

HMSNEWS

Historical Metallurgy Society

41

Spring 1999

Forthcoming Events

10th to 12th September 1999 HMS Annual Conference The Iron Industry of Furness.

Will be held at Ambleside, Cumbria. See details and booking forms on separate leaflet. Early application necessary.

HMS AGM will be at the Institute of Materials, 1 Carlton House Terrace, London, on May 15th. There will be a lecture giving an overview of what the Institute of Materials is all about. This will be followed by lunch. In the afternoon there will be a guided tour of a disused section of London Underground (probably Aldwych) to view Victorian railway engineering.

Materials and Technology Course at the University of Bradford June 28th to July 2nd. There will be three days concerned with metals and alloys and one day on glass and another on ceramics. Part of a Postgraduate Programme that aims to promote greater understanding of the nature and degradation of ancient and historic objects. Or use as a "refresher" or for general interest. Will examine both the practical and chemical processes involved in the conversion of raw materials to final product. The laboratory sessions allow students to develop skills in microscopy, metallurgy of copper alloys, iron and steels, preparation of samples and the identification of characteristic microstructures. Tuition fees £290 or unassessed option £220. For further details contact John McIlwaine, Co-ordinator for Continuing and Professional Education, Dept. of Archaeological Sciences, University of Bradford, Bradford BD7 1DP E-Mail: j.j.mcilwaine@bradford.ac.uk.

AEA Annual Conference at the University of Surrey, Guildford. 27th to 29th August. The

Environmental Archaeology of Industry. The conference aims to focus attention on bioarchaeological aspects of past industry, and to bridge the gap between industrial and environmental archaeology. Papers are invited on aspects of the bio- and geoarchaeology of all kinds of industry. Organisers Patricia Wiltshire (Institute of Archaeology, UCL) P.Wiltshire@ucl.ac.uk. and Peter Murphy (University of East Anglia) P.L.Murphy@uea.ac.uk.

Counterfeiting: Ancient and Modern: 14-15th September 2000

This joint RNS-BM symposium is organised through the Scientific Research Committee of the RNS and will be held in London at The Society of Antiquaries, Burlington House, Piccadilly. The theme of the meeting will be counterfeiting in its broadest sense and it is anticipated that this will cover all aspects of the technology and scientific investigation of the manufacture and context of unofficial currency issues both ancient and modern. This would include, for example, coins for collectors, plated and cast coin forgeries, false dies, semi-official copies (e.g. Roman issues from eastern Europe), banknotes, forgers workshops, materials associated with forgery production, experimental replication of processes, examples of anti-forgery practice and novel techniques of forgery examination or detection. It is expected that the proceedings will be published by the RNS in its series 'Metallurgy in Numismatics', as MIN5.

Further details can be obtained from: Mr Mike Cowell, Department of Scientific Research, British Museum, London WC 1B3DG. Tel: 0171 323 8277 / Fax: 0171 323 8276 / e-mail m.cowell@british-museum.ac.uk

THE TOOL AND TRADES HISTORY SOCIETY invites applications from individuals for grants or awards 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 Vic-President of TATHS. The fund provides up to £1000 per annum in the form of Grants towards the cost of research projects to be undertaken and/or awards for research work already completed. Application forms and further details from The Administrator, TATHS, 60 Swanley Lane, Swanley, Kent, BR8 7JG. UK.

Archaeometallurgy

New university posts at Freiberg, Cardiff and London

Good news for this issue includes the appointment of three new university posts, reflecting an expansion of academic interest in ancient technology and materials.

Firstly, an endowed professorship for archaeometallurgy has been established at the Technical University of Mining and Technology in Freiberg, Germany, through the support of the Volkswagen Foundation. In addition to teaching the prehistoric archaeology of Europe and adjacent regions, as at other German universities, the syllabus also includes science and engineering and its application to archaeology. Courses are held in German language but it is planned to offer summer schools in English.

Research topics include:

- Inception and development of copper metallurgy in the Old World.
- Origin of tin bronze technology (recent research programs in central Asia and the Erzgebirge).
- Metal procurement and distribution in Bronze Age central Europe.
- Characterisation and provenance studies of ancient gold.
- Chemical and mineralogical classification of Trojan pottery.
- Material properties of early alloys.
- Authenticity of metal artefacts.

