

# Conference reports

## Golden conferences

Archaeometallurgical research is justifiably dominated by studies of the production and processing of copper and iron and their alloys. Gold and silver, outside the numismatic world, have perhaps not received the metallurgical study that they should and are too much the province of the art historian. In recent years this has changed dramatically and two recent conferences have shown just what is going on across Europe.

In September 1993 a NATO Advanced Research Workshop on **Prehistoric Gold in Europe** was held at Seon in Bavaria. This was in association with a Stiftung Volkswagenwerk-funded project on gold sources in Bavaria and Bohemia and their exploitation in Celtic Iron Age times; there was also a link with the *Keltische Jahrtausend* exhibition in Rosenheim. The proceedings of the workshop are now published (G Morteani and J P Northover (eds), 1994, *Prehistoric Gold in Europe: Mines, Metallurgy and Manufacture*, NATO ASI Series E, Vol. 280. Dordrecht: Kluwer Academic Publishers, ISBN 0 7923 3255 5 — to be reviewed in a forthcoming issue of *Historical Metallurgy*). NATO rules mean that the publication is entirely in English though the contributors were from a number of different countries.

The meeting had four principal sections: the place of gold in ancient society; the sources of precious metals in Europe and their formation; the composition and metallurgy of ancient gold and its alloys; and goldsmithing techniques in prehistory. Highlights were the descriptions of Iron Age gold mines in the Limousin in France and Iron Age gold washing installations in Bohemia, the elucidation of the use of Celtic coin moulds for making blanks for gold coins, and a number of papers emphasising prehistoric goldsmithing skills, especially in Iberia. Also useful were discussions of the geochemistry and geology of gold, and some regional reviews of A Hartmann's published Bronze Age gold analyses. These can now be seen to present a story of similar developments right across Europe, a question that needs further study.

Some of the goldmining activities in Bohemia mentioned above are now linked by a historical trails and a theme park where the public can do their own panning. For further information contact: Jiri Waldhauser, Narodni Technike Muzeum, Kostelni 42, CS 17078 Praha 7, Czech Republic.

In November 1994 a meeting was held in Limoges, France in association with an exhibition about the excavation of the Iron Age gold mines in the Limousin, and with a field trip to what is left of these mines. The excavations had been rescue digs ahead of modern opencast gold mining; the modern production in the area is two tonnes per year with reserves for several years yet. There were two phases of ancient mining within the La Tène period, the first opencast and the later one underground as well. As the veins were followed downwards the drainage problems were solved by digging adits through the side of the hill containing the vein; these adits survive in good condition. The lower parts of the mines had to be fully timbered and this timbering survives in very good, waterlogged condition. Settlement and processing were adjacent to the mines with roasting beds, crushing and washing areas, crucibles and even a touchstone being recovered.

The excavator, Beatrice Cauuet, can be reached at: URA 997 CNRS, Universite de Toulouse Le Mirail, 5 allée Antonio Machado, F-31058 Toulouse cedex, France. She has written a small booklet about the project: *Les mines d'or gauloises du Limousin* (Limoges: Association Culture et Patrimoine du Limousin, ISBN 2 9507521 6 0).

In contrast to the Seon meeting there was more emphasis on archaeological and ancient history aspects of gold, and the place of gold in Bronze Age, Celtic and Roman societies. There was also an excellent presentation by Barbara Armbruster on present day non-industrialised gold mining and smithing in Niger and Mali. It is planned to publish proceeding of the conference with colour pictures of the gold objects discussed on an accompanying CD-ROM.

Other recent events have been the Greek Gold exhibition and conference at the British Museum in October 1994, with a good day of technical discussions, and the building of a new treasury and exhibition for prehistoric to Viking gold and silver at the Statens Historiska Museum in Stockholm.

Peter Northover

**The social organization of the European iron industry, 1600-1900** (Session C32 of the 11th International Economic History Congress, Milan, September 1994).

