

Archaeometallurgical conferences in 1997

1997 was a good year for conferences, and we are pleased to present personal views of four of the best of them. Below are three shorter reports, while Tim Smith's account of the Jernkontoret anniversary conference follows. The geographical range and the diverse subject matter of these meetings demonstrate the increase in work on the history of metallurgy and the vitality of the subject; perhaps next year will be better still.

The Metallurgy of Prehispanic America: 49th International Congress of Americanists

The meeting was held in Quito, Ecuador, from 7-11th July 1997 and the participants came from Europe and USA, as well as several Central and South American countries. The scope of the papers covered all the metals found commonly in the prehispanic assemblage; copper, arsenical copper, bronze, gold, silver and platinum.

The conference was opened with a paper by Heather Lechtman (Massachusetts Institute of Technology) presenting new evidence for the production of arsenical copper throughout the Andean region in the first centuries AD for tools, pins and ornaments with arsenic contents up to 6%, but generally lower (1-3%). A distinctive nickel-rich arsenical copper has been identified in a zone to the south of Lake Titicaca. An interesting use of metal in building construction was illustrated by arsenical copper clamps cast directly into H-shaped grooves in adjoining rectangular stone blocks. Several other papers dealt with arsenical copper in areas including the Mantaro Valley, Peru (Anikó Bezúr, University of Arizona) and western Mexico (Dorothy Hosler, MIT). The question of deliberate choice of alloy for tools, bells and ornaments was discussed, as were the reasons for the replacement of arsenical copper by tin bronze, and also the evidence for trade in metals by land and sea.

Several papers discussed the conservation of base gold alloys and the particular problems of composite objects of copper, silver and gold, as well as metal combined with organic materials such as feathers and fabric, which are coming out of excavations of extremely rich shaft tombs at Sican on the northern coast of Peru.

A team from the National University at Buenos Aires reported on current excavations at an Imperial Inca period (1470-1530 AD) habitation site in Argentina where ceramic mould fragments for casting small copper and

bronze items have been found. A major handicap for the study of prehispanic metallurgy is the lack of controlled excavation. The majority of the metal artefacts, especially of gold, have no context, and with this lack of certainty the market is vulnerable to fakes. Karen Olsen Bruhns (San Francisco State University) gave a controversial paper casting doubt on the authenticity of two sheet gold diadems in the form of the sun, one of which is the chief treasure of the Museo del Banco Central of Ecuador.

However, The Gold Museum, Bogota has obtained ¹⁴C dates on charcoal from casting cores of gold objects with no excavation context, producing a framework of dates for the cultures of Colombia in spite of the lack of archaeological information.

Platinum was used by the cultures of Ecuador, north Peru and south Colombia as early as the 1st century AD. The then impossible feat of reaching the melting point of platinum (1769°C) was circumvented by sintering the platinum granules with a little gold dust in a very early practice of powder metallurgy. An example examined by David Scott (Getty Conservation Institute) showed evidence of having been worked and annealed without dissolving all the particles of platinum.

Electrochemical plating of copper with gold from solution without an external supply of current was practised around the third century AD in the Loma Negra region of northern Peru. Howe, Schorsch and Wypyski (Metropolitan Museum of Art, New York) presented evidence from metallographic examination of the objects and the results of replication experiments. Nigel Meeks (British Museum) discussed the non-equilibrium structures seen in cast tumbaga (base gold-copper alloys), the composition of placer gold from the Cauca river, Colombia and its use in making the many fish hooks which are found in the region. An interesting paper on the range of stone and metal tools in museum collections in Peru, all thought to be related to metalworking, was given by Paloma Carcedo (Lima). The stone tools included hammers and grinding stones for crushing ore, a fine polished stone anvil and flat faced stone hammer for beating out gold sheet, a touchstone with streaks of gold still visible, and shaped formers with designs matching those found on sheet gold ornaments.

