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POTTERY OF *PIKUTKOWO* TYPE
IN THE FUNNEL BEAKER CULTURE:
CHARACTERISTICS, DISPERSION AND CONTEXT

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ABSTRACT

The article discusses the current state of knowledge concerning the set of specific pottery characteristics of the Funnel Beaker culture that constitutes the so-called *Pikutkowo* stylistics. It is especially strongly represented in Kujawy, where the changes in the *Pikutkowo* set of characteristics define Phases IIIB and IIIB-C dated to 3700-3200 BC. Already in 3700/3650-3500 BC, *Pikutkowo* pottery appears not only on the Polish Lowland (including Wielkopolska and central Poland as well as the Chełmno Land and Gostynin Lake District), but also on the old Uplands in the upper Vistula basin. The latest data indicate that at the same time *Pikutkowo* characteristics are also present in Funnel Beaker assemblages from the Subcarpathian foothills and upper Dniester area. It is argued that this wide distribution delimits the *Pikutkowo* stylistics space, which was a zone of active circulation of cultural patterns within the Funnel Beaker culture. The culture-forming potential of this zone is best seen in the increased transfer of one of the key technological innovations of the Eneolithic, i.e. copper (including arsenic copper) use and processing.

Keywords: Funnel Beaker culture, pottery ornamentation, *Pikutkowo* style, adaptation of copper

Today's periodization schemes of the Funnel Beaker culture (FBC) on the Polish Lowland originate with Konrad Jażdżewski's almost 85-year-old conception published in his doctoral dissertation [Jażdżewski 1936]. The conception distinguished two phases on the strength of different characteristics of clay vessels: older – Wiórek and younger – Luboń. In the middle of the 20th century, the two phases were supplemented with the third oldest phase, taken from Carl J. Becker [Chmielewski W. 1952: 37], designated as AB or Sarnowo [Gabałówna 1968; 1970]. The sources that defined it came from underneath Kujawy long barrows and their seniority with respect to Wiórek pottery was stratigraphically proven [Chmielewski W. 1952: 35]. Built in this way, a relative chronology scheme consisted of three phases: Sarnowo, Wiórek and Luboń and applied to the development of the FBC eastern group [Jażdżewski 1961; Kostrzewski *et al.* 1965: 82-83; for a different opinion *see* Kowalczyk 1969]. It is this version – comprising early, middle and late phases – that is still used by some archaeologists [Grygiel 2016: 95]. Its continuous use is a paradox of sorts but also bears out the excellent intuition of Jażdżewski, who developed his initial 2-phase scheme, relying on sources of doubtful homogeneity. For neither of his eponymous sites (Wiórek and Luboń) met conditions acceptable today [*cf.* Kaczmarek *et al.* 2009].

The scheme, however, was not only used, but also gradually made more specific, beginning with the late 1950s. The first amendments were introduced by Lidia Gabałówna, who relied on new sources discovered in Kujawy [Gabałówna 1959; 1971]. Ultimately, a 5-stage record of the FBC in Kujawy was developed [Koško 1981: 49-52], which underwent further concretisations, resulting in the division of phases into sub-phases. Its current version [Koško 1981; Czerniak, Koško 1993] comprises the following taxa:

- Phase I
- Phase II (sub-phases: IIA and IIB)
- Phase III (sub-phases: IIIA, IIIB, IIIB-C and IIIC)
- Phase IV (sub-phases: IVA and IVB)
- Phase V (sub-phases: VA, VB and VC)

In addition, an 'epi-Beaker' horizon was distinguished – of the Żabno type – combining the characteristics of the FBC and the Corded Ware culture [Czebreszuk, Koško 2000].

In the current interpretation of their research significance, the listed taxa are called phaso-groups – i.e. categories of development stage designation, combining both typo-chronological and typo-chorological identifications.

The early 21st century witnessed the presentation of another version of the taxonomy of the early (Middle-Neolithic) FBC [Rzepecki 2004: 38-59]. It featured five taxa called groups (designated as FBC-s1 – FBC-s5) that corresponded to Phases I, IIA, IIB and IIIA distinguished earlier. Three were divided into ‘the structures of a lower order (hypothetical phases of groups)’ [Rzepecki 2004: 59]: KPL-s1a, KPL-s1b, KPL-s2a, KPL-s2b, KPL-s3a and KPL-s3b.

This article focuses on one aspect of the classic FBC in Kujawy, namely a specific pottery style set named after *Pikutkowo* that defines the stage used to be called Early Wiórek, i.e. Phases IIIB and IIIB-C.¹ Its diagnostic trait is so-called pottery with frugal decoration known also as pottery with sparse ornamentation. The period of 3700/3650-3500 BC witnessed its wide distribution across the FBC eastern group and outside this taxon: in the south-eastern group as well as in the northeast peripheries of FBC settlement. The point of departure for the identification and description of *Pikutkowo* style sets was Kujawy.

1. THE KUJAWY PERSPECTIVE: THE CONCEPT OF THE *PIKUTKOWO* STYLE SET

In Kujawy, the beginnings of identifying pottery with frugal decoration within the FBC were associated with the exploration of the eponymous site *Pikutkowo* 6 located in the eastern part of the region, near the Vistula, in Włocławek District. The site was excavated in part by Konrad Jazdzewski in 1937, but the results were published only 30 years later [Niesiołowska 1967]. The author of the publication, Ewa Niesiołowska in her study of materials from this site (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] referred to her work, creating the outline of two developmental stages as part of the second phase of the FBC: an older one – labelled the early Wiórek or *Pikutkowo* and a later one – the Wiórek phase proper.

Gabałówna described the *Pikutkowo* style as consisting of sparsely ornamented ceramics, stressing the presence of such decorative elements as rows of rectangular stamps, zigzags, ‘ladders’ and fingerprints, and among the vessel forms – collared flasks [Gabałówna 1968: 143]. In her later works, she used the observations of Chmielewski [1952] and her own ones from Sarnowo site 1 and 1A, Włocławek District, and also of Niesiołowska from *Pikutkowo* site 6, for the distinction of transitions from the AB Phase (= the oldest) to the Wiórek phase

¹ This article refers in part to our previous publication [Koško, Szmyt 2019].

