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Abhandlung

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A first toast in Kuyavia: New evidence for drinking rituals in Neolithic Europe from Sławęcinek, Poland

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Zusammenfassung: Ausgrabungen in Sławęcinek in Zentralpolen haben Beweise für die neolithische Trichterbecherkultur erbracht, die mit einer Reihe von Veränderungen einherging, die in der Mitte des vierten Jahrtausends v. Chr. in weiten Teilen Europas stattfanden. Es wurde eine Reihe von Gefäßen mit Kragenflaschen, Keramikgläsern und einem Becher gefunden, die belegen, dass zwischen 3500–3350 v. Chr. laktosearme Milchgetränke getrunken wurden. Eines der Gefäße, ein Trichterbecher, weist eine Ikonographie auf, die eines der frühesten bekannten Beispiele für ein Transportmittel auf Rädern in der Welt darstellen könnte. Die Funde lassen auch auf die Entstehung von Geheimgesellschaften von Frauen im neolithischen Europa schließen.

Schlüsselworte: Spätneolithikum, TRB, Baden, Trinkrituale, Molkerei, Transport auf Rädern, Geheimgesellschaften von Frauen

Abstract: Excavations at Sławęcinek in central Poland, have yielded evidence for the Neolithic Funnel Beaker Culture, concurrent with a sweeping set of changes that occurred across much of Europe in the mid-fourth millennium BC. A set of vessels containing collared flasks, ceramic glasses and a beaker were found, demonstrating that libations of lactose-reduced dairy beverages were performed between 3500–3350 BC. One of the vessels, a funnel beaker, features

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iconography that may represent one of the earliest known examples of wheeled transport in the world. The evidence also raises the possibility of the emergence of women's secret societies in Neolithic Europe.

Keywords: Late Neolithic, TRB, Baden, drinking rituals, dairying, wheeled transport, women's secret societies

Introduction

The fourth millennium BC marks the start of the Funnel Beaker Culture (*Trichterbecherkultur*, henceforth TRB) on the stage of European prehistory. As successors of the first farmers, the TRB people of Central Europe and southern Scandinavia promoted a mixed-farming economy and paved the way for new social and religious developments. The archaeological evidence indicates an increased level of human mobility in comparison to the preceding period, followed by a reorganisation of household space and production[1]. Ritual activities were moved away from settlements as demonstrated by the characteristic earthen long barrows and other types of monumental architecture[2]. The archaeological record of the period also contains evidence of ritual violence towards both objects and people, as exemplified by human sacrifices and depositions of weaponry and ceramics into watery places, which are known throughout much of the North European Plain[3].

This overall picture changed profoundly by 3650/3500 BC, when the Baden Culture of the Carpathian Basin, representing an extracultural adoption of a new set of shared values and social opportunities, came to encompass a large part of Central Europe and was much or less selectively taken up by the TRB farmers from the region that is today Poland[4]. During this period, Europe was interconnected by a network of exchange and social activities that followed a trajectory from Lesser Poland, south-central Germany to the Eastern Alpine region and from southern Poland, Moravia and Slovakia through Hungary and southwards to Serbia. The old idea of monumental architecture was challenged with the emergence of new attitudes towards death and the deposition of a dead body, as exemplified by settlement burials and cremation. The settlements now became a place where the ritual and domestic domains met together and intermingled. Major central-place settlements appeared as hubs for the neighbouring hamlets and set the social and political trends in the region, as seen, for example, at the TRB sites of Bronocice and Kałdus[5]. A more intimate contact zone emerged in Lesser Poland and Silesia, where the stylistic influences of the Baden Culture are particularly pronounced in the TRB's ceramic repertoire. In addition, a chain of Baden–TRB connections (the so-called badenization process) can be traced through the advances in farming and animal exploitation, particularly the introduction of new agricultural techniques such as manuring and animal traction[6]. Fundamental to this process was the increasing importance of secondary animal products, discernible in mortality profiles and sex ratios of herds[7] and ceramic assemblages with dairy lipids and proteins[8] along with the prevalent use of conical spindle whorls and other weaving accessories[9].

The increasing links between the TRB and Baden Culture regions fostered the flow of luxuries such as flint axes and macrolithic retouched blades[10], and metals[11]. These items were accepted by the local TRB power elites from Poland as means of materialising their particular social and political interests. Continuing impulses of the Baden Culture also gave rise to the emergence of common conventions for public rituals of drinking, which employed a range of ceramic vessels from the local TRB repertoire, including cups with horned handles (*ansa lunata*), wide-mouthed beakers, glasses and collared flasks. The material correlates of this process can now be traced to the TRB site of Sławęcinek in Kuyavia, central Poland, where a set of drinking equipment was discovered, which was used for libations of dairy products. The drinking set and other evidence from the site offer insights into the social and ritual aspects of the blending of Baden Culture elements into local settings. The finds also contribute to our understanding of the complex interplay between dairying, drinking rituals and the earliest wheeled transport, and touch upon the issues of women's secret societies in Neolithic Europe.

1 Hodder 1992.

2 Jażdżewski 1981; Midgley 1992; Nowak 2009.

3 See, e. g. Koch 1998; Wentink 2006; Adamczak 2013.

4 See, e. g. Furholt 2015; Furholt *et al.* 2008; Nowak/Zastawny 2015; Przybył 2009; 2015; 2017; Sherratt 1997; Sochacki 1981.

