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Continuity or Great Transformation? Corded Ware Culture Communities in the Lower Oder Region at the Threshold of the Bronze Age (2300–2000 BCE)

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This article explores the issue of continuity versus socio-cultural transformation in the Lower Oder region during the Late Neolithic and Early Bronze Age (2300–2000 BCE). An integrated analysis of material culture, settlement patterns, and environmental data highlights the complexity of cultural dynamics in this area. Elements of the Corded Ware Culture (CWC), the Bell Beaker phenomenon (BB), and southern influences linked to the Proto-Únětice Culture (PÚC) have been identified; however, their interrelations cannot be reduced to a simple chronological succession. Particular attention is given to ceramic forms and flint daggers, which reflect local adaptations of the cultural "packages" characteristic of the BB phenomenon, alongside the persistence of CWC traditions. Moreover, palynological evidence provides insights into landscape use and subsistence strategies during this transitional period. The study argues that, rather than undergoing an abrupt cultural rupture, the region experienced a gradual, multifaceted transformation marked by considerable microregional diversity.

KEYWORDS: Lower Oder region, Late Neolithic, Early Bronze Age, pottery, flint daggers, radiocarbon dating, palynological data

INTRODUCTION

Around the mid-third millennium BCE, the Lower Oder region witnessed the intensive development and consolidation of regional settlement patterns associated with the Corded Ware Culture (CWC) communities (Matuszewska 2011: 148–149). In the following centuries, this region exerted a notable influence on adjacent areas,

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including Mecklenburg, southern Brandenburg, western Kuyavia, and Greater Poland. As early as 2300 BCE, CWC groups from Pomerania came into contact with Proto-Bronze Age communities, selectively incorporating elements of their material culture. These interactions laid the groundwork for the region's gradual integration into Early Bronze Age cultural networks.

The initial phase of this process, lasting until approximately 2000 BCE and often referred to as the "dagger period", was distinctly transitional. Traditional cultural patterns were increasingly overlaid by emergent Early Bronze Age traits, as evidenced by grave assemblages from this time. The fully developed Early Bronze Age in the Pomeranian zone is generally considered to begin only with the substantial influx of Únětice-type bronze artefacts.

For many years, research on the Late Neolithic and Early Bronze Age in this region remained stagnant (Matuszewska 2011: 50–56), resulting in a degree of scholarly inertia. Archaeologists frequently described the cultural dynamics of this period as ambiguous (e.g., Kaczmarek 2018: 10), and synthetic studies tended to focus primarily on metal artefacts (e.g., Bugaj 2017). In recent years, however, this situation has changed thanks to comprehensive, source-based studies encompassing the entire Lower Oder region (Matuszewska 2011; Kozłowska 2024). This renewed scholarly attention justifies a re-examination of the cultural transformations at the threshold of the Bronze Age and highlights the interpretive potential of ongoing research.

This study focuses on three interrelated cultural phenomena observed in northern Poland at the dawn of the Early Bronze Age: the CWC, the Bell Beaker phenomenon (BB), and the Proto-Únětice Culture (PÚC). These categories do not represent homogeneous or sharply defined cultural entities but rather broad cultural currents exhibiting considerable regional and chronological diversity. In the Lower Oder region, the latest phase of the CWC is represented by a well-established local group which, although regionally distinctive, maintained cultural contacts with neighbouring areas (Matuszewska 2011). In the following discussion, the terms BB and PÚC are used as convenient analytical labels referring primarily to typological and stylistic features rather than to uniform cultural systems. The materials associated with these phenomena in the Lower Oder area should therefore be interpreted as evidence of the transmission of ideas and prestige goods rather than indicators of coherent cultural formations.

The issues addressed in this article concern broader questions related to developments in the Lower Oder region during the transitional phase from the Neolithic to the so-called Proto-Bronze Age (2300–2000 BCE), as well as during the subsequent Early Bronze Age IA phase (2000–1700 BCE; cf., Czebreszuk and Kozłowska-Skoczka 2008: 32, table 5; Matuszewska 2011: 95–96). A significant cultural shift

occurred around 2400/2300 BCE, corresponding to the onset of the CWC Phase 3 (Matuszewska 2011: 148–149). This period was characterised by the consolidation and spatial expansion of CWC groups from the Lower Oder region, accompanied by the gradual incorporation of Proto-Bronze Age elements. The CWC communities thus became part of broader cultural processes, including the emergence of distinctly allochthonous elements associated with the BB phenomenon and the PÚC.

This stage represents a phase of cultural consolidation within the CWC, reflected in increased settlement density. Notably, Phase 3 of the CWC is associated with the highest number of sites, including burial grounds. Among these are collective graves, some of which have been interpreted as family burials (e.g., Czelin, Melz; cf., Kowalski *et al.*, 2010). At the same time, an expansion of the Lower Oder CWC groups occurred — certainly multidirectional, though limited in scale. This process probably involved relocating small population groups into adjacent territories. Material culture traits associated with these communities appear northward and northwestward, reaching Mecklenburg and the island of Rügen (Berlekamp 1955; Kaufmann 1969: fig. 3; Jacobs 1991: map 4). Similarly, evidence of cultural influence is visible along the Noteć River, extending into the Krajna and western Kuyavia (Pałuki) regions, preceding the emergence of groups linked to the earliest phase of the Únětice Culture (ÚC; cf., Kośko 1979: 141). These patterns most likely reflect networks of interaction and the diffusion of material traditions rather than direct population movements.

