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ABSOLUTE CHRONOLOGY OF SETTLEMENT REMAINS OF THE GLOBULAR AMPHORA CULTURE IN THE SANDOMIERZ UPLAND (SITE GAŁKOWICE-OCIN, MIERZANOWICE, ZŁOTA – NAD WAWREM)

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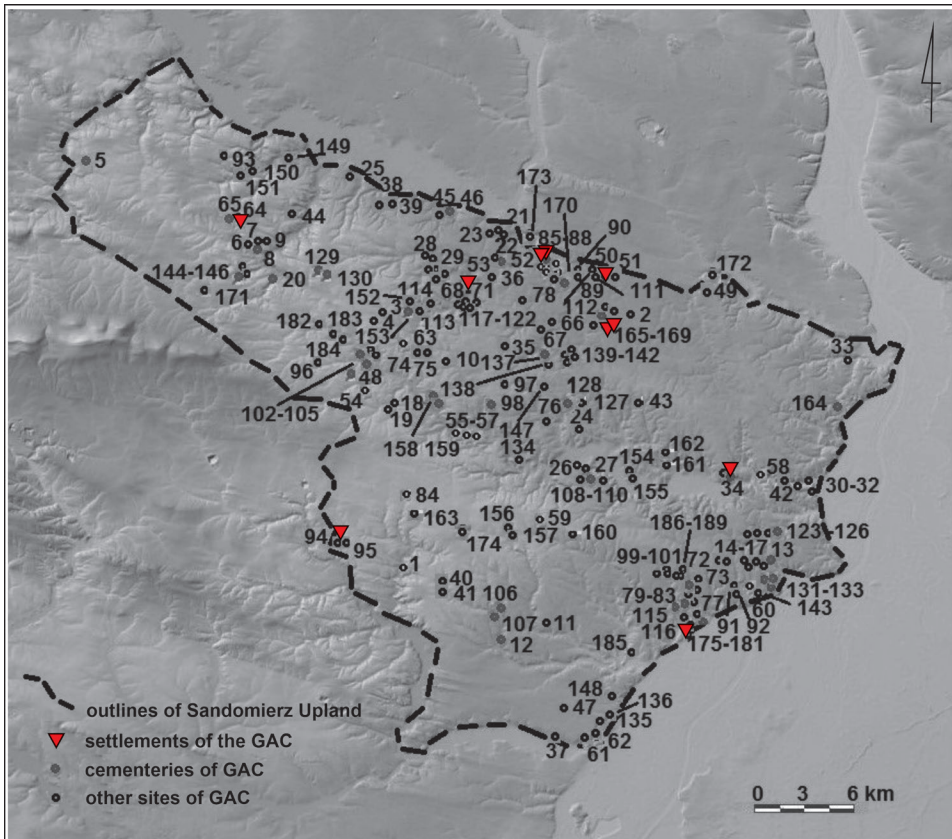
ABSTRACT

Under the project financed by the National Science Centre no 2014/12/S/HS3/00355 the first series of chronometric data has been obtained which forms the basis for establishing the chronology of the Globular Amphora culture in the Sandomierz Upland. It has produced altogether 42 absolute age determinations setting a chronological bracket of the Sandomierz-Opatów subgroup, of which 19 new radiocarbon determinations came from five settlements of this culture. Some are sites known in the literature, while others have been discovered in recent years. In general, the data from the settlements are compatible with the series obtained from graves, but a few dates and materials indicate the possibility of GAC surviving until the second half of the 3rd millennium BC.

Keywords: Globular Amphora culture, radiocarbon dating, large upland settlements

One of the elements distinguishing the Sandomierz-Opatów subgroup of the Globular Amphora culture (GAC) from the sources of this culture from other regions is the presence of large upland settlements in its territory. These sites have greater cognitive value than typical lowland settlements, if only because loess soils allow for obtaining well-preserved osteological materials for dating. However, this potential has not been appropriately used hitherto. Before the start of the project dedicated to the GAC from the Sandomierz Upland, we had only eight determinations of the absolute age from the this area referring to the above-discussed culture, made from charcoal samples [Witkowska 2021].

In the Sandomierz Upland the 13 settlements of the GAC were excavated (Fig. 1). Most of them were explored during the old investigation and part have been lost during the long period of storage. For this reason, the selection of objects for dating was often guided by the criterion of the availability of materials, which is obviously not optimal, but has allowed to obtain a series of radiocarbon samples from the largest settlements of the Sandomierz-Opatów subgroup from Mierzanowice and *Złota-Nad Wawrem*. This was one of the aims of National Science Centre, Poland,



research project no. 2014/12/S/HS3/00355, under which the dating was funded. Multiplied dates are proven to be more reliable than single absolute age determination as evidenced by analysis of absolute chronology of GAC cemeteries from the described area [Witkowska 2021]. Among the available materials, features whose fill contained only artefacts of the GAC were selected. Taking into account the long history of storing such, this allowed to limit the possibility of taking a sample from mixed materials. In addition, pits with exogenous elements found between GAC artefacts were included in the dated series. The context of those discoveries clearly indicated their simultaneous nature, which raised interesting research questions about the chronological position of these materials. The pool of samples was completed with a single date from the site in Gałkowiec-Ocin and the unpublished settlement in Kichary Nowe (research by Hanna Kowalewska-Marszałek).

Fig. 1. The sites of the Globular Amphora culture in the Sandomierz Upland. Prep. by M. Florek

Key: 1 – Beradz; 2 – Bidziny, site 7; 3 – Bogusławice, site 12; 4 – Bogusławice, site 14; 5 – Boleszyn, site 2; 6 – Broniszowice, site 6; 7 – Broniszowice, site 10; 8 – Broniszowice, site 12; 9 – Broniszowice, site 19; 10 – Brzezie, site 17; 11 – Bystrojowice, site 9; 12 – Byszów, site 22; 13 – Chwałki, site 1; 14 – Chwałki, site 6; 15 – Chwałki, site 17; 16 – Chwałki, site 21; 17 – Chwałki, site 26; 18 – Czerników Karski, site 3; 19 – Czerników Karski, site 5; 20 – Czerwona Góra, site 3; 21 – Ćmielów, site 1; 22 – Ćmielów, site 33; 23 – Ćmielów-Przepaść, site 9; 24 – Daromin, site 45; 25 – Denkówek, site 5; 26 – Dobrocice, site 16; 27 – Dobrocice, site 17; 28 – Drzenkowice, site 27; 29 – Drzenkowice, site 31; 30 – Dwikozy, site 3; 31 – Dwikozy, site 14; 32 – Dwikozy, site 19; 33 – Dziurów, site 19; 34 – Gałkowiec-Ocin, site 15; 35 – Gierczyce, site 10; 36 – Glinka, site 3; 37 – Gnieszowice, site 55; 38 – Goździelin, site 4; 39 – Goździelin, site 8; 40 – Goźlice, site 56; 41 – Goźlice, site 60; 42 – Góry Wyższe, site 14; 43 – Grochocice, site 6; 44 – Gromadzice, site 25; 45 – Grójec, site 5; 46 – Grójec, site 24; 47 – Jachimowice, site 3; 48 – Jałoweszy, site 28; 49 – Jankowice, site 4; 50 – Jasice, site 23; 51 – Jasice, site 26; 52 – Jastków, site 3; 53 – Jastków, site 24; 54 – Jurkowiec, site 5; 55 – Karwów, site 22; 56 – Karwów, site 24; 57 – Karwów, site 28; 58 – Kichary Nowe, site 2; 59 – Kleczanów, site 1–2; 60 – Kobierniki, site 5; 61 – Koprzywnica, site 22; 62 – Koprzywnica, site 26; 63 – Kornacice, site 39; 64 – Kosowice, site 3; 65 – Kosowice, site 12; 66 – Koszyce, site 2; 67 – Koszyce, site 4; 68 – Krzczonowice, site 52; 69 – Krzczonowice, site 54; 70 – Krzczonowice, site 63; 71 – Krzczonowice, site 69; 72 – Lenarzyce, site 11; 73 – Lenarzyce, site 26; 74 – Lipowa, site 1; 75 – Lipowa, site 2; 76 – Lisów, site 31; 77 – Łojowice, site 3; 78 – Łukawka, site 6; 79 – Malice, site 1; 80 – Malice, site 6; 81 – Malice, site 8; 82 – Malice, site 19; 83 – Malice, site 20; 84 – Małżyn, site 10; 85 – Mierzanowice, site 1; 86 – Mierzanowice, site 3; 87 – Mierzanowice, site 4; 88 – Mierzanowice, site 5; 89 – Mikułowice, site 6; 90 – Mikułowice, site 35; 91 – Milczany, site 13; 92 – Milczany, site 29; 93 – Mychów Kolonia, site 38; 94 – Mydłów, site 38; 95 – Mydłów, site 51; 96 – Niemienice, site 16; 97 – Nikisiałka Duża, site 4; 98 – Nikisiałka Mała, site 44; 99 – Obrazów, site 1; 100 – Obrazów, site 2; 101 – Obrazów, site 3; 102 – Opatów, site 6; 103 – Opatów, site 17; 104 – Opatów, site 61; 105 – Opatów, site 62; 106 – Ossolin, site 2; 107 – Ossolin, site 42; 108 – Pęczyny, site 1; 109 – Pęczyny, site 9; 110 – Pęcznyce, site 10; 111 – Podgajcze, site 1; 112 – Podgajcze, site 5; 113 – Podole, site 4; 114 – Podole, site 29; 115 – Polanów, site 1 (*Złota-Gajowizna*); 116 – Polanów, site 6; 117 – Przeuszyn, site 1; 118 – Przeuszyn, site 2; 119 – Przeuszyn, site 5; 120 – Przeuszyn, site 9; 121 – Przeuszyn, site 13; 122 – Przeuszyn, site 37; 123 – Rzeczycza Mokra, site 1; 124 – Rzeczycza Mokra, site 2; 125 – Rzeczycza Mokra, site 5; 126 – Rzeczycza Mokra, site 13; 127 – Sadłowie, site 17; 128 – Sadłowie, site 34; 129 – Sadowie, site 3; 130 – Sadowie, site 23; 131 – Sandomierz, site 43; 132 – Sandomierz, site 44; 133 – Sandomierz, site 78; 134 – Słabuszewice, site 46; 135 – Sońniczany, site 6; 136 – Sońniczany, site 33; 137 – Stodoły, site 1; 138 – Stodoły, site 11; 139 – Stodoły Kolonia, site 3; 140 – Stodoły Kolonia, site 6; 141 – Stodoły Kolonia, site 7; 142 – Stodoły Kolonia, site 52; 143 – Strochcice, site 3; 144 – Stryczowice, site 4; 145 – Stryczowice, site 7; 146 – Stryczowice, site 63; 147 – Studzianki, site 10; 148 – Szewce, site 2; 149 – Szewna, site 14; 150 – Szwarzowice, site 15; 151 – Szwarzowice, site 29; 152 – Trębanów, site 1; 153 – Trębanów, site 2; 154 – Tułkowice, site 14; 155 – Tułkowice, site 35; 156 – Usarzów, site 51; 157 – Usarzów, site 55; 158 – Wąworków, site 1; 159 – Wąworków, site 3; 160 – Węgrce Panięskie, site 18; 161 – Wilczyce, site 10; 162 – Wilczyce, site 64; 163 – Wilkowice, site 6; 164 – Winiary, site 3; 165 – Wojciechowice, site 1; 166 – Wojciechowice, site 4; 167 – Wojciechowice, site 6; 168 – Wojciechowice, site 8; 169 – Wojciechowice, site 20; 170 – Wojnowice, site 4; 171 – Worowice, site 6; 172 – Wólka Chrapanowska, site 7; 173 – Wólka Wojnowska, site 32; 174 – Zdanów, site 19; 175 – Złota, site 2; 176 – Złota, site 3 (*Złota-Nad Wawrem*); 177 – Złota, site 38; 178 – Złota, site 45; 179 – Złota, site 62; 180 – Złota, site 68; 181 – Złota, site 72; 182 – Zochcin, site 35; 183 – Zochcinek, site 13; 184 – Zochcinek, site 17; 185 – Żuków, site 2; 186 – Żurawica, site 4; 187 – Żurawica, site 5; 188 – Żurawica, site 7; 189 – Żurawica, site 8.

