Quaternary Science Reviews 343 (2024) 108757

Contents lists available at ScienceDirect

Quaternary Science Reviews

journal homepage: www.elsevier.com/locate/quascirev

Late Bronze Age salt production in the Carpathians and its socio-economic context

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ARTICLE INFO

Keywords:
Prehistoric salt
Briquetage
Peaceful encounters
Warlike interactions
Late Bronze Age
Poland
Carpathians

ABSTRACT

The paper focuses on observations of Late Bronze Age salt production at Tyrawa Solna in southeastern Poland. The discoveries of the evaporation and combustion of brine by means of *briquetage* from the San area in the Eastern Beskids are put into relation with the current state of knowledge on contemporaneous salt production and the salt trade at this time beyond the ancient world. Furthermore, aspects of social and economic conditions in the first centuries of the last millennium BC relevant to the topic are considered.

1. Salt springs in the Eastern Carpathians

Salt has been extracted in the Carpathian Zone using various techniques since the Neolithic (Pelisiak, 2008; Pelisiak and Dębiec, 2014; Preoteasa, 2015; Saile, 2017; Andronic and Niculică, 2023; Diaconu and Dumitroaia, 2023). Well known are, for example, the brine spring of Lunca "Poiana Slatinei" on the eastern edge of the Carpathian Arc, possibly exploited for eight millennia (Weller and Dumitroaia, 2005; Weller et al., 2008), or the Bronze Age troughs of Băile Figa in Transylvania (Harding and Kavruk, 2013; Kavruk et al., 2023). In this respect, the study presented here bridges a gap between the Cracow-Wieliczka region in western Lesser Poland and the well-researched areas in the southeastern Carpathians (Przybyła, 2015; Mazur and Dzięgielewski, 2021).

As late as the 19th century, several hundred brine springs were known to exist in the entire eastern arc of the Carpathians, as is evident from corresponding maps of Galicia and Bukovina (Kelb, 1876, pl. 14; Fischer, 1899, geological overview map after p. 40). Among the wells are several from the lower course of the Tyrawka, a right tributary of the San (Szajnocha, 1891, 4). Here, in the Beskids in southeastern Poland, they are concentrated on the higher parts of the northern slopes of the Góry Słonne, the Salt Mountains (Fig. 1). In 1918, J. Tokarski (1921) chemically analysed the brine from two of the springs in Lviv and found a surprisingly high salt content of 11%.

The first written sources mentioning salt extraction in the area date back to the 15th century, when salt springs were given as fiefdoms to wealthier people (Maślankiewicz, 1965, 240; Skowrońscy and Skowrońscy, 2002; Dębiec and Saile, 2018, 141). In the military annotations to the first comprehensive land survey of Galicia and Lodomeria, the salterns of Tyrawa Solna are described as abandoned (Bukowski et al., 2014, 109 no. 9). Nonetheless, the last source of salt water in Tyrawa Solna was only shut down in 1824 (Kelb, 1876, 171, 191) in favour of salt from the Habsburg-controlled salt works in the Cracow region, namely Wieliczka and Bochnia. However, some of the brine springs were temporarily used at local level until the 1950s. Dilapidated wooden constructions could still be seen in several places, and residents remembered this salt extraction (Jodłowski, 1985, 62–63).

The salt springs in the lower reaches of the Tyrawka River attracted the attention of archaeologists when A. Jodłowski (1985, 60 fig. 15) mapped the precise location of four of them. At least 13 active brine wells are currently known, mainly as a result of fieldwork conducted by M. Skubisz (Fig. 1): 11 are located in the parish of Tyrawa Solna (Sanok commune) and two in Siemuszowa (Tyrawa Wołoska commune) (Dębiec and Saile, 2018, 139). The relatively high concentration of archaeological sites from the Neolithic onwards in the area around the confluence of the Tyrawka and San rivers, an otherwise forested region, can be explained by the salt and copper deposits that compensated for the environmental disadvantages (Gedl, 1998a, 101–102 fig. 45, 186 no. 116, 235 no. 399; 1998b, 222 fig. 5; Dębiec et al., 2015, 191–192 figs. 2 and 3).

2. Field research on salt in the Tyrawka Valley

Research into the early use of salt has been carried out with varying

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https://doi.org/10.1016/j.quascirev.2024.108757
Received 28 February 2024; Received in revised form 16 May 2024; Accepted 4 June 2024
Available online 2 September 2024

