

# Pottery of Pikutkowo Style and the Processes of the Eneolithisation of “Megalithic Cultures” in the 4th Millennium BC

Aleksander Koško<sup>a</sup> and Marzena Szmyt<sup>b</sup>

The authors discuss the current state of knowledge concerning the specific pottery features of the Funnel Beaker culture (FBC) that constitute the “cycle of Pikutkowo stylistics”. These characteristics are especially strongly represented in the Kuyavia region where the changes in the “Pikutkowo” set of characteristics define phases III B and III B–C of the FBC, dated to 3700–3200 BC. Relatively quickly, because already in the period 3700–3600 BC, “Pikutkowo” pottery appears not only in the Polish Lowlands (including Greater Poland and Central Poland, as well as in the Chełmno Land and the Gostynin Lake District), but also in the old upland areas located in the upper Vistula basin. The latest data indicate that at the same time “Pikutkowo” characteristics are also present in FBC assemblages from the Subcarpathian foothills, as well as from the upper Dniester.

In the final centuries of the first half of the fourth millennium BC, “Pikutkowo” features were present with varying intensity within the borders of the Vistula and Odra catchment area in the west and the Dniester drainage basin in the east. The authors argue that this wide distribution designates the “Pikutkowo stylistics space”, which was a zone of active circulation of cultural patterns within the FBC. The culture-forming potential of this zone is best confirmed by the phenomenon of the transfer of one of the key innovations at the time, i.e. copper (including arsenic copper) processing.

KEY-WORDS: Funnel Beaker culture, pottery ornamentation, zone of Pikutkowo stylistics, adaptation of copper/arsenic copper.

The starting point for the considerations contained in this article are the comments of Jan Kowalczyk, presented in his habilitation monograph (Kowalczyk 1969), and re-read on the centenary of the birth of this still-inspiring scientist. One of the significant and at the same time disputable threads of J. Kowalczyk’s thought was the attempt to analyse the concept of the autogenesis, including particularly the identification of the topogenesis of the Funnel Beaker culture (FBC), which was for him a key problem in Polish studies

<sup>a</sup> Faculty of Archaeology, Adam Mickiewicz University in Poznań, 89D Umultowska st., 61-614 Poznań, Poland, e-mail: antokol@amu.edu.pl ORCID: 0000-0002-0529-3004

<sup>b</sup> Faculty of Archaeology, Adam Mickiewicz University in Poznań, 89D Umultowska st., 61-614 Poznań, Poland, e-mail: marzena@amu.edu.pl ORCID: 0000-0002-5975-4494

on the Neolithic period. This approach to the problem of the FBC largely resulted from his experience of researching its “large settlements” in the old-upland (loess) part of the Vistula river basin (e.g. Ćmielów in Ostrowiec Świętokrzyski district, and especially Gródek in Hrubieszów district – this site in literature is referred to as “Gródek Nadbużny”). It was also a consequence of the author’s concept of revising the idea of the “northern genetic centre” of the FBC as suggested by Carl J. Becker. As a result, J. Kowalczyk realised: *accepting the view of C. J. Becker, generally speaking, of the later date of the northern Danish group in relation to more southerly located areas, imposes the necessity to distinguish and recognise in succession the older phases of this culture and the more older, the further south we move, concluding himself ultimately, that the oldest elements of the FBC should be sought in the southern group, i.e. in Lesser Poland* (Kowalczyk 1969: 36).

By applying this approach to the material evidence, J. Kowalczyk stated: *already the very general features of the vessels of the “oldest phase of the Linear Pottery culture” themselves correspond above all to the ornamental tendencies of the FBC ceramics. There is here a rule of the same frugality in decoration, the very clear domination of fingerprints, especially in the large group of wide-open (baggy) vessels, plastic ridges and of course the clearly separated vessel bases* (Kowalczyk 1969: 43, with emphasis by the authors).

From the 1970s, Kowalczyk’s evaluation was the inspiration for studies on the southern genesis of the FBC pottery styles, or more strictly: inscribing them into the old-upland cycles of “linear” or “postlinear” ceramic styles. In the first case, it was the concept assuming the links of the early FBC to the Podgaj type cultural assemblages (Koško 1980; Czerniak 1988; 1994), while in the second case this refers to an attempt to refer the early FBC to the Lengyel-Polgár cycle from Lesser Poland and to the Malice culture (Kukawka 2015).

In this paper, we intend to outline the third trend, diverging from previous discussions connected with research on the genesis of the FBC. Our main focus is on the question of what kind of autogenetic position was played in the development of the FBC by “pottery with frugal ornamentation”, which has previously been classified as typical of groups in “Lesser Poland” or as diagnostic for the south-eastern group. At the same time, we switch our focus to the area of Kuyavia, where a series of important taxonomic and cultural observation have been made over the past few decades (e.g. Koško 1981; 2000; Koško and Przybył 2004; Koško and Szmyt 2006; 2007a; 2007b; 2014; 2015). Because the Kuyavian settlement and cultural mesoregion occupied a special position in the circulation of cultural patterns in Central and Eastern Europe, the conclusions about its taxonomic features have significance for studies of the cultural phenomena over more extensive areas.