Galkowice-Ocin, site 15

The site was examined in October 2016 during intervention works by the Institute of Archaeology, Maria Curie-Skłodowska University. The five survey excavations, measuring 25 sq. m, were established, covering an area of over one are in total. Despite the presence of numerous artefacts and bones on the surface of the site, only one feature was found in the excavations, which was a GAC settlement pit. This probably indicates some degree of degradation of the site.

Feature 1

The pit was only partially recognized. It was oval and had lengths of at least 300 cm, width undefined and depth 80 cm. At the level of the bottom of the pit four circular recesses were found, basin-like in the cross-section, with a diameter of 60 cm each and a depth of 10 to 40 cm.

In the fill, 97 pottery shards were discovered: a large fragment of a beaker with a simple, horizontal corded ornament (Fig. 2: 1), two rims with a composition of rectangular stamps with cord impressions (Fig. 2: 2–3) and one undecorated rim (Fig. 2: 4). There was also a damaged clay whorl fragment (Fig. 2: 5). On the surface of the site other fragments with more complex ornamental motifs were found: one shard with festoon corded elements (Fig. 3: 1) and one with wavy and horizontal quadruple corded lines (Fig. 3: 2), and the next four with mat-like cord impressions (Fig. 3: 3–6). On another shard the above co-occurred with one knob on the belly (Fig. 3: 7).

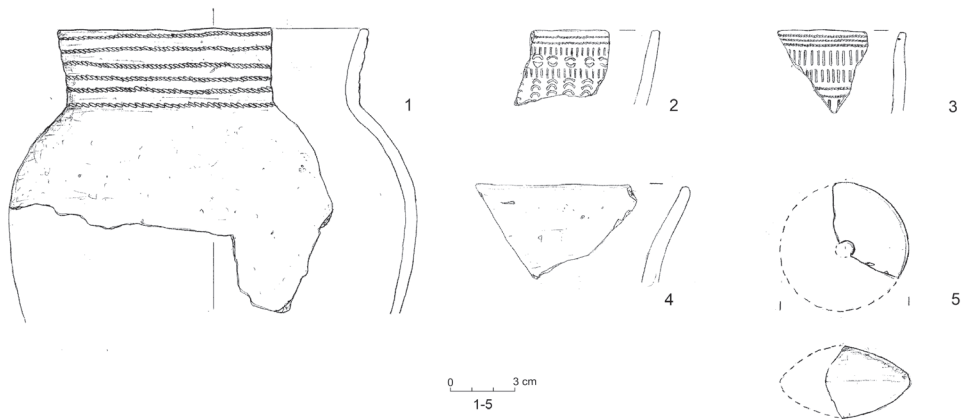


Fig. 2. Galkowice–Ocin, site 15, Wilczyce district. Pottery from Feature 1. Drawn by M. Florek

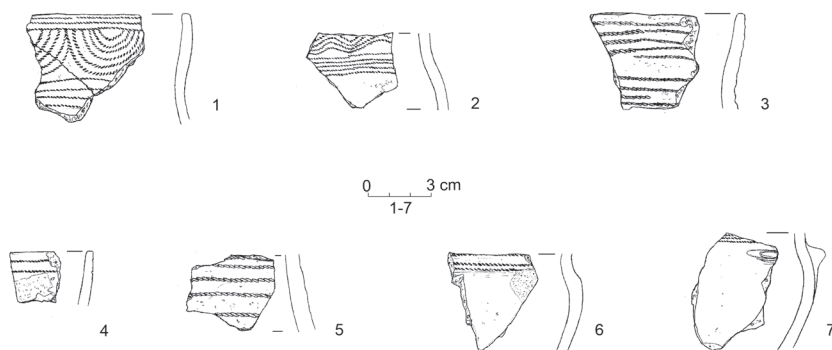


Fig. 3. Galkowice–Ocin, site 15, Wilczyce district. Pottery of the Globular Amphora culture found in topsoil. Drawn by M. Florek

The flint inventory of the feature comprises a damaged small fragment of an axe made of Świeciechów flint and four flakes of the same raw material, one flake of striped flint and one flake of Jurassic flint. In addition, the fill of Feature 1 yielded a fragment of a groundstone, 13 fragments of animal bones, four mussel shells and a lump of daub. At the bottom of the pit and in its ceiling there were a dozen stones of various size – lumps and crumbs of local rock.

Mierzanowice, site 1

The settlement marked with this number was located on the top of a hill in the Gierczanka river basin. It was discovered in 1935 and explored by K. Salewicz in 1938. In total 30 features were found there, most of which belong to the GAC [Nosek 1967: 167–181]. The field documentation alas, has been lost. The artefacts from settlement pits founded on this site were published by B. Balcer [1963].

Feature 173

Judging by the amount of material and information from the tags, it was a large pit divided into parts. It is possible that several features merged into stratigraphic relations with each other were registered here. However, the pottery found there is quite homogeneous and referenced only to the GAC. There were remains of numerous unornamented vessels in the type of bowls [Balcer 1963, Pl. IV: 1; V: 11–12], two-handed amphorae [Balcer 1963, Pl. IV: 4; V: 6,9–10] and beakers [Balcer 1963, Pl. V: 4; VI: 2]. Others were ornamented only with fingerprints [Balcer 1963, Pl. V: 7] or a row of knobs [Balcer 1963, Pl. V: 3]. The share of pottery decorated only with a combination of stamps was quite large in the set. There were remains of vessels only with simple rows of stamp [Balcer 1963, Pl. IV: 5; VI: 4], with rows combined with zigzags [Balcer 1963, Pl. VI: 1,6] and metopes made in

the same technique presented on four-handle amphorae [Balcer 1963, Pl. V: 13]. Some are connected with horizontal corded lines [Balcer 1963, Pl. V: 1; VI: 12]. The most complex multi-elements motifs were made of cord impressions consisting of suspended [Balcer 1963, Pl. VI: 7] or hatched triangles [Balcer 1963, Pl. VI: 3,13] bound by horizontal lines and summed up by a row of vertical impressions. One of the rims had short vertical cord impressions between horizontal lines and, below the neck, metopes filled with diagonal sections of the cord [Balcer 1963, Pl. VI: 8]. The rest of the shards were decorated with simple horizontal cord impressions on the neck [Balcer 1963, Pl. IV: 1,4,8]. Altogether, several hundred fragments of pottery from at least 35 vessels were discovered in the pit.

There were also a few blades made of Świeciechów flint [Balcer 1963, Pl. IV: 11–12,14,16], several dozen flint flakes (unpublished), one bone awl [Balcer 1963, Pl. IV: 13] and animal bones.

Feature 187

It was a circular pit with a diameter of about 100 cm [Balcer 1963, Fig. 2]. The depth and shape of the cross-section is unknown. There were almost one hundred pottery shards in the fill and one, almost entire, wide-necked tureen with six handles [Balcer 1963, Pl. VI: 3]. Among the remaining fragments were some with a horizontal cord (unpublished) and two rims decorated with a combination of cord impressions and a row of stamps [Balcer 1963, Pl. VII: 2,4].

In the fill were also animal bones and a damaged axe made of striped flint [Balcer 1963, Pl. VII: 7]. Another axe [Balcer 1963, Pl. VII: 5], a retouched blade made of Świeciechów flint [Balcer 1963, Pl. VII: 1] and over a dozen flakes were found near the pit.

Feature 194

The shape of the pit and its dimensions are unknown. Dark fill has been noticed at the depth of 75 cm. The artefacts were discovered above, but it seems to be a homogeneous set. There were 130 pottery shard, among them, a rim and belly of the beaker ornamented with wavy and horizontal cord impressions [Balcer 1963, Pl. VII: 17] and fragments of bottoms from two other vessels [Balcer 1963, Pl. VII: 18–19].

The flint inventory consisted of 16 flakes (one retouched) of striped flint, six blades and five flakes of Świeciechów flint, one flake-core and six flakes made of chocolate flint (unpublished). There were also many lumps of daub in the set marked with this number.

Feature 211

The field notes show that the pit was partially damaged by contemporary fosse. We do not know anything about its shape and dimensions. Pottery, numbering over one hundred was found in the fill, featuring large fragments of Kujawian amphora decorated with horizontal and festoon corded lines [Balcer 1963, PL. IX: 19],

a beaker with vertical, short corded sections between horizontal corded lines on the neck [Balcer 1963, Pl. IX: 8], another with corded checkered and a zigzag [Balcer 1963, Pl. IX: 4]. One fragment had wavy cord impressions (unpublished). Other rims were ornamented with a solely stamp technique with rows and zigzags [Balcer 1963, Pl. IX: 3,5]. One of them had incrustation [Balcer 1963, Pl. IX: 6]. There were also vessels with a row of fingerprints and another without an ornament [Balcer 1963, Pl. IX: 20].

The flint inventory consisted of two damaged striped flint axes [Balcer 1963, Pl. IX: 7,13], two sidescrapers [Balcer 1963, Pl. IX: 16] and 56 flakes made of the same raw material. There were also a perforator (unpublished), retouched and rough blades of chocolate flint [Balcer 1963, Pl. IX: 10], three blades [Balcer 1963, Pl. IX: 9, 14–15], 11 flakes and a concretion of Świeciechów flint, and a sanding plate. The next tool was a bone awl [Balcer 1963, Pl. IX: 17]. The function of boar tusks found in inventory is unclear [Balcer 1963, Pl. IX: 12]. The fill of the pit contained animal bones, including cattle, pigs and deer, shells and lumps of daub.

Feature 226

According to the field notices it was oval pit with dimensions of 220 by 240 cm and depth of 75 cm. It was basin-shape in cross-section. Almost two hundred pottery shards were found in the fill: a whole undecorated amphora [Balcer 1963, Pl. XI: 15], another vessel of this type with ornament made only of rectangular stamps arranged in rows, zigzags and metopes [Balcer 1963, Pl. XI: 11], a bowl with the same technique of decoration [Balcer 1963, Pl. XI: 19], beakers ornamented with suspended triangles made of corded lines between rows of stamps [Balcer 1963, Pl. XI: 13] and another shard with festoon cord impressions [Balcer 1963, Pl. XI: 9].