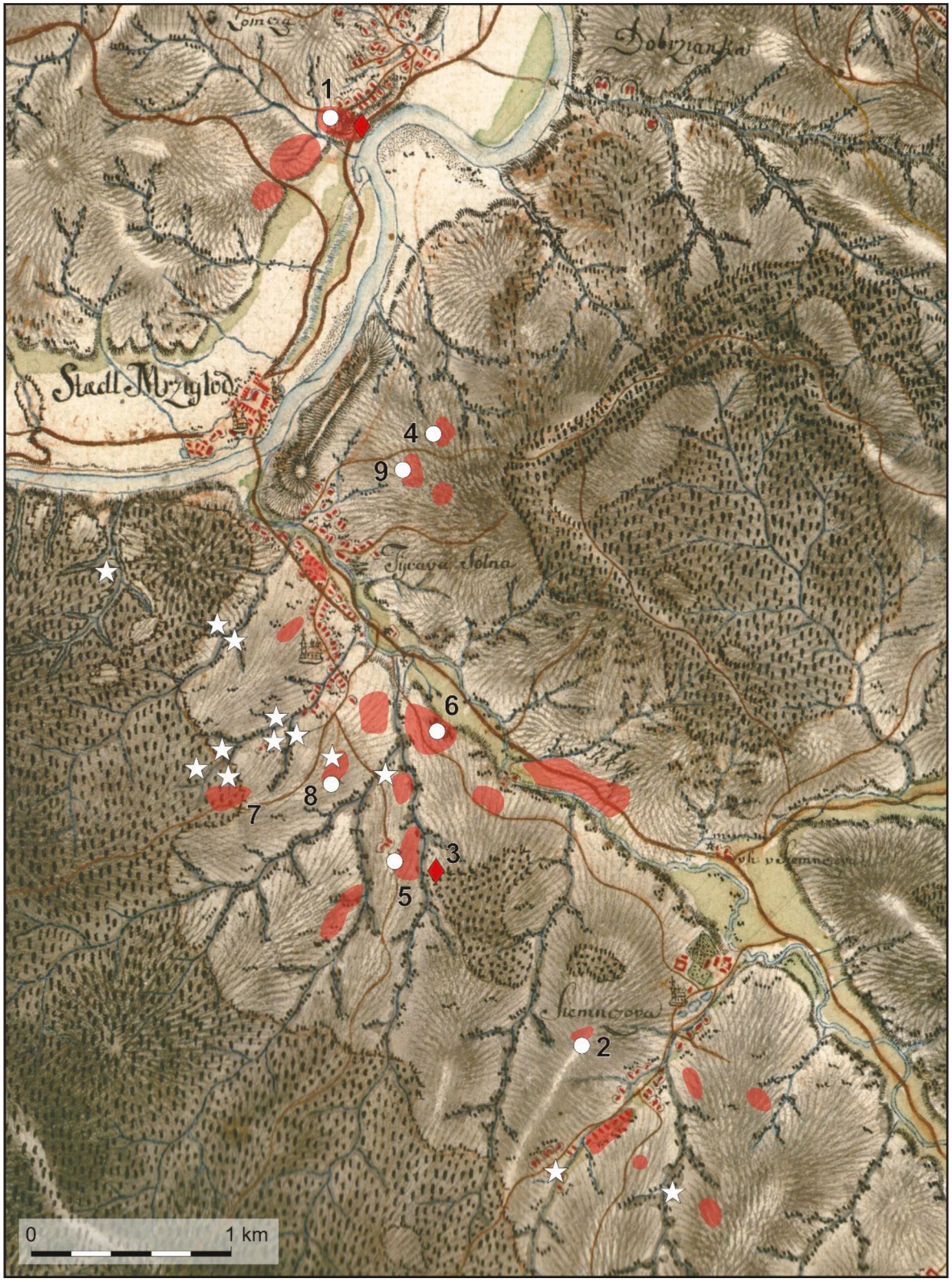

Fig. 1. The area of the mouth of the Tyrawka into the San was densely populated in the Late Bronze Age and Early Iron Age. Settlements are marked in red, as are the two hoard finds (lozenges). At present, 13 brine springs are active (white stars) and briquetage has been found at eight settlements (white circles). Base map: Josephine Land Survey of Galicia and Lodomeria, 1:28.800, Section 120 Mrzygłód (ca. 1780). 1 – Hłomcha 1, 2 – Siemuszowa 4, 3 – Tyrawa Solna 2, 4 – Tyrawa Solna 5, 5 – Tyrawa Solna 8, 6 – Tyrawa Solna 12, 7 – Tyrawa Solna 24, 8 – Tyrawa Solna 26, 9 – Tyrawa Solna 33. – After Gedl, 1998a, 102 fig. 45; 1998b, 222 fig. 5 and Dębiec et al., 2015, 192 figs. 2 and 3; with modifications.

Fig. 2. Tyrawa Solna 12. General plan of the magnetic prospection area. Magnetogram range: −4/+4 nT (black/white). Grid: UTM34N ETRS89.

intensity in the landscapes of Europe (Saile, 2000; Harding, 2013a). In addition to regions that are now well researched, there are areas where prehistoric use of salt is likely, but for which no convincing evidence can currently be provided. Recently, Harding and Kavruk (2013, 182), referring to Tyrawa Solna, emphasised that it is not yet possible to adequately assess the importance of the brine springs of this area in prehistoric times; however, it is "highly unlikely that the springs were unknown and unexploited".

In the meantime, magnetic prospecting has been carried out at several locations in the Tyrawka Valley, namely at Tyrawa Solna 12, 20, 24 and 30, as well as at Siemuszowa 3, totalling about 12 ha. The most conclusive result was achieved in Tyrawa Solna 12 (Fig. 1, no. 6). Unfortunately, the outcomes of the magnetic investigations at the other sites were not particularly convincing. Obviously, the size of the surveyed areas was too small until the field work had to be stopped during the coronavirus pandemic, and there was too much scrap metal on some areas.

Excavations took place at Tyrawa Solna 12 and 33 (Fig. 1, nos. 6 and 9); Hłomcha 1 had already been dug previously (Fig. 1, no. 1). The extraction of salt from brine was attested above all by the discovery of very coarse earthenware vessels used in the evaporation and combustion processes. Such *briquetage* was also discerned in several surface collections in the region (Gedl, 1998a, 79 pl. 40, 1.4–13), namely at Siemuszowa 4 and at Tyrawa Solna 5, 8, 24, and 26 (Fig. 1, nos. 2, 4–5, and 7–8).

Tyrawa Solna 12 is located on the southern high bank of the Tyrawka, about 400 m north-east of a brine spring (Fig. 1, no. 6). To the west, the approximately 8 ha site is bordered by an unnamed stream, into which the brine from the spring drains. To the south, the site gradually rises towards the brine spring. Neolithic, Late Bronze Age, and Early Iron Age finds were collected there around 1980 by M. Parczewski (1984) within the framework of the Archaeological Picture of Poland programme. Some pieces were classified as probably of Bandkeramik origin (Czekaj-Zastawny, 2008, 229 no. 702).

The site is currently used as arable land and grassland. In this respect, it is well suited for a magnetometer survey; accordingly, almost 6 ha were explored by M. Posselt (Figs. 2 and 3). A loose scattering of anomalies with low to high amplitude was detected on the site.