As a result of these developments, the Kruszki group emerged along the Greater Poland–Kuyavia borderland, rooted in the Lower Oder tradition. In the second half of the 3rd millennium BCE, Lower Oder elements also appear in Greater Poland. In contrast, the southern trajectory and the influence of the Lower Oder groups on the latest (Phase III) stage of the CWC in Silesia seem to have been minimal. Materials bearing traits of the Lower Oder territorial group found in this region suggest only a fleeting presence. The southwestern area (southern Brandenburg) also warrants mention, where sites genetically linked to this phenomenon can be clearly identified (Wetzel 1969: fig. 6; Seyer 1971).

From approximately 2350/2300 BCE onward, Early Bronze Age patterns from the west (BB) and the south (PÚC) were increasingly adopted. The CWC communities actively participated in this transformative process, serving as a key substrate for emerging cultural changes. This adoption was selective and limited to particular categories of material culture. While the indicators of these external influences have been previously discussed (Matuszewska 2011: 98–102), the present paper focuses on issues of innovation, standardisation, and the potential scope of changes in material culture. It should be emphasised from the outset that this study relies on typological and stylistic comparison rather than technological analysis. The central question is:

how did local communities incorporate elements associated with the BB phenomenon and the PÚC sphere? An attempt to answer this question involves an analysis of ceramic materials, considering both macromorphological features and decorative styles. Another crucial aspect is the spread of flint dagger production, which is undoubtedly linked to the BB tradition.

The Lower Oder region has been repeatedly defined in the literature as the area bounded to the west by the Randow River valley and to the east by the Parsęta River valley, which also marks the north-eastern limit of the Szczecin Lowland. The region's northern boundary coincides with the Baltic coast, while the southern and eastern margins follow the limits of the same lowland (cf., Matuszewska 2011: 11, fig. 1; Kozłowska 2024: 8, fig. 1). From this area, approximately one hundred sites have been identified as belonging to the latest stage of the CWC marked by Proto-Bronze Age traits. These comprise burial assemblages, probable graves, and stray pottery finds (Matuszewska 2011, Catalogue; 2016; Kowalski *et al.*, 2011; Kozłowska 2024: Catalogue). In addition, 250 flint daggers are known from the Lower Oder region, 54 of them originating from well-documented contexts and 196 as stray finds (Matuszewska *et al.*, in print).

CERAMICS

One of the fundamental approaches to studying cultural transformations is the analysis of ceramic techniques and forms, which provides insights into evolving production practices and their socio-cultural implications (cf., Gosselain 2000; Wallaert-Petre 2001). Changes in pottery, manifested in aspects such as macromorphology and decoration, may reflect the assimilation of new cultural patterns and shifts in social organisation. Beyond taxonomic and chronological considerations, a socio-cognitive perspective on ceramic production is essential. In this regard, ethnographic research, particularly from the French School of the Anthropology of Techniques, offers valuable analytical frameworks. Central among these is the concept of the *chaîne opératoire*, the sequence of production steps, which serves as a key marker of artisans' social identity. Behavioural studies indicate that technical gestures employed in pottery-making are internalised during the learning process and become motor habits that are difficult to modify later in life (Gomart *et al.*, 2017: 1502). As Valentine Roux notes, "the transmission process of techniques takes place within socially related groups" (Roux 2016: 102). Consequently, pottery-making practices are embedded within kinship, ethnic, or linguistic structures, forming distinct "communities of practice".

In this context, vessel morphology functions not only as a classificatory tool but also as evidence of production norms, intergroup interactions, and artisanal competencies (cf., Heitz and Stapfer 2017; Kleijne 2019). Several questions arise: Do new vessel forms appear in the final phase of the CWC in the studied region? If so, do these forms reflect the traditions of two or more distinct communities occupying the same area at different times, or were they produced by a single group employing diverse techniques? Did the emergence of new cultural phenomena (BB, PÚC) influence — and if so, how — the local traditions of ceramic decoration? Did these innovations require changes in potters' motor habits? Can we speak of ceramic standardisation in the context of grave goods?

Cultural, semantic, and communicative dimensions of pottery have a long and well-established research tradition in archaeological literature (e.g., Gosselain 1992; Lemonnier 1993; Czebreszuk 2001: 83, 105; Stark 2003, cf., for further references; Roux 2015; 2016; 2019; Spataro and Furholteds 2020; Pyzel and Gomart 2023). The significant changes in production methods, including decoration techniques, were not merely technical. While they involved the acquisition and consolidation of new skills — building upon existing knowledge — they also entailed overcoming certain cognitive boundaries. Social organisation was a key factor in the emergence of these innovations, which were socio-symbolic rather than economic. Alterations in commonly used domestic items, as well as grave goods, may have been prompted by intercultural contact and the gradual acceptance of foreign elements into local traditions.

The ceramic assemblage of the final (Lower Oder) phase of the CWC comprises primarily S-profile cups, amphorae, pots, mugs, vase-shaped vessels, bowls, and a few beaker-type vessels. Compared to earlier phases, there is a marked diversification of forms, even within specific typological categories. While some vessels retain features typical of the CWC tradition (notably S-profile cups), the majority represent new forms. Additionally, a suite of techniques and decorative motifs characteristic of the BB tradition is present, including knurling, zonal and zonal-metopic decoration, and occasionally, barbed-wire ornamentation.