5 Kruk/Milisauskas 2018; Adamczak *et al.* 2024.

6 Sherratt 1981; 1983.

7 Lasota-Moskalewska 2005; Nowak 2009.

8 Roffet-Salque/Evershed 2015; Evans *et al.* 2023.

9 Grabundžija *et al.* 2021.

10 See, e. g. Adamczak/Sudoł-Procyk 2024.

11 See, e. g. Adamczak *et al.* 2015; Kowalski *et al.* 2016; 2019; 2024; Łęczycki 2004; Pieczyński 1985.

The TRB site at Sławęcinek

The archaeological site of Sławęcinek lies on a flat morainic upland overlooking the fertile black earth of the Inowrocław Plain in the Kuyavia region, an area densely settled since the Early Neolithic. During the construction of a ring road in the spring of 2016, 4.75 hectares of the site were excavated, uncovering 1033 features that signify three different phases at the site during an extended chronology spanning the Late Neolithic to the early modern period, c. 3650 BC to AD 1800 (Fig. 1). The earliest occupation level recorded in Sławęcinek can be linked to the TRB that has been dated by ceramic typology to the second half of the fourth millennium BC. Evidence of the TRB settlement has been exposed over a substantial proportion of the site and is attested by 216 archaeological features and structures, including homesteads, wells, and human inhumations providing evidence of domestic, funerary and ritual activities at the site.

The TRB site spanned up to 5 hectares and was organised into two distinct spatial and functional zones. The stratigraphic evidence indicates that domestic structures were located in the southern part of the settlement and included three homesteads with numerous storage and midden pits. The western and central homesteads encompass regular post-hole structures with pit clusters, which may represent two rectangular buildings oriented NW-SE and W-E. They measure approximately 26 m in length by 8.8 m in width, and are equipped with storage facilities (Fig. 1). Additionally, the fieldwork identified a burial cluster containing two adult female inhumations and a pit grave with the skeletal remains of two individuals of unspecified sex and age, situated to the north of the homesteads. A further inhumation of an adult female in burial pit 804 was unearthed in close proximity to the western household. The deposition rules for the skeletal remains found at the site are difficult to ascertain. One individual was buried in a prone position with the face downwards (Fig. 2), while another was placed in a flexed position on the left side (Fig. 3). These female individuals were granted disparate mortuary treatment relative to the pre-Baden funerary norms of the TRB East Group with mandatory supine burial, constituting a further expression of the Baden Culture in the region[12]. The disarticulated skeletal remains of an adult (female?) individual and a child that were found in the midden pits of the western house may reflect the unusual social status of the deceased or might be representative of ritual violence at the site.

The TRB residence at Sławęcinek yielded almost 6300 potsherds based on diagnostic shapes, technology and decorative motifs. The majority of the sherds are from the homesteads. The burial pits yielded fewer ceramics (n=962, 15 %) and generally contained between 10 and 80 fragments; only two pits (nos. 273 and 804) had more than 750 potsherds. Medium and large, thick-walled vessels are the main focus of the storage ware. A common type is the funnel-shaped beaker, although amphorae also occur with some frequency. The serving ware comprises small beakers and bowls. Other types encompass collared flasks, pots, and ceramic strainers (Fig. 4). In terms of decoration, the TRB assemblage displays a variety of incised decorations and plastic applications. The zigzag motif and rows of stamped, vertical or horizontal imprints under the rim are particularly common. The ladder motif on the belly is also a distinctive feature, as are the complete absence of cord impressions. The use of applied cordons with fingertip impressions or incisions that resemble arcade rims is a relatively common practice. Additionally, the assemblage contains examples of plastic knobs and lugs with horizontal perforations. The white inlay on some vessels can also be considered a decorative element. The assemblage exhibits some traits common to the *Mątwy* ceramic style that developed in the TRB East Group[13]. There are few storage vessels with a wide mouth that have associations with the Boleráz Culture[14] (Fig. 4), yet the rate of non-local stylistic elements in the assemblage is low.

The site yielded 5700 bones or their fragments, the majority of which are identified as belonging to cattle, followed by sheep/goat and pig. In accordance with data from other TRB sites in the region, wild taxa formed a relatively minor component of the subsistence economy at Sławęcinek[15]. The exploitation pattern for pigs implies a focus on a meat-oriented strategy, whereas the age-at-death profiles observed for cattle and ovicaprinae indicate intensification in milk production and a mixed dairy species management at the site[16].

The TRB residence at Sławęcinek was relatively short-lived, between 1–180 years (95.4 % probability), but most probably between 1–40 years (68.2 % probability). With the exception of one determination (Poz-116372), the human and animal bones from graves and pits in the western homestead, burial cluster and pit 943 (see Fig. 1) returned broadly similar dates consistent with a single phase. The earliest directly dated event relating to the TRB activity at the site is the burial of an adult female in a pit grave 318 (Poz-133585) which occurred between 3460–3370 cal BC (68.2 % probability). The final event associated with the deposition of a