Contact: Lehrstuhl für Archäometallurgie, Prof. Dr. Ernst Pernicka, Gustav-Zeuner-Straße 5, D-09596 Freiberg, email: pernicka@ww.tu-freiberg.de

Secondly, **Kilian Anheuser** has been appointed as Lecturer in Conservation Science in the School of

History and Archaeology, University of Wales, Cardiff. As part of an ongoing programme of metallographic and microanalytical studies of precious metal plating he is looking for examples of medieval fire-gilding on iron and steel. Although medieval literary evidence suggests the use of copper plating of the iron prior to the application of the gold amalgam, this has not yet been recognized on objects earlier than the 16th century, and earlier examples of fire-gilded iron in general appear to be very rare. He would be particularly interested in collaborating with museums or archaeologists who have medieval gilded artifacts among their finds and would like to learn more about their techniques of manufacture. Contact: anheuserk@cf.ac.uk or tel. (01222) 875157.

Most recently, the University College London has decided to strengthen archaeomaterials research and teaching at the Institute of Archaeology, and has set up a new Chair of Archaeological Materials and Technologies. From September 1st 1999, Thilo Rehren, currently at the Deutsches Bergbau-Museum in Bochum, will join UCL for this. One emphasis of the new position will be to further develop high temperature process reconstructions within their broader archaeological and cultural context. Teaching of science-based methods in archaeology will also gain further support from the new appointment. Thilo is very much looking forward to both national and international cooperation with archaeologists and scientists actively working in this field.

Middle Saxon iron smelting furnaces in Cambridgeshire

William Wall, of **Cambridgeshire County Council Field Archaeology Service**, has passed on details of an archaeological excavation on the route of an Anglian Water pipeline. The 1997 site evaluation revealed the remains of two iron-smelting furnaces and other metalworking features near Bonemills Farm, Wittering, Cambridgeshire. Further excavation work, funded by Anglian Water, showed that the two furnaces were similar, consisting of sub-oval pits about 2.2m long, 0.6m wide and 0.15m deep. At one end the underlying clay in which the pits were dug was discoloured by intense heat indicating where the bases of the furnace structures lay. The internal diameter of each furnace was

estimated at 0.30–0.40m. Running out from the area of the furnace bases were thick flows of tap slag, which were clearly in situ. The total weight of tap slag recovered from furnace 1 was over 18kg, and from furnace 2 over 12kg. A third feature consisted of a circular pit 0.60m in diameter and 0.33m deep. This also had a discoloured area around one part of the circumference, and there was a large plano-convex hearth bottom adhering to the pit side. This hearth bottom weighed 3kg and appeared to be in situ. This feature is interpreted as a possible bloomsmithing hearth.

Several pits adjacent to the furnaces were found to contain charcoal and burnt ironstone, with evidence of burning at the pit base. These may have been used for roasting the ore prior to smelting. Deposits of ironstone outcropped along the pipeline route and one, within a few metres of the site, may have been the ore source. Charcoal from furnace 1 gave a radio-carbon date of 1350 ± 80 BP, cal AD 575 to 875 (2 sigma, 95% probability). That from the possible bloomsmithing hearth gave a date of 1230 ± 50 BP, cal AD 680 to 905 and cal AD 920 to 950 (2 sigma, 95% probability).

East African crucible steel

Given the recent spate of interest in early crucible steel, **David Killick** at the **University of Arizona** would like to draw attention to a publication which may have been overlooked:

Kusimba, Chapurukha M., David Killick and Richard G. Cresswell (1994) Indigenous and imported metals in Swahili sites on the Kenyan coast. In *Society, Culture and Technology in Africa*, S. Terry Childs (ed), 63-77. Philadelphia: The University of Pennsylvania Museum (MASCA Research Papers in Science and Archaeology, Supplement to vol. 11).

The paper reports three direct radiocarbon dates (by accelerator mass spectrometry) on samples of crucible steel excavated from sites on the Swahili culture on the coast of Kenya. The details are:

Ungwana, sample 15/3061d. Crucible steel (1.4 wt% C). 530 ± 90 BP (TO-3890), calibrated by CALIB 3.0.3 to 1290–1520 cal AD (2 sigma).