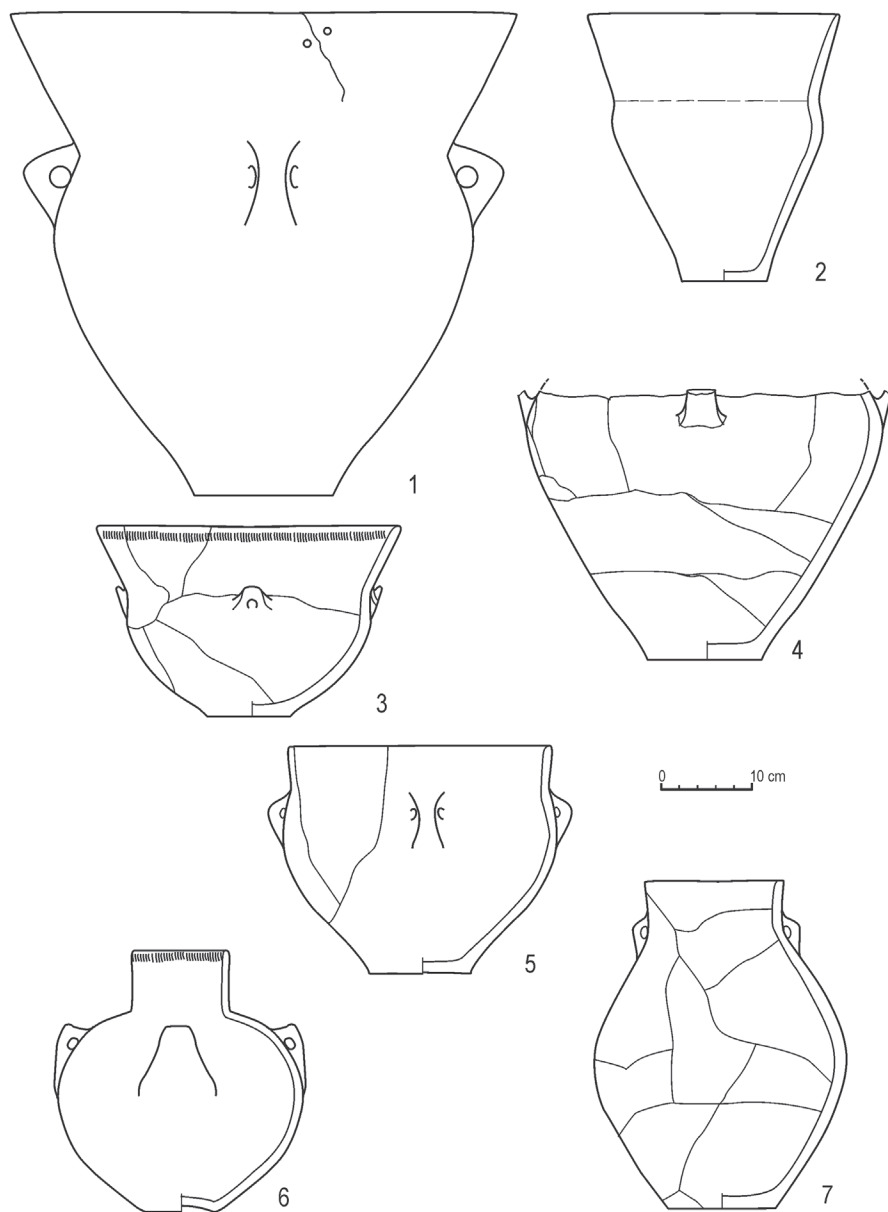


Fig. 1. Pikutkowo, site 6, Włocławek District. Vessels from Pit 25. By Niesiołowska 1967, re-drawn by B. Bednarczyk

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 decided to call this early Wiórek phase the *Pikutkowo* phase [Gabałówna 1971: 250].

Wiślański introduced the concept of the *Pikutkowo* phase to the taxonomic terminology, while maintaining the ambivalence and terminological uncertainties of earlier writers, by saying: in assemblages that can be associated with the *Pikutkowo* stage, ‘archaic’ traits having very clear connections with the AB Phase relatively commonly occur [Wiślański 1979: 177].

In developing this concept, based on new evidence (in particular from site Inowrocław-Mątwy 1, Inowrocław District, central Kujawy – Fig. 2 and 3), a taxonomic approach to the Wiórek-Pikutkowo style was proposed: it was used to define sub-phase IIIB of the local (Kujawy) FBC, characterised as a state of ‘periodic’ growth, among the technological and stylistic traits of the ceramics of Eneolithic tradition linked to the FBC groups of Małopolska and the late stage of the Tripolye culture [Koško 1981: 48; 1988: 164]. Moreover, a hypothesis was formulated about the eastern Kujawy stylistic region [Koško 1981, Fig. 14], with which the eponymous site *Pikutkowo* 6 was associated, as the local (Kujawy) equivalent of the pottery assigned to Bronocice II or Jevišovice C2 in Małopolska and Moravia [Koško 1988: 165].

The next stage of understanding the position of ceramics with frugal decoration in Kujawy was reached while investigating the settlement in Dąbrowa Biskupia site 21, Inowrocław District (the older stage of settlement on the site according to Piotr Chachlikowski, whom we kindly thank for the information), and exploring features on the routes of new linear construction projects (pipelines and roads), crossing the Kujawy Plateau, including, first of all, site Bachorce 4, Inowrocław District (Fig. 4) [Koško, Przybył 2004: 256-259]. This led to the development of the concept of a cycle of sub-phases in the development of the Wiórek-Pikutkowo style: IIIB (classic *Pikutkowo*) and IIIB-C (late Wiórek), dated to 3700–3500 and 3500–3200 BC, respectively. The diagnostic styles of the classic *Pikutkowo* come from sites located in central Kujawy: Inowrocław-Mątwy 1/occupation stage A, Dąbrowa Biskupia 21/occupation Phase I, and Bachorce 4 [Koško, Przybył 2004: 256-259].