12 Adamczak *et al.* 2023.

13 See, e. g. Kośko 1981; Kukawka 1991.

14 Cf. Němejcová-Pavúková 1981; 1998.

15 Adamczak *et al.* 2021.

16 Evans *et al.* 2023.

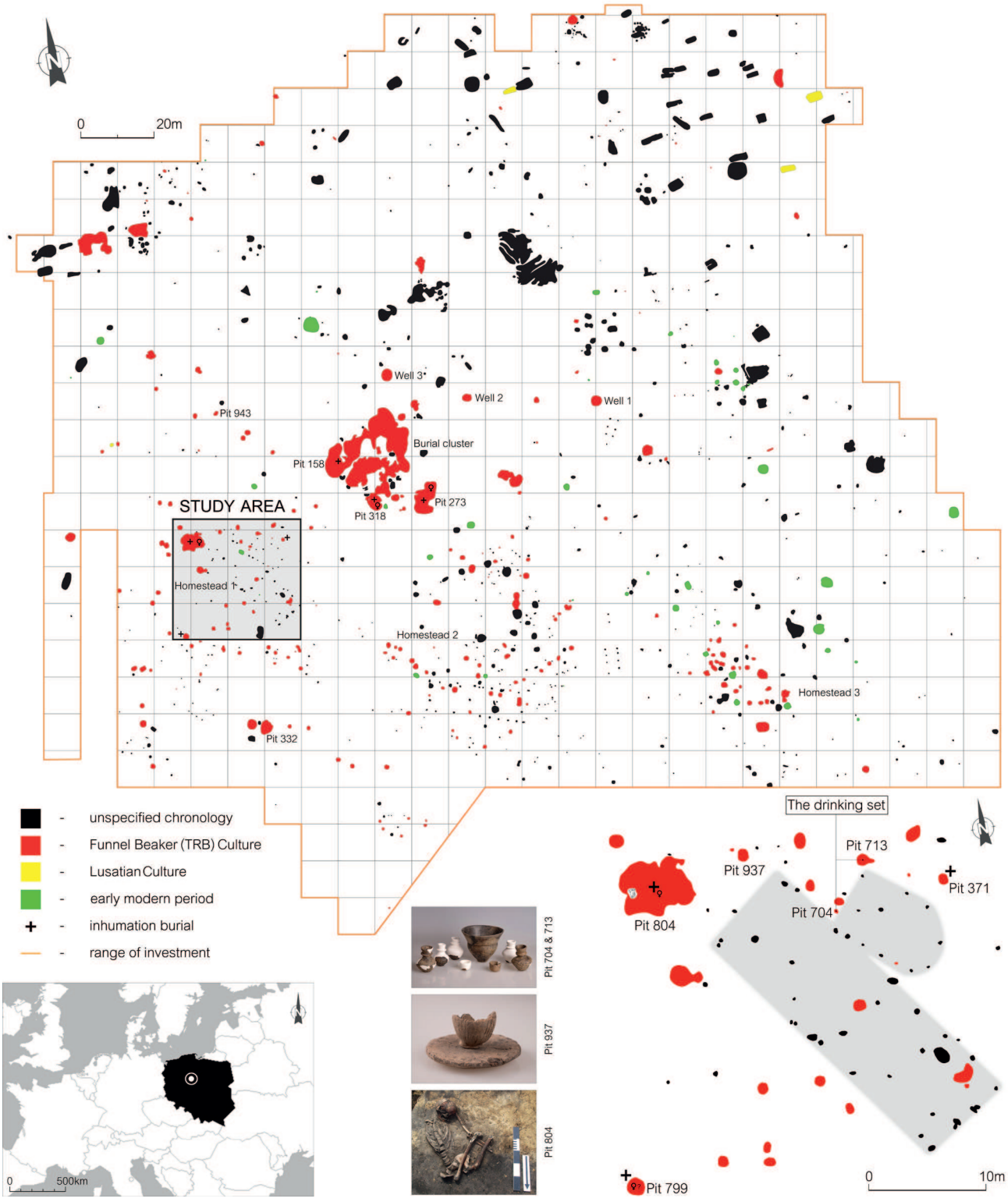


Fig. 1: Location and site plan of Sławęcinek, with a close-up of the western homestead that yielded the drinking set. The features labelled as "unspecified chronology" yielded no ceramic material (site plan and drawings by B. Gruszka, P. Zawilski and Ł. Kowalski; photographs by W. Ochotny).

Fig. 2: *In situ* view of pit 273 at Sławęcinek, identified as the settlement burial of a mature female (photograph by J. Śledziński).

Fig. 3: *In situ* view of pit 804 at Sławęcinek, identified as the settlement burial of an adult female (photograph by J. Śledziński).

Fig. 4: Examples of storage and serving ware from Sławęcinek. Shown on the left are potsherds decorated with the motif distinctive to Boleráz ware (photograph by W. Ochotny).

decorated bone dagger[17] dates to the 34th or 32nd centuries cal BC, in 3370–3260 cal BC (62.5 % probability) or 3250–3100 cal BC (33.0 % probability). The Bayesian model refines the obtained dates and provides a potential start date for the TRB residence of 3540–3440 cal BC, the end of the TRB activity at the site is modelled at approximately 3450–3350 cal BC (both 68.2 % probability).

The drinking set

The site of Sławęcinek is exceptional in terms of evidence for public drinking rituals in Neolithic Europe. Drinking equipment was recovered from pit 713 in the western homestead, comprising a decorated funnel-beaker, five collared flasks and two ceramic glasses (Fig. 5). The beaker itself is 17.5 cm high, with a rim diameter of 21.5 cm and a wall thickness of 0.7 cm. The collared flasks are 11.7 cm high and have identical wall thickness of 0.5 cm, while the two glasses measuring 4 cm in height have slightly thicker walls of 0.6 cm and a rim diameter of 5.5 cm. The vessels are of generally fine quality, although their state of preservation varies. The beaker was found in two parts within distinct pits (nos. 713 and 704) separated by a distance of 5 m, one collared flask and glass are fully or almost fully preserved, while the other vessels are mostly fractured, suggesting the possibility of ritual breakage of the drinking set. Pit 713 yielded 199 animal bone fragments (predominantly from cattle and pig), which can potentially be interpreted as evidence of feasting debris associated with the drinking rituals. The radiocarbon dating of the animal bones from features 713 and 704 resulted in two coherent radiocarbon ages, with an age range of 3520/3510–3370 cal BC (at 95.4 % probability; with mean and median centred on 3450 cal BC), roughly corresponding with the early Baden period in Central Europe.

In the latter half of the fourth millennium BC, the Baden Culture spread across much of Europe, and saw the introduction of distinctive vessels for the dispensing and consumption of liquids (Fig. 6). These vessels were often combined into services or sets and are found in both domestic

17 Adamczak *et al.* 2021.

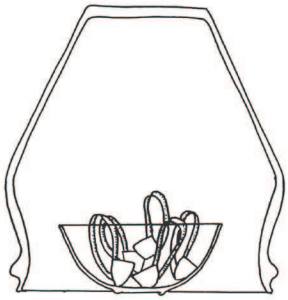
Fig. 5: Drinking set from Sławęcinek. The beaker was found in two parts within distinct pits. The reconstruction of the vessels to their full shapes is informed by the potsherds that were utilised for biomolecular analyses (photograph by W. Ochotny).

and funerary contexts[18]. The assemblage of cups and a jug from Dřetovice in Bohemia[19], and a scoop with channelled decoration found at Igołomia in Lesser Poland, assisted by five *ansa lunata*-type mugs[20], represent a novel style of beverage consumption, largely confined to the context of communal feasting. A set of dippers from the Baden settlements at Bešeňová in northern Slovakia[21] and Zesławice in southern Poland[22] serve to corroborate the argument for identifying similar finds as material expressions of communal feasting and ceremonies. The same custom of collective deposition of vessels for the manipulation of liquids is evidenced among the more southerly Baden groups in the Balkans[23].