The economic and technological history of ironmaking in the early modern period is now fairly well understood

for many areas of Europe. Yet the social organization of production is virtually unexplored — ‘social organization’ being taken to mean the ways in which the deployment of ironmaking technologies was determined by the political, legal, institutional and cultural conditions in which iron production took place. Quite clearly, the making of iron has never been a socially neutral process; it has been profoundly affected by the ways in which power is distributed between different social groups and institutions and the ways in which power is exercised. How this has happened historically was the subject of a session at the 11th International Economic History Congress.

The session involved approximately twenty-five scholars considering centres of pre-modern iron production from Britain to the Basque Country, from Italy to the Urals. The starting point for most contributions was the nature of property rights and the extent of civil freedoms in iron-making areas. Much of Europe during the period under review was subject to feudal or quasi-feudal jurisdiction. This was of crucial importance in determining the ownership of — or at least, access to — mineral and fuel resources, and hence in determining who had the right to produce iron. Moreover, the gathering and transportation of ore and charcoal was often the lot of a peasantry subject to feudal obligations. In such circumstances the ability of the peasantry to resist the exactions of the nobility could have a considerable bearing on the success of the production process. Elsewhere the owners of ironworks had to contend with the fact that the iron mines upon which they depended were the communal property of ‘free’ miners who were not easily coerced into supplying the necessary ores. This was one of the themes of the paper by Raphael Uriate (Universidad del Pais Vasco, Bilbao, Spain): ‘Preindustrial ironmaking technology and social organization in the Basque Country’. Indeed, the essential mineral and vegetable inputs upon which iron production depended were produced by a peasant class which derived its subsistence from a variety of different sources. Ore and charcoal were often produced as a means of eking out the bare living to be had from agriculture. Mining during the winter months could supplement the meagre returns from the land. Charcoal production could likewise be undertaken on a seasonal basis, when agricultural tasks were at their lightest. Yet it follows that the relative prosperity of the peasantry could have a significant effect on their willingness to submit to the demands of ironmasters: if crops were bountiful, the less inclined would the peasantry be to devote themselves to charcoal production or mining.

The agrarian context of iron production and its wider ecological setting have always to be appreciated. The issue of iron production was not, however, just a matter

for an enclosed rural world. Iron was a vital international commodity, and its production and trade a source of tax revenue. As such it was a matter of concern to the state, and there is plentiful evidence of the degree to which European states sought to govern the environment in which iron was produced and exchanged. Sweden provides a particularly interesting example. The entire framework of iron production in Sweden was transformed at the behest of the state in the course of the 17th century. The technologies employed and the social groups responsible for iron export were closely controlled by a state anxious to maintain the competitiveness of Swedish bar iron on international markets. The peasantry in the central mining district (the Bergslagen) was restricted to the lowly and unremunerative role of supplying charcoal and pig iron to a more capitalised and internationally orientated set of bar iron producers drawn from the ranks of the nobility and mercantile classes whose forges were built in a zone beyond the Bergslagen — one of the processes elucidated in the contribution of Anders Florén and Göran Rydén (University of Uppsala, Sweden): ‘Social organization of the Swedish bar iron production, 1600-1880’. Yet this was no simple process, for the Swedish governing class had to contend with the fact that the free peasantry were represented in the national Diet and therefore could invoke some sort of institutional protection against their subordination, as was made clear by Maria Sjöberg and Maria Ågren (University of Stockholm and University of Uppsala, Sweden) in their paper ‘State, peasantry and iron production in early modern Sweden’. The political influence which iron producers could wield was always a matter of great moment for the success of their industry. In 18th century Britain ironmasters formed a relatively cohesive lobby group, but one which was hard pressed to resist the clamour of iron consumers, most notably hardware manufacturers, for an extension of iron production in the American colonies. Indeed, in the 1740s and 1750s some heretical members of the ironmaster community were prepared to contemplate the abandonment of iron smelting in the British Isles and to concentrate on the refining of American pig iron instead, devoting scarce charcoal resources to the high value-added forge sector. This would have meant the reconfiguration of iron production in the British empire on a transcontinental scale. But how else, it was asked, was the shortfall of iron in Britain to be made good? The only alternative was a still greater dependence on Baltic iron. However, the success of coal-based technologies in both smelting and refining from the 1750s resolved the dilemma and restored unity to the iron trade, facilitating ironmasters’ resistance to successive attempts to tax pig iron production in the late 18th and early 19th centuries. This was the subject of the paper by Chris Evans (University of Glamorgan, UK), ‘The corporate culture of the British iron industry

1650-1830'.

