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POTS: THE KEY TO THE TYPE-CHRONOLOGY OF THE LUBLIN-VOLHYNIAN CULTURE CERAMICS

ABSTRACT

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The Lublin-Volhynian Culture is the oldest community representing the Early Eneolithic socio-economic model in Lesser Poland. Together with the Wyciąże-Złotniki group, it has been the subject of a multifaceted analysis as part of the National Science Centre's project, 'Adaptation of Transcarpathian cultural patterns of the Copper Age in Younger Danubian cultures in the Lesser Poland Upland,' which was carried out between 2018 and 2023. A significant element of this research was a typological and chronological analysis of the ceramics of the Lublin-Volhynian culture. It showed that pots show apparent variability in form and ornamentation over time. The clarification of the absolute chronology of the Lublin-Volhynian culture enabled the separation of a group of graves containing pots, whose chronology was defined by AMS dates. These became the base for a pattern of variation in the forms and decoration of the pots. The resulting pattern corresponds to the general dynamics of development of the discussed unit between c. 4050-3700 BC.

Keywords: Eneolithic, pottery, typology, chronology, Lesser Poland, Carpathian Basin
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1. INTRODUCTION

The Lublin-Volhynian culture (LVC) is the largest Early Eneolithic taxonomic unit in south-eastern Poland (Fig. 1). Although almost a century has passed since the first materials were discovered (Żurowski 1930), many of its characteristics remain controversial. Over the years, numerous attempts have been made to solve the mystery of its origin and chronology (*e.g.*, Podkowińska 1953; Nosek 1955b; Gurba 1973; Kulczycka-Leciejewiczowa 1979; Kruk and Milisauskas 1985; Kamieńska and Kozłowski 1990, 56-64; Kadrow and Zakościelna 2000; Zakościelna 2006). Most of the views expressed in the literature share an emphasis on the role of the Malice culture as a substrate on which, under the influence of the Tiszapolgár culture, the earliest Lesser Poland Eneolithic communities formed. Sławomir Kadrow and Anna Zakościelna (Kadrow and Zakościelna 2000) proposed dating the LVC between approximately 4400/4200 and 3400 BC and dividing its development into three phases, which would reflect the dynamics of cultural change in the Carpathian Basin during the Early and Middle Copper Age.

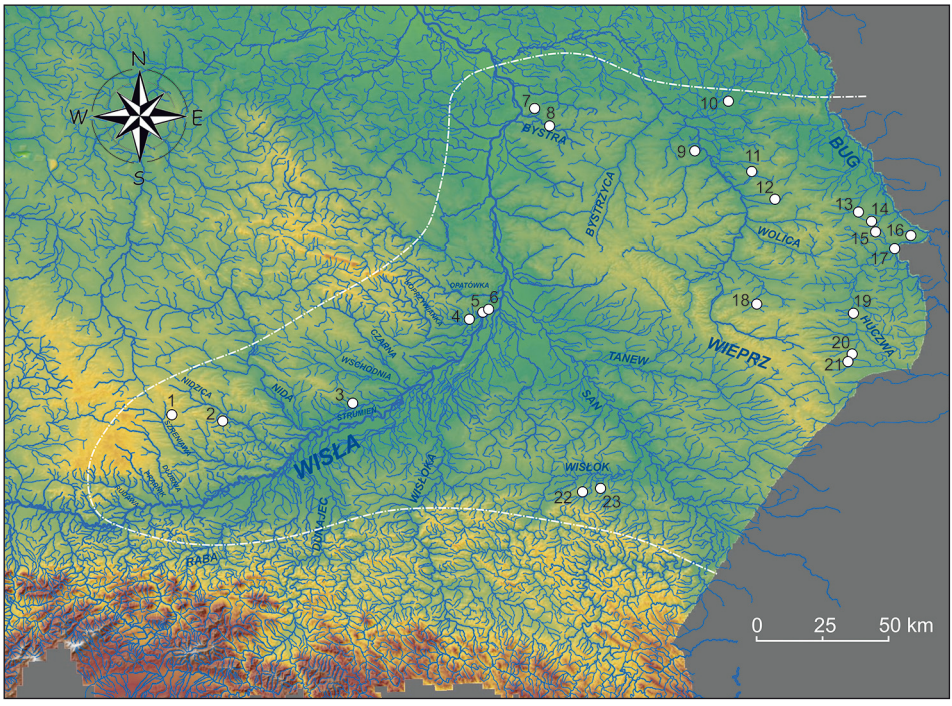

Fig. 1. LVC area with the locations of the sites mentioned in the text: 1 – Miechów, 2 – Bronocice, 3 – Książnice, 4 – Złota, 5 – Sandomierz – Wzgórze Zawichojskie, 6 – Sandomierz – Kamień Plebański, 7 – Wąwolnica, 8 – Las Stocki, 9 – Jaszczów, 10 – Garbatówka Kolonia, 11 – Krasne Kolonia, 12 – Siennica Różana, 13 – Raciborowice, 14 – Stefankowice Kolonia, 15 – Moniatycze Kolonia, 16 – Strzyżów, 17 – Gródek, 18 – Topornica, 19 – Tyszowce, 20 – Podlodów, 21 – Łubcze, 22 – Łańcut, 23 – Kosina. By S. Wilk

Less than a decade after the publication of the cited work, the validity of the proposition that the origins of the LVC were shaped by the influence of the Tiszapolgár culture came under scrutiny (Chmielewski 2008). One of the many contentious issues was the proper assessment of the genetic and typological relationships of the LVC pottery. Some of its features, especially the presence of white-painted geometric motifs on vessel walls and decoration with stamped or pierced hollows arranged in triangular motifs, were considered to be of high chronological significance in older publications (Kadrow and Zakościelna 2000, 213, 214; Zakościelna 2006, 82-84). Similarly, some vessel forms were also regarded as precise indicators of chronology and intercultural links due to their similarity to pottery used in the Carpathian Basin (Kadrow and Zakościelna 2000, 223; Zakościelna 2006, 85). These included high-necked amphorae presumed to refer to the milk pots of the Bodrogkeresztúr culture.

However, new data on the absolute chronology of Early Eneolithic/Copper Age populations on both sides of the Carpathians (Oross *et al.* 2010; Raczky and Siklosi 2013; Brummack and Diaconescu 2014; Chmielewski 2019; Siklósi and Szilagyi 2021), including the LVC and the Wyciąże-Złotniki group (Nowak 2014; 2017; Wilk 2016; Włodarczak 2017; Kadrow 2017; Kadrow and Zakościelna 2022a; 2022b; Mattila *et al.* 2023; Wilk *et al.* 2024), have brought into question the importance of the aforementioned pottery characteristics as sensitive chronological determinants.

'Adaptation of Transcarpathian cultural patterns of the Copper Age within the Younger Danubian cultures in the Lesser Poland Upland' is a Preludium 13 project of the National Science Centre of Poland, which was carried out from 2018 to 2023 at the Faculty of History of the Jagiellonian University in Kraków. As part of this project, the author of this article attempted to verify older hypotheses concerning the role of ceramic markers in intercultural relations. Among other things, the analyses conducted at that time enabled the establishment of a typology of LVC pottery, primarily based on funerary materials (Wilk 2021, 243-278). In the course of the research, it became clear that pots were the only type of vessel whose formal variation could be reliably correlated with broader changes of a sociocultural chronological nature. Hence, the proposal is to base the relative chronology of the pottery of LVC on this type of vessel.

2. TYPOLOGY OF LVC POTS

LVC pots are bipartite vessels with an S-shaped profile, provided with handles on the rim or on the widest part of the body, meeting the following criteria: $r1:h1 \leq 1.2$, when $r2 < r1$ (Dreczko 2016, 13 – modified, with 1.2 instead of 1.1). LVC pots typically have rough surfaces, occasionally with traces of smoothing, but they are never as carefully smoothed as cups, amphorae or flowerpot-shaped vessels. Most of the vessels were made of clay tempered with grog, with an admixture of fine sand. The rims can be smooth, notched (incised)

or covered with fingertip impressions. The decoration is dominated by various types of knobs and cordons applied to the neck or the upper body.

With their wide variety of shapes, LVC pots proved very difficult to subdivide. Eventually, they were divided into two subtypes using the ratio of the diameter of the rim to the height of the vessel (r1:h1): slender pots (subtype A), where r1:h1<1.0, and squat pots (subtype B), where 1.0<r1:h1>1.3 (Fig. 2). In the typology developed by Ewa Dreczko for Funnel Beaker culture pots from Lower Silesia, on which the system presented here was partly modelled, slender pots are defined by the ratio r1:h1<0.7 (Dreczko 2016, 13, fig. 2). This criterion could not be applied to the LVC pots as none of the vessels analysed would have met it. It was therefore decided to use the ratio r1:h1<1.0.

