

# Glassware from the Excavations at the Sector R-23 of Pontic Olbia

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As part of research on site R-23 of the Roman citadel of Olbia in 2016–2018 and 2021, more than 100 fragments of glass vessels of Roman and Late Roman times have been found. The article analyses the most informative forms and also considers the technological methods for manufacturing vessels. The finds are divided into two chronological groups. The first group are the tableware of the Roman time (1st – the middle of the 3rd centuries), the second group includes vessels of the period of Late Antiquity (4th–5th centuries), which can be correlated with the residential and utility complex of the culture discovered at this site.

KEY-WORDS: Northern Black Sea region, Olbia, Roman period, Late Roman period, glass vessels, Cherniakhiv culture

## INTRODUCTION

In the course of research on the site of the Roman citadel of Pontic Olbia, which was carried out as part of a joint Ukrainian-Polish project in 2016–2018 and 2021, more than 100 fragments of glass vessels of the 1st–5th centuries AD were found. Such a wide chronological range is explained by the peculiarities of the stratigraphy of the site with the presence of objects extending into earlier layers. Unfortunately, the finds are highly fragmented, covered with iridescent weathering, as a result of which only a small part of the fragments can be subject to classification (Table 1). At the same time, the technique of their production characterizes almost all technological methods used in glassmaking in Roman and Late Roman times.

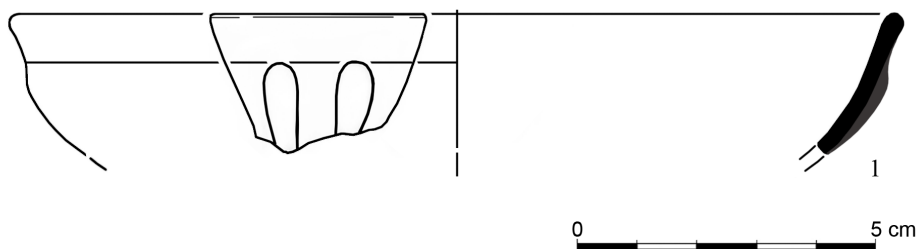
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Table 1. List of glass vessels fragments from the excavations at the sector R-23 of Pontic Olbia.

Inv. No.	Name	Chronology	Technological method	Typology (Isings)	Figure
O-2016/R-23/4	Fragment of a bottom of the vessel of miniature form	1st – mid-3rd cent. AD	Mould-blowing	Form 50	Fig. 2:3
O-2016/R-23/65	Fragment of a wall a polished ornament in the form of vertical cutting	Second half of the 2nd – mid-3rd cent. AD	Free-blowing	Form 96 b	Fig. 4:3
O-2016/R-23/82	Fragment of a bowl with ribs	1st–2nd cent. AD	Shaping	Form 3	Fig. 1
O-2016/R-23/116	Fragment of a bottom with protrusions	3rd–6th cent. AD	Free-blowing		Fig. 6:2
O-2016/R-23/187	Fragment of a bottom of the unguentaria	1st–2nd cent. AD	Free-blowing		Fig. 6:4
O-2016/R-23/189	Fragment of a bottom with the remains of stamp in the form of relief with concentric circles arranged one in one	1st – mid-3rd cent. AD	Mould-blowing	Form 50	Fig. 2:4
O-2016/R-23/260	Fragment of a bottom with protrusions	3rd–6th cent. AD	Free-blowing		Fig. 6:3
O-2016/R-23/299	Fragment of a wall with a polished ornament in the form of vertical cutting	Second half of the 2nd – mid-3rd cent. AD	Free-blowing	Form 96 b	Fig. 4:4
O-2017/R-23/87	Fragment a thickened fire-rounded rim	Second half of the 2nd – mid-3rd cent. AD	Free-blowing	Form 85	Fig. 4:1
O-2017/R-23/103	Fragment a thickened fire-rounded rim	Second half of the 2nd – mid-3rd cent. AD	Free-blowing	Form 85	Fig. 4:2
O-2017/R-23/104	Fragment of a bottom with the remains of stamp in the form of a bulging circle	1st – mid-3rd cent. AD	Mould-blowing	Form 50	Fig. 2:2
O-2017/P-23/501	Fragment of a wall with soldered threads	4th cent. AD	Free-blowing		Fig. 7:1

Inv. No.	Name	Chronology	Technological method	Typology (Isings)	Figure
O-2018/R-23/72	Fragment of a horizontal rim	1st – mid-3rd cent. AD	Mould-blowing	Form 50	Fig. 2:1
O-2018/R-23/104	Fragment of a wall with a “honeycomb” ornament	4th – the beginning of the 5th cent.	Mould-blowing	Form 107a	Fig. 3:2
O-2018/R-23/169	Fragment of a wall with an oblique oblong drop of blue glass and a belt of five engraved stripes	Late of the 4th – the beginning of the 5th cent.	Free-blowing	Form 96	Fig. 5
O-2018/R-23/445	Fragment of a wall with an expressive teardrop-shaped protrusion	3rd–6th cent. AD	Free-blowing	Form 196b2	Fig. 6:1
O-2021/R-23/31	Fragment of a wall with soldered threads	4th cent. AD	Free-blowing		Fig. 7:1
O-2021/R-23/56	Fragment of a conical foot	Middle – second half of the 4th cent. AD	Free-blowing		Fig. 7:2
O-2021/P-23/580	Fragment of a wall with a “honeycomb” ornament	4th – the beginning of the 5th cent.	Mould-blowing	Form 107a	Fig. 3:1