Ungwana, sample 11/2660b. Strip of crucible steel back with strip of ferrite — measured carbon content (average of both) 0.9 wt% C. 870 ± 100 BP

(TO-3889), calibrated by CALIB 3.0.3 to 990–1300 cal AD (2 sigma).

Galu, sample 33/006b. Crucible steel (they think). (1.7 wt% C). 1300 ± 70 BP (TO-3894), calibrated by CALIB 3.0.3 to 630–890 AD.

The first two samples are unproblematic, but the researchers are not sure what to make of the third and earliest sample. There is no intrinsic reason to doubt the radiocarbon date, and they are fairly confident that it is crucible steel, though it does contain some slag (the first two do not). However, the date seems anomalous for the site (for which another date of 740 ± 70 BP (TO-3894) is preferred), so the earlier date may reflect some admixture of old or dead carbon, such as coal, in the making of the steel. Time will tell! Using metallography ten pieces of crucible steel have been identified from Swahili sites. Since there is no evidence so far of the production of crucible steel on the East African Coast, it is presumed that these were imported from India, Sri Lanka or the Near East.

Iron and steel industry of Islamic Spain

Mattias Karlsson at the **School of Oriental and African Studies**, University of London is currently in his second year of a PhD. The research project comprises the first extensive, cross-disciplinary analysis of the ferrous industry in Islamic Spain (711–1492) in terms of technology, trade and socio-economic circumstances, based on analyses of excavated metallurgical debris together with information from literary sources. During the field-work period a survey of archaeological iron and steel objects dated to the Islamic period will be carried out, thus primarily focusing on metallic remains. The main analytical methods are SEM with electron microprobe analyser and metallography. Material from al-Andalus will be compared with information obtained through analytical investigations of material from other parts of the Islamic world, in order to identify differences or similarities in metallurgical technology.

Iron smelting in Virginia

JH Brothers IV is writing an MA thesis on the Colonial Iron Furnaces of Virginia (USA). His premise is that the viability of a furnace was largely dependent on the proper assessment of resource

availability by the organizers of the iron works (ore, water power, market, transportation network, flux, and wood for charcoal). An extensive data base of furnace locations, ore bodies, historic documents and archaeological/architectural remains has been assembled. A further project, to collect and analyse slag samples from all of the iron works of Virginia, is being coordinated by Lyle E Browning (email lebrowning@worldnet.att.net).

Early iron research

Mike Wayman, of the **University of Alberta**, Edmonton, Canada, is spending a years study leave in the Department of Scientific Research of the **British Museum**, working on various aspects of early iron technology. A major publication in the British Museum's Occasional Paper series (No. 136 in that series). The *Ferrous Metallurgy of Early Clocks and Watches*, is nearly complete and is expected to appear in the summer of 1999. He is also carrying out microstructural and chemical analyses of Chinese ferrous materials from the British Museum's collections. One project concerns white cast iron coinage from the Sung dynasty (10th–13th Century AD); this came into use as a result of a shortage of copper in a booming economic period. Work is also being carried out on tools, weapons, and statuary in wrought iron, steel and cast iron (both grey and white) from the past two-and-one-half millennia.

Vorsprung durch Technik as they say in Freiberg, Cardiff and London!

Many thanks to the contributors for the above items. Any archaeometallurgy contributions for the Summer 1999 issue, by 4 June to: **David Starley, Ancient Monuments Laboratory, English Heritage, 23 Savile Row, London W1X 1AB. Tel. (0171) 973 3306 Fax. (0171) 973 3330 email: D.Starley@eng-h.gov.uk**

BOOKS

Behind the Scenes at Time Team

-Or Archaeology with a JCB

Tim Taylor, producer of the popular television series 'Time Team' has written a fascinating account of the trials and tribulations encountered during the making of some 40 programmes over the past seven years for what for many has become compulsive Sunday evening viewing on Channel 4.

The programme, with its objective of finding out as much as possible about a site within just three days, seems to polarise the attitudes of both amateur and professional archaeologists as to its merits. On the plus side, according to Tim Taylor, applications for University courses in archaeology have risen 15% in recent years and the general public have become more aware of the value of their heritage — gardeners, for example, are referred to as Britain's largest field walking group and a valuable source of finds for local museums and interest groups. On the down side, the apparent 'bull in a china shop' syndrome — epitomised by the obligatory use of the JCB digger to open a trench — can give a poor impression of how to set about a dig.