Found were one flake-core and one unfinished axe made of striped flint, 14 flakes of this raw material, a flake-core and scraper of chocolate flint, eight flakes of Świeciechów flint, a groundstone and pestles. Among animal bones found in the fill were a jaw of a pig, remains of a sheep or goat and cattle.

Feature 229

We have not had any information about the shape and dimensions of the pit. It is also unknown how many artefacts have been discovered here. Among them, a large fragment of a beaker ornamented with horizontal corded lines and rows of stamps [Balcer 1963, Pl. XI: 22], an undecorated rim of another vessel [Balcer 1963, Pl. XI: 23] and some shard with a handle (unpublished) have been preserved in the collection as well as a lump of daub.

Mierzanowice, site 4

The settlement adjacent directly to Site 1 described above, is perhaps an extension of this. It was excavated in 1957 and 1959 as a continuation of the field work

of Salewicz. In total, more than 30 features have been discovered there, of which 16 can be associated with the GAC [Gardawski, Miśkiewicz 1958; Wrotek 1961; Nosek 1967: 182–186; cf. history of research in Bąbel 2013]. For radiocarbon dating features excavated in 1957 were selected.

Feature 2

An oval shape measuring 200 by 150 cm at the discovery level, pear-shaped and flat-bottomed in cross-section [Gardawski, Miśkiewicz 1958, Fig. 3], reaching a depth of 215 cm. Dozens of pottery fragments were discovered in the fill, among them, shards ornamented horizontal cord impressions (unpublished) and a bowl decorated with rows of stamps, triangles and zigzags made in this technique [Gardawski, Miśkiewicz 1958, Pl. L: 1].

There were also several blades and flakes made of striped and chocolate flint (unpublished) and animal bones, including cattle.

Feature 5

A circular pit with a diameter of 120 cm and depth of 110 cm. It had straight walls and a flat bottom in the cross-section. Over one hundred pottery shards were found inside. Among them, were fragments of vessels decorated in horizontal corded lines, sometimes cut by a vertical element [Gardawski, Miśkiewicz 1958, Pl. XLIX: 4] or complementary stamps or knobs [Gardawski, Miśkiewicz 1958, Pl. L: 6]. A bowl with horizontal and festoon cord impressions was also found [Gardawski, Miśkiewicz 1958, Pl. XLIX: 7]. There were moreover, bowls and beakers with a complex decorative motif made of horizontal corded lines and suspended triangles combined with plastic elements like handles or knobs [Gardawski, Miśkiewicz 1958, Pl. XLIX: 5, Fig. 8] and an incrustation was recorded on some ornaments. Other vessels had simple decorations in the form of a row of fingerprints [Gardawski, Miśkiewicz 1958, Pl. L: 3]. One fragment of a bowl, decorated with a round stamp imitating a cord, is also interesting in terms of provenance [Gardawski, Miśkiewicz 1958, Pl. XLIX: 6].

In addition, a bone awl [Gardawski, Miśkiewicz 1958, Pl. LI: 5], dozens of flakes made of striped and chocolate flint (unpublished) and many animal bones were to be found in the fill.

Feature 19

A circular pit measuring 180 cm in diameter. It was basin-shaped and reached 160 cm in the cross-section. Inside, dozen of pottery shards ornamented with horizontal cord impressions, some combined with a row of stamps were found. There were also fragments of bowls and beakers. One of them was additionally decorated with wavy, horizontal and vertical multiple corded bands connected with knobs on the neck [Gardawski, Miśkiewicz 1958, Pl. XLIX: 2].

The inventory of flint boasted two axes of Świeciechów and striped flint [Gardawski, Miśkiewicz 1958, Pl. LI: 6–7] and dozens of blades and flakes (unpublished). The fill contained also animal bones and charcoal.

Złota-Nad Wawrem

Site 3 in Złota, commonly called *Nad Wawrem*, is a part of the well-known multicultural complex of sites near Sandomierz. This place is the largest settlement of the Sandomierz-Opatów subgroup. According to the preliminary reconnaissance carried out as part of the NSC project, at least 75 settlement features of the GAC have been registered there [Witkowska, Włodarczak 2021, Fig. 2]. However, due to the lack of a complete processing of the site, an estimate of definite number of GAC pits is impossible. The radiocarbon samples were obtained for 10 of them. Some of the dated features were previously presented in the literature as belonging to the Złota culture (features 49, 71, 90, 140, 184) [Krzak 1976]. Moreover, four of them were discussed in detail in a separate article in this volume due to their relationship with the CWC [Witkowska, Włodarczak 2021]. There is also a complete history of research and publication of the site explored in the years 1926–29.

Feature 16

A settlement pit of indeterminate shape and illegible borders. In the field drawing, the approximately circular cluster of artefacts is outlined with a rectangular line, probably reflecting the space of exploration [Krzak 1976, Fig. 7]. The materials occupy a space with a diameter of about 190 cm and the depth of the feature was 90 cm. About 300 fragments of pottery were discovered in the fill, of which 250 belong to the GAC. Among them, are shards ornamented with horizontal imprints of cord, probably mostly from beakers (Fig. 4: 1–6), some with a row of stamps (Fig. 4: 9) or fingerprints (Fig. 5: 6–7), remains of two-handle undecorated amphorae (Fig. 4: 10) and rims of other unornamented vessels (Fig. 4: 7–8, 12–14). There were also a few fragments with a round stamp imitating cord impressions (Fig. 5: 1–3), one rim with a horizontal cord band cut across by a vertical impression (Fig. 5: 4) and one with a wavy and horizontal cord (Fig. 5: 5). The remaining 50 fragments make up almost the entire big amphora of a clearly exogenous nature (Fig. 5: 8) [Krzak 1976, Fig. 8: a]. This vessel finds analogies in the Baden cultural circle [cf. Zastawny 2015a, Fig. 9].

The tool inventory consisted of 13 artefacts made of striped and Świeciechów flint, including a blade retouched in the proximal part (Fig. 6: 1) and two end-scrapers made of irregular, massive flakes (Fig. 6: 2–3) and 10 unretouched flakes (Fig. 6: 4–13), one from an axe (Fig. 6: 13). Moreover, the pit's fill yielded some stones, shells, lumps of daub and several animal bones.

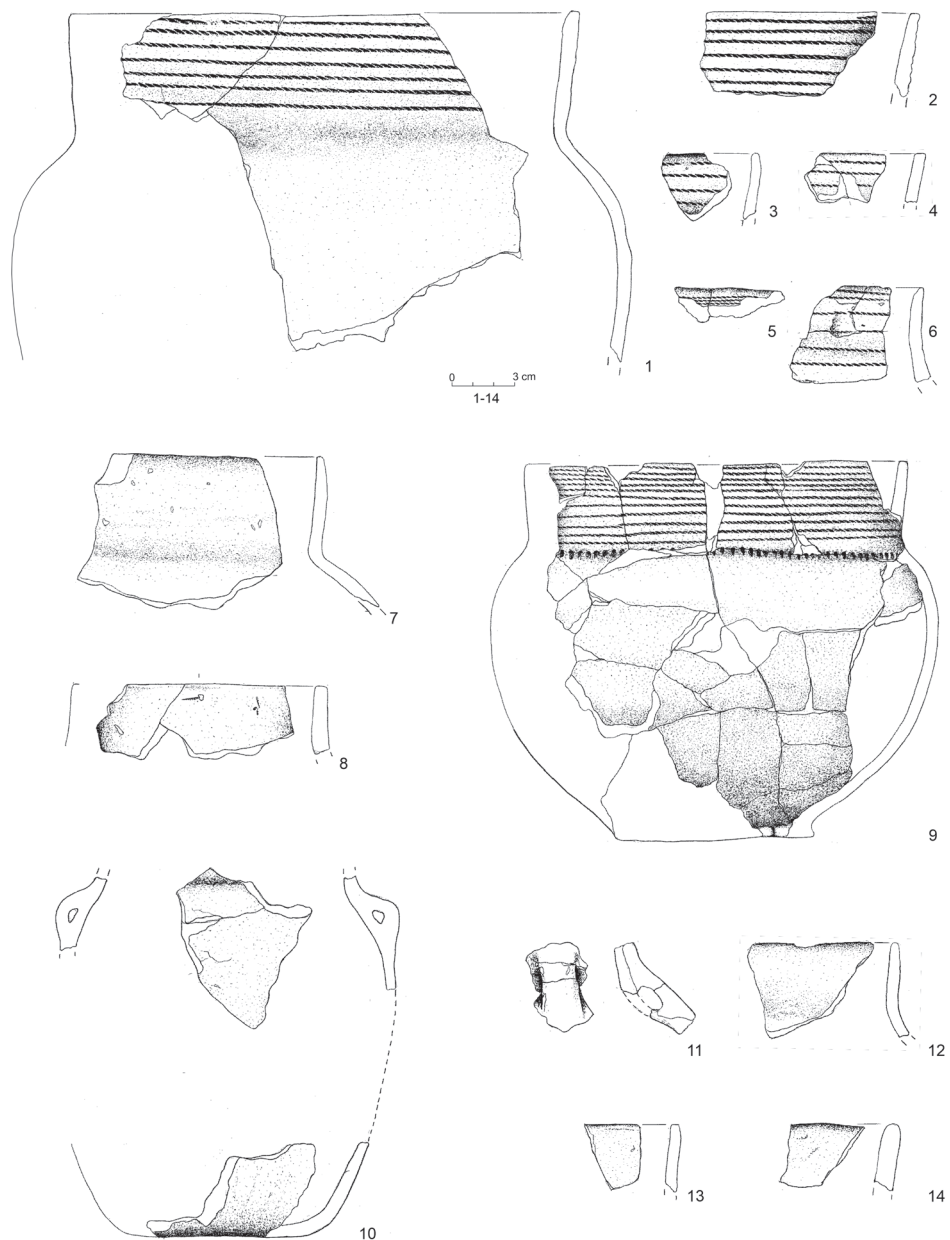


Fig. 4. Złota-Nad Wawrem site, Sandomierz district. Pottery from Feature 16. Drawn by B. Witkowska