**Fig. 1.** Glass vessels from sector R-23: ribbed bowl. Drawings: O. Puklina.

## SHAPING

### *Ribbed bowl*

Shaped products include a fragment of a bowl with ribs made of transparent glass with a bluish shade (O-2016/R-23/82; Fig. 1). The technique of manufacturing these products involves the shaping of the body and ribs with a special tool for sharpening (Stern and Schilic-Nolte 1994: 72–78; Lierke 1999: 51–55; Taylor and Hill 2003b). This form was one of the most common in Early Roman times. Similar vessels are known on many ancient sites of the 1st century BC–2nd century AD (Isings 1957: 17–19, Form 3; Grose 1989: 244–249; Minchev 1989: pl. 1:1; Cool and Price 1995: 15–19, figs 2.2.–2.7; Lazar 2003: 37, fig. 11:2.1.4; Weinberg and Stern 2009: 33, fig. 3, 4; Chiriac and Boțan 2014: 543, pl. 1; Antonaras 2017: 54–55). Such bowls were widely used outside the Roman Empire (Eggers 1951: 178, Type 182, 183). In the Northern Black Sea region, fragments of them have been found in the urban layers of the first centuries AD of Panticapaeum (Sorokina 1962: 215, fig. 3: 3,4; Golofast 2006: 310, fig. 5:15), Tyras (Saveliev 2017: 124, fig. 3:3–9), Tanais (Yatsenko 2005: 279, abb. 1: 2, kat. 2), in the contexts of the sanctuary at the Gurzufske Sidlo pass (Novichenkova 2015: 97, fig. 198:6, 7), as well as in the Roman fortress near the village of Orlivka in the lower reaches of the Danube (Sorokina 1994: 177, fig. 1:1). Several whole specimens come from the necropolis of Panticapaeum (Kunina and Sorokina 1972: 156, fig. 5:11; Sorokina 1978: 269, fig. 2: 5; Kunina 1997: 268, cat. 93). One bowl is found in Burial 51 at the necropolis of Gorgippia (Aleksieva and Sorokina 2007: 57, fig. 10, pl. 38:4). It should be noted that finds of fragments of such bowls are also known from other parts of Olbia (Sorokina 1962: 217; Krapivina and Buiskykh 2010: 112, fig. 7:1).

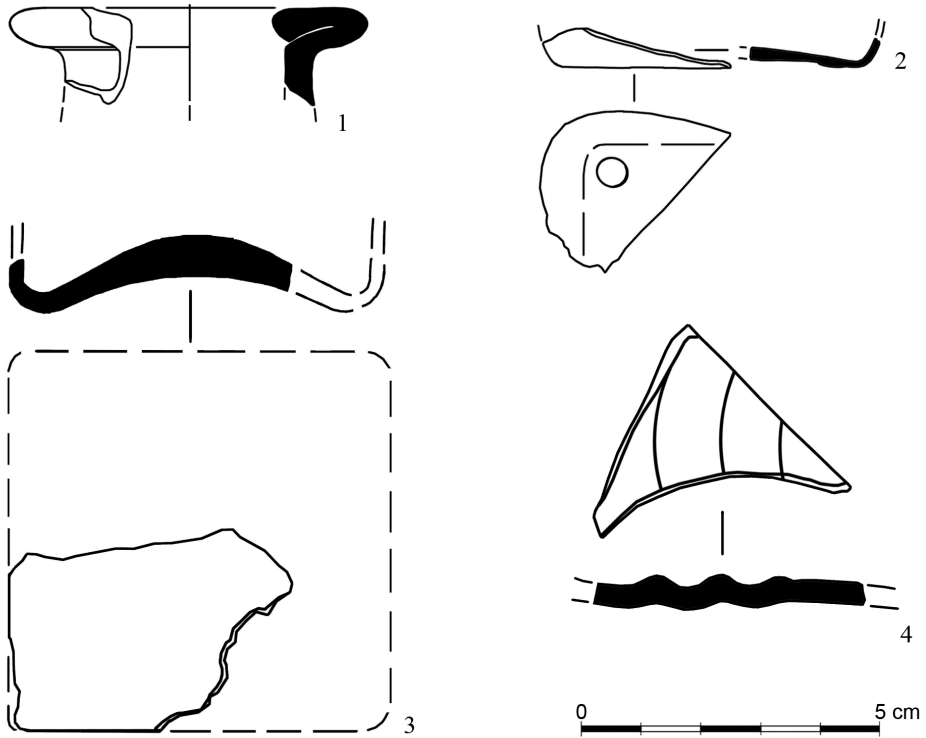


Fig. 2. Glass vessels from sector R-23: square bottles. Drawings: O. Puklina.

## MOULD-BLOWING

During research in Trench R-23, several fragments of vessels shaped with the mould-blowing technique were found. These fragments reliably correlate with square-bottomed jugs and glasses decorated with the so-called “honeycomb” ornament.

