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Metallurgical production of the Lusatian culture in the Lublin region – discussion questions

In the Lublin region, more and more artefacts are being discovered that prove the existence of local bronze metallurgy there. Moreover, we should not exclude the presence and activity of highly qualified metallurgists coming from European bronze centres in the discussed area. On the other hand, the possibility of local iron metallurgy will remain in doubt.

KEY WORDS: metallurgy, bronze, iron, Lusatian culture, Lublin region

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Until recently, it was believed that scarcity of bronze items, especially during the younger periods of the Bronze Age, was typical of the Lublin region area (J. Dąbrowski, A. Gardawski 1979, p. 113; J. Dąbrowski 1982, p. 266). Today such views should be merely memories, however, despite the significant increase of archaeological sources, the territory in question in terms of known material base clearly lags behind, especially when compared with western provinces of the Lusatian culture. Such state of affairs is due to several factors. Primarily, the Lublin region did not provide as favourable conditions for bronze metallurgy as, for instance, Silesia, where since the Early period of the Bronze Age there was an intense inflow of products, and hence the opportunity appeared to become acquainted with the current design, which resulted in the development of local metalworking skills. The proximity of the European mining and metallurgical centres contributed to the fact that bronze metallurgical activity in Silesia developed on a scale, which allowed for the development of local products, and for the production and distribution of surpluses. This could not take place in the Lublin region considering its unquestioned peripherality in respect to the bronze production centres. There was a paucity of raw material here, and local population probably did not show sufficient skills in handling it.

Imports, at times from very distant territories, constituted the vast majority of metal products found within the area under consideration (cf. E.M. Kłosińska 2007a; 2009a). Their number depended on the distance to their place of origin, as well as the nature of the contact, thanks to which they arrived in the Lublin region. Undoubtedly, among the most exotic ones were the products coming from northern European areas: Nordic (e.g. the spearhead of the Borbjerg type from Stary Machnów, dist. Tomaszów Lubelski – E.M. Kłosińska 2009b, pp. 247–251, figs. 1, 2; probably belonging to a metallurgist set of items along with a half of a bronze mould for casting axes of the Mälär-

Akozino type – E.M. Kłosińska, P. Sadowski 2014a, p. 22; [2017] in print), or from the east Baltic metallurgical centre (e.g. axes from the vicinity of Kock, dist. Lubartów and Lublin, and items from Pióry Wielkie, dist. Siedlce, Horodyszczce, dist. Biała Podlaska, Radzic Stary, dist. Łęczna and Żółtańce-Kolonia, dist. Chełm – E.M. Kłosińska 2016 [in this volume]). Additionally, metal objects from the Hallstatt zone, such as, for instance, boat-shaped fibula discovered between Topornica and Lipsko, dist. Zamość (E.M. Kłosińska 2014), or fibula with open work hanger and sound-making pendants from a multiple-find set from Wakijów, dist. Tomaszów Lubelski (T. Poklewski 1954) should be included among the exceptional finds. The influx of such individual items could be of an occasional nature and be the outcome of movement of people, who, for example, were engaged in exchange trade, metallurgy, or were other representatives of the elites of the time. Also a chain exchange system should not be excluded in this regard. The amount of imports was increasing significantly in situations when a particular metallurgical centre was relatively close. During the younger stages of the Bronze Age the most important role as the supplier of bronze products for the Lublin region was played by the eastern part of the Carpathian Basin and part of the Dniester region, i.e. the lands within the spread of the Gáva-Golihrary culture metallurgical centre. The concentration of the finds within the south-eastern outskirts of the area under consideration (E.M. Kłosińska 2007b, pp. 232–233, fig. 7) suggests that the Golihrary centre from the territory of western Ukraine could have been more important in this regard for the region. It was from this centre that not only the finished products, for instance, the so-called beak axes from the vicinity of Tomaszów Lubelski and Lubycza Królewska, dist. Tomaszów Lubelski, or the axe from the vicinity of Hrubieszów, dist. Hrubieszów (E.M. Kłosińska 2006, pp. 307, 314), but also bronze raw material in small ingots like the one discovered

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in Stary Machnów (E.M. Kłosińska 2007c, p. 119, fig. 10: 2; 2010, p. 245, fig. 2: 3) were inflowing into the Lublin region.

Also the Lusatian culture centre of Silesia, Greater Poland and Kuyavia gained certain importance when it comes to providing bronze items for the Lublin region (from that centre came, for instance: a knife found in Stary Rachów, dist. Kraśnik referring to the Wrocław-Grabiszyn type or the Bojanowo Stare type – E. Kłosińska 2004a, pp. 306–307, table I: 11; an axe of the Kowalewko type from Trzciniec, dist. Opole Lubelskie [unpublished]; a necklace from Wakijów – T. Poklewski 1954; a pin from Kolemczyce, dist. Chełm – K. Prożogo 1972). Additionally, the Tarnobrzeg centre developing in the San river drainage basin (for example ring shaped ornaments were made there, which were found in Modryniec, dist. Hrubieszów – A. Kokowski 1993; Opoka Kolonia, dist. Kraśnik – E. Kłosińska 2004a, p. 306, table I: 10) was also of some importance. Also, from the broadly understood Urnfield culture milieu occasionally bronze items of large size were appearing in the Lublin region, such as the striking fibula of the Spindlersfeld type from Strzyżów, dist. Hrubieszów (G. Orlińska 1993–1994), or the sword from Dorohusk, dist. Chełm¹ (E. Banasiewicz 1990).

Both the distribution of the metal items and their local production could have been done by individuals competent in metallurgy who came from outside the Lublin region. They acted from their good will and received appropriate equivalent for desired items. Probably one metallurgist fulfilled the needs of a local community, but it is also possible that more people influenced the metallurgical process. Very interesting, though extremely difficult to verify, is the hypothesis of using slave-specialists in the manufacture process of metal items within a particular area (cf. T. Węgrzynowicz 1973, p. 99; further literature there). The described situation could not rather have taken place in the case of the Lublin region, especially considering the fact that for these activities such prisoner-specialist would need a relatively regular inflow of raw material, which was rather impossible due to a certain distance separating this territory from the central European centres of bronze metallurgy and also relatively small amount of metal suitable for remelting. Ready-made products probably reached the

Lublin region as a result of a simple exchange of goods. Part of the bronze items could constitute an important aspect of this exchange, being a type of item based money (pre-monetary system), or standard for the Bronze Age units of metal – weights – that functioned within the framework of the weight system of the time (cf. A. Mozsolics 1963, p. 68n; C. Sommerfeld 1994). Probably the same function was played by some sickles, uniform when it comes both to the formal appearance and weight, or bracelets, which circulated on local markets and changed owners. Metals came also together with migrating people. In the Early Iron Age relatively numerous metal items of eastern provenance (earrings, arrowheads) reached the Lublin region, where – as it seems – they were initially used by the newcomers, and later were made locally. Moreover, local production of nail-shaped earrings has already been confirmed within the range of the Tarnobrzeg Lusatian culture (J. Michalski 1982, pp. 201, 206). The new designs came from the territory of western Ukraine, and especially from the upper Dniester region, where a culture of the Scythian-type was developing in the Early Iron Age.