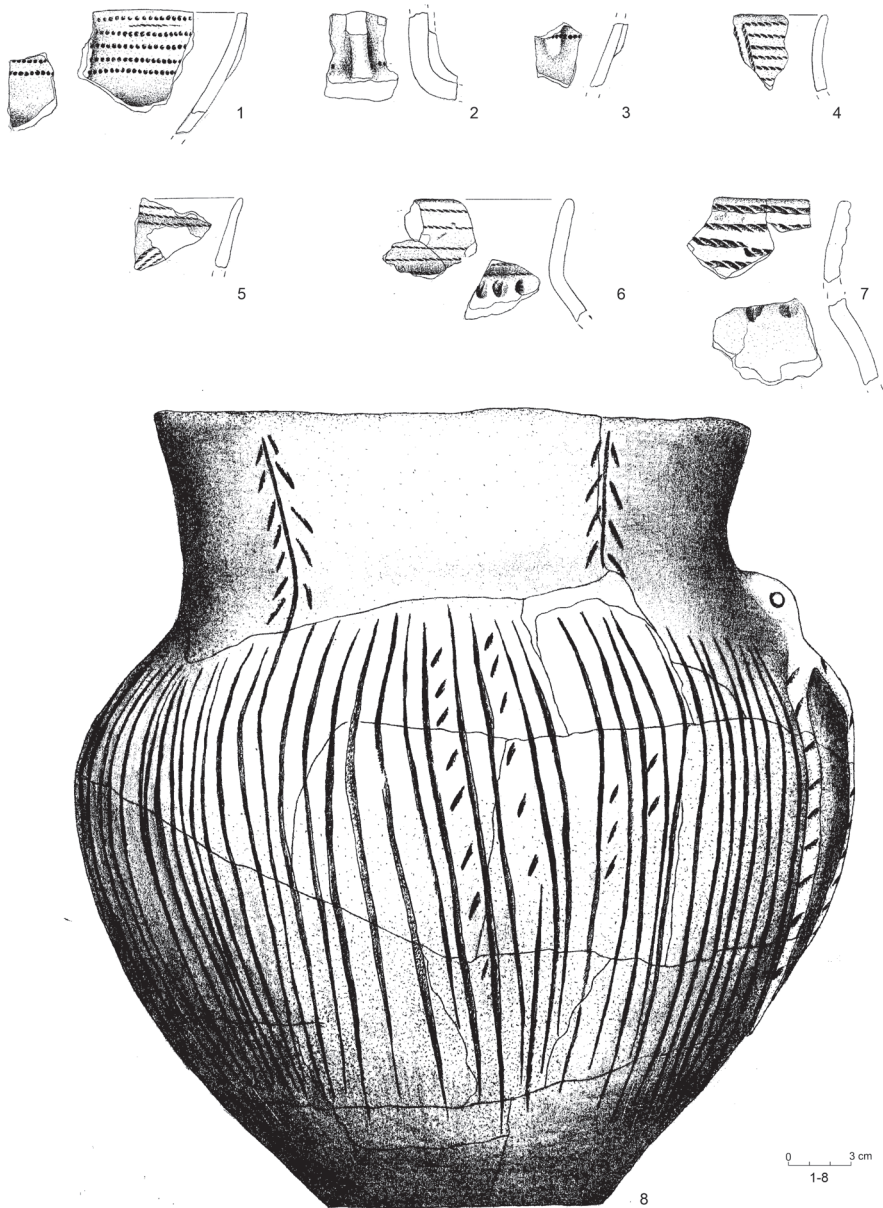


Fig. 5. Złota-Nad Wawrem site, Sandomierz district. Pottery from Feature 16. Drawn by B. Witkowska

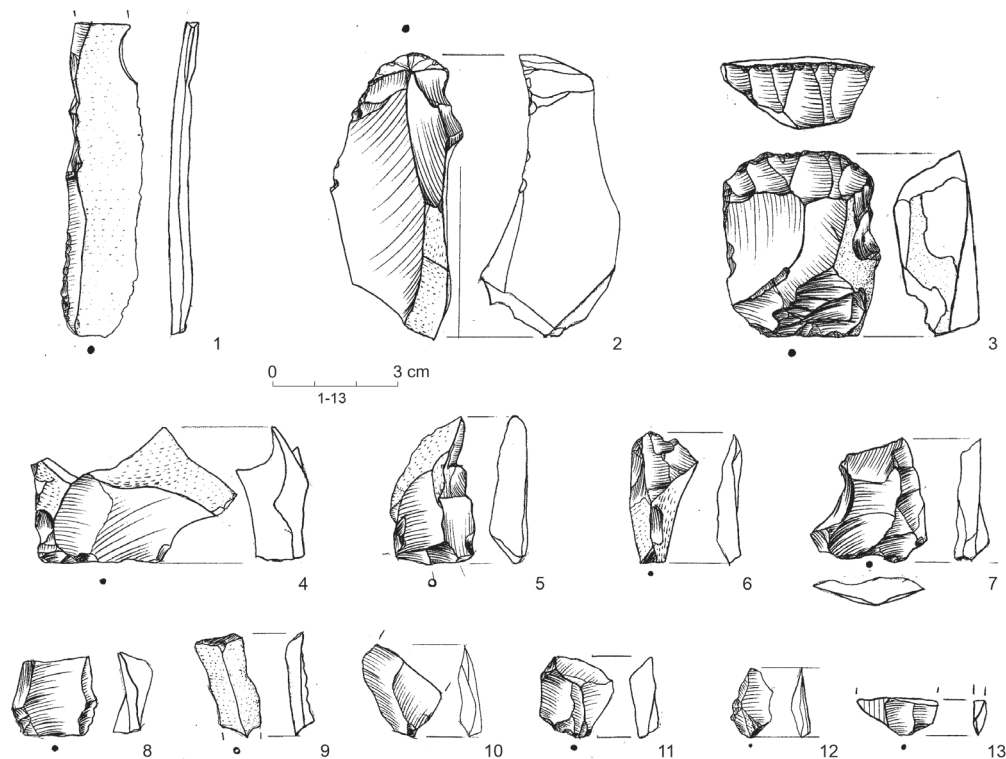


Fig. 6. Złota–Nad Wawrem site, Sandomierz district. Flint artefacts from Feature 16: 1–3, 7–10 – Świeciechów flint; 4–6, 11–13 – striped flint. Drawn by B. Witkowska

Feature 32

A rectangular large pit with a trapezium-shaped vertical cross-section. At the level of discovery, it was 190 cm wide and 250 cm long. On the bottom, the longer axis of the pit measured 350 cm. The depth of the feature reached 150 cm. From the level of 80 cm, the fill was saturated with materials. Over a thousand pottery shards were found there. Among them, there were numerous rims of the beakers decorated by horizontal cord impressions (Fig. 7: 1–7), remains of two- and four-handled amphorae with an analogous ornament (Fig. 7: 8, 10–11), a bowl with a festoon corded ornament analogous to the one found in Pit 90 [Witkowska, Włodarczak 2021, Fig. 18: 9], shards from beaker and bowls with combined horizontal and wavy cord impressions (Fig. 7: 9; 8: 1–2), one belly with short cord impressions grouped in diagonal metopes between horizontal lines (Fig. 8: 4), a bowl decorated with a single, horizontal cord and V-shaped stamps (Fig. 8: 5). There were also vessels with only knobs (Fig. 8: 6) and unornamented specimens (Fig. 8: 7–10).

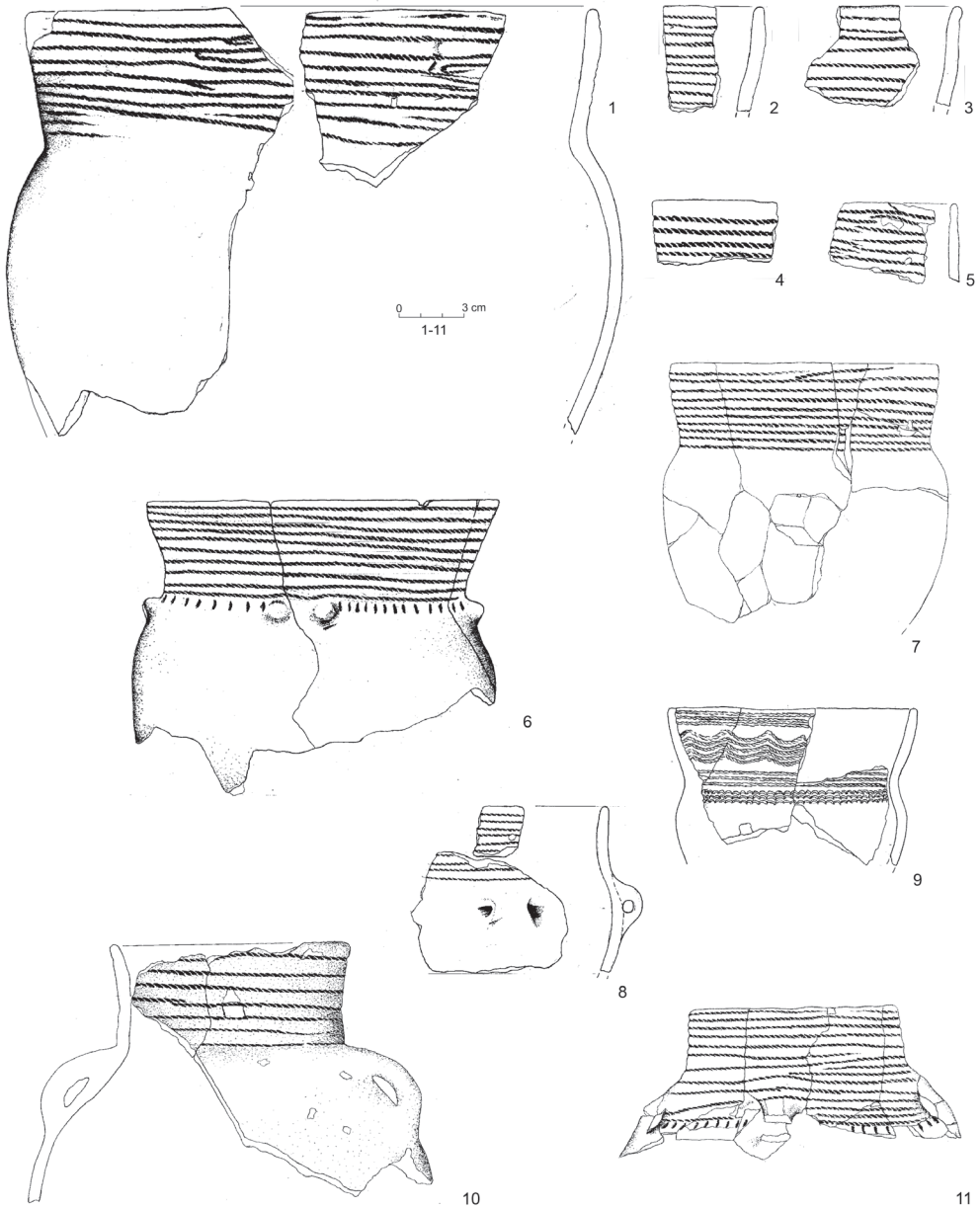


Fig. 7. Złota-Nad Wawrem site, Sandomierz district. Pottery from Feature 32: 1-5, 7-11 – drawn by B. Witkowska; 6 – after archives of State Archaeological Museum in Warsaw

