Unterscheidung keramischer Deponierungen vorzunehmen. Die Arbeit liefert somit wichtige Anregungen im Diskurs zum ritual feasting. Darüber hinaus werden in der Analyse stark fragmentierter Keramikensembles interessante Ansätze aufgezeigt, die sicher die Forschung weiter anregen werden.


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Iron production has undoubtedly been a major area of manufacturing for over 3000 years, essentially determining the civilisational development as well as political and military importance of European societies. It is all the more surprising that the beginnings of iron smelting in the Przeworsk culture – one of the largest and longest functioning (end of the 3rd century BC to mid-5th century AD) cultural formations in Poland – has not yet been the subject of a monographic study. This was even despite achievements in studies on large production centres in the Świętokrzyskie Mountains and Western Mazovia or numerous discoveries of metallurgical sites in Silesia and other regions of Poland. This is partly understandable, given the complexity of technical and technological issues, discouraging for archaeologists-humanists, combined with the scarcity of sources and their poor state of preservation, typical of dawns of any industry. To date, Szymon ORZECHOWSKI’s monograph on iron smelting centres of the Przeworsk culture (Region żelaza. Centra hutnicze kultury przeworskiej [Kielce 2013]) has been the most thorough one on this topic. Still, it leaves
numerous uncertainties. Therefore, Enrico Lehnhardt’s attempt at this challenge is even more welcome, especially taking the major linguistic barrier caused by majority of writing being available in Polish. The book is the slightly revised version of his dissertation, which was submitted to the Department of History and Cultural Studies at the Freie Universität Berlin in December 2015 and defended in June 2016.

The work was inspired by research carried out in 2008–12 under the international research structure “Excellence Cluster Topoi. The Formation and Transformation of Space and Knowledge in Ancient Civilisations”, within research group A-1. The study focused on the secondary distribution settlement of the Przeworsk culture population in the foothills of the Southern Harz in the younger pre-Roman period, which was shown to be closely related to the presence of iron ore in that area. The author aimed at verifying this thesis. Thus, the earliest traces of iron making had to be examined against the background of settlement processes occurring in the native areas of the discussed culture, with particular emphasis on Silesia as a probable starting point area. As a result, an original concept was created which provides a new perspective on the emergence of iron smelting in the Przeworsk culture.

Geographically, the study has not been limited to this culture unit only. E. Lehnhardt examined a much wider area on multiple levels (p. 11), starting from large areas on the European continent and adjacent Asian areas known for their early iron production (global perspective), to then move on to increasingly small units (local perspective). Apart from literature data on excavation and surface research conducted since the beginning of the 20th century, the author also used archives and documents from AZP (Archaeological Picture of Poland) research as a source base at the meso- (Silesian area) and micro-regional levels (a fragment of the Widawa valley).

