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The first radiocarbon dates for the Globular Amphora culture cemetery in Sadowie in the Sandomierz Upland

Abstract

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The article presents new results of radiocarbon dating for the settlement of the Globular Amphora culture from the Sandomierz Upland area. These are three determinations obtained for animal graves (No. 4, 7 and 11) coming from the site 23 in Sadowie near Opatów, where traces of a vast cemetery were discovered. ^{14}C dating was established in the Poznań Radiocarbon Laboratory. The received values were verified by indicating diagnostic features in the composition of artefacts that are referenced in groups of other features of the Globular Amphora culture.

Keywords: Globular Amphora culture, Sandomierz Upland, radiocarbon dates

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Introduction

The chronology of the settlement of the Globular Amphora culture in the Sandomierz Upland has been the subject of scientific research since the 1960s. The issue related to periodization was discussed for the first time by Nosek in his monographic study of the discussed culture in the Lublin region, and then on the whole Polish lands (1954/55; 1967). Moreover, Wiślański also presented his remarks on the chronology presenting the studies on the Globular Amphora culture in north-western Poland (1966). At the beginning of the 1990s, Ścibior and Ścibior (1990; 1991) joined the discussion, while organizing information about the Globular Amphora culture in the Sandomierz Upland with reference to the studies of single funerary complexes. A little later, some determinations were obtained to establish the absolute chronology of the society of the Globular Amphora culture in the neighbouring areas (Kadrow and Szmyt 1996). At present, a serious barrier for the studies on the chronology of the Globular Amphora culture in the Sandomierz Upland is a small series of absolute dates, which would allow the presentation of a chron-

ological framework and identification of the stages of development. There are also no undisturbed deposits that could be valuable in the analysis of relative chronology. To date, there is only one, clear ^{14}C designation which has been obtained for the site 78 in Sandomierz (Ścibior and Ścibior 1990, 192).

During recent research on the newly discovered cemetery in Sadowie near Opatów, a series of absolute determinations were obtained for the late Neolithic graves. Three of them relate to graves No. 4, 7 and 11 which contain the animal remains of the Globular Amphora culture. The aim of this article is to publish the obtained ^{14}C dates and verify them in terms of the relative chronology.

Characteristics of the site

The archaeological site 23 is located on a plateau of one of the prominences of the Sandomierz Upland (height, 280 m above sea level; height difference 30 m; Kondracki 2002, 277–278), strongly separated from the surroundings and topographically exposed in the area (Fig. 1). From the south, it passes into a series

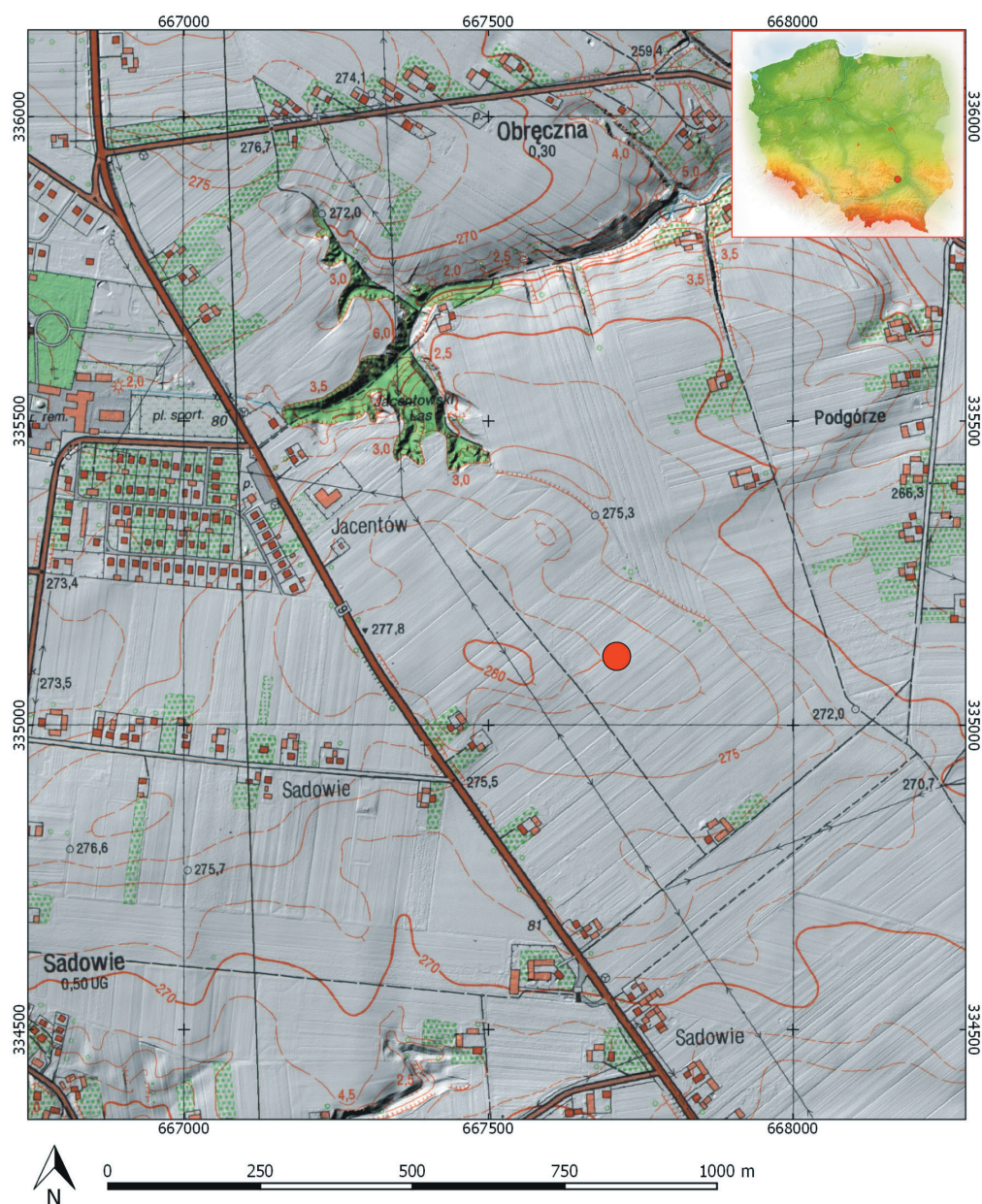


Fig. 1. Location of the site No. 23 in Sadowie, Opatów dist. (marked as a red point) on the background of the shaded terrain model and the 1: 10 000 map (prepared by M. Mackiewicz and B. Myślecki).

of flat and fragmented hills located at an altitude of about 250-220 m above sea level, drained by tributaries of the Przepaść stream (also known as Trębanówka or Obręczówka), located in the catchment of the Kamienna River. The part of the hill on the north-west side lowers with terraced slopes towards the Kamionka River. With reference to geomorphology, it is an area of a loess accumulation plain, developed during the Middle-Polish and North-Polish glaciations (Czarnecki 1996; Romanek 1994, 5-8). The surface of the area is heavily cut by deep gullies, often reaching below the hydro-glacial and glacial deposits, before the Quaternary (Dowgiałło 1974, 40). The hydro-

graphic network is most developed in the north-eastern part of the area around the site in Sadowie. The main rivers in the discussed area are the Opatówka, Kamienna and Kamionka, which drain water from the Jeleniowski Range to the south-east.

The soils in the site and its hinterland are relatively slightly diversified. Chernozem or brown soils predominate in the plateau zone, while deluvial and alluvial soils are common in the valleys. Their bedrock is mainly loess from the Vistula glaciation period and late Pleistocene sands, loams and silts (Romanek 1991). At present, these areas are heavily eroded and this is related to the intensive, destructive

slope processes as well as agricultural mechanization that mainly covers the plateau zones (see i.e. Mroczek 2018, 43-53; Pasieczna 2006). The soil profiles at the site are characterized by a high degree of disturbance by the leaching of calcium carbonate into the topsoil, subsoil and transitional levels up to the bedrock (up to a depth of almost 100 cm). Moreover, the area of cultivated fields is often subjected to chemical fertilization and plant protection products, which have a large impact on the state of preservation of the discovered material remains, mainly bone remains.

The cemetery is located within the archaeological site No. 23, discovered by M. Florek in 1996 and it has been known so far from the finds of ceramic materials typical of the Funnel Beaker culture. Since 2015, archaeological excavations have been carried there, during which two trenches with a total area of over 13 ares were established. It resulted in the discovery of a total of 25 Late Neolithic graves. Twenty-three of them belonged to the Globular Amphora culture, and the other two can be associated with the Złota culture (Fig. 2). The extent of the cemetery, with reference to the results of geomagnetic research, is about 20-25 ares and it covers a triangular-shaped space with a base length of about 70 m and a height of about 50 m (Mackiewicz *et al.* 2016). In addition to the Late Neolithic burials, two settlement pits, dated to the Early Bronze Age were discovered in the studied part of the site (most likely the Mierzanowice culture) as well as a communication trench from the Second World War. Apart from that, single culturally undefined features have also been uncovered.