A detailed analysis of the ceramic material reveals several noteworthy observations. In the studied region, some vessels can be directly attributed to the BB tradition. Sites such as Angermünde, Pinnow, Wrzosowo, and Żdżary are particularly illustrative (cf., Fig. 1). Graves containing ceramics explicitly referencing the CWC tradition continue to occur (e.g., Szczecin-Podjuchy 2; Grünz 1), though Proto-Bronze Age elements invariably accompany them. Another group comprises assemblages with "beaker" elements, primarily vessel forms, decorative styles, and flint daggers, sometimes accompanied by flint or stone axes (e.g., Brüssow, Grenz, Kolin, Trampe, Wolin; cf., Fig. 2).

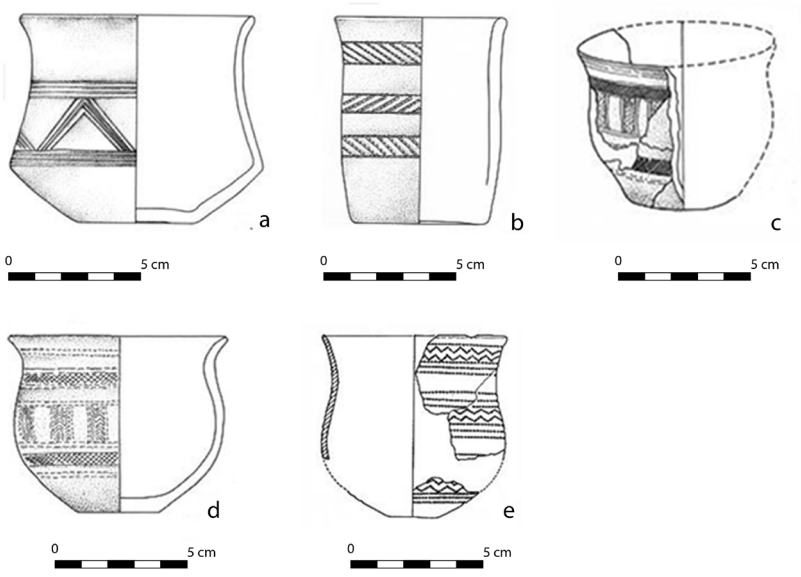

Fig. 1. Examples of vessels directly associated with the BB tradition. a – Wrzosowo; b – Żdżary 15; c, d – Pinnow; e – Angermünde. After: Kozłowska 2024.

A final group includes graves containing materials associated with BB, CWC, and PÚC traditions, or combinations thereof (e.g., Babin, Casekow, Dębogóra, Grünz, Letnin, Liepe, Melzow, Pinnow, Siadło Górne).

Regarding decoration, zonal and zonal-metopic motifs predominate, with the latter more frequently observed on vessels from this period. Of particular note is a distinctive ornamentation style known as *Gurtband*, consisting of bands encircling the vessel and filled with decorative elements. These may represent a local evolution of zonal ornamentation and a specific innovation of the Lower Oder region under BB influence (Czebreszuk 2001: 120–124; Matuszewska 2011: 99).

Concerning standardisation, identical or nearly identical vessels occur across the region (cf., Fig. 3). These are most often S-profile cups and vases, occasionally amphorae, pots, mugs, and jugs, decorated with bands of circumferential lines in repeated sequences, separated by a rib-like band. Many feature a plastic knob, a particularly popular decorative element during this period. This motif is typically executed via incision, though examples using cord impressions (mostly on mugs and jugs) or knurling also exist. Another group

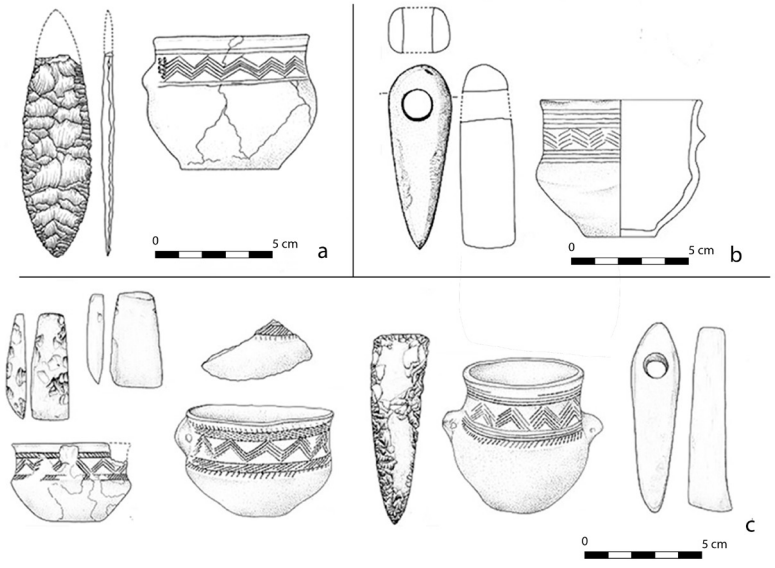

Fig. 2. Examples of assemblages containing beaker-type vessels, flint daggers, stone axes and battle axes. a – Wolin 8; b – Kolin 13; c – Grenz 3. After: a – Matuszewska 2016; b – Kozłowska 2024; c – Matuszewska 2011.

includes cups and pots with knobs ornamented with all-around cord impressions (e.g., Czelin, Dębogóra, Liepe, Schönow).

