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CORDED WARE CULTURE BURIAL RITES: NEW EVIDENCE FROM ORŁY, SITE 4 IN THE SUBCARPATHIAN LOESS REGION, SOUTHEASTERN POLAND

ABSTRACT

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Archaeological investigations conducted in 2023 at Orły, Site 4, in the Subcarpathian loess region, revealed a niche grave associated with the Corded Ware culture. Inside, the remains of two adult men were found, accompanied by a rich assemblage of grave goods, including ceramic vessels, lithic tools, and a bone awl. This article presents the results of the analysis of the grave's construction, osteological material, and grave goods, relating them to the cultural and chronological issues of the Final Eneolithic communities in the 3rd millennium BC.

Keywords: Subcarpathian loess region, Corded Ware culture, niche grave, Final Eneolithic, chronology
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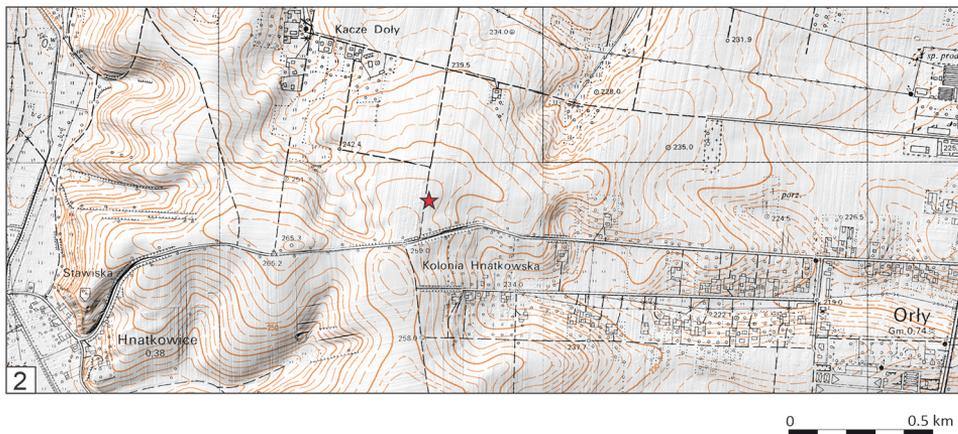
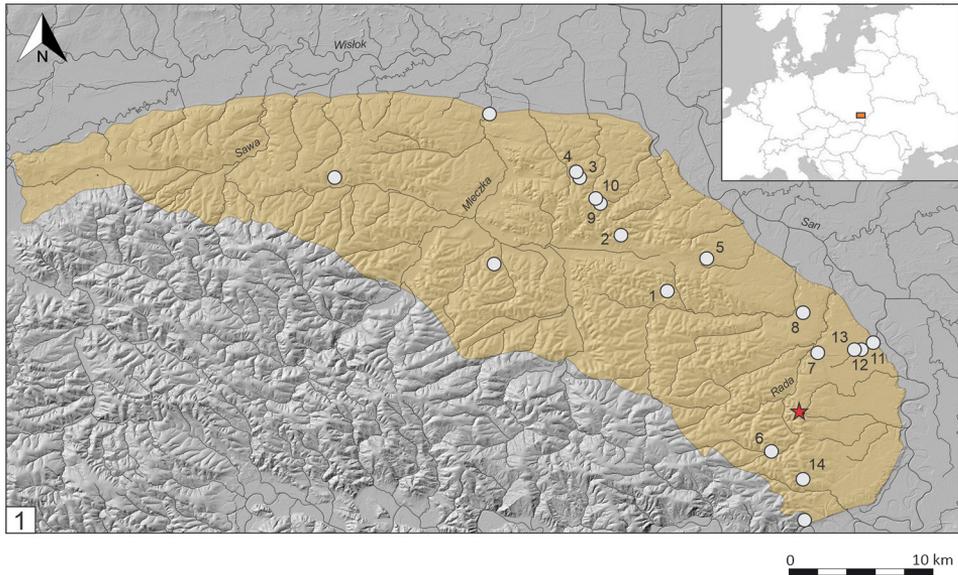
INTRODUCTION

The Subcarpathian loess region, encompassing the Rzeszów Foothills and the adjacent Lower San Valley (southeastern Poland), was of particular interest to the semi-nomadic communities of the Final Eneolithic Corded Ware culture (CWC) during the 3rd millennium BC. This relatively small area, which offered exceptionally favourable environmental conditions for the subsistence of prehistoric human groups (*e.g.*, Łanczont *et al.* 2001b; 2023), gained research significance during the excavations prior to the construction of the A4 highway (Machnik 2011, 62-70). During these investigations, several intriguing CWC burial sites were recorded, revealing the remains of destroyed barrows and various types of graves, including niche graves. These sites were most often scattered across well-exposed locations, including Mirocin, Sites 24 and 27 (Machnik *et al.* 2019), Skołoszów, Site 7 (Rybicka *et al.* 2017), Szczytna, Sites 5 and 6 (Hozer *et al.* 2017), and Święte, Sites 11, 25, and 20 (Dobrakowska and Włodarczak 2018; Janczewski *et al.* 2018; Olszewski and Włodarczak 2018). As Prof. Jan Machnik (2011, 62) highlighted, the results of these field campaigns did not merely add to the existing body of knowledge but rather paved the way for a revision of many important concepts (*cf.*, Hozer *et al.* 2017; Kośko and Włodarczak 2018; Machnik *et al.* 2019). Recently, in 2023-2024, three new CWC Sites were identified in the Subcarpathian loess region: Orły, Site 4, Skołoszów, Site 16 (both investigated by D. Król's team), and Żurawica (investigated by G. Płoskoń). The remains of niche graves at the first two sites were uncovered during subsequent rescue excavations of Funnel Beaker culture (FBC) settlements (*cf.*, Król 2018; Król and Niebieszczański 2019). This article presents the results of the study of the niche grave (Feature 15/2023) at Orły, Site 4, and discusses its significance in the context of similar discoveries in the southeastern CWC 'world'.

SITE LOCATION

The site is located on the southeastern edge of the Rzeszów Foothills, the southern part of the Sandomierz Basin (Kondracki 2002; Solon *et al.* 2018), about 7 km north of Przemyśl (Fig. 1: 1). It is situated on the gentle northeastern slope of a flattened hill (average inclination of 1.30°), offering an extensive view of the loess terrace platform of the Lower San Valley (Fig. 1: 2), which rises up to 30 m above the floodplain of the San River (*cf.*, Gębica 2023). The site's elevation ranges from about 253 m to 258 m a.s.l.; however, the niche grave is situated at 256.1 m a.s.l. The nearest significant watercourse, the Rada River – a left tributary of the San River – is located about 1.1 km west of the site. Slightly closer, at about 0.5 km, are the springs of three unnamed watercourses: one drains directly into the Rada River, while the other two flow toward the San River, merging with additional minor streams along the way. The entire site is covered with loess

soils. At the same time, various patches of chernozem are also observed in its vicinity, particularly to the north and east, in areas not exceeding 240 m a.s.l. (*cf.*, Dobrzański and Zbysław 1955; Gębica 2023).



★ - Orły, site 4 ○ - other CWC burial sites  - Subcarpathian loess region

Fig. 1. Location of the Orły, Site 4, Przemysł District. Burial sites mentioned in the article. 1 – Cieszacin Wielki, Site 37; 2 – Chłopice, Site 26; 3 – Mirocin, Site 24; 4 – Mirocin, Site 27; 5 – Morawsko, Site 8; 6 – Orzechowce; 7 – Skołoszów, Site 7; 8 – Skołoszów, Site 16; 9 – Szczytna, Site 5; 10 – Szczytna, Site 6; 11 – Święte, Site 11; 12 – Święte, Site 15; 13 – Święte, Site 20; 14 – Żurawica, Site 12. Edited by D. Król

GRAVE DESCRIPTION

The niche grave of the CWC, identified as Feature 15/2023, was discovered immediately adjacent to the western edge of the trench, defined by the N-S axis of a local road (Fig. 2). During the initial phase of investigations, only the entrance pit of the grave was uncovered, with the top of its upper fill located about 40 cm below the modern ground level. It appeared as an oval layer of yellow loess mixed with a light grey organic substance. The structure was found to have been cut into the accumulation (cultural) layer of the FBC from the 4th millennium BC, also partially disturbing a shallow older pit (No. 1/2023) of uncertain chronology. Additionally, the entrance pit was later intersected by a later ditch (Fig. 2). Further exploration revealed a classic niche grave layout, consisting of two spatially related elements: an oval-rectangular niche and an entrance pit, measuring 249×122 cm and 130×122 cm, respectively (Fig. 3: 1, 2). These were connected by a narrow and short corridor (65×30 cm), thus forming a T-shaped structure (Fig. 3: 2). The entire funerary structure was oriented along the E-W axis, with the niche positioned on the western



Fig. 2. Orły, Site 4, Przemysł District. Layout of the trench from 2023. a – FBC features; b – CWC feature (entrance pit of the niche grave No. 15/2023); c – early Medieval features; d – features of undefined chronology; e – extent of the FBC cultural layer; f – boundary of the local road; g – area of the trench.