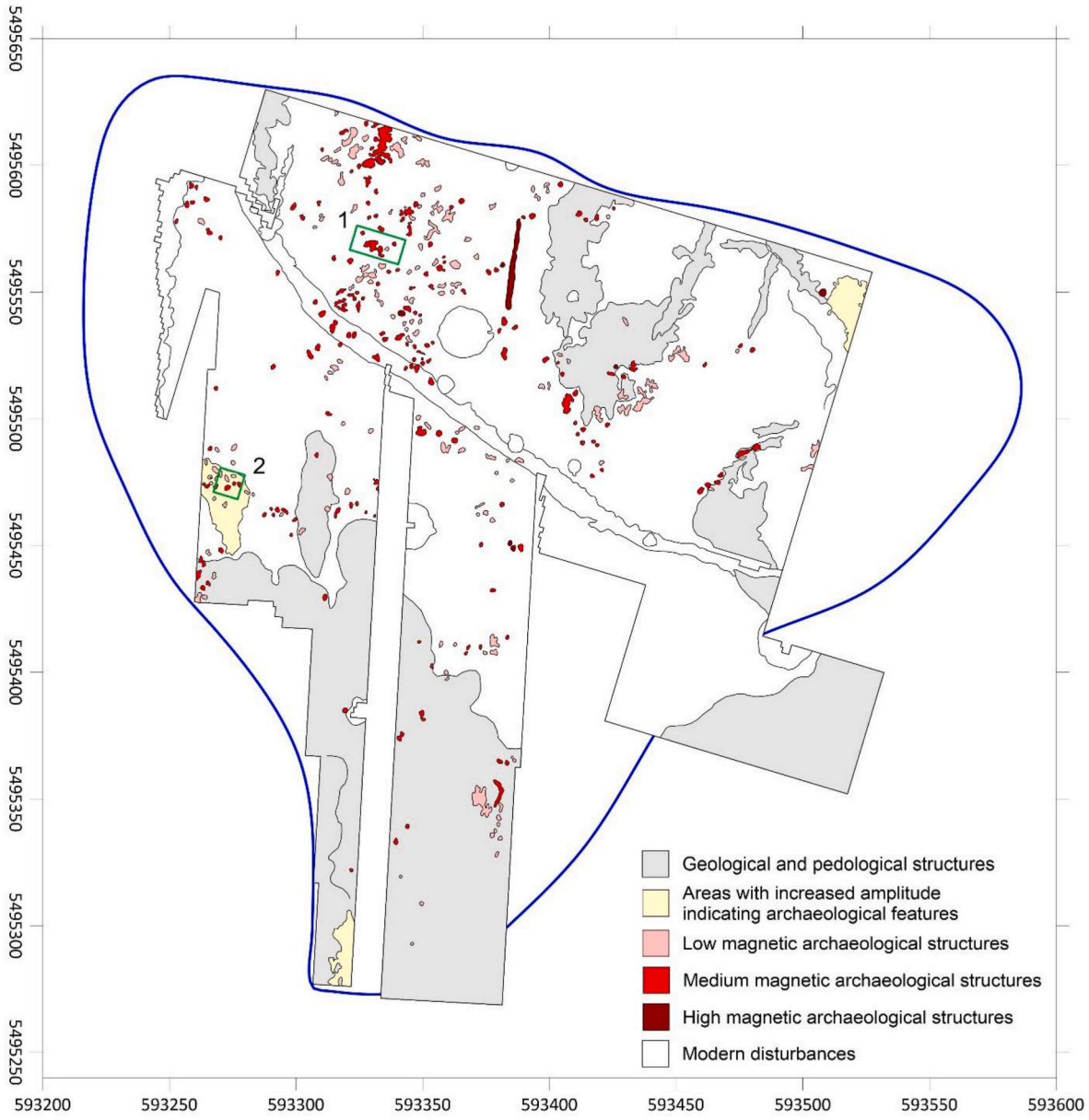

Fig. 3. Tyrawa Solna 12. Interpretative drawing of the magnetogram and location of the two excavation trenches.

Particularly in the west, numerous pits or pit complexes are recognisable as structures with medium magnetic amplitude. Archaeological objects with very high susceptibility were discovered primarily in the north-eastern part of the survey area. They appear to be related to the intensive use of fire; among other things, the still missing pottery kilns for *briquetage* production can be surmised here.

Some of the anomalies suggestive of prehistoric settlement activity were investigated in three consecutive field campaigns under the local direction of M. Dębiec. Two trenches measuring 10 × 20 m and 10 × 10 m were laid out, which were excavated in 2015/16 and 2017 respectively. They yielded several pits of different shapes and dimensions (Figs. 4 and 5). The maximum extent of the pits was 5.0 m, but most of them only had a diameter of around 2 m or less. In trench 1 in particular, they were only a few decimetres deep. The greatest depth of a feature was reached in pit 19 at 1.2 m below ground surface. The *briquetage* fragments deposited in the shallow pits were often encountered directly after the topsoil had been removed (Dębiec et al., 2016, 76 fig. 2). Occasionally, the concentration of *briquetage* in the pit complexes gave the impression that the ceramic remains of individual working processes were disposed of in them as waste (Fig. 4). In the deeper pits (e.g., Fig. 5, pits 19 and 21), the *briquetage* originates mainly from their lower parts (Dębiec et al., 2022, 253 fig. 1), while the upper sections may have been deliberately backfilled later.

The *briquetage* discovered at the lower course of the Tryawka is characterised by a considerable admixture of crushed stone, mainly black hornblende. This gives the technical pottery a local uniqueness that sets it apart from other regions. The *briquetage* can be divided into structures, i.e., evaporation basins or furnaces, and containers, which initially hold the brine and later the wet salt in the production process (cf. Gedl, 1998a, 79 pl. 20, 6–7 and 21, 4.11).

In Tyrawa Solna 12, several fragments of upper parts of furnace-like structures were excavated, the appearance of which we can only speculate about. The depressions in the dome of these furnaces were apparently used to hold the brine or the still moist salt crystals (Fig. 6). There are also individual chalice-like *briquetage* vessels with pointed bases (Fig. 7), which, like the recesses of the ovens, ultimately had to be smashed in order to extract the salt cake. This explains the large quantities of waste discovered at the site.

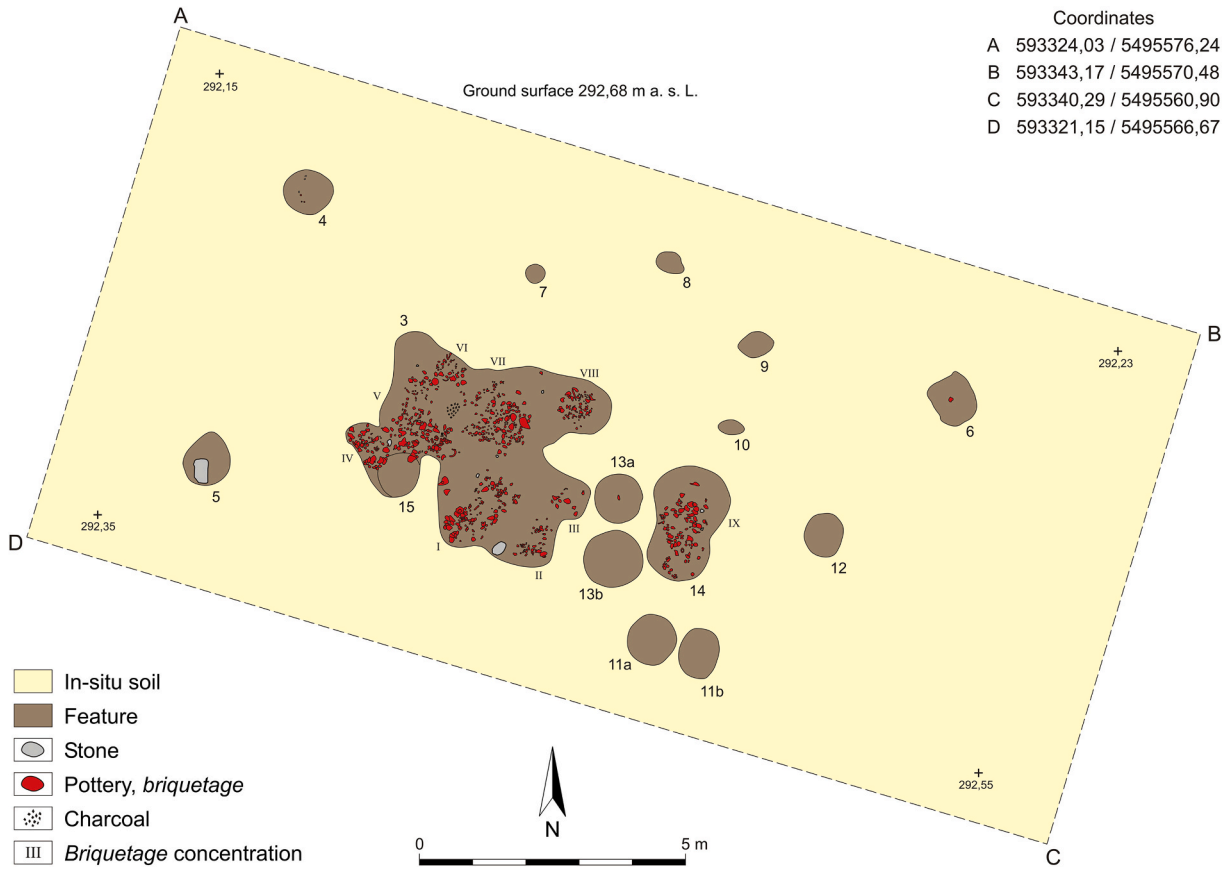

Fig. 4. Tyrawa Solna 12. Trench 1, excavated in 2015/16.

