the functionality, precision, and reproducibility of early modern cupellation under controlled conditions.

Historical and Technical Context

In the 16th century, assaying formed the analytical backbone of mining administration and mint control. The cupellation process exploited the affinity of silver for lead: silver-bearing materials were alloyed with lead, heated in a porous ash cupel, and oxidised so that lead converted to litharge (lead oxide) and was absorbed, leaving behind a bead of metallic silver. Despite the absence of modern instrumentation, historical sources suggest a remarkably high level of analytical accuracy.

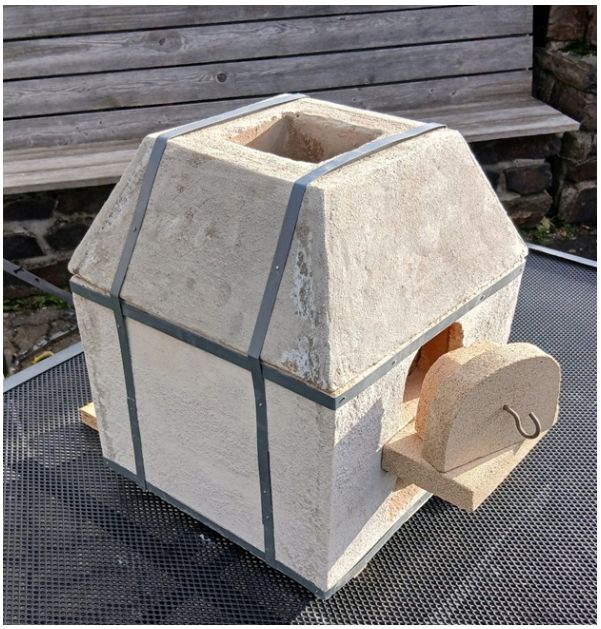


Figure 1: Reconstructed assay furnace with reinforcement (photo: M. Schuster)

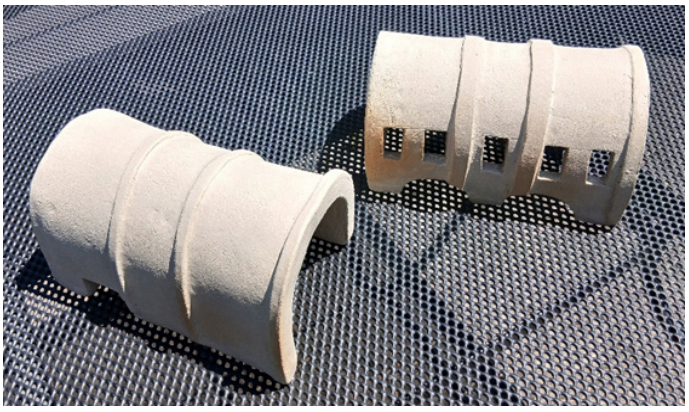


Figure 2: Muffels produced for the experiment (photo: M. Schuster)

L. Ercker's work stands alongside that of Georgius Agricola and Vannoccio Biringuccio, yet surpasses them in procedural detail. His motto, "Erst prob's – dann lob's" ("Test first, then praise"), encapsulates a culture of empirical verification central to Early Modern metallurgical practice.

Experimental Reconstruction

To assess L. Ercker's method, a historically inspired assay furnace was reconstructed based on descriptions and illustrations from his works (Fig. 1). While modern refractory materials were used for safety and durability, the design, dimensions, and working principles closely followed early modern models. Custom-made clay muffles (Fig. 2) and ash cupels replicated historical consumables.

Figure 3: View into the assay furnace during heating (photo: M. Straßburger)

Assays were conducted using lead with a defined silver content (2.5%), allowing direct comparison between expected and recovered values. The cupellation (Figs 3-4) was carried out using charcoal as fuel, with temperature control guided by visual indicators, as described by L. Ercker.

Across multiple trials, the resulting silver beads consistently weighed 80 mg (Fig. 5), exactly matching the theoretical silver content of the input material. This demonstrated not only the accuracy of the historical method, but also its reproducibility, provided that careful weighing, temperature control, and repetition were applied.