Raw material and finished metal products were, therefore, brought in by their producers and/or owners, and a variety of circumstances caused that they were becoming objects of exchange. It can be assumed that the first step was to acquire (or order) a product from a merchant/craftsman that offered his goods or skills in exchange for determined equivalent. Probably in the time of the development of the Lusatian culture such equivalent consisted of products the natural economy of the time. It is believed that the most prominent role in the exchange for bronze was played by wax – substance essential in metallurgy, then also honey, fur and leather. Additionally, salt was another sought-after equivalent for the metal (J. Dąbrowski 1992, p. 96), but the feasibility of obtaining this mineral in the Lublin region is, so far, poorly documented in the sources. Moreover, metal was not exchanged for agricultural and animal husbandry products, not only because of the difficulties in transportation (J. Dąbrowski 1985, p. 48; 1992, p. 96), but also due to the likely permanent lack of surpluses in food production (T. Węgrzynowicz 1973, p. 98). Furthermore, it is not known whether metal was not exchanged also in return for living beings, for example, women (E.M. Kłosińska 2007a, p. 285), however, considering their high mortality, they could have been regarded by a community as a too valuable “good”. Metal items obtained by means of long-distance exchange were then entering local “market” and passed on to the neighbouring communities as a result of matrimonial exchange (as a “dowry”?), or changed the owners as a result of looting and other dramatic circumstances. Such local “flow” of bronzes took place probably within small areas, for example, within a settlement region, or between neighbouring ones. However, in the case of the Lublin region these are purely theoretical assumptions. At the same time, it seems quite likely that the appearance of metal items in the milieu of the Lusatian culture did not have any significant social repercussions, at least during the Bronze Age. It was only in the Early Iron Age that sumptuous sets of jewellery could have reflected social stratification in this cultural environment.

There are traces of the implementation of various metallurgical activities still preserved on the imported metal products found in the Lublin region. Numerous artefacts, mainly those produced during the Bronze Age, bear the relics of carefully ground casting flashings. These items were casted

¹ This item was recognised as an import from the Carpathian Basin dated to the 4th period of the Bronze Age, or a local product dated to the end of the 4th and the beginning of the 5th period of the Bronze Age and compared to swords of the Liptov type (E. Banasiewicz 1990, p. 34), at that time widely spread in the Central European lands (c.f. J. Hrala 1954; J. Fogel 1979, p. 47 and following; Z. Bukowski 1998, pp. 208–209). Most likely, this artefact did not origin from local workshops of the Lusitanian culture population, as for its production high technical skills were necessary and considerable amount of raw material was needed (E.M. Kłosińska 2009b, p. 253). It is also difficult to unambiguously determine the particular type of the find considering that it is damaged, and, moreover, its drawing documentation is not adequate. The sword refers to specimens known from southern Germany, Austria, Czech Republic, Slovakia, and Hungary, for instance to some modestly decorated swords of the Schwaig, Illertissen, or Liptau types that are dated to the periods HaA1-HaA2 (H. Müller-Karpe 1961, Taf. 9: 7, 9; 16: 1, 2; 17: 1). The Polish examples of similar weapon are dated to the periods BaD-HaA2 (W. Blajer 2001, p. 125). The find from Dorohusk was compared to the swords known from bronze hoards of the Kurd horizon known from the area of Hungary (S. Czopek 1997, p. 215).

using permanent moulds, mostly two-piece ones. This is the way in which tools and weapons, for example, axes, sickles, knives and spearheads were most often made. Careful finishing can be seen on the sides of, for instance, some spearheads or socketed axes, where the casting flashings are almost invisible (Masłomęcz, dist. Hrubieszów – E.M. Kłosińska 2006, p. 310, fig. 3). Great lengths were also given to the final finish of individual sickles (Komarów-Osada, dist. Zamość – E.M. Kłosińska 2007c, photo 1), which is confirmed by carefully ground dorsal surfaces of these artefacts. Probably some arrowheads and disks of earrings were made in permanent casting moulds as well, as they bear on their surfaces relics of characteristic flashings (Stary Machnów – E.M. Kłosińska 2007d, pp. 274, 276, figs. 1: 3–5; Maziły, dist. Tomaszów Lubelski – E.M. Kłosińska 2009c, fig. 1: 3). Some of the metal items that were brought to the Lublin region were made using waste mould casting method which used wax models. This is the technique in which bars were made that were the base material for various ring ornaments, and among them the most spectacular items – necklaces, armlets and leg rings originating probably from Kuyavian or Masovian-Podlachian metallurgical centre (Zemborzyce, dist. Lublin – J. Gurba 1961; Radecznicza, dist. Zamość – E. Kłosińska, U. Kurzątkowska, J. Nogaj-Chachaj 2005; cf. also J. Kostrzewski 1964, p. 23; T. Węgrzynowicz 1973, p. 26). Within the area under consideration there are no artefacts cast in moulds with core (maybe except the previously mentioned Nordic spearhead of the Borbjerg type from Stary Machnów), while there are many of those produced using metallurgical suspended core (all socketed axes). The know-how of the “lost wax” technique appeared in the Lusatian culture already in the younger stage of the Bronze Age (J. Fogel 1983, p. 151), and became widespread in the Early Iron Age (M. Gedl 1982, p. 61). Such castings were technically better than the ones made in permanent moulds, as gases can freely be released through the porous structure of the waste moulds. Meanwhile, numerous bubbles were created inside the artefacts cast in permanent moulds, thus affecting the quality of such products (A. Gardawski 1979a, p. 275).