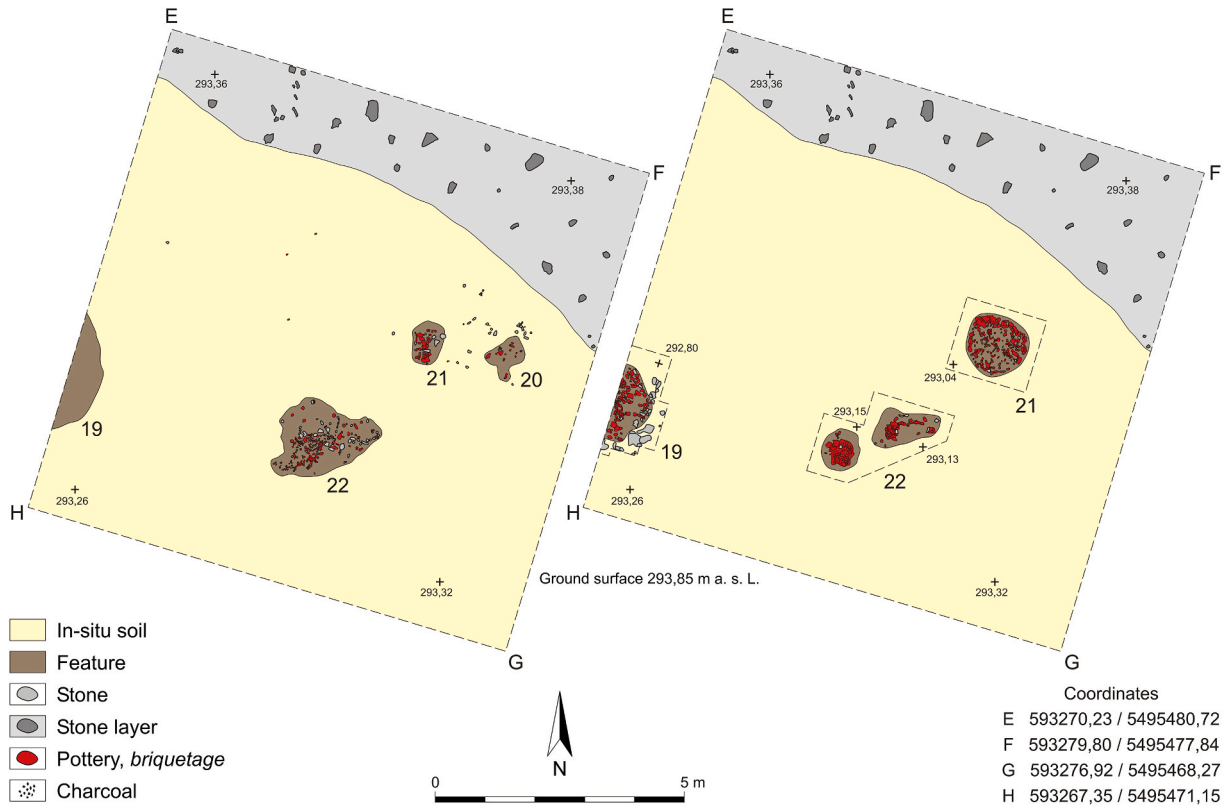

Fig. 5. Tyrawa Solna 12. Trench 2, excavated in 2017. Left: planum 1 approx. 0.5 m below the ground surface, right: deeper excavated areas ca. 0.8 m below the ground surface.

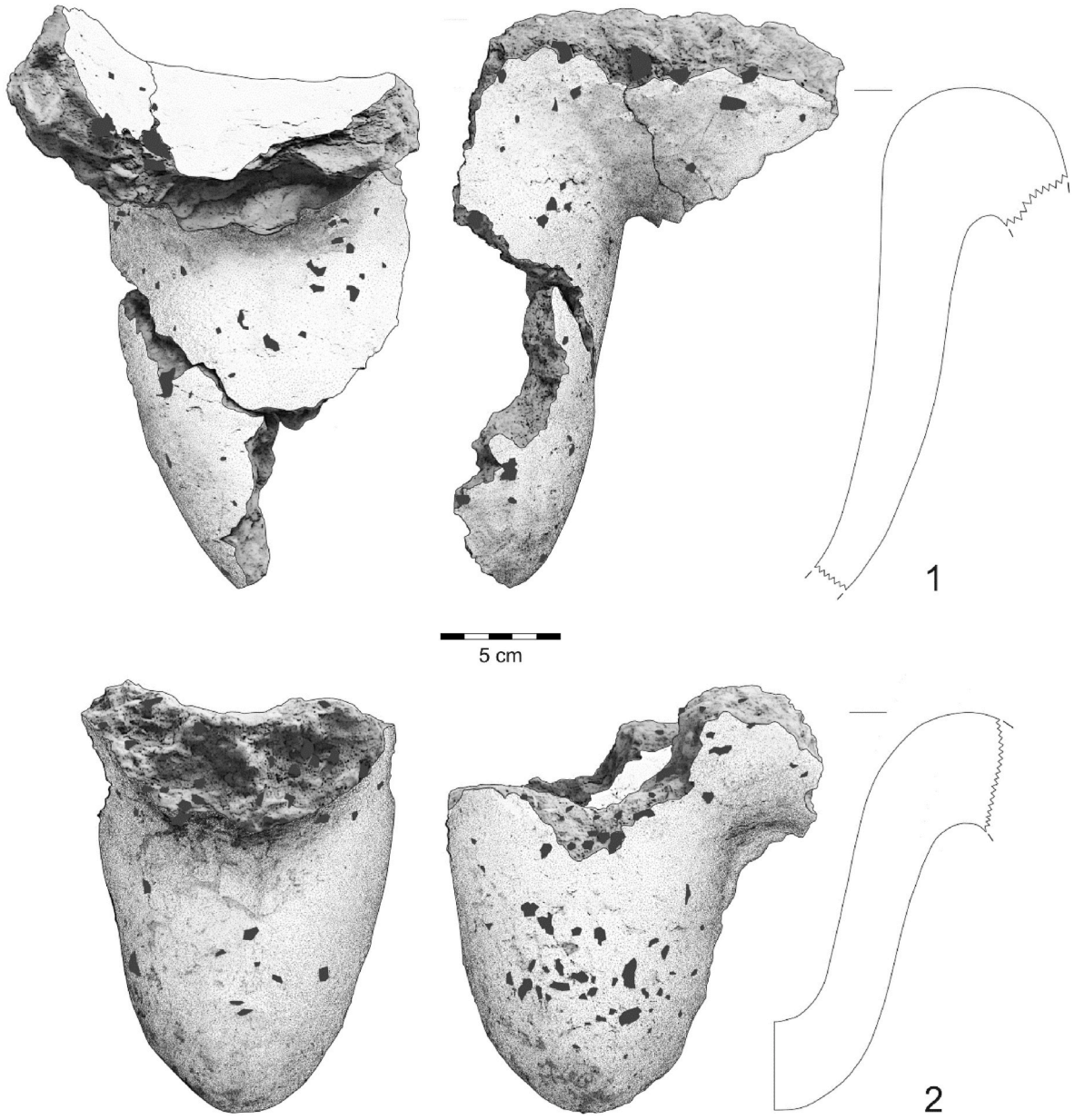

Fig. 6. Tyrawa Solna 12. *Briquetage* fragments of structures from objects 19 (2) and 20 (1).