Results and Significance

The experiments confirm that Early Modern silver assaying was far from approximate or speculative. On the contrary, L. Ercker's procedures represent a highly standardised analytical system, capable of detecting and quantifying minute amounts of precious metal with impressive precision.

Beyond its technical implications, the study highlights the broader cultural significance of assaying. The art of assaying (Probierkunst) functioned as a bridge between science, craft, and governance, underpinning fiscal control, resource management, and trust in coinage. The systematic documentation of tools, workflows, and measurements facilitated knowledge transfer across European mining regions.

Outreach and Knowledge Transfer

The reconstructed furnace and assay process have also proven valuable for public and academic outreach. Demonstrations at the historic Ercker House in Annaberg-Buchholz - part of the UNESCO World Heritage Site Montanregion Erzgebirge/Krušnohoří - have made early modern metallurgy tangible for both specialists and the wider public. For students and researchers, the reconstruction offers a rare insight into the embodied knowledge behind historical analytical practices.

Figure 5: Cooled cupel with slag ring and visible silver bead (photo: M. Straßburger)

Conclusion

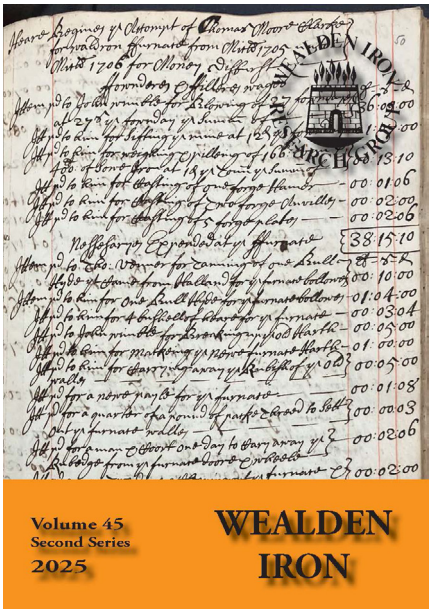
Reconstructing silver assaying after Lazarus Ercker demonstrates that Early Modern metallurgists combined empirical observation, material knowledge, and systematic repetition to achieve reliable analytical results. The success of the experimental cupellations underscores the technical sophistication of historical assaying and reinforces its importance within the history of metallurgy.

Five centuries on, L. Ercker's principle still holds true: *first test, then praise.*

Michael Schuster & Martin Strassburger

WEALDEN IRON, SECOND SERIES, 45, 2025

BULLETIN OF THE WEALDEN IRON RESEARCH GROUP



The latest Bulletin of research into the iron industry in the Weald of south-east England comprises the usual mix of field and documentary work. Discoveries of evidence of early ironworking in scatters of bloomery slag have been noted at Aldington and Rolvenden in Kent and at Rotherfield and Guestling in East Sussex. The site in Pookwell Wood, Rolvenden, is in a classic ghyll setting, on the boundary of the Ashdown Beds and Wadhurst Clay strata, the latter probably being the source of the ore from a small adjacent quarry. No date has been found so far but wood-marked slag suggests non-tapping technology. Interest in Roman activity around the village of Icklesham in East Sussex has led to the discovery of a section of Roman road, and the search, using magnetometry, for the possible extent of the road to the west of the village revealed the scatter of tap slag in a field at Guestling Thorn.

Researching in the 1920s for his pioneering monograph Wealden Iron, Ernest Straker made extensive use of the mid-19th century Tithe Award maps and apportionments to locate placenames associated with iron, particularly the occurrence of Cinder or Sinder as a prefix. Two areas that he apparently overlooked form the subject of a note with a recommendation for field investigation.

To preheat or not to preheat a bloomery furnace is the subject of a discussion which explores the processes involved from a theoretical point of view in determining the most advantageous conditions for experimental smelting. The group has been conducting experiments since the late 1970s.

The publication in the 2024 Bulletin of the evidence for the hitherto unknown blast furnace and finery site called Cowden Paddock, the location of which remains to be discovered, has given rise to an article which explores the connections between a small number of ironworking families in the Weald. The ironmaster John Lunsford's connections with the Pelham, Morley, Sackville and Fynes families points to their possible influence on his involvement in the iron trade of the mid-16th century.