The graves of the Globular Amphora culture that were discovered and examined in Sadowie included human and animal burials, both skeletal and cremation ones. They differed in shape, type of fill, type of stone structures and material remains. Human graves (total number 7) were burials in pits with additional construction elements, such as paving, stone cists or kerbs (Pasterkiewicz 2017, 283). Their interiors included collective human remains, as well as secondary deposited skeletons, often with missing bones or having been mixed up following ritual procedures. One of the unique discoveries has been made in the grave No. 10, which had the character of a "house for the dead" or might have been the remains of a funeral pyre. Animal burials (15 cases in total) were found most often in elongated pits with a rectangular outline. The arrangements of the skeletons were varied e.g., crouched position, antipodal, or only deposited fragments of animals. Burials included elements of stone structures in the form of paving or individual stone blocks

around some pits. The equipment found in graves, both human and animal, consisted mainly of vessels, often incomplete, affiliated to the Globular Amphora culture, flint artefacts such as punches and axes, and amber ornaments. In addition, a significant number of flint preforms were found and individual, badly damaged bone items (wild boar or pig's tusks). The layout of the discovered graves in the cemetery in Sadowie is arranged in certain regularities. There were animal graves in the vicinity of the human graves, containing individuals of different ages and species, ranging from one to three individuals. As for the uncovered area of the cemetery there were six such groups, arranged along the east-west (graves No. 1-2, 3-5), north-west-south-east (graves No. 7, 8?; 9, 10; 22, 11-13; 20-21; 19, 18 A, B, C) and north-south lines (No. 14 and 15; Pasterkiewicz 2017, 285). According to observations and analysis performed in other cemeteries, it can be assumed that the graves included in such clusters were simultaneous (e.g. Złota, Sandomierz dist., site "Gajowizna"; Krzak 1977, 66-67; Koszyce, Proszowice dist., site 3; Włodarczak and Przybyła 2013, 223). Due to the location of the cemetery in Sadowie, it can be included in the Kielce group of the Globular Amphora culture according to Nosek (1967, 340-346) or the Małopolska group included in the Polish group according to Wisłański's suggestions (1966, 88, 89). With reference to Włodarczak and Przybyła, this area is defined as the local Sandomierz-Opatów group (Włodarczak and Przybyła 2013, 233). Site No. 23 is also located within one of the largest clusters of settlement points of this culture, located in the loess of the Sandomierz Upland (Ścibior 1991, 57; Kowalewska-Marszałek 2019, 127-130).

In 2019, four samples from three animal burials - No. 4, 7 and 11 - were selected for research to perform in the Poznań Radiocarbon Laboratory. Establishing the radiocarbon dating was financed by the Institute of Archeology of the University of Rzeszów, for which I would like to express my sincere thanks to the Director at that time - dr hab. prof. UR A. Rozwałka. In the course of selecting them, some aspects were taken into account such as the burials containing well-preserved and complete bone remains as well as their location, i.e. their location in one of the grave clusters. They could help to trace the spatial development of the cemetery and to establish chronological relations between the various groups of graves. When qualifying, the presence of material remains with diagnostic features was also important, so that the results of dating could be confronted with stylistic analysis.



Fig. 2. Sadowie, Opatów dist., site 23. Plan of excavations, discovered features, their chronology and location of the graves determined by radiocarbon dating.

Description of the dated graves

Grave No. 4

At a depth of 30 cm from the ground level, the grave presented an oval-shaped outline with dimensions of 2.45×1.1 m, oriented with its longer axis in the north-west – south-east direction (Fig. 3: A). In its cross-section, it was rectangular in shape with a flat bottom, reaching up to 30 cm deep (Fig. 3: C). Its fill was homogeneous, consisting of layers of ordinary brown dust. Inside the burial pit there was a burial made up of at least three skeletons and possibly fragments of animals (Fig. 3: B). The bone material from the described graves was subjected to archaeozoological identifica-

tion by Dr M. Zabilska-Kunek. The central part included the remains of large cattle (No. 1), which consisted of the pelvic bone, vertebrae, mandible, fragments of the scapula and long bones. A little further to the east, there was a poorly preserved skeleton of a pig, most likely deposited on its left side (No. 3). More towards the eastern corner, there were bones belonging to another, smaller individual of cattle (No. 2): fragments of the mandible, skull, single vertebrae and scapula, and a few long bones. The remains of the animal were covered by blocks of stone, probably deposited in order to press the animal material. The grave inventory (an amphora) was located in the eastern part, in the vicinity to the skull of cattle No. 2 and it was broken, with its fragments scattered inside the grave.

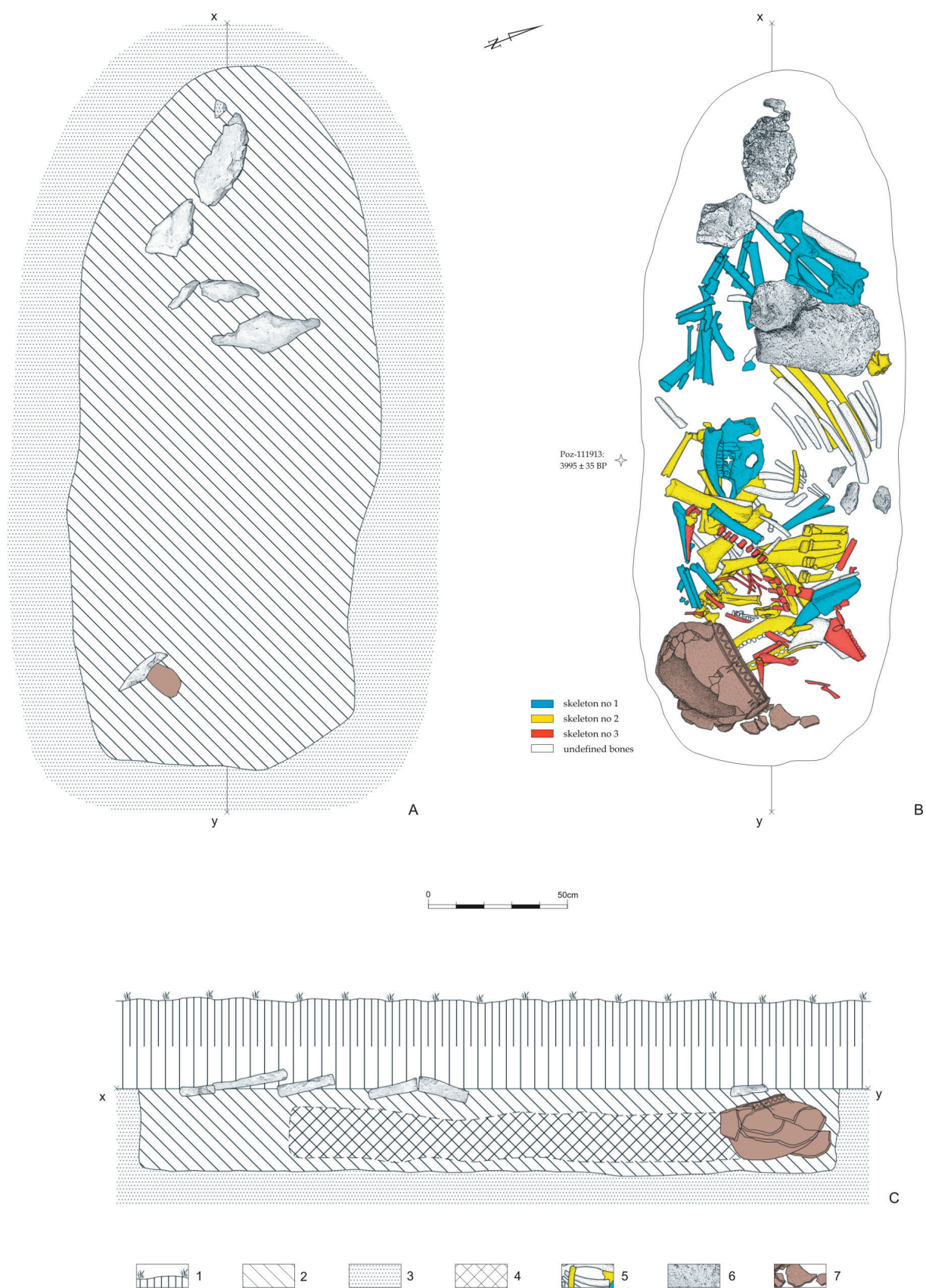


Fig. 3. Sadowie, Opatów dist., site 23. Documentation of the animal grave No. 4: A – plan view, profile of the burial pit, location of animal skeletons and inventory. The figure shows the ^{14}C date from the sample collected in the indicated place. Legend: 1 – surface layer; 2 – brown fills of feature; 3 – loess subsoil; 4, 5 – bone remains; 6 – stone; 7 – pottery vessel (drawn by A. Bardetsky)

Artefacts:

- 1) a pottery vessel – a large amphora (mass find No. 150/2019; Fig. 4) referring to the shape of the belly to some forms of vases and wide-mouth vessels type VII B1 according to the division of Wiślański (1966, 31, 32, data sheet V) and the so-called „barrel-shaped amphorae” according to Nosek (1967, 296, 297, tabl. VI). With reference to the typological classification of Szmyt, it is similar to the type VBIII1-21-2a-ca (1996a, 31). The amphora has a low, straight neck with a narrow, slightly rounded rim, provided with six symmetrically arranged vertical handles in a cylindrical shape. Below the rim and partially in the upper part of the belly, there is a decoration made with the cord impressions in the form of a double wavy line underlined at the top and at the bottom by a similar impression in a horizontal, triple arrangement. The belly is strongly defined, descending conically towards

a small base. The base is ill-defined, finished with a low foot. The clay paste has a high content of medium and large-grained grog admixture and a small amount of whitish stone grains. The surfaces of the vessel walls are carefully smoothed, have a uniform, brown colour, and only in the bottom part there are slightly darker spots. In addition, there are traces of brushing with grass or straw on the outer and inner surfaces. The firing of the vessel is good, uniform, the fracture is compact, and the surfaces are hard. Weight: 3578 g. Dimensions: height – about 36 cm; rim diameter – 25.5 cm and 28.5 cm; neck height – 4.5 cm; the largest belly diameter – 35 cm; base diameter – 12.5–13 cm; wall thickness: below the rim – 5 mm; in the middle part of the belly – 5.3–6.5 mm; above the base – 6–7 mm; base thickness – 10–13 mm.