I am very grateful to the Historical Metallurgy Society for a grant from the R F Tylecote fund towards the cost of attending this conference, where I presented a paper on the metallurgical studies being carried out on the British

Museum's South American collections, particularly on the gilding techniques. The conference proceedings will be published in three volumes of the *Museo del Oro Boletín*, Banco de la Republica, Bogota, Colombia.

In addition to the visit to Quito, Nigel Meeks and I were funded by the Royal Society and the British Museum to study the metal collections at the Gold Museum, Bogota, Colombia, and the main museums in Lima, Peru. This has resulted in setting up collaborative studies of Calima bi-metallic castings and research into the problems of identifying fakes. We also visited a mining area at Mt Chacaltaya, Bolivia where copper and tin were extracted until recently, at the breath-taking altitude of 17,000 feet. There is no surviving evidence at the site for ancient mining activity but the area is thought to have been a source of tin in the Inca period.

Susan La Niece

Metals in Antiquity

When 200 archaeologists from four continents all interested in metals converge in a single room some interesting things are bound to happen. This recent conference at Harvard University (10-13 September 1997) was no exception and the organisers should be congratulated. The original 'call for papers' seemed to promise a refreshing break from so many 'archaeometallurgical' conferences as this one would attempted to include technical studies along with the social studies of metals in antiquity. There was the usual dose of scientific papers which rarely went beyond analytical details and emphasised geological determinism and also the token anthropological studies to remind us that mining, smelting and metalworking are after all human activities and must be spoken of in those terms, not simply described by chemical composition. Nevertheless there were also some papers which integrated scientific analysis with an anthropological approach. It was the range of papers presented and the fact that for once it felt as though the boundaries between science and the humanities were being eroded which made this conference feel so special. Such enthusiasm isn't intended to give the impression that everybody there was slapping each other on the back. Conversely, much of the success was attributable to frank criticisms of what archaeometallurgy has become and what it should not be, in short, it seemed to identify the future agenda for the archaeological study of metals. Interestingly, the word 'archaeo-metallurgy' seemed to be as absent from this agenda as it was from the title conference. It is to the credit of those working in the field, and no doubt a sign of their maturity that the archaeometallurgists of old now realise they cannot continue to work in an area that has largely disinherited itself from its parent discipline to the point where in some

cases it is seen as little more than the metallurgy of old things. Like many conferences the true significance of the proceedings were only realised a week or two after returning from the conference.

The first session, 'Current research on ancient mining and archaeometallurgy', was a bit of a mish-mash of subjects but in many ways this was its strength as it was good to be in a session which dealt with a diverse range of subjects. These ranged from the perennial questioning of lead isotope analysis, and asking whether it is more a guide to technology than provenance, to the social organisation of iron production in Scotland as deduced from scientific studies by Effie Photos-Jones. The Greek world was well represented with papers by Bernard Knapp on the comprehensive work of the Sydney Cyprus Survey project and Evanthia Boaboula and Peter Northover who are conducting extensive metallographic work on Late Minoan assemblages. Ron Hancock also straddled the divide between archaeometallurgy and entertainment in telling us of his deep understanding of the correlations he found in bivariate plots for copper alloys from two 17th century sites in southern Ontario, Canada.

The second session, 'Mineralogy and geochemistry of ore deposits and ancient extractive metallurgy', was much more tightly focused on the geochemistry of ore deposits. Papers which stood out included the thorough work of Rob Ixer and the plea by Richard Thomas for archaeometallurgists to change their ways or perish. One paper, which to my mind was one of the best in the whole proceedings, was perhaps not best placed in this session. This was the work of Sharada Srinivasan who effectively demonstrated how useful lead isotope studies could be when thoroughly integrated into archaeological work and appraised by a competent archaeologist. Her methodology of integrating lead isotope and good typological studies should act as a lesson to everyone on how such techniques can be brilliantly effective and simultaneously archaeologically important.