Traces of activities undertaken in order to give the items their final shape are also perceptible on the metal artefacts that arrived in the Lublin region in the younger stages of the Bronze Age and in the Early Iron Age. Here one may point out to the relics of bar twisting – necklaces (Radecznicza – E. Kłosińska, U. Kurzątkowska, J. Nogaj-Chachaj 2005, figs. 2, 3), flat and low relief hammering of metal sheets – disks and fittings (Śniatycze, dist. Zamość – E.M. Kłosińska 2008, pp. 266–273, figs. 2–5; vicinity of Puławy, dist. Puławy – E.M. Kłosińska 2007b, fig. 10a; “by the Sieniocha River” (“znad Sieniochy”), dist. Tomaszów Lubelski – E.M. Kłosińska, S. Sadowski 2017 [in print]), forging and combining bronze elements as well as bronze and iron ones into one fixed compound item – battle axe and dagger blade (Werchrata, dist. Lubaczów – E. Kłosińska 2003; Ślipcze, dist. Hrubieszów – E.M. Kłosińska 2009b, pp. 253–255, fig. 3), cold hammering of bronze band – bracelets (Deszkowice Drugie, dist. Zamość – J. Kuśnierz 1998, p. 47), metal pressing – decorations of horse bridles (Śniatycze – as above), and incised ornamentation – bracelet (Turkowice, dist. Hrubieszów – E.M. Kłosińska 2015). Also, tools for holding items were used – in the case of the necklaces (Radecznicza – as above), not to mention: stamps, punches, dies, or a compass – in the case of the horse

bridle ornaments (Śniatycze – as above). At time, it is also possible to detect traces of grinding and tools sharpening – for example on the arrowheads (Maziły, Swarczów, dist. Zamość, Róża, dist. Tomaszów Lubelski, Nowosiółki Kardynalskie, dist. Tomaszów Lubelski, Dorohusk, Żulice, dist. Tomaszów Lubelski, Topornica, Gródek, dist. Hrubieszów, Żyłka, Hrebenne, dist. Hrubieszów – E.M. Kłosińska 2013, figs. 4: 30–42).

Furthermore, defective products also reached the discussed territory, like the axe head from Stary Machnów, which was made of two kinds of bronze with different tin content (E.M. Kłosińska 2010, pp. 243–244, figs. 1: 2; 4: 1a, 1b). Additionally, it is worth mentioning probable cases of individual reworking of larger ring ornaments (armlets?) into bracelets, such as the ones found in the hoard from Szczepieszyn, dist. Zamość (cf. J. Kuśnierz 2007, figs. 3: 4, 5).

The point of origin of the raw material from which the products coming to the Lublin region were made is rather impossible to determine. Natural composition of the copper raw material was altered during the ore processing and then, when creating tin alloy. The bronze that was obtained could then be subjected to repeated remelting (J. Fogel 1983, pp. 143, 144). It should be expected, however, that the items referring to the designs of the Gáva-Golihady complex were created basing on the raw material from the eastern part of the Carpathian Basin, or on local bronze scrap. Only few (i.e. 20) analyses of material composition were made for the artefacts found in the Lublin region, but even looking at this small sample one can clearly see how diverse they are. Only one artefact (fibula from Deszkowice Drugie – J. Kuśnierz 1998, p. 47, photo 2B), in terms of the composition is close the optimal proportions of tin bronze, that is about 90% of copper and 6–12% of tin. Additionally, the presence of bronzes with low tin content should be pointed out (including an earring from Łuszczów-Kolonia, dist. Hrubieszów – J. Niedźwiedź 1989, p. 153, Table III: 4; oval strap distributor/link from Szczepieszyn – E. Nosek, J. Stepiński 2007, p. 399, fig. 1a). At the other extreme are the items, in the case of which reduced share of copper and increased share of tin with a significant admixture of other elements such as silicon, phosphorus, iron, arsenic, antimony or lead was noted (such as a disk and fitting from Śniatycze – E.M. Kłosińska 2008, pp. 268, 270, figs. 1: 3, 9; axe and arrowhead from Stary Machnów – 2010, pp. 244, 245, figs. 1: 2; 2: 4; 4: 1, 3; strap junction from Głodno, dist. Opole Lubelskie – 2012, p. 336, fig. 2). It is difficult to conclusively state whether the composition of the alloy reflected the intentions of a metallurgist, or whether it was rather obtained by chance, when different scrap was used in the metallurgical process. Appropriate admixture of tin (from 7 to 13%) allowed for production of bronzes characterised by high hardness and not prone to breaking. Increased amounts of this compound in the alloy gave it golden colour, which was not insignificant in the case of jewellery (J. Dąbrowski 2009, p. 192; 2012, p. 88). When the content of tin reached around 30%, the alloy became worthless (J. Fogel 1983, p. 149). Among the artefacts from the Lublin region it is well exemplified by the axe from Stary Machnów, which is delaminating under pressure. Also, increased presence of antimony and arsenic does not influence positively the strength of the alloy (Z. Hensel 1982, p. 157). At the same time, the presence of lead and phosphorous in the alloy favourably affected its casting properties. Such observation

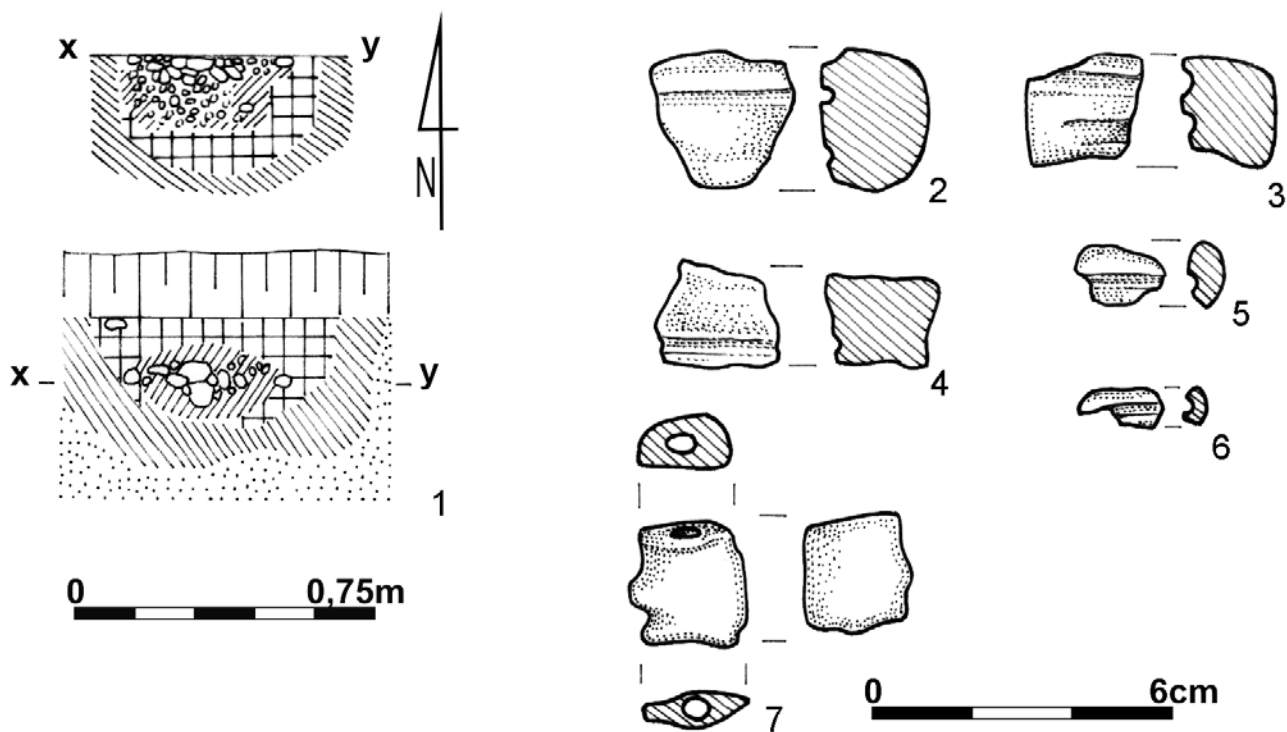


Fig. 1. Wronowice, dist. Hrubieszów, site 5: plan and profile of a metallurgist's hearth – 1; waste moulds – 2–7 (after Z. Wichrowski 1989; redrawn by T. Demidziuk)