To be fair on the programme, a full time archaeologist is now employed to write up all the digs — something missing from earlier site investigations - as well as the use of a regular team of trained diggers in addition to the well known faces of Prof Mick Aston of Bristol University, Phil Harding of Wessex Archaeology and Carenza Lewis of RCHME. This team, along with local County archaeologists and specialists, have undoubtable enabled the funding of professional and technologically advanced investigation of sites which would otherwise remain known but uninvestigated. The Team also accepts its responsibility to conserve and catalogue all finds and a significant sum is put aside for this where necessary.

Despite how it may appear to the viewer, an extensive amount of research is put into the site prior to Time Team undertaking an excavation, and also 'finds' are not as spontaneous as they appear in the edited version — having myself assisted on the reconstruction of a bloomery furnace at Beauport Park for the Programme, I can vouch for this.

A 'cameo' reconstructing some aspect of the period has become obligatory as the series has developed, with local interest groups and specialists called upon to perform this task - sometimes in period costume, at other times, the theatricals are thankfully dispensed with.

The book, which is liberally illustrated with excellent photographs, follows five digs from the current series to be broadcast in January to March

1999. At times, there is evidence of the undercurrents arising from both the conflicting interests of 'good TV and getting the job completed, as well as between the approaches of amateur archaeologists and professionals.

The 192 page book describes more of the process of turning a dig into interesting television, than the archaeology, although each chapter commences with a resume of the history relevant to the period of the site. Some inaccuracies in technical descriptions have survived the proof reading stage. At a price of £18.99, it may be better to ask your local library to order a copy, or wait until it finds its way to the 'Bookstop' chain at cut price.

Behind the scenes at Time Team by Tim Taylor, Channel 4 Books 1998 ISBN 0 7522 1327 X

Tim Smith

Sir Henry Bessemer: Father of the Steel Industry

To commemorate the 100th anniversary of the death of Sir Henry Bessemer, the Institute of Materials has published a compilation of the history of the development of the Bessemer process in Europe and USA.

Edited by Professor Bodsworth, who also wrote the introductory chapter on the life of Bessemer and a chapter on the use of the process in NW England, other contributors are Trevor Lodge of British Steel, ME & RD Walker (South Wales), Friedrich Toussaint (Europe) and E Turkdogan (USA). My only lament for an otherwise most excellent book is that, just as Bessemer did in his autobiography, Sweden has been consigned to a passing mention. Goran Fredrik Göransson, who introduced the converter to Edsken (present day Sandvik) where the local low phosphorus ores were ideal for the acid lined converter, and built the first commercially viable Bessemer steelshop, gets hardly a mention and is not included in the index.

The title is a little misleading since only the first chapter is devoted to Sir Henry Bessemer; the man, but this and the subsequent chapters are full of 'gems' of information liberally scattered through descriptions of the development of the process. Included is the discovery by Robert Mushet in 1857 that additions of spiegeleisen (Fe-Mn-C) would deoxidise the otherwise unsound product, and the

eventual solving of the phosphorus problem by the Gilchrist cousins with the introduction of a basic lining in their experimental converter at Blaenavon. The location of Blaenavon for this development appears to be one of history's little quirks since - as every schoolboy used to know - it was Blaenavon iron which Bessemer first used for his experiments and to which their success was owed since that iron was low in phosphorus and could be treated in Bessemer's silica (acid) lined converter. Once other irons were used when the process was commercially launched, the phosphorus problem revealed itself and Bessemer was forced to refund much of the licensing money he had received. To alleviate the problem, Bessemer's approach was to set up his own steel- works restricting his use to low P iron. He recognised that iron from the NW of England was made from low P haematite ore and purchased his iron from the Workington Iron Company. Most history books conclude this solved the problem. One of the 'gems' revealed in this book is that the first trials with Workington iron were failures; it was not until Bessemer visited the ironworks that he saw the ore was being mixed with residues from puddling furnaces which were high in phosphorus and so contaminated the iron. When this was stopped, the acid converter could thrive.