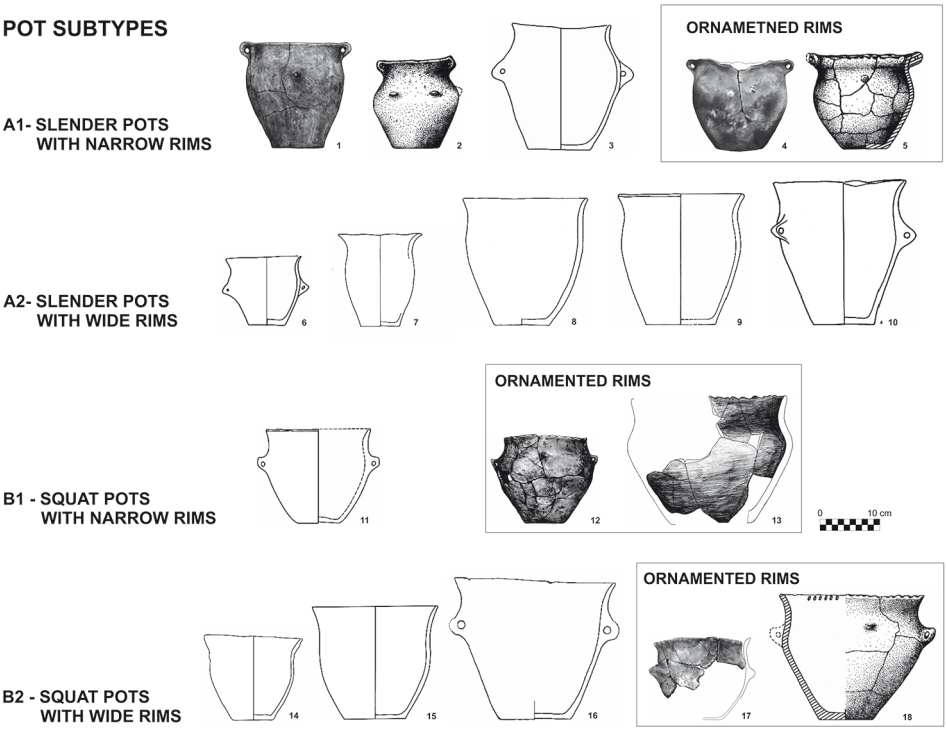

Fig. 2. Typology of pots of LVC: 1 – Grave 5 at Książnice 2; 2 – Grave 390 at Złota-Grodzisko I; 3 – Grave 6 at Garbatówka Kolonia 7; 4 – Grave 10 at Książnice 3; 5 – Grave 101 at Złota-Grodzisko II; 6 – grave at Garbatówka Kolonia 7; 7 – Grave 1/1961 at Strzyżów 1A; 8 – Grave 18 at Podlodów 2; 9 – Grave 2 at Żuków; 10 – Grave 1 at Strzyżów 10; 11- Grave 1/1947 at Sandomierz-Kamień Plebański, 12 – Grave 9 at Książnice 2; 13 – Pit 458 at Miechów 3; 14 – Grave 1/1987 at Tyszowce 25B; 15 – Grave III at Gródek 1C; 16 – damaged graves at Topornica 36; 17 – Grave 11 at Książnice 2; 18 – Grave 122 at Złota-Grodzisko II. Illustrations: 2-3, 5-11, 14-16, 18 – after Zakościelna 2010; 1, 4, 12, 18 – drawing by K. Kielijańska, 13 – by courtesy of the authors of the study of Site 3 in Miechów: M. Nowak and M. M. Przybyła, drawing by M. Podsiadło

The two subtypes were further split according to the ratio of rim diameter to maximum body diameter (r1:r3). Pots with wide mouths, where r1>r3, were described as Variant 1, while those with narrower mouths, where r1<r3, were described as Variant 2. Both subtypes include vessels with handles on the rim, with handles or other grips at the broadest part of the body, and those without handles or grips.

2.1. Slender pots (subtype A)

Among the sepulchral sites of the LVC, the most significant number of pots of subtype A (8 pieces) were found in the cemetery of Książnice: Ks/c/2/9/03 from Grave 4, Ks/c/1/1/04 from Grave 5, Ks/w/22/08 from Grave 7, Ks/w/7/11 from Grave 10, Ks/22/12 from Grave 12, Ks/37/12 from Grave 14, Ks/72/12 from Grave 16, and Ks/w/8/23 from Grave 21 (Fig. 3: b-c, e, g, i-k, n). Apart from the penultimate pot, in which the rim part has not survived, all the others have two opposed handles on the rim. Two pots, Ks/c/4/3/04 from Grave 6 and Ks/37/12 from Grave 14, have two vertical holes in the rim or just below it (Fig. 3: d, j). Subtype A pots were also discovered in Grave I at Gródek IC (Kokowski and Zakościelna 1988, fig. 6: a), in Grave 1 at Jaszczów (Nosek 1949; Zakościelna 2010, pl. 20A: 1), in Grave 1/1961 at Strzyżów 1A (Głosik and Gurba 1963; Zakościelna 2010, pl. 52: 6), and in Graves 3 and 4 at Strzyżów 26 (Zakościelna 2010, pl. 63a: 8, 64a: 7). Interestingly, they all lacked handles. The only pots outside of Książnice with slender proportions and handles on the rim come from Złota: from Grave 390 at the Grodzisko I site (Sałacińska and Zakościelna 2007, fig. 12: 1) and from Grave 101 at the Grodzisko II site (Sałacińska and Zakościelna 2007, fig. 20: 7). In addition, a miniature pot of this type was discovered in Pit 316 (grave) at Site 3 in Miechów (Fig. 4: d). Pots with handles on the belly were discovered in a grave at Garbatówka Kolonia 7 (Polańska 1999, fig. 2: 2); in Grave 2 from Jaszczów (Kowalczyk 1954, fig. 3); in a Grave 18 from Podlodów 2 (Bagińska and Banasiewicz-Szykuła 2002; Zakościelna 2010, pl. 47: 2, 47a: 6); in Grave 1 at Strzyżów 10 (Zakościelna 1996, fig. 5: a, b); and in Graves 2, 5 and 7 at Strzyżów 26 (Zakościelna 2010, pl. 62: 3, 65: 3, 66: 3) (Fig. 2: 1-10).

In the LVC, slender pots are much more common in settlement contexts. They were found at, among other locations, the Grodzisko I site in Złota, in Pit s 3 and 36 (Podkowińska 1953, fig. 8, pl. 10: 2); at Łańcut 3 in Pits 30 and 30A (Gruszczyńska and Mitura 2002, pl. 5: 10-11); and at Łańcut 10 in the only LVC pit examined at this site (Kadrow and Kłosińska 1988, fig. 7: a, b). Another example of this subtype is known from Site 7 at Las Stocki, from Pit 46 (Zakościelna 1986, fig. 10: 5). An interesting variant of this pot, with an egg-shaped body and a notched rim shaped into four protrusions with vertical holes, was found in Pit 1601 at Miechów 3 (Fig. 4: f).