The latest stage in the development of ideas, initiated in the 21st century, is associated with studies on the cultural landscape of Kujawy 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 Kujawy [Koško, Szymt 2006; 2007a; 2007b; 2014; 2015] are of key significance for the topogenetic qualifica-

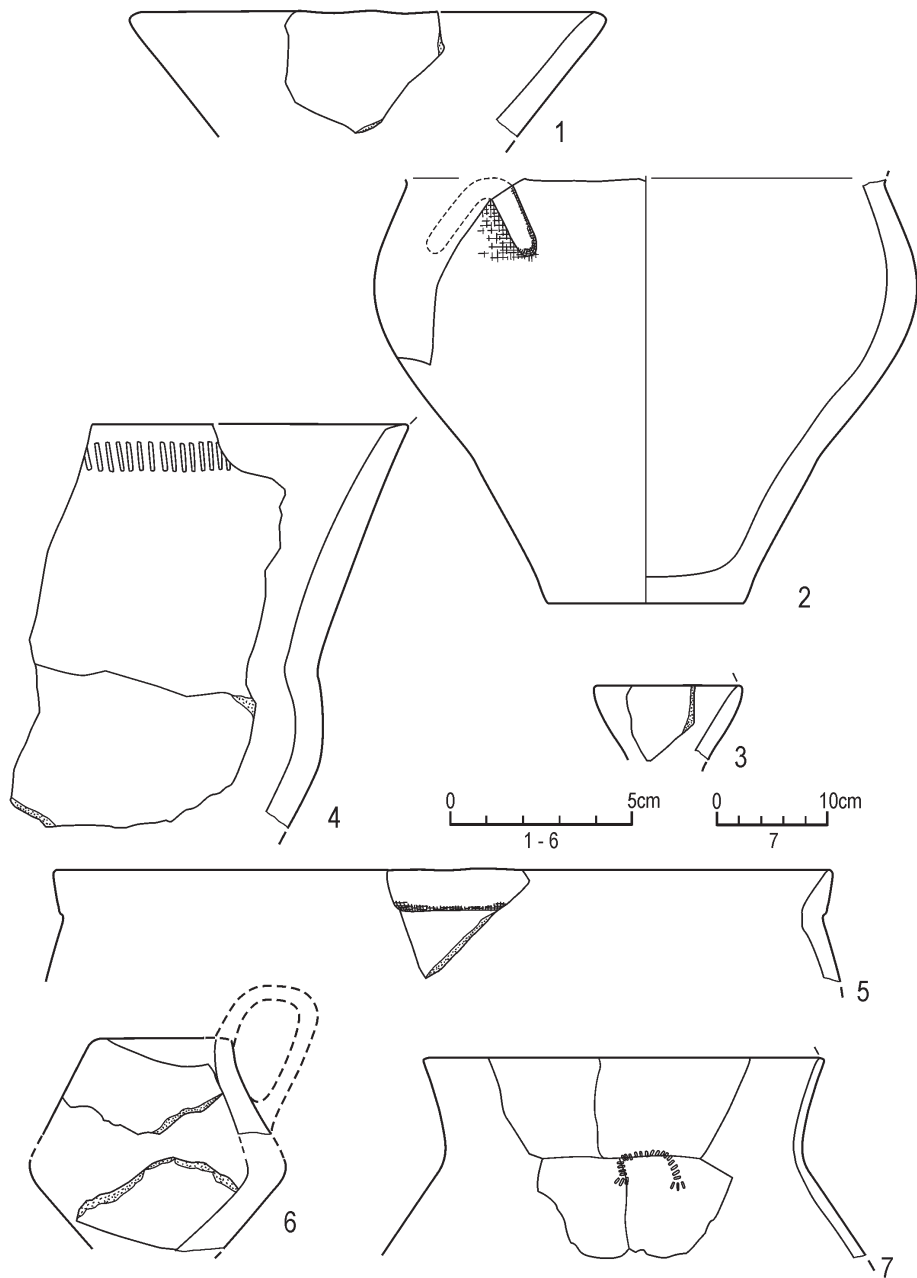


Fig. 2. Inowrocław-Mątwy, site 1, Inowrocław District. Selected pottery from feature 49B. By Koško 1988, redrawn by B. Bednarczyk