As can be seen from this fuzzy description, several details of the salt extraction process using *briquetage* vessels have not yet been fully clarified. Successful evaporation appears to require the porous surface of the *briquetage* to be impermeable to the brine, which can be achieved with organic materials. In any case, the numerous experiments on salt production have led to contradictory results (Tencariu et al., 2015).

The Beskid *briquetage* has been categorised as clay crucibles by some authors, but it is obvious that the clay of the vessels was not exposed to the extremely high temperatures that would occur during metalworking in the smelting process. There is also no evidence of metal processing such as smelting furnaces, moulds, or slag on the site.

Among the few fragments of common settlement pottery, some were found that can be associated with the Late Bronze Age Gáva culture of the Carpathian Basin (Czopek, 2005, 53–56 figs. 3 and 4; 2009, 24–25; Przybyła, 2009, 188–200; 2017, 234, 252; Dębiec et al., 2020, 544 fig. 7). Two radiocarbon dates obtained from the charcoal of features 19 and 20 corroborate a dating of the site to the early last millennium BC (Poz-96834 [19]: 2800 ± 35 bp = 1043–846 calBC [95 %]. – Poz-96833 [20]: 2715 ± 30 bp = 913–810 calBC [95 %]). This corresponds approximately to phase IV (Tarnobrzeg-Lusatian culture) of the chronological classification by M. Gedl (1998a, 85–86) or Ha B1/B2 and Mont. Per. IV/V.

The Tyrawa Solna 33 site is located on a south-west facing slope on the right bank of the Tyrawka River (Fig. 1, no. 9). It was discovered in 1988 by M. Parczewski and excavated to a limited extent in 2017 by A. Kubicka-Marek and G. Płoskoń. There are no known salt springs in the immediate vicinity. The discovery of *briquetage* from five Late Bronze Age pits therefore came as a surprise. In total, more than a thousand *briquetage* fragments and several pieces of non-technical pottery were unearthed (Dębiec et al., 2020). As in Tyrawa Solna 12, some of the few common settlement vessels show cultural connections with the trans-Carpathian late Gáva-Goligrady-Grănicești cultural complex with fluted pottery (Bandrivs'kij, 2014; Kašuba et al., 2019, 187). For their part, the Gáva communities were involved in the exploitation of salt deposits further south in Transylvania (Ciugudean, 2012, 239 fig. 15).

Some of the Early Iron Age hoards of the Sanok-Jasło-cluster appear to be related to salt extraction (Blajer, 2023, 92). This view is supported by the presence of *briquetage* at the site of Hłomcza 1 (Gedl, 1998a, 79 pl.

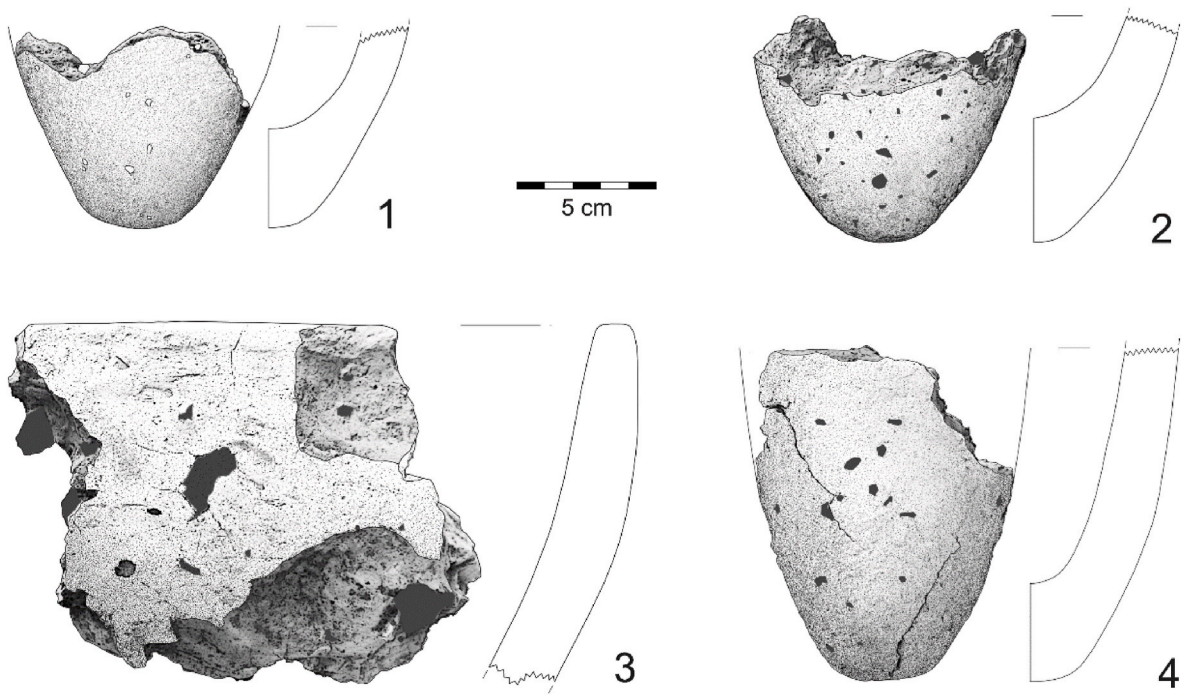

Fig. 7. Tyrawa Solna 12. *Briquetage* fragments of vessels from object 3, concentration I (1) and III (4), and object 20 (2–3). – After Dębiec et al., 2022, 253 fig. 2; with modifications.

