

Conference reports

Bloomery smelting during 2000 years

In hosting the 1991 conference of the Comité pour la Sidérurgie Ancienne, Arne Espelund and his colleagues from the University of Trondheim provided a stimulating program of lectures, excursions, experimental smelting and social events for over 120 participants from 20 nations. The chosen venue was the small community of Budal in the mountainous region of Trondelag, central Norway.

The lecture program comprised three sessions, divided geographically. The first considered bloomery ironmaking in the local and general Norwegian context and provided a setting for Dr Espelund's own research in the area. The contributors were: O Nilsen: The bedrock geology of the Budalen area; A Bakken: The quaternary geology of Budalen; A Espelund: Bog iron ore for the bloomery process; T Solem: Effects of early iron production on vegetation — A study by means of pollen analysis; A Espelund: A retrospective view of direct iron production; L Stenvik: Iron production and economic "booms" during 2000 years; O Stemshaug: Place name evidence of bloomery ironmaking in Norway; G Blom: Iron in Medieval documents and literature.

The first three papers provided a detailed geological context for iron ore extraction in the Budalen region. A further five papers demonstrated the potential contribution to the study of iron production from such varied approaches as palynology, metallurgy, field survey and excavation, and the study of place names and literary sources. Although these papers were given in Norwegian, all delegates had, with admirable efficiency, been presented on arrival with the English translation in published form. This forms Volume I: "Ancient Ironmaking in a Local and General Norwegian Context" of the three volumes planned for the conference proceedings under the general title "Bloomery Ironmaking during 2000 Years" and is available from Arne Espelund, Budalseminaret, N-7034 Trondheim.

A second, shorter, session broadened the geographic limits to Sweden, Denmark, Iceland and the Faeroes. The five papers, presented in English, were: M Hermanns-Audardottir & T. Fridriksson: Former ironmaking in Iceland; S Arge: Iron in the Faeroe Islands; O Voss & V Buchwald: Iron production in Denmark in Viking and Medieval times; A Odman: Castles and iron in northern Scania; I Martens: Iron in eastern Norway in the Early Medieval period — Recent

investigations and some current problems; A Espelund: Mellagertomta in Trondheim — a Medieval metal Workshop. Whilst each of these papers concentrated on regional developments, a general picture emerged of shifting patterns of production and dependence on imports within the Scandinavian sphere of influence. This was seen against a background of steadily increasing demand for iron, to support expansion to the islands of north-west Europe and urbanisation within Scandinavia. These papers will be published early in 1992 as Volume II of the conference proceedings: "Iron in the West Nordic Area During the Middle Ages" which will also include details of the experimental smelt carried out in the Evenstad furnace.

In the final session the seminar moved away from local iron production and a miscellany of international contributions were heard. This was, for me, the least satisfactory session. Despite some last minute rescheduling, very little time was allowed for each paper. Presentations were given in French, German or English with scant opportunity for discussion or clarification between. The papers were: R Pleiner: Punch marks on High Medieval iron artefacts; M Mangin: La production du fer dans la Gaule de l'Est — Les districts sidérurgiques antiques de Bourgogne et Franche-Comte; P Benoit: Les forges des mines en Moyen Age et a la Renaissance — Approche palaeometallurgique; C Blair: Experimental smelting in a Burgenland type furnace. A Williams: Slag inclusions in armour plate (1400–1640); J Peets: Eisenverhuttung auf der Insel Saaremaa im 11.-14. Jahrhundert; P Crew: Currency bars with welded tips; H Laumann: Eisenherstellung und energie-Am beispiel Siegerland. R Leineweber: Romerzeitliche eisenverhuttung in der Altmark — Archaeologie und experiment; G Sperl: Die metallurgie phosphorreicher eisenerze — Am beispiel Burgenland und Joldelund; P Arrias: Structures of iron samples from a Catalan forge in the Pyrenees. These papers will be published later in 1992, as Volume III of the conference proceedings, which will also include the results of the excavation of the Storbekkan furnace.