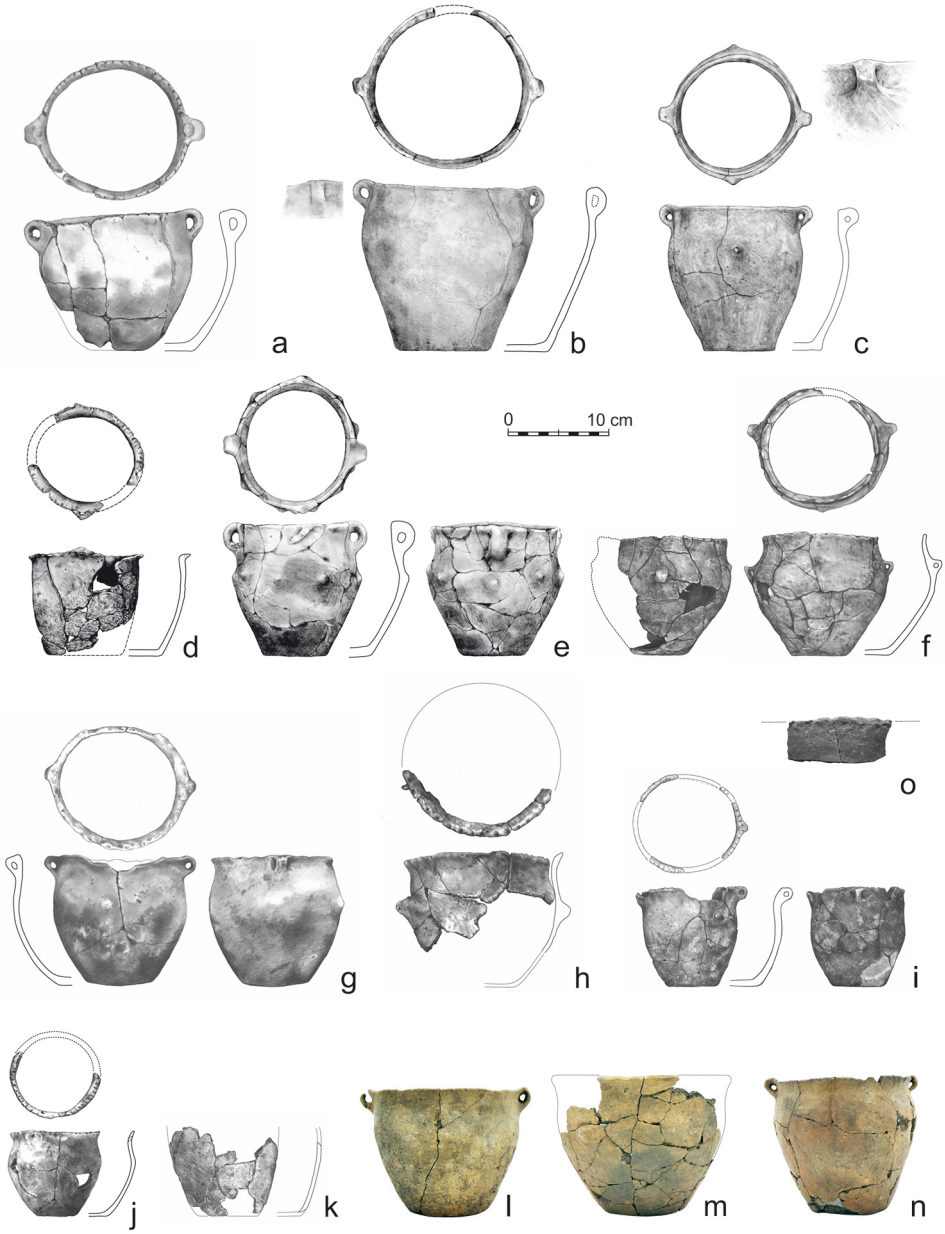

Fig. 3. Pots from the cemetery of LVC at Site 2 in Książnice: a – Ks-c/3/9a/02 from Grave 2, b – Ks-c/2/9/03 from Grave 4, c – Ks-c/1/1/04 from Grave 5, d – Ks-c/4/3/04 from Grave 6, e – Ks/w/22/08 from Grave 7, f – Ks/w/10/10 from Grave 9, g – Ks/w/7/11 from Grave 10, h – Ks/w/18/12 from Grave 11, i – Ks/w/22/12 from Grave 12, j – Ks/w/37/12 from Grave 14, k – Ks/w/72/12 from Grave 16, l – Ks/w/16/22 from Grave 19, m – Ks/w/3/22 from Grave 20, n – Ks/w/8/22 from Grave 21, o – fragment of pot Ks/220/06 from Pit 16/06, drawings by K. Kielijańska and N. Kędzierska

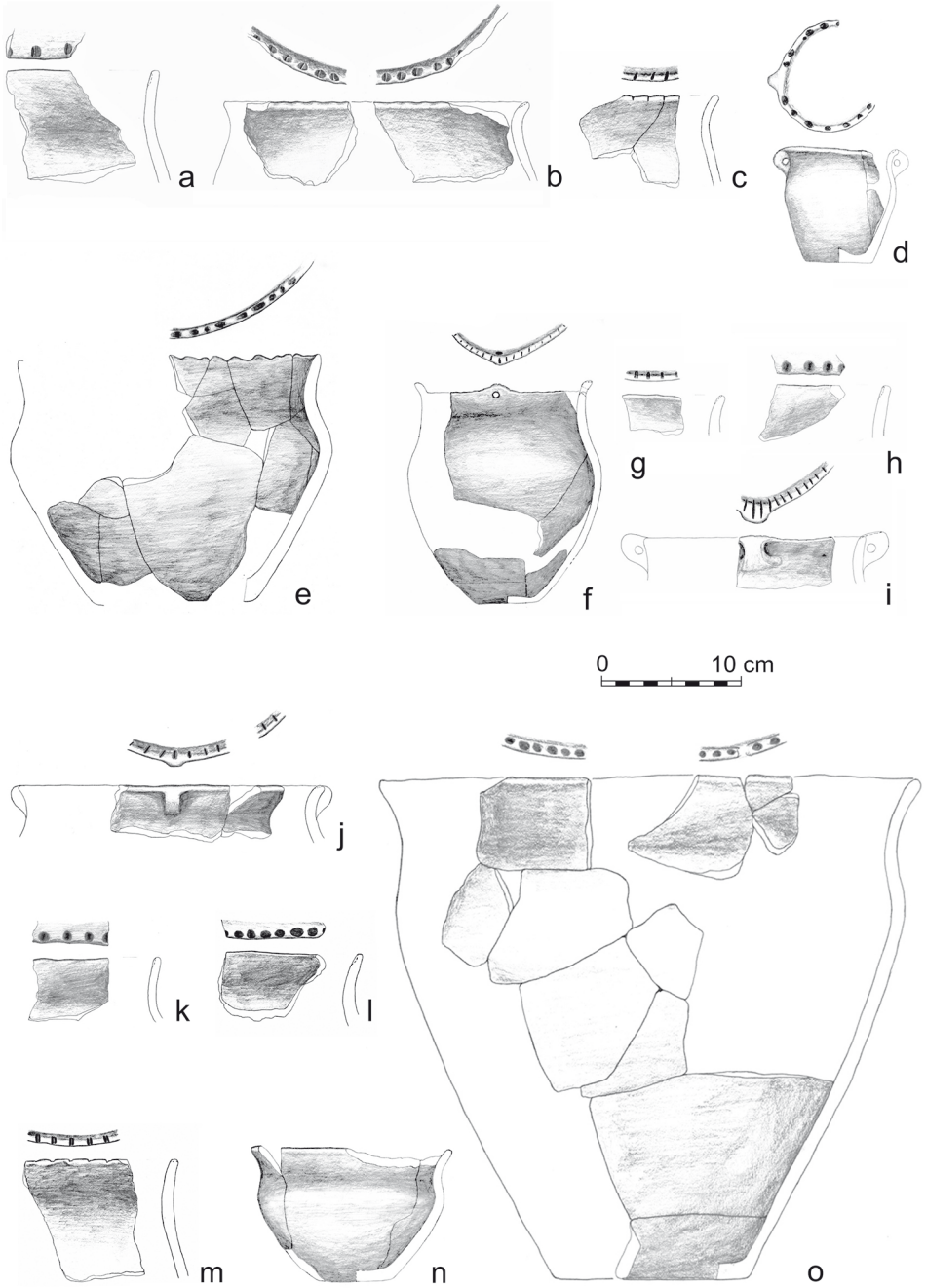

Fig. 4. Examples of LVC pots from Site 3 in Miechów: a, b – Pit 425, c – Pit 355, d – Pit 316, e – Pit 458, f-i – Pit 1601, j-k – Pit 2031, l-m – Pit 2681, n – Pit 1603, o – Pit 431, drawings by M. Podsiadło