## THE KUYAVIAN PERSPECTIVE: THE CONCEPT OF THE PIKUTKOWO STYLISTIC CYCLE

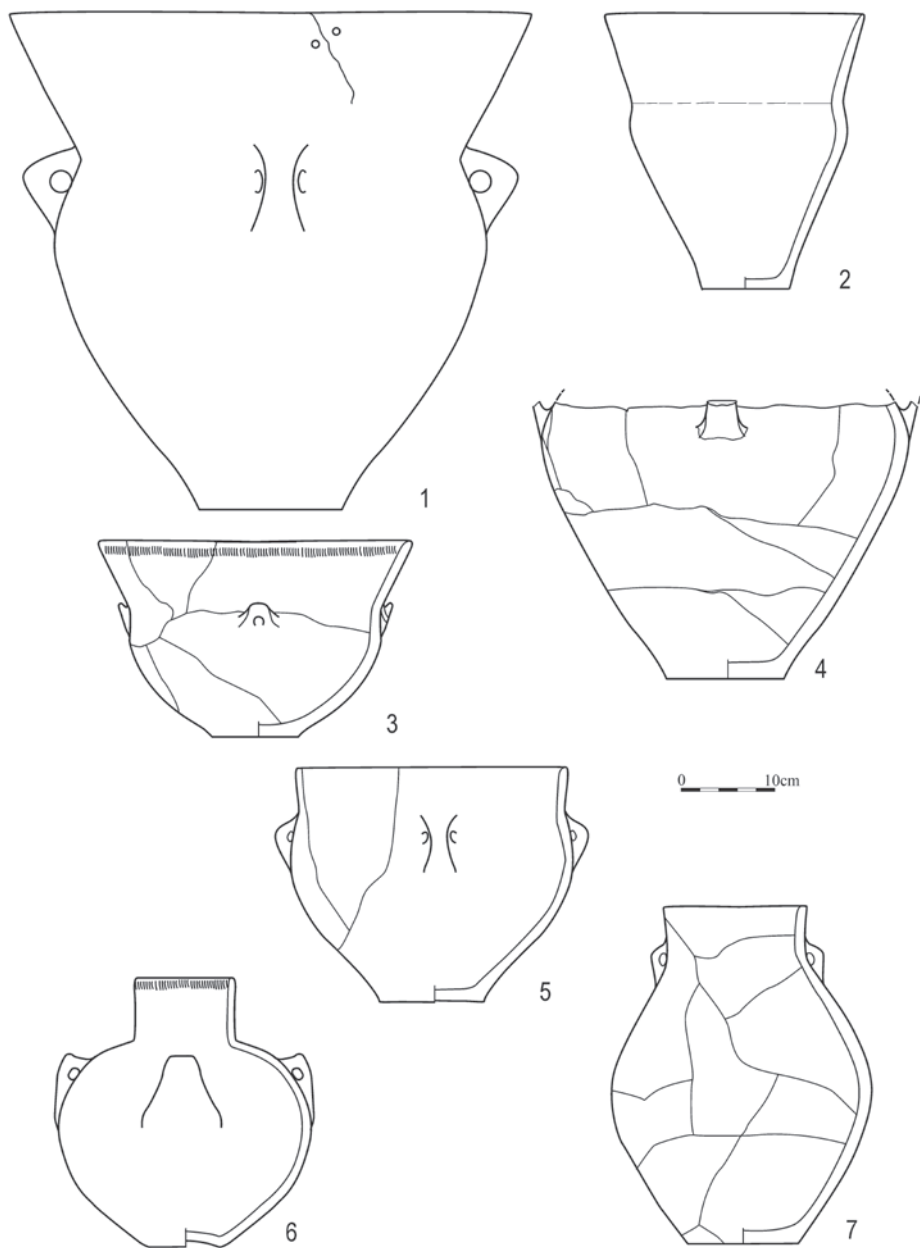
In the Kuyavia region, the beginnings of identifying pottery with frugal decoration with the FBC should be associated with the work of Ewa Niesiołowska, who in the study of materials from the site Pikutkowo 6 located in eastern Kuyavia, Włocławek district (Fig. 1) included the concept of the Pikutkowo phase as *the initial stage of the Wiórek phase* (Niesiołowska 1967: 121). In later years, Lidia Gabałówna (1968: 143; 1971: 249) and Tadeusz Wiślański (1979: 177) made reference to her work, creating the outline of two developmental stages as part of the second phase of the FBC: the older labelled the "Early Wiórek or Pikutkowo" and the later the (main) "Wiórek phase".

Gabałówna characterised the Pikutkowo style in 1968 as consisting of sparsely ornamented ceramics, accentuating the presence of such decorative elements as rows of rectangular stamp, zigzags, ladders and fingerprints, and among the macromorphological characteristics – collared flasks (Gabałówna 1968: 143). In her later works, the cited author used the observations of Waldemar Chmielewski (1952) and her own ones from Sarnowo site 1 and 1A, Włocławek district, and also of E. Niesiołowska from Pikutkowo site 6, for the distinction of transitions from the AB phase to *the Wiórek phase understood in extenso* (Gabałówna 1971: 249). In an article published posthumously in 1971, she made a remark about the presence of *an increasingly distinctive group of materials*, which she once named temporarily "early Wiórek". In conclusion she stated: *I would propose calling this Wiórek phase the Pikutkowo phase* (Gabałówna 1971: 250).

Wiślański (1979: 177) introduced the concept of the Pikutkowo phase to the taxonomic terminology, while maintaining the ambivalence and terminological uncertainties of earlier writers, saying: *in assemblages that can be associated with the Pikutkowo stage, "archaic" features having very clear connections with the A/B phase relatively commonly occur*.

In developing this concept, based on new evidence (in particular from the site Inowrocław-Mątwy 1, Inowrocław district, located in the central zone of the Kuyavia region), a taxonomical approach to the Wiórek-Pikutkowo style has been proposed – it was used to define sub-phase IIIB of the local FBC, characterised as a state of *"periodic" growth, among the technological and stylistic features of the ceramics of Eneolithic tradition belonging to the FBC groups of Lesser Poland and the late stage of the Tripolye culture* (Koško 1981: 48; 1988: 164). A hypothesis was also formulated about the eastern Kuyavian stylistic region (Koško 1981: 62f.), with which the eponymous site Pikutkowo 6 was associated, as the Kuyavian equivalent of the pottery styles of Bronocice II in Lesser Poland or Jevišovice C2 in Moravia (Koško 1988: 165).

The next stage of understanding the position of ceramics with frugal decoration in Kuyavia was reached in research on the so-called large settlement in Dąbrowa Biskupia site 21, Inowrocław district (the older stage of settlement on the site according to Piotr



**Fig. 1.** Pitutkowo site 6, Włocławek district. Vessels from pit 25.  
By Niesiołowska 1967. Redrawn by B. Bednarczyk.

Chachlikowski, whom we kindly thank for information), and then exploration of features on the routes of new linear investments (pipelines and roads) crossing the Kuyavian Plateau, including, first of all, the site at Bachorce 4, Inowrocław district. This led to the development of the concept of a cycle of subphases in the development of the Wiórek-Pikutkowo style: *IIIB (classical Pikutkowo) and IIIB-C (late Wiórek) = 3700 – 3500 – 3200 BC = styles Inowrocław-Mątwy stage A; Dąbrowa Biskupia 2I, phase I; Bachorce 4* (Koško and Przybył 2004: 256f.).

The latest stage of the development of ideas, initiated in the 21st century, is associated with studies on the cultural image of the Kuyavia region in the middle of the 4th millennium BC. It can be examined from three positions taking as a starting point the research projects at: (A) Opatowice, (B) Brześć Kujawski and (C) Wilkostowo.

