

HMSNEWS

Historical Metallurgy Society

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Summer 2003

Geoprospection techniques for metalworking – Geochemical Survey

Chris Carey

The discovery of metalworking remains is common on archaeological sites dating from the Bronze Age onwards. Often the discovery of artefacts such as slag, furnace lining, etc is unexpected. Even projects and excavations that specifically aim to identify metalworking foci lack field techniques that can identify specific areas of such activity. The development of geophysical techniques (from the pioneering work of Peter Crew) aimed at locating ironworking hearths, furnaces, smithing floors and slag heaps has gone a long way to addressing the problem of geoprospection of metalworking remains. However, geophysical survey is still only capable of identifying major heating events, leaving many aspects of metalworking invisible to current methods of geoprospection.

Chris Carey has spent the last three years developing a geochemical survey technique to identify metalworking remains in the field. The basis of the technique is the application of correct methods of data collection and analysis to multidimensional data sets, collected over suitable sample intervals. This technique is applied to soil samples collect on an intra site basis. The geochemical survey technique has been tested against geophysical survey and excavation, with the geochemical results proving to be reliable. Importantly, comparison with geophysical (magnetometer) survey has been excellent, with both types of survey identifying the loci of metalworking but both survey techniques producing different types of data. For example a geophysical survey can reveal an anomaly of a strong heating event, whilst the geochemical survey can identify the same anomaly and also identify the elements present, giving an indication of the process.

The geochemical survey technique has been employed extensively by the ExFe (Exmoor Iron) Project under the leadership of Dr. Gill Juleff and has also been used on a number of hillslope enclosures (thought to date to the Late Iron Age) to start to build a model of metal exploitation in the Late Iron Age in the Southwest. The results from the Iron Age hillslope enclosures are

looking very interesting, with metalworking being the exception rather than the rule on such enclosures. The results from the ExFe surveys are also looking good and have provided a solid bed of ground testing for the geochemical survey technique. In essence a geochemical survey methodology has been developed that can identify metalworking foci within the archaeological record and identify the metallic elements involved in the process. The application of combined geochemical and geophysical survey is proving to be a very powerful tool in the investigation of metalworking sites.

Further results of this research will be reported at the HMS conference in September 2003.

Chris Carey. Email: c.j.carey@exeter.ac.uk

Evidence for medieval stamping of copper alloy sheet

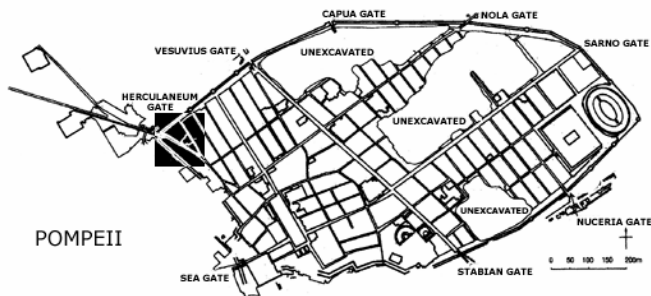
David Dungworth

The decoration of copper alloys has been achieved in a variety of different ways and significant among these was the formation of designs in relief. This could be achieved 'freehand' by using punches to hammer designs from the back. Alternatively, a design could be carved onto a stamp and this was then used to produce the desired decoration in one go. The process is similar to that of striking coins but uses just one stamp with a soft supporting medium underneath. Material from excavations of the Guildhall Yard in London is currently being investigated at the English Heritage Centre for Archaeology. This includes a small sheet of lead (48mm by 36mm by 1–2mm) which had been used as the supporting medium for stamping (context dating 1050–1140). A dental rubber impression taken from the lead sheet shows the hind leg and tail of an animal such as a lion.