The conference was dedicated to the memory of Ole Evenstad who, in 1782, published a detailed description of the construction and operation of an open pit bloomery furnace. It was fitting therefore that a reconstruction of this furnace was made for the meeting. Using very fine, locally extracted, bog ore with pinewood for fuel, a bloom of iron was produced by Ivar Berre, part of which was subsequently forged by Heinz Denig.

Lecture sessions were interspersed with excursions and social events. The first excursion included the partially excavated remains of two Roman Iron Age slag pit furnaces at Storbakken and a reconstructed traditional farmstead at Storbekkoya Museum. A mid-conference break from ferrous metallurgy was provided by a coach trip to the historic copper smelting town of Roros. Founded in 1644, smelting ceased only recently and

work to preserve this remarkable industrial landscape is well advanced. In the Smelthytta Museum 1:10 scale models have been used to great effect to demonstrate the techniques of mine engineering and smelting processes used.

A final excursion brought us full circle to the opening themes of the conference; to look at bog iron ore sources in the locality of Budalen. From there we moved on to see pitfalls for trapping moose and finally stopped for refreshments at a traditional mountain summer farm, a rare survivor from the past, transhumant, lifestyle of the Alpine region.

On the whole the conference was well-conceived and efficiently run, for which the organisers deserve credit. Additionally the residents of Budal should be thanked for the warmth of their hospitality towards the participants.

I should like to express my gratitude for the award of a R F Tylecote Travel Bursary towards my expenses in attending the conference.

David Starley

The 1st International Colloquium on 'The Role of Chemistry in Archaeology'

This conference was held in the Birla Science Centre, Hyderabad, India from 15–18 November, 1991. As the title suggests, the meeting was primarily concerned with conservation but there were some diverse and interesting papers touching on metallurgy.

Annie Howell, based in Hyderabad with the British School of South Asian Studies, spoke on the preserved organic remains in metal corrosion products. Professor E V Gangadharam of the Centre for Marine Archaeology, Amdhra University, Waltair Kiskhapalram, described work on the wreck of the *Voc Rispan* which sank in 1727 off Malaysia. The cargo included unusual tin ingots which, although quite small, had clearly been formed by pouring molten tin around still smaller solid ingots. Professor Rierderer of the Staatlicher Museum, Berlin, offered a paper on the composition of Nepalese and Tibetan bronzes.

O P Agrawal, Hari Narain and Jai Prokosh of the National Research Laboratory for the Conservation of Culture and Historical Property, Lucknow, U P, described the metallographic study of iron found on the Iron Age site of Khairadh, U P, which was occupied about 2,000 years ago, and other contemporary sites. Their results suggested that the technology was basically that of forging and welding wrought iron, some of which had a low carbon content. There was no evidence for quenching or tempering. Paul Craddock gave a paper on a comparison of the traditional zinc smelting processes in India and China and his colleague L H Gurjar of Hindustan Zinc, showed a film of the project.

Hyderabad is now the centre of the Bidri-making craft and the opportunity was taken to record the process. Bidri is made from an alloy of about 95% zinc and 5% copper. The alloy is cast into vessels, plaques etc. and then inlaid with silver and the surface treated to produce a rich matt black patina over the alloy which acts as a perfect background to the silver. The technique is believed to have started about 600 years ago in the nearby city of Bidar, which was also visited. A number of representative pieces of modern bidri ware were bought for the British Museum collection.

About 200 km to the north of Hyderabad, in the Niziamabad district, are the sites of crucible steel making, in particular the small town of Konasamudram which Vosey visited and described in the early 19th century. Konasamudram is now a rather sleepy place, well off the beaten track, with little to suggest its past beyond some rather good vernacular architecture and great heaps of used crucibles, lids, tuyeres, furnace lining and slag. Even the mud walls of the houses are full of refractory fragments. The opportunity was taken to examine and photograph a selection of this material for comparison with that already seen in Sri Lanka and further south in Karnata.

Wrought iron was heated in rather squat crucibles with heavy conical lids. These were a variety of sizes and were apparently fired together in large furnaces. There is no mention of any charcoal being added, but even so the carburised iron melted and formed the Wootz or crucible steel so prized by Persian and other swordmakers.

The award of an R F Tylecote Travel Bursary towards the expenses of attending the conference is gratefully acknowledged.

Paul Craddock