Ewood Furnace, near the village of Newdigate in Surrey, was established in the 1550s and was notable for its pond which extended to more than 80 acres (32ha). It was the subject of a paper by Montague Giuseppi in the Surrey Archaeological Collections in 1912. Its closure date has remained uncertain, but land transactions in the early-17th century have been examined in an article, which concludes that the ironworks ceased operation and were replaced by a cornmill in 1604.

Among the most extensive contemporary accounts of Wealden ironworks are those that have survived of the Pelham family's furnace at Waldron and their forges at Brightling and Bivelham. Those of the furnace are confined to the years 1690-1716 and the operation of the site is detailed in an article which examines its campaigns, products, raw materials, personnel and other aspects of its management year on year.

All 61 previous Bulletins of the Group are available in pdf format on the Group's website – **www.wealdeniron.org.uk.**

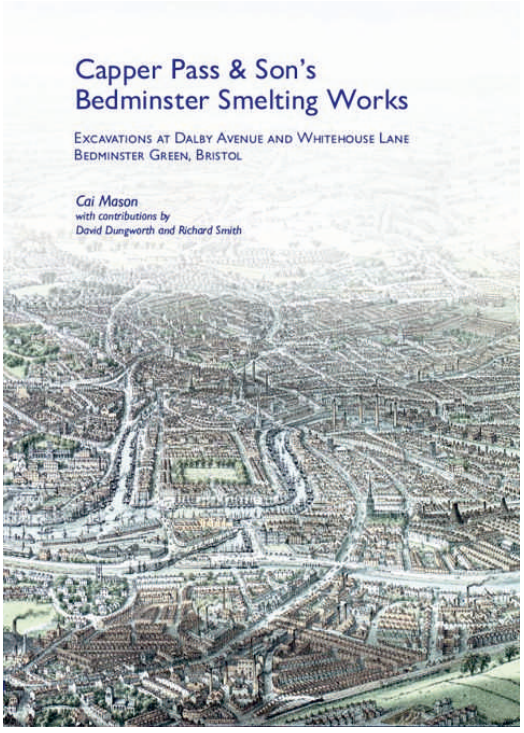
Jeremy Hodgkinson

HMS RESEARCH IN PROGRESS

The date of the Research in Progress Meeting 2026 and further details will be announced in the coming months. For updates please see: https://archaeothommy.github.io/hms-rip-meeting/. This online conference provides a forum for everyone working on topics related to ancient and historical metallurgical practices, the past use of metal objects, and related fields. The meeting aims to foster links between the different disciplines and geographical regions. Therefore, we particularly encourage submissions from early career researchers, contract archaeologists/conservators, and colleagues from outside Europe.

CAPPER PASS & SON'S BEDMINSTER SMELTING WORKS: EXCAVATIONS AT DALBY AVENUE AND WHITEHOUSE LANE, BEDMINSTER GREEN, BRISTOL

Excavations ahead of the Metal Works development in the Bedminster district of Bristol provided an opportunity to investigate a specialist non-ferrous smelting works that flourished during the Second Industrial Revolution of 1870–1914.



The company originated as a backyard operation run by the eponymous Capper Pass in late 18th- and early 19th-century Walsall, Birmingham and Bristol. Small and unreliable profits led Pass to dabble in criminality, something that resulted in his permanent transportation to Australia in 1819. The family's fortunes were revived by his son and namesake Capper Pass II, who in 1840 established a new smelting yard in Bedminster. Although modestly successful, the business remained small until 1866, when he and his son Alfred Capper Pass discovered a product – solder – that produced reliable and increasingly large profits. As the company grew, adjacent streets were subsumed by the smelting works. Twentieth-century innovations, such as the use of electrorefining to process Bolivian tin ore, helped keep the company afloat during the inter-war period, but its location, hemmed in on all sides by streets of terraced housing, hampered further expansion. In 1937, the company opened a new works in Melton, Yorkshire, and in 1963, the Bedminster works closed.