Ryc. 1. Wronowice, pow. Hrubieszów, stan. 5: rzut poziomy i profil paleniska metalurgicznego – 1; fragmenty form – 2–7 (wg Z. Wichrowski 1989; przerys. T. Demidziuk)

was made regarding the selected elements of a multielement deposit in Śniatycze (E.M. Kłosińska 2008, p. 288).

Unfortunately, nothing can be said about the metal composition of the few iron items from the Lublin region. Most probably, finished iron products of large overall dimensions flowed mainly from the east and should be addressed in the context of broadly understood Scythian culture. The hypotheses about sourcing the iron raw material from the Scythians (cf. K. Moskwa 1976, p. 129) are not confirmed as yet. Undoubtedly, bog iron ore – limonite was the most easily accessible raw material. Additionally, there is no consensus on the once expressed believe that the people of the Lusatian culture were possibly using iron ore from the Świętokrzyskie (Holy Cross) Mountains (J. Dąbrowski 2009, p. 197). However, the studies on the composition of the iron of some ornaments encountered in the assemblages of the Tarnobrzeg Lusatian culture² offer a new perspective in this regard. The only thing that can be said about the particular iron imports found in the Lublin region, is their excellent state of preservation, minimal signs of corrosion and clear traces of metallurgical surface treatment – forging (battle axe from Werchrata – E. Kłosińska 2003, p. 219, fig. 1). It probably proves the high quality of the raw material and advanced skills of the craftsman.

Hence, the question arises – which of the items in the assemblage of the metal artefacts discovered in the Lublin region could have been made on the spot. Local metallurgical

production was proven by the finds at the site in Wronowice, dist. Hrubieszów (Z. Wichrowski 1989, *passim*). In one of the hearths (feature 5) few lumps of daub with traces of very regular, elongated depressions were found. In the light of the current determinations and with no doubt, these fragments are believed to be destroyed casting moulds, probably for the production of pins or some wire ornaments (Fig. 1). However, it is unknown whether burnt traces that are typical of the metallurgical process were present on these moulds. However, a relic of a bronze wire, even still within a clay mould, was discovered in the plough zone of this site. The hearth, where the small bronze ornaments were made, was probably a free standing feature at a distance of about 25 meters from the nearest buildings. The distance from the wooden buildings had to be kept not only because of the fire hazard, but also to ensure free flow of air around the hearth. A short distance north of it, there was a relic of a small and shallow feature no. 10 containing lumps of daub, which perhaps was an integral part of a metallurgical workshop, being a place where clay for production of waste moulds was stored. When it comes to bronze ornaments, the workshop from the settlement in Wronowice probably satisfied only the local needs. These could have been the simplest forms – wires, out of which then little bracelets or earrings were made. Such simple skills were probably familiar to the residents of other settlements in the Lublin region. It seems that if needed small military items that did not require advanced metallurgical knowledge from the maker were also produced. These included arrowheads, primitively cast (Brzeziny, dist. Lubartów – E. Kłosińska 2004b, p. 243, figs. 2:8, 9), or cut out of bronze sheet (Bielsko, dist. Opole Lubelskie and Stary Machnów – unpublished; Topornica

² A large group of items was made of iron with low phosphorus content, which is characteristic of the raw material from the Świętokrzyskie (Holy Cross) Mountains (cf. S. Czopek 1992, p. 124).

– E.M. Kłosińska 2007e, p. 354, fig. 8:10), probably left over from scrap metal. The reworking of a Scythian arrowhead into a pendant (which probably took place in the environment of the local population of the Lusatian culture) is a very interesting example of a creative use of damaged metal items and giving them a new role (Hrebenne – J. Gurba, A. Zakościelna 1994).

To summarize the hitherto determinations it has to be stated that during the period when the Lusatian culture was developing in the Lublin region the local metallurgical production was progressing simultaneously in two different ways. Some technologically advanced items were made on the spot by specialized craftsmen who arrived in this territory with the knowledge and raw materials. The second direction of the local metallurgy was implemented by domestic production, in the process of which only the simplest forms could have been made. It can be assumed that both the specialised metallurgists, and the local not technically advanced producers had their ways of dealing with metal and their knowledge on this was drawn from unconnected metallurgical experience.

It is assumed that 150 days per year were spent on metallurgical activities in the Lusatian culture (J. Piaskowski 1957, p. 20). In the Lublin region, due to the scarcity of the raw material and inadequate technical abilities, this activity was probably undertaken only occasionally, and with no doubt much less frequently than other branches of domestic production.

So far, the independent iron metallurgy by the population of Lusatian culture in the HaD period is indicated by specimens of iron billets/blooms (D. Durczewski 1961, p. 10–12, figs. 1: 2, 3; 2: 1), as well as the phenomenon of a leap both in quantitative terms and when it comes to the range of products made of this material that was recorded mainly in Greater Poland and reflected the existence of a local production centre in the basin of the middle Warta river (cf. J. Kostrzewski 1954, p. 49–50; A. Gardawski 1979b, p. 132; Z. Bukowski 1981, p. 100; K. Szamałek 2009, pp. 132; 134). Undoubtedly, the Lublin

region became acquainted with iron later than Greater Poland or Silesia (T. Węgrzynowicz 1973, p. 100). Considering the current state of the studies on the archaeological materials the thesis about the local iron ore processing seems to be controversial. However, some data indicate that a primitive treatment of this metal in an open fire hearth could have had place. In such a stone-paved feature (no. 6) at the cited earlier settlement in Wronowice iron slag was present and the Lusatian culture context of these finds is indisputable (Z. Wichrowski 1989, p. 132). It should not be excluded that the first steps in acquiring iron were made also by the inhabitants of the settlement in Drażgów-Kolonia, dist. Ryki, site 2, where among the Lusatian culture inventory an iron refined bloom was encountered (A. Kokowski 1989, p. 30). Indigenous iron metallurgy on the territory under consideration remains still an unresolved phenomenon. However, it can be tentatively assumed that its origins took place during the younger stages of the Early Iron Age or during the La Tène period, contemporaneously to the emergence of the Pomeranian culture. Locally, the secrets of the knowledge of casting iron could have also been brought in by people arriving at the same time from the east. A similar process was probably taking place within the Tarnobrzeg Lusatian culture, where unquestioned local smelting of iron was already long proven (cf. S. Czopek 1992, p. 124). It is believed that familiarity with the new technology occurred the earliest among the experts in bronze metallurgy in places where metallurgical workshop already functioned (J. Ostoja-Zagórski 1982, p. 186). The relevance of these findings is confirmed by the settlement in Wronowice, where the presence of two hearths – for smelting bronze and iron respectively was discovered.