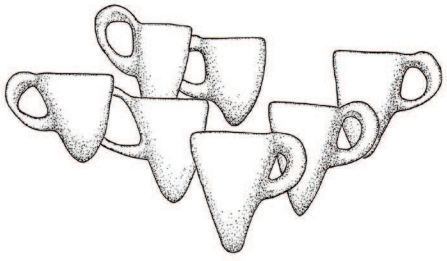
The vessel shapes and repertoire that suggest the use of drinking sets also made their appearance in other regions of Late Neolithic Poland. An illustrative example originates from the TRB East Group site of Annopol in central Poland[24]. The settlement comprised five houses and a central structure, which yielded nineteen collared flasks and over twenty vessels, predominantly small beakers. These finds are posited as evidence of a ceremonial house that hosted drinking and feasting events. The wide-mouthed beakers with bone admixture (Fig. 6) that occur in large numbers at the TRB site of Kałdus[25] also attest to the presence of drinking rituals throughout the TRB of Poland.

18 Sherratt 1997; Spasić 2010; Struhár *et al.* 2015; Struhár 2017; Dunne *et al.* 2023.
19 Sherratt 1997.
20 Żaki 1950.
21 Struhár *et al.* 2015.
22 Zastawny 2015.
23 Spasić 2010.
24 Papiernik/Rybicka 2004.
25 Adamczak *et al.* 2021; see also Kowalski *et al.* 2020.

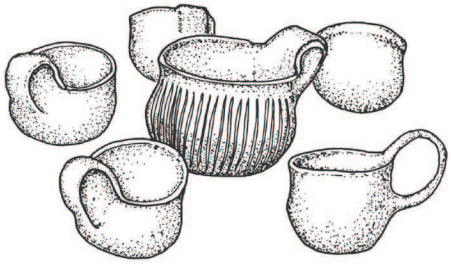
Set of Baden cups
from Dřetovice, Czech Republic



Set of Kostolac cups
from Sremski Karlovci, Serbia



Set of Baden cups
from Bešeňová, Slovakia



Set of Baden cups
from Igołomia, Poland

Fig. 6: Examples of drinking sets from the Baden Culture and contemporary groups of the fourth millennium Europe (re-drawn by Ż. Pankowska-Gajek). Below are presented wide-mouthed beakers with bone admixture from the TRB site of Kałdus, which may have served as ceremonial ware for drinking rituals. References for the drawings are in the text.

Further evidence for the earliest wheeled transport in Europe?

The imagery depicted on the upper body of the funnel beaker, which was found alongside the flasks and glasses from Sławęcinek, presents an intriguing feature of the piece (Fig. 7). The motifs of what could be a wagon recur three times, interspersed with three sections comprising sets of three hatched triangles, and are shown in a side view. The wagon motif (2.7 cm wide and 4.7 cm long) is formed by the needle etching (*Furchenstich*) decorative technique and composed of two wheels, each defined by two concentric circles (outer ∅ = 1.7 cm and inner ∅ = 1 cm) with an additional element in the centre that may possibly represent the ends of the axle that had passed through the wheel. The wheels are connected by two horizontal lines (1.4 cm long and 0.4 cm wide) with transverse intersections that evoke the image of an axle or a lower part of the wagon box. Additionally, two angled lines (0.7 cm in length) extend outward from each wheel and terminate at the base of the beaker's neck. These lines may be interpreted as representing the sides of a wagon box, analogous to three-dimensional ceramic models of wheeled vehicles from the Late Baden (Pécel) graves at Budakalász and Szigetszentmárton in eastern Hungary, dated to 3300–3100 BC[26].

The claimed wagon pictograph on the Sławęcinek beaker is paralleled by an image portrayed on a decapitated amphora from the TRB settlement at Kałdus, which is only 60 km north of Sławęcinek (Fig. 7), demonstrating potential communication between these two TRB groups. The modelled age ranges for the beaker deposition are between 3530 and 3360 cal BC at 93 % probability (Table 1), while the animal bone from the pit that contained the Kałdus amphora yielded a practically identical date of 3530–3350 (at 94.5 % probability; Poz-95657)[27].

The dates for the Sławęcinek and Kałdus images are tightly clustered with those obtained for a renowned TRB pot with four-wheeled wagon pictographs found at the TRB settlement of Bronocice in southern Poland, dated to 3635–3370 cal BC (at 94.5 % probability; GrN-19612). The Bronocice pictographs represent the earliest well-dated ceramic evidence for the use of wagon transport from Mesopotamia and Western Europe[28]. In Poland, there are few additional appearances of wheeled vehicles that can be connected to the early Baden period (Fig. 8). Two-dimensional images that appear to portray a four-wheeled vehicle were incised on TRB vessels discovered in Ostrowiec Świętokrzyski[29] and Dopiewo[30]. A schematic motif of what seems to be a four-wheeled vehicle is depicted on ceramic amphorae from the TRB settlement at Zawarża, located to the northeast of Bronocice[31]. These vessels are joined by a further example from Inowrocław-Mątwy near Sławęcinek[32], which appears to extend the evidence of the earliest wheeled transport and traction in northern Poland[33]. Another wheeled vehicle can be discerned in a side view on the surface of potsherds from the TRB sites of Poganice in northern Poland[34] and Zakrzew in central Poland[35]. About half of the frieze at the Zakrzew potsherd is missing, but extrapolation from the preserved section suggests that a wagon with a box was originally depicted. It seems reasonable to conclude that the image preserved on a broken vessel from the TRB settlement at Nowy Młyn in Kuyavia follows a similar way of schematically rendering wagons[36]. In addition, a fragment of a circular clay disc with a bifacial perforated nave, which may be a model wheel, was found at the site of Opatowice in central Poland[37]. The counterparts of the Opatowice object appear at the Baden settlement at Veľká Lomnica, "Burchbrich" in northern Slovakia (Fig. 8) and Arslantepe in eastern Turkey, dated to 3400–3100 BC[38].