The amphora from grave No. 4 does not have many analogies in the complexes of Globular Am-

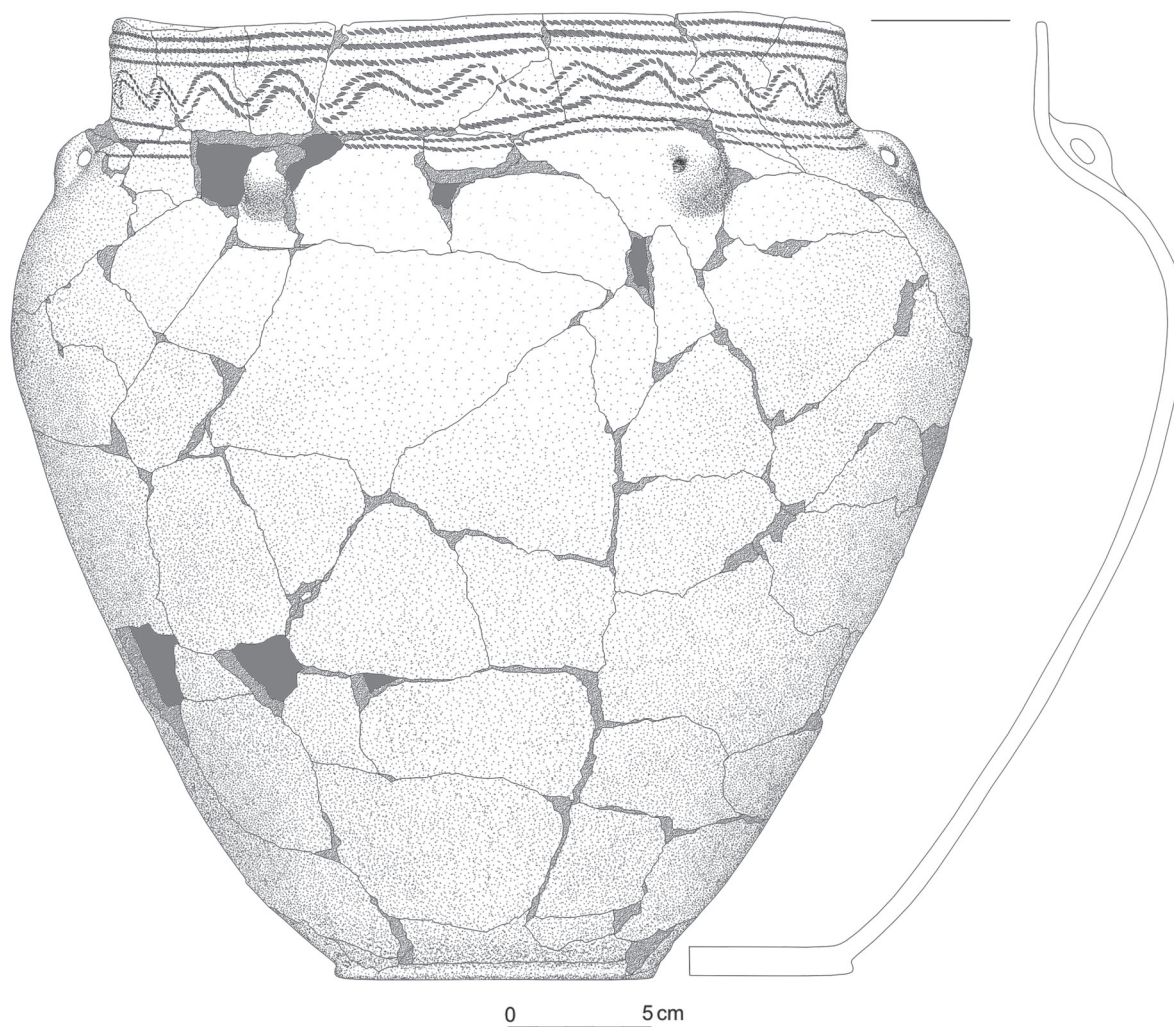


Fig. 4. Sadowie, Opatów dist., site 23. A pottery vessel – an amphora from the inventory of the grave No. 4 (drawn by A. Bardetsky).

phora culture from different settlement zones. A close counterpart in terms of form is known only from Złota – „Gajowizna”, from an undetermined part of the site (Krzak 1977, 58, fig. 75). Contrary to the vessel from grave No. 4, it is an undecorated amphora.

Morphologically, similar items can also be identified in places quite distant from the Vistula basin. It includes, for example, a vessel from the settlement in Persopnica, on the Stubla river (Shelomentsev-Terskiy 1996, fig 3: 6), for which we have a radiocarbon determination 3910 ± 50 BP (Kadrow, Szmyt 1996, tab. 1). However, unlike our discussed amphora, it does not have handles and is ornamented with finger imprints. A characteristic feature of the amphora from grave No. 4 is its ornamentation in the form of horizontal, multiple and wavy cord impressions. Similar patterns of ornamentation can be found in the complexes from Mierzanowice, belonging to the younger stage of the Globular Amphora culture in the Sandomierz Upland. They are present, among others on the amphorae from pit No. 170c (Balcer 1963, tabl. III: 11) and in the vicinity of pit No. 194 (Balcer 1963, tabl. VII: 17). It is worth noting that the amphora from grave 4 resembles in shape (a wide belly with a highly located shoulder converging towards a small base) vessels from the Yamna culture inventories (e.g. Shmaglii and Chernyakov 1970). Relations of a broadly understood circle of the Yamna culture with the materials from the Globular Amphora culture were found in the area of the forest-steppe between the Prut and Dniester rivers. There are many burial sites with the Globular Amphora culture material from this area (e.g. Szmyt 1996b, 22–24; 1999, 107–108; 2001, 185–191, figs. 17–21).

Grave No. 7

At the level of discovery (30 cm from the ground surface), the grave presented an oval outline and dimensions of 2.1×1.5 m, with an orientation along the north-west – south-east axis (Fig. 5: A). In its cross-section, it was characterized by a regular, rectangular shape with a flat bottom reaching up to 43 cm (Fig. 5: C). At the bottom, at a depth of 30 cm, in the north-west part of the grave, there was an animal burial (No. 1), most likely a cattle one, secondarily damaged, with some bone missing (Fig. 5: B). The arrangement of the preserved fragments of the skull and vertebrae indicates that the individual was originally placed on its side, with its head facing north-west. There was also a trace of a trench made for ritual or robbery purposes. In addition, the burial included single fragments of two damaged vessels (Figs. 6: 2, 3) and a flint lump (the initial form of an axe?; Fig. 7) in its fill. Another burial

(No. 2) was registered in the south-eastern part, under a large stone block. These were the bones of the front limbs and torso of cattle, lying in a crouched position on their side, with the head facing the south-east. Above the head bones was a pottery vessel of the Globular Amphora culture – an amphora decorated with imprints of a vertical stamp and a zigzag (Fig. 6: 1).

Artefacts:

- 1) a pottery vessel – a small, asymmetrical, amphora (mass find No. 472/2016; Fig. 6: 1) similar to forms of type IIA1 according to Wiślański (1966, 28, 29, data sheet II) and the so-called „amphora of the Kuyavian type” in Nosek’s terms (1967, 292–295, tabl. III–IV). In the classification made by Szmyt, it can be classified as type VBIII1-21-2b-cb (1996a, 31). The amphora has four tunnelled handles, located at the bottom of a well-defined neck, at the transition to the belly. The edge of the rim has a clearly marked overhang. On the neck and in the area between the handles, there is an ornament in the form of band arrangements of a row of vertical stamp impressions, underlined by circumferential horizontal rows of zigzag impressions. The belly is strongly defined, the base is slightly separated in the form of a small foot. With reference to the clay paste, it contains a large amount of medium and coarse-grained grog with whitish coarse-grained sand. The surfaces of the walls are smooth, have a uniform, orange colour and darker, brown spots in some places. The pottery firing is quite good, the fracture is compact, and the surfaces are medium-hard. Weight: 1322 g. Dimensions: height – about 20 cm; rim diameter – 11.5–12 cm; neck height – 4 cm; the largest belly diameter – 23 cm; base diameter – 9–9.5 cm; wall thickness – near the rim 4–5 mm; in the middle part of the belly – 5.5–6.5 mm; above the base – 6–7 mm; base thickness – 10–11 mm.
- 2) the lower part of a medium-sized vessel (amphora?), graphically reconstructed (22 fragments- mass find Nos. 462, 463, 465–468, 470, 471/2016; Fig. 6: 2). It has a spherical belly and a weakly separated base. No decorations were found on the preserved fragments of the vessel. The clay paste contains an admixture of stone of a whitish colour and various grains. The surfaces of the walls are smooth, slightly shiny, have a uniform black colour and in some places lighter, dark grey spots. An inner surface has traces of brushing with grass or straw. The firing of the vessel is quite good, the fracture is compact, and the surfaces are quite hard. Weight: 383 g. Dimensions: the largest belly diameter – about 25 cm;