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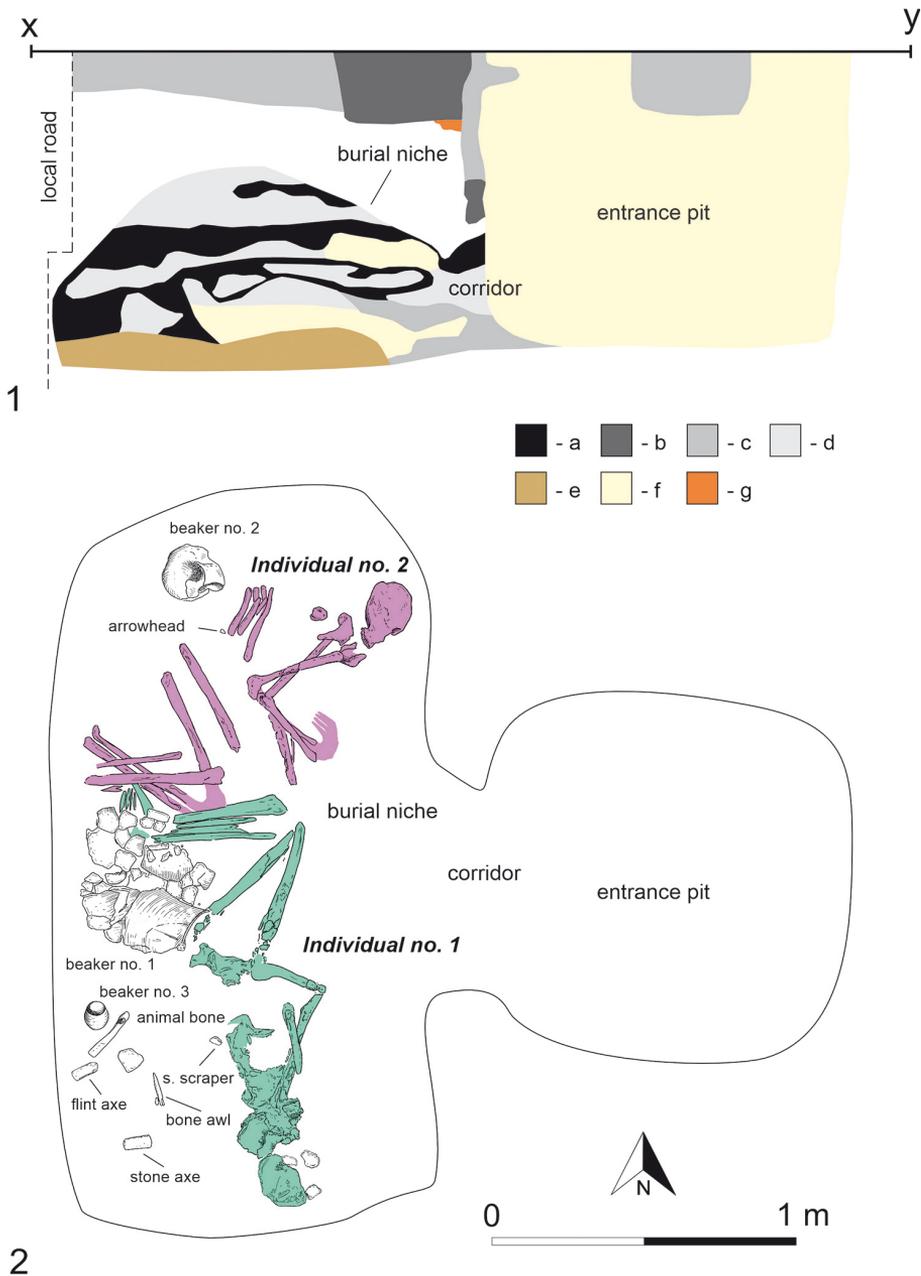


Fig. 3. Orty, Site 4, Przemysł District. Construction of the niche grave No. 15/2023. 1 – cross-section of the niche grave; 2 – layout of the bottom of the burial niche. a – dark gray and black layer; b – dark gray layer; c – gray layer; d – grayish yellow layer; e – brown layer; f – light gray-yellow; g – burned layer.

Edited by D. Król

side (Fig. 3: 1, 2). Its westernmost wall was located beneath the local road, necessitating several compromises in the excavation strategy to ensure its complete exploration (Fig. 3: 1, 2). The bottom of the niche was located approximately 2 m below modern ground level. In contrast, the bottom of the entrance pit was several centimetres higher (Fig. 3: 1). The stratigraphic characteristics of the entrance pit (filled with light grey-yellow sediments) indicate a very slow filling process. The niche was exceptionally well-preserved, showing no evident signs of collapse, although slight erosion of its walls was observed (Fig. 3: 1). Its fill suggests a gradual accumulation of dark sediments. Interestingly, a consistent, straight boundary between these layers indicates the possible presence of a partition that blocked the entrance to the niche (Fig. 3: 1).

At the bottom of the burial niche, the poorly preserved skeletal remains of two adult individuals were discovered in a flexed position (Fig. 3: 2). The body of Individual No. 1 was lying on its right side along the N-S axis, head facing south and face turned east. In contrast, that of Individual No. 2 rested on its left side, aligned with the NE-SW axis, with the head oriented toward the northeast and the face turned southeast. The human remains were accompanied by a set of pottery, lithic artefacts, and bone items (Fig. 3: 2).

In the southwestern part of the burial niche, at the level of Individual No. 1's shoulders, a stone axe and a poorly preserved bone awl – probably using bone from a sheep or goat – were discovered. At the level of the same individual's pelvis, near the western wall of the burial niche, a flint axe, an animal bone, a pottery fragment, and a miniature vessel (Beaker No. 3) were found. A flint tool was located near the pelvis, while three pottery sherds were identified near the skull. Additionally, near the western wall of the feature, a large beaker (No. 1) was placed close to the lower limbs of Individual No. 1 (Fig. 3: 2).

In the northern part of the burial niche, at the level of Individual No. 2's pelvis, another beaker (No. 2) – though in a very poor state of preservation – was identified. A flint arrowhead was found closer to this individual's ribs (Fig. 3: 2).

GRAVE GOODS

Beaker No. 1

A large, unornamented beaker with an S-shaped profile, a small, prominent foot, a distinctly swollen belly in its lower part, and a gently tapering neck that flares outward with a straight rim. The vessel is characterised by good firing, and its surface is smooth and floury, with a colour ranging from brown-grey to brick-red. It was made from fat clay with a small amount of mica and a medium temper of fine ceramic grog. Dimensions: height – 28 cm, rim diameter – 17 cm, base diameter – 7 cm, belly diameter – 17 cm, wall thickness – just over 5 mm, but in some parts – such as the lower belly zone – it exceeds 7 mm (Fig. 4: 1).

Beaker No. 2

A small beaker with an S-shaped profile, characterised by a very fragile structure. The belly of the vessel flows smoothly into the flattened bottom, while the clearly profiled neck ends at the rim, which is slightly tilted outwards. The vessel is poorly fired, its colour is light brown, and its fabric is the same as that of Beaker No. 1. Dimensions: height – 15 cm, rim diameter – 10 cm, base diameter – 5 cm, belly diameter – 13 cm, wall thickness – rarely exceeds 6 mm (Fig. 4: 2).

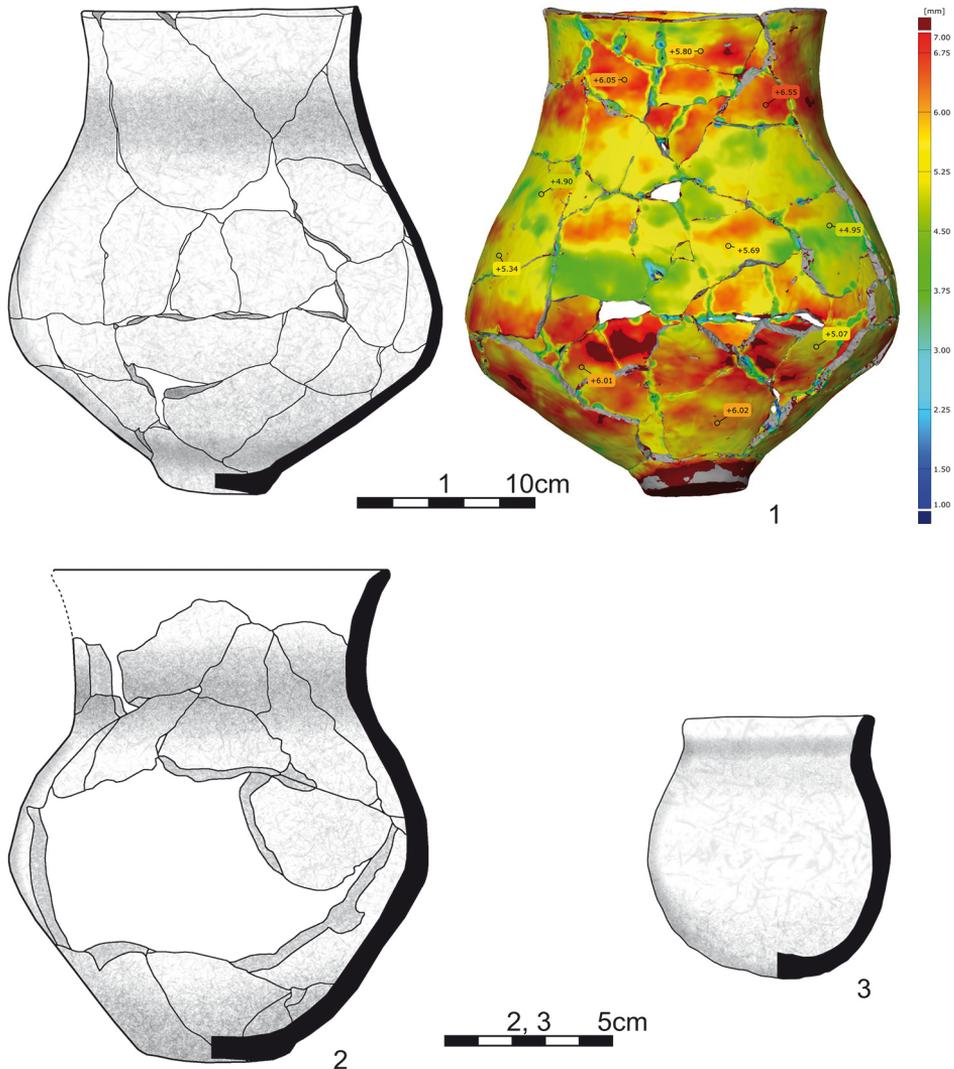


Fig. 4. Orly, Site 4, Przemysł District. Grave goods from the niche grave No. 15/2023. 1-2 – beakers; 3 – miniature beaker. Draw by M. Głowacz and K. Orczyk; 3D scan by P. Maruszczak