The success of the Converter closely followed the growth of railways worldwide. At first, railway companies were reluctant to adopt Bessemer steel because of its early failures — John Ramsbottom, Chief Engineer of LNWR, is quoted as saying to Bessemer; '. . . would you have me tried for manslaughter?' — but the far superior wear characteristics of Bessemer steel won the day. The apocryphal story is retold that Ellis, a partner in John Brown's Atlas Works in Sheffield, surreptitiously took a gang of platelayers one dark night and replaced one of the wrought iron rails of the nearby Midland Railway with a Bessemer rail. This so outlasted the other rails that, when its origin was revealed, the superiority of Bessemer steel was recognised in this rapidly expanding market. Indeed, much of the reason for adopting the process in the USA from 1864 was to supply the enormous demand for rail, the low P ores of the Lake Superior region enabling Bessemer's acid process to be use.

Bessemer had competitors in the States who claimed similar processes. Kelly had developed a pneumatic

process, and Mushet's patent for adding spiegeleisen was also protected there. Andrew Carnegie played a predominant role in getting the process accepted, and later in preventing the adoption of the Thomas process to treat P ores by buying the exclusive rights from Thomas for \$275000 so as to protect acid Bessemer steelmakers from its competition.

In contrast, in much of Europe, the Thomas process was widely adopted and, although more expensive to operate due to the need to employ double deslagging, the value of the high P slag as a fertiliser was such that some ores were blended to increase the P content to enable the Thomas process to be applied.

The 150 page hardback book contains numerous illustrations, graphs and tables and an index. Price £25 (EU countries) (US\$50 elsewhere). *Sir Henry Bessemer: Father of the Steel Industry* Edited by C Bodsworth. ISBN 1 86125 054 1 1998 Published by The Institute of Materials, 1 Carlton House Terrace, London SW1Y 5DB, England. Tel (0)171 839 4071 Fax (0)171 839 3576.

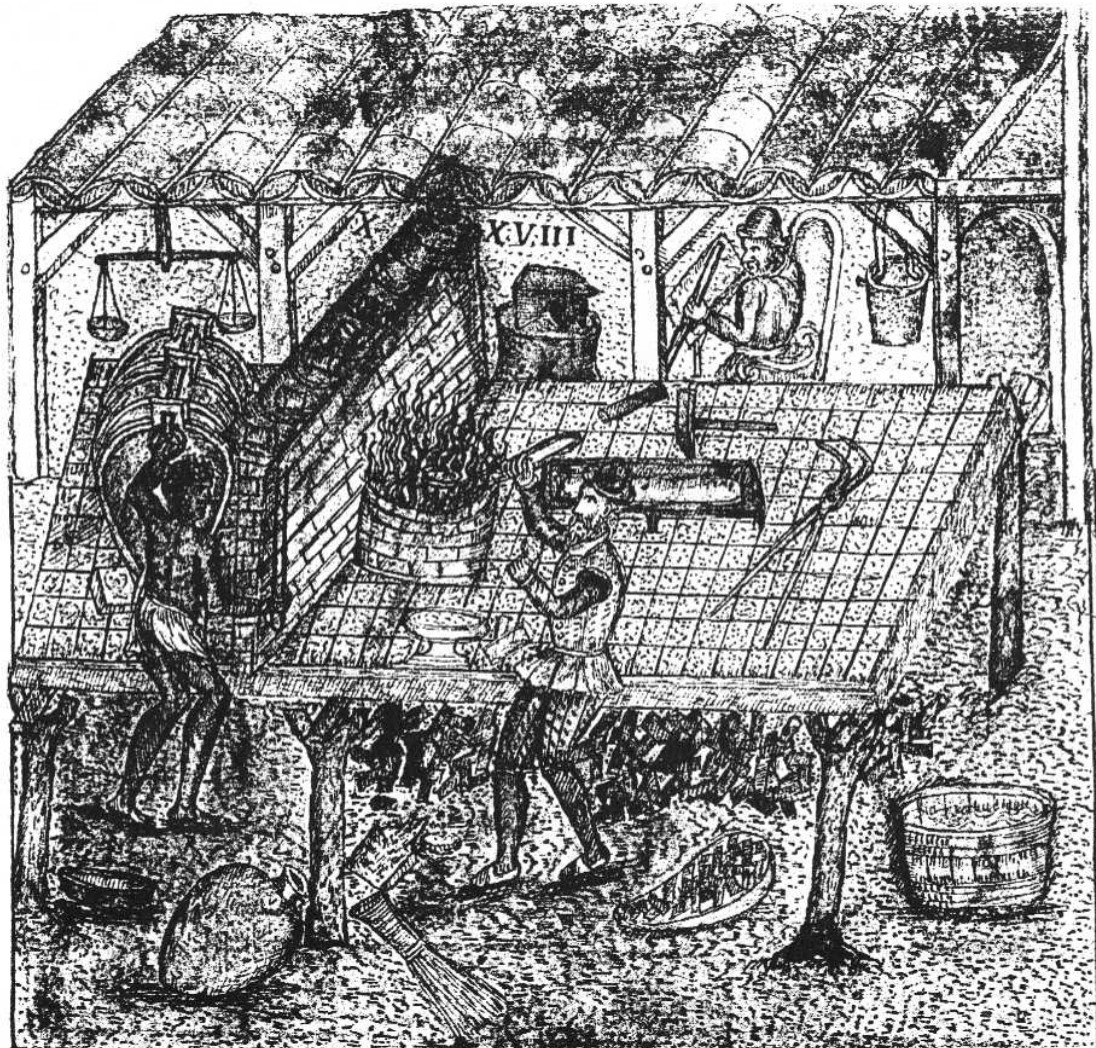
Reviewed by Tim Smith and reproduced with permission of Steel Times