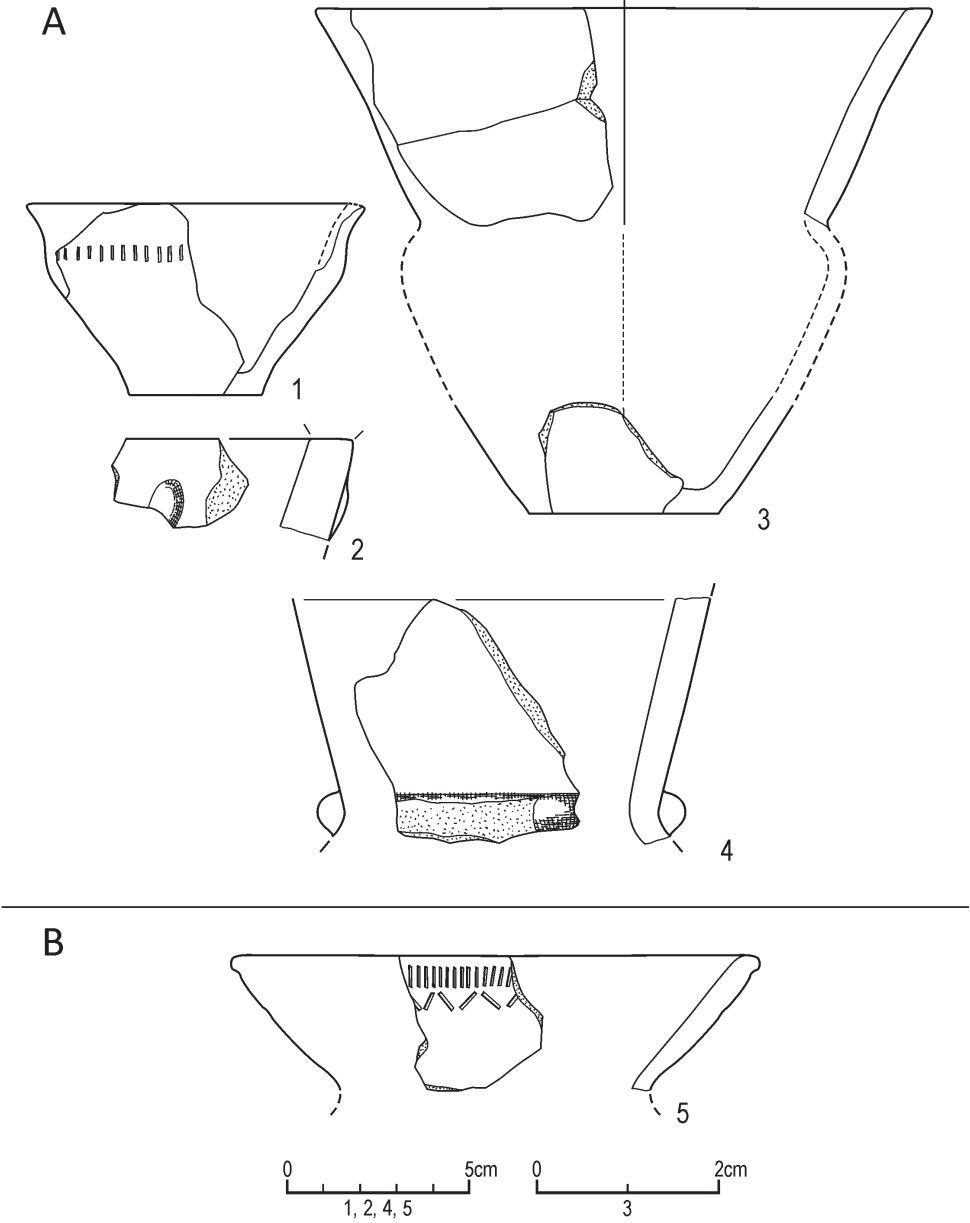


Fig. 3. Inowrocław-Mątwy, site 1, Inowrocław District. Selected pottery from feature 49A (A) and 51 (B). By Koško 1988, redrawn by B. Bednarczyk