2.2. Squat pots (subtype B)

Like the slender pots, vessels with squat proportions were made with or without handles (Fig. 2: 11-18). Examples of pots with squat proportions come from locations that include Grave III at Site 1C in Gródek (Zakościelna 2010, pl. 12: 1), Grave 1/1987 at Site 25B in Tyszowce (Buszewicz 1987; Zakościelna 2010, tabl. 71: 4), and Grave 1 at Moniatycze Kolonia (Gurba 1967, fig. 9). Five of the vessels from the Książnice cemetery belong to the discussed subtype: Ks/c/3/9a/02 from Grave 2, Ks/w/10/10 from Grave 9, Ks/18/12 from Grave 11, Ks/w/16/22 from Grave 19, and Ks/w/3/22 from Grave 20 (Fig. 3: b, f, h, l-m). The pots from Graves 2 and 19 have handles located on the rim, while those from Graves 9 and 11 have handles or grips located at the widest part of the belly. In the case of the pot from Grave 20, it is difficult to say whether it had handles due to its fragmentary state of preservation. Squat pots with handles or other grips at the broadest part of the body, similar to examples Ks/w/10/10 and Ks/18/12, form a relatively compact group. They can be found in Grave 122 at the Grodzisko II site in Złota (Sałacińska and Zakościelna 2007, fig. 29: 1), at Site 36 in Topornica (Buszewicz 1993; Zakościelna 2010, pl. 67: 1, 67a: 6), in a grave at Site 4 in Gródek (Gąssowski 1954; Zakościelna 2010, pl. 16B: 1), in a grave 1/1947 at the Kamień Plebański site in Sandomierz (Nosek 1950; Zakościelna 2010, pl. 49: 5), in grave at Site 7 in Garbatówka Kolonia (Polańska 1999, fig. 3: 5), and other locations. It is worth noting that the artefacts from Grave 9 from Książnice (Ks/w/10/10) and Grave 122 at Grodzisko II in Złota differ from the others in that they have additional small knobs placed slightly higher than the handles. It is also significant that both these pots were found in cenotaphs. A similar vessel was found in Pit 458 at Miechów 3 (Fig. 4: e), and a slightly slenderer example comes from Pit 431 at the same site (Fig. 4: o). In addition, similar vessels have been found in Pit 46 at Las Stocki 7 (Zakościelna 1986, fig. 9: 1) and in Pit 49 at the Wzgórze Zawichojskie site in Sandomierz (Kowalewska-Marszałek *et al.* 2017, pl. II.59: 1). The latter site yielded fragments of pots of proportions that are difficult to determine, which were found in material from the eroded loess slope below Wzgórze Zawichojskie (Ścibior 1993, pl. 10: 1-11, 11: 1-10). Similar fragments of pots decorated with notches or fingertip impressions on the rim were also found in large numbers at Site 3 in Miechów (Fig. 4: a-c, g-m).

The category of squat pots includes a specific group of vessels with rims wider than the greatest width of the base (r1>r3). Their proportions are similar to the tulip-shaped pots known from Younger Danubian Neolithic cultures. Examples of this type of vessel are known from locations that include Grave III at Site 1C in Gródek (Zakościelna 2010, pl. 12: 1), Grave II at Site 27 in Łubcze (Koman 1997, fig. 6: 2) and Grave 1/1987 at Site 25B in Tyszowce (Zakościelna 2010, pl. 71: 4). An analogous vessel also occurred in Pit 1603 at Miechów 3 (Fig. 4: n).

3. POTS OF LVC – THEIR ORIGINS AND CHRONOLOGY

Due to the great variety of forms and ornamentation, the pots used by the people of the Lublin-Volhynian culture can be considered chronologically sensitive artefacts. Referring to artefacts discovered in settlement contexts at Las Stocki 7 and Wąwolnica 6, Anna Zakościelna and Sławomir Kadrow have proposed linking the appearance of this type of vessel with the second phase of the discussed culture (Kadrow and Zakościelna 2000, 214, figs 22-24; Zakościelna 2006, 82, fig. 3).

This hypothesis was already questioned by the author of this paper in 2017, on the occasion of the publication of Grave 14 from the Książnice cemetery (Wilk and Szczepanek 2017, 363). Indeed, suppose we accept the genetic links between the Rzeszów phase of the Malice culture and the classic stage of the LVC, as emphasised by Sławomir Kadrow and Anna Zakościelna. In that case, we should assume that the custom of decorating pot rims with fingertip impressions and notches originated from Malice culture. This, however, would not explain the flourishing of this type of decoration at sites dated to the third phase, where S-profiled pots with fingertipped or notched rims make up a significant proportion of the ceramic assemblage. Examples of such ornamentation can be found, among other places, at Sites 3 and 10 in Łańcut (Gruszczyńska and Mitura 2002, 50, 51; Kadrow and Kłosińska 1988, 12, fig. 7), at the defensive settlement of Bronocice (Kruk and Milisauskas 1985, 55-57), at the cemetery and settlement in Złota Grodzisko I and II (Podkowińska 1953, fig. 8, pl. 4: 3; 10: 1, 2; Sałacińska and Zakościelna 2007, fig. 12: 1; 20:7; 29: 1), and at the cemetery at Site 2 in Książnice (Wilk 2004, figs 4B: 3 and 7C: 2; 2006, fig. 8B).

The arguments put forward a few years ago take on a deeper meaning since both the early chronology (corresponding to the classic phase of the LVC) of the hanging triangle motif on pottery from Las Stocki 7 and its relationship to the Rzeszow phase of the Malice culture and the Tiszapolgár culture have been questioned (Chmielewski 2008; Wilk 2021, 486-503). This has two important implications. First, there is no longer any reason to argue for the presence of relics of the classic phase of LVC (in the understanding of Sławomir Kadrow and Anna Zakościelna) at this settlement. Second, we should assume that most of the artefacts discovered there should be associated with the later phase of this site, dated to c. 4000/3950-3700/3650 BC based on four 'younger' radiocarbon dates (Wilk 2021, 500). This is supported by several stylistic features, including references to the Scheibenhenkel style, notched plastic rings of hollow-pedestal bowls, notched pot rims and fingertip impressions on the inside of pot rims (Fig. 5), that are generally characteristic of younger LVC assemblages, as first pointed out by Tomasz Jacek Chmielewski (Chmielewski 2008, 60-69).

In conclusion, in light of the arguments presented above, there is no sufficient basis for considering any of the elements discovered at Las Stocki 7, including the group of pots with a S-shaped profile, as exemplary of the classic phase of LVC (Fig. 5). In addition, the analysis of pots from the grave assemblages dated by Anna Zakościelna to the classic phase

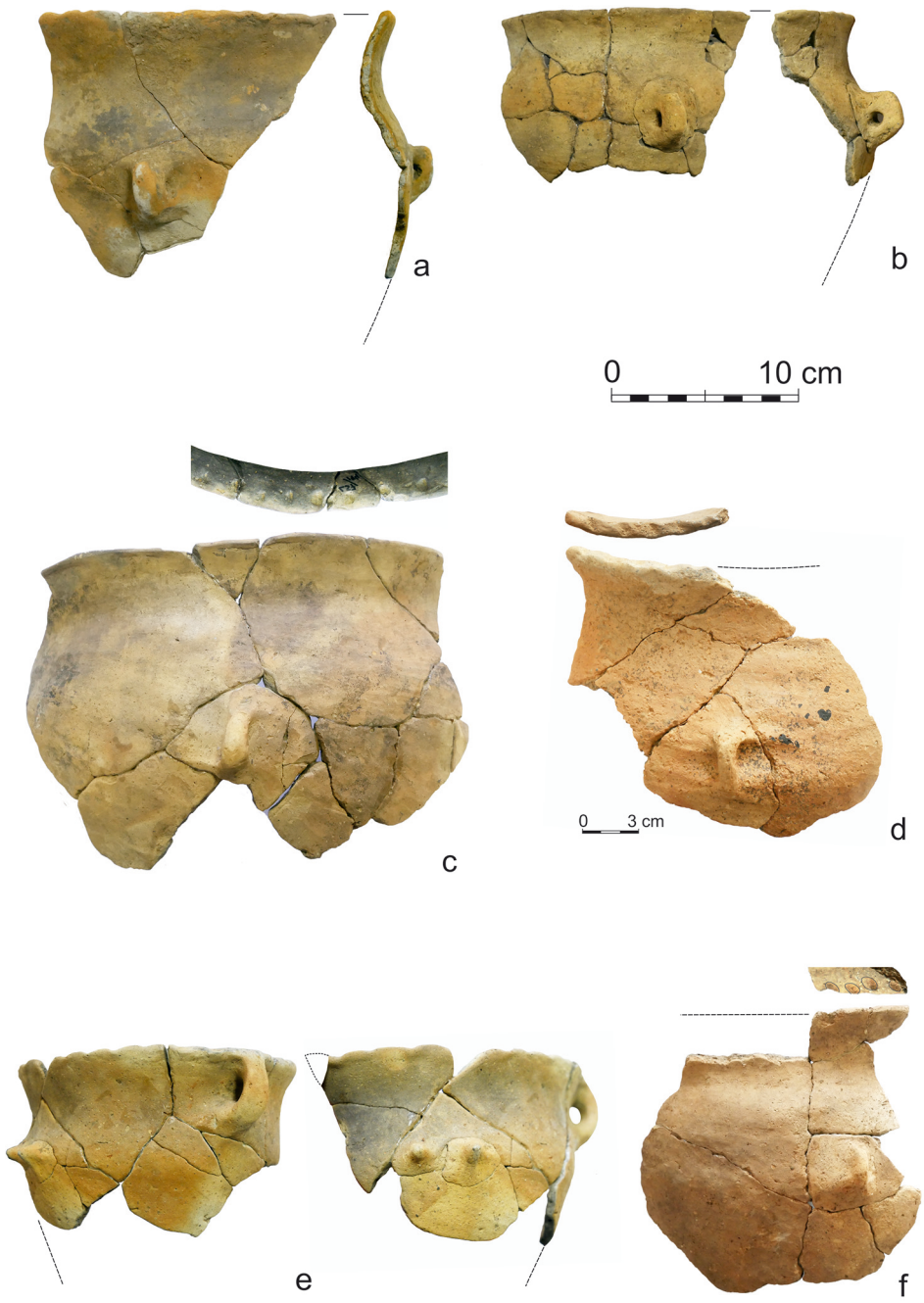

Fig. 5. Examples of LVC pots from Site 7 at Las Stocki, photo. S. Wilk.
Illustration courtesy of Anna Zakościelna, author of the research on Site 7 in Las Stocki