- A.** The investigations carried out in 1983–1998 on Prokopiak Mount in Opatowice, Radziejów district, in the central part of Kuyavia (Koško and Szmyt 2006; 2007a; 2007b; 2014; 2015) are of key significance for the topogenetic qualification of the above-mentioned taxa (i.e. subphases IIIB and IIIB–C). A set of components (identified with the stylistic traditions of the FBC) that were recognised in the local pottery production can be read in terms of a record of long-distance and neighbourly ties. In this programme, an attempt was made to embed a large series of taxonomic observations in the context of the currently discussed concept of the autogenesis of the FBC settlement of the Kuyavian mesoregion. In the light of these studies, in the period of 3650–3200 BC, the FBC Kuyavian communities, genetically identified with the eastern agglomerations (i.e. with the Eastern Group) of the large-valley mesoregion, were subjected to two-way external cultural inspirations. These ran: (a) meridionally between the Vistula and Warta-Upper-Odra basins and Moravia, and (b) latitudinally between the Warta basin (Greater Poland) and the Saale – Elbe drainage basin.

Attention should be focused on inspirations from the Moravian region, dated to 3650–3500 BC and recognised in their initial version at the site of Opatowice 33 (strictly: in the phase/settlement Opatowice 33–A1). The pottery traits there are continued by the “Łojewo” trend of the local FBC assigned to the phase IIIA (Szmyt 1992; Czerniak and Koško 1993: 105; cf. the style FBC s2b – Rzepecki 2004: 49). These have numerous references to the traditions of the south-eastern group, both from the loess areas (local phases: Bronocice II, Zimne I, Gródek Nadbużny I; cf. Kruk and Milisauskas 1983; 2018; Bronicki *et al.* 2003), as well as from the so-called para-lowland zones (Czopek and Kadrow 1987; Nowak 1996; 2001). There are also clear references to more distant agglomerations of the FBC (Fig. 2). These include the Moravian-Upper Silesian subgroup (the older phase – Jevišovice C2; cf. Bukowska-Gedigowa 1975; Medunová-Benešová 1981; Šmid 2017), and even the Baalberg group from the Czech Basin (from the younger phase, with stamped



**Fig. 2.** Sites with pottery of “Pikutkowo” traits and copper daggers in the context of the distribution of basic territorial groups of the Funnel Beaker culture.

Map by Midgley 1992, amended by the authors and redrawn by B. Bednarczyk.

Key: a – sites with pottery of “Pikutkowo” traits; sites mentioned in the text are numbered (1 – Bronocice I; 2 – Gródek I; 3 – Zimne I; 4 – Skołoszów 3I; 5 – Pliszczyn 9; 6 – Kotoryny-Grodzisko III); b – finds of copper daggers in the context of the Funnel Beaker culture (7 – Kałdus; 8 – Gaj I; 9 – Słonowice 5); c – Kuyavia.

ceramics – Siřem; B1; cf. Pleslová-Štiková 1985; 1987). These convergences concern the advanced (Eneolithic) techniques of surface elaboration (e.g. slipping) and the firing of the vessels as well as their stylistic features identified as “classic Pikutkowo” (Koško 2006: 191–192).

These features can be summarized in the form of a model of the technological-stylistic basis for the Pikutkowo style zone, present both in Kuyavia area as well as in the south Polish uplands (cf. below). The basic packet (“classic Pikutkowo” = phase III B) can be defined, in idealised form, as the co-occurrence of the following set of diagnostic attributes:

- technology – the presence of **slipping** (diagnostic feature) + well smoothed surface, possibly also strong firing;
- macromorphology – the presence of typological groups of **funnel beakers** (diagnostic feature) + amphorae + collared flasks + pots + bowls + vases;

- ornamentation – the presence of **rows made with a rectangular (“orthogonal”) stamp and placed in the zone under the rime** (diagnostic feature) + under-rim rows made with comb + under-rim applied clay strips with fingertip impressions + elements placed on the belly of the vessels (rectangular stamps, applied zig-zags, knobs, ladders).

In the “late Pikutkowo” stage (= phase IIIB–C), diverse deviations taking many regional forms can be observed in the stylistic package described above. Their detailed recognition is still an important analytical task, both taxonomic as well in terms of cultural studies (cf. below).

An important development of the programme under discussion is current research on the chronometric characteristics of the eastern Kuyavian stylistic region based on evidence from the research on the A1 motorway route, as, for instance, at the site Janowice 2, Włocławek district, dated to 3580–3530 BC (Koško and Žurkiewicz 2016: 142–144) and other features (e.g. Rzepecki and Golańska 2015; Grygiel 2016). Some of them can be interpreted as a confirmation of the phenomenon of “peripheral atavism” (cf. Koško1981).

- B.** Research conducted in eastern Kuyavia in the area of Brześć Kujawski, Włocławek district (Grygiel 2016; 2018), has led to modifications to our knowledge of the Middle Neolithic FBC (Rzepecki 2004), situated in the space of influences both from the west (to the “large valley” type, mainly in relation to the *Mittellelbe-Saale Gebiet*) and the north-west, from the genetic centre in the eastern Holstein region and southern Jutland, dated to around 4200 BC (Grygiel 2016: 97of; cf. Nowak 2009). In this perspective, the developmental context of the Brześć Kujawski culture is minimized, it is separated from the prologue of the Kuyavian FBC (about 3900 BC) by a distinct “chronological break” (Grygiel 2016: 996, Tab. 91; 2018: 197, Fig. 10). An important novelty in this period are numerous stylistic references to the Lublin-Volhynian culture, the second of the basic centres of “Eneolithisation of the Polish Lowland”, genetically distinct from the “Lengyel tradition” present in the Brześć Kujawski culture. For example, according to R. Grygiel, in material from the Smólsk site *are legible the influences of the Lublin-Volhynian culture, discovered in several rubbish pits and one inhumation grave, in the form of well copied vessel patterns of the LVC, as well as the appearance of large amounts of chocolate flint at sites of the early phase of the FBC, the main, and then perhaps only group with access to its deposits, were precisely the “Lublin-Volhynian” communities living there* (Grygiel 2016: 973–974). In conclusion, the author suggests verification of the existing knowledge on the significance of this cultural unit of the Middle Neolithic that is still probably too little known and thus underestimated (Grygiel 2016: 974).



In the local sequence of the FBC from the Brześć Kujawski region, three phases are distinguished (Grygiel 2016: 966, Tab. 91, Fig. 687): early – 3900/3800–3600 BC (corresponding to I–IIA phases in Central Kuyavia), classical – 3650–3400 BC (= phases IIB–IIIC, as above), and late – 3400–3200/3100 BC (= phases IVA–VB, as above).

The “Brześć” sequence also refers directly to the eponymous site of Pikutkowo 6, classified by R. Grygiel as the prologue of the classical phase. Two radiocarbon dates were obtained for bone from graves, which confirm the occupation of the site in two phases: in the period 3737–3644 BC and 3628–3589 BC, already perceived by E. Niesiołowska (Grygiel 2016: 151).