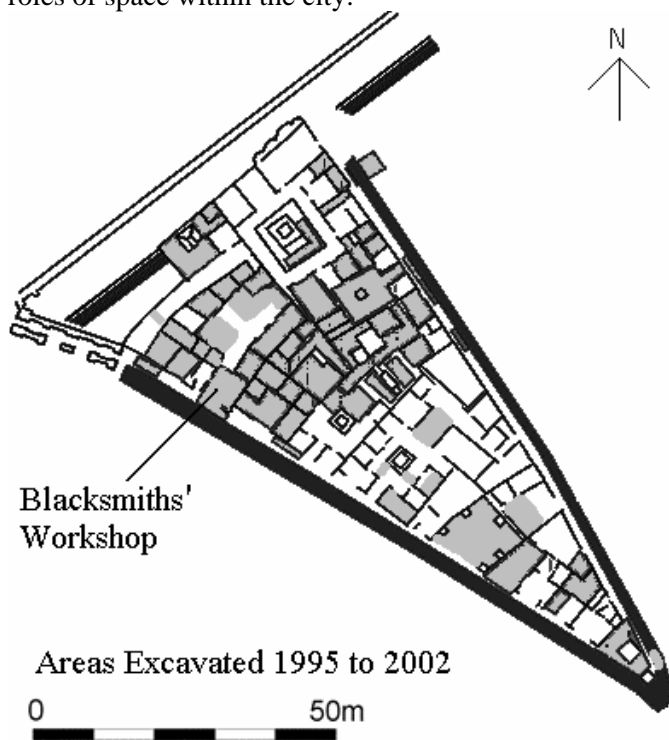


Blacksmithing in First Century BC Pompeii

Megan Denis

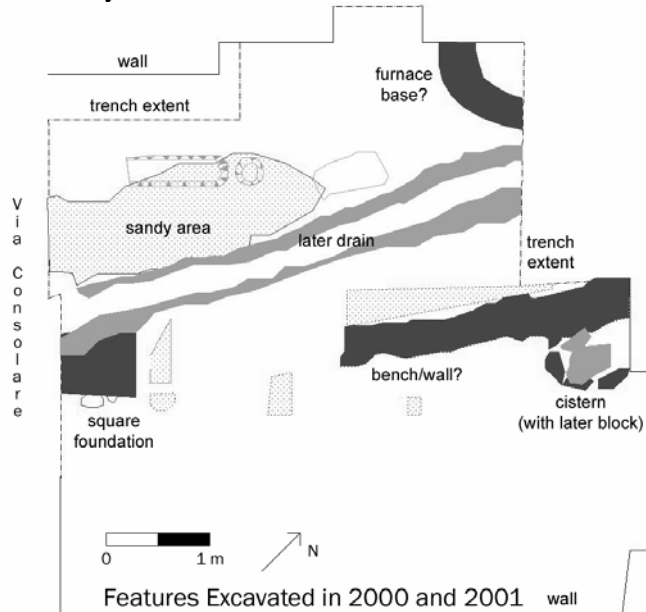


Excavations in the 2000 and 2001 seasons of the Anglo-American Project in Pompeii (directed by Rick Jones and Damian Robinson and run by the University of Bradford) at Regio 6, Insula I, near the Herculaneum Gate revealed the fragmentary remains of an early blacksmiths' workshop dating to the 1st century BC. Previous identifications of workshops based on the presence of anvils and other portable equipment have only revealed areas used for such work in AD 79. The identification of earlier industrial features gives us an opportunity to begin studying the changing nature of the technologies employed by the smith and the changing roles of space within the city.

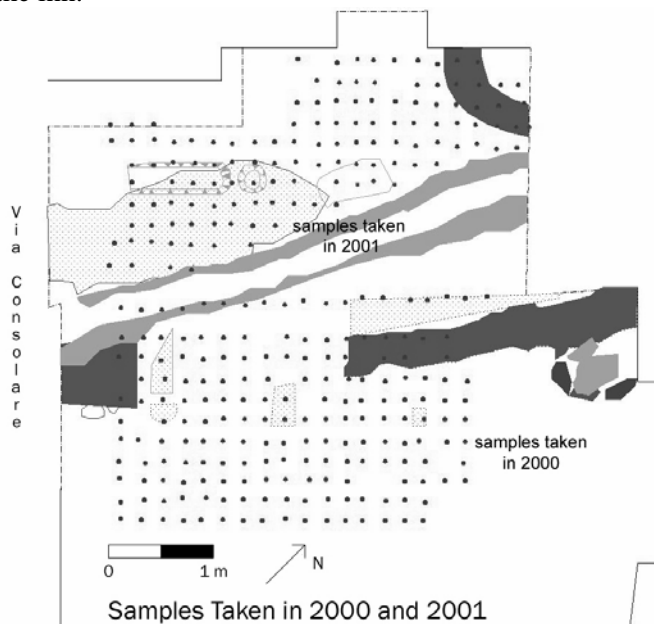


The excavation of the area that was the entrance to an inn when Vesuvius erupted in AD 79 demonstrated the presence of a complex sequence of activities that took place on the site. First activities appear to be the dumping of levelling layers in the 2nd century BC. The construction of several large concrete lined tanks and an associated cocchiopesto (mortar and crushed ceramic) floor were linked to industrial activity that seems to