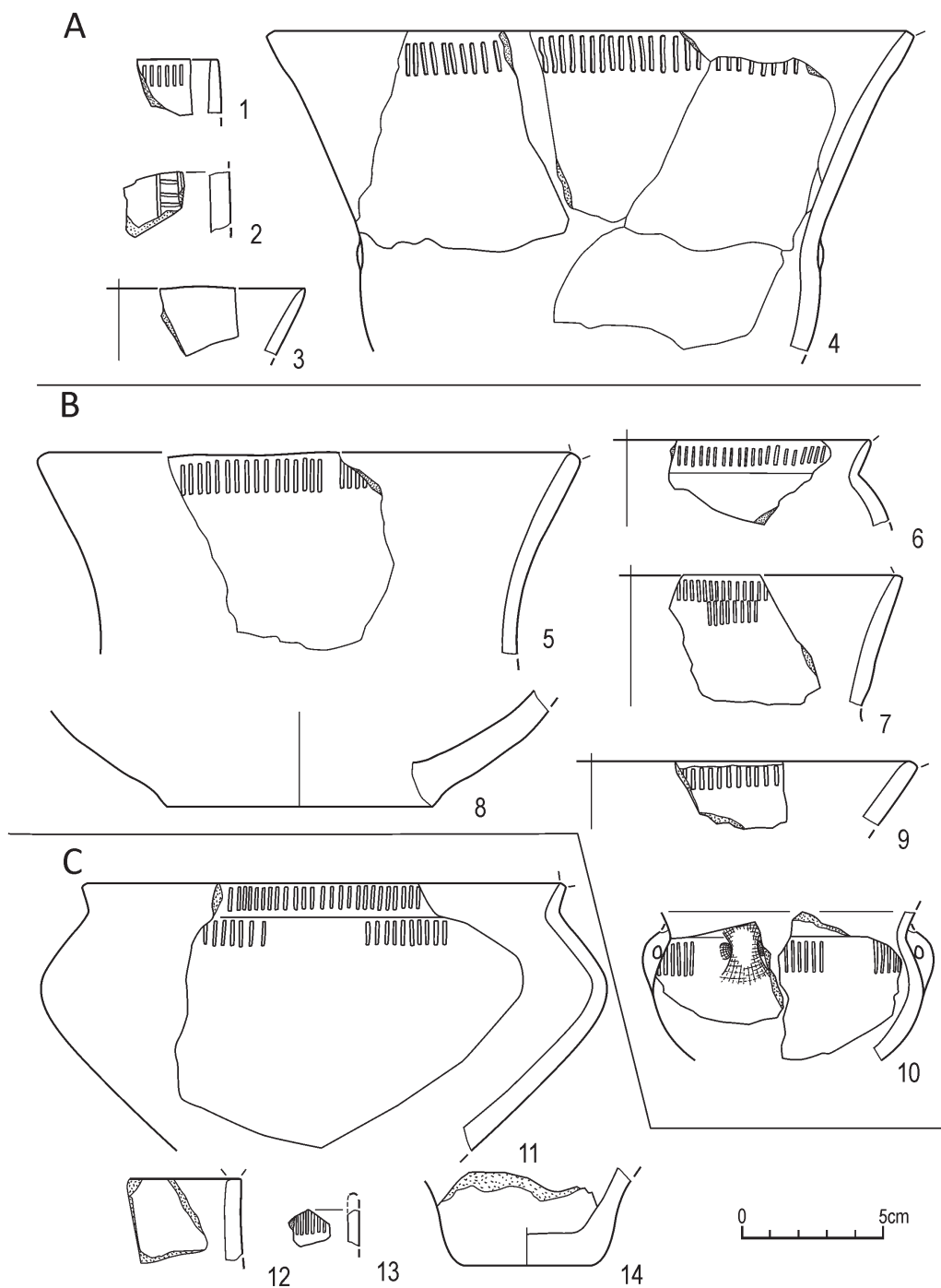


Fig. 4. Bożejewice, site 4, Inowrocław District. Selected pottery from feature 49 (A), 53 (B) and 54 (C). By Koško, Przybył 2004, redrawn by B. Bednarczyk

tion of sub-phases IIIB and IIIB-C. A set of components identified with the various 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. An attempt was made to embed a large series of taxonomic observations in the context of the concept of the autogenesis of the FBC settlement in the Kujawy mesoregion. In the light of these studies, in the period of 3650-3200 BC, the communities, genetically identified with the FBC eastern group in the Lowland zone, were subjected to a two-way external cultural impact: (a) meridional, between the Vistula and Warta and upper Oder basins and Moravia, and (b) latitudinal, between the Warta basin (Wielkopolska) and the Mittelelbe-Saale basin.

Attention should be focused on the impact from Moravia, dated to 3650-3500 BC and identified in its initial version at the site of Opatowice 33 (strictly: in the phase/settlement Opatowice 33-A1). The pottery traits found there are continued by the ‘Łojewo’ trend of the local FBC assigned to Phase IIIA [Szmyt 1992; Czerniak, Koško 1993: 105-113, *cf.* FBC group s2b – Rzepecki 2004: 49]. These show numerous references to the traditions of the FBC south-eastern group, from both the loess areas (local phases: Bronocice II, Zimne I, Gródek Nadbużny I) [Kruk, Milisauskas 1983; 2018; Bronicki *et al.* 2003] and the so-called para-Lowland zones [Czopek, Kadrow 1987; Nowak 1996; 2001]. There are also clear references to more distant agglomerations of the FBC. These include the Moravian-Upper Silesian subgroup, specifically, its older phase – Jevišovice C2 [Bukowska-Gedigowa 1975; Medunová-Benešová 1981; Šmid 2017], and even the Baalberg group from the Bohemian Basin (from the younger phase, with stamped ceramics – Siřem/B1) [Pleslová-Štiková 1985; 1987]. These convergences concern the advanced (Eneolithic) techniques of pottery production: surface treatment (e.g. slipping) and vessel firing, as well as pottery stylistic traits designated as classic *Pikutkowo* [Koško 2006: 191-192].

These traits can be summarised as a model of technological-stylistic grounds for delimiting the *Pikutkowo*-style zone, found in both Kujawy and Uplands in the south of Poland (*cf.* below, Sect. 3). The basic package (classic *Pikutkowo* = Phase IIIB) can be defined, in an idealised form, as the co-occurrence of the following set of diagnostic attributes:

- technology – the presence of **slipping** (diagnostic trait) + well smoothed surface, possibly also strong firing;
- macromorphology – the presence of typological groups of **funnel beakers** (diagnostic trait) + amphorae + collared flasks + pots + bowls + vases;
- ornamentation – the presence of **rows made with a rectangular** (‘**orthogonal**’) **stamp under the rim** (diagnostic trait) + under-rim rows made with a comb + under-rim appliqué clay strips with fingertip impressions + elements placed on vessel bellies (rectangular stamps, appliqué zigzags, knobs, ladders).

In the late *Pikutkowo* stage (= Phase IIIB-C) [*cf.* Koško, Przybył 2004: 259], various deviations taking many regional forms can be observed in the stylistic package described above. Their detailed identification is an important analytical task still facing researchers, in terms of both taxonomy and cultural studies.

An important development in the programme under discussion is current research on the chronometry of the eastern Kujawy stylistic region based on evidence from investigations along the A1 motorway route, as, for instance, at the site Janowice 2, Włocławek District, dated to 3580-3530 BC [Koško, Żurkiewicz 2016: 142-144] and other sites [e.g. Rzepecki, Golańska 2015; Grygiel 2016]. Some of them can be interpreted as a confirmation of the phenomenon of ‘peripheral archaism’ [*cf.* Koško 1981: 69].

B. Investigations conducted in eastern Kujawy, in the area of Brześć Kujawski, Włocławek District [Grygiel 2016; 2018], has led to modifications to our knowledge of the Middle Neolithic FBC, subjected to influences from both the west (of the ‘large valley’ type, mainly in relation to the Mittelbe-Saale Gebiet) and the northwest, from the genetic centre in eastern Holstein and southern Jutland, dated to ca 4200 BC [Grygiel 2016: 970-977; *cf.* also Nowak 2009]. In this perspective, the context of the Brześć Kujawski culture is minimized: it is separated from the prologue of the Kujawy FBC (about 3900 BC) by a distinct ‘chronological break’ [Grygiel 2016: 996, Table 91; 2018: 197, Fig. 10]. An important novelty is numerous stylistic references to the Lublin-Volhynia culture from south-eastern Poland and Volhynia, the second of the principal centres of Eneolithisation of the Polish Lowland. It was genetically distinct from the Lengyel tradition that is present in the Brześć Kujawski culture. For example, according to Grygiel, in a ‘large’ FBC settlement Smólsk 2/10 site, there are legible Lublin-Volhynia culture influences, discovered in several rubbish pits and one inhumation grave as well as in the form of well-copied vessel patterns. Moreover, large amounts of chocolate flint are noticeable on Kujawy sites, dated to the early phase of the FBC, with the main, and then perhaps only group with access to its deposits being precisely the Lublin-Volhynia communities living there [Grygiel 2016: 973-974].