(Grave 1/1987 at Gródek 1C; Graves 1 and 2 at Jaszczów 5; Grave II at Łubcze 27; Grave 1 at Moniatycze Kolonia; Podlodów 2; the Karolicha site in Raciborowice; Sandomierz-Kamień Plebański; Siennica Różana; Grave 1/1982 at Stefankowice Kolonia 3; Grave 1 at Strzyżów 1A; Grave 4 at Strzyżów 2A; Grave 390 at the Grodzisko I site in Złota; Zubków; Zakościelna 2010, pl. 5) revealed no features that would consistently distinguish them from other LVC pots. On the contrary, most of these graves were assigned to the second phase based on other criteria, such as the decoration with oval or circular stamp impressions, the white-painted decoration on the cups, the presence of knobs or handles on the lower body, and so on. This observation was behind the decision that, when establishing a typology of LVC pottery based on funerary material, the diachronic variability of some types of ceramic vessels, including pots, should also be investigated (Wilk 2021, 243-278).

3.1. Chronology of LVC pots

Due to the number and variety of pots at Site 2 in Książnice, unprecedented at other sites, as well as the well-recognised and precisely dated context of the discovery, the vessels from this cemetery turned out to be the key to understanding the chronology and typology of LVC pots. The artefacts of interest were found in fourteen out of the twenty-one graves reliably associated with the LVC (Nos 2, 4-7, 9-12, 14, 16 and 19-21). Absolute age determinations are available for seven of these burials (Table 1). If we add the pots from other radiocarbon-dated cemeteries (Graves 101 and 122 at the Grodzisko II site in Złota;

Table 1. List of radiocarbon dated LVC graves with pots from the cemetery in Książnice 2

No.	Grave no.	Laboratory no.	Radiocarbon Age (BP)	References
1	2	Poz-91025	5050±35	Mattila *et al.* 2023; Wilk *et al.* 2024
2	4	Poz-91024	5160±40	Mattila *et al.* 2023; Wilk *et al.* 2024
3	5	Poz-117118	5235±35	Wilk *et al.* 2024
4	6	Poz-117119	4940±35	Wilk 2021
5	7	Poz-117064	5180±35	Wilk 2016; Wilk *et al.* 2024
6	9	Poz-117120	4970±40	Wilk 2021
7	10	Poz-91026	5040±40	Mattila *et al.* 2023

Table 2. List of radiocarbon dated LVC graves with pots from other cemeteries

No.	Site	Grave no.	Laboratory no.	Radiocarbon Age (BP)	References
1	Podlodów 2	feature 18	Ki-8730	5180±100	Zakościelna 2010
2	Złota, Grodzisko I	390	Poz-17501	5170±40	Sałacińska, Zakościelna 2007
3	Złota, Grodzisko II	101	Poz-19407	5060±30	Sałacińska, Zakościelna 2007
4	Złota, Grodzisko II	122	Poz-19408	5020±40	Sałacińska, Zakościelna 2007
5	Krasne Kolonia 16	9	Ki-7835	4970±90	Zakościelna 2010

Grave 390 at the Grodzisko I site in Złota; Feature 18 at Podlodów2; Grave 9 at Krasne Kolonia 16; Table 2), we arrive at a collection of thirteen vessels from twelve graves. Pots from three other radiocarbon-dated graves: Graves 2 and 4 at Strzyżów 26 and Grave III at Gródek 1C, are not included in the analysis due to their controversial, very 'young' dates, which after calibration fall into the middle or even the second half of the 4th millennium BC (Zakościelna 2010, 35, table 6).

Following calibration and Bayesian analysis of the above set of twelve radiocarbon dates from graves containing pots, the resulting calendar age ranges are: 4072-3616 BC (start of the boundary start parameter and end of the boundary end parameter for 95,4% range) and 4046-3688 BC (start of the boundary start parameter and end of the boundary end parameter for 68% range) (Fig. 6).

The result of applying Bayesian analysis to the data set in question was a division into three groups. A second Bayesian modelling (Fig. 7) was carried out to test whether this division corresponded to the typological variability of the pots. The result was a division into three chronological phases, which partly coincide with the typological variability of the LVC pots. The division in question is most clearly legible in the 68% calibration and

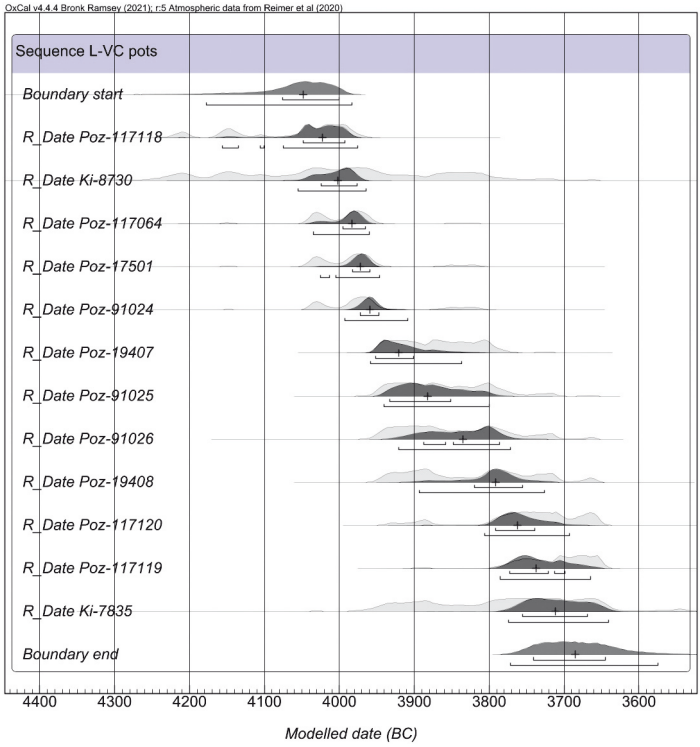

Fig. 6. Calibration (pale grey) and Bayesian modelling (dark grey) of radiocarbon dates from LVC burials with pots; Amodel=174.4 Aoverall=169.7

modelling range. Based on the dates from Graves 5, 7, 4 at Książnice 2, Feature 18 at Podlodów 2, and Grave 390 at the Grodzisko I site in Złota, Phase I can be dated to *ca*. 4046-3945 BC (beginning of the boundary start parameter and end of the boundary end parameter for 68% range). Phase II, based on the dates from Graves 2 and 10 at Książnice 2 and Graves 101 and 122 at the Grodzisko II site in Złota, falls to c. 3959-3793 BC (beginning of the boundary start parameter and end of the boundary end parameter for 68% range). Phase III, based on the results of radiocarbon dating of Graves 9 and 6 at Książnice 2 and Grave 9 at Krasne Kolonia 16, is dated to *ca*. 3806-3688 BC (beginning of the boundary