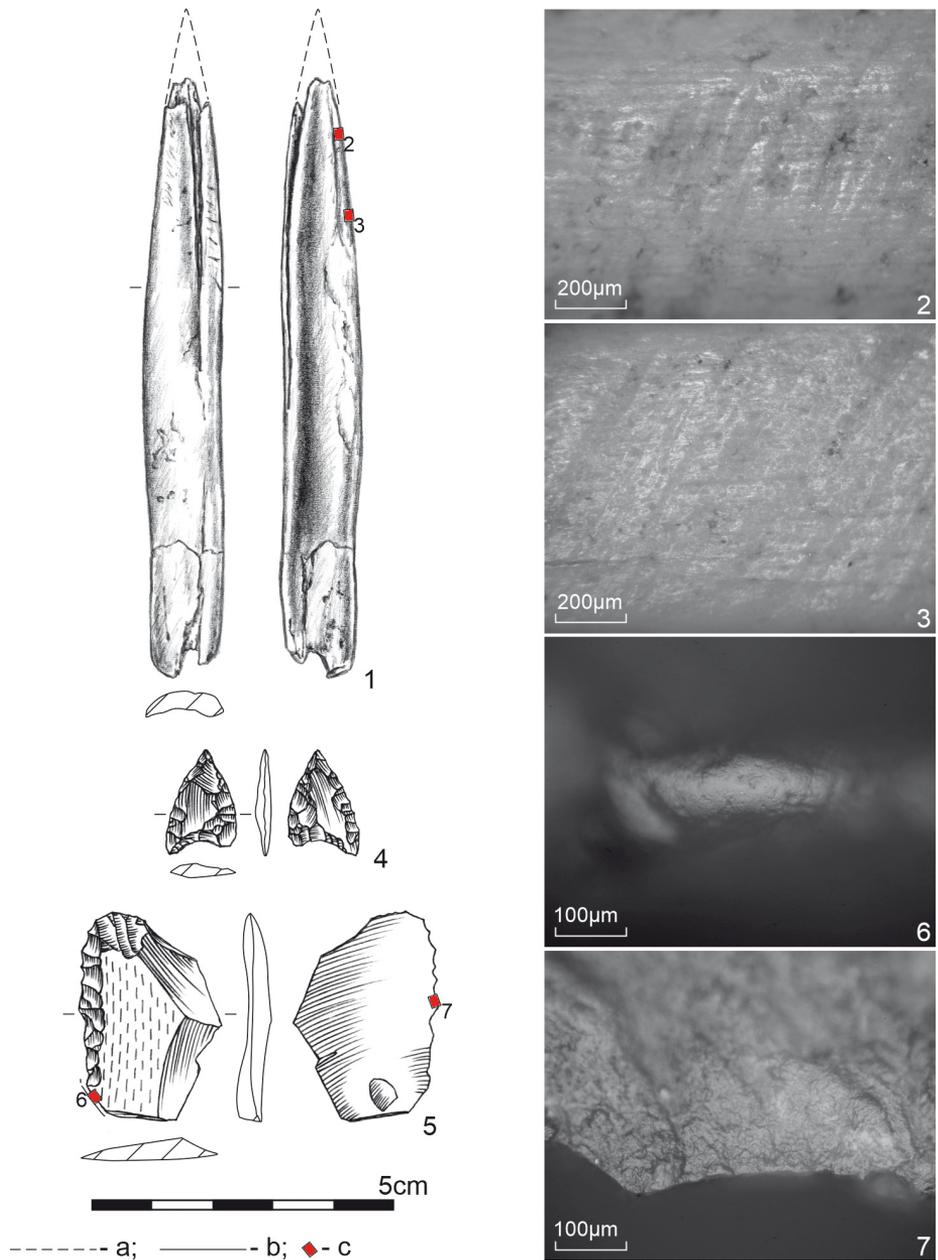


Fig. 5. Orły, Site 4, Przemysł District. Grave goods from the niche grave No. 15/2023. 1 – awl; 2, 3 – technological traces visible on the awl; 4 – arrowhead; 5 – side scraper; 6 – processing wood, plants, or (less likely) soft bone/antler; 7 – natural surface of flint. a – tool reconstruction; b – use-wear traces; c – place where photograph was taken, the number indicates the photograph's number in the figure.

Draw by A. Jączek and P. Mączyński; Photo by P. Mączyński

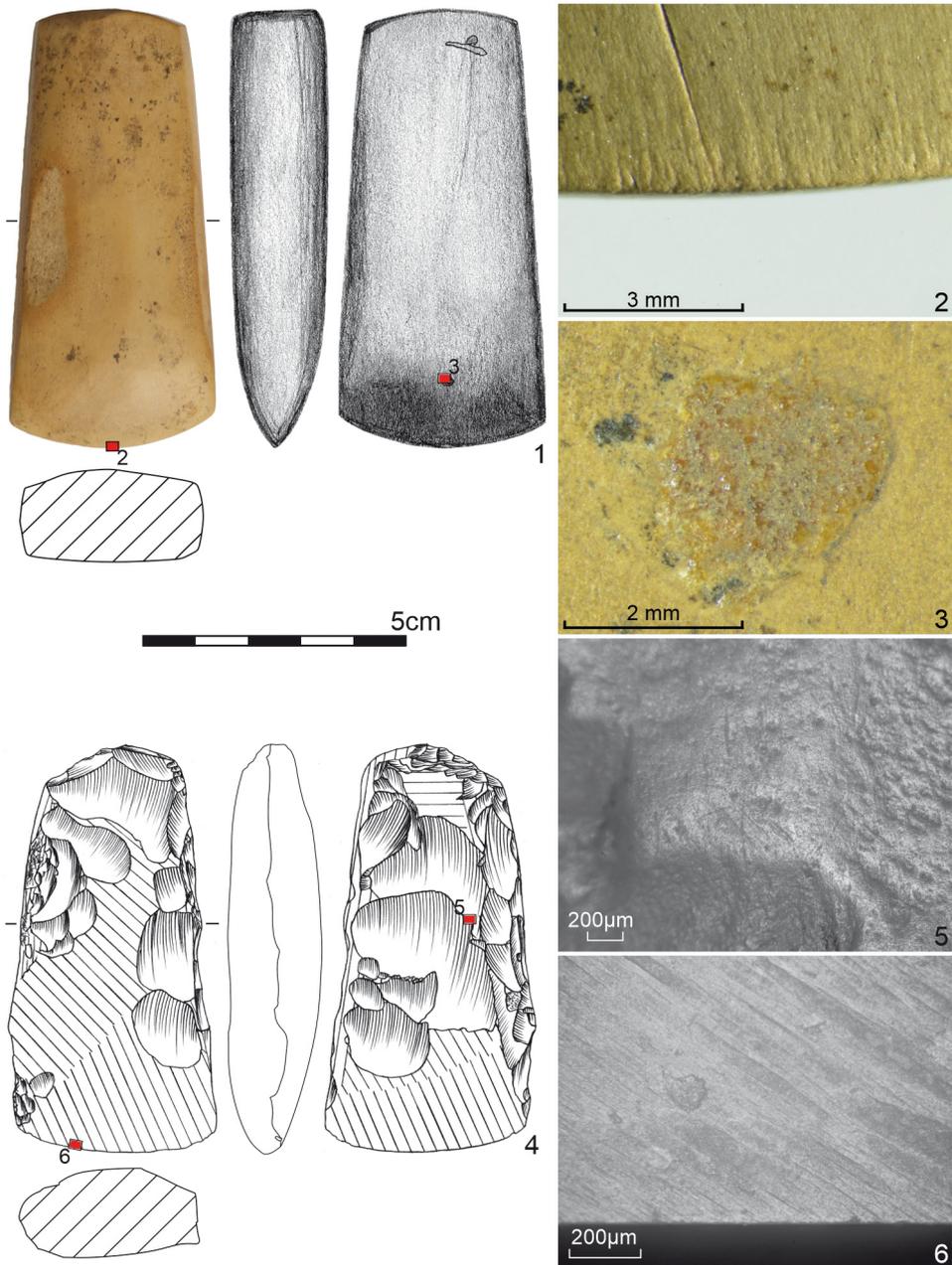


Fig. 6. Orły, Site 4, Przemysł District. Grave goods from the niche grave No. 15/2023. 1 – stone axe; 2 – traces of unknown origin visible on the axe blade; 3 – residual substance; 4 – flint axe; 5 – hafting traces; 6 – traces of sharpening. Draw and photo by P. Mączyński

Beaker No. 3

A miniature fully preserved beaker with a slightly flattened base and an oval belly that transitions smoothly into a subtly defined neck, which minimally flares outward with a straight rim. The vessel was made of lean clay with a small amount of mica and a slight temper of ceramic grog. Its yellow-brown surface is partially smoothed but remains uneven and floury in texture. Dimensions: height – 8 cm, rim diameter – 5 cm, belly diameter – 7 cm, wall thickness – rarely exceeds 4-5 mm; however, in some places, it exceeds 6 mm (Fig. 4: 3).