- C. The archaeological research at the site Wilkostowo 23/24, Aleksandrów Kujawski district, revealed a stable settlement of the FBC, from the mid-fourth millennium BC – 3525–3450 BC (Rzepecki 2014: 335). Thanks to large scale excavation, we have a relatively comprehensive record of the everyday and occasional life of Kuyavian communities of the FBC at the turn of phases IIIB and IIIB–C (Rzepecki 2014; 2015). From the perspective of the issues of the Eneolithisation of “megalithic cultures”, an essential phenomenon is evidence of the lack of the use of copper. It should be noted, however, that a similar programme of “large settlement” research in Dąbrowa Biskupia, site 21, the oldest stage of the development of which coincides with phase IIIB, revealed the presence of this metal, albeit in a small amount (Hensel 1988, Table 1). These phenomena should be interpreted in the context of “large settlements” from the loess upland regions of the South (cf. below).

#### “PIKUTKOWO ANALOGIES” IN OTHER REGIONS OF THE POLISH LOWLAND AND THE OLD UPLANDS

The extent of the phenomena related to the Pikutkowo style was significantly expanded due to the research on the FBC in the Polish Lowlands conducted in several regions. Among them are the Chełmno region (Kukawka 1991; 1997), the Gostynin Lake District (Rybicka 2004) together with central Greater Poland (Wierzbicki 2013), and also in central Poland – e.g. in the Grabia catchment (Pelisiak 2003). Material related to the Kuyavian phase IIIB has been identified in these areas, however, it is still difficult to include the results obtained in a detailed comparative analysis and to relate them to taxonomic findings from the central Kuyavian stylistic region (cf. above).

Another group of analogies that are inspiring involves those from the old upland areas (more strictly from the river basins of the upper Vistula and Bug), dated to the classic phase, which corresponds to the third Kuyavian phase (Włodarczak 2006: 34). It is worth recalling that this is the so-called stage of central places, i.e. the period of exis-



tence of large upland settlements of the Bronocice type (Kruk and Milisauskas 1999: 135). In the cited systematisation, the “classic Pikutkowo” period (phase IIIB) corresponds to the phase/style of Bronocice II, currently dated to 3750/3700–3500/3400 BC, while the “late Pikutkowo” period (phase IIIB–C) corresponds to the phase/style of Bronocice III, dated to the period 3500/3400–3300 BC (Kruk *et al.* 2018: 77; cf. Kruk and Milisauskas 2018: 79–85). The date 3500 BC marks the prologue of the Boleráz stage (Włodarczak 2006: 36).

In relation to the previously-cited observations from the Kuyavia region, the old upland zone has only a small number of stylistic sequences (from sites or microregions), which is one of the weaknesses of the taxonomic diagnosis of these areas. It is still limited to a few large settlements in Bronocice, Pińczów district, Gródek, Hrubieszów district and in Zimne, Volodymyr-Volynskyi raion (West Ukraine). Moreover, the situation is complicated by the conservatism of ceramic stylistics *which may be an additional difficulty in determining the periodisation of remains of the FBC settlement* (Rybicka 2017: 26).

The latest research results on the Subcarpathian foothills and in the upper Dniester area open new opportunities for research (Rybicka 2017, Fig. 8). In the light of current knowledge it is possible to state that the FBC communities appeared in the upper Dniester region *very early (...), because about 3700/3600 BC, i.e. at a similar time as, or even earlier than, in the Bug River region* (Rybicka 2017: 26; cf. Bronicki *et al.* 2003; see also: Kadrow 2007).

It may therefore be stated in conclusion that in the region concerned (within the borders of the Vistula and Odra catchments in the west and the Dniester basin in the east), we have identified markers of the active circulation of cultural patterns in the form of the emergence of the “classic Pikutkowo stylistics cycle” in the final centuries of the first half of the 4th millennium BC. For this, the diagnostic sites are: Pikutkowo 6, Inowrocław-Mątwy 1/phase I, Dąbrowa Biskupia 21/phase I, Bachorce 4, Bronocice 1/phase II, Zimne 1 /phase I, Skołoszów 31, Kotoryny-Grodzisko III.

In view of the hypothetical date of the beginning of this activation process around 3700/3650 BC, the Eneolithic civilisational background for this process could at that time have been created by the waning of the Brześć Kujawski culture (in the north) and the Lublin-Volhynian culture (in the south) and the initial states of the lowland transmission of the Tripolye culture – since the CI/CII stage (cf. Diachenko, Harper 2016, there further literature) and of the Lesser Poland “proto-Boleráz” agglomerations of “Wyciąże” or “Niedźwiedz” type (Włodarczak 2006: 36–38, Zastawny 2008, there further literature).

Leaving aside the distribution of flint raw materials from the Volhynia-Dniester area in FBC assemblages of Lesser Poland, generally related to the Bronocice II-III horizon (Libera and Zakościelna 2011: 89f.), there is no satisfactory analytic evaluation of reception of the ceramic features identified with the Pontic Eneolithic. In the set

of cultural patterns considered Eneolithic within the old upland sites of the “classic Pikutkowo stylistics cycle”, the Tripolye component was only faintly evidenced. These features have also not been seen in Bronocice II (Kruk and Milisauskas 1983; Włodarczak 2006: 57), although Małgorzata Rybicka recently recalled the remark of Janusz Kruk and Sarunas Milisauskas (1981: 98) that *in one of the features of the BR II phase there was a (...) ceramic fragment with a similar* [with respect to discoveries in the BR III and IV assemblages – A. K., M. S.] *ornament of red colour*. She pointed out that this may be a stylistic borrowing from the Tripolye culture circle (Rybicka 2017: 103). In addition, she underlined the Tripolyean provenance of pottery ornaments made of so-called double cord imprints found, for example, at the sites Skołoszów 31, Jarosław district (Rybicka 2017: 107f.) and Pliszczyn 9, Lublin district – here on ceramics dated to around 3550–3450 BC (Chmielewski T. J. 2015: 221). Anyway, the problem of the topogenetic context of the cord application in the FBC ornamentation has already been the subject of archaeo-technological studies (Koško and Szmyt eds 2010).

A new direction in research may be marked by the finding of FBC ceramics with clear Wiórek phase connotations in the centre of the Baden culture area at Salgótarján-Pécskő, Nógrád district (Horváth 2018: 145–146).

#### THE CONTEXT OF “NON-TAXONOMIC” DATA FROM THE 4TH MILLENNIUM BC: BEGINNINGS OF METALLURGY IN THE CIRCLE OF “MEGALITHIC CULTURE” COMMUNITIES

We propose placing the process of gaining expertise in metalworking, recognized as a symptom of broader changes in terms of ideology and social organization, in the focus of current reflections on the Eneolithic appearance of the cycle of the Pikutkowo style, and especially its initial stage (3700/3650–3500 BC).