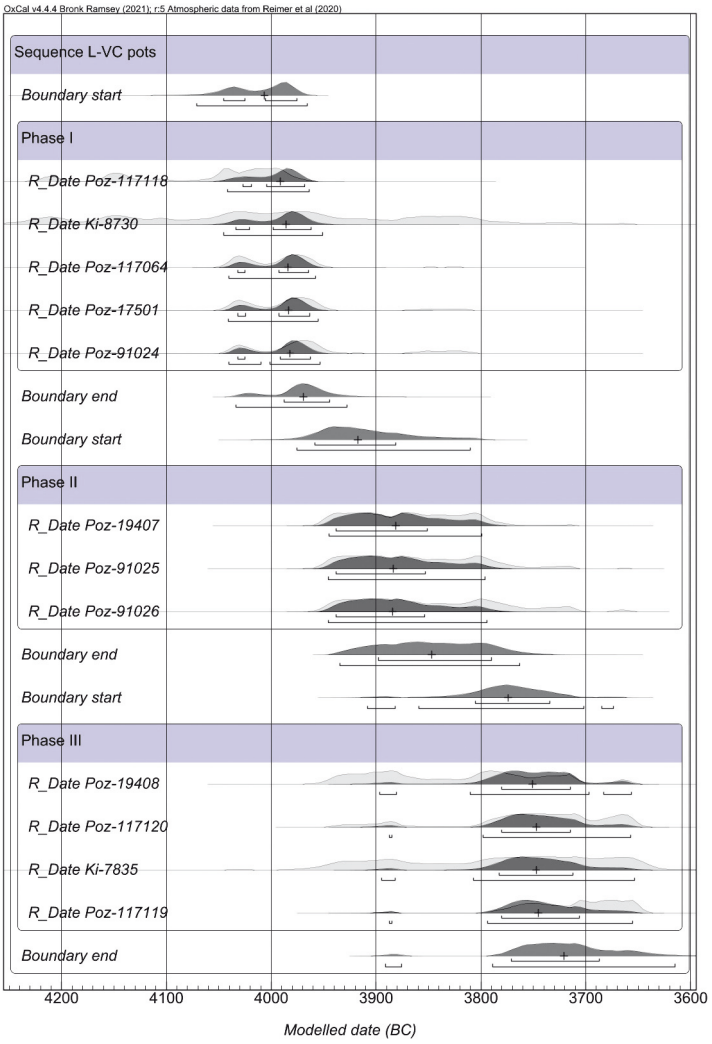

Fig. 7. Calibration (light grey) and Bayesian modelling (dark grey) with phases of radiocarbon dates from LVC burials with pots; Amodel=152.5 Aoverall=155.3

start parameter and end of the boundary end parameter for 68% range). At this point it should be noted that due to the specificity of the calibration curve for the second half of the 5th millennium BC and for the 1st half of the 4th millennium BC, the age determinations included in Phase I (apart from the date from Podlodów, which has a high standard error and has been used conditionally in this compilation) are characterised by exceptional dating precision. The exception is the date from the grave in Podlodów, which is characterised by a very large standard error and has been used conditionally in this compilation only because it is the oldest uncalibrated age designation among all LVC radiocarbon dates from the Lublin region. This is in contrast to the dates from Phase II, which fall entirely on the plateau of the beginning of the 4th millennium BC (c. 3950-3800 BC) and those from Phase III, which fall into the next flattening of the calibration curve (*ca*. 3770 to 3720 BC) (Fig. 7).

The oldest well-dated pot of LVC is a specimen from Grave 5 at Site 2 in Książnice, a burial belonging to the first chronological period. However, when we look at the calibration curve with the superimposed results of the calibration and Bayesian modelling of dates from LVC graves with pots, it is clear that the calendar age range of the sample from Grave 5 deviates slightly from the other determinations (Fig. 8). The calendar age range of this grave obtained by Bayesian modelling is 4028-3969 BC with 68% probability and 4042-3965 BC with 95,4% probability. In our opinion, this grave was most likely created shortly before the beginning of the 4th millennium BC.

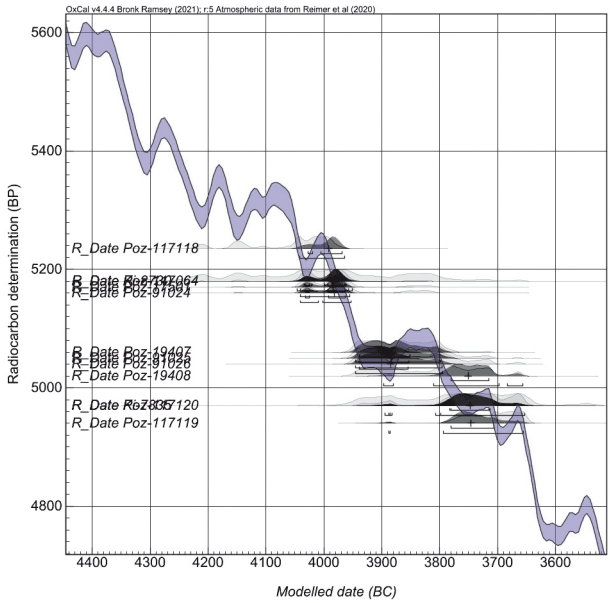

Fig. 8. Calendar age ranges of LVC burials with pots against calibration (light grey) and Bayesian modelling (dark grey) for the second half of the 5th millennium BC and the first half of the 4th millennium BC

So, what does the oldest reliably dated LVC pot look like, and what are its distinguishing features? The vessel has an S-shaped profile with a gently rounded body, rough walls, and two small handles protruding slightly above the plain, undecorated rim. There are two small conical knobs at the broadest part of the belly, symmetrically placed in the spaces between the handles, and traces of a white substance are preserved in the central part of the vessel (Fig. 3: c). Of particular note is the fact that the rim of the pot from Grave 5 was neither notched nor otherwise decorated, which suggests that it was most likely made before the influence of the Hunyadihalom-Lažňany horizon became noticeable in Lesser Poland. Such an assumption aligns with the aforementioned new findings on the absolute chronology of the Early and Middle Copper Age cultures in the Carpathian Basin. Another important feature of the described vessel is the presence of two opposed conical knobs placed on the handle line. The decoration with two single knobs or two pairs of knobs is typical of LVC pots and was most probably borrowed from the Malice culture. One of the oldest examples of such decoration is a pot from Feature 49 at Wzgórze Zawichojskie in Sandomierz, which is described as a vase in the source publication and broadly dated to the Lengyel-Polgar cycle (Kowalewska-Marszałek *et al.* 2017, 112; 107, 108, pl. 2.59: 1). The radiocarbon date obtained for a charcoal sample taken from this feature (Gd-4459) is 5680±140 BP (Kowalewska-Marszałek *et al.* 2017, 108).

Graves 7 and 4 from Książnice produced comparable radiocarbon dates, namely 5180±35 BP and 5160±40 BP. For Grave 7, the calendar age ranges obtained by Bayesian modelling are 4033-3965 BC, with a 68% probability, and 4041-3958 BC, with a 95.4% probability. Grave 4 can be dated to 4033-3963 BC with a 68% probability and to 4041-3954 BC with a 95.4% probability.

The vessels from these two graves represent different styles. The pot from Grave 7 is one of the best indicators of the Hunyadihalom-Lažňany horizon in the Książnice cemetery and in the LVC in general (Wilk 2016, 15). Its distinctive features are two notched cordons placed diagonally from the rim towards the neck, eight conical knobs placed at the widest part of the belly, and the distinctly oval mouth (Fig. 3: e). The closest analogues to this artefact come from the north-eastern part of the Carpathian Basin. An identical decoration was found, among other cases, on a vessel from Grave 21 in the cemetery of Šebastovce (Šiška 1972, Abb. 30: 6), and with slightly larger knobs, on a vessel from the Panyola settlement (Patay 2011, Taf. 3: 5). Six knobs decorate a similar vessel from Grave 10 at Barca (Šiška 1972, Abb. 32: 2). Eight knobs, but in a double arrangement (four pairs, each consisting of two knobs one above the other) were observed on, among other examples, vessels from Grave 39 in Šebastovce and Grave 8 in Barca (Šiška 1972, Taf. 9: 3, 10: 13). Diagonal cordons, plain or notched, are known from, among other sites, the settlement of Tiszalúc (Patay 2005, Taf. 35: 11, 15).

