

for coastal pastoralism for this same period. Mader's detailed strontium isotope analysis conclusively shows that while camelids were found across the whole of the coast to the highland transect, they were originally from the high Andes. In essence, if there was ever significant coastal pastoralism in the southern Andes, it did not start with Late Paracas society.

A third crucial aspect was the high prevalence of Jichja Parco/Quispisisa obsidian within the transect sites. 96.4 per cent of the lithic artefacts recovered from these were obsidian, of these 90 per cent were from the Jichja Parco/Quispisisa source. At a mere 63km from this important pre-Hispanic obsidian source, Cutamalla was a gateway settlement for the production and export of obsidian nodules and products throughout the full 160km length of the drainage and across its over 4000m gradient, creating mobility pathways that ebbed and flowed throughout prehistory.

In summary, this is a solid, detailed, well-written book that delves deeply into the Paracas economy, reappraising old models and proposing new ones that I wager will be useful beyond the remits of this case study. End case, Christian Mader's book is simply a must-read for anyone studying South American pre-Hispanic economies.

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MARKOLF BRUMLICH, ENRICO LEHNHARDT & MICHAEL MEYER (ed.). 2020. *The coming of iron: the beginnings of iron smelting in Central Europe*. Rahden-Westf: VML; 978-3-89646-528-3 hardback €59.80.



This volume publishes the proceedings of the international conference Freie Universität Berlin Excellence Cluster 264 Topoi, held 19–21 October 2017. It makes a welcome addition to the growing number of books concerning the origins of this often neglected but crucial ancient industry. It begins with an introductory chapter by the editors that sets the conference and these proceedings in context, building on the work of Radomír Pleiner and previous conferences held at Hüttenberg, Austria (Cech & Rehren 2014) and Prague in 2017 (Hošek & Crew 2018). The editors highlight the patchy nature of the adoption of iron with no obvious pattern of diffusion, there often being a gap of several centuries between regions. The aims of the conference and volume were well structured,

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focusing particularly on chronology, technology, production and resources, and societal considerations presented by a mixture of well-known and newer scholars of the subject.

Klimscha follows with a theoretically based and wide-ranging chapter on the processes of innovation and diffusion, providing comparisons with other innovations with an impressive bibliography. Lychatz then provides a useful overview of the bloomery process, mixing the results of experimental smelting and chemistry. One aspiration of archaeometallurgists working on ancient iron is the ability to trace places of production in order to reconstruct patterns of trade and exchange. In the next contribution, Jouttijärvi explains a geochemical approach to solving this problem by combining data on major and trace elements in slag inclusions.

The next two chapters (Chapters 5–6) present accounts of iron and ironworking in the Danish peninsula during the Iron Age. Lyngstrøm begins with an important revision to the understanding of the significance of highly decorated bronze razors from Armitlund, Jutland, which were thought to be inlaid with iron wire and dated to around 1000 BC, thus representing the earliest introduction of this metal into Denmark. Later analysis, however, showed that the inlaid wire was not iron at all but corroded copper. Perhaps the most striking idea put forward here is that knowledge of iron production was learned as children observed and investigated the various stages of the *chaîne opératoire*. Olesen, Hansen, Christensen and Egeberg provide a comprehensive and detailed account of iron smelting in central and western Jutland in the Early Iron Age (500 BC–AD 200). It is refreshing to see ironworking and production placed into a landscape setting, based on a combination of geophysical survey and excavation. A photograph taken in 1924, showing a large heap of slag and fieldstones, provides a reminder of how much evidence has been lost through the intensification of agriculture. The main conclusions reached from this survey are that, starting around 500 BC, iron production was closely associated with farmsteads, with intensification of production in the later part of the period, perhaps associated with increasing militarisation.

Joosten then covers iron production in the Netherlands in the Roman and early medieval periods, which for the most part mirrored developments elsewhere in Western and Central Europe. One interesting observation, however, was the use of Rattlestones, consisting of an envelope of iron hydroxide over a loose-fitting core of clay in the early Middle Ages rather than bog ore, which was extensively used across most regions of Central Europe covered in this volume.

The next chapter by Stöllner shows the benefits of long-term landscape study over some 18 years in the Siergerland of Germany, with its rich iron ores generating intensive mining and iron production. Palaeoenvironmental analysis has also shown that the intensive iron industry here had a profound effect on the woodland of the region. Stöllner's chapter is appended by a section on experimental smelting by Garner and Zeiler that rounds off this impressive piece of research.

The next chapter by one of the editors, Markolf Brumlich, examines the Teltow, “one of the pioneer regions for iron smelting in northern central Europe” (p. 127). Again, the writer takes a whole landscape approach, integrating iron production and settlement sites against geology and other environmental elements. Excavation at the settlement at Glienicke 14 produced an impressive array of well-preserved bloomery furnaces that were replicated in experiments. Radiocarbon-dating showed a sharp decline in activity in the Late Iron Age/Early

Roman period. Moving farther east into what is now Poland, Lehnhardt, another of the editors, explores the beginnings of iron smelting in the area of the Przeworsk Culture. Covering chemical analysis of iron objects and slags, this chapter also makes useful comparisons with iron production elsewhere in Central Europe and the Netherlands. In the following chapter, Madera continues the study of Polish Iron Age iron, focusing on Silesia and closing with a proposed periodisation of iron production in the region. Also focusing on Poland, Orzechowski provides a countrywide review of the early iron industry, suggesting that the major breakthrough came with the Przeworsk Culture and the introduction of slag-pit furnaces, which developed in the Roman period into the extraordinary and intensive iron-production centre of the Świętokrzyskie Mountains (Holy Cross Mountains).

Wallner examines centralised iron production in Austria, linking the iron production of the late La Tène period with fortified hilltop settlements. A combination of lidar and other survey methods have demonstrated the considerable scale of these production centres. Unusually in the archaeology of this period, it is possible to link Austrian iron production with classical sources, and the final section of this chapter suggests a reinterpretation of the *deserta boiorum* (the Hungarian plains south west of the Danube, referred to by Strabo and Pliny) with the Iron Age iron-production area of the Middle Burgenland exactly at the centre of this region, and also *ferrum Noricum* (high-quality iron from Noricum, an area roughly equivalent to parts of Austria and Slovenia), regarded as some of the highest quality iron produced in the Roman period. Zoltán Czajlik continues with a chapter on Iron Age iron production in the Carpathian Mountains, which began in the Hallstatt period.

The final chapter by Becker, Eser, Schmid and Schütt leaves mainland Europe and considers the chronology and fuel consumption of one of the major iron-production centres of the Roman world, the island of Elba, referred to by ancient writers such as Strabo. According to Strabo, iron could no longer be smelted on Elba and the ores were transported to the mainland for this process. One of the reasons given was lack of fuel. Research by Becker *et al.* has, however, shown that both mining and smelting production continued on Elba into the first century AD, and that deforestation did not occur at that time. This volume provides a mass of new material and, with the inclusion of many radiocarbon dates, chemical analyses and GIS-based landscape surveys, takes previous publications on early iron a step forward. Hardback, printed on high-quality paper with a plethora of excellent illustrations, the editors and authors are to be congratulated for producing a volume that will be essential reading for anyone interested in early ferrous metallurgy.

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