

# HMSNEWS

## Historical Metallurgy Society

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Spring 2003

### Forthcoming Events

**Members should already have received leaflets on the following two meetings**

**HMS Annual General Meeting 2003 will be held on Saturday 10th May at the Royal Armouries, Leeds.** The associated Spring meeting will address research frameworks in archaeometallurgy. There will also be an opportunity to visit behind the scenes in the conservation and scientific sections at the Royal Armouries.

**HMS Annual Conference 2003 (12-14 September)** will be held on Exmoor. The focus of the conference will be on metal production landscapes and field visits will include non-ferrous mining and smelting from the Late Iron Age to the 19th century. In particular, it is hoped that participants will be shown newly emerging evidence for a significant Roman iron production industry in the area.

### **William Reynolds Bicentenary.**

The Wrekin Local Studies Forum, a Group of Shropshire Local History Societies, is holding a **Conference on 14 - 15 June 2003** to commemorate William Reynolds ironmaster, scientist, inventor and canal builder. Reynolds was related to the Darby family of Coalbrookdale and managed a large part of the Darby ironmaking concern at the end of the 18th Century. There will be a series of illustrated talks on the Saturday and a tour on the Sunday. Speakers include Barry Trinder, and Hugh Torrens. An exhibition of documents maps and artefacts associated with Reynolds will run from 3rd-15th June. Events will be centred on the Long Warehouse, Coalbrookdale. £5 for Saturday, £5 Sunday Or £9 for both. For further details Tel. 01952-504135. Or write Neil Clarke, Cranleigh, Wellington Road, Little Wenlock, Shropshire, TF6

5BH for leaflet and/or accommodation information. Please send sae.

Society for Post-Medieval weekend visit to Blaenavon World Heritage Site 5th - 7th September 2003 Will be housed at Hill House, Abergavenny. It was a focus for early post-medieval industrial activity, including iron ore extraction from the 1670s, ironworking from the 1780s, and steel-making (including the Basic process, 1878) and coalmining until the 20th c. Contact Martin Locock, Glam.- Gwent.Archaeological Trust, Heathfield House, Heathfield, Swansea. SA1 6EL; Tel. 01792-655208.

### **A CHANGE OF EDITOR FOR THE NEWS**

Over the last eighteen years I have produced 50 issues of HMSNews. I took over from Roy Day who initiated it as an occasional publication. At first it was two pages stapled together, gradually it became the present eight page format issued three times a year. I hope it has served a purpose in keeping members together and keeping them informed.

**I should like to thank everyone who has sent contributions and made it possible, particularly David Cranstone, David Starley, Jeremy Hogkinson and Tim Smith.**

I should also like to thank European Engineering Services who have so competently printed the News, and at a very reasonable price.

People are beginning to send digital photographs which at present I cannot use, so perhaps it is time to move forwards with other technology in other hands. David Dungworth has kindly agreed to take over, and you will find his particulars on page eight.

Amina Chatwin

## Wortley Top Forge

The South Yorkshire Industrial History Society was founded in 1933, as the Society for the Preservation of Old Sheffield Trades and later known as The Sheffield Trades Historical Society, therefore, next year, 2003, we commemorate the 70th. anniversary of our foundation. The year also sees the 50th. anniversary of the purchase and taking into care by the Society of the Wortley Top Forge.

The latter was the derelict site of a wrought iron forge operated by water-wheel driven forging hammers and furnace blast-making equipment that had, since its closure as a forge in 1908, been used as a storage area, a stable, and for various other purposes. The buildings were in great disrepair and tumbledown. The heavy forging hammers were, although still recognisable, overgrown and unworkable. The water wheels were rotten and silted up, as were the leats and water courses from the river Don and associated dams.

However, members of the Society recognised the importance of the site as being probably the last remnant of a once great industry, and that the remains of the equipment were irreplaceable relics. Money was raised to initially lease the site, and then to purchase it, and work commenced, by volunteers and dedicated conservationists to renovate and preserve the buildings, the water wheels, the hammers, and other equipment. Examples of railway wheels and axles were begged from owners such as the National Railway Museum in order to be able to demonstrate the last use of the forge before its closure - the manufacture of Wortley railway axles.