The most distinctive feature of pottery from this period is its marked multiculturalism, understood as the coexistence of elements characteristic of the Lower Oder CWC, BB, and PÚC. These elements often appear not only within a single assemblage but also on individual vessels. Decorative motifs typical of the BB tradition are found on vessels associated with both the CWC and, often, the PÚC. Such motifs were executed using a variety of techniques, including cord impressions, incisions, and knurling.

FLINT DAGGERS

During the 3rd millennium BCE, the specialised production of characteristic lanceolate flint daggers, including the Grand-Pressigny forms and their derivative variants

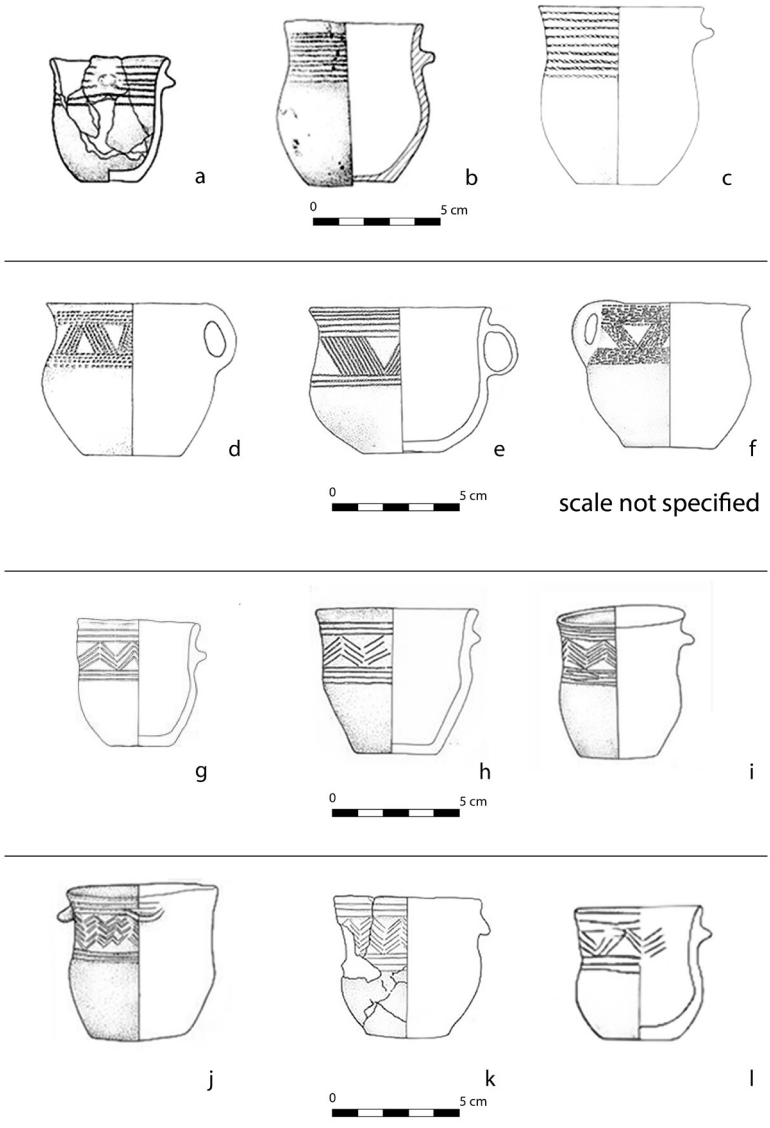

Fig. 3. Examples of standardised vessels from the Lower Oder region. a – Czelin 23; b – Dębogóra 2; c, d – Liepe; e – Dębogóra 2; f – Pinnow; g – Ramin; h – Casekow; i – Röpersdorf; j – Wollschow 1; k – Wollschow 20; l – Letnin. After: a – Kowalski and Matuszewska 2011; b–l – Matuszewska 2011.

(German *Spandolchderivate*; see Czebreszuk and Kozłowska-Skoczka 2008: 11), spread across a wide area of Europe. Their distribution extends from the Rhine through central Germany to western Norway and northwestern Poland (Czebreszuk and Kozłowska-Skoczka 2008: 10–11).

Lanceolate flint daggers are widely distributed across Central and Northern Europe, and their origins and significance cannot be confined to a single cultural sphere. As emphasised by Czebreszuk and Kozłowska-Skoczka (2008: 41; and references therein), scholarly debate has long focused on the relationship between the idea of using flint daggers (particularly the lanceolate type) and the BB phenomenon. In the south-western Baltic zone — including the Lower Oder basin — both phenomena appear simultaneously, around 2350–2300 BCE, suggesting coexistence rather than a coincidental overlap (Czebreszuk 2001; 2003a). However, it should be stressed that the presence of daggers in the materials from the Lower Oder region is not solely the result of BB influence but reflects a broader process of ideological and social transformation that began already within the framework of the Single Grave Culture. The BB idea merely allowed for the development and reinterpretation of pre-existing patterns – particularly those associated with individualisation and the prestige of the male warrior (Czebreszuk 2003).

Within present-day Poland, the Lower Oder River basin stands out as the principal area of occurrence of these objects. From Western Pomerania alone, 236 daggers and fragments have been recorded (Fig. 4), classified into six main types (I–VI; cf., Czebreszuk and Kozłowska-Skoczka 2008; Matuszewska 2011; Kozłowska 2024). The earliest examples in this region appear in the Late Neolithic; however, their peak distribution corresponds to the Late Neolithic/Proto-Bronze Age phase, contemporaneous with the Scandinavian Late Neolithic I (LN I) and the pre-classical phase of the Únětice Culture (ÚC; Czebreszuk and Kozłowska-Skoczka 2008: 42).