Arrowhead

Triangular arrowhead with notched base. Raw material: Cretaceous flint (erratic?). Dimensions: 18×11×3 mm, weight: 0.5 g (Fig. 5: 4).

Side scraper

Made on a flake with an aeolian surface on the upper side. Raw material: unspecified type of flint (erratic?). Dimensions: 36×23×4 mm, weight: 3.5 g (Fig. 5: 5).

Axe No. 1

Trihedral axe, trapezoidal in the face view, with rounded butt and arched cutting edge; lenticular in longitudinal section; irregular in cross-section; polished only in the bottom part and on lateral edges; raw material: Volhynian flint. Dimensions: 79×39×17 mm, weight: 76 g (Fig. 6: 4).

Axe No. 2

Tetrahedral axe, trapezoidal in the face view; with arched cutting edge; wedge-shaped in longitudinal section; rectangular in cross-section. Polished on the entire surface. Raw material: chert or hornstone. Dimensions: 85×49×19 mm, weight: 90 g (Fig. 6: 1).

Bone awl

Made of a fragment of a split bone shaft, most likely from a sheep or goat; the tip was made with the use of polishing. Dimensions: 102×13×5 mm, weight: 3 g (Fig. 5: 1).

ANTHROPOLOGICAL ANALYSIS

The anthropological analysis of the two discovered skeletons was performed using classical, macroscopic research methods (Buikstra and Ubelaker 1994; Bass 2005; White and Folkens 2005). A significant limitation in the information obtained and in the final determinations is the state of preservation of the remains. In these particular cases, the skulls were incompletely preserved, almost without viscerocranium, but with dentition. Postcranial skeletal remains are fragmentary, represented mainly by poorly preserved pieces of long bone shafts. Age at death was determined based on the degree of wear of the dental crowns as well as the degree of obliteration of the cranial sutures. Sex was based on the morphology of the mandible, frontal bone, occipital squama, and the size of the mastoid process of the temporal bone. Unfortunately, the pelvic bones, of which only frag-

ments remain, were not useful in this regard. The measurements taken of the bones primarily reflect their state of preservation.

Individual No. 1

Maturus (?), male

The skull is mainly the calvarium (Fig. 7: 1-3). A small fragment of the right and left parts of the frontal bone, with the *bregma* point visible. Parietal bones damaged laterally; also present is a transverse fracture running through the sagittal suture – a highly probable perimortem cranial injury. Fragment of occipital squama with fragment of left parietal bone and the mastoid part of the left temporal bone (fused/connected? during analysis with parietal bones). Very prominent upper nuchal crest, marked external occipital protuberance (Fig. 7: 3), mastoid process long. In addition, three fragments of the calvarium. Bone loss in the region of the *lambda* point and right side, from which fractures begin, on the right side under and parallel to the sagittal suture, as well as two in the downward direction forming a triangle. Cranial sutures – coronal open, sagittal obliterated in S3, and its remnants obliterated partially, the lambdoid suture closed in L1, whereas in L2, L3 obliteration in progression.

In terms of the facial part, a fragment of the alveolar process of the right maxilla, mandible and dentition are preserved (Fig. 7: 1, 4). The mandible has a broken body between the right canine and lateral incisor; height at the canine 27 mm; prominent mental protuberance. Preserved right ramus with partially damaged processes. The left part of the mandible is essentially teeth stuck in a lump of earth with bone crumbs.

Table 1. Permanent teeth (showing wear): po – *postmortem* loss, ? – it is not known whether it was formed, u – unformed

8	7	6	5	-	-	-	-	-	-	-	-	-	-	-	?
u	7	6	5	4	3	po	po	-	-	-	-	-	6	7	u

Postcranial skeleton poorly preserved, incomplete, bones fragmentary (Fig. 7: 1), no signs of perimortem injuries. Vertebrae represent a bone conglomerate of two body fragments, in addition, three fragments of vertebral body from the thoracic or lumbar region. A fragment of the first rib and a fraction of a shaft are present. Preserved fragment of the right scapula including a sculptured infraspinous fossa, lateral border and part of the glenoid cavity. The sternum, clavicles are missing. Four fragments of the ilium bone were separated. Fragments remained of the long bones of the upper limbs, as well as of the lower limbs. From the left humerus is a fragment of the shaft, 92 mm long. From the right humerus, apart from small pieces, two longer fragments of the shaft (in longitudinal section) are present, that is a fragment with the head 157 mm long and a fragment of the lower half 153 mm long. The bones of the left forearm are small, brittle fragments connected to a lump of earth.



Fig. 7. Orły, Site 4. Przemysł District. Human remains from the niche grave No. 15/2023. Individual No. 1, male, *Maturus* (?). 1 – preserved bones; 2 – calvarium; 3 – calvarium, view of the occipital squama, prominent superior nuchal line and external occipital protuberance; 4 – maxilla and mandible with teeth.
Photo by J. Rogóż

Two shaft fragments of 120 mm and 85 mm in length remained from the left femur, while several fragments of 183 mm, 84 mm, 80 mm, and 77 mm in length remained from the right femur. Preservation of two tibias – from one three adjacent shaft fragments of 139 mm, 113 mm, 92 mm in length, and the other two shaft fragments of 91 mm and 45 mm in length. In addition, three fragments of fibula shafts, 59 mm, 55 mm, and 26 mm long. The bones of the hands and feet, patellae, are missing. To the skull and each of the long bones, the presence of small bone fragments should be added.

Individual No. 2

Adultus, male

The skull consists mainly of a damaged calvarium (Fig. 8: 1, 2), where no perimortem injuries were clearly detected on macroscopic examination. The right orbital area had white margins of *postmortem* damage. Frontal bone and parietal fragments are present. Coronal suture visible and open; glabella prominent, upper edge of the left eye socket rounded, right eye socket damaged, nasal bones also damaged (Fig. 8: 1-2). From the facial part, a fragment of the alveolar process of the left maxilla with teeth and the mandible with teeth has been preserved. This one has a massive, high body (33 mm), with a marked mental protuberance and mental triangle (Fig. 8: 1, 3). Preserved from the right lateral incisor through the entire left part, up to the separated ramus. The coronoid process is present, but the condylar process is absent. A fragment of the right part of the body remained separately, from the right first premolar to the obliterated socket of the second molar. The edges of the mandibular fragments are white, indicating their *postmortem* origin. Their perimortem origin cannot be confirmed.

Table 2. Permanent teeth (slightly worn): po – *postmortem* loss, r – only root present, obl – loss and obliteration of the socket, ? – it is not known whether it was formed, u – unformed; teeth of the right maxilla loose

?	7/8?	6	5	4	3	2	1	r	r	3	4	5	6	7	8
?	obl	6	r	4	po	2	r	r	2	3	4	5	6	7	u

The bones of the postcranial skeleton are represented selectively and fragmentarily (Fig. 8: 1). No perimortem injuries were observed. Together with the right upper limb, a fragment of the clavicle shaft (right?) was collected, with a total length of 66 mm, but broken into two parts. Fragments of the scapula. Long bones of the upper and lower limbs. There are four adjacent shaft fragments from the left humerus, length 227 mm, and from the right bone – three shaft fragments, length 130 mm. Bones of forearms and hands not preserved. The femurs are – on the left side, two fragments of the shaft, 181 mm and 154 mm long, on the right side, two fragments with a total length of 133 mm and two further fragments, each 63 mm long. A relatively well-preserved fragment of the shaft of the left tibia, in two pieces with a total length of 242 mm, with a visible nutrient foramen, and another,



Fig. 8. Orły, Site 4. Przemyśl District. Human remains from the niche grave No. 15/2023. Individual No. 2, male, *Adultus*. 1 – preserved bones; 2 – calvarium, frontal view, prominent glabella and eyebrow arch; 3 – mandible with teeth, visible morphology of the mental protuberance and the degree of dental crown wear. Photo by J. Rogóż

larger fragment of the shaft, 85 mm long. A larger fragment of the shaft, 56 mm long, remained from the right tibia. Additionally, there are small fragments of the shaft of the left fibula and fragments of the right bone. Two bones of the right foot are present, that is the second or third metatarsal bone, without the head, and the proximal phalanx. The presence of small bone fragments should be added to the skull and each of the long bones.