In the taxonomy of the Kuyavian FBC group, copper appears at the turn of phase I and II. This is evidenced by material from Sarnowo 1, Włocławek district (tomb 8), Leśniczówka 1, Koło district (tomb II) and from a settlement in Przybranówek 43, Aleksandrów Kujawski district (Gabałówna 1970: 83; Czerniak and Koško 1993). In the current chronological framework, this would be a period with a maximum chronological spread between 4400/4200 and 3800 BC. In compliance with observations at Brześć Kujawski, the same process should, however, be dated to between 3900 and 3600 BC (Grygiel 2016, Fig. 687). In previous topogenetic conceptions, a cultural transfer between the Brześć Kujawski and FBC societies has been assumed (Gabałówna 1970: 86; cf. Koško and Czerniak 1993; Czerniak 1994). While maintaining this diagnosis, it should be noted that in the region of eastern Kuyavia, within the “Brześć” societies, Ryszard Grygiel (2016: 981) assumed the development of the Brześć Kujawski culture took place certainly within the fifth millennium BC, while he dates the

appearance of the first wave of FBC migration only to the period of around 3900/3800 BC (Grygiel 2016: 981). Regardless of the chronometric discussions summarised above, the problem of the final caesura of the Brześć Kujawski culture remains undoubtedly closely related to the concept of the autogenesis of the Globular Amphora culture (cf. Szmyt 2017, with older literature).

It is also necessary to note the presence of copper objects on site 4 at Brześć Kujawski and on site 6 at Nowy Młyn, Włocławek district. They are linked with the classic FBC phase, i.e. after 3700/3600 BC. The results of metallurgical analyses prompted R. Grygiel to formulate the opinion that these items *do not differ significantly in chemical composition from the group of older products of the Brześć Kujawski group, they form here their own concentration between two assemblages of Lengyel culture. Analysis could therefore lead us to cautiously assume a continuity of development of the old centres of European copper working, from the mid-5th millennium BC* (Grygiel 2016: 925).

The oldest manifestations of local copper processing come from large settlements of the FBC of Lesser Poland, dated to the classic phase, in Niedźwiedz, Cracow district, Ćmielów and Gródek, *where copper slag has been discovered, in the last two sites also burnt foundry crucibles* (Wiślański 1979: 273; Gumiński 1989: 166–169). However, serious objections are raised regarding Ćmielów and Gródek (e.g. Kadrow 1998; Koziorowska 2006). The list of other evidence, also rather questionable, is wider (cf. Midgley 1992: 294, see there the older literature).

Therefore, it is probable that it was during the prologue of the Pikutkowo stylistic cycle that the beginning of copper processing can be seen in the FBC. Undoubtedly, the introduction of this material was a complex process, which is only now slowly and gradually becoming better understood as a result of archaeometallurgical studies (e.g. Kowalski *et al.* 2016; Kowalski *et al.* 2017). In this place we would like to draw attention to the results of the studies of Stefan Łęczycki who argued that identifiers of this process are the Bytyń type axes. The axes can be dated to the middle of the 4th millennium BC, through the ceramic context in Kietrz, Głubczyce district (feature 113: Jevišovice C2 – C2/C1 phase), as well as the imitation of the form of a lithic implement, shaft-hole axe with a button-like butt in Szczecin-Śmierdnica (Łęczycki 2004; cf. Szpunar 1987) According to the same author's opinion, *axes of Bytyń type belong, in the majority, to the EoI group, which correspond to the use of arsenical copper, appearing in the third metallurgical horizon (Bodrogkeresztur–Trypolje CI) most probably as a result of influences from Asia Minor* (Łęczycki 2004: 66, 68, there further literature). The Caucasian-Anatolian metalworking utilising arsenical copper, and then arsenic bronze, as well as the distribution of the products in Europe is most broadly described by the concept of Evgeni N. Chernykh of the existence of a Circumpontic Metallurgical Province/Circumpontic Cultural Province, the prologue of which is dated to around 3600 BC (Černych 1977; Chernykh 1992). The issue of the correspondence of "Bytyń metalurgy" with this province needs to be the subject of future research (cf. previous

suggestions on the topogenesis of the copper objects from Gródek; Gumiński 1989: 168). Currently, this assessment seems to be additionally justified by the latest research on Carpathian-Volhynian metallurgical centres (Klochko and Klochko 2013; Klochko 2017). Against this background, it is worth noting the presence of FBC ceramic “imports” with features corresponding to the Pikutkowo style zone (Rybicka 2017: 43–47) in central Transdnistria, in the area of local copper deposits (Klochko *et al.* 2000; 2003; Klochko 2017).

Valuable information on the question of the relationship of the metallurgical centres of the Jevišovice C2/C1 horizon with the FBC is provided by a deposit of copper artefacts from Kałdus in Chełmno district. Among other things, it contains a dagger of Usatowo type (Adamczak *et al.* 2015). The ceramic context of the deposit is identified with the Wiórek-Mątwy pottery style zone and thus associated with the IIIC phase. In the evaluation of this assemblage, M. Rybicka states *that these are artefacts of a possible south-eastern, probably Tripolyean, origin* (Rybicka 2017: 141). An analogy to this find may be a dagger made of arsenical copper from Gaj 1, Włocławek district. This was the only furnishing of the central burial of tomb no. 2 (Papiernik *et al.* 2018: 450 and Fig. 9) dated to 3620–3380 BC (Poz-83418, 4700±50 BP). The next analogy to the copper dagger comes from the old upland area on the upper Vistula, from Słonowice site 5, Kazimierza Wielka district, long barrow VIII, feature 104. It was found in a clear FBC context and is dated indirectly to the period 3625–3350 BC (Przybyła and Tunia 2013: 145–154 and 157).

## CONCLUSION

In our opinion, the current state of research outlined above on the taxonomical and autogenetic location of the FBC pottery with frugal decoration should lead to a broader reflection on the strategy of interregional relationships concerning both the diagnostic features of this category of material (along with the standardisation of its recording) as well as analytical procedures. The second of the postulated research fields includes the recognition of forms and generators of application of copper/arsenic copper products in the FBC and their relationship to the concept of the “Pikutkowo style zone”, as well as the problem of its relationship to the new “megalithic culture” which was formed at that time in a version of the Globular Amphora culture. Future work should include reflection on the methods of their cultural conceptualisation. We consider this to be one of the main requirements for progress in the understanding of the 4th millennium BC as the era of the Neolithic/Eneolithic breakthrough on the plains of Central and Eastern Europe, in the broad context of its relationship to the circle of “megalithic cultures”.