When characterising the Przeworsk culture in the pre-Roman period, Lehnhardt quotes a well-established view that high consumption of iron, noticeable from the very beginning, contributed to the parallel development of the local production of this metal based on native ores. Nearly from the outset of archaeology, a paradigm has prevailed that the technology transfer in both iron producing and its processing resulted from contacts with the La Tène culture. However, this view, too, is increasingly being criticised, with the Jastorf culture being indicated as an alternative direction. In chapter 2 (pp. 31–96) the author, referring mostly to theoretical findings, tries to explain various processes that took place in the initial stages of development of iron metallurgy in a specific area and reveals motivations for craftsmen’s activities. He is primarily concerned with innovation, the concept which has recently gained popularity also in archaeology (p. 34 figs. 17–18). When considering iron as an innovation, the reference to the work of Vincent C. Pigott (The innovation of iron. Cultural dynamics in technological change. Expedition Magazine 25,1, 1982, 20–25) could not be omitted. According to this author the production of iron may be seen as “an innovative stage within a pyrotechnological continuum which began with the earliest intentional smelting of metallic ores” (Pigott 1982, 20). Lehnhardt points out that the iron-smelting process required profound knowledge and experience in terms of raw materials, construction of devices and subsequent production stages. It allowed, through continuous practice and learning processes (p. 40 fig. 23), to develop a certain set of production and technological rules (p. 40 fig. 22). Discussing the problem of the origin of innovation and the mechanism of its diffusion in prehistoric societies, the author shares opinion of Holger Braun-Thürmann (Innovation [Bielefeld 2005] 35) about the need to combine linear models describing them on the basis of feedback (p. 40 fig. 24). The spread of iron-smelting technology depended on several natural, social, and economic factors. Above all, it could only be established where mineral resources were available. Moreover, on the basis of the theory of innovation by Everett M. Rogers (Diffusion of Innovations [New York, London 1983] 247–250), in prehistoric societies specific groups of recipients can be distinguished, who accepted
technical or technological novelties faster or slower, or who were unable or unwilling to accept them for various reasons. For example, easy access to iron products through exchange or import meant that the local population was not interested in iron producing and processing on their own. If, however, there was a technology transfer, it had to take place only through cultural and interpersonal contacts, including migration or mobility of craftsmen. Theoretical conclusions made here will play an important role in building the concept of the beginnings of iron smelting both in the discussed culture and in the wider context.

The author devoted the next subchapter to presenting the earliest manifestations of iron metallurgy in several selected areas, which he describes as model regions: Georgia (Kolkhida), Levant (Jordan, Israel), Iberian Peninsula, Germany (North Black Forrest, Siegerland, Brandenburg), Denmark (Zealand, Central Jutland), England (East Yorkshire). He includes technical, social and cultural points of view, seeking to clarify mechanisms for diffusion and adaptation of iron smelting technology. This leads to the conclusion (p. 68 tab. 2) that this technology was adapted in different communities and cultures. It was predetermined by a readiness to accept novelties resulting from the demand for iron. In addition to cultural contacts, population migration was certainly an important factor in technology transfer. In general, there are clear economic and organisational similarities. There are differences in the raw material base, as well as the technical sphere.

In the last part of this chapter Lehnhardt discusses canal-pits, which are typical technical phenomena in the Przeworsk culture iron smelting. Simultaneously, they are quite widespread in Central Europe and beyond. The chronological aspect of their occurrence is very interesting, too. The author argues here with S. Orzechowski’s thesis according to which furnaces with this construction represent an early stage of iron making in its local dimension (S. ORZECHOWSKI, The canal-pit and its role in the bloomery process: the example of the Przeworsk culture furnaces in the Polish territories. In: J. Hošek / H. Cleere / L. Mihok [eds], Archaeometallurgy of Iron. Recent Developments in Archaeological and Scientific Research. [Prague 2011] 41–54). Their occurrence in some areas of the Barbaricum only in the late Roman period clearly contradicts this.

The main part of the study (chapter 3, pp. 97–297) opens with an analysis of the use of iron in Silesia in the pre-Roman period. The presence of iron objects marks this whole period starting from the Ha C phase. They appear in variable saturation and assortment (p. 131 tab. 11). The author presents a detailed statistics and spectrum of iron objects and their forms successively in the Lusatian (north-eastern group of the Hallstatt culture), Billendorf, Pomeranian, La Tène and Przeworsk cultures. The development of the Przeworsk culture started the most iron-rich settlement period in this region, whereas types of iron artefacts and their forms match those of the La Tène culture.

Another aspect important for the study are the results of numerous chemical analyses of ferrous objects related to phosphorus content carried out by Jerzy Piaskowski (p. 132). In the whole pre-Roman period, including the Przeworsk culture area, the vast majority (about 80%) of samples show low content of this element (below 0.2%). This may indicate that it was mainly imported raw material produced from low-phosphorus “mountain” ores which was used.