USE-WEAR ANALYSIS

The analysis of the use-wear traces recorded on the flint artefacts and the bone awl was conducted using two types of microscopes. In the initial phase, a stereoscopic Zeiss SteREO Discovery.V8 microscope was employed, which provided real magnification ranging from 10 to 80×. This microscope was equipped with a dedicated cold LED light source. During the first observation phase, the focus was on distinguishing potential working edges and determining their locations (Van Gijn 1989, 13). The artefacts were analysed at magnifications ranging from 10 to 40×. The next step involved using a Meiji Techno MC-50T metallographic microscope, which allowed for higher magnifications ranging from 50 to 500×. However, the flint artefacts were analysed at magnifications of 50×, 100×, and 200×. The obtained images enabled the determination of the nature of use-wear sheen and linear traces (D'Errico *et al.* 1984; Olsen 1984; Vaughan 1985, 5, 6, 10; Van Gijn 1989, 12; Małecka-Kukawka 2001, 22-23; Osipowicz 2010, 23-25; Orłowska *et al.* 2022).

All flint tools and the bone awl were subjected to microscopic analysis. The set of flint artefacts consists of four tools: a side scraper (unspecified type of siliceous material), a triangular arrowhead with a notched base (erratic flint?), a trihedral axe (Volhynian flint), and a tetrahedral axe (chert/hornstone?).

Use-wear traces were recorded on two of the three flint artefacts (Figs 5: 5 and 6: 4). The axe showed distinct traces resulting from hafting. The extent of these traces indicates that at least two-thirds of the tool was covered during use (Fig. 6: 5). Interestingly, no wear patterns were observed on the cutting edge (Fig. 6: 6). On the other hand, the polish was very distinct, which may suggest that the artefact was sharpened before being deposited in the grave.

Traces of similar preparatory procedures were also recorded on the side scraper (Fig. 5: 5). In this case, 'sharpening' involved covering the edge with flat, regular retouch. This interpretation is supported by the complete absence of use-wear traces on the tool's surface. Fortunately, the retouch did not cover the entire edge, allowing us to observe use-wear traces on a small section. These patterns were probably formed before the retouching occurred. Their characteristics suggest that the tool was used in processing materials rich in silica, such as plants, or possibly wood or soft bone, although the latter is less likely (Fig. 5: 6, 7). The final flint tool, the arrowhead, showed no use-wear traces (Fig. 5: 4).

One of the most intriguing tools discovered near Individual No. 1 is the axe made of a sedimentary rock, possibly chert or hornstone (Fig. 6: 1). This material is relatively soft, as indicated by the fact that the entire surface of the artefact, including the butt, was polished – an unusual feature for flint tools produced by the CWC community (*cf.*, Libera 2022). The most notable features were observed on the cutting edge, including rounding of the edge and linear traces. These patterns probably resulted from contact with a soft material. At this stage of research, it is difficult to conclusively determine whether these are use-wear traces or marks formed during the tool's shaping process (Fig. 6: 2). The latter interpretation is supported by the presence of similar patterns on other parts of the tool, such as the butt, though these are less distinct. Additionally, traces of a residual substance were found on the lower part of the axe, but due to the methods used, it was not identified (Fig. 6: 3).

The awl, made from the shaft of a split bone, was also analysed (Fig. 5: 1). The tip of this specimen, which probably served as the working edge, was damaged. Furthermore, the specimen's surface had been significantly altered by post-depositional processes. These factors greatly limited the possibility of conducting further analyses, which were restricted to identifying technological traces related to the production of the awl (Fig. 5: 2, 3). The only patterns observed were polishing scratches, visible on the lower side and the working edge. The tool was polished obliquely to its main axis. The artefact exhibits rounded edges and protruding points, and at least some of these features may have resulted from prolonged contact with wrapping or human handling during use.

ORŁY, SITE 4 IN THE CONTEXT OF THE CWC

The niche grave at Orły, Site 4, offers new insights into the burial practices of Final Eneolithic CWC communities in the Subcarpathian loess region. To date, several cemeteries within a 10 km radius of this site have been identified and excavated (Fig. 1). Among them are Skołoszów, Site 7 (Rybicka *et al.* 2017), as well as Sites 11, 15, and 20 at Święte (Dobrakowska and Włodarczak 2018; Janczewski *et al.* 2018; Olszewski and Włodarczak 2018), which were discovered during rescue excavations conducted prior to the construction of the A4 highway. These cemeteries are situated 4 to 6 km north and northeast of Orły, Site 4. The local funerary landscape is further enriched by three additional sites: Orzechowce, Skołoszów, Site 16, and Żurawica, Site 12. The first is known primarily from archival records, documenting the accidental discovery of a CWC grave during the construction of a defensive fort in the late 19th century (Demetrykiewicz 1898, 81-83). The latter two sites represent the most recent fieldwork conducted in 2023-2024.

Looking northwest, deep into the loess-covered Rzeszów Foothills, it is also important to highlight other significant burial sites (Fig. 1). For instance, about 12 km from Orły, Site 4, in Cieszacin Wielki, Site 37 and Morawsko, Site 8, numerous CWC barrows have been

documented (Machnik 1995; Poradyło and Kostek 2000; Łanczont *et al.* 2001a; 2023). Further northwest, more than 20 km from the analysed site, several noteworthy CWC cemeteries have been excavated, yielding exceptional data on ritual and ceremonial practices in the 3rd millennium BC. This group includes, among other sites, Szczytna, Sites 5 and 6 (Hozer *et al.* 2017), and Mirocin, Sites 24 and 27 (Machnik *et al.* 2019).

How does the discovery at Orły, Site 4, compare to other CWC burial sites? Drawing on insights from previous ‘highway’ excavations, it is plausible to consider that the uncovered grave may form part of a larger funerary complex. For instance, the nearby cemetery at Święte, Site 11, has yielded a total of 11 CWC graves (Olszewski and Włodarczak 2018, 9, fig. 2), while a slightly smaller number – nine graves – were found at Święte, Site 15, located less than 1 km away (Janczewski *et al.* 2018, 96, fig. 2). Comparable burial patterns have also emerged from other sites, such as Szczytna, Site 6, and Mirocin, Site 24, where seven and five graves were uncovered, respectively (Hozer *et al.* 2017, 104, fig. 51; Machnik *et al.* 2019, 14, fig. 3).

When discussing the arrangement of CWC cemeteries with niche graves, it is essential to consider the fact that such funerary structures sometimes appeared in association with barrows – either cut into the mounds or situated nearby (*e.g.*, Włodarczak 2006). In the Subcarpathian loess region, this pattern is well-represented at Szczytna, Site 6 (Hozer *et al.* 2017, 104, fig. 51). However, there are also burial sites where no direct evidence of barrows has been recorded, such as at Święte, Site 11 (Olszewski and Włodarczak 2018, 53, 54). Could similar structures have originally existed at Orły, Site 4? Given the minimal scope of excavation work at the site thus far, it is not possible to answer this question at present.

At this point, it is appropriate to focus more closely on the niche grave itself. Burial structures of this type display notable morphological variation at the regional level (Włodarczak 2006; Machnik *et al.* 2009). At Orły, Site 4, the burial niche is well preserved, enabling examination of its constructional details. As previously noted, the niche was filled with dark sediment, interspersed with layers of dislodged yellow loess. At the same time, the entrance pit contained a lighter grey-yellow fill (Fig. 3: 1). The clear boundary between these two layers (indicating the physical separation of the spaces) evokes comparisons with, for example, Grave No. 405A at Święte, Site 15 (Janczewski *et al.* 2018, 102, fig. 7) and Grave No. 360 at Mirocin, Site 27 (Machnik *et al.* 2019, 92, photo 28). Additional parallels can be drawn with other construction details. In both Orły, Site 4, and Mirocin, Sites 24 and 27, Szczytna, Sites 5 and 6, Skołoszów, Site 7, and Święte, Sites 11 and 15, the bottoms of the burial niches were positioned nearly level with the bottoms of the entrance pits, typically just a few centimetres lower, occasionally slightly more. This arrangement suggests a connection between the niches and the entrance pits through a horizontal, or possibly slightly diagonal, corridor (*e.g.*, Hozer *et al.* 2017, 75; Rybicka *et al.* 2017; Janczewski *et al.* 2018; Olszewski and Włodarczak 2018, 55; Machnik *et al.* 2019, 83). Outside the Subcarpathian loess region, this construction trait is also observed in the Sokal Ridge area, part of the western Volhynian Upland (*e.g.*, Machnik *et al.* 2009). The burial feature at Hubinek,

Site 4, stands out in this area as the most comparable to the one at Orły, Site 4, with both sites sharing a similarly domed structure for the niche vaults (Fig. 3: 1; Bagińska 1998, 71, fig. 2: a). In contrast, distinct burial constructions were identified in the Kraków-Sandomierz CWC group, where numerous burial niches were positioned much lower than the bottoms of the entrance pits (*e.g.*, Tunia 1979, 55, fig. 6; 1997, figs 5-7; Włodarczak 2006; Jarosz *et al.* 2009, 184, fig. 11).