An analysis of the metrical characteristics of these artefacts, in conjunction with comparative materials from other regions, suggests that at least some daggers were produced locally using regionally sourced raw materials (Czebreszuk and Kozłowska-Skoczka 2008: 42–43). In CWC graves from the Lower Oder region, lanceolate dagger forms predominate. These often lack a clearly defined tang or possess only a poorly developed one. Notably, such forms account for over 50% of all known flint dagger finds in the region (Matuszewska *et al.*, 2025). Typologically, they are linked to the BB tradition (Czebreszuk and Kozłowska-Skoczka 2008: 41).

The concentration of finds in the Lower Oder region aligns with a broader distribution pattern that extends across Mecklenburg and Western Pomerania. Within this network, the Lower Oder may have functioned as a significant hub of interaction, which, according to Jan Apel (Apel 2001: 272–273; 2008: 93), also included southern

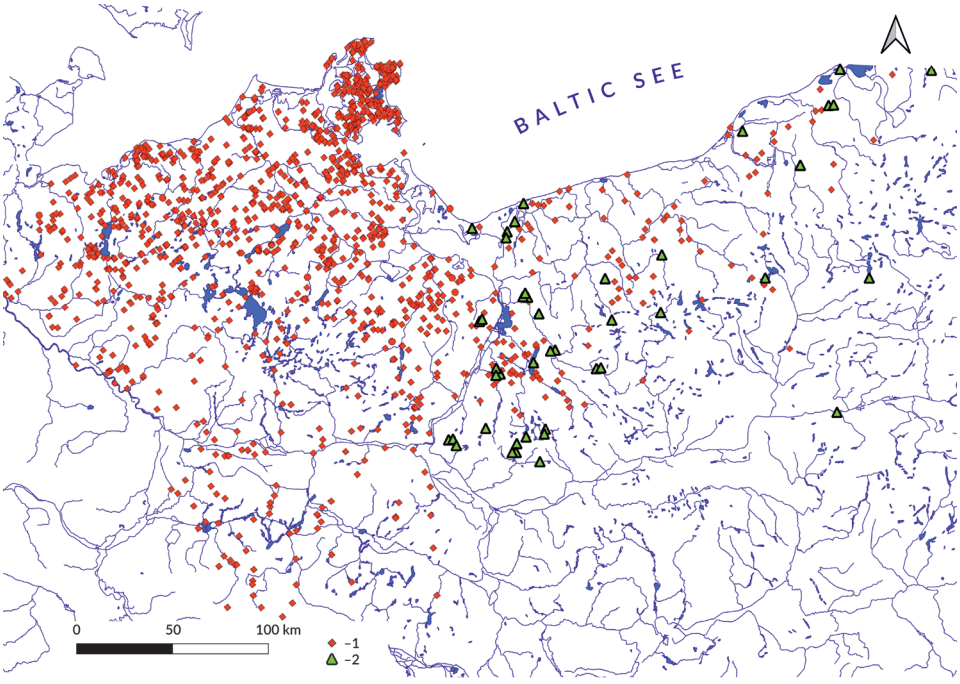

Fig. 4. Spatial distribution of flint dagger finds from Pomerania, contextualized against a part of the territories of neighboring Mecklenburg-Vorpommern and Brandenburg: 1 – based on Czebreszuk and Kozłowska-Skoczka 2008; Rassmann 1993; 2 – unpublished dagger discoveries not included in the 2008 monograph, compiled from dagger finds according to Kozłowska 2022. After: Matuszewska *et al.*, in press.

and central Scandinavia, the western coast of Norway, the northeastern Netherlands, and northern Germany. Whether the region acted primarily as a producer, a recipient, or a site of intensive contact remains an open question.

The function of flint daggers appears to have been complex, combining both practical and symbolic dimensions. In some regions, such as the Netherlands, they primarily served as prestige goods displayed in social and ritual contexts (van Gijn 2010: 147, 189–192). At the same time, a significant proportion of specimens, over 50% in Western Pomerania, and 80–88% in some Scandinavian regions, show traces of resharpening and repair (Czebreszuk and Kozłowska-Skoczka 2008: 27–31; table 3). These traces include restoration of cutting edges, repair of tangs, and shifts of the blade's maximum width toward the handle. Such evidence demonstrates that

the daggers were not solely symbols of prestige but also served practical functions, as tools or thrusting weapons, and were subsequently adapted for new purposes after damage. Their significance, therefore, combined utilitarian and symbolic aspects, with the boundary between them being fluid and context-dependent.

By contrast, flint daggers are rare and widely dispersed in the neighbouring regions of Greater Poland and Kuyavia (Teska *et al.*, 2018: 170, fig. 1). This contrast underscores the exceptional nature of the Western Pomeranian concentration and its integration into the broader transregional exchange network.

CHRONOLOGY

From the Lower Oder region, five radiocarbon dates currently fall within the range of 2300–2000 BCE. Four of these derive from collective graves: one from Site 23 in Czelin (cf., Kowalski *et al.*, 2010; 2011; Kowalski and Matuszewska 2011), and three from graves at Site 2 in Dębogóra (Matuszewska 2011: 110–113). The fifth sample comes from west of the Oder River, from a single grave at Site 3 in Storkow (Matuszewska 2011: 111–112).