Schemes for the spatial re-distribution of iron production — some abortive, some successful — pose the question of how technical knowledge was transmitted. Technique in this period, it is quite clear, was embodied in flesh-and-blood ironworkers and not in scientific treatises. As a result, the transmission of technique depended upon the migration of workers. Occasionally, it is possible to find documentary sources to illuminate the process. Thus, the movement of master ironworkers from the mining basin to the north of Bergamo can be traced throughout Italy and the Alpine region during the 17th century. Their characteristic smelting practices, involving the seasonal use of smelting plant in mountain encampments, were, for example, established in the Dauphiné in the early years of the 17th century and long remained distinct from the mainstream of metallurgical technique in the rest of France. Moreover, with their migratory habits the Bergamasque ironmasters were instrumental not just in transmitting technical information, but in introducing new social mores into apparently isolated mountain communities. Evidence for this was presented by Marco Tizzoni (Università degli Studi di Bergamo, Italy) in his paper 'Bergamasque iron-working masters in Europe and their function in their native communities during the 17th century'.

Communities of ironworkers were often mobile, but were they always necessarily cosmopolitan? The evidence from France suggests otherwise. The presentation of Denis Woronoff (Université de Paris 1, France), 'Entre famille et village: la structuration de la main d'oeuvre de la sidérurgie française, fin XVIIIe siècle – début XIXe siècle [Between the family and the village: the structuring of the workforce in the French iron industry at the end of the 18th and start of the 19th centuries], revealed that furnace and forge workers, secluded in forest locations, were markedly endogamous and showed little affinity with the milieu in which they were implanted. As a consequence there were constraints on the speed at which the labour force could be expanded and the facility with which new techniques could spread. Particular forms of expertise were the property of quite small groups of families, and the transplantation of techniques into new regions depended entirely upon the movement of these key workers. It seems to have been the case, for example, that the diffusion of the slitting mill in France was effected by the repeated migration of families of slitters from Normandy, the province into which slitting technology had been introduced from the Low Countries in the late 16th century. While a circulation of labour within France seems to have taken place on a regular basis over many decades it was not a truly national phenomenon: western and eastern France

comprised two separate circuits, involving entirely different sets of ironworking families. Evidence for this was provided by Jean-François Belhoste (Inventaire Général, Ministère de la Culture, France) in his paper, 'Dynasties de maîtres de forges et d'ouvriers du fer (1600 et 1800). Origines, renouvellements et rôles dans le transfert des techniques' [Dynasties of ironmasters and ironworkers in France, 1600-1800: their origins, renewal and importance in the transfer of techniques].

As has been noted, French ironworkers appear to have been notable for their social isolation, their mobility notwithstanding. But isolation should not be confused with weakness. As an elite workforce in secure possession of their skills, French forgers and founders enjoyed a strong bargaining position with their masters. Indeed, endogamy may have been adopted as a conscious strategy to restrict the flow of labour into the iron trades. Moreover, French ironworkers enjoyed legal freedom. This was not necessarily true of their counterparts elsewhere. Most forge workers in upper Hungary in the 17th and 18th centuries were serfs who were obliged to pay customary fees to their landlords. They were nonetheless free to change the forge master under whom they worked after a given period of notice, without reference to their landlord. The situation of workers in the Urals was considerably worse. They were serfs who belonged to the proprietor of the mining district to which they had been assigned. They might know a high degree of mobility, but that mobility was not of their choosing. Serf-ironworkers were transferred between different works within a mining district according to the *fiat* of their proprietor, much as if they were inanimate equipment. This does much to explain the penal quality of metalworks in the Urals, and the resort which workers had to theft and plunder as a means of resistance. Russian ironworkers did exercise considerable metallurgical expertise, but could not do so independently of the works owners. This was one circumstance which structured the take-up of new technology in the Urals, another being the concern of the state to preserve state-owned resources. The state was the proprietor of the best part of the ore, forests and lands devoted to iron making. Accordingly, the Mining Management Board would only licence new plant and new techniques that would not increase aggregate fuel consumption. The contrasts between these two eastern European centres were conveyed in the paper of Akos Paulinyi (Technische Hochschule Darmstadt, Germany) 'Die eisenerzeugung in der Slowakei vor der Industrialisierung (16. bis 18. Jahrhundert)' [Preindustrial ironmaking in Slovakia from the 16th to the 18th centuries], and that of V G Zhelezkin and S V Ustiansev (Institute of History and Archaeology, Ekaterinburg, Russia), 'Control over production and technological evolution in the Ural iron industry between the late 18th and mid 19th centuries'.