In the Lublin-Volhynian culture, characteristic diagonal cordons also appeared on two vessels from the cemetery at Hołyszów Wołyński (Голишів, Hołysziw): on the neck of a small vase from Grave 4 (Zakościelna 2010, pl. 85: 5) and on a fragment of a vase from

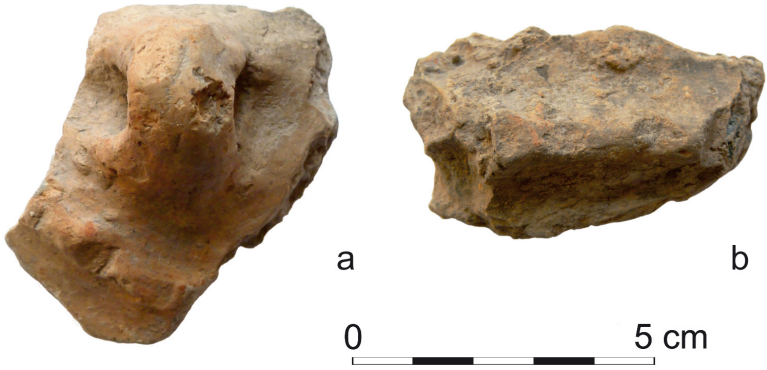

Fig. 9. Fragments of LVC pots with cordons at Łańcut 10: a – fragment from Pit 1, b – fragment from the surface of Trench II, photo. S. Wilk. By courtesy of the District Museum in Rzeszów

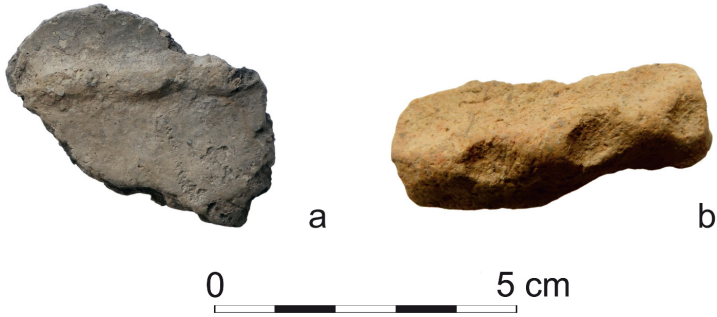

Fig. 10. Fragments of LVC pots with cordons: a – from Pit s 20, 30A at Łańcut 3, b – from the cultural layer at Kosina 35, photo. S. Wilk. By courtesy of the District Museum in Rzeszów

Fig. 11. Fragment of LVC vessel with a diagonal cordon from Pit 10 at Wąwolnica 6, photo. S. Wilk. By courtesy of Anna Zakościelna, author of the research on Site 6 in Wąwolnica

destroyed graves (Zakościelna 2010, pl. 86: 3). Similar cordons, but applied horizontally or vertically, were discovered at Site 10 in Łańcut. One fragment, with a cordon placed diagonally under a small handle, comes from Pit 1 (Fig. 9: a), while the other was found on the surface of Trench 2 (Fig. 9: b) (Kadrow and Kłosińska 1988, Fig. 5: d). Similar cordons decorate vessel fragments from Features 30 and 30A at Łańcut 3 (Fig. 10: a) (Gruszczyńska and Mitura 2002, pl. 4: 6) and from the cultural layer at Kosina 35 (Fig. 10: b) (Kadrow 1992, fig. 7: t). A slightly different, deeply notched cordon appears on a fragment of a wide-mouthed S-shaped vessel from Pit 10 at Wąwolnica 6 (Fig. 11). In addition, horizontal notched cordons attached below the rim occur on several sherds from the Bronocice settlement (Kruk and Milisauskas 1985, pl. 5: 2, 3; fig. 23: 4-4). The pot from Grave 4 at Książnice, although slightly larger, is similar to the artefact from Grave 5. It has an S-shaped profile with the widest part at three-quarters of the height, two small handles protruding slightly above the rim, and rough walls, with a white substance preserved in places in the central part of the vessel (Fig. 3: b).

From the same period (first half of the 39th century BC), we know of three more pots from radiocarbon-dated grave assemblages. Two of them (a slender pot with two horizontally pierced handles in the broadest part of the body, which is slightly above the mid-height of the vessel, and a slender pot with a gentle S-shaped profile, without handles) were found in a grave (Feature 18) at Site 2 in Podlodów (Zakościelna 2010, 281, 282, pls 47: 2 and 47a: 6). The radiocarbon date obtained for this grave (Ki-8730) is 5180±100 BP (Zakościelna 2010, tab. 6). Bayesian modelling resulted in the following calendar age ranges: 4034-3963 BC, with 68% probability, and 4046-3952 BC, with 95,4% probability. The third pot comes from Grave 390 at the Grodzisko I site in Złota. In the source publication, the vessel of interest is described as a biconical amphora (Sałacińska and Zakościelna 2007, 89, 90). Its widest part, decorated with two conical knobs, is situated slightly above the middle of the vessel's height, while two small handles protrude above the rim (Sałacińska and Zakościelna 2007, fig. 12: 1). It was the presence of the conical knobs that determined the classification of the vessel in question to the group of pots. The radiocarbon date obtained for Grave 390 (Poz-17501) is 5170±40 BP (Sałacińska and Zakościelna 2007, table 2). Bayesian modelling yielded calendar age ranges of 4033-3964 BC, with a 68% probability, and 4042-3956 BC, with a 95.4% probability.

The middle group of dates, falling between c. 3959 and 3790 BC (the beginning of the boundary start parameter and the end of the boundary end parameter for a 68% range), comprises the age determinations for samples from Graves 2 and 10 at Książnice and Grave 101 at the Grodzisko II site in Złota. Despite relatively small standard errors (±35), the calendar age ranges obtained after calibration are very wide. This is due to the shape of the calibration curve, which flattens out noticeably between c. 3940 and 3800 BC. In the case of Grave 2, the calendar age range obtained by Bayesian modelling is 3939-3854 BC, with 68% probability, and 3946-3797 BC, with 95.4% probability. The pot discovered in Grave 2 at Książnice belongs to a group of squat vessels. It is characterised by a fairly wide

mouth, a gentle body line with a faintly marked shoulder, a short, poorly defined neck, and two small handles protruding over the notched rim. The handles have single, shallow hollows at the upper bases (Fig. 3: a). After Bayesian modelling, the sample from Grave 10 at Książnice yielded calendar age ranges of 3939-3855 BC, with a 68% probability, and 3946-3795 BC, with a 95.4% probability. The pot found in Grave 10 has slender proportions and an S-shaped profile. It is also provided with two small handles protruding slightly above the rim, which are decorated on the inside with a series of oval fingertip impressions. At the broadest part of the belly, on either side, were originally two small conical knobs, one of which has survived intact, while only a trace of the other remains (Fig. 3: g). The date obtained for Grave 101 at the Grodzisko II site in Złota (Poz-19407) is 5060±30 BP (Sałacińska and Zakościelna 2007, table 2), which, after Bayesian modelling, gives calendar age ranges of 3939-3852 BC, with 68% probability, and 3946-3800 BC, with 95,4% probability. The pot from this grave has slender proportions, an S-shape profile with a gently rounded belly, and two handles protruding clearly over the rim, which is notched on the inside. The pot is decorated with two conical knobs, located slightly above the widest part of the body, in the spaces between the handles (Sałacińska and Zakościelna 2007, fig. 20: 7).

As can be easily seen, the described pot model is present in both the features assigned to Phase I and those of Phase II. How should this be interpreted? It seems that the appearance of this type of vessel in Lesser Poland at the beginning of the 4th millennium BC confirms the spread of ceramic patterns from the Hunyadihalom-Lažňany milieu (notched rims, circumferential knobs, fingertip impressions, cordons, *etc.*). However, the motif of single or doubled conical knobs situated between the handles, as shown above, should be seen as a continuation of an older local tradition.

The link between Phases II and III is Grave 122 (a cenotaph) at Grodzisko II in Złota. A sample taken from an animal bone from this grave produced a radiocarbon date (Poz-19408) of 5020±40 BP (Sałacińska and Zakościelna 2007, table 2). After calibration, the following chronological ranges were obtained: 3781-3716 BC, with 68% probability, and 3897-3657 BC, with a 95.4% probability. This is important because this grave marks the first appearance of a new type of pot, characterised by an S-shape profile and squat proportions (r1:h1 >1.0), a wide, almost funnel-shaped neck topped by a rim decorated on the inside with a row of fingertip and fingernail impressions, and two horn-shaped handles placed at the widest part of the belly (Sałacińska and Zakościelna 2007, 98-101, fig. 29: 1). Admittedly, the earliest example of such a pot was found in Feature 18 at Podlodów 2, but this type of vessel did not appear in its fully developed form until the beginning of the 38th century BC. It should also be taken into account that the grave from Podlodów, due to the already emphasised very high standard error of the radiocarbon date, may be younger than suggested by the Bayesian analysis (Fig. 7). In which case, the presence of a pot of the type in question in its inventory would not be such a big surprise.

The feature in which the described type of pot reappeared is another cenotaph – Grave 9 from the Książnice cemetery, which represents the latest chronological stage of burials

with pots. The radiocarbon date for this burial, obtained from an animal shoulder blade (horse or cattle), is 4970±40 BP (Poz-117120). Bayesian modelling resulted in a calendar age range of 3781-3715 BC, with a 68% probability, and 3888-3658 BC, with a 95.4% probability. Compared to the vessel from Grave 122 at Złota, the pot from Grave 9 is slightly lower and has a shorter neck. However, the other features are almost identical, including the fingertip and fingernail impressions on the rim, the two horn-shaped handles at the widest point, and the conical knobs between the handles (Fig. 3: f). Grave 9 at Krasne Kolonia 16 has a radiocarbon date of 4970±90 BP (Ki-7835) (Zakościelna 2010, 35). In this case, the sample came from charcoal at the bottom of the burial pit. Bayesian modelling resulted in the following calendar age ranges: 3783-3713 BC, with a 68% probability, and 3895-3654 BC, with a 95.4% probability. The pot's widest part is at two-thirds of its height, and it has a short, straight neck with two small, horizontally pierced handles (Zakościelna 2010, 266, pl. 31: 1). Unfortunately, no analogy could be found for this vessel.