The Kernel density model in Fig. 8 clearly shows that the ceramic iconography, which seems to portray the earliest use of wheeled vehicles in Poland appeared between 3610 and 3350 cal BC (95.4 %) simultaneously in Bronocice, Sławęcinek, Kałdus and Zawarża. This distribution can be refined to 3530–3370 cal BC at 68.2 % probability. The radiocarbon dates for two-dimensional images of wagons from Poland have overlapping calibrated age ranges with radiocarbon determinations for the archaeological and inscriptional evidence for the earliest wheeled vehicles from Uruk-Eanna in south Iraq and Flintbek in northern Germany. This overlap indicates that the technology spread simultaneously over much of Europe and the Near East between 3500–3350 cal BC[39].

26 Bondár 2012.
27 Kowalski *et al.* 2019.
28 Piggott 1983; Bakker *et al.* 1999; Anthony 2007.
29 Uzarowiczowa 1975.
30 Przybył 2015.
31 Kulczycka-Leciejewiczowa 2002.
32 Kośko 1981.
33 Cf. Adamczak *et al.* 2023.
34 Wierzbicki 1999; for other examples from Poland see Kruk/Milisauskas 2024.
35 Jażdżewski 1936.
36 Grygiel 2016.
37 Przybył 2015.
38 Bakker *et al.* 1999; Anthony 2007; Struhár *et al.* 2015.
39 Anthony 2007; for a detailed discussion see Bakker *et al.* 1999 and Bondár 2018.

Fig. 7: Full view of the imageries depicted on ceramic vessels from Sławęcinek and Kałdus in north-central Poland. The needle etching decoration used for the imageries made its first appearance in the Carpathian Basin and eastern Alpine region on small beakers with handless and jugs that were chiefly used as drinking vessels (Kovárník 2008; Zastawny/Grabowska 2011) (drawings by K. Kulesz; photograph by W. Ochotny).

Tab. 1: Bayesian chronological model of radiocarbon dates for the TRB site at Sławęcinek (A_{model}=95.4; $A_{overall}$=94.8). Dates are calibrated in OxCal v4.4.2 (Bronk Ramsey 2009) against the IntCal20 calibration curve (Reimer *et al.* 2020) and rounded to the nearest 10 years.

Feature	Context	Sex	Age at death	Dating material	Material ID	Laboratory code	Age BP	Unmodelled age cal BC (68.2 %)	Unmodelled age cal BC (95.4 %)	Modelled age cal BC (68.2 %)	Modelled age cal BC (95.4 %)	Agreement index	References
								Boundary		**3540–3440**	**3560–3370**	**...**	
318	Burial	Female	30–35	Animal bone	Cattle (*Bos taurus*), metatarsal	Poz-133585	4740±40	3630–3550 (41.1 %) 3540–3510 (13.1 %) 3430–3380 (14.1 %)	3640–3490 (68.2 %) 3460–3370 (27.2 %)	3460–3370	3530–3370	67.9	Evans *et al.* 2023
937	Storage pit	...	...	Animal bone	Red deer *(Cervus elaphus)*, antler	Poz-127983	4700±30	3530–3490 (19.3 %) 3450–3370 (49.0 %)	3630–3580 (8.4 %) 3540–3370 (87.0 %)	3470–3400 (56.6 %) 3390–3370 (11.7 %)	3520–3370	103.3	This work
799	Burial	Female (?)	20–35	Animal bone	Cattle (*Bos taurus*), mandibula	Poz-176610	4685±35	3520–3490 (14.9 %) 3460–3370 (53.4 %)	3620–3580 (3.8 %) 3530–3360 (64.4 %)	3500–3490 (3.9 %) 3470–3370 (64.4 %)	3520–3370	107.4	This work
713	Storage pit	...	...	Animal bone	Cattle (*Bos taurus*), mandibula	Poz-116373	4680±35	3520–3490 (15.1 %) 3470–3370 (53.1 %)	3610–3580 (2.3 %) 3530–3360(93.1 %)	3510–3490 (5.8 %) 3470–3370 (62.4 %)	3520–3370	107.5	Evans *et al.* 2023
704	Post-hole	...	...	Animal bone	Cattle (*Bos taurus*), phanalx	Poz-162638	4670±40	3520–3490 (17.5 %) 3470–3420 (31.8 %) 3410–3390 (11.6 %) 3390–3370 (7.4 %)	3610–3580 (2.2 %) 3530–3360 (93.3 %)	3510–3420 (53.0 %) 3410–3370 (15.3 %)	3510–3370	109.5	This work
943	Storage pit	...	...	Animal bone	Cattle (*Bos taurus*), humerus	Poz-138300	4660±40	3520–3420 (56.9 %) 3410–3370 (11.3 %)	3530–3350 (95.4 %)	3500–3420 (58.6 %) 3390–3370 (9.7 %)	3510–3360	108.7	Evans *et al.* 2023
804	Burial	Female	20–25	Human bone	Phalanx proximalis ossa manus	Poz-127981	4635±35	3500–3430 (55.9 %) 3380–3360 (12.4 %)	3520–3350 (95.4 %)	3500–3430 (59.1 %) 3380–3360 (9.2 %)	3510–3360	101	This work
371	Burial	...	0–6	Animal bone	Cattle (*Bos taurus*), mandibula	Poz-176609	4625±35	3500–3430 (52.2 %) 3380–3360 (16.0 %)	3520–3340 (95.4 %)	3490–3430 58.8 %) 3380–3360 (9.5 %)	3510–3360	98	This work
273	Burial	Female	35–55	Animal bone	Cattle (*Bos taurus*), scapula	Poz-176631	4605±35	3500–3450 (37.5 %) 3380–3340 (30.8 %)	3520–3330 (89.2 %) 3220–3180 (4.1 %) 3160–3120 (2.1 %)	3490–3430 (55.5 %) 3380–3360 (12.8 %)	3510–3350	92.4	This work
								Boundary		3450–3350	3490–3330	...	...
332	Storage pit	...	...	Animal bone	*Red deer* (*Cervus elaphus*)/European elk (*Alces alces*), metapodial	Poz-116372	4520±35	3360–3320 (14.3 %) 3240–3170 (28.4 %) 3160–3100 (25.6 %)	3360–3260 (31.3 %) 3250–3100 (64.1 %)	3370–3280 (56.5 %) 3230–3190 (11.8 %)	3370–3260 (62.5 %) 3250–3100 (33.0 %)	95.8	Adamczak *et al.* 2021
								Boundary		3360–3060	3370–2460	...	...