In the local sequence of the FBC from the Brześć Kujawski region, three phases are distinguished [Grygiel 2016: 966, Table 91, Fig. 687]: early – 3900/3800-3600 BC (corresponding to Phases I-IIA in central Kujawy), classic – 3650-3400 BC (= Phases IIB-IIIC in central Kujawy), and late – 3400-3200/3100 BC (= Phases IVA-VB in central Kujawy).

This sequence also refers directly to the eponymous site of *Pikutkowo* 6, classified by Grygiel as the prologue of the classic phase. Two radiocarbon dates were obtained for bones from graves in *Pikutkowo*; they confirm two occupation phases of the site in 3737-3644 BC and 3628-3589 BC perceived already by Niesiołowska [Grygiel 2016: 151; *cf.* Niesiołowska 1967: 120].

C. The excavation at site *Wilkostowo* 23/24, Aleksandrów Kujawski District, revealed a relatively stable settlement dated to 3525-3450 BC [Rzepecki 2014;

2015]. Thanks to large scale exploration, the site yielded a relatively comprehensive record of the everyday and occasional life of an FBC community at the turn of Phases IIIB and IIIB-C. From the perspective of the Eneolithisation process, the fact that copper was not used within the settlement should be underlined. However, a similar programme of settlement investigations at site Dąbrowa Biskupia 21, the oldest stage 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 settlement’ patterns from the loess upland regions of the South.

2. ‘PIKUTKOWO ANALOGIES’ IN OTHER REGIONS OF THE POLISH LOWLAND AND IN THE UPLANDS

The range of the phenomena related to the *Pikutkowo* style was significantly expanded owing to the research on the FBC in several regions of the Polish Lowland such as the Chełmno Land [Kukawka 1991; 1997], Gostynin Lake District [Rybicka 2004], central Wielkopolska [Wierzbicki 2013] and central Poland [Pelisiak 2003]. Materials related to Kujawy Phase IIIB have been identified in these areas; however, it is still difficult to include them in a detailed comparative analysis and to relate them to taxonomic findings from the central Kujawy stylistic region.

Another group of promising analogies includes ones from the old Uplands, namely from the drainage basins of the upper Vistula and Western Bug rivers. The first to draw attention there to pottery with frugal decoration was Jan Kowalczyk [1969: 43]. The discussed pottery is now dated to the classic phase of the south-eastern FBC group, which corresponds to Kujawy Phase III [Włodarczak 2006: 34]. It is worth noting that this is the so-called stage of central loci, i.e. the period of existence of large upland settlements of the Bronocice type [Kruk, Milisauskas 1999: 135]. In this systematisation, the classic *Pikutkowo* period (= Kujawy Phase IIIB) corresponds to the phase/style of Bronocice II, 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 3500/3400-3300 BC [Kruk *et al.* 2018: 77; *cf.* Kruk, Milisauskas 2018: 79–85]. At the same time, the date 3500 BC marks the prologue of the Boleráz stage [Włodarczak 2006: 36].

In comparison to the observations from Kujawy, the old Uplands yielded only few stylistic sequences (from sites or microregions), which is one of the shortcomings in the taxonomic diagnosis of these areas. It is still limited to a few large settlements: Bronocice, Pińczów District, and Gródek, Hrubieszów District in Poland as well as Zimne, Volodymyr Volynskyy *raion* in western Ukraine. Moreover, the situation is complicated by the conservatism of ceramic stylistics, which may

be an additional difficulty in determining the local FBC periodisation [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 Western Bug River region* [Rybicka 2017: 26; cf. Bronicki *et al.* 2003; see also Kadrow 2007].

It may therefore be concluded that in areas on the Vistula and Oder rivers in the west and the upper Dniester basin in the east, markers of the active circulation of cultural patterns can be identified in the form of the ‘classic *Pikutkowo* style set’. This could be dated to the final centuries of the first half of the 4th millennium BC. The diagnostic sites are:

- in the Lowland: *Pikutkowo* 6, Inowrocław-Mątwy 1/stage A, Dąbrowa Biskupia 21/Phase 1 and Bachorce 4
- in the Uplands: Bronocice 1/Phase II, Zimne 1 /Phase I, Skołoszów 31
- in the upper Dniester basin: *Kotoryny-Grodzisko III*.

Taking the date of the beginning of this activation process to be ca 3700/3650 BC, its Eneolithic civilization background could have been created by the waning of the Brześć Kujawski culture (in the north) and the Lublin-Volhynia culture (in the south) as well as the initial stages of Tripolye culture transmission to the Lowland – since stage CI/CII [Diachenko, Harper 2016] – and the rise of the Małopolska ‘proto-Boleráz’ agglomerations of the ‘Wyciąże’ or ‘Niedźwiedz’ type [Włodarczak 2006: 36-38; Zastawny 2008].

Leaving aside the distribution of flint raw materials from the Volhynia-Dniester area in the FBC assemblages of Małopolska, generally related to the Bronocice II-III horizon [Libera, Zakościelna 2011: 89–95], there is no satisfactory analytic evaluation of the reception of pottery components related to the Pontic Eneolithic. In the set of Eneolithic cultural patterns found on the old Upland sites displaying the classic *Pikutkowo* style set, the Tripolye component was only faintly evidenced. It was not seen either in Bronocice II [Kruk, Milisauskas 1983; Włodarczak 2006: 57], although Rybicka recently recalled the remark of Janusz Kruk and Sarunas Milisauskas [1981: 98] that in one of the features dated to Phase BR II, there was a pottery shard with a painted ornament of a red colour. This may be a stylistic borrowing from the Tripolye culture circle [Rybicka 2017: 103]. She also stressed the Tripolye provenance of pottery ornaments made of so-called double cord imprints found, for example, on sites Skołoszów 31, Jarosław District [Rybicka 2017: 107-109] and Pliszczyn 9, Lublin District – here on pottery dated to ca 3550-3450 BC [Chmielewski T.J. 2015: 221]. The problem of the topogenetic context of the application of cord imprints in the FBC ornamentation has already been the subject of archaeo-technological studies [Koško, Szmyt (eds.) 2010].