At Dębogóra, an elongated grave pit (approximately 1 × 2 m), oriented northwest–southeast, contained the remains of four adult males (aged 30–45 years, with one of indeterminate adult age) and four ceramic vessels covered with large stones (Fig. 5). Near the torso of Skeleton I, a beaker with a strap handle decorated below the rim with cord impressions was found. Osteological analysis yielded a radiocarbon date of 3820 ± 35 BP, calibrated to 2356–2192 BCE (77.2% probability). By the lower limbs of Skeleton II, an undecorated bowl with a knob was discovered. Near the skull of Skeleton III, a shallow, slightly profiled cup with a knob and cord-impressed decoration on the neck was deposited, yielding a radiocarbon date of 3770 ± 35 BP, calibrated to 2296–2121 BCE (83.8% probability). Adjacent to the skull of Skeleton IV, a two-handled, undecorated cup was found, dated to 3795 ± 35 BP, calibrated to 2346–2133 BCE (92.2% probability).

At Site 23 in Czelin, a Roman Period cemetery, a heavily disturbed grave attributed to the CWC in 2008 was documented. Only part of the grave pit, a ceramic vessel (Fig. 6), and scattered skeletal remains were preserved. The grave pit, probably circular or oval in plan with a diameter of approximately 1.5 m, oriented north–south and reaching 0.8 m in depth, contained the remains of three individuals: a mature woman (aged 40–45), a child (*infans* II), and an adult of indeterminate sex (Kowalski *et al.*, 2010: 226–227). Grave goods included a single S-profiled small cup with a lug, decorated with a band of cord impressions around the neck. Subsequent investigations

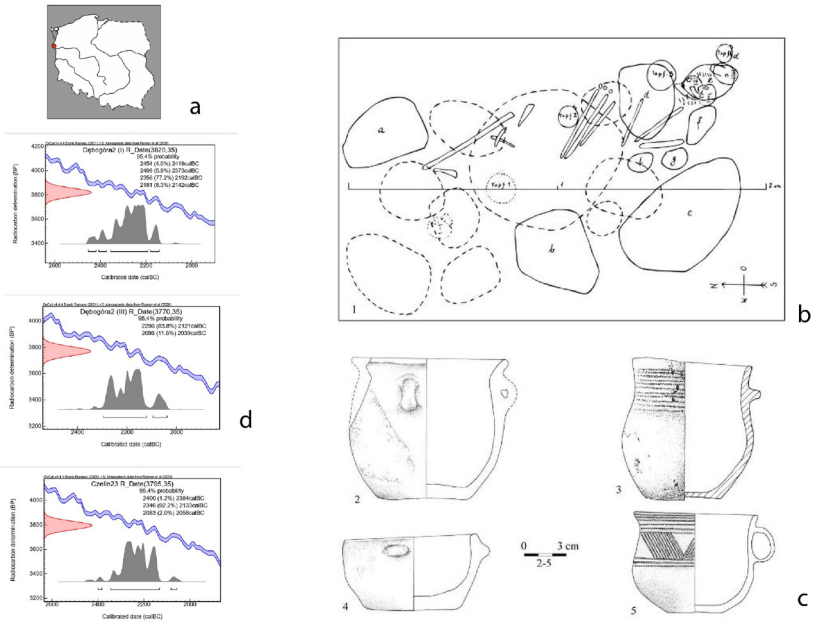

Fig. 5. Dębogóra, site no. 2, a – site location; b – sketch of the structure and contents of the grave; c – vessels from the grave goods; d – calibration of radiocarbon dates from grave. After: b, c – Matuszewska 2011.

uncovered a second vessel of the same type and a stone axe classified as K5–K8 according to Glob and Struve, or type C1a following Schroeder (Glob 1944; Schroeder 1951; Struve 1955; cf., Jacobs 1991: 24–25; Matuszewska 2011: 85). The vessels share similar macromorphological features, including profiling, rim and base shapes, and a single applied handle, differing mainly in size (heights of 8.4 cm and 12 cm), lug form, and decorative technique.

A radiocarbon determination from the adult woman yielded 3785 ± 35 BP, calibrated to 2346–2133 BCE (92.2% probability). The similarity between this Czelin cup and a vessel from Dębogóra, along with the collective burial character of both graves, indicates a comparable chronology, subsequently confirmed by radiocarbon dating. These graves are associated with the final phase of the Lower Oder CWC (Matuszewska 2011: 107–110), corresponding to the Late Neolithic/Early Bronze Age transition (2300–2000 BCE), as defined by Czebreszuk and Kozłowska-Skoczka (2008: 31–33, table 6; see also Kowalski and Kozłowska-Skoczka 2011: 67, table 1).