### *Square bottles*

To this kind of vessels belonged fragments of bottoms with the remains of stamps in the form of a bulging circle (O-2017/R-23/104; Fig. 2:2), as well as in the form of relief with concentric circles arranged one in one (O-2016/R-23/189; Fig. 2:4). For this type of jug is also characteristic a neck with a horizontal rim made of transparent glass with a bluish shade (O-2018/R-23/72; Fig. 2:1). Some fragments belonged to

miniature forms (O-2016/R-23/4; Fig. 2:3). Such vessels are known from many sites of the Early Roman and Late Roman times in the territory of the Roman Empire (Isings 1957: 63–67, Form 50; Goethert-Polaschek 1977: 193, 201, Form 114/119; Minchev 1990: 59, Type I; Cool and Price 1995: 179, figs 11.7–11.12; Dussart 1998: 159, fig. BXI. 231, Pl. 47: 5; Weinberg and Stern 2009: 110, fig. 17; Chiriac and Boğan 2014: 547, pl. V; Fünfschilling 2015: 427–428, Form AR 156; Antonaras 2017: 115–117) and beyond (Eggers 1951: 181, Type 244). Their production in different centres of the ancient world is confirmed by the variety of stamps (Aguilar-Tablada and Sánchez de Prado 2006: 177–193; Fadić and Štefanac 2009: 206–210; Pánczél 2011: 175–187). They could be used not only as tableware but also for transporting liquids over long distances (Foy and Nenna 2001: 114). In Pompeii, in the house of Menander, such jugs were found stored in two boxes, which made it possible to assume their use as transport vessels (Isings 1957: 63).

Square-bottomed jugs with or without stamps are well known on ancient sites of the Northern Black Sea region: in Panticapaeum (Sorokina 1962: 222, fig. 6: 7; Sorokina 1965: 230, fig. 12: 15–20; Kunina and Sorokina 1972: fig. 7: 23; Kunina 1997: cat. 165–169); Tanais (Sorokina 1965: 230–231, fig. 12: 9–14; Yatsenko 2005: 297–299, abb. 8, cat. 97–103), Gorgippia (Aleksieva and Sorokina 2007: 74–75, pl. 54: 2–4), Kepoi (Sorokina 1977: 124), Chersonesos (Sorokina and Gushchina 1980: 95), Tyras (Son 1988: fig. 4: 2, 3, type 2), Olbia (Sorokina 1965: 229, fig. 12: 4–8), at the Kozyrka settlement (Burakov 1976: 119–120, pl. 12: 35). In addition, finds of such vessels have been recorded on some barbarian sites from Roman period in the region (Rikman 1975: fig. 8: 3; Sorokina and Gushchina: 1980: fig. 2:6; Strzheletskiy *et al.*, 2003–2004: Pl. XXVIII: 30, 31). The time of their appearance in the Northern Black Sea region is considered for the first half of the 1st century (Kunina and Sorokina 1972: 156, fig. 5: 27, 28). One of the earliest items was discovered in Tomb 28 in the Panticapaeum necropolis, where it was accompanied by a coin from 14–9 BC (Sorokina 1965: 228). Vessels from other complexes of this necropolis can be dated to the 1st century (Sorokina 1978: 269, fig. 1: 11; Kunina 1997: cat. 163, 164). To the 1st century belong whole forms from the grave at the Cape Tuzla (Sorokina 1957: pl. 12: 3, 4). The upper part of the jug, found at the necropolis of Kepoi, belonging to the type with a square body is recorded among the materials dated for the middle of the 1st century (Sorokina 1977: 124). Two jugs (one of them with a stamp) come from burials from the necropolis of Nymphaeum dated to the end of the 1st–the first half of the 2nd century (Kunina 1982: 119–124). One example with a stamp was part of the inventory of Grave 74 found in Bel'bek dated to the first half of the 2nd century (Sorokina and Gushchina: 1980: 94–95, figs 2, 6). Vessels from Graves 60 and 104 from the cemetery discovered at “Sovkhoz 10” were, according to the accompanying inventory, date to the 2nd century. (Strzheletskiy *et al.*, 2003–2004: 123–124,

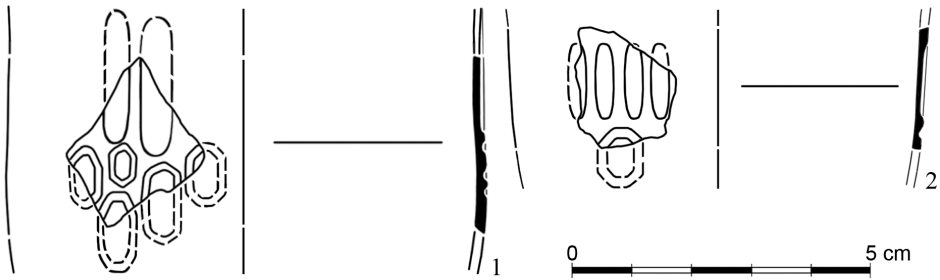
pl. XXVIII: 30, 31, Type IX: 3). A jug with a stamp was found also in a Sarmatian burial of the 2nd century, at Pervomaevsk (Rikman 1975: 20–21, fig. 8: 3; Dzigovskiy and Ostroverkhov 2000: 153–156). Their finds from the necropolis of Tanais are mainly associated with complexes from the 2nd–mid-3rd centuries (Yatsenko 2005: cat. 97–103). Thus, the most reasonable date for the arrival of vessels with a square body in the North Pontic region is the 1st–mid-3rd centuries AD.