Then Lehnhardt conducts a detailed analysis of selected cemeteries from the Przeworsk and Oksywie culture located across Poland, focusing on occurrence, number and assortment of iron artefacts in particular chronological phases (pp. 132–179). To estimate the total weight of iron coming from these sites, and thus enable a comparative analysis, he assigns model values to statistically most significant or heaviest categories of artefacts: from 1 to fibulas to 40 to swords. Comparisons between the individual necropolises reveal that factors determining the amount of iron might have included their geographical location, or more precisely connections with the trade and transport network based on major rivers. Another significant fact is that raw material for different product
groups came from different sources. Weapons and larger items were mainly made from low-phosphorus iron. For smaller products, however, high-phosphorus iron was mostly used.

Considering iron production in the Iron Age in Poland further on, the author states that the thesis that the Lusatian, Billendorf and Pomeranian cultures were engaged in iron making cannot be proved (pp. 179–185; 237). Settlement structures of the La Tène culture which developed in southern Poland since the Lt B1 phase do not provide any convincing evidence for the existence of iron production, either. However, it is difficult to agree with this opinion taking the research results from Sułków E site (Upper Silesia), dated to the Lt C1b–C2 phases. As apart from traces of a smithing workshop (p. 191 fig. 187), a relatively small excavation revealed over 1000 kg of slag morphologically typical for slag-pit furnaces (B. Czerska, Celtycki ośrodek hutniczy w Sułkowie w powiecie Głubczyce. Acta Univ. Wratislaviensis 157 = Stud. Arch. 5 [Wrocław 1972] 6) and big slag-cakes resulting from the refining of blooms (p. 190 fig. 185). This discovery is particularly valuable as no traces of any younger settlement were found either in or around the site. Moreover, hopes are high that a discovery made in 2019 in Warkocz 12 (Lower Silesia) – a sunken-floored bloomery ironwork with 12 slag-pit furnaces – can provide an explanation concerning the technology and organisation of iron production in the eastern zone of the La Tène culture (unpublished research by Przemysław Dulęba).

The situation, however, is different in the Gubin group of the Jastorf culture which occupied the western part of Silesia until the A2 phase. Iron production in this culture is undisputable and the prevalence of slag (perhaps only partially bloomery slag) at settlement sites is astonishing. For this reason, involvement of this group in the shaping of iron metallurgy in the Przeworsk culture should be seriously considered.

Conversely, the assessment of the dawn of the Przeworsk culture iron smelting is highly controversial. The author lists only two sites in the Świętokrzyskie Mountains and the settlement enclave on the Nida River (pp. 197–200; 241): Gardzienice II and Pokrzywnica III, which could possibly be associated with the younger pre-Roman period. With reference to production centres in Mazovia, only the Falenty site can be dated based on pottery finds exclusively to the phases A2 and A3 (p. 207). Taking the scale of the research, on the other hand, there was very little radiocarbon dating. Like in the case of the Świętokrzyskie Mountains, the obtained dates include both the pre-Roman and the Roman period. Considering the equally broad artefact dating, it makes them useless in determining the chronology of the production activity. Focusing on the area of Silesia, Lehnhardt analyses 40 sites where traces of iron production and material from the younger pre-Roman period were found (pp. 212–218; 241–244; 242–243 tab. 56–57). For all six excavated sites, on which remains of bloomery furnaces were discovered (Domasław 10–12, Namysłów 69, Polwica-Skrzypnik site complex, Psary 1, Radwanice 2 and Tarchalice 1), it is virtually impossible to date iron production to the pre-Roman period due to the multi-phase character of the settlement. The series of 14C datings made only for the Psary and Polwica-Skrzypnik sites and covering also the Roman period are not conducive to this, although in the former case the author allows the beginning of the iron production in the A3 phase. In general, however, iron smelting is automatically associated with the Roman period, if only because of the predominance of ceramic material. The situation is similar on the remaining 34 sites, where only surface finds of slag or possibly loose pieces of it were found in the fillings of settlement features. Most sites yielded also finds from the Roman period or the Middle Ages, but in some of the locations, known mainly from the AZP research, the slag was found only with the pre-Roman sherds. Most of them form a cluster in the Widawa valley near Namysłów (Upper Silesia). For a long time researchers had high hopes related to excavating and verifying it, possibly even discovering the “cradle” of the Przeworsk culture metallurgy. However, the comprehensive field work undertaken by Lehnhardt in this area did not confirm iron production.
in the younger pre-Roman period. Essential data were provided by geophysical investigations and excavations at Pielgrzymowice 5 site (pp. 250–291). Two smelting furnaces were discovered there (pp. 272–275 fig. 313–318; 326–334). They belong to the category of devices with a ‘very large’ slag-pit, and based on the ceramic finds and the \(^{14}\)C analysis they were dated to the middle and late Roman period (p. 289 tab. 60; p. 290 fig. 343). However, no traces of iron production from the younger pre-Roman period were found. The results of this work have been carefully documented and provide valuable input to settlement research and study on the smelting technology in this part of the region.