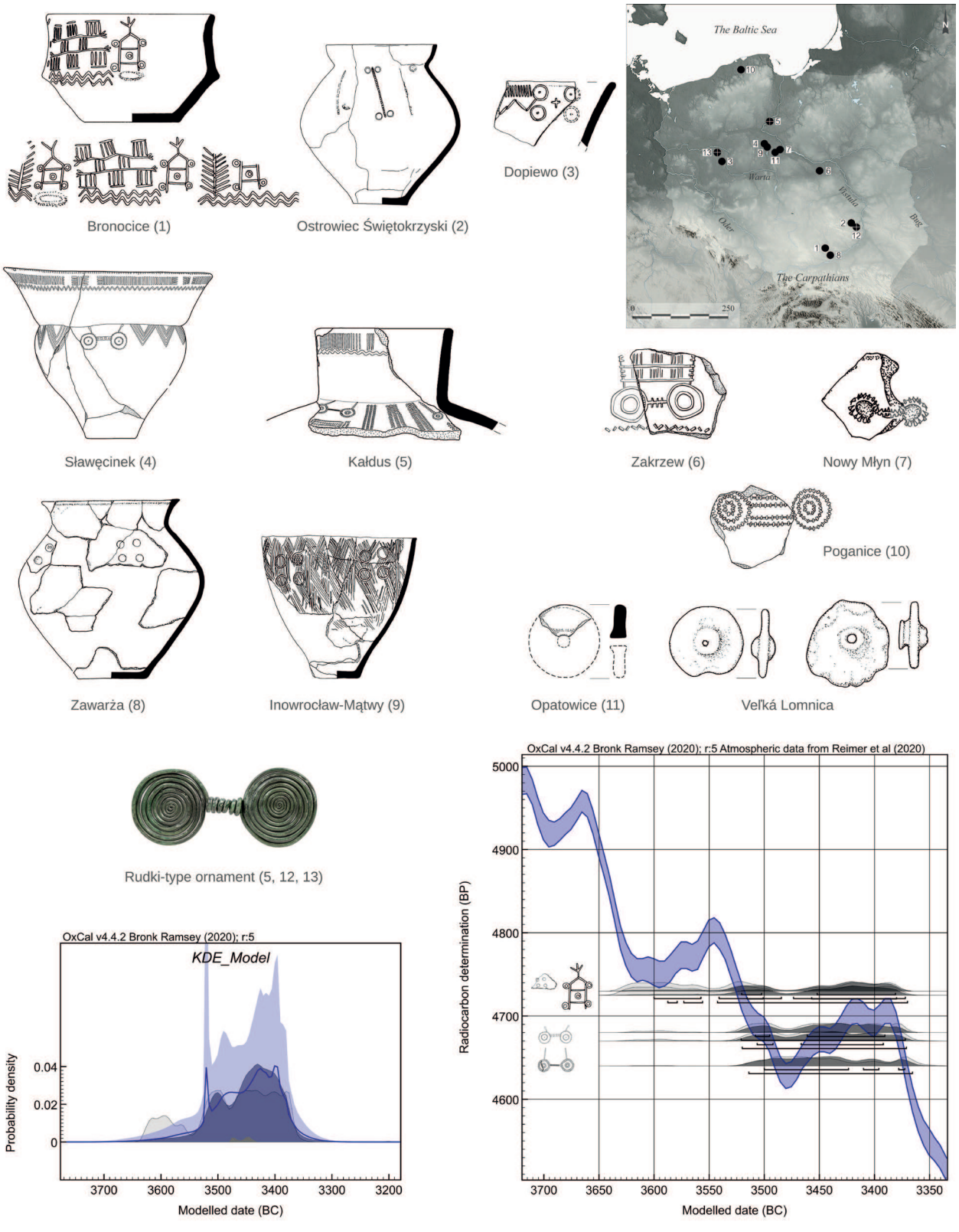


Fig. 8: The images depicted on the TRB vessels that may represent the earliest wagons in Poland, with the corresponding calibrated radiocarbon determination and Kernel density model (KDE). The pictographs from Zawarża have indirectly determined radiocarbon age of 4730±40 BP (ICA 15B/0615). The wagon pictographs co-occur with the major clustering of TRB sites (except for Silesia) and the *Rudki*-type spiral ornaments. The ceramic miniature wheels of a wagon from the region are also shown (re-drawn by Ż. Pankowska-Gajek). References for the drawings are in the text. Radiocarbon dates after Bakker *et al.* 1999, Kruk *et al.* 2018, Kowalski *et al.* 2019 and Evans *et al.* 2023.