It should be said that the Top Forge was the only one of six works that straggled the valley of the river Don to form the Wortley Iron Works that could be preserved. In total the Iron Works consisted, in 1888, of two wire works, a tilt and slitting mill, the Top Forge, the Low Forge rolling mill, and an erstwhile Tin Mill with a sheet rolling mill, the earliest of which was founded in 1600.

The Wortley Top Forge is situated about ten miles north of Sheffield following the A61 out of the City and by then following the A629 towards Huddersfield. Go through Wortley village and turn left at the traffic lights in the village of Thurgoland. The Forge lies on the left after passing under the

disused railway bridge. We open the Forge to visitors on every Sunday between the hours of ten am. and four pm. except in January when we close for the month.

Much work and money, equivalent to almost £1,000,000, has been spent upon the preservation of the Top Forge. The site now forms a very unique, true, and 'working' restored heavy iron forge housed in period buildings with attached workshops, workmen's cottages, water courses, and dam.

The aims of the Society, and the Trust that is responsible for its management, is to preserve the Forge, install and preserve examples of later forging techniques and machinery, and to enable the site to become an educational and heritage centre for an old South Yorkshire industry and associated Sheffield trades. In March 1994 the Institution of Mechanical Engineers presented a Heritage Hallmark Plaque to Wortley Top Forge.

We are conscious that the site lacks the modern amenities required by a 21st. century Museum Site of importance. Toilets are antiquated, a visitor centre and refreshment facilities are now a 'must'. Improved, and discreet explanation and interpretation boards are necessary. And these must be paid for. We are, therefore appealing for funds and donations.

But, more importantly, volunteers are also desperately needed, to act as guides, to dismantle, renovate, and rebuild donated equipment, operate machine tools, do some bricklaying and other building work for maintenance. Attendance is required for several fixed Sundays a year, or for every Sunday if people could spare the time. Skills are not necessary in every case, although people with specialist skills and knowledge will be more than welcome. Heavy lifting equipment and carrying vehicles are available on site and these are maintained and insured, as, indeed are all our visitors and volunteers. Volunteers are also invited to carry out an ecological investigation of the site, its surrounding woodland, its field, dam, and water courses. The last one undertaken was held more than twenty years ago by a local naturalist but his records have been mislaid.

We currently have just over 2000 visitors a year the majority of whom are ordinary people, two or three

hundred come as organised trips from learned and interested bodies and societies, and we hope to attract more, especially children and teenagers from local schools and colleges.

What we are looking for is publicity, especially in the run-up to our jubilee's year. We are a volunteer organization looking after an internationally recognised Heritage site and an important industrial relic. Please can you help us?

**Christopher C. Morley**

President, South Yorkshire Industrial History Society.

## **Examination of a Crucible Steel Mirror in the British Museum.**

The recently published magisterial survey of Persian iron and steel (Allan and Gilmour), showed that crucible steel was much more prevalent than had hitherto been demonstrated. It was in fact used for the wide variety of tools and fittings for which we would use good carbon steel today. However, crucible steel has other properties there are now taken for granted, but which in the past were likely to be of great importance. One of these was the ability to take a good polish. Ordinary wrought iron and the steel made from it invariably contained slag stringers, whether made by the bloomery process or by the fining of pig iron. These caused blemishes and rough areas on the surface. Crucible steel was, of course, free of such inclusions and therefore took a much more brilliant polish.

A recent examination of a superb 14th century steel mirror, believed to have been made in either Egypt or Syria, now in the British Museum, (OA Reg. 1960, 1-15, 1), has shown that it is almost certainly made of crucible steel, the first to have been identified. The mirror has lost its handle, but is otherwise in superb condition with a splendid calligraphic band inlaid with gold running around the back. The superb condition is both a problem and a blessing. It is out of the question to cut a section or even to polish a taper section on the edge of such a fine and intact piece, thereby limiting the information on the nature of the steel and the fabrication history. However, at a number of places on the rim of the mirror, the original filing has left flat surfaces extending for several mm, and as the iron only has minimal tarnish, light polishing produced an acceptable surface for metallographic

examination (it is hoped to produce a fully illustrated report on the mirror in the near future for the HMS Journal). Examination of the etched surface at high magnification revealed a microstructure of spheroidised pearlite in a ferrite matrix, suggesting a carbon content in the region of 0.6 to 0.7%, that is just below the eutectoid composition of 0.8% carbon. Some of the carbides were elongated during the forging of the steel.