In an extensive chapter 4 (pp. 299–332) Lehnhardt reviews sources concerning the beginnings of iron use and production in the eastern part of Central Europe. Phenomena similar to those characteristic of the pre-Roman Przeworsk culture can be observed in all of the examined areas. Thus, in the author’s opinion, the widespread use of iron on the one hand, and the scarcity (the example of Bohemia) or absence of traces of iron smelting clearly dated back to the La Tène period on the other, are a supra-regional feature. Indeed, it is only in the Roman period that the number of the ironmaking sites clearly increased.

The study also includes a reference to technology transfer in the Przeworsk culture (chapter 5, pp. 333–336). The key issue is the origin of the slag-pit single-use furnaces, which highly relies on interpretation of the available data. The author believes that they cannot derive from the La Tène patterns, as they were virtually unknown in the La Tène culture, at least in its eastern zone and single examples from Bohemia may raise doubts as to dating. It is equally improbable that this technology was transferred from the Jastorf culture, while the involvement of the Gubin group must be ruled out because it disappeared before the beginning of iron smelting in the Przeworsk culture. Thus, it must have been the Elbe-Germanic tribes who were responsible for the transfer of the new technology to Silesia, as well as to Bohemia and Slovakia, as they had already mastered the secrets of iron production at the time in question.

Finally, the author returns to the initial thesis concerning the motives for the appearance of the Przeworsk culture settlement in the earlier phases of the younger pre-Roman period in Thuringia (pp. 337–342). Excavations in Nordhausen-Himmelgarten and Leimbach (DE) did not, however, yield traces of iron production in the A1 and A2 stages. The fact that settlers had no interest in smelting iron in favourable environmental conditions, visible in the archaeological material, may indirectly testify to the ignorance of this technology in their home area.

The multifaceted, detailed and consistently conducted analysis resulted in a new, extremely interesting concept concerning the beginnings of iron production activity in the Przeworsk culture, which stands in opposition to the views that have been established for years in the literature. It is based on the thesis that there is no conclusive evidence of iron smelting in the younger pre-Roman period. The author can accept the existence of local production only from the A3 phase and just in few selected areas in Silesia and Mazovia. The demand for iron, both finished products and raw material for blacksmith manufacturing, was satisfied by imports from the metallurgical centres of the La Tène culture, most probably located within the zone where phosphorus-poor ores occurred. Vast transport and exchange networks with La Tène communities were used for this purpose, especially along the Amber Road. Extensive iron production appeared in Silesia and Mazovia only in the early Roman period. Lehnhardt links it with the fact that at the turn of the La Tène and the Roman period the Elbe-Germanic population moved to Bohemia, Moravia and Slovakia, which were previously occupied by Celtic tribes. That coincided with civilizational and military pressure from the Roman Empire. These changes may have disrupted iron supplies and encourage own production. Thus, the technology transfer to the Przeworsk culture area might have taken place through contacts
with Marcomanni and Quadi people, who pursued the idea of self-sufficiency and the use of local raw material sources, while in terms of technical equipment they preferred slag-pit furnaces.