The feature No. 15/2023 at Orły, Site 4, belongs to the category of double burials. According to the anthropological analysis, the remains of both individuals were those of men of *Maturus* (?) and *Adultus* age. This is relevant, as in the CWC tradition, men were most often buried in a flexed position on their right side (Włodarczak 2006). In the niche grave in question, Individual No. 1 lay on his right side, while the second lay on his left (Fig. 3: 2-4). The left-side position was characteristic of female burials, although there were some deviations from this pattern, which were not uncommon (Włodarczak 2006). These exceptions occurred when the individuals were buried with their legs facing each other and their faces turned towards the entrance of the niche. If they were of the same sex, the standard orientation rule could not be applied. Arrangements of this kind are known from niche grave No. 4 at Łubcze, Site 25 (Koman 1999, 52, fig. 8). This is exactly the case at Orły, Site 4, where the faces of the individuals were turned east and southeast, directly towards the entrance pit (Fig. 3: 2). The remains of both individuals show no signs of post-mortem manipulation, such as displacement to create additional space within the niche. They are neither disarticulated nor arranged in any form of a stack. This distinguishes them from, for example, the double burial No. 220 at Szczytna, Site 5, where the remains of two male individuals were identified within a slightly larger niche, *i.e.*, 320 × 250 cm (Hozer *et al.* 2017, 22, fig. 11). According to the funerary site's researchers, the disarticulated and repositioned remains may reflect ritual practices (Hozer *et al.* 2017, 24).

The assortment and arrangement of grave goods within the niche construction at Orły, Site 4, follows a pattern typical of the CWC (Włodarczak 2006, 69, 70, figs 38, 39). As previously highlighted, the largest beaker (No. 1) was placed near the lower limbs of Individual No. 1, while the miniature vessel (No. 3) was positioned behind his pelvis. Another beaker (No. 2) was found at the level of Individual No. 2's pelvis (Fig. 3: 2-4). Both S-profiled 'normal-size' vessels (Nos. 1 and 2) morphologically align with the widely represented PIV type of beakers (Machnik 1966, 27, 28; Włodarczak 2006, 14, 223-227, plates 2-5). Due to their specific characteristics (Beaker No. 1) and/or state of preservation (Beaker No. 2), it is, however, not possible to definitively assign them to a more narrowly defined category.

Overall, a relatively large number of IV type beakers have been identified in various niche graves in the Subcarpathian loess region. Among them, the undecorated beaker, distinguished by a distinctly defined base, discovered in burial feature No. 431A at Święte, Site 15, is particularly noteworthy (Janczewski *et al.* 2018, 121, fig. 25: 2). Due to its smaller rim width compared to the maximum belly width and the presence of the mentioned base, it is more similar to Beaker No. 1 (Fig. 4: 1, 2). Additionally, S-profiled beakers with

decorative elements have been identified within the Święte burial complex. For instance, a beaker from Grave No. 751 at Święte, Site 11, features sparsely placed incisions on the neck and upper belly, forming a distinctive herringbone pattern (Olszewski and Włodarczak 2018, 11, fig. 3: 1). In contrast, vessels from Grave No. 173 at Święte, Site 15 (Janczewski *et al.* 2018, 99, fig. 4: 1), and Grave No. 43 at Święte, Site 20 (Dobrakowska and Włodarczak 2018, 148, fig. 6: 1, 2), were adorned with cord impressions. The Type IV beakers were also recorded in the context of niche constructions at Szczytna, Sites 5 and 6 (Hozer *et al.* 2017, 85, fig. 43) and Miocin, Sites 24 and 27 (Machnik *et al.* 2019, 95, fig. 54). Similar to the cemeteries in Święte, their proportions differ from the beakers identified at Orły, Site 4 (Fig. 4: 1, 2). Some of them, however, were also undecorated. This group is represented, for example, by a small vessel from Grave No. 220 in Szczytna, Site 5 (Hozer *et al.* 2017, 25, fig. 12: 6), as well as relatively slender ones from Grave No. 396 at Miocin, Site 27 (Machnik *et al.* 2019, 81, fig. 48). Certain types of similarities to Beaker No. 1 can also be observed beyond the Subcarpathian zone, particularly in the Roztocze region. A noteworthy example is the beaker from niche grave No. 7 at Wierszczyca, Site 31, on the Sokal Ridge, which also lacks the characteristic ornamentation of the CWC (Machnik *et al.* 2009, 163, fig. 128: 1).

The third vessel, a miniature beaker (No. 3) (Fig. 4: 4), belongs to a category of forms recorded at other funerary sites within the CWC 'world' (Włodarczak 2006, 243, plate 21). On the Subcarpathian loess plateau, they were discovered, for example, in Grave No. 273 at Miocin, Site 27 (Machnik *et al.* 2019, 60, fig. 33: 1) and in burial feature No. 220 at Szczytna, Site 5 (Hozer *et al.* 2017, fig. 12: 1, 6). The vessel morphologically most similar to the one under analysis appears to be the small beaker, decorated with uneven, incised vertical lines and vertical incisions, from niche grave No. 173 at Święte, Site 15 (Janczewski *et al.* 2018, 99, fig. 2: 2)

The flint artefacts were found in proximity to the two buried individuals. Both axes and the side scraper were associated with Individual No. 1 (Fig. 4: 2-4). The triangular arrowhead, on the other hand, was located near the pelvis of Individual No. 2. This artefact is probably part of the grave inventory; however, there remains a possibility that the arrowhead may have been the cause of the man's death (Borkowski and Kowalewski 2021). The general stylistic and metric features of the discussed tools are consistent with those of artefacts found in graves attributed to the Corded Ware culture across the Subcarpathian loess region (Libera 2022, 102-110). The set of tools discovered near Individual No. 1 warrants further discussion. Despite their modest number, these tools are notably significant and should be regarded as typical for the warriors of the CWC circle (Włodarczak 2006). Both axes are particularly interesting. The first one, made of Volhynian flint, is trihedral, slightly asymmetric, and stocky. One of its sides was shaped using picotage, which, together with the asymmetry of the sides, gives it a resemblance to a stone battle axe (*cf.*, Machnik 1966; Włodarczak 2006, 27, 28, 245, plate 23; Budziszewski and Włodarczak 2011; Libera 2016; 2022, 103-106). We can assume that it served a similar function. The other axe, made of a sedimentary rock – hornstone or chert – is a tetrahedral specimen,

polished on its entire surface. Such forms are typically found across the Subcarpathian loess region. However, they are rare in other areas, so their presence should be interpreted as part of the local cultural tradition (Libera 2022, figs 47 and 48). It is worth noting that the specimen from Orły was more precisely shaped than similar tools from the region. It was probably an equivalent of a symmetric flint axe.

Recent years have seen an increase in analyses of use-wear traces on flint materials from CWC-associated funerary features. These analyses have primarily been conducted on inventories discovered across the Sandomierz Upland (Winiarska-Kabacińska 2019; Libera and Mączyński 2024) and the eastern Lublin Region (Pyżewicz 2017; Osipowicz 2022). Previously, such analyses had not been performed on artefacts from the Subcarpathian loess region. However, the artefacts from Orły, Site 4, suggest that this could be an interesting research avenue. The elements of the grave goods deposited near Individual No. 1 appear to have been specifically prepared. The flint tools placed beside the buried man (the side scraper and dihedral axe) were 'sharpened' through retouch or edge polishing. These were accompanied by a stone axe that was unsuitable for processing wood due to the material used in its production, suggesting it might have been created specifically as a grave good (Libera 2022, 117, figs 47 and 48).

CHRONOLOGICAL ISSUES

An essential aspect of the present study is chronology. Due to poor preservation of the human remains, which prevented collagen extraction, radiocarbon dating could not be performed on either individual. Consequently, we are unable to determine, at the radiometric level, which of them was interred first. Other factors also preclude such an assessment, particularly the absence of any traces of *postmortem* interventions, such as the displacement of one individual's remains to make room for another. The typochronological characteristics of the grave goods accompanying the buried individuals (Figs 4-6) do not seem to allow for such precise chronological differentiation of burials within the same niche. It is essentially possible only to outline a general time frame for at least one of the burials, based on the radiocarbon date obtained from an animal bone found near the western wall of the niche, behind the pelvis of Individual No. 1 (Fig. 3: 2). This date is FTMC-DV47-6: 3996 ± 36 , i.e., 2568 -2470 BC (1 σ) and 2624 -2410 BC (2 σ), respectively (Fig. 9). Assuming that the animal bone was part of the grave goods associated with this particular *Maturus* (?) man, it is plausible that the obtained date corresponds to the time of his burial. On the other hand, considering the overall spatial organisation within the niche grave (Fig. 3: 2), it may be inferred that both individuals were buried either within a very short time span or at least not significantly apart in time.

The obtained radiocarbon value aligns perfectly with the earlier phase of the nearby cemeteries at Święte, Sites 11 and 15, dated to 2575-2470 BC (Włodarczak 2018, 182). This

is represented, among others, by burial feature No. 431 at Święte, Site 15, in which, as previously mentioned, an unornamented S-profiled beaker was recorded (Janczewski *et al.* 2018, 121, fig. 25: 2). It also relatively matches the results of radiocarbon analyses for the grave at Szczytna, Site 6 (Hozer *et al.* 2017, 108, tab. 5; *cf.*, Włodarczak 2018, 187). However, it is older than the dates, for instance, from Święte, Site 20 (Włodarczak 2018, 180, table 1), and Skołoszów, Site 7 (Rybicka *et al.* 2017, 128, table 2), which fall within the general timeframe of the second phase of the cemeteries at Święte, Sites 11 and 15, *i.e.* 2434-2323 BC and 2454-2338 BC, respectively (Włodarczak 2018, 182). Broadly speaking, it aligns with an earlier stage of the later phase of the CWC, specifically the so-called niche grave phase in Lesser Poland (Włodarczak 2006; 2013; 2016; Jarosz and Włodarczak 2007).