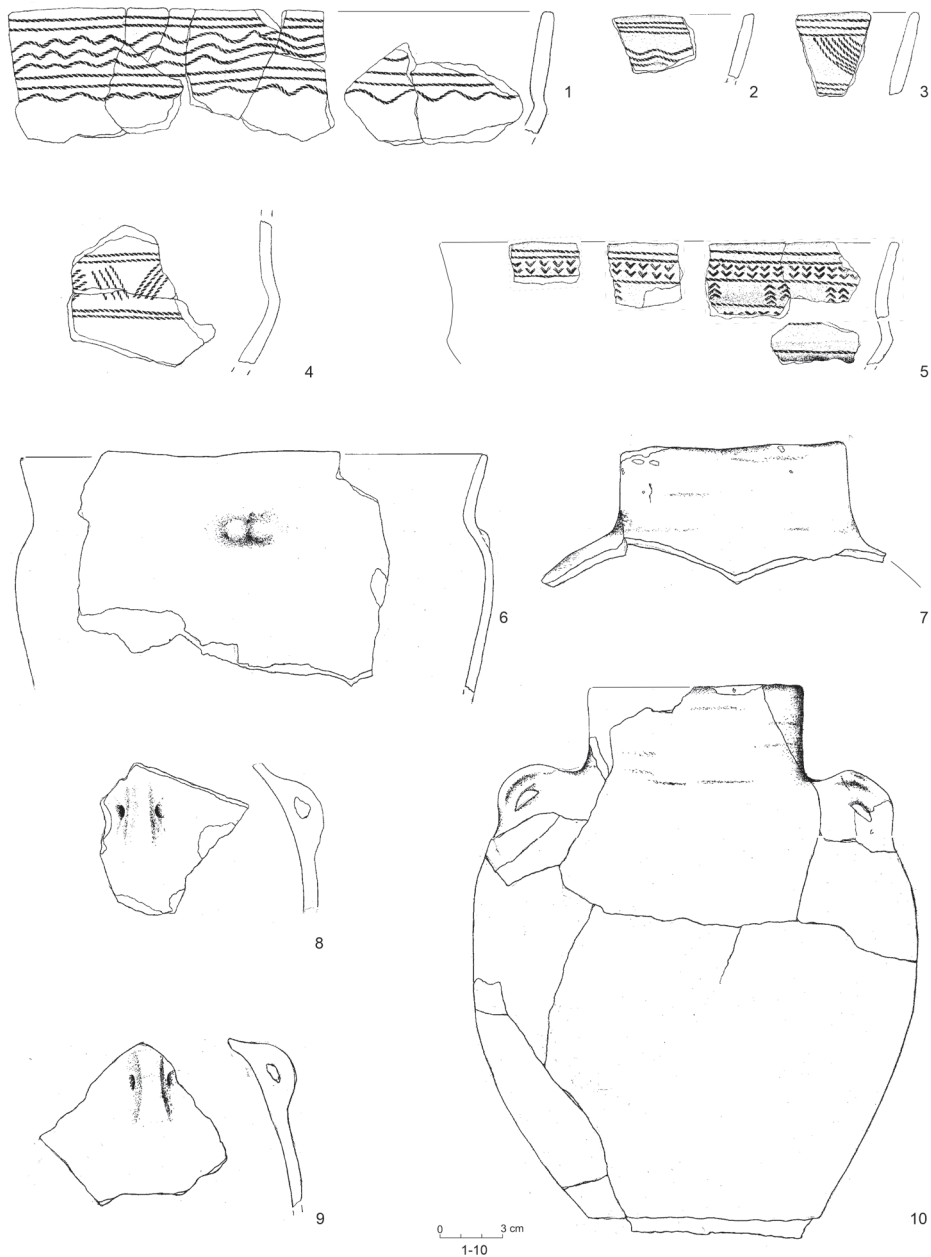


Fig. 8. Złota–Nad Wawrem site, Sandomierz district. Pottery from Feature 32. Drawn by B. Witkowska

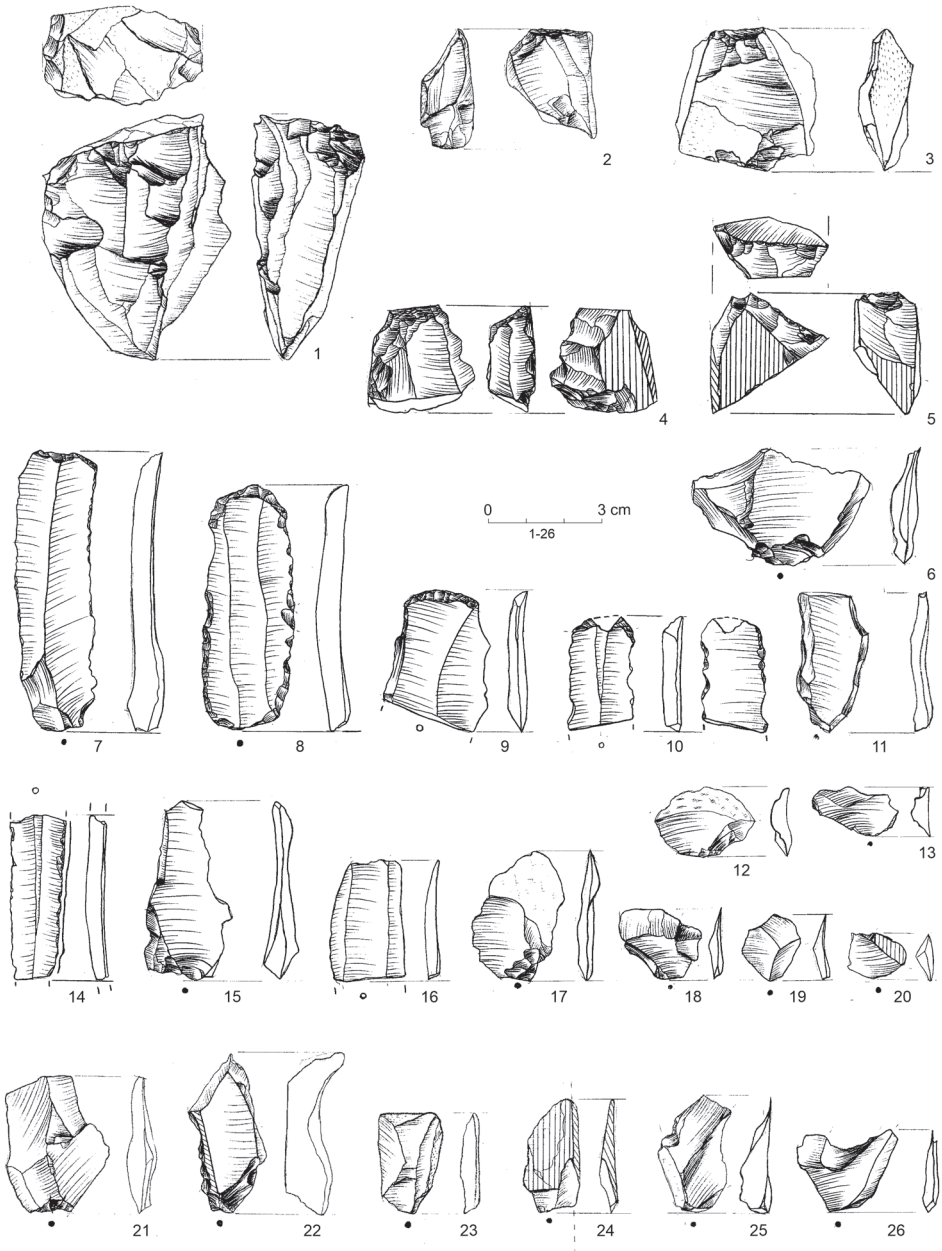


Fig. 9. Złota-Nad Wawrem site, Sandomierz district. Flint artefacts from Feature 32: 1, 4-5, 7-9, 14-18, 20-24 – Świeciechów flint; 2-3, 10-13 – chocolate flint; 19, 25-26 – striped flint. Drawn by B. Witkowska

The flint inventory comprises 25 artefacts, including one single-platform bladed core (Fig. 9: 1), four splintered pieces (Fig. 9: 2–5), two of them coming from axes (Fig. 9: 4–5), one half-tilted (Fig. 9: 7), three endscrapers (Fig. 9: 8–10), one sidescraper (Fig. 9: 11), one retouched blade (Fig. 9: 14), two unretouched (Fig. 9: 15–16) and 14 flakes (Fig. 9: 6,17–26), as well as two from polished axes (Fig. 9: 20,24). The Świeciechów flint is the dominant raw material of the set with 15 artefacts made of it, four of striped flint, the next four of chocolate flint and two of undefined flint. The toolkit includes also two bone blades (Fig. 10: 1–2), one made from a boar's tusk (Fig. 10: 2). Animal tooth pendants also were found above the object in the topsoil layer (Fig. 10: 3). In addition, the fill of the feature contained stones, many daub lumps with structural impressions, charcoals, animal bones and a cluster of shells.

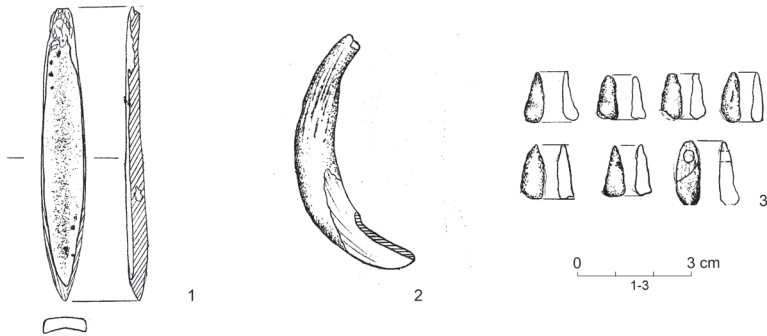


Fig. 10. Żłota–Nad Wawrem site, Sandomierz district. Bone artefacts from Feature 32 and topsoil above. Drawn by B. Witkowska

Feature 49

A large oval-rectangular pit. At the level of discovery, it was 520 cm wide and 600 cm long. Down to a depth of 100 cm, it was regularly slightly basin-like shaped; below, it separated into several depressions. In the deepest place it reached 210 cm. Probably it was a kind of domicile with accompanying storage pits [Witkowska, Włodarczak 2021, Fig. 3]. In the feature 2,342 fragments of pottery from about 170 vessels ornamented by horizontal and wavy cord impressions combined with stamp or finger impressions were found. There were some vessels with plastic elements or without an ornament also [Witkowska, Włodarczak 2021, Fig. 4–7]. Among them, fragments of the so-called A-amphora were discovered [Witkowska, Włodarczak 2021, Fig. 7: 16,20].

The tool inventory includes 55 flints and one bone blade in the type of a perforator [Witkowska, Włodarczak 2021, Fig. 8]. Moreover, the feature fill yielded

a damaged amber ornament, 40 shells, fine charcoals and large structural daub lumps with impressions. Apart from these, many animal bones were discovered.

Feature 71

The GAC settlement pit was cut into by a CWC grave. It was round with a maximum diameter of about 140 cm and had straight vertical walls [Witkowska, Włodarczak 2021, Fig. 12: a-b]. Its depth reached 100 cm. The pit yielded 1,334 highly comminuted pottery shards among which the remains of at least 33 vessels could be identified. A large portion was unornamented [Witkowska, Włodarczak 2021, Fig. 12: 1–7]. Other materials were decorated by a horizontal cord in a few combinations with stamps, knobs and finger or festoon cord impressions. In three cases, the stamp impressions occurred alone. One of the beakers was ornamented with only a row of finger impressions [Witkowska, Włodarczak 2021, Fig. 13].