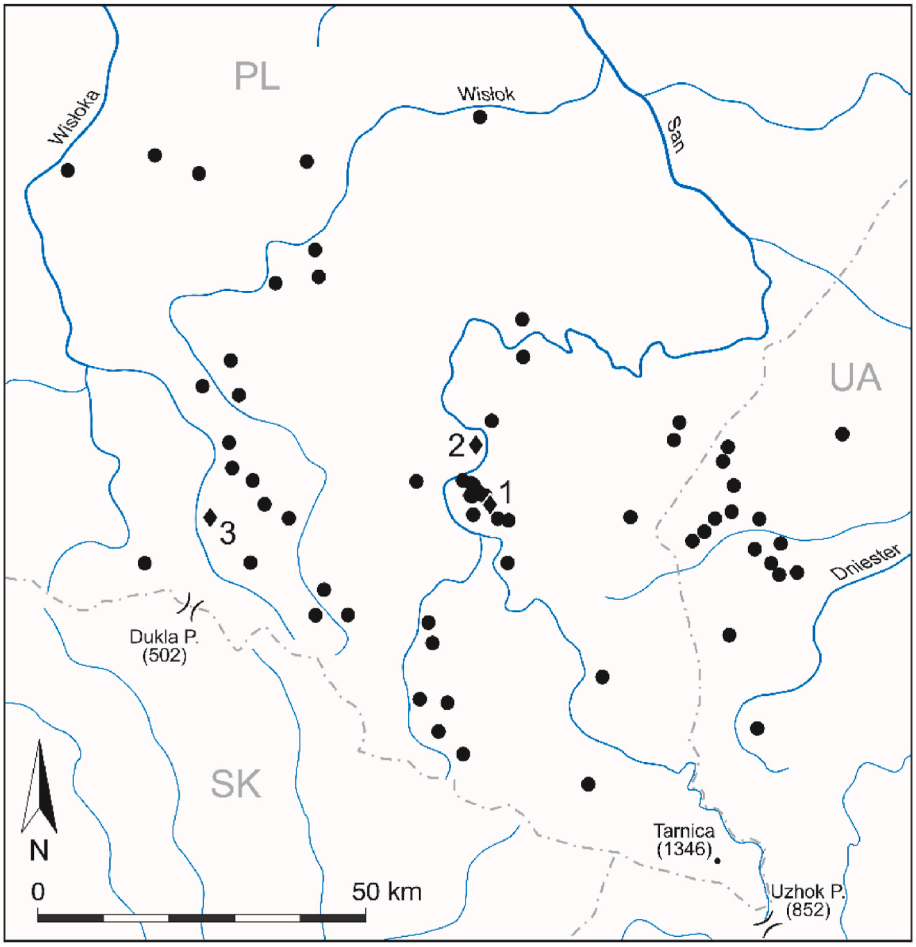

Fig. 8. Salt springs in the Polish-Ukrainian Carpathians and the Early Iron Age hoard finds discovered at Hłomcza 1 (1), Tyrawa Solna 2 (2) and Lubatówka 16 (3). – After Kunysz, 1963, after p. 56 fig. 1 and Jodłowski, 1971, 308 map 1; with modifications.

20–21; 1998b, 222 fig. 8; Muzyczuk, 2003, 352 fig. 8; Blajer, 2023, 100 no. 1) and among the finds from Lubatówka 16 (Gancarski and Leszczyński, 2021, 552–555 fig. 8; Blajer, 2023, 106 no. 8). The latter hoard is located some 35 km west of Tyrawa Solna and about 15 km north of the Dukla Pass and is probably associated with salt springs in the Rymanów Hills (Fig. 8). Certainly, the presence of *briquetage* in hoards and graves has a symbolic meaning (Jockenhövel, 2012). The hoard from Tyrawa Solna 2, however, consists of only four bronze rings (Gajewski, 1965; Gedl, 1998a, 48 fig. 20, 1998b, 218 fig. 7; Blajer, 2023, 104 no. 26).

3. Organisation of salt extraction

All of today's salt springs are located on the left bank of the Tyrawka River, on middle slopes stretching towards the north-east. It is unlikely that their location has changed significantly since the Bronze Age. Some are in the immediate vicinity of Late Bronze Age sites (Fig. 1, no. 7). Occasionally, *briquetage* was also found there (Fig. 1, no. 8). However, distances of more than 1 km often had to be covered between the salt springs and *briquetage* sites. It can be assumed that a concentrated (?) brine or a salt slurry was regularly transported to the place where it was further processed and eventually, salt refinement could have taken place (cf. Alessandri et al., 2021, 34–36). This was obviously more economical than transporting the fuel to the brine springs, even if at first glance one might think that transporting a liquid must be more complicated than transporting large quantities of firewood (Saile, 2007).

There is only scant evidence of the salt boiling process at the presumed production sites. So far, no evaporation basins have been discovered, which would have been expected. Some fragments may have belonged to furnaces (Fig. 6). After all, broken *briquetage* was frequently found; following final evaporation, the chalice-like container had to be broken to obtain the salt cake (Fig. 7). The quantity of common settlement pottery is small, and no evidence of permanent buildings or a continuous habitation was identified. It therefore seems quite conceivable that the settlements and the production zones were spatially separated.

In view of the climatic conditions, the assumption of seasonal salt exploitation seems reasonable. The quantity of salt manufactured is more likely to have been intended for local consumption. However, short-term activities may have been quite intense. The numerous *briquetage* sites indicate greater exploitation, but it should be borne in mind that the production sites were probably not all used simultaneously. At the same time, many skills were required to carry out production work effectively, which promoted a process of increasing division of labour. Salt extraction was certainly not a "two-men-and-a-dog" venture. The production centre in the salt-bearing area of Wieliczka and Bochnia near Cracow was operated on a much larger scale. Here, in western Lesser Poland, various settlements specialised, for example, in the manufacturing of *briquetage*, the evaporation of brine, or the packaging of salt (Mazur and Dzięgielewski, 2021).

Salt exploitation at subsistence level seems to be the most suitable explanation for the discoveries made so far in the San area. In part, it could have taken place in the context of expeditions from more distant areas, for which the San Valley, connecting the Vistula with the Uzhok Pass (Fig. 8), would have been a favourable access corridor (Dębiec et al., 2020, 541–543). In this case, the parties involved had to deal with rights of access. Property rights may have been affected, as the salt wells were in the home range of a group of people, in their zone of repeated use and management. Outsiders had to be invited or at least given permission to extract salt (Michel, 2023, 177). In the end, the labour investment created property (Earle, 2017, 5). Notable is the lack of extraordinary accumulation of wealth in the region, which supports the notion of an overall lower intensity of production. This is in striking contrast to the well-furnished graves from Hallstatt, where large-scale rock salt production took place. On the other hand, the long-assumed association between bronze hoards and salt sources for Romania has recently been called into question (Harding, 2013a, 97–110). Apparently, there is no clear correlation between salt production and distribution on the one hand and the accumulation of wealth and higher social status on the other.

In the context of obtaining salt in the Bronze Age, there might have been taboos and prohibitions. Access to salt deposits could have been limited and associated with rituals (cf. Hopi or Navajo religious rites: Titiev, 1937; Hill, 1940). The links between salt and mythology in the Bronze Age can only be speculated about; however, the sacred and spiritual character of salt is well attested in ethnographic records.

4. Salt extraction in a broader context

So far, we have dealt with the archaeological observations on the lower reaches of the Tyrawka and their interpretations. The question of the significance of this local salt production in the context of the Late Bronze Age economic system and its social order is an obvious one. Was local production virtually forced by the circumstances of the time? Even if this may be too wide a field, to quote Theodor Fontane, a cursory examination of these complex issues seems to be one way of appropriately assessing the significance of the discoveries made.