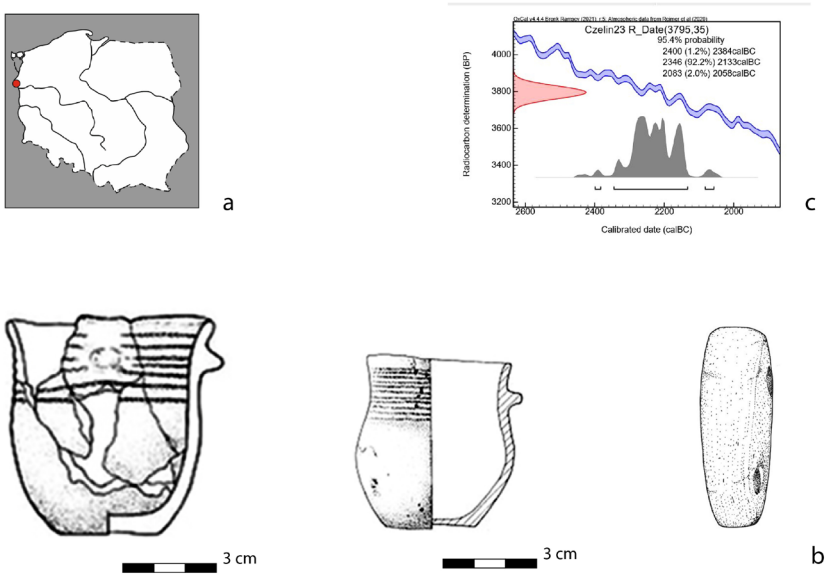

Fig. 6. Czelin, site No. 23, a – site location; b – beakers and stone axe from the grave goods; c – calibration of radiocarbon dates from grave. After: b – Kowalski and Matuszewska 2011.

At Site 3 in Storkow, a grave pit measuring 1.4 × 1.2 m with a stone setting was uncovered directly beneath the humus layer. It contained an S-profile cup decorated with circumferential incised lines and angular motifs on the rim and belly, as well as fragments of a second vessel. Additional ceramic fragments were recovered among the stones. A bone sample from this grave yielded a radiocarbon date of 3670 ± 50 BP, calibrated to 2152–1921 BCE (88.2% probability).

THE POTENTIAL OF PALYNOLOGICAL ANALYSIS

Palynological analysis represents one of the most promising tools for investigating environmental and settlement changes at the microregional scale. When high-resolution pollen profiles are available, they can effectively complement typochronological studies by enabling the identification of changes over relatively short time intervals.

Although palaeobotanical data from the Lower Oder region do not fully meet these criteria, they nonetheless allow for several significant observations.

This discussion draws on analyses conducted on both the Polish side (Lake Racze, Lake Ostrów, the Kołczewo and Wolin peat bogs; cf., Latałowa 1992; Herking 2004) and the German side (lakes Felchowsee, Unter-Ückersee, Kleiner Fauler See, and Ahlbecker See; cf., Jahns and Herking 2002). Pollen diagrams from the region reveal two distinct models of environmental transformation:

Model 1 – Relative Forest Stability
In several diagrams, sustained forest cover or reforestation of previously cleared areas is evident. These profiles are dominated by mixed forests, most commonly pine-oak or oak-hazel. The relatively low values of cereal pollen indicators, particularly in Unter-Ückersee during 2730–2100 BCE, may reflect limited small-scale agriculture (as in Felchowsee) or, in some cases, its near-complete absence (e.g., Ahlbecker See, Lake Ostrów).

Model 2 – Intensive Anthropogenic Pressure
A contrasting pattern is observed at Kleiner Fauler See and in the Wolin region, where advanced deforestation and traces of slash-and-burn practices are apparent, primarily related to animal grazing and, in Wolin, also to cereal cultivation. While these features reflect typical pastoral practices, evidence of agriculture is also notable. Some researchers attribute these traces to late groups of the Funnel Beaker Culture (Latałowa 1992: 200), but this interpretation appears oversimplified. It is plausible that cereal cultivation, alongside animal husbandry, remained an important economic activity in some areas. Notably, around the mid-3rd millennium BCE, the first — albeit rare — cereal pollen grains, such as barley and millet, were recorded at other sites, for example, Rathsdorf 5 (Märkisch-Oderland district), dated to the Late Neolithic (2460–2140 BCE; Jahns *et al.*, 2018: 17).

Similar processes have been documented elsewhere in Europe, where remains of wild and domesticated animals occur alongside traces of cereals such as wheat, barley, and oats (Kleijne 2019: 55–56). In parts of the southern Baltic zone (e.g., Schleswig-Holstein and western Mecklenburg), pollen and archaeobotanical data indicate a marked decline in settlement activity and land-use intensity between *c.* 2400 and 2300 BCE, interpreted as a phase of environmental and economic crisis. Around 2200–2100 BCE, a renewed increase in human impact, settlement activity, and agricultural production is evident (Brozio *et al.*, 2019: 1567; Feeser *et al.*, 2019: 1602–1603). As emphasised by Brozio *et al.*, (2019), research in southern Schleswig-Holstein and western Mecklenburg reveals a clear correlation between economic expansion, agricultural intensification, and

the development of supra-regional exchange networks of raw materials and metals. This phenomenon is interpreted as an adaptive response to environmental stress and a component of broader social and economic transformations.

DISCUSSION AND CONCLUSIONS

The study area functioned as a dynamic hub within the broader pan-European BB network, specifically associated with the Northern Group (cf., Czebreszuk 2001; 2003: 481–482; Czebreszuk and Szmyt 2012: 162), facilitating interactions, exchanges, and the circulation of ideas and materials. In Northern Europe, the BB phenomenon either replaced local CWC groups (Vander Linden 2024: 47) or enriched the existing repertoire of "corded" cultural traits (Czebreszuk 2001: 138). The emergence of BB groups in the southern Baltic zone, particularly in Western Pomerania and Mecklenburg, has been variously dated. Earlier studies placed their beginnings around 2450/2400 BCE (Czebreszuk 2001; 2003), while more recent analyses suggest a slightly later development, around 2350 BCE, corresponding to the early phase of BB adoption in northern Germany and southern Scandinavia (Kleijne 2019: 188). Compared to the rest of the BB province, the northernmost groups started relatively late, no earlier than 2350 BCE (Vander Linden 2024: 47).