have dominated the northern part of the insula during this period. This liquid-based industrial workshop was destroyed by the attack of Sulla in 89 BC, and a rough packed earth floor was then laid down. Associated with this surface were several features including a wall/bench foundation, blocked cistern or well, possibly anvil foundation and a partially excavated circular heated clay feature.

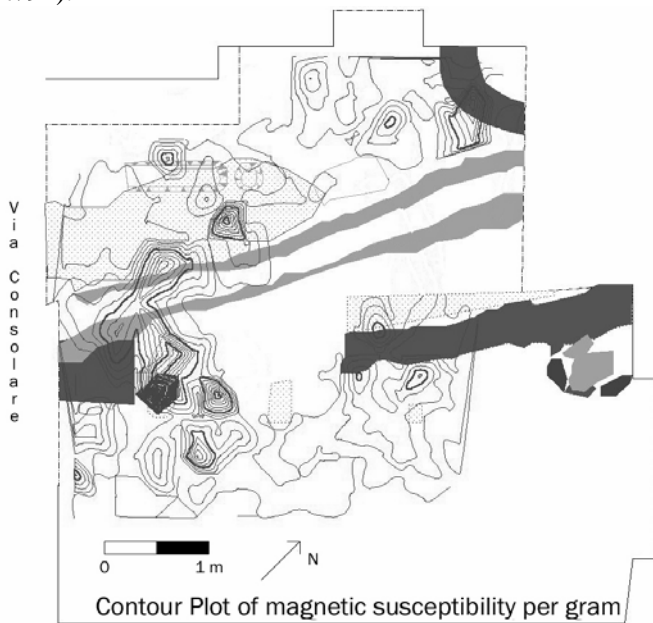


On the eroded surface small fragments of hammerscale were still *in situ*, identifying that the workshop was being used as a smithy. Overlying this floor a fill level included several smithing hearth bottoms, further evidence of the blacksmith's work. Overlying this fill where further packed earth surfaces that belonged to several phases of use of the space as the entrance way to the inn.



Identification of the presence of magnetic hammerscale (a micro-slag produced by the blacksmith as iron is hammered) led to a development of a full-scale

sampling strategy. Small soil samples were taken every 20 centimetres over the area of interest using cleaned trowels and a simple planning frame. The magnetic susceptibility of each sample was measured and converted to a magnetic susceptibility per gram figure. The work of Gerry McDonald at the Technology Section of the Ancient Monuments Laboratory had previously shown that magnetic susceptibility is directly related to amount of hammer scale in the samples (published as Ancient Monuments Laboratory Report 47/92).



Therefore the highest measurements, found around a square foundation allowed us to identify the anvil, slightly lower measurements were found around the end of a bench foundation nearest the anvil suggesting that some light work was also being carried out there. There were also high magnetic susceptibility readings from a possible hearth base, where a macro blacksmithing slag (plano-convex block or smithing hearth bottom) was found *in situ*. These slags form below the tuyère, where air is blown into the hearth from the bellows. This suggests the bellows for the hearth were situated to the north of the excavated portion of the hearth.

The soil samples taken will now be examined microscopically to clarify that these high magnetic susceptibility readings are from heating of the area and not the presence of iron rich hammer scale. The proportions of different types of hammer scale will be measured to establish the temperature at which the iron was being worked. Further questions remain answered – for example the unusually large distance between the hearth and the anvil, and the structure of the unexcavated portion of the hearth. The scale of work taking place in the workshop is unclear, but it is possible that the workshop was linked to rebuilding work that was carried out in the area after Sulla's attack. The positioning the workshop near to the Herculaneum

Gate may also have provided weary travellers with new horseshoes or repairs. In the meantime the painstaking work of uncovering such friable evidence has led to recognition of the first fully understood blacksmithing workshop in ancient Pompeii.

Europe's earliest brasses?