## ACKNOWLEDGMENTS

We would like to thank the anonymous reviewers for their valuable comments.

*Translated by Andrzej Leligdowicz*

## REFERENCES

- Adamczak, K., Kowalski, Ł., Bojarski, J., Weinkauf, M. and Garbacz-Klempka, A. 2015. Eneolithic metal objects hoard from Kałdus, Chełmno commune, kujawsko-pomorskie voivodeship. *Sprawozdania Archeologiczne* 67: 199–219.
- Bronicki, A., Kadrow, S. and Zakościelna, A. 2003. Radiocarbon Dating of the Neolithic Settlement in Zimne, Volhynia, in Light of the Chronology of the Lublin-Volhynia Culture and the South-Eastern Group of the Funnel Beaker Culture. *Baltic-Pontic Studies* 12: 22–66.
- Bukowska-Gedigowa, J. 1975. Kultura pucharów lejkowatych w dorzeczu górnej Odry. *Przegląd Archeologiczny* 23: 83–186.
- Černych, E. N. 1977. O europejskiej strefie circumpontyjskiej prowincji metalurgicznej. *Acta Archaeologica Carpathica* XVII: 29–53.
- Chernykh, E. N. 1992. *Ancient Metallurgy in the USSR. The Early Metal Age*. Cambridge.
- Chmielewski, T. J. 2015. Znaleźiska ceramiczne. Wytwórczość ceramiki i jej codzienne użytkowanie. In T. J. Chmielewski and E. Mitrus (eds), *Pliszczyn. Eneolityczny kompleks osadniczy na Lubelszczyźnie / Eneolithic settlement complex in the Lublin region*, 61–106. Pękowice–Wrocław. Ocalone Dziedzictwo Archeologiczne 5.
- Chmielewski, W. 1952. *Zagadnienie grobowców kujawskich w świetle ostatnich badań*. Łódź.
- Czerniak, L. 1988. Czynniki zewnętrzne w rozwoju kulturowym społeczeństw Kujaw w okresie wczesnego i środkowego neolitu. In A. Cofta- Broniewska (ed.), *Kontakty pradziejowych społeczeństw Kujaw z innymi ludami Europy*, 55–79. Inowrocław.
- Czerniak, L. 1994. *Wczesny i środkowy okres neolitu na Kujawach*. Poznań.
- Czerniak, L. and Koško, A. 1993. *Z badań nad genezą rozwoju i systematyką kultury pucharów lejkowatych na Kujawach*. Poznań. Źródła do Studiów nad Prahistorią Kujaw 11.
- Czopek, S. and Kadrow, S. 1987. Osada kultury pucharów lejkowatych w Białobrzegach, st. 5, woj. Rzeszów. *Sprawozdania Archeologiczne* 38: 73–88.
- Diachenko, A. and Harper, T. K. 2016. The Absolute Chronology of Late Tripolye Sites: a Regional Approach. *Sprawozdania Archeologiczne* 68: 81–108.
- Gabałówna, L. 1968. Sprawozdanie z prac wykopaliskowych w Sarnowie, pow. Włocławek, przeprowadzonych w r. 1967 na stanowiskach I i IA. *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi. Seria Archeologiczna* 15: 135–147.
- Gabałówna, L. 1970. Wyniki analizy C14 węgla drzewnych z cmentarzyska kultury pucharów lejkowatych na stanowisku I w Sarnowie – z grobowca 8 i niektóre problemy z nimi związane (informacja wstępna). *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi. Seria Archeologiczna* 17: 77–91.
- Gabałówna, L. 1971. Z najnowszej problematyki neolitu kujawskiego. *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi. Seria Archeologiczna* 18: 247–252.
- Grygiel, R. 2016. *Neolit i początki epoki brązu w rejonie Brześcia Kujawskiego i Ostówek. T. III. Środkowy i późny neolit. Kultura pucharów lejkowatych*. Łódź.