The metal is very clean and the structure reasonably homogeneous, quite typical of crucible steel. The polished edge was analysed by energy dispersive X-ray fluorescence, and the only metal besides iron to be detected was manganese of which about a percent as present in the metal. This is, of course, very high for pre-modern irons. However, al Tarusi, writing in the 12th century AD, on the making of crucible steel, was just one of several Islamic authorities to include in the charge added to the crucible magnesia (which is to be understood in these contexts as manganese oxide). During the smelting much of the manganese would act as an excellent slag former, which was probably the main reason for adding it, but some undoubtedly would have been reduced to metal which would then have dissolved in the forming steel.

Ferrous mirrors seem to have been reasonably common in the Medieval and post Medieval Islamic world, and are usually described as being of steel by both contemporary authorities and by present day art, historians. In both cases the description appears to have been made without technical knowledge or scientific examination. Very likely the old distinction was made between rusty low status objects being described as being of iron and polished objects qualifying for the accolade of steel.

In fact crucible steel is a very good material for mirrors. It is hard and strong and as such will be resistant to both scratching and distortion by bending. It was also capable of taking a much better reflecting surface than other contemporary irons and steel because of the absence of inclusions, and this property is reflected in the epitaph 'glittering steel' given to crucible steel by al Biruni in the 11th century. The French traveller Bertrandon de la Brocquiere, writing from Damascus in the 15th century describes how the steel was polished, and commented that the sword blades of crucible steel were so bright that the soldiers used them as mirrors when adjusting their turbans!

Nor was appreciation of this property to be exclusively Islamic. Some of the first users of crucible steel in Europe also appreciated this property. No less than Matthew Boulton was one of Benjamin Huntsmans' first customers, not only using his crucible steel for rolls and dies but also to make fancy buttons. For this the steel had to be decarburised so that it could be easily shaped by the fly-presses in Boulton's Soho works in Handsworth, prior to polishing and case hardening. Writing some 50 years later in his *Technological Repository* 6, Gill noted that for the manufacture of bright steel buttons 'we should always choose decarbonated (sic) cast steel' which was 'free of the flaws, blisters etc which are often found in items made of common iron' (Rawlings 1978).

Steel mirrors never seem to have become popular in Europe, but they are certainly widely used now in public toilets etc where the ability to withstand vandalism is the overriding consideration, thus does the choice of materials follow societies' priorities.

#### References

Allan, J.W. and Gilmour. B., 2001 *Persian Steel: The Tanavoli Collection*. OUP, Oxford.

Rawlings, R.D., 1978 The manufacture of cut steel buttons and studs, *JHMS* 12, pp. 88–97.

**Paul Craddock and Janet Lang.**

Department of Scientific Research, The British Museum, London WC1B 3 DG.

#### Thanks

David Starley has stepped down as the editor of the archaeometallurgy section of HMS NEWS after 10 years service. David has made the archaeometallurgy section both informative and entertaining and his successor (David Dungworth) hopes he will be able to do as good a job.

Contributions for the next issue by 31st May to:

**David Dungworth**, English Heritage,

Centre for Archaeology, Fort Cumberland,  
Portsmouth, P04 9LD

Tel: 023 9285 6783 Fax: 023 9285 6701

**david.dungworth@english-heritage.org.uk**

#### Historical Rammelsberg.

In Germany the old town of Goslar in the Harz Mountains and the nearby Rammelsberg ore mine

are on UNESCO's World Cultural Heritage list. The ore mine had been worked for over 1000 years until it closed in 1988 because of the exhaustion of economically recoverable ore. In its lifetime lead, zinc, copper and silver ores were mined there. The mine and its buildings have been transformed into a mining museum and a visitors mine.