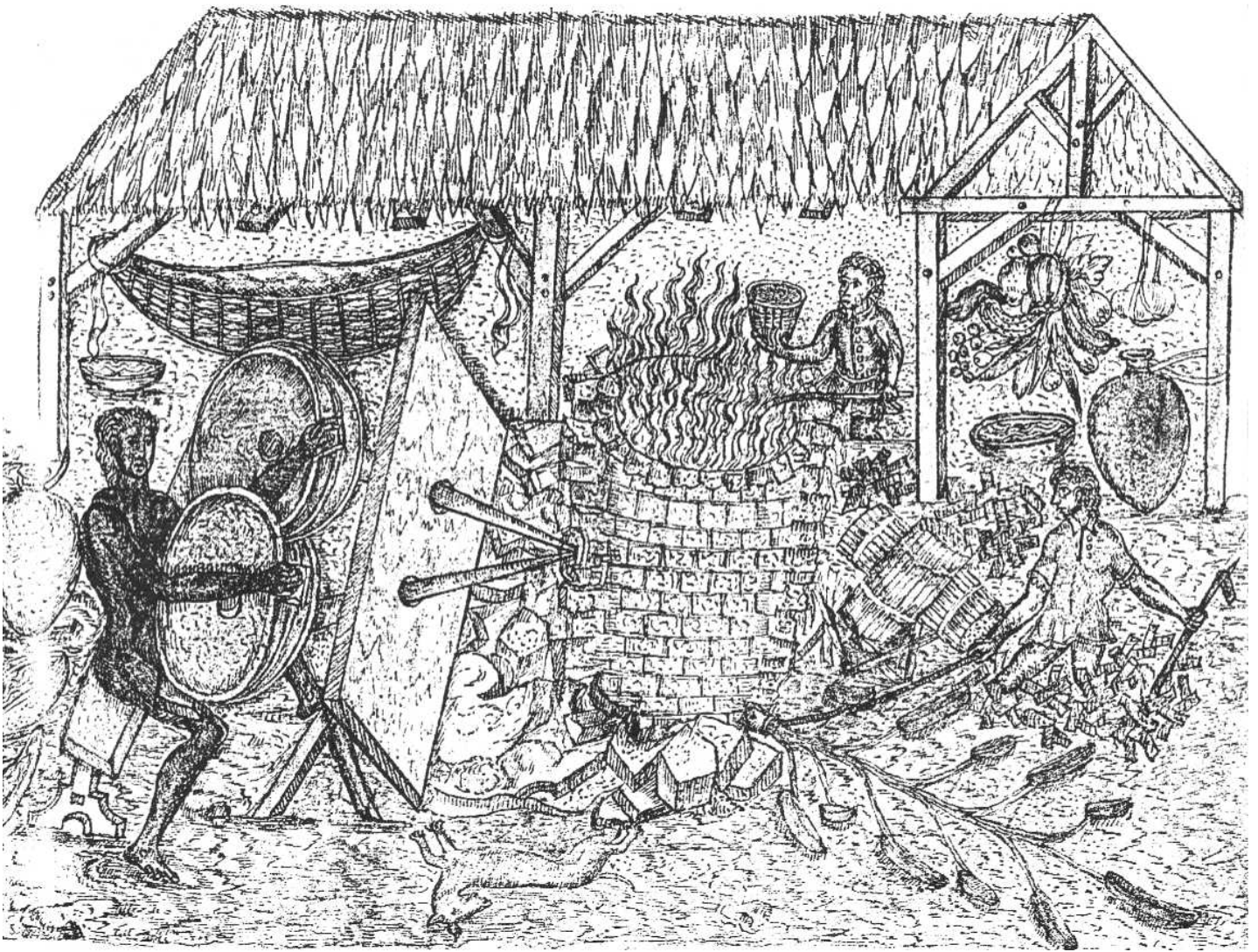
The Drake Manuscript

Published by Andre Deutsch ISBN 0 233 9909 7 Price £39.95 reproduces a full colour facsimile of illustrations in a 16th century book known as the *Histoire naturelle des Indes* now in the Pierpont Morgan Library in New York. It comprises 200 water- colour paintings of the flora and fauna of America and of the Indians and their habits. I must point out that there are only two illustrations that deal with metallurgy and we are indebted to the Pierpont Morgan Library for allowing us to reproduce them here.

It is not permitted or legal/or anyone, whoever it is, negro, Spaniard or Indian, to have a forge or furnace to smelt the gold coming out of the mines. They are obliged to bring it to the Royal Forge to

Below: The Royal or ordinary forge where the gold coming from the mines is made. Erected by the King of Spain to levy his tribute.





Above: The Furnace prescribed for the smelting of the silver coming from the mines

pay the tribute to the King of Spain which amounts to a fifth of everything. Having paid the tribute to the Major-Domo, called *Maitre d'hotel*, who receives the tribute he stamps the gold of the coins with the arms of the King of Spain in order to show that the tribute has been paid and adds above the value of the gold after it has been assayed, namely whether it is worth twenty, twenty-one, or twenty-two carats so the people know its price. When it is found that the tribute has not been paid, the gold is confiscated and everything else, such as silver, precious stones and pearls; before passing from the Indies to Spain, they must register at the contestation the amount of gold, silver, gems and pearls they take out of the country.

This furnace is placed high and is being heated with a great deal of wood and charcoal which is put inside. The Indians take two bellows and blow into them with great force to make the furnace hot. They