The assemblage that closes the development of the Książnice cemetery is Grave 6, which is also the latest radiocarbon-dated LVC burial with a pot (Wilk 2006, 249, figs 10-13). The radiocarbon date of 4940±35 BP (Poz-117119) was obtained from a goat/sheep bone found in this grave. Bayesian modelling resulted in calendar age ranges of 3781-3707 BC, with a 68% probability, and 3888-3656 BC, with a 95.4% probability. The pot found in this grave has a very gentle profile and lacks a defined neck. Its distinguishing feature is the rim, which is strongly everted and forms a kind of narrow overhang covered with fingertip and fingernail impressions. In addition, the pot has no handles, only two tongue-like projections that extend beyond the rim and are pierced vertically (Fig. 3: d). The described pot is somewhat reminiscent of flowerpot-shaped vessels, but due to the shape and decoration of the rim and the rough outer surface, it has been classified as a pot. A fragment of a similar vessel was found in Grave 16 at Książnice 2 (Fig. 3: k). Grave 14 on the same site contained a miniature S-profiled pot with no lugs, a notched rim, and two holes (Fig. 3: j). Similar vessels with vertical holes are known from Site 7 at Las Stocki (Zakościelna 1986, 43, fig. 12: 4), from the second grave at Jaszczów (Kowalczyk 1954, 4, fig. 3), and from the Hunyadihalom culture settlement in Tiszalúc (Patay 2005, 182, Taf. 30: 16).

4. SUMMARY

The analysis presented above demonstrates that pots do indeed vary in shape and decoration over time (Fig. 12). Specimens with slender proportions and an S-shaped profile, provided with two small handles protruding above the undecorated rim, were found in the earliest confidently dated grave assemblages (Graves 5 and 4 at Książnice 2, Grave 390 at the Grodzisko I site in Złota). The chronology of these features can be closed within the range of c. 4046-3945 BC. Some of the vessels are decorated with conical knobs (single or double) applied to the widest part of the body.

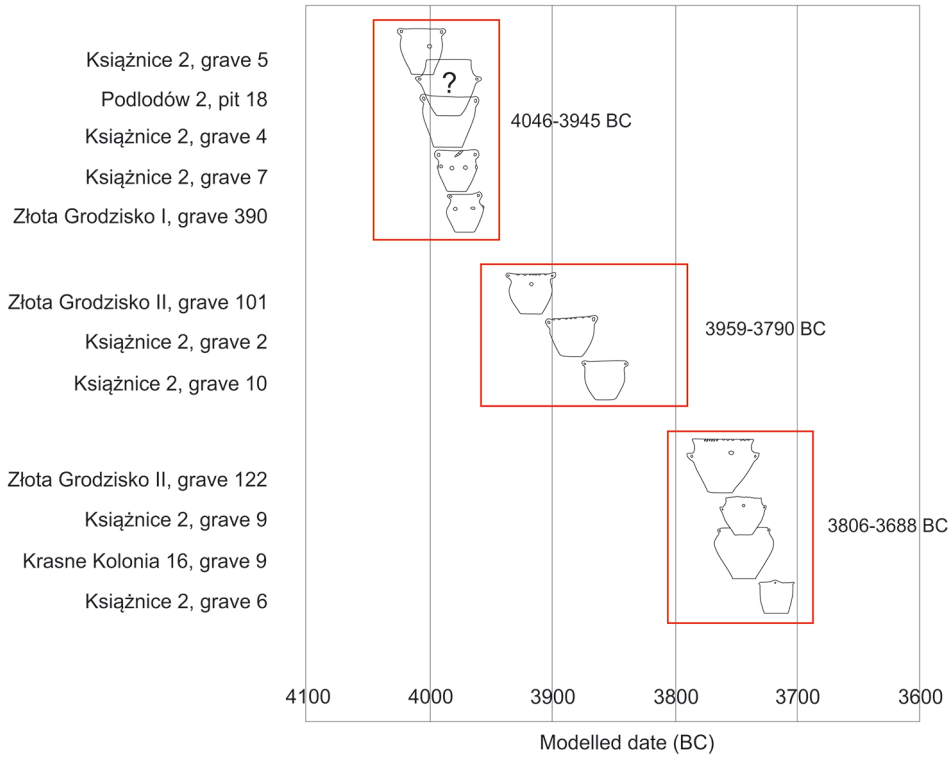

Fig. 12. Formal variation of pots during the development of LVC. 68% calendar age ranges obtained by calibration and Bayesian modelling of radiocarbon dates for burials with pots, by S. Wilk

In the first half of the 4th millennium BC, the first influences of the Early Hunyadihalom-Lažňany environment appeared in LVC, bringing with them the ornamental motifs originating in the eastern part of the Carpathian Basin, such as knobs and fingertipped cordons. The best example of this style is the vessel from Grave 7 at Książnice 2. From about the middle of the 40th century, throughout the 39th century, and into the early 38th century, pots essentially retained their original form. However, a new stylistic element appeared in the form of notches and fingertip and fingernail impressions on the inside of the rim. The practice of decorating the body with single or double knobs continued. This type of pot is represented by vessels from Graves 2 and 10 at Książnice 2 and Grave 101 at the Grodzisko II site in Złota.

Pots decorated in the manner described are found mainly in the western part of the LVC ecumene. However, they also appear east of the Vistula River, the best examples being the vessels from Las Stocki 7, or Sites 3 and 10 in Łańcut, already mentioned above.

The earliest pot with an S-shaped profile and slender proportions, with handles placed at the widest part of the belly, was found in a Grave 18 in Podlodów 2, classified as phase I

on the basis of Bayesian analysis. However, the chronological position of this grave is problematic, and it may well be younger. In their fully developed form – as vessels characterised by squat proportions, funnel-shaped, short necks and wide rims decorated with fingertip and fingernail impressions, and with single or double knobs at the widest part of the belly – such pots did not become popular until the beginning of the 38th century BC. This is evidenced by the chronology of Grave 122 at the Grodzisko II site in Złota and Grave 9 at Książnice 2 (Fig. 6). Further examples come from Graves 11 and 20 from Książnice, which have not been radiocarbon dated (Fig. 3: h, m). In addition, similar vessels were found at, among other locations, Topornica 36; in a grave from Garbatówka Kolonia Site 7 (Polańska 1999, fig. 3: 5); in a Grave 1/1947 at Sandomierz-Kamień Plebański; in Grave at Gródek 4 (Zakościelna 2010, pls 49: 5 and 16B: 1); in Pit 10 at the Grodzisko II site in Złota (Podkowińska *et al.* 1959, fig. 10: b); and in Pit 31 at the Grodzisko I site in Złota (Podkowińska 1953, tabl. 10: 1). They have also been found in settlement pits in Bronocice (Kruk and Milisauskas 1983, fig. 2: 9), as well as in Pit 458 at Miechów 3 (Fig. 4: e). Similar specimens, but of much more slender proportions, were found in a Grave 1 at Strzyżów 10 (Zakościelna 1996, fig. 5: a), in Graves 2 and 5 at Strzyżów 26 (Zakościelna 2010, pls 62: 3 and 55: 3), and in a grave at Garbatówka Kolonia 7 (Polańska 1999, fig. 2: 2), among other locations. Based on other characteristic elements of the inventory, such as the Michelsberg-Baalber beakers from Grave 5 at Strzyżów 26, or the flowerpot-shaped vessels with slightly concave bodies from a grave in Garbatówka Kolonia, one can venture the hypothesis that pots with handles at the widest part of the belly but with slender proportions became particularly popular towards the end of the LVC development.

Other vessels that should be associated with the end of the discussed cultural unit are miniature pots with fingertip and fingernail impressions on the rim and with holes instead of handles, known from Graves 6, 16 and 14 at Książnice 2 (Fig. 3: d, k, j). They demonstrate that the practice of decorating pot rims with various types of incisions and finger impressions, which began in the mid-39th century with the beginning of the influence of the Hunyadihalom-Lažňany horizon, survived in Lesser Poland until the end of the Early Eneolithic period.

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