Especially when approaching the research field of political structures of Bronze Age societies, one quickly feels lost "in the churning sea of prehistoric hypotheses" (Bastian, 1878, IV). The impression is conveyed that it is unlikely, as E. Leach (1979, 120) once puts it, "that archaeologists working with the … fragmentary material residues of Bronze Age … Europe should be able to say anything that is sociologically convincing concerning the associated human societies". And admittedly "in the jargon of the archaeologist there is an abundance of allegorical terms, a sure sign that one only guesses what one is talking about" (Kossack, 1974, 32).

5. Socio-political conditions in the Late Bronze Age

However, there is a general consensus on how people lived together in the Central European Late Bronze Age (Clausing, 1999, 391–397, 410–411; Brück and Fontijn, 2013). The world was primarily agrarian in character, and ownership of land and its yields formed the economic basis of independence. The little differentiated groups of farmers had only very restricted fields of activity resulting in a lack of opportunities to generate larger surpluses. It seems that the socio-political relations were characterised by an oscillating mosaic of competing corporate groups, i.e., groups of people acting together politically.

In the unstable, clan-based social order, violent confrontations were widespread and the polycephaly of the time was threatened by the rise of more hierarchical regimes. Raids were the predominant form of gang violence organized by the chief and his retinue. We encounter these potentates among the rich sword and wagon graves of the time (Clausing, 1999; 2005; Pankau, 2024). The client groups were based on genealogical rank and descent, and the entourage was held together by kinship, loyalty, and dependency. Numerous hillforts from the Late Bronze Age bear witness to a considerable degree of group aggression, since they served as the necessary infrastructure for war-bands. This went hand in hand with the spread of an "ideology of martiality" and the rise of a male warrior elite as a belligerent social category (Harding, 2018, 19).

Peace first had to be negotiated. Networks based on the exchange of useful and/or prestigious goods facilitated this, as ethnological examples show (Hansen, 2023). However, when advantageous, trade was accompanied by violence. Raids on raw material centres were certainly not an unusual means of procuring needed goods. The quest for control over trade routes and marketplaces may have frequently led to conflicts, only some of them were occasionally settled peacefully. In Niederviehbach (Lower Bavaria) there is particular evidence of a martial conflict, which will be discussed here in a brief digression.

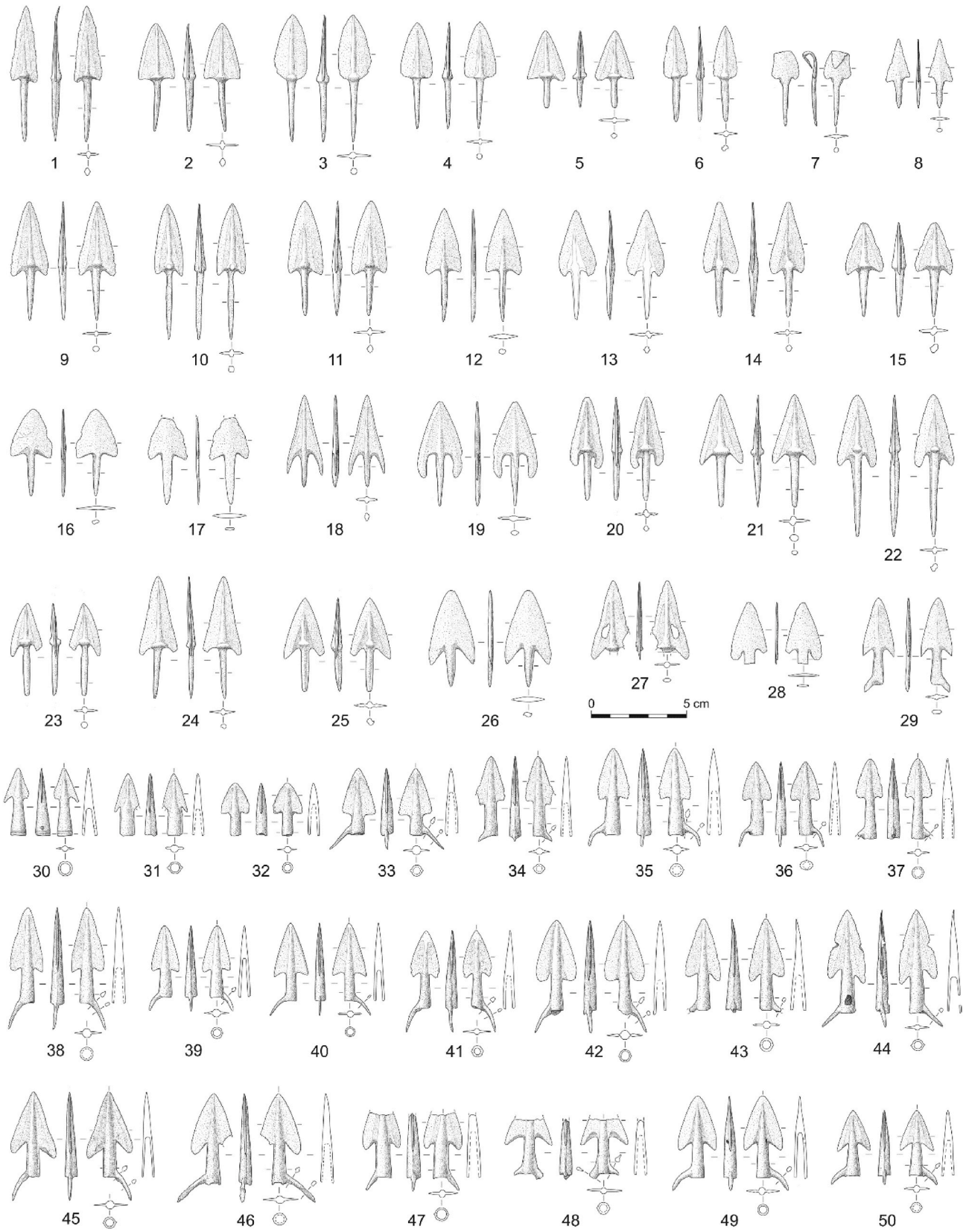

Fig. 9. Niederviehbach (Lower Bavaria). A compilation of tanged arrowheads with flat-based blade (1–17), tanged arrowheads with barbed blade (18–28), a tanged spurred arrowhead (29), socketed arrowheads (30–32), and socketed spurred arrowheads (33–50), representing a characteristic sample from the find complex comprising several hundred bronze arrowheads.

Excursus: a violent encounter at Niederviehbach

Arrowheads belong to the rather inconspicuous archaeological finds that do not occur in large numbers. However, more than 500 Late Bronze Age metal artefacts, mainly arrowheads, were collected from an area of approximately 1500 m^2 on a slight elevation in the Isar valley, a presumed natural levee, about 2 km north of Niederviehbach (Lower Bavaria). Unfortunately, the material is scattered among various private collectors (Goldschmidt and Kaltenegger, 2006). A characteristic selection of 50 of the arrowheads with an average weight of 4.7 g is shown in Fig. 9, whereby the proportion of the types probably largely corresponds to their share of the total collection. Tanged arrowheads are the predominant category. Most of the socketed arrowheads have a spur protruding from the side of the socket. The tanged spurred arrowhead no. 29 in Fig. 9 is a rather marginal type (German: *Schwalbenschwanzpfeilspitze*).