As mentioned previously, among the Lusatian culture population in the Lublin region specialised metallurgists coming from outside and offering ready-made products or casting items on-the-spot basing on own raw material could have been active. The mentioned above raw material to lesser

Fig. 2. Stary Machnów, dist. Tomaszów Lubelski, site 41: raw material ingots – 1, 2 (drawn by E.M. Kłosińska; redrawn by T. Demidziuk); Biała, dist. Radzyń Podlaski: bronze scrap – 3 (drawn by E.M. Kłosińska; redrawn by T. Demidziuk); Olchowiec, dist. Chełm: bronze scrap – 4 (photo by M. Piotrowski)

Ryc. 2. Stary Machnów, pow. Tomaszów Lubelski, stan. 41: sztabki surowca – 1, 2 (rys. E.M. Kłosińska; przerys. T. Demidziuk); Biała, pow. radzyński: fragment z brązu – 3 (rys. E.M. Kłosińska; przerys. T. Demidziuk); Olchowiec, woj. chełmskie: fragment z brązu – 4 (fot. M. Piotrowski)

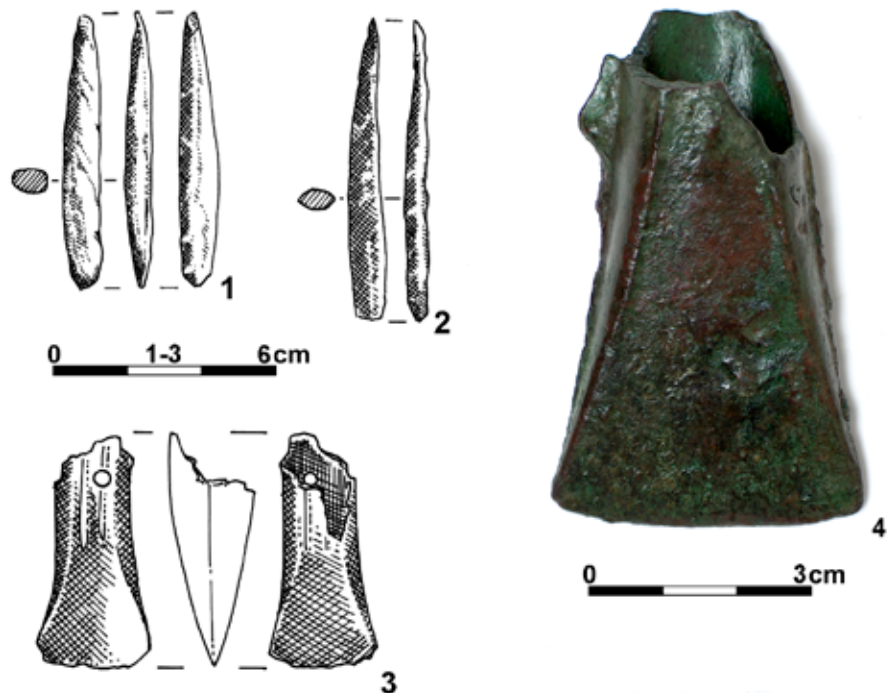




Fig. 3. Kułakowice Drugie, dist. Hrubieszów: damaged ornaments strung on a bronze rod (part of a multi-element bronze hoard of a metallurgist) (photo by A. Hyrchała)

Ryc. 3. Kułakowice Drugie, pow. hrubieszowski: uszkodzone ozdoby zawieszane na drucie z brązu (część wieloelementowego brązowego skarbu metalurga) (fot. A. Hyrchała)

degree consisted of metal ingots (Fig. 2: 1, 2) that were suitable for mechanical processing (cf. J. Fogel 1983, p. 149), since it was mostly scrap metal (damaged items, worn-out and defective ones – Fig. 2: 3) that was melted and cast. Scrupulous collecting of damaged bronze items at settlements (e.g. Hrebenne, site 34 – M. Polańska 1999, p. 89, figs. 4: 2, 3; Hrubieszów-Podgórze, dist. Hrubieszów, site 1 – E. Banasiewicz 1991, p. 26, fig. 4: 12; Teptiuków, dist. Hrubieszów, site 6 – J. Niedźwiedź 1996, p. 141, fig. 2: 13; as well as among the unpublished discoveries by this author) undoubtedly proves that metal was among valuable raw materials. It is also worth noting, that among some bronze items, which were found within the analysed territory without cultural context, potential scrap metal included unfinished products (with very clearly visible, unground flashings) and damaged ones (e.g. axe from Olchowiec, dist. Chełm – Fig. 2: 4). At the same time, the presence of relatively numerous and often damaged bronze items within burial grounds was dictated by the requirements of the funeral rite and symbolic culture.

In the area of the Lublin region there are known outstanding examples of securing valuable bronze scrap from loosing. In this context not only the damaged axe from Biała, dist. Radzyń with a suspension hole bored on one of the front surfaces (Fig. 2: 3) should be mentioned but – above all – the bundle of scrap metal from the hoard from Kułakowice Drugie, dist. Hrubieszów (B. Bartecki, A. Hyrchała, in print), where some of the spiral, multiple coil forearm ornaments were put of a long and massive rod with quadrangle cross-section that was then winded into 1,5 coil (Fig. 3). This hoard was probably deposited towards the end of the Middle and the beginnings of the Younger Bronze Age (HaA) by a metallurgist representing metallurgical centre of the Tarnobrzeg Lusatian culture. Such craftsmen were in the forefront of the local bronze metallurgy, being in possession not only of the raw material and skills, but also of sets of necessary accessories. Another hoard, probably belonging to a metallurgist, was disclosed in an unspecified place by the Sieniocha river and introduced into scientific circulation of knowledge as a set “from by the Sieniocha River” (“znad

Sieniochy”) being dated to the Late Bronze Age – HaB2-HaB3 ((H. Taras 2014, *passim*; E. Banasiewicz-Szykuła, I. Gołub, W. Koman, G. Mączka, P. Zieniuk 2014, Fig. 21 [as Zubowice, dist. Zamość]; Wysyp skarbów... 2016, *passim*; E.M. Kłosińska, S. Sadowski, 2014a, p. 22; 2014b; in print). This extremely interesting discovery contained a half of a bronze mould for casting axes of the Mälar-Akozino type, an elongated bar ingot of raw material and damaged bronze items, probably as scrap material (Fig. 4). These artefacts were wrapped in leather with fur, and the entire package was further wrapped with a string. It is likely that its owner – craftsman-metallurgist – came to the Lublin region from the Nordic zone E.M. Kłosińska, S. Sadowski, in print; further literature therein).