P.T. Craddock, M.R. Cowell & I.M. Stead

There has recently been a spate of accounts of early occurrences of zinc and brass from all over the world. This note adds a more local contribution.

There has been the extraordinary report of what is apparently a late Roman or early Byzantine coffin case made of zinc, excavated in Jerusalem (*The Times* 30th July 2001), and there have been continuing reports of early copper-zinc alloys from the second millennium way back to the fifth millennium BC.

For some years now the existence in China of two small bars of copper with more than 30% of zinc, dating to the third millennium BC, has been known in the West. Despite coming from an excavated context they have been treated with some caution, even suspicion both because of their high zinc content and apparent uniqueness. However, they were not alone, having now been joined by reports on a further two examples, a fragment of sheet and a small roll of metal also from excavated contexts, this time dated to the fifth millennium BC, which although excavated in the 1970's have only recently been scientifically studied and published (Zhou Weirong 2001). Their analysis and the re-analysis of the earlier finds show they all contain between 20% and 32% of zinc. Further to the West recent publication of the analysis of approximately 110 pieces of small metalwork from the site of Tepe Yahya in Iran, revealed three pieces containing between 16% and 19% of zinc, from contexts dating to the mid second millennium BC (Thornton *et al* 2002). Small items of copper alloy with similar zinc contents and similar date are also now reported from the site of Nuzi in Mesopotamia (Bayley 1998).

It is very uncertain whether the production of these few pieces was in any way deliberate, controlled or even if they were always recognised as being different from ordinary copper or bronze, such that we hesitate to use the term brass to describe them as that implies a deliberate alloy. However, by the first millennium BC in the Eastern Mediterranean, it does seem that copper-zinc alloys were both recognised as a distinct metal and were being deliberately produced. So far few examples have been identified, but now it seems that some brass may have penetrated into Celtic Europe, even to Britain well before the Romans. Previously, the earliest well

documented evidence for brass usage in Celtic Europe were a fibula, hook and strap containing between 11 and 23% of zinc, excavated at a workshop site at Titelberg in Luxembourg and dated to between 100 and 50 BC (Hamilton 1996, p.59).

A well-preserved sword found many years ago on the Thames foreshore at Syon Reach, Isleworth and acquired by the British Museum (PEE Reg. 1929, 11-11, 2) has recently been studied for inclusion in the forthcoming catalogue *British Iron Age Swords and Scabbards*, by I.M. Stead and to be published by BMP. The sword is now ascribed to the La Tène II period of the Iron Age and dated to the second half of the third or the second century BC. It has two makers marks stamped onto the blade and these are overlaid with foils which, because of the excellent condition of the sword generally, are totally uncorroded and appear very golden. Semi-quantitative X-ray fluorescent analysis on the uncleaned surfaces shows the foils are of copper with about 20% of zinc. Examination showed that such iron corrosion as is present overlaps the foils; clearly the foils had been in place before corrosion commenced and thus are original. NB Some metalwork from anaerobic waterlogged environments similar to that in which the Syon Reach sword must have lain, develop a thin layer of iron sulphide, giving the metalwork a very golden hue (Scott 2002, 277–300), good examples having been found in the Thames (Duncan and Ganiaris 1987). No sulphur was detected on the surface of the foils; their golden colour is that of the brass alone.

These foils would seem to be the earliest known examples of brass from the British Isles, by several centuries, the next earliest being some brooches from St Albans and Colchester from the decades just before the Roman invasion in 43AD (Bayley 1998), and thereafter many Late Iron Age ‘bronzes’ from the ‘Celtic’ areas of the British Isles contain some zinc (Dungworth 1996 & 1997).

It is possible that there are other early brass-foiled stamps. Some other La Tène swords with foiled stamps have been reported from Germany and France. The foils are described as being of gold, but apparently without analysis, although one foil from France ‘failed to respond to the touchstone’. It is possible that some of these foils are also of brass, used in imitation of gold, and constituting the first deliberate use of brass in Western Europe. The source of the brass is presently unknown but could be Anatolia, one of the early brass coins from that region contains more than enough metal for all the stamps so far known.