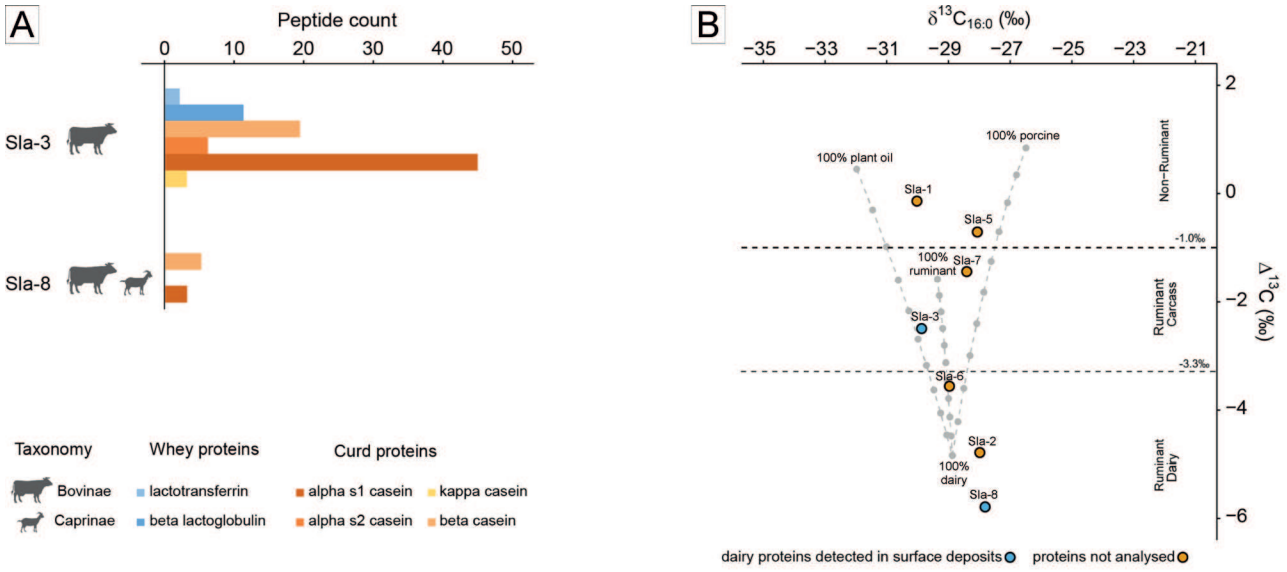


Fig. 9: Protein results for drinking set from Sławęcinek including dairy proteins and taxonomy (A). Theoretical mixing curves of $\delta^{13}C_{16:0}$ and $\Delta^{13}C$ values resulting from mixing modern dairy with modern plant oils, porcine fat and ruminant carcass fat, where filled circles are representative of percentage contributions in 10 % increments between the mean values (B). Coloured dots show the $\Delta^{13}C$ values of the individual mid-chain length fatty acids ($C_{16:0}$ and $C_{18:0}$) obtained from all samples from the drinking set. Blue dots indicate samples where dairy proteins were identified in the calcite surface deposits. $\Delta^{13}C$ values less than −3.3‰ are typically associated with ruminant fats, between −3.3‰ and −1.0‰ are associated with ruminant carcass fats, and above −1.0‰ are associated with non-ruminant fats based on modern reference values (adapted from Evans *et al.* 2023). Collared flasks: Sla-1, Sla-2, Sla-3, Sla-5, and Sla-8; ceramic glasses: Sla-6 and Sla-7. See text for further details.

Dairying, mortuary and drinking rituals at Sławęcinek

A combined protein, lipid and stable isotopic approach was recently applied to the drinking set by Evans et al.[40], providing evidence that the local TRB people may have been consuming dairy foods reduced in lactose. The protein results revealed Bovinae (likely cow) dairy proteins in two collared flasks, one of which additionally contained Caprinae (likely sheep or goat), indicating the use of dairy from both taxonomies at Sławęcinek (Fig. 9A). When scrutinising the specific proteins detected, these two vessels contained mostly or exclusively curd proteins, which is unusual in ancient protein studies, where whey, and especially BLG usually dominate protein detections[41]. Comparison with modern cheesemaking residues, soft cheese and whole milk revealed that the ancient vessels' high curd to whey ratio reflected cheese and cheesemaking residues but not whole milk, indicating that a curd-enriching dairy process was likely at play. Organic residue analysis indicated the presence of ingredient mixtures, such as ruminant adipose fats in addition to the dairy detected by proteomics (Fig. 9B), which could be explained by the addition of ruminant carcass fats during dairy processing, the practice of sealing the ceramic with ruminant carcass fat before dairy processing, or sequential pot use for different ingredients/processes. The lipid profiles of two collared flasks contained only non-dairy ingredients such as plant products, and non-ruminant carcass fats.

The findings reported by Evans et al.[42] for the TRB ceramics from Sławęcinek demonstrate compelling evidence for the presence of dairy products in the collared flasks and glasses from the drinking set, adding to the decades-old discussion on the use and role of collared flasks across Neolithic Europe. It has long been suggested that collared flasks served as containers for opium due to their distinct shape and decorations bearing similarities to the inverted opium poppy head[43]. Indeed, *Papaver somniferum* (opium poppy) has been reported in archaeobotanical assemblages of the period[44], and opioid alkaloids and their decomposition products have recently been reported for the TRB miniature vessels and collared flasks from south-eastern Poland[45]. No evidence for *Papaver somniferum* was identified in the drinking set from Sławęcinek through the proteomic and

40 Evans *et al.* 2023.
41 See, e. g. Hendy *et al.* 2018a; 2018b.
42 Evans *et al.* 2023.
43 See, e. g. Sherratt 1997; Bąbel 2006.
44 See, e. g. Nowak *et al.* 2020.
45 Taras *et al.* 2023.