In the Lublin region other relics of metallurgists' work preserved in the form of crucibles (Milejów, dist. Łęczna;



Fig. 4. “Znad Sieniochy” (“from by the Sieniocha River”) in dist. Tomaszów Lubelski: metallurgist's hoard (photo by S. Sadowski)

Ryc. 4. „Znad Sieniochy”, pow. Tomaszów Lubelski: skarb metalurga (fot. S. Sadowski)

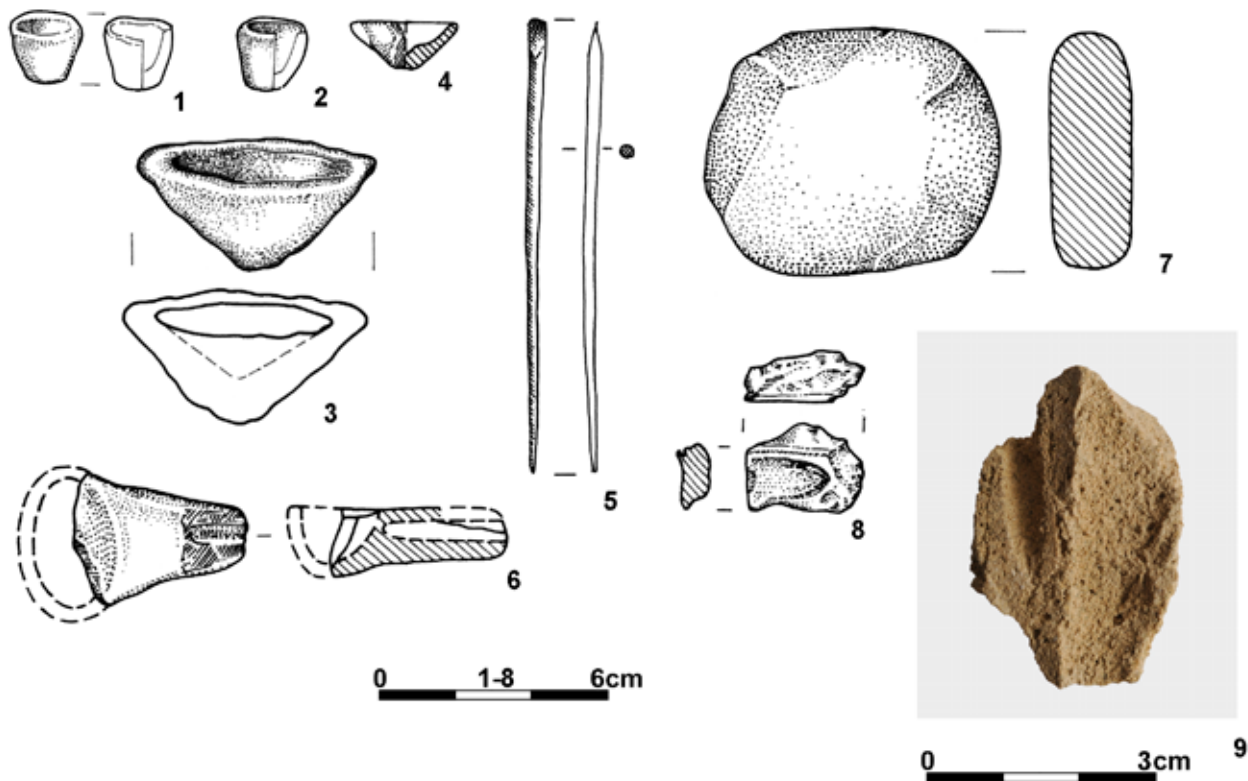


Fig. 5. Milejów, Łęczna county: clay crucibles – 1, 2; Wieprzec, dist. Zamość: clay crucible – 3; Żurawce, dist. Tomaszów Lubelski: clay crucible – 4; Stary Machnów, dist. Tomaszów Lubelski, site 41: chisel/punch – 5; Siekierzyńce, dist. Hrubieszów: smelting spoon – 6; Teptiuków, dist. Hrubieszów, site 6: anvil (?) – 7 (drawn by E.M. Kłosińska, redrawn by T. Demidziuk); Siedliszcze, dist. Chełm: metallurgical mould – 8 (by J. Dąbrowski 1969; redrawn T. Demidziuk); Petryłów, dist. Chełm, site 1: metallurgical mould – 9 (photo by G. Zabłocki)

Ryc. 5. Milejów, pow. łęczyński: gliniane tygle – 1, 2; Wieprzec, pow. zamojski: gliniane tygle – 3; Żurawce, pow. tomaszowski: gliniane tygle – 4; Stary Machnów, pow. tomaszowski, stan. 41: dłuto – 5; Siekierzyńce, pow. hrubieszowski: łyżka do wytapiania – 6; Teptiuków, pow. hrubieszowski, stan. 6: kowadło (?) – 7 (rys. E.M. Kłosińska, przerys. T. Demidziuk); Siedliszcze, pow. chełmski: forma metalurgiczna – 8 (J. Dąbrowski 1969, przerys. T. Demidziuk); Petryłów, pow. chełmski, stan. 1: forma metalurgiczna – 9 (fot. G. Zabłocki)