The flint inventory comprises 36 artefacts, including 16 flakes, 10 blades, one endscraper and two scrapers on a flake, three splintered pieces, a flint hammer and a round, flat stone which could have served as a pestle [Witkowska, Włodarczak 2021, Fig. 14–15]. Moreover, there were found one bone awl, large structural daub lumps, animal bones and many shells.

Feature 80

A small, circular pit with a diameter of 150 cm and depth of 100 cm. It had a very regular shape and straight walls reaching to a slightly basen-shape bottom. The fill was full of artefacts. Over 400 fragments of pottery were found there. Among them, almost a whole beaker with grouped corded lines (Fig. 11: 1) and cup with horizontal and wavy corded bands (Fig. 11: 2), many remains of bowls with a similar ornament (Fig. 11: 3–5), some completed with a V-shaped stamp (Fig. 11: 7–8) or festoons made of cord (Fig. 11: 6) and fragments of Kujawian amphorae (Fig. 11: 9–10). There were also many rims and fragments of necks with horizontal cord impressions (Fig. 12: 1–2), including some with a row of stamps (Fig. 12: 3), knob (Fig. 12: 4) or nail impressions (Fig. 12: 5). Some ornaments on amphorae and bowls bear traces of incrustation.

The flint inventory comprises four unretouched blades, one flake and one damaged axe, all made of Świeciechów flint, one bladed core of striped flint, one natural fragment of this raw material and one blade of chocolate flint. Further, in the fill of the pit were discovered several animal bones and lumps of daub.

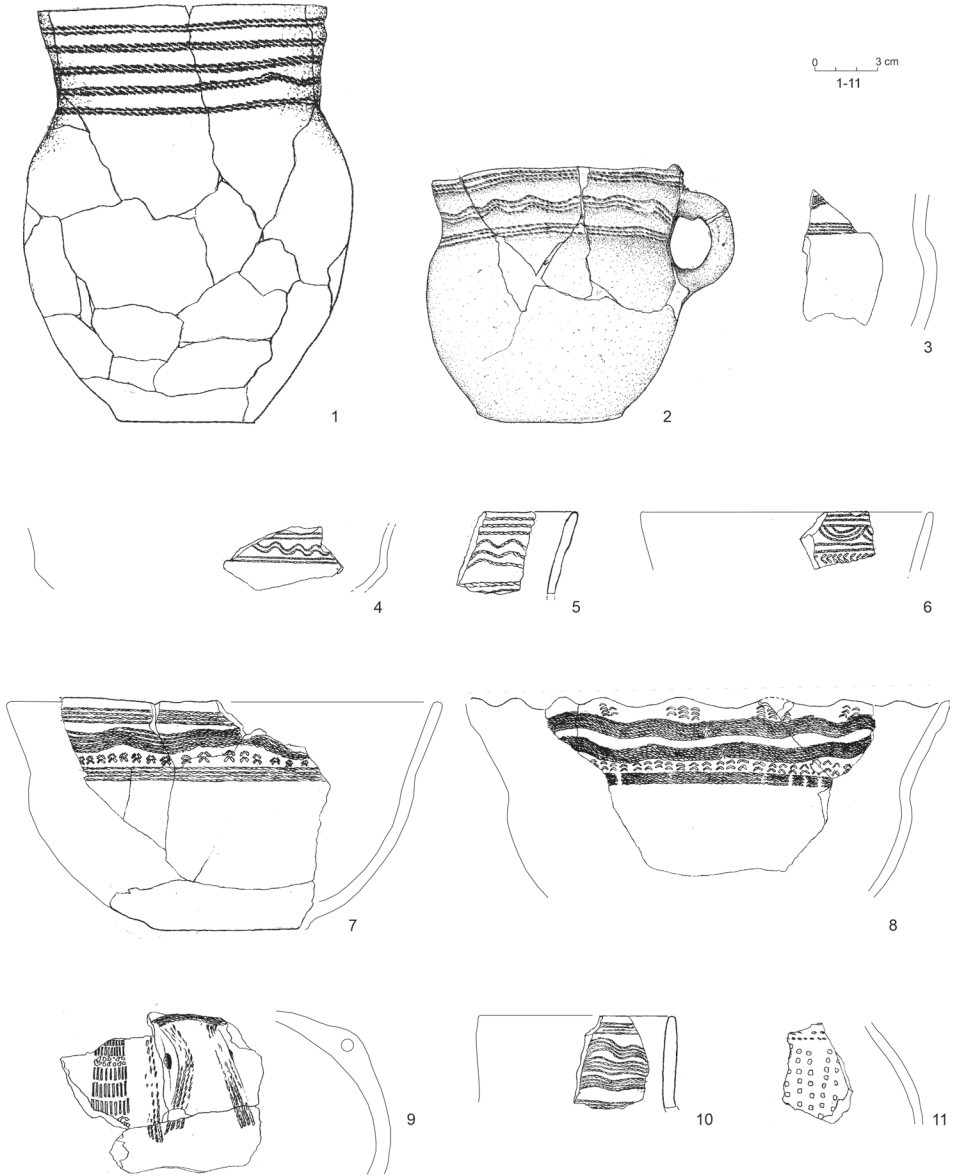


Fig. 11. Złota-Nad Wawrem site, Sandomierz district. Pottery from Feature 80: 1-2 – drawn by A. Czubińska; 3-11 – after archives of State Archaeological Museum in Warsaw

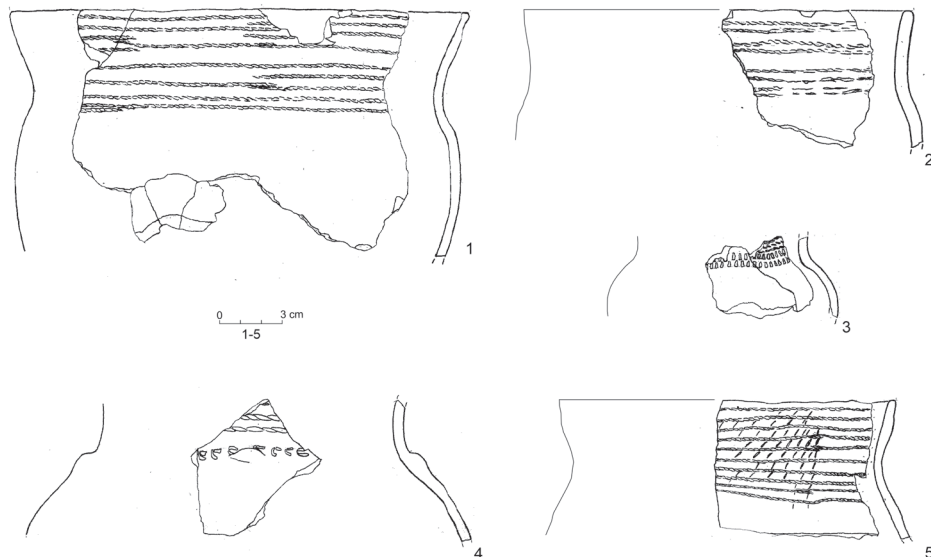


Fig. 12. Złota–Nad Wawrem site, Sandomierz district. Pottery from Feature 80. After archives of State Archaeological Museum in Warsaw

Feature 90

A settlement pit of the GAC cut into by a CWC grave designated by the same number. It is hard to definitely determine the shape and size of it. The GAC materials that occupied a space about 160 cm long and less than 100 cm wide, were encircled with a line marking a greater range. Perhaps the line marked the boundary of the exploration dig, while the feature itself was probably oval in shape [Witkowska, Włodarczak 2021, Fig. 18: a]. Inside, 612 pottery shards were found, coming from about 16 vessels decorated with horizontal or festoons cord impressions, combinations of stamps, cord and knobs or without an ornament [Witkowska, Włodarczak 2021, Fig. 18: 1–11].

There was only one tool found: a massive endscraper made out of a striped-flint flake [Witkowska, Włodarczak 2021, Fig. 18: 12]. Additionally, there was a single pebble with traces of use, shells and fine animal bones.

Feature 140

According to the field documentation, it was a very large, irregular pit with an uneven bottom, 13 meters long and 8.5 meters wide [Krzak 1976, Fig. 20]. The deepest part of the pit reached two meters, but most of the bottom surface was at a depth of 80 cm. One of the cross-sections shows a recess in the type of

cellar (unpublished field documentation from the State Archaeological Museum in Warsaw). Probably Feature 140 was a dwelling pit similar to Pit 49.

Over 4,500 fragments of pottery were discovered there. Among them, were remains of undecorated vessels in the type of beakers [Krzak 1976, Fig. 21: c] or two-handled (unpublished) and four-handled amphorae [Krzak 1976, Fig. 21: e]. The other amphorae were ornamented with very complex multi-elements motifs combined with horizontal and wavy cord impressions and stamps grouped in the metopes. There was almost a whole tureen [Krzak 1976, Fig. 21: d], a large fragment of a typical Kujawian amphora (unpublished) and numerous smaller fragments from four-handled amphorae decorated in this style. The fusion of cord impressions and stamps on the beakers were observed, one case with a single horizontal line and a zigzag made of stamps [Krzak 1976, Fig. 21: b] and another with corded festoons and impressions of round stamps [Krzak 1976, Fig. 21: f]. The other beakers were adorned with less complex motifs of a horizontal corded band [Krzak 1976, Fig. 21: a], sometimes combined with rows of fingerprints, stamps or knobs (unpublished), sometimes grouped in two or three lines (unpublished). There were also bowls with a wavy and horizontal corded band and vessels with simple rows of fingerprint or grouped knobs (unpublished).

Over a hundred flint artefacts were discovered (all unpublished). The dominant raw material of the inventory was Świeciechów flint represented by one blade-core, 38 flakes and four blades. The next 37 were of striped flint, one of them was a sidescraper on the cortical flake. Some flakes were retouched. The damaged axe was made of the same raw material. There were also a few chocolate flakes. The collection of tools was enlarged by two bones awls (unpublished). Many animal bones, shells, rough stones, large structural daub lumps with impressions of construction and charcoals were found also in the fill.

Feature 170

The shape and dimensions of the pit at the discovery level is unknown, as it was part of a larger stratigraphic complex. According to the field documentation, it was clearly distinguished at lower levels, but it was not drawn. Only a drawing of the cross-section has survived. It shows a trapezoidal pit with a bottom diameter of about 170 cm and depth of 70 cm. There were few artefacts in the fill, where only 130 fragments of pottery were found: a rim of a bowl decorated with wavy and horizontal corded bands (Fig. 13: 1), a fragment of another bowl with a preserved row of stamps (Fig. 13: 2), shards with simple horizontal cord impressions (Fig. 13: 3–5), some with a row of fingerprints, one fragment with a single knob (Fig. 13: 7), an unornamented handle of an amphora (Fig. 13: 10) and rims of other undecorated vessels (Fig. 13: 6,8–9).

Among flint artefacts there was a retouched blade and burin made of chocolate flint, a retouched flake of Turonian flint and one flake of striped flint. Only a few animal bones, shells and many rough stones were found in the fill.