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Wealden Iron Research Group

Details of the experimental iron smelting carried out by the Wealden Iron Research Group are now reported on their web site (www.wealdeniron.org.uk). The group hope to reproduce the techniques used to make iron in early shaft furnaces of the type believed to be operated in the Roman period. They have produced tap slags of similar chemical composition to those found in the field, but have not yet produced the high densities generally exhibited by these ancient slags. Their trials produce a more porous and friable material of a type occasionally found in the field. The group are now establishing the upper and lower limits of blowing rates and charge compositions which will produce a bloom and a dense slag.

Lead Smelting at Combe Martin, Devon

Sarah Paynter and Trevor Dunkerley

The lead ore found around Combe Martin in Devon is rich in silver. Although the earliest documentary references to the mining of this ore are from the 13th century, there was no archaeological evidence for Medieval smelting before Trevor Dunkerley recovered large quantities of silver/lead waste slag excavating in Combe Martin village during 2001/2. The contexts containing the majority of the slag also had associated pottery and, after 1620, clay pipes, allowing for reasonably accurate dating to the 16th/17th century. The slag was dense, glassy and opaque grey/blue/green, with flowed upper surfaces. There were also surface finds of less dense, dark grey slag, thought to be waste from 19th century lead ore smelting. Samples of these slags were examined by SEM (scanning electron microscopy) and analysed using EDS (energy dispersive spectrometry) as part of an ongoing project at the English Heritage Centre for Archaeology.

The 16th/17th century slag had a fairly uniform composition, suggesting that it was all produced by the same process, and was predominantly an iron silicate containing small metal sulphide droplets. Overall the slag contained 2–6wt% lead oxide and the silver content was below detectable levels, indicating that the process used to extract the metal was quite efficient. From the slag composition it is estimated that temperatures of around 1200–1300°C were attained. Documentary research by Peter Claughton has shown that Joachim Hochstetter arrived in Combe Martin from Germany in 1528 and he would have been familiar with the latest continental technology using water-powered bellows to blow a charcoal-fired smelting furnace. However that working was short lived. In 1587 a mining entrepreneur named Bevis Bulmer arrived in Combe Martin from the Mendips and may have introduced a type of furnace construction known as an ore hearth. The lead-rich slag by-products of the ore hearth could have been processed further in a structure known as a slag hearth to recover more of the metal, producing slag of the type excavated at Combe Martin.

The suspected 19th century smelting slag contained a high concentration of alumina, iron oxide and lime and small amounts of barium, consistent with what would be expected from a flowing furnace of the type used by the Combe Martin and North Devon Smelting Co. 1846–52. Less metal was lost in the waste from the 19th century smelting process than the Medieval process, but higher temperatures, probably in the order of 1400–1500°C, were required. Trevor Dunkerley will be presenting the results of the Combe Martin project at the HMS conference in Exmoor.

The Trevithick Society

The Trevithick Society is the organisation for everybody interested in Industrial Archaeology and all aspects of the industrial past in Cornwall. Membership is open to all who are interested in the region's great industrial past, whether or not they live in Cornwall. The Society takes its name from one of Britain's foremost inventors and pioneers of the Industrial Revolution, Richard Trevithick

On Christmas Eve 1801 Richard Trevithick ran the world's first self-propelled, passenger carrying vehicle through the streets of Camborne, Cornwall, UK. This high pressure steam-driven vehicle was the world's first car! Two hundred years to the day, the Trevithick Society replica of the engine that changed the world had successfully re-enacted its original journey.

Members of the Society receive a quarterly Newsletter and an annual Journal. Meetings are held throughout the year and these consist of lectures on a diverse range of subjects relating to Industrial Archaeology, plus a number of guided walks around former mining and industrial sites. Society members also man and operate the Levant Winding Steam Engine and at least once a year operate the 50" Parkandillack beam engine.

Hon. Secretary Mrs. Janet Cambridge,
20 Devon Terrace, Plymouth, PL3 4JD Devon.

The Tool and Trades History Society

The object of the Society is to advance the education of the general public in the history and development of hand tools and their use, and of the people and trades that used them.

The Society invites applications from individuals for grants or onwards from the Salaman Fund. The Fund was established in memory of Raphael A. Salaman (1906–1993), a distinguished historian of tools and trades. He always liked to consider tools within the context of their use and he took a particular interest in the lives and working conditions of the tradesmen who used them. He was the author of two indispensable reference books, the *Dictionary of Woodworking Tools* and the *Dictionary of Leather-Working Tools*. He was a Fellow of the Society of Antiquaries and he was a founding Vice-President of TATHS.