Fig. 5. Selected sites with pottery of „Pikutkovo” traits and copper daggers and axes of Bytyń type on the background of basic territorial groups of the Funnell Beaker culture. Map by Midgley 1992, amended by the authors and re-drawn by B. Bednarczyk. Location of daggers and axes based on Kowalewska-Marszałek *et al.* 2006; Przybyła, Tunia 2013; Adameczak *et al.* 2015; Papiernik *et al.* 2018; Kowalski *et al.* 2019

Key: a – sites with pottery of „frugal decoration” mentioned in the text (1 – Bronocice 1; 2 – Gródek 1; 3 – Zimne 1; 4 – Skołoszów 31; 5 – Pliszczyn 9; 6 – Kotoryny-Grodzisko III); b – finds of copper daggers in the context of the Funnell Beaker culture (7 – Kałdus; 8 – Gaj 1; 9 – Kichary Nowe 2; 10 – Słonowice 5); c – finds of copper axes of Bytyń type on the Vistula and Odra; d – Kuyavia.

A new direction in research may be marked by the finding of FBC ceramics with clear Wiórek (or Pikutkovo/Wiórek) phase connotations in the centre of the Baden culture area at Salgótarján-Pécskő, Nógrád District [Horváth 2018: 145-146; *cf.* Horváth in this volume].

Summing up, the wide distribution of the discussed stylistic components may give grounds to distinguish a special – *Pikutkovo* – zone, taken as a space of exchanging cultural patterns within the FBC circle. It would cover the areas of the eastern and south-eastern groups as well as the south-eastern (as far as the upper Dniester) and north-eastern peripheries of the FBC oecumene (Fig. 5). It took shape in 3700/3650-3500 BC.

Certainly, it is not a coincidence that – within the same space and in a similar time – local FBC populations learned the technologies of copper processing.

3. BEGINNINGS OF FBC COPPER METALLURGY AND THE CONTEXT OF *PIKUTKOWO* TYPE ASSEMBLAGES

In the Kujawy FBC, copper artefacts appeared very early because already at the turn of Phase I and II. This is evidenced by findings from Sarnowo, site 1 (long barrow 8), Leśniczówka, site 1, Koło District (long barrow II) and from a settlement in Przybranówek, site 43, Aleksandrów Kujawski District [Gabałówna 1970: 83; Czerniak, Koško 1993: 92]. In the current chronological framework, this would be a period with a maximum chronological spread between 4400/4200 and 3800 BC [*cf.* a different opinion: Nowak 2009]. In compliance with observations made at the FBC agglomeration around Brześć Kujawski (eastern Kujawy), 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 culture and FBC societies has been assumed [Gabałówna 1970: 86; *cf.* Koško, Czerniak 1993; Czerniak 1994]. While maintaining this diagnosis, it should be noted that it is assumed that the development of the Brześć Kujawski culture took place in eastern Kujawy in the 5th millennium BC while the appearance of the first wave of FBC migration is dated only to the period of ca 3900/3800 BC [Grygiel 2016: 981]. Regardless of the chronometric discussions summarised above, the problem of the final date of the Brześć Kujawski culture remains undoubtedly closely related to the concept of the origin of the Globular Amphora culture [*cf.* Szmyt 2017, here further references].

It is also necessary to note the presence of copper artefacts on sites Brześć Kujawski 4 and Nowy Młyn 6, Włocławek District [Grygiel 2016: 381 and 924]. They are linked to the classic (middle) FBC phase there, i.e. after 3700/3600 BC. The results of metallurgical analyses show that these items *although not diverging from the basic chemical composition of the objects of the Brześć Kujawski culture, form their own concentration between the two Lengyel assemblages. The analysis can be taken to indicate the continuity of development of the old centres of European copper production from the middle of the 5th to the middle of the 4th millennium BC* [Grygiel 2016: 958].

In the drainage basins of the Vistula and Oder, the oldest relics of local copper processing come from large FBC settlements in Małopolska, dated to the classic phase, in Niedźwiedź, Cracow District, Ćmielów, Ostrowiec Świętokrzyski District and Gródek, Hrubieszów District, where copper slag has been discovered accompanied in the case of the last two sites by burnt foundry crucibles [Wiślański 1979: 273; Gumiński 1989: 166-169]. However, the evidence from Ćmielów and Gródek has given rise to serious objections [e.g. Koziorowska 2006]. The list of other evidence, also rather questionable, is wider [*cf.* Midgley 1992; here further references]. The inspiring context for this doubts is created by the concept of the symbolic substitution in the FBC of 'massive metal objects' (identified with post-

linear cultures, e. g. with the Lublin-Volhynia culture) – by flint macrolithic artefacts [cf. Budziszewski 2000]. In conclusion Sławomir Kadrow stated: *Contrary to the north group of the TRB[...] there is no evidence of metallurgy and the use of copper vobjects of symbolic and prestige functions. Instead, in centers of flint production quite commonly copper tools were used, which were implemented in a process of core exploitation aiming at obtaining long blades.* [Kadrow 2011: 193; cf. also Kadrow 2010: 85].