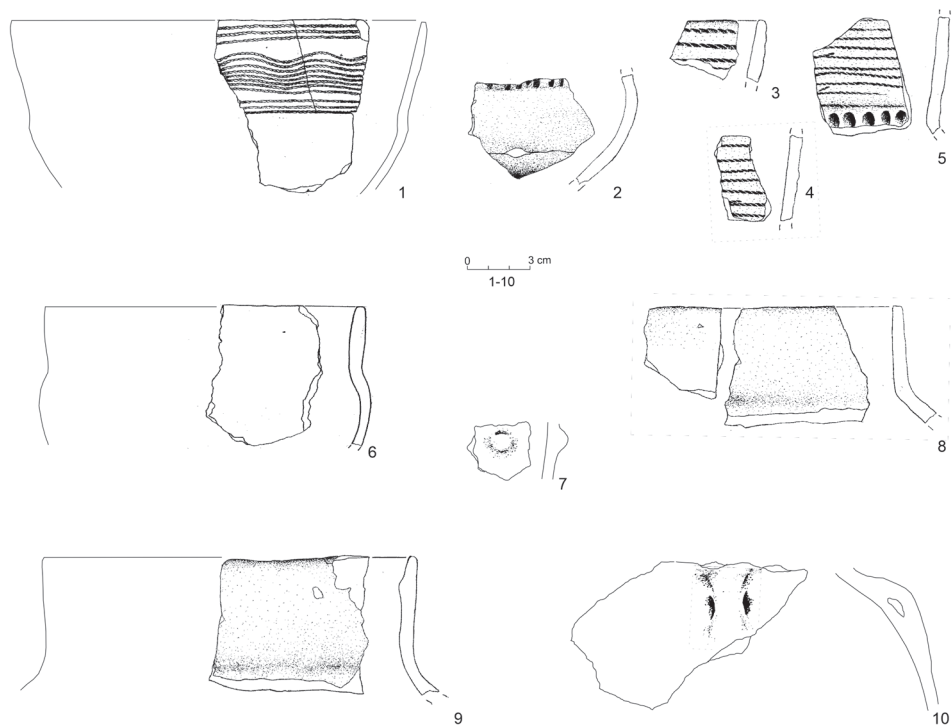


Fig. 13. Złota-Nad Wawrem site, Sandomierz district. Pottery from Feature 170: 1, 6 – after archives of State Archaeological Museum in Warsaw; 2–5, 7–10 – drawn by B. Witkowska

Feature 184

A circular pit with a trapezium-shaped vertical projection, had a diameter of 160 cm at the level of discovery and 250 cm on the bottom. Its depth reached 120 cm [Witkowska, Włodarczak 2021, Fig. 9: a-b]. In the feature were discovered 921 fragments of pottery, originating with at least 55 vessels of which most were decorated with horizontal cord impressions. Those ornaments co-occurred with wavy cord, finger imprints, knobs or a few kinds of stamp [Witkowska, Włodarczak 2021, Fig. 9: 1–15, 10: 1–12]. Among the GAC pottery was an almost complete large Type A amphora identified with the milieu of the early CWC [Witkowska, Włodarczak 2021, Fig. 10: 13].

In Feature 184, 11 flint artefacts were found, mostly unretouched scaled pieces and small flakes. Only one tool was there: a single amorphous Świeciechów flint sidescraper [Witkowska, Włodarczak 2021, Fig. 11]. The fill of the pit yielded four rough stones, many shells, daub lumps with structural impressions and animal bones.

Feature 202

A small, circular pit with a diameter of 100 cm and a depth of 85 cm. In the cross-section an annex forming a step was visible. A patch of burnt clay was also

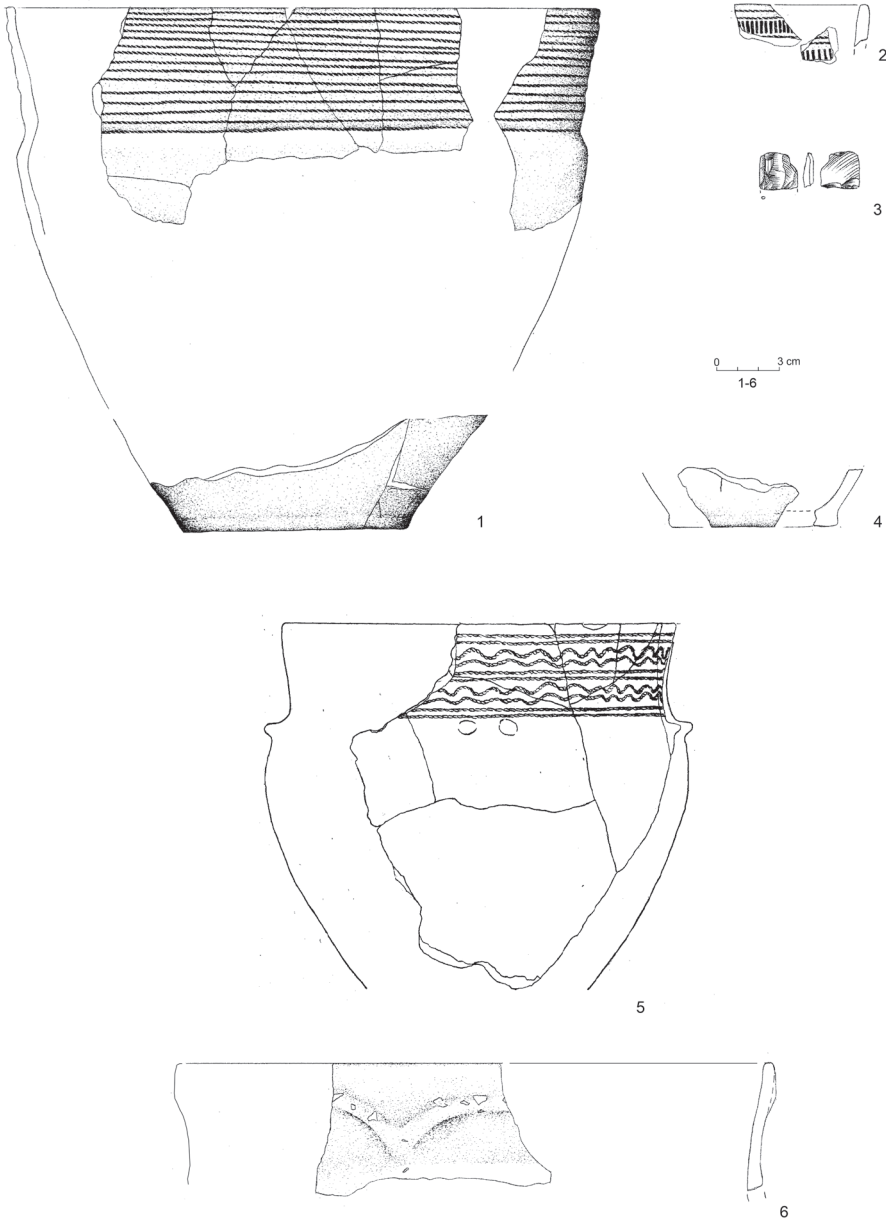


Fig. 14. Złota–Nad Wawrem site, Sandomierz district. Artefacts from Feature 202: 1–4, 6 – drawn by B. Witkowska; 5 – after archives of State Archaeological Museum in Warsaw

found at this level. The function of the pit is undefined. Relatively few materials were found in it. There were about 90 fragments of pottery from four vessels: a large beaker decorated in horizontal cord impressions (Fig. 14: 1), a vessel ornamented by alternating single horizontal and wavy cord lines with double knobs (Fig. 14: 5), a rim with a wavy plastic strip (Fig. 14: 6) and a small rim with a combination of rectangular stamps and single cord impressions (Fig. 14: 2). The rest of the ceramic material is undecorated.

Moreover, in the fill one splintered piece made of Turonian flint (Fig. 14: 3) and 64 shells were discovered.

RESULTS OF RADIOCARBON DATING

Altogether 22 absolute age determinations have been obtained from the features described above (Table 1 and Fig. 15). The AMS radiocarbon tests were carried out in the Poznań Radiocarbon Laboratory, only on osteological material – animal bones. As mentioned above, only homogeneous features of the GAC were selected to date. However, in two cases, they yielded results that differed from our knowledge about chronological ranges of the GAC based on the traditional methods of taxonomic classification of materials. There were radiocarbon determinations of Feature 229 from Site 1 in Mierzanowice (3500 ± 35 BP) and Pit 184 from *Złota-Nad Wawrem* (3545 ± 35 BP). Both dates, after calibration, clearly indicate the first half of the II millennium BC, i.e. the Bronze Age. In the light of the current knowledge about the GAC, adopting such a long chronological framework for the development of this culture is impossible [Witkowska 2021; Witkowska, Włodarczak 2021]. In this context, erroneous results are probably the consequence of mixing materials in the storage.

Most of the remaining dates obtained for GAC settlements from the Sandomierz Upland show a high degree of agreement and almost all of them fall within the range of 2895–2550 BC. This bracket is compatible with the chronological framework defined by the series of radiocarbon dates from the grave assemblages of the Sandomierz-Opatów subgroup [Witkowska 2021]. However, among them, we can distinguish absolute age determinations markedly younger that cross borders of the so-called Neolithic plateau entering the second half of the III millennium BC. These are radiocarbon dates of Features 173 (4030 ± 40 BP) from Site 1 in Mierzanowice or Pit 16 (4065 ± 35 BP) and Pit 202 (3980 ± 35 BP) from *Złota-Nad Wawrem*. The dating of the latter feature is entirely outside the plateau, only assuming 95% probability, somewhat near its limit. Thus young radiocarbon dates were obtained for only a few GAC assemblages from the entire range of their occurrence [Witkowska 2021]. However, their presence obliges us

to consider the possible survival of the Sandomierz-Opatów subgroup deep into the III millennium and examine GAC materials in terms of the possibility of their eventual chronological stratification.

T a b l e 1.

List of radiocarbon dating of settlements features related to the Globular Amphora culture in the Sandomierz Upland.