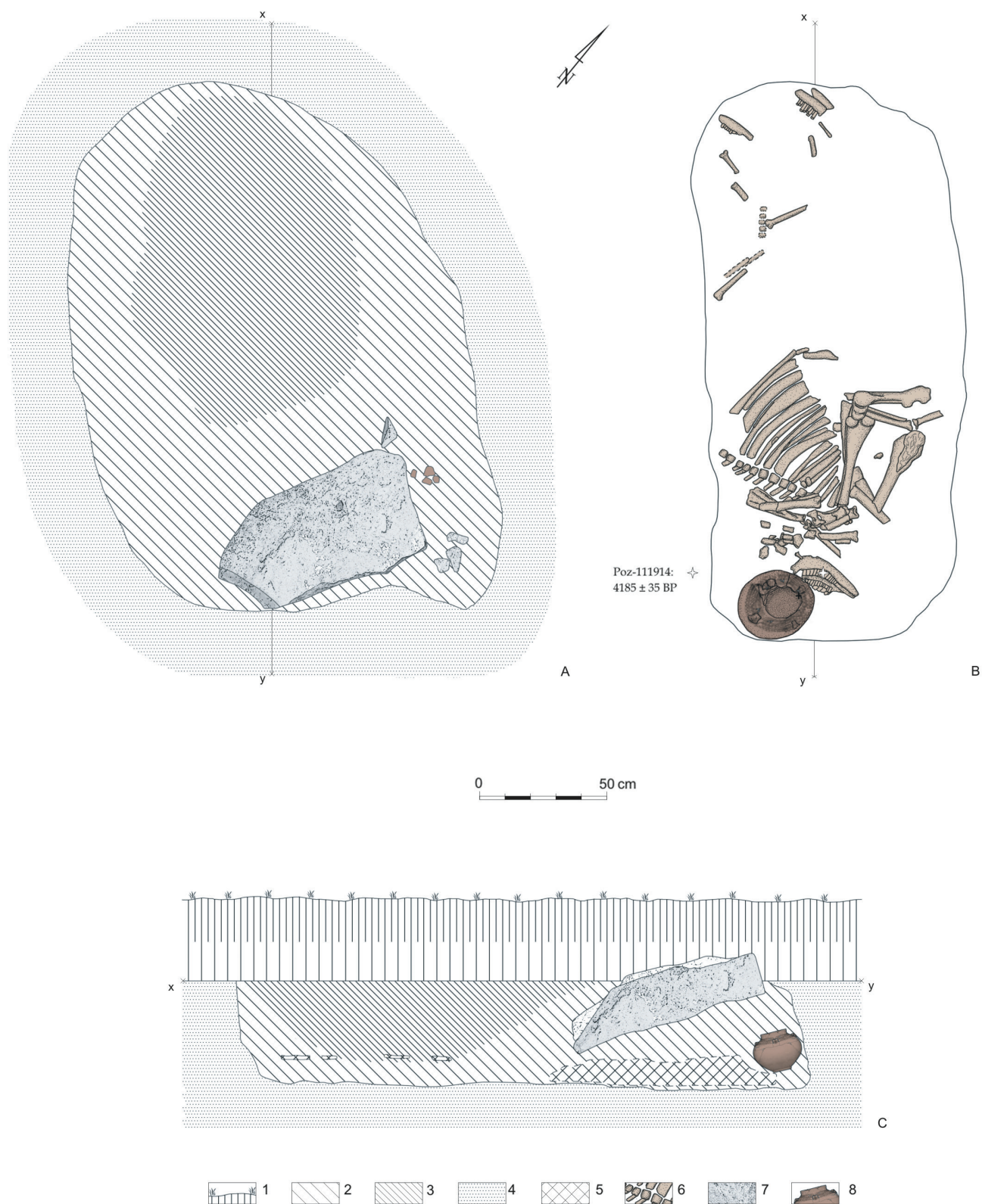


Fig. 5. Sadowie, Opatów dist., site 23. Documentation of the animal grave No. 7: A – plan view, profile of the burial pit, location of animal skeletons and inventory. The figure shows the ^{14}C date from the sample collected in the indicated place. Legend: 1 – surface layer; 2 – brown fills of feature; 3 – dark grey fills of feature; 4 – loess subsoil; 5, 6 – bone remains; 7 – stone; 8 – pottery vessel (drawn by A. Bardetsky).

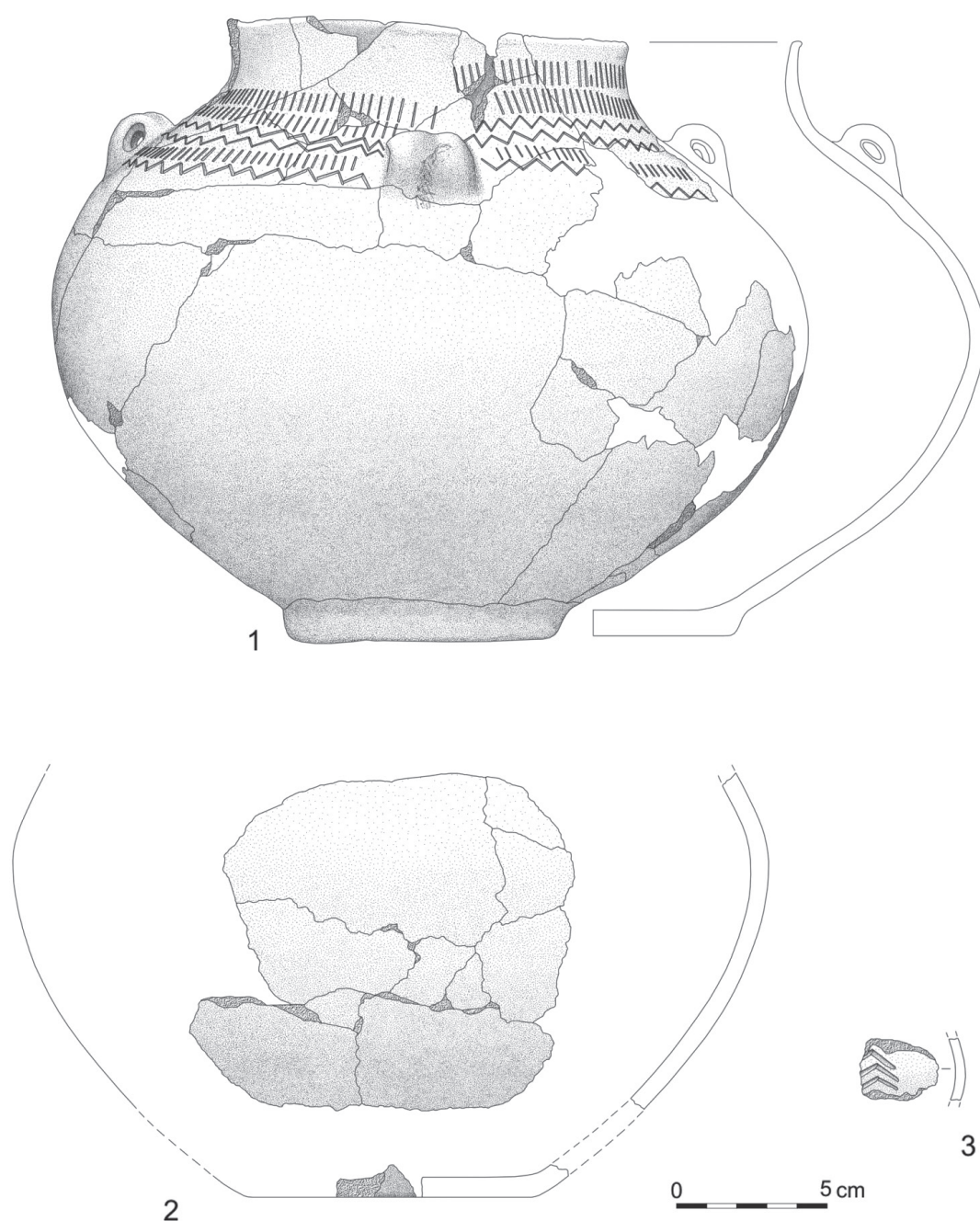


Fig. 6. Sadowie, Opatów dist., site 23. Pottery from the grave inventory No. 7 (drawn by A. Bardetsky).

base diameter – 9–9.5 cm; wall thickness – 5 mm in the place of the largest belly diameter; above the base – 6 mm; base thickness – 7 mm.

- 3) small pottery sherds, including one item decorated with the impressions of a rectangular stamp in the form of a vertical herringbone (mass find Nos. 462, 464, 469/2016; Fig. 6: 3). The clay paste contains a large content of medium and large-grained, sharp-edged stone admixture, whitish in colour. The surfaces of the walls are carefully smoothed,

have a grey colour from the outside and inside surfaces, and grey-brown fractures. Weight: 7 g. Dimensions: thickness of the walls: 3–4 mm.

- 4) 1 flint lump with traces of knapping (most likely the initial form of an axe; registered find No. 32/2016; Fig. 7). Cortex visible on one side. Striped flint. Dimensions: length – 95 mm, width in the middle: 59 mm, thickness in the middle – 31 mm.

With reference to the items that can be dated from the inventory of grave No. 7, it is necessary to mention



Fig. 7. Sadowie, Opatów dist., site 23. A flint artefact from the grave No. 7 (photo by author).

the „Kujavian-type amphora” decorated with stamp impressions and zigzag, with four handles. As for the form, it is a typical vessel for the ceramic artefacts of the Globular Amphora culture (e.g. Wiślański 1966, 28, 29, data sheet II; Nosek 1967, 292–295, tabl. III, IV; Szmyt 1996a, 31; 1999, 23, fig. 4). The amphora has numerous references to the burial complexes of the discussed culture from the Lublin Upland, including radiocarbon-dated inventories. It is worth mentioning a vessel from a grave in Świerszczów, Hrubieszów dist., site 5 (Ścibior *et al.* 1991, 82, figs. 3: g, f) for which ^{14}C dating: 4170 ± 35 BP was obtained (Kadrow and Szmyt 1996, tab. 1). Good analogies can also be found in terms of form and decoration in Trzeszkowice, Świdnik dist., site 14 discovered among the grave goods in the burial (Polańska 2016, 36, fig. 3: 3). The age of the grave was determined by the date ^{14}C : 4170 ± 35 BP as a result of bone analysis (Polańska 2016, 42). This vessel also has analogies in many places of the Globular Amphora culture in the basin of the upper Vistula, including the Sandomierz Upland. In terms of style, similar forms are known from the settlement in Mierzanowice, site 1 among the pottery inventory from pit No. 211 (Balcer 1963, tabl. IX: 3, 19) and from Złota – “Gajowizna” (Krzak 1977, 34, fig. 42).

Grave No.11

At the level of discovery, only 20 cm above the ground, a regular, rectangular outline with rounded corners and orientation along the north-west-south-east axis has been discovered (Fig. 8: A). Its overall

dimensions were 2.6×1.2 m. In its vertical section, the grave had a regular, rectangular shape with an uneven, slightly concave bottom, reaching 37 cm (Fig. 8: C). In the north-west side there was a stone paving, made of several large, irregular lumps of sandstone. From a depth of 15 cm to the bottom of the pit, there were the remains of an animal-cattle burial (so-called double burial) and some elements of grave goods (Fig. 8: B). The first skeleton lay in the eastern part of the grave, placed on the right side, the right forelimb was bent, the left one and the hind limbs were straightened, possibly due to postmortem concentration. A few vertebrae were missing in the thoracic part of the spinal column, indicating that the body of the cattle might have been cut in two before being deposited in the grave. In the western part of the pit, there was another cattle skeleton (No. 2; Fig. 8). The arrangement of the preserved bones indicates that it was placed on the left side, with the head facing east, towards skeleton No. 1. The limbs were slightly bent and leaned against the side walls of the grave. Between the skeletons, near the shoulder blades of the animals, pottery vessels were discovered inside the pit, i.e. a four-handled amphora decorated with impressions of a vertical stamp, triangles and a zigzag (Fig. 9: 1), as well as a two-handled, undecorated amphora (Fig. 9: 2). Moreover, in various parts of the burial pit and at different levels, fragments of other, at least four incomplete vessels (Figs. 9: 3, 4) and a fragment of flint blade were also found. In addition, near the bones of the lower limbs of skeleton No. 1 a flint axe (Fig. 10) and two tusks of a wild boar or