The Salaman Fund provides up to £2,000 per annum in the form of **GRANTS** towards the cost of research projects proposed to be undertaken and/or **AWARDS** for research work already completed. The total awarded to any one applicant in any year will not normally exceed £500. The **CLOSING DATE** for the receipt of completed Application forms is **31st October 2003**

Application forms and further details may be obtained from:
Simon Barley, Hollow Barn, Woodhead Road, Wortley, Sheffield, S35 7DS.
E-mail simon@barleys.fslife.co.uk

Conferences

HMS Conference 2003: Exmoor

The 2003 HMS conference will take place **13th to 15th September**. The venue will be the Yarn Market Hotel and Village Hall in **Dunster**, Exmoor. Speakers include, Gill Juleff, Chris Carey, Trevor Dunkerley, Peter Claughton, Adam Sharpe and Tim Mighall. Field trips are planned to Sherracombe Ford, Combe Martin and Horner Wood. Please book as soon as possible as accommodation is limited.

Further details, etc can be obtained from **Dr Gill Juleff**, Department of Archaeology, Laver Building, North Park Road, Exeter, Devon, EX4 4QE.

Telephone: 01392 264397

Email: g.juleff@exeter.ac.uk

HMS Conference 2004: Portsmouth

The 2004 HMS conference will be held in Portsmouth from the 10th to the 12th of September. Further details to follow in the next issue of the newsletter.

An Excursion: Metalworking in Normandy

As the 2004 Annual Conference will be based in Portsmouth, it seems an ideal opportunity to allow HMS members to spend a few days exploring some of the metallurgical history of western Normandy. Metallurgical sites that are likely to be on the itinerary include the bell foundry and sheet copper workshop at Villedieu-les-Poêles; a blast furnace, little iron museum and other ironworking sites between Domfront and Flers; the Roman town and museum at Juvigny-sous-Andaine; and the finery-forge at Aube.

The trip would probably be for 3 days, taking the ferry to Ouistreham/Caen and returning to Portsmouth on Friday afternoon, in time to register for the Conference. We might stay in either Falaise or Caen and make daily expeditions, so it would not be necessary for everyone to visit all the sites. The most economical arrangement will probably be for those going to share cars. The distances are not great; 100 miles a day should be the maximum we have to drive.

If you would like to join this expedition, please write to Justine Bayley (at the English Heritage Centre for Archaeology, Fort Cumberland, Eastney, Portsmouth PO4 9LD) before the end of September 2003. Please indicate whether you are willing to take your car or whether you would like a space in someone else's car. Those who reply will be contacted later in the autumn when a detailed itinerary and costs, which will be kept as low as possible, will be worked out.

The Society for Post-Medieval Archaeology

The Society is holding a conference examining the industrial landscape of **Blaenavon**, South Wales, with lectures and field trips to the Blaenavon Ironworks and Big Pit mining museum. The conference will run from the **5th to the 7th September 2003** and speakers include Richard Avent, Peter Wakelin, David Thomas, Martin Lawler, Jeremy Knight, Olwen Jenkins, John van Laun

and John Rodger. Further details and a booking form are on the project website

(www.mysite.freeserve.com/spma_blaenavon).

"Master of Them All"

The HMS and the Cumbria Industrial History Society are jointly organising a one-day conference this autumn on the theme of **iron and steel making in Cumbria**. Topics to be covered will include an introduction to the Lake District Bloomeries Project; the on-going survey of bloomeries in Furness & Eskdale; Magnetic Mapping; post-medieval bloomeries in South Lakeland and the recent excavations at Cunsey Forge. There will be a look at Wilkinson's peat-fuelled blast furnace at Wilson House; Backbarrow in more recent times and the end game at Millom, including spray steelmaking. Speakers include Brian Young, Peter Crew, David Cranstone, John Hodgson, Rob Maxwell, Paul Belford, Eric Holland, Richard Newman, Ian Miller, Robson Davies & Mike Davies-Shiel. The conference is to be held at the Hundith Hill Hotel, near **Cockermouth**, Cumbria on Sunday **19th October 2003**. Further details contact **Chris Irwin**, Fallowfield, Ravenstonedale, CA17 4NG Tel: 015396-23539.