Therefore, it is probable that it was during the prologue of the *Pikutkowo* style set that copper processing was introduced in the FBC. Undoubtedly, the introduction of copper was a complex process, which is only now becoming better understood, slowly and gradually, as a result of archaeometallurgical studies [e.g. Kowalski *et al.* 2016; Kowalski *et al.* 2017; Kowalski *et al.* 2019]. At this juncture, we would like to draw attention to the results of the studies by Stefan Łęczycki who argues that the identifiers of this process are the Bytyń-type axes classified also as the Remedello-Bytyń axes [cf. Klochko, Koško in print]. The axes can be dated to the middle of the 4th millennium BC on the strength of 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 – a 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 the Bytyń type belong, for the most part, to Group E01, which corresponds to the use of arsenical copper, appearing in the third metallurgical horizon (Bodrogkeresztúr-Tripolye C1) most likely as a result of influences from Asia Minor [Łęczycki 2004: 66, 68]. The Caucasian-Anatolian metalworking of arsenical copper and then arsenic bronze as well as the distribution of its products across Europe are best described by the concept of a Circumpontic Metallurgical Province/Circumpontic Cultural Province developed by Evgeni N. Chernykh, the prologue of which is dated to ca 3600 BC [Černych 1977; Chernykh 1992]. The issue of the correspondence of 'Bytyń metallurgy' with this province needs to be investigated further in the future (cf. previous suggestions on the topogenesis of copper objects from Gródek) [Gumiński 1989: 168]. Currently, this assessment seems to be additionally supported by the latest research on Carpathian-Volhynia metallurgical centres [Klochko, Klochko 2013; Klochko 2017]. Against this background, it is worth noting the presence of FBC pottery 'imports', corresponding to the *Pikutkowo* style [Rybicka 2017: 43-47], in central Transnistria, in the area of local copper deposits [Klochko *et al.* 2000; 2003; Klochko 2017]. Important is the fact that in recent years the series of Remedello-Bytyń axes in Ukraine has been greatly enlarged [cf. Klochko, Koško in print]. This may be an indicator of a greater intensity of intergroup contacts and transfer of key innovations than previously assumed [cf. Hansen 2011]. So far, however, the series of artifacts discussed in Poland has been increasing slowly (Fig. 5) [see Kowalski *et al.* 2019, Fig. 18].

Valuable information on the relationship between the Jevišovice C2/C1 horizon metallurgical centres and the FBC is provided by a deposit of copper artefacts

from Kałdus, site 2, Chełmno District, north-east of Kujawy [Adamczak *et al.* 2015; Kowalski *et al.* 2019]. They included a dagger of the Usatovo type [Adamczak *et al.* 2015: 206-213]. The ceramic context of the deposit is identified with the Wiórek-Mątwy pottery style zone and thus associated with Phase IIIC [Adamczak *et al.* 2015: 214; Kowalski *et al.* 2019: Fig. 18]. Radiocarbon datings set the absolute chronology of this pottery for period 3510-3350 BC (94.5%) [Kowalski *et al.* 2019: 4367-4368]. Evaluating the assemblage from Kałdus, Rybicka claims these artefacts are of a possible south-eastern, probably Tripolye, origin [Rybicka 2017: 141]. It should be noted, however, that the double spiral ornament of the Rudki-type that accompanied the dagger, was made of pure copper and has characteristics corresponding to the metallurgy of the Baden culture [Kowalski *et al.* 2019: 4373-4374]. Thus, the Kałdus deposit, containing artifacts of various provenance, documents the important role of the exchange route along the Vistula.

This is supported by the distribution of finds with similar characteristics. The closest analogy to the dagger from Kałdus may be offered by the find in Gaj 1, Włocławek District, where a dagger made of arsenical copper was the only furnishing of the central burial of FBC long barrow 2 dated to 3620-3380 BC [Papiernik *et al.* 2018: 450 and Fig. 9]. Two other analogies come from the FBC south-eastern group. The first, a copper dagger, comes from Słonowice site 5, Kazimierza Wielka District, long barrow VIII, Feature 104. It was found in a clear FBC context and dated indirectly to 3625-3350 BC [Przybyła, Tunia 2013: 145-154 and 157]. The second – ‘a copper dagger blade with a preserved trace of the mounting’ – has a clear connection to the FBC because it was found in an FBC grave no. 25 on site Kichary Nowe 2, Sandomierz District [Kowalewska-Marszałek *et al.* 2006: 347]. However, its indirect dating points to only the late 4th and early 3rd millennia BC or to the beginning of the 3rd millennium BC [Kowalewska-Marszałek *et al.* 2006: 348]. The ceramic context of this find was only in general terms referred to the classic phase in the FBC south-eastern group [Kowalewska-Marszałek *et al.* 2006: 347]. If this absolute chronology is borne out, this will be the youngest dagger specimen deposited in an FBC context north of the Carpathians. Its chronology is considered late, too, when compared to the rough dating of such artefacts found along the Black Sea coast [Vajsov 1993, Abb. 34].

4. CONCLUSION

Vessels displaying the *Pikutkowo* style set spread widely towards the end of the first half of the 4th millennium BC. They are recorded not only in the eastern and south-eastern groups, but also in the south- and north-eastern peripheries of the FBC. The presence of this unique pottery (‘with frugal decoration’ made

of orthogonal, i.e. rectangular stamp) may delimit the *Pikutkowo* zone of cultural pattern exchange within the FBC circle. It would cover the areas of the eastern and south-eastern groups as well as the south-eastern (as far as the upper Dniester) and north-eastern peripheries of the FBC oecumene. It took shape in 3700/3650-3500 BC. In the same time and within the same space, FBC communities adapted key innovations: the technologies of copper and arsenic copper processing. The process of innovation transfer in the FBC was accelerated within the *Pikutkowo* zone. Its material evidence is offered in all probability by axes of the Remedello-Bytyń-type as well as daggers of the Usatovo type².

Over time, the *Pikutkowo* zone is subject to changes and transforms into other networks of circulation of cultural patterns, whose identifiers in the Lowlands are the stylistics of ‘Wiórek’ (classical-late) and ‘Wiórek-Mątwy’.

² Both artefact types made of copper or arsenic copper are carefully studied now. The results will be crucial for the better understanding of the 4th millennium BC as the era of civilizational transitions in central Europe.

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