- Grygiel, R. 2018. The Funnel Beaker culture in the Brześć Kujawski and Osłonki Region (Kuyavia). *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi. Seria Archeologiczna* 47 (2016–2017): 177–201.
- Gumiński, W. 1989. *Gródek Nadbużny. Osada kultury pucharów lejkowatych*. Wrocław-Warszawa-Kraków-Gdańsk-Łódź. *Polskie Badania Archeologiczne* 28.
- Hensel, Z. 1988. Z badań nad produkcją brązu na Kujawach. Analizy wprowadzające. In A. Cofta-Broniewska (ed.), *Kontakty pradziejowych społeczeństw Kujaw z innymi ludami Europy*, 219–228. Inowrocław. *Studia i Materiały do Dziejów Kujaw* 2.
- Horvath, T. 2018. Ózdcsódlátosföldje. A Baden-kultúra Ózd-Pilinyvariánsa Északkelet-Magyarországon/ *The Marvelous Land of Ózd. The Ózd-Piliny Variant of the Baden Culture in North-Eastern Hungary*. Budapest.
- Kadrow, S. 2007. Kontakty kultur środkowoeuropejskich ze środowiskiem kulturowym na terenach Ukrainy we wczesnym neolicie – wybrane zagadnienia. In M. Gierlach and L. Bakalarska (eds), *Wspólnota dziedzictwa archeologicznego ziem Ukrainy i Polski*, 250–269. Warszawa.
- Klochko, V. I. 2017. Yamnaya Culture Hoard of Metal Objects, Ivanivka, Lower Murafa: Autogenesis of “Dniester Copper/Bronze Metallurgy”. *Baltic-Pontic Studies* 22: 226–245.
- Klochko, V. I. and Klochko, L. 2013. Complex of metal goods between the Vistula and Dnieper rivers at the turn of the 4th/3rd to the 3rd millennium BC. Concept of the Carpathian – Volhynia “Willow Leaf” Metallurgy Centre. *Baltic-Pontic Studies* 18: 39–71.
- Klochko, V. I., Manychev, V. I., Kvasnitsa, V. K., Kozak, S. A., Demchenko, L.V. and Sokhatskiy, M. P. 2000. Issues concerning Tripolye metallurgy and the virgin copper of Volhynia. *Baltic-Pontic Studies* 9: 168–186.
- Klochko, V. I., Manichev, V. I., Kompanec, G. S. and Kovalchuk, M. S. 2003. Wychodnie rud miedzi na terenie Ukrainy zachodniej jako baza surowcowa metalurgii kolorowej w okresie funkcjonowania kultury trypolskiej. *Folia Praehistorica Posnaniensia* X/XI (2002/2003): 47–77.
- Koško, A. 1980. The position of Funnel Beaker Culture in the Lowland model of neolithisation. In J. K. Kozłowski and J. Machnik (eds), *Problèmes de la néolithisation dans certaines régions de l'Europe*, 123–138. Wrocław-Warszawa-Kraków-Gdańsk. *Prace Komisji Archeologicznej* 21.
- Koško, A. 1981. *Udział południowo-wschodnioeuropejskich wzorców kulturowych w rozwoju niżowych społeczeństw kultury pucharów lejkowatych*. Poznań.
- Koško, A. 1988. *Osady kultury pucharów lejkowatych w Inowrocławiu-Mątwach, woj. Bydgoszcz, stanowisko 1*. Inowrocław.
- Koško, A. 2000. Osadnictwo społeczności kultury pucharów lejkowatych (grupy: wschodnia i radziejowska). In A. Koško (ed.), *Archeologiczne badania ratownicze wzdłuż trasy gazociągu tranzytowego. T. III. Kujawy. Part 4. Osadnictwo kultur późnoneolitycznych oraz interstadium epok neolitu i brązu: 3900–1400/1300 przed Chr.*, 19–133. Poznań.
- Koško, A. 2006. Ceramika kultury pucharów lejkowatych. In A. Koško and M. Szmyt, *Opatowice – Wzgórze Prokopiaka*. T. I, 139–194. Poznań. *Studia i Materiały do Badań nad Późnym Neolitem Wysoczyzny Kujawskiej I*.
- Koško, A. and Przybył, A. 2004. Kultura pucharów lejkowatych. In J. Bednarczyk and A. Koško (eds), *Od długiego domu najstarszych rolników do dworu staropolskiego. Wyniki badań archeologicznych na trasach gazociągów Mogilno – Włocławek i Mogilno – Wydartowo*, 235–314. Poznań.
- Koško, A. and Szmyt, M. 2006. *Opatowice – Wzgórze Prokopiaka*. T. I. Poznań. *Studia i Materiały do Badań nad Późnym Neolitem Wysoczyzny Kujawskiej I*.
- Koško, A. and Szmyt, M. 2007a. *Opatowice – Wzgórze Prokopiaka*. T. II. Poznań. *Studia i Materiały do Badań nad Późnym Neolitem Wysoczyzny Kujawskiej II*.
- Koško, A. and Szmyt, M. 2007b. *Opatowice – Wzgórze Prokopiaka*. T. III. Poznań. *Studia i Materiały do Badań nad Późnym Neolitem Wysoczyzny Kujawskiej III*.



- Koško, A. and Szmyt, M. 2014. *Opatowice – Wzgórze Prokopiaka*. T. IV. Poznań. *Studia i Materiały do Badań nad Późnym Neolitem Wysoczyzny Kujawskiej IV*.
- Koško, A. and Szmyt, M. 2015. *Opatowice – Wzgórze Prokopiaka*. T. V. Poznań. *Studia i Materiały do Badań nad Późnym Neolitem Wysoczyzny Kujawskiej V*.
- Koško, A. and Szmyt, M. (eds) 2010. "Cord" Ornaments on Pottery in the Vistula and Dnieper Interfluvial Region: 5th – 4th Mill. BC. *Baltic-Pontic Studies* 15.
- Koško, A. and Żurkiewicz, D. 2016. Osadnictwo ludności kultury pucharów lejkowatych. In M. Szmyt (ed.), *Osadnictwo społeczności neolitycznych na stanowisku 2 w Janowicach, woj. kujawsko-pomorskie*, 125–156. Poznań. *Studia i Materiały do Badań nad Późnym Neolitem Wysoczyzny Kujawskiej VI*.
- Kowalczyk, J. 1969. Początki neolitu na ziemiach polskich. *Wiadomości Archeologiczne* 34(1): 3–69.
- Kowalski, Ł., Adamczak, K. and Garbacz-Klempka, A. 2017. Wyniki analiz metaloznawczych sztabki miedzianej ze Skołoszowa, stanowisko 31, pow. jarosławski, woj. podkarpackie. In M. Rybicka (ed.), *Wielokulturowe cmentarzysko w Skołoszowie, stanowisko 7, pow. jarosławski, w kontekście osadnictwa z neolitu i wczesnej epoki brązu we wschodniej części Podgórze Rzeszowskiego*, 105–111. Rzeszów.
- Kowalski, Ł., Krzyszowski, A., Adamczak, K. and Garbacz-Klempka, A. 2016. Wyniki badań archeometalurgicznych tzw. siekiery z dawnej miejscowości Antoniny, pow. chożeski. *Fontes Archaeologici Posnanienses* 52: 175–205.
- Koziorowska, L. 2006. Jakościowa analiza składu chemicznego pozostałości materiałowych – osadów znajdujących się w przedmiotach pochodzących z Ćmielowa (nr inw. PMA II/3135) i Złotej „Nad Wawrem” (nr inw. PMA II/7699). In J. Libera and K. Tunia (eds), *Idea megalityczna w obrządku pogrzebowym kultury pucharów lejkowatych*, 195–196. Lublin-Kraków.
- Kruk, J. and Milisauskas, S. 1981. Wyżynne osiedle neolityczne w Bronolicach, woj. kieleckie. *Archeologia Polski* 26: 65–114.
- Kruk, J. and Milisauskas, S. 1983. Chronologia absolutna osadnictwa neolitycznego z Bronolic, woj. kieleckie. *Archeologia Polski* 28(2): 257–320.
- Kruk, J. and Milisauskas, S. 1999. *Rozkwit i upadek społeczeństw rolniczych neolitu*. Kraków.
- Kruk, J. and Milisauskas, S. 2018. *Bronolice. The Chronology and Development of a Neolithic Settlement of the Fourth Millennium BC*. Kraków.
- Kruk, J., Milisauskas, S. and Włodarczak, P. 2018. *Real Time. Radiocarbon Dates and Bayesian Analysis of the Neolithic Settlement at Bronolice, Fourth Millennium BC*. Kraków.
- Kukawka, S. 1991. *Kultura pucharów lejkowatych na ziemi chełmińskiej w świetle źródeł ceramicznych*. Toruń.
- Kukawka, S. 1997. *Na rubieży środkowoeuropejskiego świata wczesnorolniczego. Społeczności ziemi chełmińskiej w IV tysiącleciu p.n.e.* Toruń.
- Kukawka, S. 2015. Początki kultury pucharów lejkowatych na Niżu Polskim. *Folia Praehistorica Posnaniensis* 20: 277–300.
- Libera, J. and Zakościelna, A. 2011. Cyrkulacja krzemienia wołyńskiego w okresie neolitu i we wczesnej epoce brązu na ziemiach polskich. In M. Ignaczak, A. Koško and M. Szmyt (eds), *Między Bałtykiem a Morzem Czarnym. Szlaki międzymorza IV – I tys. przed Chr.*, 83–115. Poznań. *Archaeologia Bimaris – Dyskusje* 4.
- Łęczycki, S. 2004. Kietrz, Bytyń, Szczecin-Śmierdnica. Einige Anmerkungen zur Kulturhörigkeit des Hortfundes von Bytyń. *Sprawozdania Archeologiczne* 56: 33–77.
- Medunová-Benešová, A. 1981. *Jevišovice – Starý Zámek, Schicht C2, C1, C. Katalog der Funde*. Brno. *Fontes Archaeologiae Moravice* 13.
- Midgley, M. 1992. *TRB Culture. The First Farmers of the North European Plain*. Edinburgh.
- Niesiołowska, E. 1967. Materiały neolityczne ze stanowiska 6 w Pikutkowie, pow. Włocławek. *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi. Seria Archeologiczna* 14: 79–144.
- Nowak, M. 1996. *Ceramika kultury pucharów lejkowatych w Kawczycach*. Kraków.