Attempts to systematize the stamps on square-body vessels from the Northern Black Sea region were made by Nina Sorokina (1965: 228–231, fig. 12) and Stanislav Shabanov (2017: 88–104). It is believed that such products came from workshops in Asia Minor, Syrian and Western Europe. At the same time, the vessels from Asia Minor prevailed in the Bosphorus, while mainly those of Mediterranean production are found in the Chersonesos (Sorokina and Gushchina: 1980: 94). According to Nina Sorokina (1965: 229), they could have come to Olbia via Dacia from the workshops in Gaul and the Rhine Valley.

#### *Beakers with honeycomb pattern*

Fragments of beakers made of transparent colourless glass with a so-called “honeycomb” ornament come from Trench R-23 (O-2021/P-23/580, O-2018/R-23/104; Fig. 3). On two fragments are preserved relief channels, which could be located in the upper part of the glasses. Vessels with such ornamentation are known from many sites from the Western Mediterranean to the Eastern Black Sea region dated to the 4th–5th centuries (Harden 1936: 165, pl. XVI: 472; Isings 1957: 133, Form 107a; Goethert-Polaschek 1977, Form 50; Doppelfeld 1966: 45, taf. 56, Gruppe 3.4; Barkóczy 1988: 95, Typ 65, taf. XIII:140–142, Fünfschilling 2015: 343, Form AR 66.6; Antonaras 2017: 64). They could have been produced in different workshops of the ancient world (Fremersdorf 1961: 57–58, taf. 113; Whitehouse 2001: 111–115, cat. 606–611).

In the North Pontic region, fragments of such beakers were recorded during excavations at Phanagoria (Golofast and Ol'khovskiy 2019: 51), in the layers of the Late Antiquity period of Chersonesos (Sorokina 1973: 187, fig. 2: 13, Golofast 2001: 126–127, fig. 81, 19, Type 1), Panticapaeum (Sorokina 1962: 231; fig. 11:5, 13:5), Tanais (Yatsenko 2007:478), Kyteion (Molev 2004:411, pl. II: 23). Whole forms come from the Panticapaeum necropolis (Sorokina 1973, fig. 2: 14; 1978: fig. 3:8), as well as from a number of barbarian burials in Crimea and the North Caucasus dated to the Late Roman period. It is the materials of the Crimean and Caucasian complexes that make it possible to reliably determine the chronology of the beakers with a “honeycomb” ornament in the Pontic region. In Grave 254 at “Sovkhoz 10” such a vessel was found with beads and red-slip vessels from the 4th–early 5th centuries (Sorokina 1973: 186–187, fig. 2: 11; Strzheletskiy *et al.*, 2003–2004: 123, pl. XXVIII: 15, Type VIII: 15; Ivanova 2009: 33). In a barbarian



**Fig. 3.** Glass vessel from sector R-23: beakers with a honeycomb pattern. Drawings: O. Puklina.

burial near the Roman fortress of Kharaks (Grave 29), a glass with a “honeycomb” ornament, presumably of Mediterranean production, was accompanied by two coins of Rhescuperides VII (320–325; Sorokina 1973: 186, 188; Gey and Bazhan 1997: Pl. 33:12). A glass vessel from Grave 30 at the Suvorovo cemetery has a similar decoration, which Vladislav Yurochkin and Aleksandr Trufanov referred to Phase III (second–third quarters of the 4th century) according to the chronology of the third and fourth centuries AD burials from Central and South-Western Crimea (Yurochkin and Trufanov 2007: 368, fig. 6: 16). Another vessel comes from the burial of the 1st grave in the 11th burial complex at Aloniya, which is dated from the end of the 4th to the beginning of the 5th centuries (Turova and Chernysh 2015: 139, fig. 16: 181). N. Sorokina, based on the materials from the burial complexes in the valley of the River Tsebelda, identified beakers with such ornamentation as a second group, dated to the 4th–early 5th centuries (Sorokina 1979: 63, fig. 1: 6). S. Shabanov dates these vessels, from the Northern Black Sea region and the Caucasus, in approximately the same way, identifying them as the variant 2 of glass beakers with a “honeycomb” ornament and dating to the Late Roman period (2019: 316).