Having visited the museum on several occasions and finding no literature available in English on the history of the mine I bought a booklet in German entitled *Historical Rammelsberg* by Heinfried Spier and translated it to learn more.

*About 1740 the Maltermeister tower became the home of the Rammelsberg Maltermeister, who until 1870 measured the wood/or the fire setting (1 Mailer is about 2 cubic meters) and passed it on to the miners.*

It surveys the evidence remaining above ground of past mining activity. It describes the extensive underground improvements carried out by mine master Roeder at the end of the 18th century to improve productivity at the mine. The transport system was improved with the digging of new strategically placed shafts and transport tunnels. The water drainage system was also improved. Power for the improvements was supplied by a system of underground water wheels. This system lies at the heart of the museum underground tour area known as the Roeder Stollen.

Water seeps through the old mine workings dissolving remaining metal ores producing strongly acidic metal sulphate solutions. These later precipitate on the walls of underground workings giving rise to vivid green, blue, red, yellow, brown and white colourations. In the past the sulphate ores were mined using fire setting from which various vitriols could be produced. Vitriol production was quite important to the town of Goslar in times past. The methods used in vitriol production and uses to which vitriols were put are outlined.

The booklet contains 73 pages with pictures and diagrams. It can be made available as a WORD document on CDROM if anyone is interested.

Contact **J.R.Weale**, 8 Hawthorn Close, Chelmsford, Essex, CM2.9NP

## **Aspects of the Tin Industry in South West England.**

A grant was awarded to Albertine Malham of Bradford University who is currently working on aspects of the tin industry in south west England. As part of that wider project, a number of tin slags and ore samples have been obtained on loan from Exeter City Museum, Torquay Natural History Museum and Plymouth City Museum and Art Gallery, for the purpose of analysis. A photographic record of the material has also been made, in order that a comprehensive database of tin-smelting slags may be compiled.

Characteristics of slags, such as physical appearance, abundance of tin metal prills, and chemical composition of slag and metal inclusions, will be investigated with a view to showing how changes in tin-smelting technology through the course of history can be recognized in the industry's archaeological remains. To date, the microstructures and compositions of only a small number of slag samples have been determined and few conclusions have been reached regarding the significance of the data. When complete, this study of the materials from museums will more than treble the number of sites for which analyses are available. Preliminary work on polished sections has already revealed that the variety of microstructures found in pre-seventeenth century tin smelting slags is greater than was previously believed.

Several samples have, so far, proved not to contain any tin. However, a number of other samples of doubtful classification have been confirmed as tin smelting slags.

Albertine Malham  
475 Idle Road, Bradford, West Yorkshire BD2 2AY.

### **The Book House**

**After nearly 20 years at Grey Garth, in Ravenstonedale (and 40 years of bookselling), The Book House has moved to the other end of the village.** The new shop is all on the ground floor, wheelchair accessible, and holds rather more books. The shop is near the top of the village street, on the left as you go up, and is alongside a modern house called Fallowfield set back from the road.

In 2003 we hope to have an increased programme of conference stalls and book fairs. If any members would like to know when we are in their area please let us know. Already in the frame are the AIA spring and summer conferences, the NAMHO event in Ireland, and what we hope will be a joint HMS/CIHS conference in Cumbria this autumn.

Our phone and e-mail remain the same: 015396-23634 and mail@thebookhouse.co.uk respectively. The address is now The Book House, Ravenstonedale, Kirkby Stephen, Cumbria, CA17 4NG. Opening hours are 9am to 5pm daily except Sundays & Tuesdays. We look forward to seeing any fellow HMS members travelling through Cumbria Ravenstonedale is only ten minutes east along the A685 from the M6 at Junction 38 (Tebay).

Chris Irwin.

### **Correspondence**

#### **Re: Trostre Works Cottage & Industrial Museum Appeal for information on Embossed Metal Mouldings.**

First of all let me thank you for including my communication of 29th August 2001 in the Winter 2001/2 of the HMS News.