- Nowak, M. 2001. Osadnicze i socjo-polityczne modele południowo-wschodniej grupy kultury pucharów lejkowatych. In J. K. Kozłowski and E. Neustupny (eds), *Archeologia przestrzeni. Metody i wyniki badań struktur osadniczych w dorzeczach górnej Łaby i Wisły*, 127–152. Kraków.
- Nowak, M. 2009. *Drugi etap neolityzacji ziem polskich*. Kraków.
- Papiernik, P., Wicha, J. and Płaza, K. D. 2018. Excavations of the Kuyavian megalithic long barrow no. 2 of the Funnel Beaker culture, situated on site no. 1 at Gaj, commune of Izbica Kujawska, province of Kuyavia-Pomerania. *Prace i Materiały Muzeum Archeologicznego i Etnograficznego w Łodzi. Seria Archeologiczna* 47 (2016–2017): 443–456.
- Pelisiak, A. 2003. *Osadnictwo. Gospodarka. Społeczeństwo. Studia nad kulturą pucharów lejkowatych na Niżu Polskim*. Rzeszów.
- Pleslová-Štiková, E. 1985. *Makotřasy: A TRB Site in Bohemia*. Prague. *Fontes Archaeologici Pragenses* 17.
- Pleslová-Štiková, E. 1987. Die kulturelle Entwicklung und die Periodisierung der TRB in Böhmen: die neueren Ergebnisse. In T. Wiślański (ed.), *Neolit i początki epoki brązu na ziemi chełmińskiej*, 397–418. Toruń.
- Przybyła, M. M. and Tunia, K. 2013. Investigations in 2012 of the southern part of the Funnel Beaker culture *temenos* at Słonowice near the Małoszówka river. Fourth report. In S. Kadrow and P. Włodarczak (eds), *Environment and subsistence – forty years after Janusz Kruk’s “Settlement studies...”*, 139–161. Rzeszów–Bonn. *Studien zur Archäologie in Ostmitteleuropa/ Studia nad Pradziejami Europy Środkowej* 11.
- Rybicka, M. 2004. *Kultura pucharów lejkowatych na Pojezierzu Gostynińskim. Chronologia, osadnictwo, gospodarka*. Łęczysca.
- Rybicka, M. 2017. *Kultura trypolska – kultura pucharów lejkowatych. Natężenie kontaktów i ich chronologia*. Rzeszów. *Collection Archaeologica Ressoviensis* 37.
- Rzepecki, S. 2004. *Społeczności środkowoneolitycznej kultury pucharów lejkowatych na Kujawach*. Poznań.
- Rzepecki, S. 2014. *Wilkostowo 23/24. Neolityczny kompleks osadniczy*. Łódź.
- Rzepecki, S. 2015. *Wilkostowo 23/24. A Neolithic Settlement in Kuyavia, Poland c. 3500 BC*. Kraków–Bonn. *Studien zur Archäologie in Ostmitteleuropa/ Studia nad Pradziejami Europy Środkowej* 15.
- Rzepecki, S. and Golańska, M. 2015. Ceramika kultury pucharów lejkowatych z badań realizowanych przez Instytut Archeologii Uniwersytetu Łódzkiego na liniach dróg i autostrad. *Raport* 10: 43–62.
- Szmyt, M. 1992. Łojewo, gm. Inowrocław, woj. bydgoskie, stan. 35. Osada z fazy wczesnowiöreckiej kultury pucharów lejkowatych. Z badań nad genezą i systematyką kultury pucharów lejkowatych na Kujawach. *Sprawozdania Archeologiczne* 44: 49–98.
- Szmyt, M. 2017. Collective graves, flint axes and cows. The people of Globular Amphora culture on the Vistula and Odra. In P. Urbańczyk and P. Włodarczak (eds), *The Past Societies. Polish lands from the first evidence of human presence to the early Middle Ages. Vol. 2. 5500–200 BC*, 211–273. Warszawa.
- Szpunar, A. 1987. *Die Beile in Polen I*. München. *Prähistorische Bronzefunde* IX, 16.
- Šmid, M. 2017. *Nálevkovité poháry na Moravě*. Brno. *Pravěk. Supplementum* 33.
- Wierzbicki, J. 2013. *Wielka kolonizacja. Społeczności kultury pucharów lejkowatych w dorzeczu środkowej Warty*. Poznań.
- Wiślański, T. 1979. Kształtowanie się miejscowych kultur rolniczo-hodowlanych. Plemiona kultury pucharów lejkowatych. In W. Hensel and T. Wiślański (eds), *Prahistoria ziem polskich. T. II. Neolit*, 165–260. Wrocław-Warszawa-Kraków-Gdańsk.
- Włodarczak, P. 2006. Chronologia grupy południowo-wschodniej kultury pucharów lejkowatych w świetle dat radiowęglowych. In J. Libera and K. Tunia (eds), *Idea megalityczna w obrządku pogrzebowym kultury pucharów lejkowatych*, 27–66. Lublin-Kraków.
- Zastawny, A. 2008. The Baden and the Funnel Beaker-Baden Settlement in Lesser Poland. In M. Furholt, M. Szmyt and A. Zastawny (eds), *The Baden Complex and the Outside World, 177–188*. Kiel-Poznań-Kraków. *Studien zur Archäologie in Ostmitteleuropa/ Studia nad Pradziejami Europy Środkowej* 4.