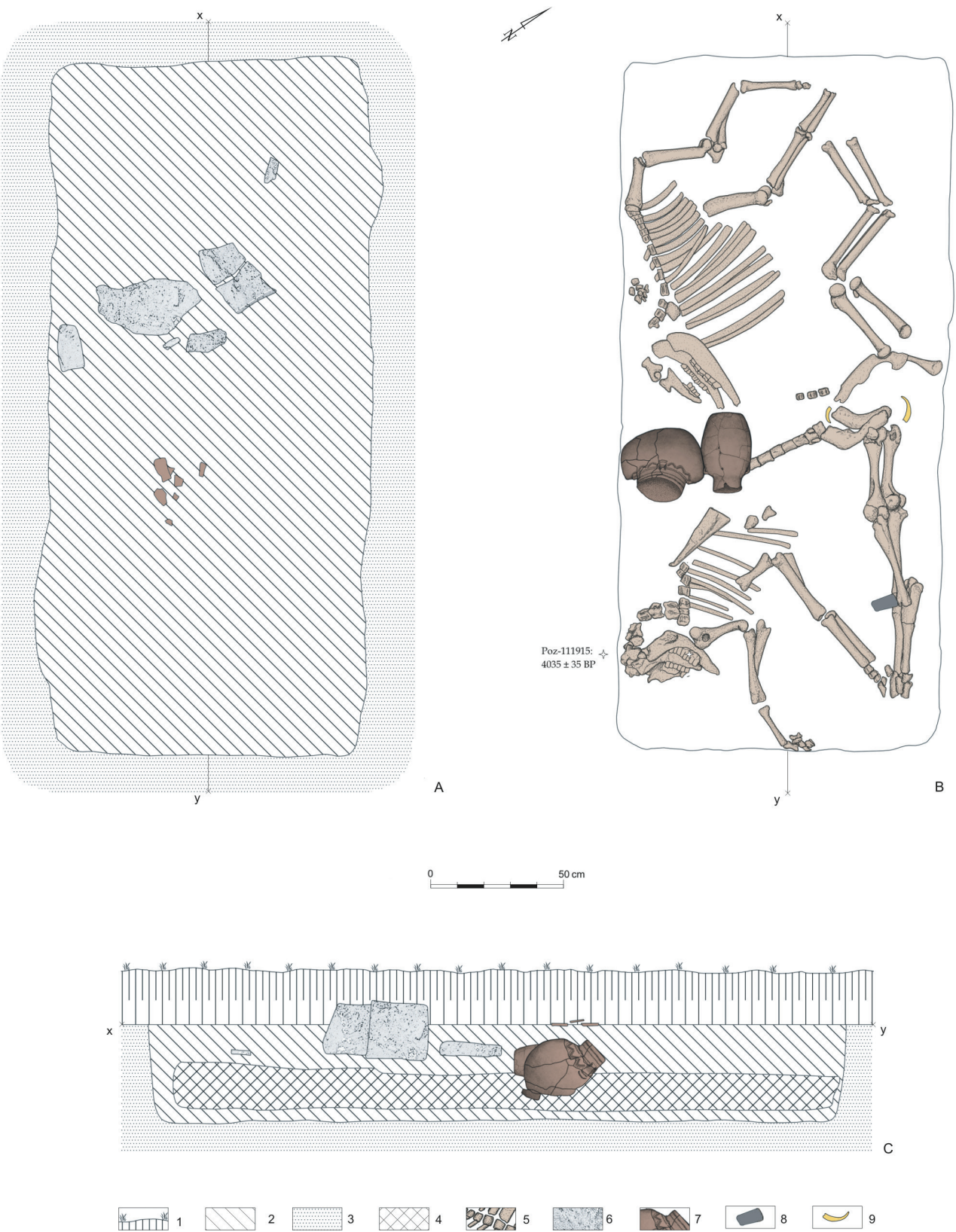


Fig. 8. Sadowie, Opatów dist., site 23. Documentation of the animal grave No. 11: A – plan view, profile of the burial pit, location of animal skeletons and inventory. The figure shows the ^{14}C date from the sample collected in the indicated place. Legend: 1 – surface layer; 2 – brown fills of feature; 3 – loess subsoil; 4, 5 – bone remains; 6 – stone; 7 – pottery vessel; 8 – flint axe; 9 – wild boar or pig tusk (drawn by A. Bardetsky).

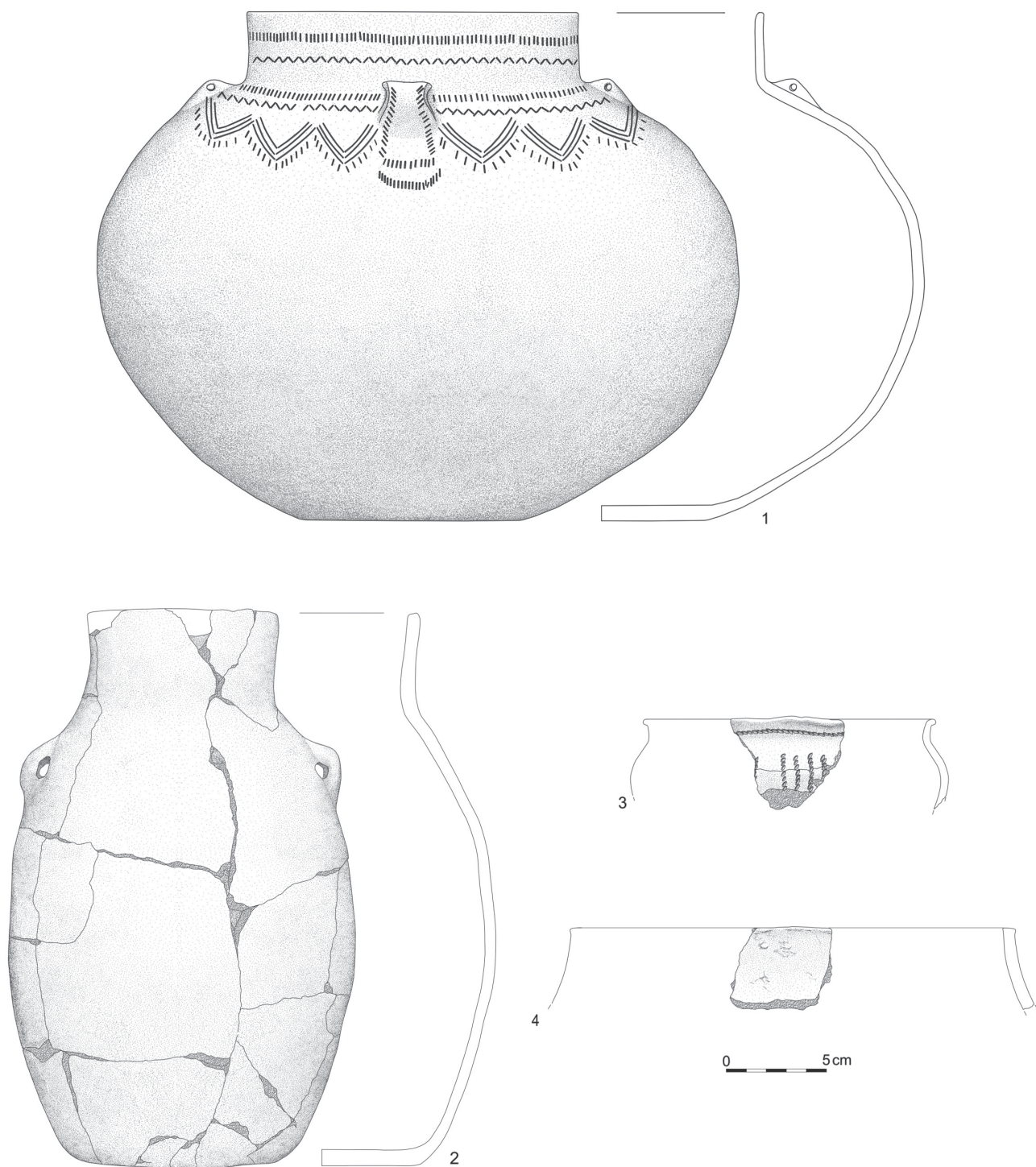


Fig. 9. Sadowie, Opatów dist., site 23. Grave inventory of the grave No. 11. Pottery vessels – amphorae (1-graphic reconstruction; drawn by A. Bardetsky).

pig were found (Fig. 11). Fragments of pig bones were also found as a grave inventory.

Artefacts:

- 1) a pottery vessel – a graphically reconstructed amphora (mass find No. 1098/2017; Fig. 9: 1) similar to forms of type IIA1 according to Wiślański (1966, 28, 29, data sheet II), the so-called „amphora of the Kuyavian type” by Nosek (1967, 292–295, tabl. III–IV) and in typological terms presented by Szmyt – amphora type VBIII (1996a, 31). It has a cylindrical, medium-high neck with four vertical handles in the upper part of the belly. Below the rim and at the point where the neck changes into the belly, there is a circumferential motif composed of stamps and zigzags. Below, in the space between the handles, there are symmetrically arranged angles composed of three or four lines, pointing with their tips down. These motives were made in the technique of deep punctures and impressions of a short stamp, incised lines and partially lines impressed with a long arch stamp. At the bottom, they are highlighted by small imprints located vertically. The decoration is also covered on handles. The vessel is made of clay with tempering material including grog (chamotte). The surfaces of the walls are carefully smoothed, have an orange-brown colour, sometimes with grey spots. The firing of the vessel is good, the fractures are compact, and the surfaces are hard. Weight: 3294 g. Dimensions: height 29.5 cm; neck height – 4 cm; rim diameter 19 cm; the largest belly diameter 37.5 cm; base diameter 12.5 cm; wall thickness – 5–5.5 mm near the rim; in the middle part of the belly – approx. 7 mm; near the base – 6.5 mm; base thickness – 6.5 mm.
- 2) a pottery vessel – a slender, undecorated amphora with two vertical handles placed symmetrically on the sides (mass find No. 1099/2017; Fig. 9: 2). Its form is related to some amphorae type I A2 and I C2 according to Wiślański (1966, 26–28, data sheet 1). In the typological analysis made by Nosek, it represents the so-called an “egg-shaped amphora” (1967, 291–292, tabl. 2), whereas in the systematic prepared by Szmyt, it belongs to the vessels of the VB group (specifically VBI1-21-2c-cb-ca; 1996a, 31). The neck of the described amphora is not high, slightly conical, widening towards the bottom. The belly is egg-shaped, with the largest belly diameter slightly above the middle of the vessel height, and its base is poorly defined. The clay contains a lot of sand and whitish crushed stone. The surfaces of the walls are carefully smoothed, have a black and grey colour on the outer surface and black inside. The firing of the vessel is good, the surfaces are medium hard. Weight: 1958 g. Dimensions: height 29 cm; rim diameter 9.5 and 10.5 cm; neck height – 5 cm; the largest belly diameter 17.5 cm, base diameter 10–11 cm; wall thickness – below the rim 5 mm; in the middle part of the belly – 5.5 mm; near the base – 5.5 mm; base thickness – 8–9 mm.
- 3) twelve fragments of a pottery vessel, presenting a rim slightly bent inside (mass find Nos. 1087, 1088, 1090–1092, 1094–1096/2017; Fig. 9: 4). Clay paste contains crushed stone tempering of a whitish colour and of various grains, and fine gravel. The surfaces of the walls are smooth, have a uniform, light brown colour and traces of the brushing of the internal surfaces with grass or straw. The firing of the vessel is quite good, the fracture is compact, and the surfaces are hard. Weight: 352 g. Dimensions: rim diameter – about 21 cm; wall thickness – 6 mm below the rim, others – 4–7 mm.
- 4) six tiny fragments of a pottery vessel decorated with dual cord impressions, most probably in the form of arches of semicircles (mass find No. 1087/2017). Clay paste contains fine and medium-grained crushed whitish stone. The surfaces of the walls are carefully smoothed, have a black colour, sometimes with grey spots. The firing of the vessel is good, the fracture is compact, and the surfaces are hard. Weight: 48 g. Dimensions: wall thickness – 5–5.5 mm.
- 5) a fragment of the upper part of a pottery vessel – most likely a vase, with a defined and outcurved neck, gently transiting into a spherical belly (mass find No. 1093/2017; Fig. 9: 3). The ornamental motif has been preserved, consisting of two horizontal lines made with cord impressions, supplemented at the bottom by short, vertical lines. Clay paste contains fine and medium-grained crushed stone with a whitish colour. The surfaces of the walls are smooth, and they are in a black and brown colour outside and inside, and a fracture is light brown. The firing is good and the surfaces are hard. Weight: 14 g. Dimensions: diameter of the outlet: 14–15 cm; wall thickness – below the rim 4 mm, near the largest belly diameter – 5 mm.
- 6) three fragments of a pottery vessel (mass find Nos. 1089, 1093, 1097/2017). They were made of clay with the admixture of medium- and coarse-grained crushed whitish stone. The surfaces of the walls are smooth, have a non-uniform, brown colour on the outer surface and black inside, as well as brown fractures. It is fragile ceramics, poorly

compact in fracture. Weight: 99 g. Dimensions: wall thickness: 5.5–6.5 mm.

- 7) a flint tetrahedral axe (registered find No. 55/2017; Fig. 10) of an irregular, trapezoidal shape, polished over the entire surface. It has a slightly asymmetrical arched cutting edge, and a narrow butt damaged at one of the ends. In the upper part, the negatives of the flat retouch coming from the forming stage are visible, and on the inter-negative ridges there are traces of obliteration and gloss caused by using the tool in a setting. One of the sides has a visible layer of white patina – most likely limestone; striped flint; dimensions: length–128 mm, width–31 mm at the cutting edge, 46 mm in the middle, at the butt 50 mm; thickness: at the butt – 23 mm, in the middle – 24 mm, at the cutting edge – 20 mm.
- 8) a fragment of a blade (with its butt) with retouching of both sides on the upper side (registered find No. 52/2017); chocolate flint; dim. 20×15×3 mm.
- 9) a wild boar or pig tusk (registered find No. 53/2017; Fig. 11: 1); height: 83 mm, maximum width: 19 mm; maximum thickness: 9 mm.

- 10) a wild boar or pig tusk (registered find No. 54/2017; Fig. 11: 2); height: 57 mm, maximum width: 13 mm; maximum thickness: 10 mm.

The pottery vessels discovered in grave No. 11 have analogies in the complexes of the Globular Amphora culture from the upper Vistula basin, both of a sepulchral and a settlement nature. The amphora with two handles with an egg-shaped belly is a form with wide chronological frames. It is present in the inventory of the feature (grave) No. 30 in the cemetery in Złota (Krzak 1977, 53, fig. 69) and among the material remains from grave No. II in Sandomierz, site 78 (Ścibior and Ścibior 1990, 162, Fig. 4: c). A similar form can be found in the settlement materials from nearby Mierzanowice, site 1, in the pit No. 173 ab and 226 (Balcer 1963, tabl. V: 6; XI: 15). Equivalents of two-handle amphorae are present in the Lublin Upland, e.g. at the settlement in Podlódów, Chełm dist., site 2 (Bagińska and Taras 1997, 32, fig. 2: e), for which the date 4160 ± 45 BP was established (Szmyt 1999, 235). Almost identical vessels were found in Klementowice, site 2 (Nosek 1967, 220, Fig. 157: 17) associated with the late stage of development of the Globular Amphora



Fig. 10. Sadowie, Opatów dist., site 23. A flint axe from the inventory of the grave No. 11 (photo by author).

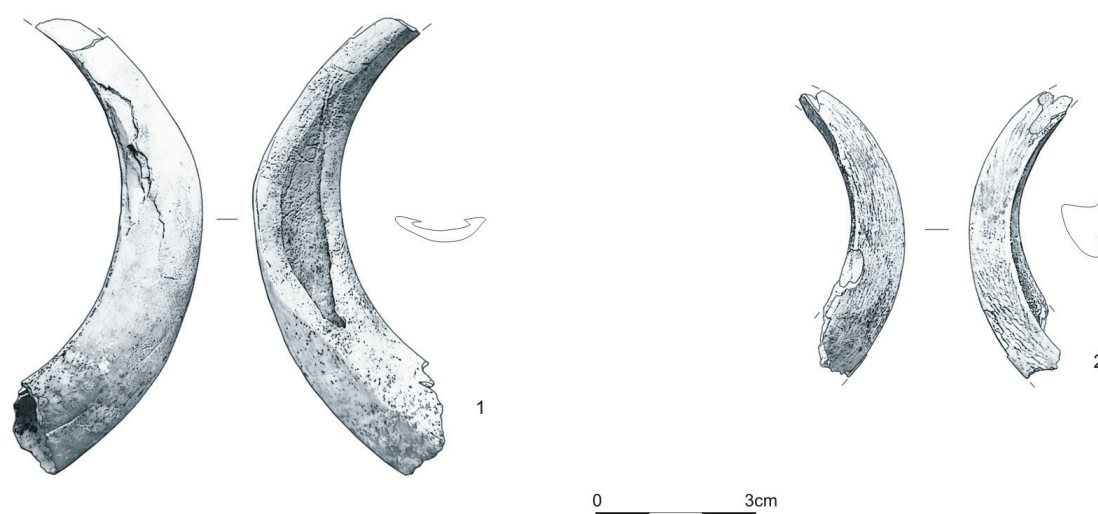


Fig. 11. Sadowie, Opatów dist., site 23. Wild boar tusks from the grave inventory No. 11 (drawn by A. Bardetsky).

culture (findings by Włodarczak and Przybyła 2013, 234). Similar, two-handle, undecorated amphorae in an egg shape can be identified in the assemblage from grave No. I at site 18 in Las Stocki, Puławy dist. (Nosek 1967, 234, figs. 167: 8–9).

The inventory of the grave also includes a „Kuyavian-type amphora” with four handles. In terms of morphological features, it refers to the vessels found in the complexes from the Nałęczów group and the Eastern-Lublin group of the Globular Amphora culture. Close analogies can be found in the vessels from the grave in Łopiennik Dolny-Kolonia, Krasnystaw dist., site 1 (Gołub 1996, 49, fig. 5: 2), for which the ^{14}C dating determination is: 4010 ± 30 BP (Kadrow and Szmyt 1996, tab. 1). Very similar items can also be found in inventories from younger periods. An example is a vessel from a grave in Czułczyce Kolonia, Chełm dist., site 6 (Bronicki 2000, 184, fig. 4: 2) for which four radiocarbon determinations were obtained: 4035 ± 90 BP, 4020 ± 90 BP, 3940 ± 85 BP (Bronicki 2000, tab. 1), and 3995 ± 35 BP (Włodarczak 2016, tab. 2). Close analogies to the amphora from grave No. 11 can be found in two vessels from Klementowice, site 2 (Nosek 1967, 220, figs. 157: 1, 15). They were ornamented in the incision and perforation techniques like our amphora. What is more, analogies in terms of forms and decorations are provided by more than one vessel from graves in Ulwówek near Hrubieszów (Nosek 1967, 211, fig. 149: 1) and in Serebryszcze (currently Srebrzyszcze), Chełm dist., site 23 (Bronicki 2016, 183, 184, figs. 135, 136: 1).

Regarding the described complex, it is also possible to distinguish a fragment of the upper part of

the vase decorated with cord impressions (Fig. 9: 3). Similar motifs, arranged in zones (straight and arched patterns), are typical of the Globular Amphora culture in the Sandomierz-Opatów loess and they are found, among others, in quite late complexes, such as Mierzanowice, site 1 (Balcer 1963, tabl. XII). In the case of the item from grave No. 11, it is difficult to indicate exact analogies due to the fragmentary preservation of the ornament.