Notably, the author does not limit his study exclusively to the emergence of iron smelting in the Przeworsk culture. It might even appear that it was just a pretext for presenting a much broader issue, namely the history of adaptation of this innovation in vast areas of Central Europe, including Poland, the Czech Republic, Slovakia and parts of Austria, Hungary and Romania. The researcher thus referred to a number of well-known publications relating to areas of Scandinavia, including Denmark and northern Germany, covering, however, a narrower territorial scope and much less factual data.

Notwithstanding his contribution, it must be noted that given the current state of research the author could only present a hypothetical picture of the beginnings of iron production. Despite its consistency, a number of counter-arguments can be pointed out in several aspects, which result from ambiguity of the available data and the successive influx of new ones. The presented concept may therefore be subject to some adjustments. For example, a recent, more thorough analysis of unpublished sources concerning Psary and Polwica-Skrzypnik casts a different light on 14C dates from these sites. Obviously, the broad artefact dating in both cases, with predominance of early Roman material (especially from the B2 phase), generates the above-mentioned problem of placing the production activity on a time scale. However, the fact remains that the radiocarbon dating of some furnaces from Psary includes with high probability the oldest phases of the Przeworsk culture (p. 218 fig. 231–233; 235). It cannot be disregarded especially when taking into account Marek Wróbel’s work (Ceramika z osady hutniczej kultury przeworskiej w Psarach, stanowisko 1, gmina Jemielno, województwo leszczyńskie. [Unpubl. master thesis, Institute of Prehistory, Adam Mickiewicz University] [Poznań 1983]) devoted to ceramic finds from this site. Namely, in the group of sherds bearing mid- and late La Tène period features, which constitutes about 18% of the whole collection, forms typical for the A1–A2 phases were clearly manifested (Wróbel 1983, 104). What is more, this chronology is confirmed by the presence of a brooch of F-type according to Kostrzewski, dated to the A2 phase (Wróbel 1983, 105, tab. XI:2). The case is similar for Polwica-Skrzypnik, where two out of seven 14C dating measurements from slag-pits include the A2 phase (P. Madera, Ze studiów nad piecami dymarskimi z kotlinką ,bardzo dużą’ na Śląsku. In: E. Blażejewski [ed.], Labor et patientia. Studia archaeologica Stanisłao Padza dedicata [Wrocław 2008] tab. 3). Simultaneously, as many as 51 settlement features dated by means of ceramic material indicate the younger pre-Roman period (L. Berdula / M. Dobrakowski, Osada hutnicza z okresu wpływów rzymskich na stanowiskach: Polwica 4–5, Skrzypnik 8, woj. Dolnośląskie. In: S. Orzechowski [ed.], Hutnictwo świętokrzyskie oraz inne centra i ośrodki starożytniej metalurgii żelaza na ziemiach polskich [Kielce 2002] 108). A direct insight into this material revealed that it comes mostly from the A2 phase. In this context, it is essential these features occurred mainly in the part of the site where the oldest of the analysed bloomeries were discovered. Lehnhardt’s suggestions concerning low relevance of 14C measurements for an earlier dating of iron production in Silesia may therefore turn out to be wrong. On the other hand, the thesis that in few places iron production started as early as in phases A1–A2, to continue after a period of settlement breakdown in the A3 phase on a much larger scale far into the early Roman period, would gain credibility. Consequently, the possibility that there had been technology transfer from the area of the La Tène and Jastorf cultures should be reconsidered. Undoubtedly, however, more reliable solutions can be provided only by further excavations, long series of 14C dates and metallographic expert opinions, and finally the widespread application of osmium isotope analyses, which are extremely promising in provenance studies.

Regardless of any remarks and reservations, it must be admitted that E. Lehnhardt created a valuable work, unrivalled by any previous literature on the eastern part of Central Europe. It is a
real challenge and inspiration for a group of archaeometallurgists, but also a powerful source of knowledge for all those who study the history of civilisation, not only in terms of raw materials.