The session on 'Reconstructing ancient metal production and use' was probably the most important one of the conference. Yanni Bassiakos and Olga Hadjianastasiou presented the earliest evidence for Early Bronze Age copper smelting on Kythnos. The implications of these findings are monumental and will redefine our understanding of Early Bronze Age society in the Aegean. Equally spectacular was Lena Kassianidou who continues to present very important evidence from ongoing research in Cyprus which for the first time ever gives us an insight in to both social and technical aspects of copper production in the later Bronze Age. Izumi Shimada and John Merkel spoke on precious metal alloy selection in Sican society and other tremendously important aspects of work carried out by them at the site of Batan Grande and elsewhere in

Northern Peru. Billy O'Brien gave a lucid account of work and post excavation results from Ross Island and was an excellent example of how a firm archaeological perspective is vital in archaeometallurgical studies.

In addition to these site-specific studies Boutron *et al* showed how ice cores could act as archives of past metallurgical activities. The sensitivity of the instrumentation used was impressive as was the general trends in the results. Although fascinating, interpretation seemed to be framed solely in terms of what was happening in the known ancient world and Europe, whilst ignoring possible causes from elsewhere, *ie* South America, Africa and China.

The 'Social context of ancient metal production and use' session contained a pleasing number of papers which, on the whole, were equally pleasing in quality. There was a healthy mix of ethnography, reconstruction experiments and archaeology. Important contributions came from Stephen Shennan, David Killick and Sandra Westover. The first two dealt largely with ethnography. Shennan spoke of African palm oil producers and suggested it as a novel way of escaping from the 'rational' economic models we too often 'paste' on to the past. In this case he used it as a new way of thinking about the social circumstances of copper producers in the Alpine region during the Bronze Age. Killick's ethnography reminded us of the great variation possible in a single smelting and between smeltings using similar tuyeres and furnaces. Certainly a reminder to the more scientific amongst us to think in terms of the range of material compositions rather than simply average compositions. Sandra Westover's paper was innovative and brave and sets itself apart from the more traditional approaches to metallurgy in the Classical world. The scale of her analysis, although extensive, was supplemented by a necessary level of detail which made her contextual analysis of metallurgy and sacrifice a meaningful one which will be of certain interest to all classical scholars.

The conference ended with a workshop on the analysis of metals. This focused explicitly on new techniques using ICP-MS and LAICP-MS. The workshop proved to be an excellent introduction and critique to the subject, even though the manufacturer's representative repeatedly fell into a predictable sales pitch. The benefits of laser ablated ICP (LAICP) will be indispensable to the archaeology and museum worlds although it seemed that this technique can still not be used as a quantitative technique! Nevertheless, future work will obviously focus on techniques such as this.

To sum up, there were perhaps two clear lessons the conference taught me. The really interesting work is taking place at single site or at most a regional level. Projects

which are conducted at a large scale are generalist and of little relevance to the archaeology which is being practised today. Secondly, despite new advances in instrumentation, the real advances in archaeology are going to arrive with the asking of interesting questions, not simply the acquisition of instruments with increasingly lower detection limits.

Roger Doonan

Early Ironworking in Europe

Those who think seven days excessive for a conference restricted to the study of ancient ironworking would be surprised at the breadth and scale of research being carried out in this topic across Europe. As usual this biennial conference (September 1997), under the auspices of the Comité pour la Sidérurgie Ancienne, brought together specialists from across Europe — an impressive 17 countries were represented. The subtitle of the meeting, 'Archaeology and Experiment', provided the two major themes for the conference whilst the 'Technical Studies' session allowed an opportunity to look at a wide range of laboratory and field-based scientific studies.