put the silver inside which is being melted and, in order to soften it, they throw a stone called *tuf* (or *tufa*), yellow in color, into the furnace which is very bright and has the capacity of softening the silver. They also put dead dogs and other carrion into the furnace and with the strong stench of the carrion and the help of the stone, they remove the bad quality of the silver, making it soft. When it has been melted, one of the Indians pierces the furnace with an iron rod through an opening at ground-level at the bottom of the foresaid furnace. The silver flows into the proper clay molds forming the silver plaques and bars. Also when the silver is so refined that it is even softer, they make *Reales*, the coins of Peru, from it which show the impression of a small cross and the royal arms of Spain. They usually trade with them, and if they do not have silver coins, they give the weight in silver of three *Reales* for two coins, all this being good revenue and value for the King of Spain.

The Book House

Ravenstonedale, Nr Kirkby Stephen, Cumbria CA 17 4NQ England. Published their catalogue 132 recently which included sections on Civil Engineering, General Industrial Archaeology, Mechanical Engineering, Mining and Geology, Metals and Metallurgy etc.

The Castle Bookshop Castle Street, Holt, Clwyd LL13 9YW published Catalogue 56 in February which has a large section on Archaeology. They also sell new copies of Archaeological reports at reduced prices. 56/A. Tel. 01829 270382

CHARCOAL PITS IN COUNTY DURHAM

Recent evaluation of medieval and prehistoric settlement sites in Upper Teesdale for the English Heritage Monuments Programme has drawn attention to the existence of a large number of charcoal pits in association with bloomery sites. Both the pits and the bloomeries were first recognised by Dennis Coggins and Ken Fairless. The pits occur in an area which is particularly rich in bloomery slag heaps. A portion of the charcoal pits are close to with the bloomery sites, but many appear to be spread more widely across the landscape, and probably reflect the distribution of medieval woodland.