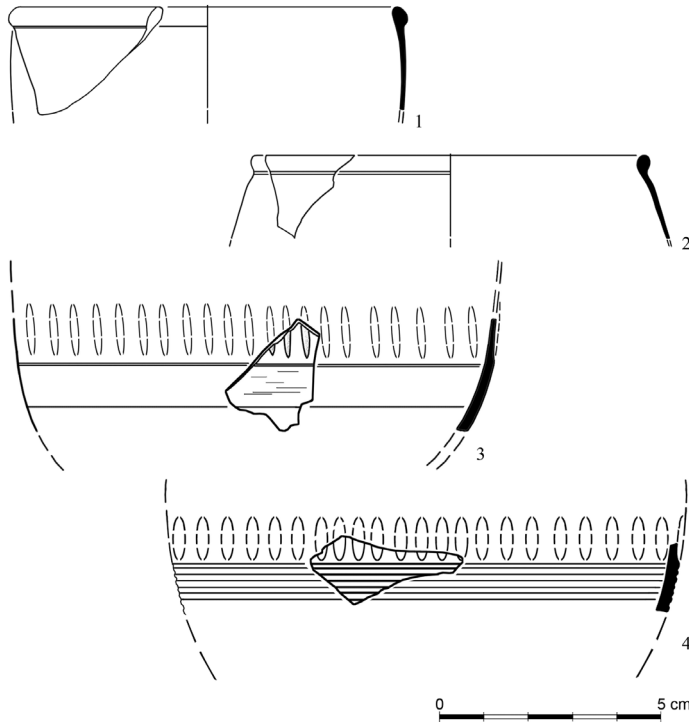
## FREE-BLOWING

The largest number of glassware fragments excavated from Trench R-23 came from free-blown tableware vessels (bowls, beakers, jugs, dishes, plates) and containers for toiletries (unguentaria). The use of a blowpipe is marked by feet with traces of pontils.

### *Cups with fire-rounded rim*

One of the most common categories of tableware are drinking vessels. In Olbia, they are represented by different types.





**Fig. 4.** Glass vessels from sector R-23: 1–2 – cups with fire-rounded rim; 3–4 – bowls with facet-cutting. Drawings: O. Puklina.

During the excavations of the Olbian settlement, fragments of thin-walled bowls with a thickened fire-rounded rim of transparent colourless glass are often found (O-2017/R-23/87, 103; Fig. 4:1, 2). Similar bowls are widely known in the western provinces and are found at many sites dated to the second half of the 2nd–3rd centuries (Isings 1957: 101–103, Form 85; Goethert-Polaschek 1977: 48, Form 47a; Arveiller-Dulong and Nenna 2005: 331, cat. 935; Fünfschilling 2015: 372–373, Form AR 98.1). In the territory of the Northern Black Sea region, they are also recorded in Tanais (Sorokina 1965: fig. 8:4), Gorgippia (Aleksieva and Sorokina 2007: 26, pl. 23:6, 7), Grave 14 of the late-Scythian cemetery Bel’bek II (Sorokina and Gushchina 1980: 96–97, fig. 2:1).

#### *Bowls with facet-cutting*

From Trench R-23 there are fragments of two bowls of transparent glass with a polished ornament in the form of vertical cutting and a belt ornament of horizontal

lines (O-2016/R-23/65, O-2016/R-23/299; Fig. 4:3, 4). In the oriental workshops of the Roman Empire, bowls with engraved lines, cutting and polished facets in the form of circles and ovals were produced during the second half of the 2nd–mid-3rd centuries (Clairmont 1963: 65–68, figs 2, 3; Weinberg and Stern 2009: 96). In the western provinces, the tradition of making such vessels existed from the middle of the 2nd to the end of the 4th centuries (Fremersdorf 1939: 6; Barkóczy 1986: 166–189, Yatsenko 2006: 134; Weinberg and Stern 2009: 95). Bowls with engraved and polished decoration were widespread not only in the territory of the Roman Empire (Isings 1957: 114–116, Form 96 b; Barkóczy 1988: 64, taf. IV: 39, 41–43; Rütli 1991: 271; Cool and Price 1995: 76–78, fig. 5.8; Lierke 1999: 107–109, abb. 273; Lazar 2003: 83, fig. 30: 2.6.2; Weinberg and Stern 2009: 96, fig. 13, Pl. 19), but also beyond (Eggers 1951: 180, Typ 216).

In the materials of ancient archaeological sites of the Northern Black Sea region, such bowls are associated with the contexts of Roman times. Fragmentary finds come from Tyras (Son 1988: 49–50, figs 2:3, 4, 6, 7; 3:7), Panticapaeum (Vysotska 1964: 17; Golofast 2006: 312, fig. 3:2), Chersonesos and the ancient settlement at Alma-Kermen (Vysotska 1964: 16–17, fig. 9: 30, 31). Two items are found in House 30 in Gorgippia (Aleksieva and Sorokina 2007: 27). Two more phialai were found in the burials of the necropolis at Tanais. However, the largest number (more than 200 fragments) was found during the excavations of residential and commercial complexes of Tanais, which allowed Elena Yatsenko to create a detailed typology of these vessels based on the materials obtained at this site and she dates them to the second half of the 2nd–mid-3rd centuries (Yatsenko 2006). According to this typology, the bowl fragments from the R-23 trench belong to the group V, scheme D (Yatsenko 2006: 133, Pl. VI: 59, 60) and have analogies from the glassmaking workshops of the Rhine Valley (Fremersdorf 1967: taf. 38). It should also be noted that the use of such phialai in the Northern Black Sea region is most likely associated with the presence of Roman military contingents. In particular, in Olbia, the finds concentrated in areas where soldiers of the Roman garrison were probably stationed (Sorokina 1982: 41; Puklina 2018: 75).

#### *Cup with glass drop*

They are defined by a wall of transparent colourless glass with an oblique oblong drop of blue glass and a belt of five engraved stripes (O-2018/R-23/169; Fig. 5).