Apart from pottery relics, the collection from grave No. 11 also includes flint (an axe, a fragment of a blade) and bone artefacts. Flint axes occur as a typical component of burial equipment in various areas of settlement of the Globular Amphora culture and in graves of various chronology (Nosek 1967; Beier 1988; Wiślański 1966; Szmyt 1996a). Wild boar tusks are also common elements in graves and do not constitute explicit dating objects. They are especially numerous in the upper Vistula basin, in male graves, where they were deposited as objects of symbolic importance (e.g. Bronicki 2016, 240, 242, 246, 247, tab. 10–12, 250). Such artefacts were found, among others, in grave No. 2 in Klementowice (4 items; Nosek 1954/55, 71, fig. 5) and in the burials in Nałęczów (3 items; Nosek 1967, 236) and Włostowice, Puławy dist., site 1 (4 items; Gurba *et al.* 1978, 139). Very numerous (as many as 13 items) were also found in the collective grave in Koszyce, site 3 (Przybyła *et al.* 2013, tabl. 10–14). As for the tusks discovered there, some of them had traces of treatment which suggests their use as tools. Wild boar or pig tusks, also in their natural form, have not yet been recorded in graves containing animal skeletons of the Globular Amphora Culture.

Results of radiocarbon analysis

Only cattle molar teeth from graves No. 4, 7 and 11 were used for radiocarbon analysis performed at the Poznań Radiocarbon Laboratory. In one of the samples (grave No. 11, skeleton No. 2, bone No. 11/79), an insufficient amount of collagen was found. These very low values were beyond the test standard. The remaining samples, from the point of view of the requirements necessary in radiocarbon analysis, had a sufficient collagen content allowing for a reliable measurement (Table 1). In addition to the quantitative criterion, the quality indicator in terms of collagen contained in bones is the ratio expressed as the amount of obtained collagen to the size of the sample. According to the findings of Oxford ¹⁴C Laboratory, this level should be 1% (Brock *et al.* 2012). Recent analyzes of the Poznań Radiocarbon Laboratory in case of establishing dating for burial complexes of the Yamna culture have shown that bone samples containing 0.5–1% of collagen are sufficient to obtain a reliable determination (Goslar *et al.* 2015). Another criterion of sample quality is the ratio of C: N atoms, which should be in the range of 2.9–3.6 (DeNiro 1985) or 3.1–3.5 (van Klinken 1999; Brock *et al.* 2010;

Bronk Ramsey *et al.* 2004). The percentage by weight of carbon and nitrogen (% C and % N) is also an indicator of the quality of collagen. In well-preserved bone, it should be at least 13% for carbon and 4.8% for nitrogen (Ambrose 1990). As a result of tests carried out on the material, three dates were obtained: Poz-111913: 3995±35 BP (grave No. 4); Poz-111914: 4185±35 BP (grave No. 7); Poz-111915: 4035±35 BP (grave No. 11; tab. 1, Fig. 12). The dating values after calibration are respectively: for the sample Poz-111913: 3995±35 BP with a probability of 68.2%: 2568–2470 BC and 2623–2411 BC with a probability of 95.4%, for the date Poz-111914: 4185±35 BP it was 2882–2698 BC and 2891–2632 BC respectively. For the date Poz-111915: 4035±35 BP we have obtained a fairly wide range, with the probability of a single standard deviation being 2580–2476 BC; and in the case of double – 2834–2467 BC.

Interpretation of the obtained radiocarbon determinations

The obtained results are consistent with the assumption that the age of graves No. 4, 7 and 11 are from the period ranging from the beginning to the

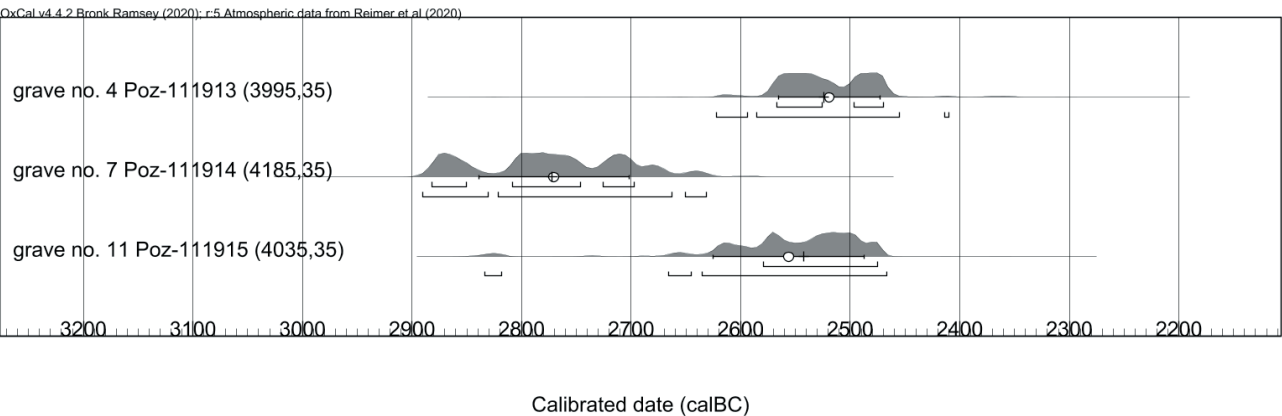


Fig. 12. Sadowie, Opatów dist., site 23. Calibration results of radiocarbon dates obtained for the graves No. 4, 7 and 11. In calibration the software OxCal v 4.4.2. Bronk Ramsey (2020) was used.

Table 1. Sadowie, Opatów dist., site 23. ¹⁴C dating obtained for animal graves of the Globular Amphora culture.

Grave number	Skeleton number	Bone number	Lab number	BP	BC (1σ)	BC (2σ)	%coll	C%	N%	C/N (at)
4	1	179/2015	Poz-111913	3995±35	2568–2470	2623–2411	1,8	46,3	16,7	3,23
7	2	829/2016	Poz-111914	4185±35	2882–2698	2891–2632	0,7	49,8	17,7	3,28
11	1	11/11	Poz-111915	4035±35	2580–2476	2834–2467	1,7	47,1	16,8	3,26

second half of the third millennium BC. This is a time frame referring to the settlement of the community of the Globular Amphora culture in the basin of the Upper Vistula (Ścibior and Ścibior 1990, 192; Ścibior 1991, 51–54; Kadrow and Szmyt 1996, tab. 1; Kruk and Milisauskas 1999, 190–193; Włodarczak and Przybyła 2013, 235–240; Włodarczak 2016). Graves No. 4 and 11 obtained similar radiocarbon determinations, characterized by a high degree of agreement. They relate to the end of the first half and the beginning of the second half of the third millennium BC, oscillating between the range of 2600–2400 BC. In the case of grave No. 7, its determination corresponds to the earlier period. The range of calendar age for the bone sample refers to the first half of the third millennium BC (2882–2698 BC). These values have their equivalents among other burial and settlement complexes from south-eastern Poland dated by radiocarbon technique (Table 2). It is worth noting that the ^{14}C results obtained are conditioned by the flattening on the calibration curve. For the first half of the third millennium (specifically 2880–2580 BC and 2620–2480 BC), there is an extensive plateau, which makes it impossible to set the dates accurately on an absolute timescale (Furholt 2003, 15, Abb. 1; Walanus and Goslar 2004, 64–68). The significance of this phenomenon for the calibration of late Neolithic dates in Europe is discussed in more detail in: Furholt 2003; Włodarczak 2007, 37–39; 2016, 539, 540.

The earliest date obtained for grave No. 7 only has references in the Lublin Upland. A similar determination comes from grave No. 7 in the cemetery in Klementowice, site 4 (IV, cemetery D; 4175 ± 30 BP; 2921–2888 BC; 4300 ± 30 BP; 2904–2774 BC; Kowalczyk 1968, 368; more details with reference to dating: Włodarczak 2016, 540). The age of other features from the Nałęczów and Eastern-Lublin groups is very similar, e.g. from Las Stocki, site 16 (cemetery C; 4180 ± 35 BP; 2881–2696 BC; Włodarczak 2016, tab. 2), Świerszczów, site 27 (5; 4170 ± 35 BP; 2877–2677 BC; Kadrow, Szmyt 1996, tab. 1) and settlements in Podlodów, site 2 (4160 ± 45 BP; 2874–2671 BC; Szmyt 1999, 235). What is more, grave No. 523 from Koszyce, on the Proszowice Plateau, should also be referred to these determinations (Włodarczak and Przybyła 2013, tab. 5, 6; Schroeder *et al.* 2019, Dataset 1). The range of the obtained dates for the 28 samples refers to the first half of the third millennium BC (2880–2776 BC).

In the case of graves No. 4 and 11, the dates coincide with the absolute age obtained, especially for the

features of the Eastern-Lublin group of the Globular Amphora culture. A very similar time span is established for the series of determinations for Łopiennik Dolny-Kolonia, site 1 (4010 ± 30 BP; Kadrow, Szmyt 1996, 109; 4110 ± 30 BP; 2851–2586 BP; P. Włodarczak 2016, table 2) and Czułczyce-Kolonia, site 6 (4035 ± 90 BP; 4020 ± 90 BP; 3940 ± 85 BP; Bronicki 2000, tab. 1; 3995 ± 35 BP; Włodarczak 2016, tab. 2) and Serebryszcze, site 23 (4045 ± 35 BP; Włodarczak 2016, tab. 2). The series of determinations correspond to the end of the first and the very beginning of the second half of the third millennium BC. At the present stage of research, it is very difficult to relate the inventories from Sadowie to other burial features from the Sandomierz Upland due to the small number of radiocarbon determinations. Thus far, only a single date has been published for grave No. VIII from site 78 in Sandomierz (Ścibior and Ścibior 1990, 192). It was established to 4370 ± 70 BP (3092–2905 BC) and is the oldest designation for the Globular Amphora culture in the upper Vistula basin.

The absolute dating for graves No. 4, 7 and 11 is consistent with the results of the relative chronology of the vessels included as grave goods. The analysis of the material remains shows that the most analogies can be found in the complexes from the Sandomierz Upland. Individual components of the inventories have numerous analogies in the assemblages from the settlement in Mierzanowice, site 1 and from the cemetery in Złota – „Gajowizna”. Regarding the set of forms and vessels, it is possible to indicate similarities to the sites from the neighbouring settlement zones of the Globular Amphora culture. These are, among others, references to inventories from the area of the Nałęczów and Eastern-Lublin groups. The presence of these materials acquires a different meaning, especially in the context of the identification of graves of the Nałęczów type (with non-cist, stone structures) at the site (unpublished research results). These groups are a manifestation of the penetration of the Sandomierz Upland by the communities of the Globular Amphora culture from the Lublin region, a phenomenon that might have been related to the local striped flint deposits.