Wieprzec, dist. Zamość; Żurawce, dist. Tomaszów Lubelski – Fig. 5: 1–4), chisels-punches (Stary Machnów – Fig. 5: 5), smelting spoons (Siekierzyńce, dist. Hrubieszów – Fig. 5: 6), flat stones used as anvils (Teptiuków, site 7 – Fig. 5: 7), a stone mould for casting knives/sickles and pins (Siedliszcze, dist. Chełm – Fig. 5: 8), and another stone or clay mould (Petryłów, dist. Chełm – Fig. 5: 9) and finally metallurgical clay nozzle (Perespa, dist. Tomaszów Lubelski – Fig. 6: 2). The chemical analysis of stone mould from Siedliszcze showed no signs of use, which, after all, could have been removed during the cleaning of the artefact following its discovery (J. Dąbrowski 1969, pp. 85, 87). Small crucibles were used to melt raw material and crushed bronze scrap (J. Fogel 1982, p. 190). Unfortunately, the items from the Lublin region do not resemble classic crucibles, which are known from the metallurgical workshops located at the sites of the Lusatian culture west of the Vistula river (cf. L. Gajewski 1982, fig. 8; J. Fogel 1982, fig. 3a; J. Michalski 1982, fig. 3). No specific studies have been carried out to prove the contact of these objects with molten metal. Only in the case of the specimens from Wieprzec and Żurawce it can be stated that these vessels were secondarily heated to a high temperature. However, clay metallurgical accessories do not always have to bear signs of overheating, especially when the

bronze was already somewhat cooled down (J. Fogel 1982, p. 181). Handling crucibles was probably facilitated by grips made from organic material. Probably the capacity of these vessels corresponded exactly to the portion of bronze that was needed to cast particular item. The clay nozzle from Perespa was characterized by strong burn, but, at the same time, nothing on this issue is known in the case of the spoon from Siekierzyńce. This particularly shaped, unique object, which formally refers to the accessories known from the metallurgical workshops from Greater Poland and Kuyavia of the Hallstat period (cf. M. Gedl 1982, fig. 23: 1; J. Ostoja-Zagórski 1982, fig. 3: 13), was undoubtedly a tool of local metal casting workshop used for melting bronze and pouring it into a mould. The capacity of similar smelting spoons was small, ranging from 40 to 60 grams of bronze (J. Ostoja-Zagórski 1982, p. 178). Metallurgical work using some of the above mentioned items required perhaps additional devices, not all of which have survived to this day. They included: stone hammers, wooden handles for the spoons, grips for crucibles made of antler or forked branches (J. Fogel 1982, p. 191). Furthermore, in a work of a metallurgist also mentioned earlier: wax, moulding materials, stone grinding slabs and sharpening stones, as well as a large amount of fuel were essential. Also, it can not be ruled out that bronze items,



1

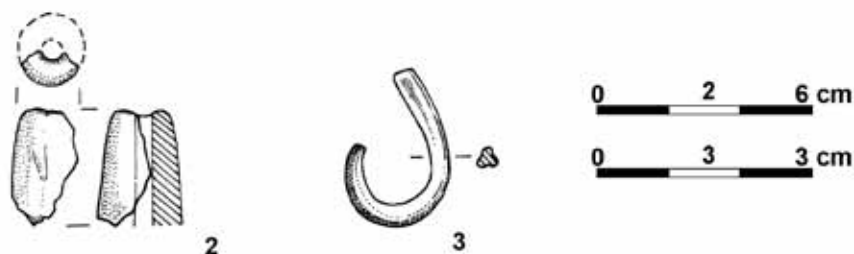


Fig. 6. Perespa, dist. Tomaszów Lubelski, site 54, grave 16: view at the time of exploration – 1 (photo by M. Piotrowski); a fragment of a metallurgical nozzle – 2; three bronze wires forged into one rod – 3 (drawn by E.M. Kłosińska; redrawn by T. Demidziuk)

Ryc. 6. Perespa, pow. tomaszowski, stan. 54, grób 16: widok w trakcie eksploracji – 1 (fot. M. Piotrowski); fragment dyszy metalurgicznej – 2; trzy druty z brązu tworzące jeden pręt – 3 (rys. E.M. Kłosińska; przerys. T. Demidziuk)

especially ornaments, were polished in order to increase their attractiveness. Those who owned these valuable items, probably often had to face the problem of matting and patination of the surfaces.

As in the other provinces of the Lusatian culture, the method of bronze casting was probably more common than bronze forging (J. Dąbrowski 2009, p. 196). In the Lublin region a fragment of a bronze rod forged from three wires that was found at the cemetery in Perespa (Fig. 6: 3) might be particularly interesting. It was probably a local semi-product intended for further mechanical treatment or a kind of a starting form for creation of some sort of twisted ornaments.

The view that the metallurgical activities were the domain of men is among the well-established scientific beliefs (Fig. 7). Bronze production was labour-intensive, required knowledge and experience, and no doubt also physical strength, mobility, and extensive contacts. Not only did the metallurgical process itself belong to the typical range of male activities, but so did preparation of metallurgical accessories made of clay (the so-called technical ceramics – crucibles, nozzles, smelting spoons,

moulds and disc-like plates), or construction of the devices for metal smelting. These activities, as shown by the model investigations carried out for Silesia, could have involved even a few people representing various age categories (A. Mierzwiński 2003, pp. 91, 93, 163, 176, 180). However, on the wave of the social change taking place in the Late Bronze Age and the Early Iron Age, one has to consider departure from the traditional roles played by both sexes in different areas of production. It is even thought that women could have taken direct part in the metallurgical process, for example, in cold hammering (J. Woźny 2011, p. 46).

It can be assumed that a metallurgist wandering between settlements evoked ambivalent feelings among inhabitants thereof. Such man, arriving from afar, and possessing special knowledge and skills was treated with respect, as a craftsman capable of turning ore, raw material or bronze scrap into a useful item using fire. At the same time he evoked fear, as a person who, in fact, was a depository of the mysterious knowledge allowing to “revive” what was “unborn” or already became “dead”. These superhuman powers, assisted in addition by

appropriate magical procedures and spells, put a metallurgist in row if not with divine beings, than definitely with the elites of the world of the time. The attractiveness of such personage resulted not only from his highly qualified knowledge and skills, but also from the fact that he could provide information “from a distant world”, spread the legends, myths and rituals (cf. M. Eliade 1998, *passim*). However, metallurgy did not have to be the only occupation of these people. In pre-Indo-European languages its meaning is combined also with flintknapping, and amber and bone processing (J. Gabriel 2011, pp. 332–333) that is activities of producing hard items with smooth surface.

From the cognitive point of view graves of metallurgists appear to be particularly attractive. Within the Lusatian culture milieu most of them occurred in Silesia (T. Malinowski 1982). The presence of metallurgical accessories among the grave inventories seems to suggest that these people not only had individual ownership of these items (cf. *ibid.*, p. 249), but they also needed them in the posthumous existence and – perhaps – these tools could not have remained among the living due to the “secret power” that was in them. In the Lublin region items related to metallurgy occurred at five sepulchral sites, and the most spectacular find among them is grave 16 at the cemetery in Perespa, site 54, containing, in addition to the burned remains of a man in adulthood, also a fragment of heavily overheated clay blowing pipe and fragments of three bronze bars hammered together, which were probably a semi-product of a twisted ring ornament (Fig. 6). The owner of these items was buried without a pottery urn, and the shape

of the pile of bones suggests that some kind of an organic container was used, probably a wooden box. The equipment related to metallurgy, different form of the grave and the location slightly on the outskirts of the cemetery, make this deceased individual a person distinguishing itself from all the other residents of Perespa. It can not be ruled out that it was a metallurgist, who was associated with the local environment only through the services he provided. Probably he did not own his own homestead in which a vessel for the burial could have been made or used. The presence of metallurgical accessories within few other burial grounds in the area of the Lublin region (Petryłów, Siedliszcze) compel us to express believe that graves of metallurgists could have been located not only in Perespa.