Vessels of various shapes with a decoration of coloured glass drops were widespread in the ancient world during the 3rd–5th centuries and were typical products of both Western and Eastern workshops (Isings 1957: 113–114, Form 96; Goethert-Polaschek 1977, taf. 39, 41, 42; Barkóczy 1988: 96, Typ 67, taf. XIII, XIV; Weinberg and Goldstein 1988: 87–91; Fünfschilling 2015: Form AR 65, 66.2).

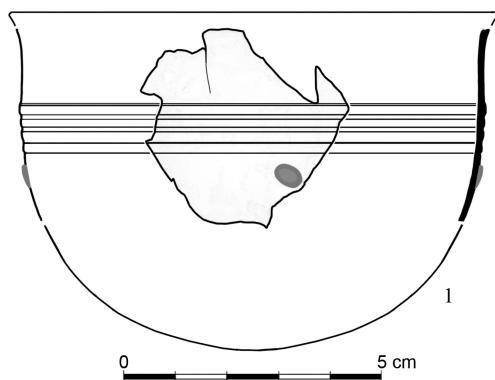


Fig. 5. Glass vessel from sector R-23: cup with glass drop. Drawings: O. Puklina.

On the territory of the Northern Black Sea region, their finds are known from Olbia (Sorokina 1976: 204–206; 1978: 273, fig. 3: 10, Poliszczuk 2006: 352, kat. 27), Chersonesos (Golofast 2001: 125–126), Panticapaeum (Sorokina 1978: 271, fig. 3: 4, 5), Phanagoria (Golofast and Ol'khovskiy 2019: 50), Kyteion (Molev 2004: 410), as well from some funerary complexes of the Cherniakhiv culture (Symonovich 1964: fig. 1:1; Lyubichev *et al.*, 2019: fig. 4:8) and the barbarian burials at Crimea (Sorokina 1973: 183, fig. 1; Shabanov 2011b: 151).

A fragment from the excavations at Trench R-23 belongs to a hemispherical bowl-phiale. Studying vessels with drops of blue glass, Sorokina separated such vessels type into variant Zh (Ж) type 1, mentioning that they are not characteristic for ancient sites of the Northern Black Sea region (Sorokina 1971: 90, fig.1:7). Two such phialai come from the burials of the Cherniakhiv culture, at Zhuravka Vilshanska, Grave 14 (Symonovich 1964: 9, fig. 1:1); Viitenky-1, Grave 102 (Lyubichev *et al.*, 2019: 17, fig. 4:8). In the system of relative chronology of the Cherniakhiv culture, developed by Evhenii Gorokhovskiy, the bowl from Zhuravka belongs to one of the chronoindicators of the final (fifth) phase of the Cherniakhiv culture, which correlates with the last quarter of the 4th–the first third of the 5th centuries (Gorokhovskiy 1988: 45). Similarly dated bowl from the Viitenky-1 cemetery's the chronoindicator (XI 04) of the last phase of the Cherniakhiv culture of the Dnipro-Donets forest-steppe (Lyubichev *et al.*, 2019: 37). Another fragment of such a vessel is found in a layer of the same burial (Shchepachenko 2022: 139). A certain amount of clarity in the question of the time of existence of such phials is also provided by the context of the discovery of a fragment from the R-23 trench, where we have an excellent opportunity to study in detail the stratigraphic situation from the level of the modern-day surface. The horizon

of the Late Antiquity period lies here almost under the humus layer. A fragment of phiale comes from Recess 3, of which *terminus post quem* mark items from the Pit 1 found immediately below it. Judging by the fragments of ceramic vessels found in it, belonging to the late subtypes of amphorae of the Shelov F type (350–370s), amphorae of the Shelov E type (the last quarter of the 4th–mid-5th centuries), Zeest 100/C Snp I (second half of the 4th–5th centuries), LRA 1 (late 4th–7th centuries), the period of its use falls on the last third of the 4th–first half of the 5th centuries. (Didenko 2019: 160). Therefore, Recess 3, in which the fragment of a glass vessel was found, should be dated no earlier than the end of the 4th century. It should be noted that both of these facilities are part of a housing complex that is related to the Cherniakhiv culture (Twardecki and Buiskykh 2021).

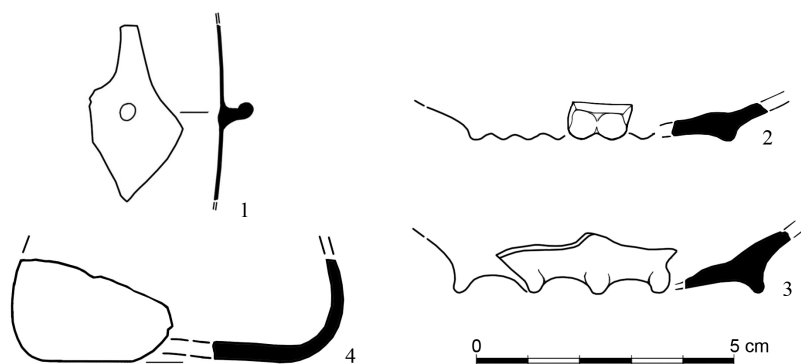
Hemispherical phiale-bowls made of transparent colourless glass with a decoration of coloured drops are typical products of the Rhine workshops. The centre of their production may well have been the Cologne (Colonia Agrippinensis) workshop (Harden 1987: 115, cat. 48), whose products are distinguished by a variety of forms (Fremersdorf 1962). The possibility of the arrival of Cologne-made products to the North Pontic region in Late Antiquity is confirmed by the finds of several more vessels with coloured drops from a number of funerary complexes of the 4th and early 5th centuries: the Neizats cemetery (Crimea), Crypt 321 (Shabanov 2011a: 423); the Cherniakhiv culture cemetery in Shyshaky (Poltava region) – Burials 112, 115 (Reida *et al.*, 2016: 24–27; 2021: fig. 3).