Site	Feature	Sample material	Lab. No.	Age C14 BP	Date BC	
					68,2%	95,4%
Gątkowice-Ocin, site 15	pit 1	animal bone	Poz-94504	4100±35	2846–2577	2867–2499
Kichary Nowe, site 2	pit 225	animal bone	Poz-94505	4125±35	2848–2632	2856–2624
Mierzanowice, site 1	pit 173	animal bone	Poz-90811	4030±40	2579–2475	2837–2464
	pit 187	animal bone	Poz-90812	4120±40	2857–2584	2874–2574
	pit 194	animal bone	Poz-90813	4170±40	2877–2676	2886–2627
	pit 211	animal bone	Poz-90814	4130±40	2862–2626	2874–2578
	pit 226	animal bone	Poz-90816	4150±40	2871–2637	2880–2584
	pit 229	animal bone	Poz-90817	3500±35	1884–1768	1924–1699
Mierzanowice, site 4	pit 2	animal bone	Poz-90818	4130±40	2862–2626	2874–2578
	pit 5	animal bone	Poz-90819	4100±40	2848–2577	2870–2498
	pit 19	animal bone	Poz-90820	4190±40	2885–2697	2895–2632
<i>Złota-Nad Wawrem</i>	pit 16	animal bone	Poz-90787	4065±35	2832–2496	2848–2475
	pit 32	animal bone	Poz-90788	4120±35	2856–2585	2871–2576
	pit 49	animal bone	Poz-90789	4155±35	2871–2671	2881–2623
	pit 71	animal bone	Poz-90790	4120±30	2854–2623	2868–2577
	pit 80	animal bone	Poz-90792	4160±35	2873–2672	2881–2627
	pit 90	animal bone	Poz-90793	4135±35	2862–2630	2874–2581
	pit 140	animal bone	Poz-90890	4090±35	2845–2573	2865–2494
	pit 170	animal bone	Poz-90891	4090±35	2845–2573	2865–2494
	pit 184	animal bone	Poz-90892	3545±35	1941–1779	2015–1751
	pit 202	animal bone	Poz-90894	3980±35	2567–2466	2580–2349

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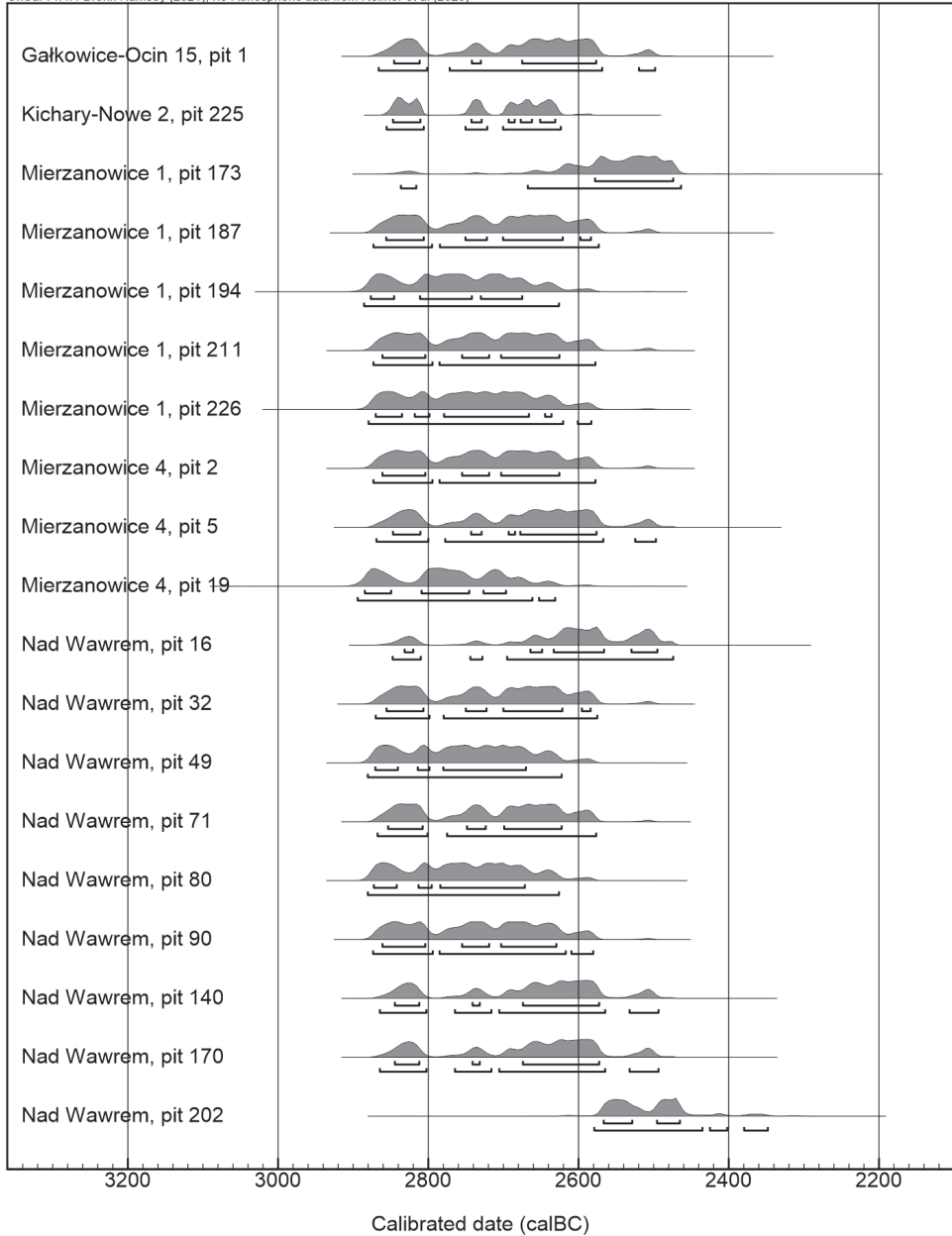


Fig. 15. The calibration of radiocarbon datings obtained within the project NSC 2014/12/S/HS3/00355 from the settlement features of the Globular Amphora culture

Some differences in the style of the ceramic artefacts discovered on upland settlements of the GAC can be noticed when analyzing the ornamentation of vessels from these places. At most sites, apart from unornamented materials, the dominant decorative element is the so-called wavy cord grouped in multiple bands. This is a distinctive ornament of the Sandomierz-Opatów subgroup. It is present in most grave assemblages of the GAC from the Sandomierz Upland [Witkowska 2021], settlement features from Gałkowice-Ocin, Kosowice [Bąbel, Kowalski 1975], Kichary Nowe (unpublished research by Hanna Kowalewska-Marszałek), Wojciechowice [Nosek 1967: 190], Złota [Krzak 1976, Fig. 17: e-f, 19: h, 21: d] and Mierzanowice Site 4 [Gardawski, Miśkiewicz 1958, Pl. XLIX: 2]. At the same time, in the latter settlement, there are also materials with a different, angular style discovered in Pits 2 and 5 [Gardawski, Miśkiewicz 1958, Pl. XLIX: 5, L: 1, Fig. 8]. Whereas, at a nearby Mierzanowice Site 1 corded angular ornamentation dominates and is numerous represented by zigzags [Balcer 1963, pL. II: 1,9; III: 6; VI: 12; VIII: 6], hatched [Balcer 1963, Pl. II: 1; III: 7; VI: 3,13; VIII: 18] or so-called suspended triangles [Balcer 1963, Pl. III: 13; VI: 7; XI: 13] found in features 166, 170c, 173, 174, 195 and 226. This type of ornament is almost absent in the *Złota-Nad Wawrem* settlement, where it occurred on single fragments from Pit 26 (unpublished materials of the State Archaeological Museum in Warsaw). On the pottery from Site 1 in Mierzanowice there is also a wavy cord present, but it is a single line used in combinations different from ornamentation known from *Złota-Nad Wawrem*. The best proof of the disagreement of materials from the two largest settlements of the Sandomierz-Opatów subgroup is the impossibility of applying a typology of decorative motifs developed on the basis of artefacts from Mierzanowice [Balcer 1963, Pl. XII] for a description of vessels found on the GAC settlement in *Złota-Nad Wawrem*. The research question is whether this reflects two chronological horizons or two development lines of the Sandomierz-Opatów subgroup. Due to the nature of the calibration curve, which forms the plateau between 2870–2550 BC, it would be difficult to disprove any thesis by radiocarbon dating.

The presence of the Baden amphora (Fig. 5: 8) among GAC artefact found in Pit16 from the *Nad Wawrem* site in Złota requires a separate discussion. Due to the fact that it was published in a monograph of the Złota culture, this feature is sometimes mistakenly attributed to this taxon [see e.g. Kowalewska-Marszałek 2008: 239; Włodarczak 2008, Fig. 8]. However, the author of this publication properly related it to the GAC [Krzak 1976: 37], considering its presence among the materials of the GAC as proof testifying to contacts between this culture and the Baden groups that preceded the establishment of the Złota culture. From the point of view of mutual contacts between the Baden circle and the GAC, the Sandomierz Upland occupies a special place, due to the geographical proximity of

the two units. Despite this, the materials of the Sandomierz-Opatów subgroup are not distinguished by a large number of badenization markers. This situation may lead to the thesis that the apogee of Baden influence on this area took place after the disappearance of the features identified by us as unequivocal determinants of Sandomierz-Opatów subgroup. According to some researchers, under the influence of Baden impact, groups of the GAC would transform into the Złota culture, in which radial elements are represented very intensively [see e.g. Ścibior 1991; Kruk, Milisauskas 1999: 208–213]. However, the entire series of radiocarbon dating obtained as part of the NSC 2014/12/S/HS3/00355 project does not authorize the construction of sequential development models. At the same time, such a late determination of the absolute age of Feature 16, which contains an element referring to the Baden milieu, is difficult to accept in the light of the absolute chronology of this culture [see Zastawny 2015b; Kruk *et al.* 2018, Tab. 10]. It seems therefore necessary to date another sample from this pit.

CONCLUSIONS

Compared to other groups of the GAC, the Sandomierz-Opatów subgroup has a relatively short chronology (Fig. 16). Probably the GAC appeared in this area in the already developed phase IIIa. Nevertheless, the possibility of its survival deep into the second half of the 3rd millennium BC should be considered, although few dates support it.

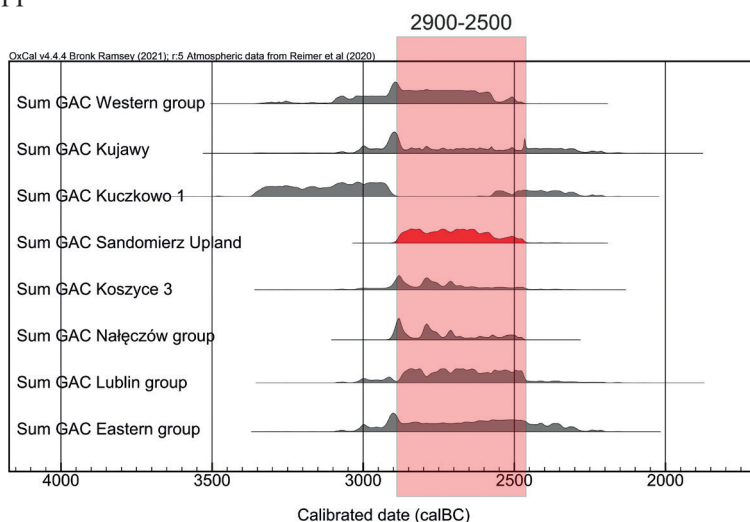


Fig. 16. The summary calibration of absolute chronology of the Globular Amphora culture from different regions

The settlement's features are not closed assemblages, which makes them of little use for classical taxonomic studies leading to the establishment of a relative chronology. However, the series of absolute age determinations obtained from pits of the Sandomierz-Opatów subgroup testify to their research value for chronometric studies. Not only have they confirmed the observations made on the basis of radiocarbon dated cemeteries [Witkowska 2021], but also prompted us to consider the possibility of chronological stratification of GAC materials from the Sandomierz Upland and raised an interesting research question about mutual relations between the GAC and other cultures developing in this region during the 3rd millennium BC.

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