The main theme for the conference was the interplay between archaeological evidence and that from experimental ironworking. Radomir Pleiner considered the aims of people undertaking reconstructions. These ranged from a desire simply to produce iron, through opportunities to popularise the subject to well organised trials directed at particular questions. All these aspects were well represented in the subsequent papers which discussed the relative success of bowl furnaces, shaft furnaces, blast-furnaces and historical Basque furnaces, forced blast, natural draft, single tuyère, multiple tuyère, rock ore, bog ore, bog ore with phosphorus ... and so on. A spirit of intense rivalry, not seen in any other area of the conference, was apparent. The spirit of *Jeux Sans Frontières* continued outdoors with the Welsh and Swedish teams competing (shaft furnaces at 10 paces) in front of enthusiastic spectators. Meanwhile, Hector Cole, who had earlier described the working up of a bloom of iron as 'like playing a fish', showed his smithing skills using a portable forge in the apparently effortless production of replica medieval arrowheads.

From the 50 papers presented it was possible to identify further themes. In his opening speech, Peter Crew identified three topics; the occurrence and use of bloomery steel, the question of wind assisted or natural draft furnaces, and the increasing evidence across Europe for early blast-furnaces. The latter included details of the recently discovered first Swiss example (Taube and Serneels), and reports on two more in the Märkische Sauerland (Jockenhövel and Willms), which join a

scattering of other sites in Germany and considerable body of data from Sweden. The increasing weight of evidence contrasts strongly with our knowledge only a few years ago, when the first Swedish remains of a blast-furnace dating back to the 13th century caused considerable controversy.

An important indicator of the maturity of the study area was shown by the recognition of biases in the data available. Examples included the realisation that magnetic surveys in Denmark emphasise slag-pit furnace technology (Voss) and that French historical sources have previously led to assumptions of medieval date for unexcavated sites (Braunstein). More alarmingly, we were warned that in Italy archaeologists tend to disregard the importance of all technological sites (Tizzoni). A further reminder of biases was provided by some of our visits to excavated sites, where most archaeologists without Peter Crew's specific interest in iron working would have failed to recognise the often frail structures associated with primitive iron smelting and smithing.

Pre-Roman Iron Age iron production was not widely covered at the conference: probably reflecting difficulties in identifying sites. This was clearly not a problem with some major production sites in later periods, for example the late Roman site of Les Oulches in France, with six thousand cubic metres of slag (Dieudonné-Glad) and the three million tons of slag estimated from three sites in north-eastern Bosnia, which supplied the Roman frontier in Pannonia (Durman). Such centralised production was contrasted by contemporary use of iron in Roman Switzerland (Doswald). Evidence of blacksmithing was widely dispersed throughout virtually all settlements, operating in small workshops associated with other crafts.

The Technical Studies sessions presented a good range of problem-led investigations. These included highly innovative techniques, such as the micro-diffraction analysis of slag inclusions extracted from iron artefacts (Dillmann and Fluzin) to various applications of standard analytical and geophysical techniques for purposes of dating, provenancing, location and understanding of iron production.

Apart from the high standard of the papers and posters, there were many reasons why this meeting was so successful. Another highlight was the film *Inagina* which recorded a traditional iron smelting in Mali. Ethnographic documentaries of iron smelting are not uncommon, but this was remarkable, not only in the quality of production but in the sensitivity with which it balanced the traditional views of the smelters with the anthropological and technological interpretation of the procedure. Perhaps the most unexpected feature of the meeting, was glorious sunshine, not normally expected of Snowdonia. This added considerably to a wide range of site visits, which included Peter and Susan Crew's own ironworking sites in the Snowdonia National Park, and a trip to the Great Orme Bronze Age copper mines. More recent industry was represented by a working slate mine and the Ffestiniog railway, not to mention the conference venue; the Snowdonia National Park Field Centre, Plas Tan y Bwlch. This had formerly housed a slate quarry owner in considerable style but provided impressive conference facilities, comfortable accommodation, good food and efficient organisation in a truly impressive setting. Peter and Susan Crew are to be congratulated and thanked for making the meeting a great success.

David Starley