#### *Vessel with pinches*

Among the fragments of dishes made using the free-blowing technique found in Trench R-23, there is a fragment of the wall of a vessel of a bluish hue, decorated with an expressive teardrop-shaped protrusion (O-2018/R-23/445; Fig. 6:1). The fashion for this specific ornamentation appears in the middle of the 2nd century and survives until the 6th century (Antonaras 2017: 136, 178, cat. 125, 129). Teardrop-shaped protrusions decorated different forms of glassware. Their finds are known throughout the Roman Empire (Isings 1957: 116, Form 196b2; Barkóczy 1988: taf. LXXV: 133, taf. LXXXVII: 341, Rützi 1991: 70, 274, taf. 62, Form AR 60.3; Bonnet Borel 1997: 33, Form 65). In particular, since the 3rd century AD, in the Syro-Palestine region and in the northwestern provinces, cups and flasks decorated in this way were especially popular (Fremersdorf and Polónyi-Fremersdorf 1984: cat. 67, 68, 152, 153; Dussart 1998: 162, fig. BXII. 214, pl. 49: 7; Whitehouse 2001: cat. 663).

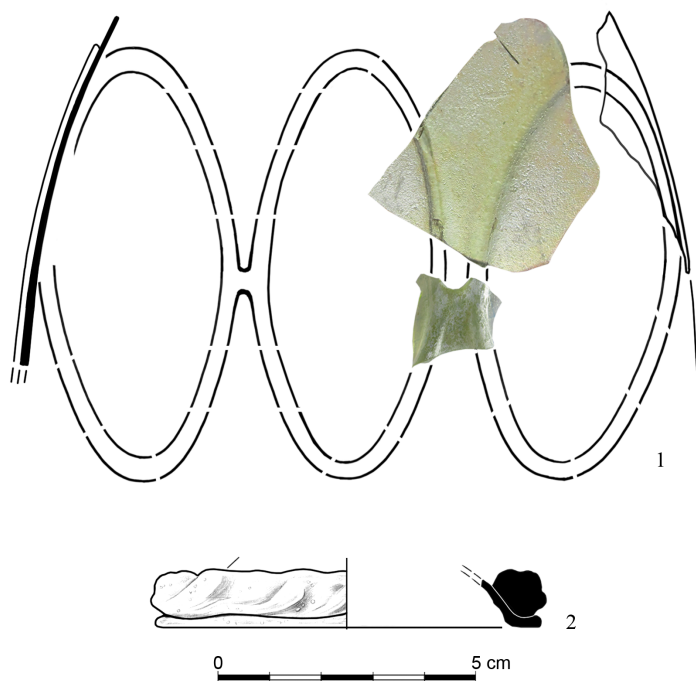
#### *Vessels with base ring of pinched-out toes*

A different kind of table vessel is represented by fragments of vessel bases made of transparent glass with protrusions (O-2016/R-23/116, O-2016/R-23/260,



**Fig. 6.** Glass vessels from sector R-23: 1 – vessel with pinches; 2–3 – vessels with base ring of pinched-out toes; 4 – unguentarium. Drawings: O. Puklina.

Fig. 6:2–3). Vessels with a similar base design found in the western provinces of the Empire are considered Mediterranean imports (Arveiller-Dulong and Nenna 2005: 436, cat. 1211; Fünfschilling 2015: 357, Form AR 198). In addition, this kind of vessels appeared in Egypt (Kucharczyk 2010: figs 1:8–10; 2:4), Greece (Weinberg and Stern 2009: pl. 23: 264–268), Italy (Penn 2018: no. 28), Pannonia (Barkóczy 1988: taf. XII: 130), in the Middle East (Clairmont 1963: 52, pl. V: 204, 207, 208, pl. VI: 211; Jackson-Tal 2016: fig. 37.3:3), in Crimea (Vinokurov 2014: fig. 226:14; Shabanov 2020: fig.2:1). Their chronology is fairly broad. A fragment of such a base was discovered in Tomb 58 (Stone Crypt 4) / 2002 at the necropolis of the Artesian settlement in the Crimean Azov Sea region and is dated to the 2nd–3rd centuries (Vinokurov 2014: 58, fig. 226:14). Renata Kucharczyk dates finds from House 1 in Marina El-Alamein (Egypt) to the 3rd–4th centuries AD (Kucharczyk 2010: 117, 119, figs 1:8–10; 2:4). László Barkóczy dates the vessels from several sites in Pannonia to the end of the 3rd century (1988: 91, Typ 59, taf. XII: 130). Fragments of a glass with such a base come from Grave 124 from the Late Roman time and discovered at the Opushki in Crimea (Shabanov 2020: 114, fig.2:1). In the Athenian Agora, bases with protrusions have been known since the middle of the 3rd century, but most of them belong to Late Roman contexts of the 5th and 6th centuries (Weinberg and Stern 2009: 108, pl. 23: 264–268). Thus, the production of vessels with bases finished with such protrusions, most likely falls in the 3rd–6th centuries.