As we have already highlighted, based on the results of 'highway' excavations, it is plausible to consider that the discovered Grave No. 15/2023 may form part of a larger funerary area. Therefore, this is most likely just a small piece of a potentially more complex chronological puzzle, similar to, for example, the cemetery at Święte, Site 11 (Włodarczak 2018, 181-183). These considerations are intriguing, especially in light of the previously discussed issue of the presence of both barrow and non-barrow burial sites in this area. Without resolving which category the Orły, Site 4 cemetery represents, it is impossible to determine whether the examined niche grave is related to the earliest phase of its use or not.

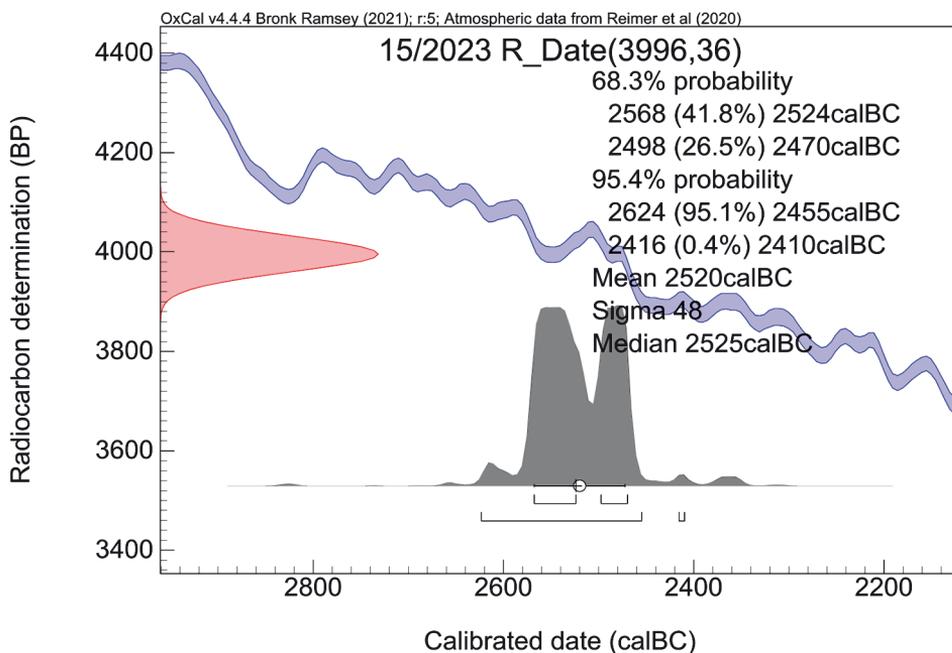


Fig. 9. Orły, Site 4, Przemysł District.

Probability distribution of radiocarbon date obtained for the niche grave No. 15/2023.

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CONCLUSIONS

The cemetery in Orły, Site 4, is another point on the map of the funerary landscape of the Corded Ware culture in the Subcarpathian loess region (Fig. 1). Although the previous small-scale fieldwork has led to the identification of only one niche grave (Fig. 3: 1-4), its quality and research value seem to provide an excellent starting point for initiating broader investigate work. The identification of a well-preserved niche, which has not completely collapsed but only suffered typical (inevitable) wall destruction, provides an opportunity to compare its specifics with those of other burial features from the Subcarpathian loess region, the Sokal Ridge, and the Małopolska Upland. This is a significant added value, considering that many such graves have not survived in good condition, and if they have, they are often explored in a less-than-optimal way due to their intricate structure.

The contents of the discovered burial feature No. 15/2023 are also interesting. It is essentially unprecedented to find exclusively unornamented vessels as grave goods in CWC niche graves. Although the two larger beakers and the miniature vessel (Fig. 4: 1-3) can be broadly compared to similar forms documented in this cultural context, they also exhibit distinctive characteristics. This is especially true for Beaker No. 1 (Fig. 4: 1). Cross-referencing this fact with absolute chronological data raises a legitimate question about the grave's chronological and spatial position within the entire cemetery and beyond. This becomes a significant challenge in the context of the very close proximity to the exceptional ritual complex in Święte (Sites 11, 15, and 20), as well as to the equally important cemetery in Skołoszów (Site 7). It appears that research at Orły, Site 4, could significantly contribute to studies on the 'Subcarpathian' populations of the Final Eneolithic in the 3rd Millennium BC, their intra-group relations, and intercultural connections. It is particularly significant given the fundamental fact that during that period this region functioned as a cultural borderland between Western and Eastern Europe (*e.g.*, Włodarczak and Koško 2018; Machnik 2019).

References

- Bagińska J. 1998. Badania kurhanu kultury ceramiki sznurowej na Grzędzie Sokalskiej w Hubinku, stan. 4, woj. zamojskie. *Archeologia Polski Środkowoschodniej* 3, 69-77.
- Bass M. W. 2005. *Human Osteology. A Laboratory and Field Manual*, 5th edition. Missouri Archaeological Society.
- Borkowski W. and Kowalewski M. 2021. 'Swoj' czy 'obcy'? Wybrane konteksty grocików krzemienych w zespołach grobowych. *Wiadomości Archeologiczne* 72, 107-116.
- Budziszewski J. and Włodarczak P. 2011. Die schnurkeramischen Beile aus den kleinpolnischen Gräbern. In H.-J. Beier, R. Einicke and E. Biermann (eds), *Dechsel, Axt, Beil & Co. – Werkzeug, Waffe, Kultgegenstand? Aktuelles aus der Neolithforschung (= Beiträge zur Ur- und Frühgeschichte Mitteleuropas* 63, *Varia Neolithica* 7). Langenweissbach: Beier & Beran, 55-64.

- Buikstra J. E. and Ubelaker D. H. 1994. *Standards for Data Collection from Human Skeletal Remains. Proceedings of a Seminar at the Field Museum of Natural History*. Arkansas Archaeological Survey Research Series 44.
- Demetrykiewicz W. 1898. Neolityczne groby szkieletów t.zw. siedzących (Hockergraber) w przemyśkiem i krakowskiem. *Materiały Antropologiczno-Archeologiczne i Etnograficzne* 3, 76-92.
- D'Errico F., Giacobini G., and Peuch P. F. 1984. Varnish replicas: a new method for the study of worked bone surfaces. *Ossa. International Journal of Skeletal Research* 9-11, 29-51.
- Dobrakowska T. and Włodarczak P. 2018. Święte 20: Graves of the Corded Ware Culture. *Baltic-Pontic Studies* 23, 140-162.
- Dobrzański B. and Zbysław B. 1955. Czarnoziemy na lessach Podkarpacia. *Annales UMCS E10*, 287-299.
- Gębica P. 2023. Prehistoric human influence on soil dynamics and slope transformation on the Subcarpathian Loess Plateau, southeastern Poland. *Geological Quarterly* 67, 55. <http://dx.doi.org/10.7306/gq.1732>
- Hozer M., Machnik J. and Bajda-Wesołowska A. 2017. Groby kultury ceramiki sznurowej i domniemane kultury mierzanowickiej w Szczytnej, pow. Jarosław – źródła, analiza, wnioski. In P. Jarosz and J. Machnik (eds), *Nekropolie ludności kultury ceramiki sznurowej z III tysiąclecia przed Chr. w Szczytnej na Wysoczyźnie Kańczuckiej (= Via Archaeologica Ressoviensia 12)*. Rzeszów: Fundacja Rzeszowskiego Ośrodka Archeologicznego, 5-130.
- Janczewski P., Kraus P. and Włodarczak P. 2018. Święte 15: Cemetery of the Corded Ware Culture. *Baltic-Pontic Studies* 23, 93-139.
- Jarosz P., Tunia K. and Włodarczak P. 2009. Burial Mound no. 2 in Małyce, the district of Kazimierza Wielka. *Sprawozdania Archeologiczne* 61, 175-231.
- Jarosz P. and Włodarczak P. 2007. Chronologia bezwzględna kultury ceramiki sznurowej w Polsce południowo-wschodniej oraz na Ukrainie. *Przegląd Archeologiczny* 55, 71-108.
- Koman W. 1999. Wyniki ratowniczych badań kurhanu nr 2 kultury ceramiki sznurowej w Łubczu na stan. 25, pow. Tomaszów Lubelski. *Archeologia Polski Środkowowschodniej* 4, 41-56.
- Kondracki J. 2002. *Geografia regionalna Polski*. Warszawa: Wydawnictwo Naukowe PAN.
- Kośko A. and Włodarczak P. 2018. A Final Eneolithic Research Inspirations: Subcarpathia Borderlands between Eastern and Western Europe. *Baltic-Pontic Studies* 23, 259-291.
- Król D. 2018. Studia nad osadnictwem kultury pucharów lejkowatych na lessach Podgórze Rzeszowskiego i Doliny Dolnego Sanu. *Materiały i Sprawozdania Rzeszowskiego Ośrodka Archeologicznego* 39, 39-55.
- Król D. and Niebieszczański J. 2019. Skołoszów 16 – A Spatial Arrangement of the Eneolithic Settlement of the Funnel Beaker Culture in the Rzeszów Foothills (South-Eastern Poland) in the Light of Previous Excavations and Geophysical Survey. *Interdisciplinaria Archaeologica* 10/2, 121-128.
- Libera J. 2016. Siedliska kultury ceramiki sznurowej z Wyżyny Lubelskiej – próba identyfikacji. In P. Jarosz, J. Libera and P. Włodarczak (eds), *Schylek neolitu na Wyżynie Lubelskiej*. Kraków: Instytut Archeologii i Etnologii Polskiej Akademii Nauk, 479-492.
- Libera J. 2022. Grobowe inwentarze kamienne ludności kultury ceramiki sznurowej w obszarze Małopolski. In A. Szczepanek, P. Jarosz, J. Libera and P. Włodarczak (eds), *Spoleczności schyłkowego*