organic residue analyses. This finding does not preclude the possibility of opium use in these vessels, as the absence of such proteins and lipids is not necessarily evidence of the absence of opium. Proteomic analysis indicated that some form of curd enriching dairy process had been practised, however the results were inconclusive regarding whether or not rennet had been used. Similarly, no proteomic evidence of lactic acid bacteria or yeasts was detected, which would have indicated the use of fermented dairy products, for example kumis, as proposed by Sherratt (1997); although this absence of protein evidence does not necessarily imply evidence of absence. The utilisation of collared flasks for milk-based products, as opposed to alcoholic beverages or psychtropics infused in liquid form, is a development that may not be wholly unexpected in the context of the Baden era. Milk lipids and proteins have been identified in some dishes from the early Baden settlement of Győr-Szabadrét-domb in western Hungary[46]. Biomolecular evidence demonstrating the processing of dairy products has also been identified in the ceramic cups from the Riedling site of the Cham Culture in southern Germany[47].

If we view the spatial organisation of the western homestead at Sławęcinek and the archaeological material therein as fossilised behaviour, it may be posited that the occasions on which the drinking set was utilised were largely those involving the celebration of burial or the dead. The skeletal remains of a 20–25-year-old woman were interred in pit 804, in close proximity to the western household. The same pit yielded the richest faunal assemblage from the site, containing almost 400 animal bones and more than 400 potsherds that can be taken as evidence of a funeral rite, perhaps representing debris from a funeral feast accompanying the burial. The disarticulated human bones of an adult (female?) individual and a child were retrieved from the midden pits adjacent to burial pit 804 (see Fig. 1). In addition to the inhumations, pit 937 was located near to the drinking set and yielded a great number of animal bones and other archaeological evidence suggestive of communal feasting. This included collared flasks and serving wares, such as ceramic plates and vessels exhibiting the distinctive Boleráz pottery style[48] (cf. Fig. 4). Among the assemblage, one collared flask was tested and found to contain deposits adhered to its surface that were identified as dairy proteins specific to Bovinae and Caprinae[49].

The wagon pictograph may prompt a new avenue of interpretation regarding the social dispensing of dairy beverages, one that is intertwined with the sowing or harvesting calendar of the local TRB farmers. Sherratt[50] develops this argument further, claiming that both drinking equipment and wheeled vehicles[51] rapidly became symbols of male elites, pervading the Bronze Age and subsequent periods. That the male ethos of social drinking extends to Sławęcinek should not, however, be assumed *a priori*. The appearance of male warrior elites is portrayed in the characteristic combination of weaponry (daggers, battle axes) and collared flasks in their megalithic graves[52]. However, the process of creolisation of the Baden Culture and TRB diasporas of north-central Poland opened the way for a cooperative mode of social organisation, whereby displays of individual power and male status became less valorised during the second half of the fourth millennium BC[53]. By way of illustration, the copper assemblage from Kałdus in north-central Poland provides an interesting example of metal hoarding adopted to relax the gender dichotomy via co-deposition of male-associated weaponry and female-gendered ornaments[54]. The content and distribution of the archaeological material from Sławęcinek likewise appear to align with this pattern. The decorated bone dagger, which was recovered from a pit at the site, does not appear to have been used as an instrument of ostentatious display of individual power, as recently suggested by Adamczak et al[55]. The deposition of the amphorae and collar flask in a single context at Sławęcinek also speaks towards the cooperative fabric of the local TRB group, as before the Baden era, these types of vessels had strict gendered associations. Additionally, two female burials (nos. 799 and 273) from the site seem to extend this argument by yielding fragments of collared flasks, which were furnishings strictly prescribed for male burials in the East TRB Group.

The fieldwork at Sławęcinek yielded no burials containing the skeletal remains of male individuals. Moreover, the funerary and drinking/feasting rituals that took place at the site were held close to the domestic and private sphere of the household, which is often coded female. The picture is thus still incomplete and blurred, but taken together these

46 Craig *et al.* 2003.
47 Dunne *et al.* 2023.
48 Cf. Němejcová-Pavúková 1981; 1998.
49 Evans *et al.* 2023.
50 Sherratt 1997.
51 The needle etching (*Furchenstich*) decoration used for the wagon imagery on the beaker from Sławęcinek (and also other vessels with wagon pictographs from Kałdus, Nowy Młyn and Ostrowiec Świętokrzyski) made its first appearance in the Carpathian Basin and eastern Alpine region on small beakers with handless and jugs that were chiefly used as drinking vessels (Kovárník 2008; Zastawny/Grabowska 2011).
52 Adamczak 2013.
53 See, e. g. Kowalski *et al.* 2019; Adamczak *et al.* 2021.
54 Kowalski *et al.* 2019.
55 Adamczak *et al.* 2021.

findings might have the potential to expand our interpretative frameworks *vis-à-vis* female lineages or women's secret societies. The latter are recognised in ethnographic data, for example among the Bantu ethnic group of the Fang people or the Ndjembe in western Africa[56]. If we consider social drinking beyond the ethos of the warrior males, it follows that we likewise need to reflect on the role of women and the ways they were engaged in the provision of social and ideological resources in the second half of the fourth millennium BC in Europe[57]. Thus far, the existence of women's secret societies in the TRB area has been inferred from the deposition of ceramic amphorae (often decapitated) in watery locations[58]. Despite its limitations, this study has gone some way towards extending our reading of the events portrayed at Sławęcinek as a complex interplay between female burials, funeral feasts, and the breakdown of the mortuary deposition pattern of male-gendered collared flasks. The use of collared flasks for dispensing and consumption of milk-based products (potentially viewed as the fluid of fertility and health-giving that symbolises the mother) invites an interpretation toward the use of secret rites or rituals as a means of solidifying female members of the group, and demonstrates that dynamic and female associated forms of power should be accounted for in our narratives.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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