Web site: www.geocities.com/irwinindarch

Email: chris@thebookhouse.co.uk

The Underground Archaeology of Mining: A Hidden Resource

A one-day seminar exploring the nature of underground mining archaeology and how it should be recorded will be held at Grassington in the Yorkshire Dales on the **11th October 2003**.

Details and a booking form are available on the web site (www.nmrs.co.uk/seminar.htm) or can be obtained from **Martin Roe**, NAMHO Conservation Officer, 7a Moor Close Parade, Queensbury, Bradford, BD13 2JG.

Lords, soldiers and craftsmen: arms and armour in Tudor and Stuart London

The fourth Armourers and Brasiers/Royal Armouries Seminar will be held on the 22nd September at Armourers Hall, London. Speakers include Guy Wilson, Sarah barter Bailey, Steven walton, Ruth Rhynas Brown, Rober Smith and Silke Akermann. Further details from: The Clerk, Armourers Hall, 81 Coleman Street, London, EC2R 5BJ.

Archaeometry 2004

The next Archaeometry conference is to be held in **Zaragoza**, Spain from 3-7th May 2004. One of the six sessions will be on the technology and provenance of metals. The deadline for submitting abstracts is December 2003. Full details are available on the website (www.archaeometry2004.info) or by writing to Marius Vendrell-Saz, University of Barcelona, Martí i Franquès, s/n, 08028 Barcelona, Spain.

Archaeometallurgy in Europe 2003

This international conference, to be held in Milan from the 24th to the 26th September 2003, will include papers on ferrous and non-ferrous metallurgy.

The programme is available on the conference website: www.aimnet.it/archaeo.htm

HMS AGM 2003

The 2003 AGM was held on 10th May at the Royal Armouries in Leeds. Bob Smith welcomed everyone to the Museum and after the formal business of the AGM there were three talks. David Starley described some recent work on metal analysis carried out at the Armouries, Bob Smith provided a preliminary report on his work on the thickness and hardness of armour and Matt Ponting rounded off the morning by outlining the thinking behind the research frameworks document he had been compiling with the help of members of the Archaeology Committee. In the afternoon David Starley showed groups round behind the scenes, in particular the conservation and scientific research facilities. We were then free to explore the whole museum, with its enormous collections of weapons and armour, ranging in date from early times to the present day.

HMS History Committee News

The History Committee has defined its purpose in a "Mission Statement":

The History Committee exists to help the Historical Metallurgy Society to provide a point of enquiry for historians requiring information about historical metallurgy, to encourage the securing, maintenance and publicity of relevant collections and archives, and to prevent their loss.

Some of the current committee projects are outlined below.

Questionnaire. A questionnaire on members' interests has been circulated. Responses have been consolidated into a spreadsheet. This will be available to the Hon. Secretary to help him pass enquiries to appropriate members. The spreadsheet is a 'live' document; if you have not yet filled in the questionnaire, there is still time.

The committee would like to thank everyone who has completed the questionnaire. The responses are a valuable resource.

Bibliography. We are discussing a bibliography of published histories of companies in the Metals Business in the UK. We would like feedback from the membership on the usefulness of such a project, and any suggestions for the format that such a bibliography might take. Suggestions for inclusion in the database are also welcome. Work will cover only published material at present.

Data Sheets. The committee has decided to produce four draft data sheets as a preliminary step in determining whether such sheets will be useful. The sheets will cover Iron & Steel, Copper, Lead, and Aluminium.

HMS Archive. We are investigating the possibility of making a Lottery Grant application for the professional cataloguing and arrangement of the HMS Archive. This is kept at the Ironbridge Museum, and is currently not catalogued. In the longer term a history of the society could be considered.

Web Site Archive List. A list of useful archives can be found under "History Resources" on the HMS web site.

Archive Generation. It is a long term objective of the committee to encourage metallurgical firms to deposit papers of historical interest in appropriate archives, such as County Record Offices.

If you have any comments or suggestions for the History Committee, please contact **Eddie Birch** on 01226 370331 or eddiebirch@btopenworld.com.

Forthcoming HMS Meetings

The 2004 AGM will be on the 15th May at the National Motor Cycle Museum, Birmingham. The meeting fee of £11 will include access to the museum.

The 2005 AGM will probably be on the 21st May 2005 (although confirmation is still awaited).