The response to the publicity that you gave my appeal for information on Embossed Metal Mouldings, (News 49 pp7-8) has been very encouraging. To date I have received data on sites containing examples of Embossed Metal Moulding in the West Country, Cornwall, South Africa and Australia. This input of information has greatly assisted me in my research. Even though I have already sent individual acknowledgements to each person who responded to my appeal, I would nevertheless, like to issue a general thank you to all through the media of the HMS News.

My research continues and information on Embossed Metal Mouldings from any other member would be gratefully received. On conclusion of my work, I hope to present my findings to the HMS Committee as a suitable subject for an article to be published in the HMS Journal **Keith E. Morgan, Curator Trostre Cottage & Industrial Museum** Or for prompt acknowledgement and response to "Casita", 87, West Road, Nottage, Porthcawl, Glam. CE36 3RY Tel.. 01656-788150.

### **Article on Cobalt in the Pharmaceutical Historian.**

Dr Juanita Bumby, of Wirksworth, wrote to me [*Editor A. Chatwin*] in January 2002 seeking material on the extraction of Cobalt oxide from Smalt, which fortunately I was able to supply. She contributed a most interesting article on 'Drug Jars and the Colour Blue' to the September 2002, Vol. 32 No 3, issue of the *Pharmaceutical Historian* (British Society for the

History of Pharmacy, 840 Melton Road, Thurmaston, Leicester LE4 8BN.)

The following sections may be of particular interest to HMS members.

“Analyses of blue glass made by the ancients show that the earliest specimens were coloured sometimes with cobalt, but much more frequently with copper. Of the many pieces of dark blue glass found on Tutankhamun’s tomb, only one specimen was found to contain cobalt, and the same was the case in finds from Nippur in Mesopotamia. These cases are now thought to be purely accidental.

“In the late 1400s an apparently useless mineral was found in mines of the Erzgebirge lying between the present day Czech Republic and Germany, but in about 1545 a Christoph Schuerer discovered that these ores could impart a deep blue to glass. Caskfuls of the roasted ore was soon exported to the Netherlands where it was widely used in the manufacture of delftware . . .

“The finest ‘Smalt’ of Saxony was monopolised by the government on behalf of the Royal Saxon Porcelain Manufactory at Meissen, close to Dresden.

“There are two main types of cobalt-containing ores: ‘Smaltine’ or ‘Speiss Cobalt’, in which cobalt is found as an arsenide, and ‘Cobaltine’ or ‘Cobalt glance’, which forms the bulk of the cobalt ores of commerce. It is the combined arsenide and sulphide of cobalt, CoAsS.

“Little has been found in Britain except in Cornwall, a small amount at Alderley Edge, Cheshire . . . and later in Scotland.”  
The Cobalt ore is broken into small pieces and spread over the hearth of a furnace . . . it is roasted at least twice for several hours, and then ground and sieved to give a very fine powder . . . mixed with twice its weight of powdered flint or quartz . . . it is then the Zaffre of commerce.

From 1730 demand increased, but owing to war between Prussia and Saxony there was a shortage and Cornish ores had to be worked.

It was fortunate that cobalt was found in a mine at Alva, near Alloa in Fife on the edge of the Ochill hills. Nicholas Crisp became involved, he was one of the few who had practical experience of making Zaffre and smalt from Cobalt ore in Cornwall during the 1750s. But by 1765 he was in serious financial difficulties and the Cobalt Mining Company ceased mining in about 1766.

Today, cobalt’s main use is in the hardening of steels which can only be shaped by forging and grinding, and in the manufacture of permanent magnets, not in the production of an attractive blue colour.

**New Hon. Editor. Dr David Dungworth**, Centre for Archaeology, English Heritage, Fort Cumberland, Eastney, Portsmouth P04 9LD. Will welcome contributions in Word, either on disc, or as attachments to e-mail addressed to david.dungworth@english-heritage.org.uk

**Contributions for next issue by May 31st.**

**Membership Secretary, Mrs Lesley Cowell** “Little

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