The Ural region provides a striking instance of how political priorities and social organization could determine the choice of technology. Other contributions to the session stressed the great diversity of techniques at use in Europe during the period under consideration and the dangers of assuming that 'bigger and better' technologies were predestined to supplant older and more modest methods. The coal-rich Low Countries were host to a number of overlapping specialised metal-working zones in the 17th and 18th centuries. The Charleroi-Namur basin and the Duchy of Luxembourg were studded with furnaces and forges, with a spread of plating and slitting mills, while the Principality of Liège was known for the multiplicity of its small metal manufacturing workshops. Production would be conducted in a bewildering variety of organizational forms — artisanal, *verlagsystem*, centralised, or according to some unique hybrid. The advent of steam-powered mass production technology, famously pioneered at Seraing by the Cockerill family, did little to eradicate small units of production. On the contrary, the processing and manufacture of iron in small workshops flourished as never before. Old production networks proved to be flexible and responsive to new market opportunities. There was no simple, linear route towards modernity, as was explained by René Leboutte (Institut Universitaire Européen, Florence, Italy) in his submission 'La forge et l'usine. Complémentarités de l'organisation du travail dans la sidérurgie wallonne aux XVIIIe et XIXe siècles' [The forge and the factory: organizational complementarities in the Wallon metal industries during the 18th and 19th centuries]. Similarly, the charcoal-fuelled iron industry of north-west Germany did not simply wither in the face of the challenge from the more 'advanced' iron and steel plants of the Ruhr during the 19th century. Rather than abandon charcoal smelting as an obsolete relic, ironmasters in the Harz mountains made innovations of their own, adapting the hot-blast and other fuel-saving procedures to a technological form that was of considerable age but far from redundant. As was explained by Michel Mende (Hochschule für Bildende Künste Braunschweig, Germany), in his paper 'Survival

in an age of constant expansion: north-west German iron industries in transition, 1850-1900', this, and a concentration on niche markets, gave charcoal smelting a surprising longevity. The strength of seemingly marginal technologies, employed on a small-scale basis, was also apparent in the town of Lecco in Lombardy. After the exhaustion of local ores, metalworking in the town during the 19th century was based upon the recycling of scrap iron. Production was carried on in forges operated in a cooperative fashion by small producers, each of whom bought or inherited the right to work the forge for a portion of the year. It was undertaken by a highly skilled set of workers who were bound together by a clannish sense of collective identity and honour. These workers have also to be situated within a varied industrial and agrarian context. Many metalworkers held plots of land in the vicinity of the town, upon which they worked for part of the year. And many were married to workers in the silk industry, the chief source of female employment in the town. All in all, a mix of activity and income enabled the metalworkers of Lecco to survive, even to flourish, in the shadow of the state-sponsored steel industry. This was a complex urban world, embracing a variety of industrial activities, which was analysed by Andrea Colli (Università Bocconi, Milan, Italy) in 'The iron society: the metalworking district of Lecco (1815-1915)'.

At the concluding meeting of the session it was decided to establish a permanent research network devoted to the further exploration of the questions which been under discussion. It is hoped to reconvene the group which met in Milan at the conference to be held at Norberg, Sweden in May 1995 entitled 'The importance of ironmaking: technical innovation and social change'. Further information can be had from Dr Chris Evans, University of Glamorgan, School of Humanities and Social Science, Pontypridd, Mid Glamorgan CF37 1DL.

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