It is worth adding that the material remains from individual graves show some differences in the forms of vessels, ornamental motifs and various decorative techniques. This may indicate the time distance between the aforementioned graves. It also confirms the thesis about the chronological stratification of the cemetery of the Globular Amphora culture and individual clusters of graves.

Table 2. List of radiocarbon datings for burial and settlement features of the Małopolska (Kielce), Sandomierz–Opatów, Nałęczów and Eastern-Lublin Globular Amphora culture groups.

No.	Site	Grave number/ feature number/skeleton number	Globular Amphora culture group	Lab number	¹⁴ C age (BP)	Calibrated age (BC, 1σ range)	Calibrated age (BC, 2σ range)	Dated material	Literature
1.	Koszyce, Proszowice dist., site 3	grave-feature 506, skeleton 1	Małopolska (Kielce)	Poz-47437	4125±35	2858–2625	2871–2578	animal bone	Włodarczak and Przybyła 2013, Table 5
2.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 1	Małopolska (Kielce)	Poz-47439	4085±35	2842–2504	2864–2492	human bone	Włodarczak and Przybyła 2013, Table 5
3.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 5	Małopolska (Kielce)	Poz-47441	4190±35	2883–2700	2893–2635	human bone	Włodarczak and Przybyła 2013, Table 5
4.	Koszyce, Proszowice dist., site 3	grave - obiekt 523 szkieleł nr 9	Małopolska (Kielce)	Poz-47442	4165±35	2874–2675	2881–2630	human bone	Włodarczak, Przybyła 2013, Table 5
5.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 12	Małopolska (Kielce)	Poz-47440	4215±35	2893–2705	2905–2672	human bone	Włodarczak and Przybyła 2013, Table 5
6.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 1	Małopolska (Kielce)	Ua-45617	4226±46	2902–2703	2915–2636	human bone	Włodarczak and Przybyła 2013, Table 6
7.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 6	Małopolska (Kielce)	Ua-45618	3960±44	2569–2351	2576–2301	human bone	Włodarczak and Przybyła 2013, Table 6
8.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 9	Małopolska (Kielce)	Ua-45619	3985±38	2569–2466	2620–2349	human bone	Włodarczak and Przybyła 2013, Table 6
9.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 14	Małopolska (Kielce)	Ua-45620	4119±38	2857–2584	2872–2575	human bone	Włodarczak and Przybyła 2013, Table 6
10.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 1	Małopolska (Kielce)	AAR-28702	4208 ±35	2891–2703	2901–2670	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
11.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 2	Małopolska (Kielce)	AAR-28703	4187±36	2883–2698	2892–2633	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
12.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 3	Małopolska (Kielce)	AAR-28704	4230±36	2902–2707	2912–2676	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
13.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 4	Małopolska (Kielce)	AAR-26315	4239±33	2905–2777	2915–2698	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
14.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 5	Małopolska (Kielce)	AAR-28705	4202±36	2888–2702	2900–2638	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
15.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 6	Małopolska (Kielce)	AAR-26316	4014±45	2574–2472	2842–2357	human bone	Schroeder <i>et al.</i> 2019, Dataset 1

No.	Site	Grave number/ feature number/skeleton number	Globular Amphora culture group	Lab number	¹⁴ C age (BP)	Calibrated age (BC, 1σ range)	Calibrated age (BC, 2σ range)	Dated material	Literature
16.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 7	Małopolska (Kielce)	AAR-28706	4220±34	2895–2706	2906–2675	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
17.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 8	Małopolska (Kielce)	AAR-26317	4330±34	3010–2898	3072–2888	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
18.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 9	Małopolska (Kielce)	AAR-26318	4204±44	2892–2699	2903–2632	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
19.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 10	Małopolska (Kielce)	AAR-26319	4126±36	2859–2625	2872–2578	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
20.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 11	Małopolska (Kielce)	AAR-28707	4215±35	2893–2705	2905–2672	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
21.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 13	Małopolska (Kielce)	AAR-28708	4211±40	2893–2702	2906–2636	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
22.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 13	Małopolska (Kielce)	AAR-28709	4264±34	2911–2878	3004–2703	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
23.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 14	Małopolska (Kielce)	AAR-28710	4379±32	3022–2922	3093–2911	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
24.	Koszyce, Proszowice dist., site 3	grave-feature 523, skeleton 15	Małopolska (Kielce)	AAR-26320	4099±53	2854–2574	2875–2492	human bone	Schroeder <i>et al.</i> 2019, Dataset 1
25.	Koszyce, Proszowice dist., site 3	grave-feature 523, single bone (sheep)	Małopolska (Kielce)	AAR-27613	4222±23	2895–2776	2901–2701	animal bone	Schroeder <i>et al.</i> 2019, Dataset 1
26.	Sandomierz, loco dist., site 78	grave VIII	Sandomierz-Opatów	Gd-2452	4370±70	3092–2905	3332–2885	charcoal from the fill of the grave	Ścibior and Ścibior 1990, 192
27.	Klementowice, Puławy dist., site 4 (IV, cemetery D)	grave 7	Nałęczów	KN-255	4300±30	2904–2774	2914–2695	charcoal from the fill of the grave	Kowalczyk 1968, 368
28.	Klementowice, Puławy dist., site 4 (IV, cemetery D)	grave 7	Nałęczów	GrN-5046	4175±30	2921–2888	3011–2881	charcoal from the fill of the grave	Kowalczyk 1968, 368
29.	Klementowice, Puławy dist. site 1 (I, cemetery A)	grave 1	Nałęczów	Poz-61735	4235±35	2878–2697	2886–2633	human bone	Włodarczak 2016, Table 2
30.	Las Stocki, Puławy dist., site 16 (cemetery C)	grave II	Nałęczów	Poz-61732	4180±35	2881–2696	2888–2632	human bone	Włodarczak 2016, Table 2
31.	Parchatka, Puławy dist., cemetery A	grave	Nałęczów	Poz-61733	4230±35	2901–2707	2911–2677	animal bone	Włodarczak 2016, Table 2

No.	Site	Grave number/ feature number/skeleton number	Globular Amphora culture group	Lab number	¹⁴ C age (BP)	Calibrated age (BC, 1σ range)	Calibrated age (BC, 2σ range)	Dated material	Literature
32.	Puławy-Włostowice, Puławy dist., site 1	grave	Nalęczów	Poz-61734	4040±35	2622–2488	2836–2468	human bone	Włodarczak 2016, Table 2
33.	Trzeszkowice, Świdnik dist., site 14	grave-feature 1	Nalęczów	Poz-58111	4170±35	2877–2677	2884–2631	human bone	Polńska 2016b, 42
34.	Czulczyce-Kolonia, Chełm dist., site 6	grave-northern chamber, western skeleton	Eastern-Lublin	Ki-7831	4035±90	2848–2463	2877–2310	human bone	Bronicki 2000, Table 1
35.	Czulczyce-Kolonia, Chełm dist., site 6	grave-northern chamber, eastern skeleton	Eastern-Lublin	Ki-7830	4020±90	2847–2411	2873–2297	human bone	Bronicki 2000, Table 1
36.	Czulczyce-Kolonia, Chełm dist., site 6	grave-southern chamber, western skeleton	Eastern-Lublin	Ki-7829	3940±85	2569–2297	2842–2146	human bone	Bronicki 2000, Tabela 1
37.	Czulczyce-Kolonia, Chełm dist., site 6	grave-southern chamber, eastern skeleton	Eastern-Lublin	Poz-61739	3995±35	2568–2470	2623–2411	human bone	Włodarczak 2016, Table 2
38.	Krasnystaw, loco dist., site 8	grave	Eastern-Lublin	Ki-5841	4120±30	2854–2623	2868–2577	human bone	Kadrow and Szmyt 1996, Table 1
39.	Łopiennik Dolny-Kolonia, Krasnystaw dist., site 1	grave	Eastern-Lublin	Ki-5434	4010±30	2569–2475	2618–2465	human bone	Kadrow and Szmyt 1996, Table 1
40.	Łopiennik Dolny-Kolonia, Krasnystaw dist., site 1	grave	Eastern-Lublin	Poz-58148	4110±30	2848–2583	2867–2573	human bone	Włodarczak 2016, Table 2
41.	Deputyce Nowe-Kolonia (now Nowe Deputyce), Chełm dist., site 12	grave	Eastern-Lublin	OxA-23438	4136±28	2861–2631	2873–2583	–	Bronicki 2016, 59
42.	Podlodów, Tomaszów Lubelski dist., site 2	pit 15	Eastern-Lublin	Ki-6545	4160±45	2874–2671	2885–2584	animal bone	Szmyt 1999, 235
43.	Raciborowice-Kolonia, Chełm dist., site 2	grave-feature 5/56	Eastern-Lublin	Poz-58109	4335±35	3011–2901	3076–2890	human bone	Polńska 2016a, 28
44.	Sajczyce, Chełm dist., site 18	grave	Eastern-Lublin	OxA-23437	4115±28	2850–2585	2866–2576	–	Bronicki 2016, 178
45.	Serebryszcze, Chełm dist., site 23	grave 1	Eastern-Lublin	Poz-61738	4045±35	2624–2491	2839–2469	human bone	Włodarczak 2016, Table 2
46.	Świerszczów, Hrubieszów dist., site 27 (5)	grave	Eastern-Lublin	Ki-5433	4170±35	2877–2677	2884–2631	human bone	Kadrow and Szmyt 1996, Table 1

Summary

The dates obtained for the graves in Sadowie are the first determinations for the Globular Amphora culture from the Opatów loess and contribute to the discussion on the chronology of the Sandomierz-Opatów group. It is worth noting that the dating of the discussed cemetery does not determine the order in which the cemetery used to function, and its chronological framework, but only episodes in the functioning of three different zones are established. Defining the chronological relationship and sequels between the graves included in the clusters will require dating more samples and a detailed analysis of artefacts. In the longer term, it will allow the presentation of the chronological system for the Globular Amphora culture in the Opatów loess and will make it possible to build a diagram of the cultural changes in the late Neolithic.

Translation: Beata Kizowska-Lepiejza

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