Pomerania — particularly the Lower Oder region — together with Greater Poland and Kuyavia, maintained long-standing ties with northern Germany and Jutland (Czebreszuk and Szmyt 2012: 162). These connections sustained supra-regional exchange networks involving raw materials (flint, amber, and metal), technological know-how, and prestige-related practices, expressed primarily through the production and use of flint daggers.

In the northern zone, BB features appear in varied contexts, with archaeological visibility differing between subregions. In Kuyavia, BB traits are primarily found in settlement contexts (Czebreszuk 2001: 134; Czebreszuk and Szmyt 2012: 168), while in the Netherlands they are best known from burial contexts (Kleijne and Drenth 2019: 295). In Schleswig-Holstein, both settlements and burials containing BB material are recorded, though relatively rare (Kleijne *et al.*, 2020). In the Lower Oder region, BB elements are predominantly associated with graves. This does not imply the absence of permanent settlements; the multi-phase settlement at Altgaul (Site 2) west of the Oder River illustrates this point (Lehmpuhl 2020: 52, table 2). Difficulties in settlement identification may reflect both the limited state of research and challenges in ceramic classification, as well as the absence of standardised technological analyses (cf., Vander Linden 2024: 48; Gibson 2019).

The pottery analysis indicates the presence of components foreshadowing the Bronze Age, with BB-associated traits predominating (macromorphology, decoration, flint daggers). Southern elements linked to the PÚC appear to a lesser extent, mainly in vessel forms such as S-profiled beakers with lugs, S-profiled cups with strap handles, handleless amphorae, and certain amphora and bowl variants (cf., Matuszewska 2011: 100, fig. 35). The legacy of the CWC remains visible in ornamental motifs and select macromorphological features (cf., Lehmpuhl 2020: 102; Kozłowska 2024). Radiocarbon-dated graves reveal influences from all these cultural traditions. Graves from the period 2300–2000 BCE, sometimes referred to as the "final group", display a complex mixture of CWC, BB, and PÚC elements, illustrating the culmination of transitional cultural processes in the Lower Oder region.

What distinguishes the Lower Oder region from other parts of the northern BB ecumene in Poland is the unusually high concentration of flint daggers. This is attributed not only to the proximity of the Rügen centre, whose influence is evident in Lower Oder assemblages (Czebreszuk and Kozłowska-Skoczka 2008: 26, 42), but also to the availability of high-quality local flint sources, exploited during the Final Neolithic and Early Bronze Age (Czebreszuk and Kozłowska-Skoczka 2008: 19).

The cultural synthesis observed in the Lower Oder region is also manifested in Kuyavia and northern Greater Poland (Bokiniec and Czebreszuk 1993; Czebreszuk 1996: 248, 250; 2001: 134, 142; Czebreszuk and Szmyt 2012: fig. 12). However, the intensity of individual cultural components varies, and artefact assemblages remain heterogeneous. This complexity challenges traditional interpretations. One approach interprets these phenomena within established cultural units (e.g., Grobia-Śmiardowo, Iwno, or Iwno/BB cultures). Alternatively, analysing material culture in terms of transformation, innovation, and adaptation highlights the concept of "social landscapes", encompassing networks of exchange, practices, and traditions (cf., Matuszewska 2011: 50–54; Kleijne 2019).

A single taxonomic label cannot fully capture these processes. Meaningful interpretation requires attention to microregional specificities and internal variability. Regarding the central research question — whether a profound social transformation occurred at the threshold of the Bronze Age — there is no clear evidence of mass migration in the Lower Oder region. Nonetheless, substantial changes in material culture are apparent. These do not represent classic BB assemblages but rather a fluid constellation of artefacts that partially conform to the Beaker canon.

No radical shifts are observed in funerary practices; differences between cemeteries are more pronounced in grave-goods composition than in burial rites themselves. Future research should explore how different groups utilise landscape areas. High-resolution palynological studies may provide insights into economic intensity and demographic changes.

Further investigation of ceramic assemblages, including detailed analyses of vessel morphology and technological proficiency, is recommended. Evaluating potters' skill levels may clarify mechanisms underlying ceramic change, reintroducing the human dimension into pottery studies (cf., Roux 2011: 80).

Finally, the adoption of BB-related traits was neither uniform nor synchronous. Regional differences in pace, scope, and character are evident. Innovations diffused through multiple mechanisms, including object exchange and human mobility (Kleijne 2019: 194), with knowledge transfer enabling local reinterpretations. The term "Bell Beaker" thus functions as a broad label encompassing diverse local expressions, and understanding the phenomenon requires treating regional variation as central to interpretation.

I am aware of the limitations of the present analysis and the potential of methods not yet incorporated into this study, including isotopic analyses (e.g., strontium) that can reconstruct human mobility. The contextual and interdisciplinary approach adopted here, encompassing the analysis of pottery, flint daggers, and palynological data, enables a comprehensive understanding of the complex cultural situation in the Lower Oder region at the threshold of the Bronze Age. These results provide a starting point for future research that will further clarify the mechanisms of cultural synthesis in this area and elucidate the dynamics of material and social transformations during the transitional period between the Late CWC and the Early Bronze Age.

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