The Niederviehbach arrowheads were made of tin bronze with a tin content ranging from 6 to 12 %, which is typical for the Late Bronze Age. The analysis of the trace elements reveals that the copper of the arrowheads has a uniform composition, indicating that the copper used came from a single deposit. However, a common casting can be ruled out, which is already implied by their typological diversity. The lead isotope ratios of the copper point to the Southern Alps as the most likely region of origin (Pernicka, 2021). This observation coincides with general trends in the relocation of supply routes for raw copper during this period (Falkenstein, 2017, 8; Nørgaard et al., 2021). The arrowheads were in a humid, ferruginous environment for a long time, as demonstrated by the high iron values when their corroded surfaces were screened (Pernicka, 2019). The long storage under the same environmental conditions confirms that the find complex discovered by metal detecting belongs together.

There is no parallel for such a large complex of arrowheads in Central Europe. The furnishings of a grave usually contain only a handful of them (Clausing, 1999, 374; Deicke, 2011, 65–69 figs. 58–61; Gedl, 2014, 5 fig. 1). They are rarely found in hoards and settlements (Eckhardt, 1996, 19–20 diagram 1). Exceptions are fortifications, e.g., the promontory fort on the Reisberg near Burgellern (Fundchronik, 2004, 156 figs. 88, 8–44; Krause, 2019, 28–31 figs. 16–17), the fortified hilltop settlement on the Schellenburg near Enkering (Winkelmann, 1926, 16; Schuβmann, 2010, 134–135 fig. 2), or the Sängersberg on the edge of the Fulda depression near the salt wells of Bad Salzschlirf (Blitte et al., 2019, 76 fig. 3; Krause, 2019, 31 figs. 18–20). 107 arrowheads were found at the Urnfield hillfort Heunischenburg in Upper Franconia. However, the quantity ratio differs significantly: there is a clear predominance of socketed arrowheads, and more than 10 % of the tanged ones are spurred (Abels, 2002, 31–35 pl. 18–19). The use of the spurred arrowhead is a Central European phenomenon (Eckhardt, 1996, 417 map 10), whereby the tip is supposed to be part of "a hunting arrow designed to bleed a wounded animal" (Mercer, 1970, 186). Tanged arrowheads tend to show a more western distribution (Eckhardt, 1996, 413 map 8) and are particularly common west of the Rhine (Mercer, 1970, 190 fig. 5), while they are almost unknown from Moravia and Poland (Říhovský, 1996; Gedl, 2014).

Archery was widespread in the Bronze Age (Harding, 2000, 283–284). Bows and arrows were used for hunting, and, to an unknown extent, they were made use of in warfare. It is easy to envisage that the large number of arrowheads from Niederviehbach points to groups of warriors who fired volleys of arrows when crossing the Isar valley in connection with a conflict. This is reminiscent of observations of organised group violence in the Tollense valley (Krause, 2019, 25; Krüger et al., 2020; Harding, 2021a, 102–111; Terberger et al., 2023, 278 figs. 9–10) or in Velim (Harding et al., 2007, 146; Harding, 2018, 18, 20–21), from where, however, far fewer arrowheads originate.

6. Economic conditions in the Late Bronze Age

Economic relations and connectivity between the different regions were significantly affected by the pervasive violence. On the other hand, the exchange of goods and materials provided the opportunity to forge alliances and thus ensure a minimum level of security in a social environment where interpersonal brutality of various kinds was presumably endemic. Trade was above all a social activity (Agbe-Davies and Bauer, 2010).

The reciprocal exchange of gifts and the more market-orientated trade in objects can be seen as two ends of a spectrum that represents the social context of transferring ownership (Earle, 2017, 10). Down-the-line exchange networks and long-distance movements of traders across the continent dominated the scene (Köhler, 1985, 42–46). There arose numerous opportunities for merchants in the broadest sense, who fostered far-reaching contacts. Providing protection and provisions during travels was one of the purposes of emerging long-distance political confederacies (Kristiansen, 2023, 242). The widespread distribution of certain metal objects like weapons or ornaments testifies to extensive exchange networks; some of these objects can be regarded as limited purpose money.

Salt was just one commodity among other raw materials exchanged like copper, tin, amber, or gold and manufactured goods such as weapons or ornaments. Salt was an integral part of the barter economy, and relationships between suppliers and customers were based on widely recognized value systems (Harding, 2013b).

Salt was of immense importance to people of antiquity, but its sources were unevenly distributed across Europe (Harding, 2021b, 4 fig. 2; Mazur and Dzięgielewski, 2021, 220 fig. 1). In order to establish a certain balance between regions involved, salt had to be transported from salt-rich areas like the Carpathians or Transylvania to salt-poor regions such as the Hungarian Plain or Ukraine. As the larger production centres in Halle or Hallstatt, and later in the Seille Valley and the coastal lagoons, were unable to meet demand, there were plenty of incentives and opportunities for local production, resulting in a wide variety of grades of salt.

7. Outlook

The archaeology of salt in the Beskids of southeastern Poland is still in its early stages and is at the same time a promising topic for future research. There are several issues that could be addressed in the period ahead. The following are just a few of them: First of all, the magnetometer surveys should be resumed as they had stalled in their initial phase. Larger areas are required to achieve meaningful results. Furthermore, petrographic and chemical analyses of the technical pottery are essential in order to rule out any confusion between vessels for salt extraction and those for other economic activities such as cooking, smelting or packaging (cf. Alessandri et al., 2021, 32, 35; 2024, 11; Harding, 2021b, 32). The settlement structure is still unclear. On the face of it, it looks as if housing and production were separate. The extent of production remains uncertain. Local use of the brine could have been organised on a seasonal basis, while extensive production would have led to characteristic, archaeologically verifiable structures. However, this raises the question of how large-scale production fitted into the Late Bronze Age/Early Iron Age network of commodity transfer.

Picture credits

Figs. 1, 4–5, and 8: H. Marx. – Figs. 2 and 3: M. Posselt. – Figs. 6–7, and 9: A. Bardetskyi.

Acknowledgements

No specific grants were received from funding organisations for this research. However, the fieldwork was gratefully supported by the Universities of Regensburg and Rzeszów. I would particularly like to thank Wojciech Blajer (Cracow), Paul Boland (Regensburg), Ian Brown (Tuscaloosa), Maciej Dębiec (Cracow), Ashley Dumas (Livingston, AL), Florian Eibl (Dingolfing), Gregor Goldschmidt (Thalham), Ernst Pernicka

(Mannheim), Martin Posselt (Traisa), and Marek Skubisz (Wieliczka) for their openness in discussing the issues involved and for the help they provided. In addition, some critical comments from the reviewers have improved the quality of the text.

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