Archaeological excavation has revealed complex and hitherto unknown details of the smelting works, including the remains of numerous buildings, furnaces and associated cellars and underground flues, and the remains of 19th-century terraced houses. Metallurgical and technological analysis has uncovered aspects of production processes, whilst artefacts and documentary records reveal evidence of global trading links, and how the smelting works affected the social makeup and development of Bedminster in the 19th and early 20th centuries

Richard Smith

Reference

Mason C., with Dungworth D. and Smith R. (2025). *Capper Pass & Son's Bedminster Smelting Works: Excavations at Dalby Avenue and Whitehouse Lane, Bedminster Green, Bristol*, Sept. 9, 2025, Wessex Archaeology, 156. ISBN 978-1-7391876-9-9.

OUT AND ABOUT - VICTORIAN GARDEN FURNITURE

While on a trip to a local garden centre I came across an interesting display of antique cast iron garden furniture made by John Jones in the 1860s. Jones was based in Southwark, London. The bench and garden table on display were described in a contemporary catalogue as 'rustic' and I particularly liked the way both had been cast to resemble entwined plants and foliage while the base of the garden table was designed to imitate the trunk of a tree with roots serving as feet. The fact that these have endured 170 years exposed to the elements is a testament to the quality of their design and the durability of cast iron. They are from an age where everyday things were made to last indefinitely, an attribute which cannot be said of today's plastic garden furniture.

Forthcoming events & Virtual content

Conference, date & locations	Description	Website, emails and prices
HMS visit to the Brescia region, N-Italy. Fri 25 to Sun 27 September 2026 Brescia region, N-Italy.	The Historical Metallurgy Society will visit the region of Brescia in Northern Italy in late September 2026. The region was home to the fascinating and unique Brescian iron-making technology. We will visit its best-preserved blast furnace and hammermills and see a wonderful collection of the products made. Also, on the programme are Roman to modern zinc mines, the world-famous Roman 'Winged Victory' bronze statue, and a series of presentations by local researchers. All this while savouring the beautiful landscape and the local gastronomy.	See https://historicalmetallurgy.org/events/hms-visit-to-the-brescia-n-italy-region/
Young Researchers in Archaeometry 2026 28 - 30 October 2026 National Museum of Iceland in Reykjavík.	The 9th Workshop Young Researchers in Archaeometry will be held in the National Museum of Iceland in Reykjavík. The conference will be held in person from 28th to 30th of October 2026 and will welcome early career researchers (masters, PhD, post-docs up to six years after their PhD) in archaeological sciences and cultural heritage studies. Contributions in all fields of natural sciences about archaeological and anthropological topics are invited. In particular, early career researchers in archaeology, art history, anthropology, biological anthropology, environmental archaeology, chemistry, conservation, cultural heritage, earth science, and material science are welcome to submit an abstract for an oral presentation or poster.	https://www.yra-ecr.org/current.html
Resonant Pasts. 32nd Annual Meeting of the European Association of Archaeologists 26–29 August 2026 National and Kapodistrian University of Athens School of Philosophy, Athens.	A variety of sessions focussing on themes in European archaeology. The following sessions relate specifically to metallurgy: • The Meaning and Practice of Bronze Metallurgy in Prehistory — Dedicated to Hephaestus, the Divine Smith • Interdisciplinary approaches to archaeological metal analysis • Hiding in plain sight: archaeological and archaeometallurgical perspectives on non-ferrous metallurgy across the Balkans, Eastern Mediterranean and Middle East	https://www.e-a-a.org/EAA2026
The Society for Medieval Archaeology Conference 2026 19 September 2026 York	The SMA annual Symposium will take place in York, jointly hosted by the University of York's Department of Archaeology and Centre for Medieval Studies. This years theme is Heritage Science.	https://medievalarchaeology.co.uk/sma-conference-2026-call-for-papers
The Historical Metallurgy Society Online	HMS Research in Progress Meeting Date TBC	https://archaeothommy.github.io/hms-rip-meeting/.

For the latest conferences and events please see the HMS Website at ***https://historicalmetallurgy.org/events/***