The pits are visible as slight hollows about 2m in diameter and up to 4m deep. There is often a slight ring of spoil visible around them. They are identifiable as charcoal pits because of the charcoal-rich soil brought up by animal disturbance. I am informed by Peter Crew that these are the first charcoal pits to be found in the UK, although they are well known in association with bloomery sites in Scandinavia. At the time of writing more than 30 pits have been identified.

Dr. Tom Gledhill

1 Hylton Terrace, Rookhope, Co. Durham DL13 2BB

ATALAYA TOURS

Have a very interesting programme of tours in international mining regions through 1999 and offer a discount of at least 5% on the basic tour prices to members of HMS. Rio Tinto and Southern West Iberia, Greece and Cyprus, Mines of Northern Spain and Portugal, Germany, Western Britain, and Mexico. For details contact Atalya Tours Ltd, Ceinionfa, Capel Dewi, Aberystwyth, SY23 3HR, UK. or David Cranstone HMS Tour, 267 Kells Lane, Low Fell, Gateshead NE9 5SU if you are interested in the Mexican Study Tour he is arranging with Atalaya.

Correspondence

I must take issue with Tim Smith's interpretation of Rockley Furnace (HMSNews 40) The date of erection of Rockley Furnace (1652 not 1632) is firmly based on documentary evidence. It formed part of the Sheffield group of ironworks belonging successively to Lionel Copley (died 1675) and then Simpson, Heyford and Co., for whom it was managed by Job

Fell. In 1696 all the Yorkshire ironmasters agreed to operate all their furnaces in partnership and Upper Bank Furnace was immediately closed. In 1707 when the lease of Rockley Furnace expired it was not renewed and the rent saved was shared between the partners. After that the furnace was not used until 1726 when it was let to William Westby Cotton and Samuel Shore, the owners of Bretton Furnace and Kilnhurst Forge for 16 years. After that its history is obscure. Having been neglected for nearly 20 years, it would have needed rebuilding or at least very substantial repairs before they could use it. What happened after the end of that lease remains obscure. It is alleged to have reopened in 1799 using coke, but evidence from 1806 fails to corroborate this.

I however wholly agree with Tim Smith that the casting pit found when the furnace was excavated is unlikely to have been for casting ordnance. The records of the Board of Ordnance only record contracts for the production of iron cannon with ironmasters who can be linked with the Weald until the Seven Years War, though evidence can very occasionally be found of cannon being made elsewhere, for example for arming merchantmen. W.W. Cotton was a subcontractor to Miles Troughton of Sowley, Hants, in 1742 for the production of cast iron ballast bars in 1742, but they were probably cast like pig iron in the furnace floor, not a casting pit: the main function of Rockley, and virtually every other furnace was to produce pig iron for consumption in forges. Every forge had at least one hammer and anvil, which were made of cast iron and had to be replaced periodically. These 'necessaries' were made at many furnaces and would have been cast with iron tapped directly from the furnace. With quarter ton or more of iron to be transferred to the mould, it would have obviously be necessary that the top of the mould should be lower than the bottom of the hearth, and it would therefore be necessary for it to be placed in a casting pit. Furthermore before Abraham Darby's invention of a better way of making cast iron pots these were cast at many furnaces. Before his patent pots seem to have been cast in loam moulds, like cannon. And these moulds would also have been placed in the casting pit.

Peter King

49 Stourbridge Road, Hagley, Stourbridge, West Midlands

Select Bibliography:

P. Riden, A Gazetteer of charcoal-fired blast furnaces in Great Britain since 1660 (2nd edition, Merton Press, Cardiff), 103.

D.W. Crossley, Rockley Furnace and engine house 'Arch. J. 137 (1980), 445-7.

Sheffield Archives, Spencer-Stanhope Collections (examined by kind permission of S.W. Fraser esq. and the archivists at Sheffield and Bradford).

The Hon. Editor Amina Chatwin, The Coach House, Parabola Close, Cheltenham GL50 3AN. Tel (01242 525086) welcomes contributions for the HMSNews, by the end of February, June 11th, and November 5th. If possible on Apple Mac, or Ascii.

NEW MEMBERSHIP SECRETARY

Mrs Lesley Cowell 17a Thorncote Road, Northill, Beds. SG18 9AQ. or e-mail (marked for her attention) m.cowell@british-museum.ac.uk.