Surcharge payments for HMS Newsletter

Due to a calibration error on weighing scales used many members have incurred a surcharge for the last set of HMS Newsletter and fliers. Please accept my sincerest apologies for this. Any member requiring recompense for this, please contact the Membership Secretary, Mrs Lesley-Ann Cowell, "Little Gables" 17a Thorncote, Northill, Beds, SG18 9AQ

Publications

New from the British Museum

Mining and Metal Production Through the Ages ed. P.T. Craddock and J. Lang. BMP. £65 hardback, 283 pages, colour and B & W plates. ISBN 0 7141 2770 1.

This volume has some 20 contributions inspired by the 1995 joint British Museum/Early Mines Research Group Conference on early metallurgy. The contributions came in from 1995 to 2000 and thus provide a comprehensive global overview at the end of the millennium. The range is wide geographically with mines from Wales through the Middle East to Chile, Copper smelting from South Africa to China. Broader issues such as the environmental effects of mining activities, the incidence of cast iron and crucible steel in the past and the development of brass making by the cementation process. Most of the materials are from excavation, but there are papers recording present traditional technologies such as tin production in India and zinc distillation in China.

News of a newly published account of an Exeter bronze foundry, March 2003

'Excavation of an early post-medieval bronze foundry at Cowick Street, Exeter, 1999–2000', by S.R. Blaylock, with contributions by P.M. Stead, D.B. Dungworth, J.P. Allan and G.I. Langman, *Proceedings of the Devon Archaeological Society* **58** (for 2000), 1–92.

This paper reports on excavation work in 1999–2000 on the site of the sixteenth and early seventeenth-century bell- and cauldron-foundry of the Birdall family in Cowick Street, St Thomas, Exeter. The foundry was established before 1550, possibly as early as 1525, and continued until the death of John Birdall in 1624/5. Archaeological investigations took place in the context of the redevelopment of a former supermarket, which had been the subject of earlier phases of excavation in 1978 and 1984 (during the original development of the site). Unfortunately these remain unpublished in detail (an interim account is available in a general overview of bell and cauldron founding in Exeter by the same author in *Historical Metallurgy* **30/2** (1996), 72–82).

The foundry installations, the evidence for the casting of bells, the dwelling house on the street frontage, and other structures excavated in 1978 and 1984 remain strictly outside the scope of the paper, but are discussed in some detail (and illustrated) in an introductory section providing the background to and describing the context of the recent work. The core of the paper deals with the extensive areas of quarry pits for clay for mould making which were spread over an area of some 4500m² and the large quantities of broken cauldron

mould recovered from the back-filled pits, totalling more than 650kg. Some 150 fragments of mould are illustrated in drawings, and selected fragments also in photographs. One mould for a skillet handle was found bearing the inscribed name of the founder, [Joh]n Birdall, providing a unique link with the founders who operated the site. Late-medieval and post-medieval cast bronze vessels are assessed and described, and the probable method by which moulds were made is discussed (and illustrated in a conjectural reconstruction of a typical cauldron mould). There are contributions on the ceramics and clay pipes from John Allan, and on the metallurgical analysis of metal casting waste and scrap by Dr David Dungworth. The last showed the use of a fairly consistent alloy for the casting of vessels, with a distinctive composition consisting mainly of copper, tin, antimony and lead. The paper concludes with a discussion of site preservation, the date of the beginning of the foundry, and of the contribution of the site to our understanding of the nature of the post-medieval cast-vessel industry.

The paper is 92 pages long, with 31 line illustrations and 32 half tones. Offprints are available from the author at 1 Colebrooke Lane, Cullompton, Devon, EX15 1EB, priced at £7.50 (including postage); cheques payable to S.R. Blaylock.

APPLICATIONS FOR GRANTS are invited to the R.F. Tylecote Fund and the Coghlan Fund.

Application forms may be obtained from Michael Cowell, Hon. Treasurer, Little Gables, 17A Thorncote Road, Northill, Bedfordshire SG18 9AQ. **Application forms must be submitted by 17th October, 2003.**

The Hon. Newsletter Editor David Dungworth,

English Heritage, Centre for Archaeology, Fort Cumberland, Portsmouth, PO4 9LD. Tel 023 9285 6783
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Contributions for HMSNews are welcomed by the end of February, June 11th, and November 5th, preferably in electronic (PC) format.

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