- eneolitu w południowo-wschodniej Polsce w świetle badań archeologicznych i analiz interdyscyplinarnych*. Pętkowice, Kraków: Wydawnictwo Profil-Archeo, 45-212.
- Libera J. and Mączyński P. 2024. Flint arrowheads from assemblages of the Corded Ware culture: morphology and function – the example of the grave from Mydlów (Sandomierz Upland). *Sprawozdania Archeologiczne* 76/1, 555-582.
- Łanczont M., Nogaj-Chachaj J. and Klimek M. 2001a. Kolejny nowy kurhan w okolicach Cieszacina Wielkiego (w pobliżu Jarosławia). *Rocznik Przemyski* 37/1, 65-69.
- Łanczont M., Nogaj-Chachaj J. and Klimek M. 2001b. Potencjał środowiska naturalnego przykarpaciej wysoczyzny lessowej dla osadnictwa neolitycznego. In J. Gancarski (ed.), *Neolit i początki epoki brązu w Karpatach polskich*. Krosno: Muzeum Podkarpackie w Krośnie, 173-199.
- Łanczont M., Nogaj-Chachaj J., Żogała J. and Komar B. 2023. Inside and outside a burial mound: when, how and in what environment were the kurgans built by Late Neolithic communities on the Subcarpathian loess plateau (SE Poland)? *Geological Quarterly* 67(32). <https://doi.org/10.7306/gq.1702>
- Machnik J. 1966. *Studia nad kulturą ceramiki sznurowej w Małopolsce*. Wrocław, Warszawa, Kraków: Zakład Narodowy im. Ossolińskich.
- Machnik J. 1995. Zapomniany kurhan kultury ceramiki sznurowej w Morawsku koło Jarosławia. *Rocznik Przemyski* 31, 3-22.
- Machnik J. 2011. Znaczenie archeologicznych badań ratowniczych na trasie planowanej autostrady A4 na odcinku Przeworsk-Radymno dla znajomości problematyki schyłku neolitu i początków epoki brązu. In S. Czopek (ed.), *Autostradą w przeszłość*. Rzeszów: Muzeum Okręgowe w Rzeszowie, 61-78.
- Machnik 2019. Considerations on the state of the research on the Corded Ware culture in southeastern Poland and needs of studies on social structures of its communities. *Materiały i Sprawozdania Rzeszowskiego Ośrodka Archeologicznego* 40, 33-72.
- Machnik J., Bagińska J. and Koman W. 2009. *Neolityczne kurhany na Grzędzie Sokalskiej w świetle badań archeologicznych w latach 1988-2006*. Kraków: Polska Akademia Umiejętności.
- Machnik J., Jarosz P. and Mazurek M. 2019. Groby ludności kultury ceramiki sznurowej w Mirocinie, pow. Przeworsk. In P. Jarosz, J. Machnik and A. Szczepanek (eds), *Nekropola ludności kultury ceramiki sznurowej w Mirocinie na Wysoczyźnie Kańczuckiej (= Via Archaeologica Ressorovien-sia 15)*. Rzeszów: Fundacja Rzeszowskiego Ośrodka Archeologicznego, Instytut Archeologii Uniwersytetu Rzeszowskiego, 7-139.
- Małecka-Kukawka J. 2001. *Między formą a funkcją. Traseologia neolitycznych zabytków krzemien-nych z ziemi chełmińskiej*. Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika.
- Olsen S. L. 1984. Analytical Approaches to the Manufacture and Use of Bone Artifacts in Prehistory. PhD thesis. London: University of London.
- Olszewski A. and Włodarczak P. 2018. Święte 11: Cemetery of the Corded Ware Culture. *Baltic-Pontic Studies* 23, 7-68.
- Orłowska J., Cwiek M. and Osipowicz G. 2022. Was it ground? A closer look at various prehistoric bone grinding techniques – An experimental and traceological study. *Journal of Archaeological Science: Reports* 46, 103675. <https://doi.org/10.1016/j.jasrep.2022.103675>

- Osipowicz G. 2010. *Narzędzia krzemienne w epoce kamienia na ziemi chełmińskiej. Studium traseologiczne*. Toruń: Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika.
- Osipowicz G. 2022. Wyniki analizy traseologicznej wytworów krzemienych kultury ceramiki sznurowej ze stanowisk kurhanowych zlokalizowanych na Grzędzie Sokalskiej i Roztoczu. In A. Szczepanek, P. Jarosz, J. Libera and P. Włodarczak (eds), *Spoleczności schyłkowego eneolitu w południowo-wschodniej Polsce w świetle badań archeologicznych i analiz interdyscyplinarnych*. Pękowice, Kraków: Wydawnictwo Profil-Archeo, 213-262.
- Poradyło W. and Kostek A. 2000. Nowe kurhany w okolicy Jarosławia. *Rocznik Przemyski* 36/1, 119-125.
- Pyżewicz K. 2017. Use-wear analysis of flint artefacts from the barrows of the Corded Ware culture in Ulów. *Folia Quaternaria* 85, 117-134.
- Rybicka M., Głowacz M. and Król D. 2017. Datowanie radiowęglowe wielokulturowego stanowiska ze Skołoszowa, stanowisko 7, pow. jarosławski, woj. podkarpackie. In M. Rybicka (ed.), *Wielokulturowe cmentarzysko w Skołoszowie stanowisko 7 w kontekście osadnictwa z neolitu i wczesnej epoki brązu we wschodniej części Podgórze Rzeszowskiego*. Rzeszów: Uniwersytet Rzeszowski, 113-142.
- Solon J., Borzyszkowski J., Bidłasik M., Richling A., Badora K., Balon J., Brzezińska-Wójcik T., Chabudziński Ł., Dobrowolski R., Grzegorzczak I., Jodłowski M., Kistowski M., Kot R., Krąż P., Lechnio J., Macias A., Majchrowska A., Malinowska E., Migoń P., Myga-Piątek U., Nita J., Papińska E., Rodzik J., Strzyż M., Terpiłowski S., Ziaja W. and Paul J. 2018. Physico-geographical mesoregions of Poland: verification and adjustment of boundaries on the basis of contemporary spatial data. *Geographia Polonica* 91, 143-170.
- Tunia K. 1979. Cmentarzysko kultury ceramiki sznurowej w Koniuszy, woj. Kraków. *Sprawozdania Archeologiczne* 31, 47-75.
- Tunia K. 1997. Grób kultury ceramiki sznurowej w Krzyżu, woj. Kielce. *Sprawozdania Archeologiczne* 49, 181-190.
- Van Gijn A. L. 1989. *The wear and tear of flint. Principles of functional analysis applied to Dutch Neolithic assemblages* (= *Analecta Praehistorica Leidensia* 22). Leiden: Universiteit Leiden.
- Vaughan P. C. 1985. *Use-Wear Analysis of Flaked Stone Tools*. Tucson: The University of Arizona Press.
- White T. D. and Folkens P. A. 2005. *The Human Bone Manual*. Elsevier Academic Press.
- Winiarska-Kabacińska M. 2019. Analiza funkcjonalna zabytków kamiennych i kościanych. In P. Włodarczak (ed.), *Wilczyce, stanowisko 10. Norma i precedens w rytuale pogrzebowym małopolskiej kultury ceramiki sznurowej* (= *Ocalone Dziedzictwo Archeologiczne* 9). Kraków, Niepołomice, Pękowice: Wydawnictwo i Pracownia Archeologiczna Profil-Archeo, Stowarzyszenie Archeologów Terenowych 'Stater', Instytut Archeologii i Etnologii PAN, 89-102.
- Włodarczak P. 2006. *Kultura ceramiki sznurowej na Wyżynie Małopolskiej*. Kraków: Wydawnictwo Instytutu Archeologii i Etnologii PAN.
- Włodarczak P. 2013. Projekt badań chronologii absolutnej eneolitu i początków epoki brązu w Małopolsce. In I. Cheben and M. Sojak (eds), *Otázky neolitu a eneolitu našich krajín – 2010*. Nitra: Archeologické ústav Slovenskej akadémie vied, 373-387.

- Włodarczak P. 2016. Chronologia absolutna cmentarzysk późno- i schyłkowoneolitycznych na wyżynie Lubelskiej. In P. Jarosz, J. Libera, and P. Włodarczak (eds), *Schylek neolitu na Wyżynie Lubelskiej*. Kraków: Instytut Archeologii i Etnologii PAN, 537-548.
- Włodarczak P. 2018. Chronometry of the Final Eneolithic Cemeteries at Święte, Jarosław District, from the Perspective of Cultural Relations Among Lesser Poland, Podolia and the North-Western Black Sea Region. *Baltic-Pontic Studies* 23, 178-212.