As the conclusions of this study it should be stated that within the south-eastern fringes of the land inhabited by the Lusatian culture population the bronze production developed to the extent that was possible at that particular time. Specialized craftsmen from European bronze metallurgy centres appeared in the Lublin region offering ready-made products, raw material and their skills. The local population was able to produce simple items. Thus the bronze production could be carried out two-tier, as occasional “performances” of specialists coming from afar and as a simple domestic production. The scale of all these activities, however, was incomparable to those of the metallurgists in the western provinces of the Lusatian culture (Silesia, Greater Poland). In fact, at that time metallurgical centres developed in those locations already had their own designs and produced significant quantities of products.

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Wytwórczość metalurgiczna w kulturze łużyckiej na Lubelszczyźnie – uwagi dyskusyjne

Streszczenie

Jeszcze do niedawna uważano, że dla terenów Lubelszczyzny, zwłaszcza w młodszych odcinkach epoki brązu, charakterystyczne było słabe nasycenie wyrobami brązowymi. Dziś takie poglądy powinny już odejść do przeszłości, jednak mimo znacznego przyrostu źródeł, analizowane terytorium pod względem zasobów wyraźnie odstaje, zwłaszcza od zachodnich prowincji kultury łużyckiej.

Zdecydowaną większość wyrobów metalowych na analizowanym obszarze stanowiły importy, pochodzące nieraz z bardzo odległych terytoriów. Napływ takich pojedynczych przedmiotów mógł mieć charakter okazjonalny i następować w wyniku przemieszczeń osób, trudniących się np. wymianą, metalurgią, czy też innych przedstawicieli ówczesnych elit. Metale napływały również wraz z migrującą ludnością. We wczesnej epoce żelaza trafiły na Lubelszczyznę stosunkowo liczne metale proveniencji wschodniej (kolczyki, grociki), które – jak się wydaje – użytkowane początkowo przez przybyszów, potem powstawały na miejscu.

Surowiec oraz gotowe wyroby metalowe przynosili zatem ich wytwórcy i/lub właściciele, a rozmaite okoliczności sprawiały, że stawały się one przedmiotami wymiany. Na importowanych wyrobach metalowych z terenu Lubelszczyzny zachowały się ślady stosowania rozmaitych działań metalurgicznych. Liczne zabytki, powstałe głównie w epoce brązu, noszą relikty, starannie spiłowanych, szwów odlewniczych. Przedmioty te wykonywano metodą odlewania z zastosowaniem form stałych, w większości dwudzielnych. Znajomość techniki „na wosk tracony” pojawiła się w kulturze łużyckiej już w młodszym odcinku epoki brązu, upowszechniając się we wczesnej epoce żelaza. Odlewy takie były technicznie lepsze od wykonywanych w formach stałych.

Rodzi się pytanie, które z przedmiotów w zbiorze zabytków metalowych odkrytych na Lubelszczyźnie mogły powstać na miejscu. Lokalna wytwórczość metalurgiczna została dowiedziona poprzez znaleziska na osadzie we Wronowicach. Warsztat odkryty na tej osadzie zaspokajał zapewne tylko lokalne potrzeby jeśli chodzi o ozdoby brązowe. Takie proste umiejętności były prawdopodobnie nieobce mieszkańcom innych osiedli Lubelszczyzny.

W okresie, gdy na Lubelszczyźnie rozwijała się kultura łużycka, lokalna wytwórczość metalurgiczna przebiegała dwu-

torowo. Niektóre zaawansowane technicznie przedmioty były wykonywane na miejscu, rękami wyspecjalizowanych wytwórców, przybyłych na to terytorium dysponując wiedzą i surowcem. Drugi nurt w rodzimej metalurgii realizował się poprzez wytwórczość przydomową, w toku której mogły powstawać tylko najprostsze formy. Można założyć, że zarówno wyspecjalizowani metalurdzy, jak i miejscowi, niezaawansowani wytwórcy posiadali swoje sposoby obchodzenia się z metalem, a ich wiedza na ten temat wywodziła się z odrębnych doświadczeń metalurgicznych.

Do ugruntowanych w nauce należy pogląd, że działalność metalurgiczna była domeną mężczyzn. Wykonywanie brązów było pracochłonne, wymagało wiedzy i doświadczenia, a bez wątpienia także siły fizycznej, mobilności oraz rozległych kontaktów. Nie tylko sam proces metalurgiczny należał do typowego zakresu czynności męskich, ale też przygotowywanie glinianych akcesoriów metalurgicznych (tzw. ceramiki technologicznej – tygli, dysz, łyżek, form odlewniczych i talerzy krążkowatych), czy też wznoszenie urządzeń do wytopu metalu. Niemniej jednak, na fali przemian społecznych zachodzących na przełomie epoki brązu i wczesnej epoki żelaza, należy się liczyć z procesami odchodzenia od tradycyjnych ról spełnianych przez obie płcie w różnych zakresach wytwórczości. Sądzi się nawet, że kobiety mogły brać bezpośredni udział w samym procesie metalurgicznym, np. w obróbce kowalskiej na zimno.

Można założyć, że wędrujący pomiędzy osadami metalurga wzbudzał ambiwalentne uczucia wśród ich mieszkańców. Przybywający z daleka, dysponujący szczególną wiedzą i umiejętnościami człowiek był traktowany z szacunkiem, jako rzemieślnik potrafiący za pomocą ognia zamienić rudę metalu, surowiec czy złom brązowy w użyteczny przedmiot, ale też z obawą, jako osoba będąca w rzeczy samej depozytariuszem tajemnicy, pozwalającej „ożywić” to co „nieurodzone” albo stało się już „martwe”. Te nadludzkie moce, wspomagane dodatkowo odpowiednimi magicznymi procedurami i zaklęciami, stawały metalurga w rzędzie jeśli nie boskich istot, to na pewno elit ówczesnego świata. Atrakcyjność jego osoby wynikała nie tylko z wysoko kwalifikowanej wiedzy i umiejętności, ale też i z tego, że mógł on przekazywać informacje „z dalekiego świata”, rozprzestrzeniać legendy, mity i rytuały.