**Fig. 7.** Glass vessels from sector R-23: jugs. Drawings and photo: O. Puklina.

### *Unguentaria*

Toiletry utensils are represented by the bottom of an unguentarium (O-2016/R-23/187; Fig. 6:4). Similar vessels were produced in the 1st–2nd centuries AD and are widely known throughout the Roman Empire, including Olbia (Kozub 1986: 41–52).

### *Jugs*

As jugs one may identify wall fragments with trailed threads made of transparent glass with a greenish shade (O-2021/R-23/31, O-2017/P-23/501; Fig. 7:1). Similar ornamentation is found on the 4th century jugs from Syro-Palestinian workshops (Harden 1987: 148, kat. 76; Whitehouse 2001: 178–180, cat. 718–719). In the territory of the Northern Black Sea region, they have been found in burials of the 4th century in the Panticapaeum necropolis (Kunina 1997: 331, cat. 393–394; Arveiller-Dulong and Nenna 2005: 458, kat. 1284).

The fragment of a conical foot made of clear green glass, which perhaps may also belong to a jug, is a rare find (O-2021/R-23/56; Fig. 7:2). A massive applied strip with a wavy relief is placed on the foot. The closest analogy in the Northern Black Sea region is the jug on the same kind of foot from the children's burial of Crypt 2(7) from the Chorna Richka cemetery (Babenchikov 1963: 116–117, fig. 21; Shabanov 2013: 157, fig. 1:4). According to the red-slip vessels, the grave can be dated no earlier than the middle of the 4th century (Ivanova 2009: 34). A foot of a jug with a similar decoration dated to the middle to the second half of the 4th century was found in the Roman necropolis of Mayenne (Haberey 1942: 284, pl. 36; Harden 1987: 144–145, cat. 72).

## CONCLUSIONS

The finds of glassware from the excavations in Trench R-23 in 2016–2018 and 2021 are quite clearly divided into two chronological groups. The first group consists of dishes of the Roman period (1st–mid-3rd centuries, the second comprises vessels of Late Antiquity (4th–5th centuries). The majority of the finds belong to the first group. These are fragments of unguentaria, jugs with a square bottom, bowls with ribs and bowls with polished ornaments. Their origin from different glassmaking workshops illustrates the active trade relations of the Olbian settlement in the Roman period. Most likely, fragments of vessels with decoration in the form of teardrop-shaped protrusions and vessels with protrusions on the bottoms should also be attributed to the Roman period. The second chronological group includes fragments of phialai with drops of blue glass of Cologne production, glass beakers with “honeycomb” ornaments, jugs with embossed foot and trailed thread decoration. The products of this group are directly related to the ‘post-Antiquity’ horizon of Olbia and are associated with the contexts of the residential and manufacturing complex found here, which correlates with the presence of the Cherniakhiv culture.

## REFERENCES

- Aguilar-Tablada, M. and Sánchez de Prado, M. 2006. Evidencias de un taller de vidrio en la ciudad de Augustobriga (Talavera la Vieja, Cáceres). *Lucentum* 25: 177–193.
- Alekseeva, E. M. and Sorokina, N. P. 2007. *Kollektsiya stekla antichnoy Gorgippii (I–III vv.)*. Moskva.
- Antonaras, A. 2017. *Glassware and Glassworking in Thessaloniki: 1st Century BC–6th Century AD*. Oxford.
- Arveiller-Dulong, V. and Nenna, M.-D. 2005. *Les verres antiques du Musée du Louvre II*. Paris.
- Babenchikov, V. P. 1963. Chornorichenskyi mohylnyk. *Arkheolohichni pamiatky URSR* 13: 90–123.

- Barkóczi, L. 1986. Geschliffene Gläser aus der ersten Hälfte des 3. Jhs. in Pannonien. *Archaeologiai értesítő* 113: 166–189.
- Barkóczi, L. 1988. *Pannonische Glasfunde in Ungarn*. Budapest. *Studia Archaeologica* IX.
- Bonnet Borel, F. 1997. *Le verre d'époque romaine à Avencher-Aventicum. Typologie Générale*. Avencher. Documents du Musée romain d'Avencher 3.
- Burakov, A. V. 1976. *Kozyrske gorodishche rubezha i pervykh stoletiy nashey ery*. Kyiv.
- Chiriac, C. and Boțan, S. 2014. Roman Glass Vessels in the Western Pontic Area (1st–3rd Centuries CE). General Remarks. *Pontica et Mediterranea* 3: 525–553.
- Clairmont, Ch. W. 1963. The glass vessels. In *Excavations at Dura-Europos. Final Report IV, part V*. New Haven.
- Cool, H. E. M. and Price, J. 1995. *Roman vessel glass from excavations in Colchester, 1971–85*. Colchester. Colchester Archaeological Report 8.
- Didenko, S. V. 2019. Obshchaya kharakteristika keramicheskoy posudy iz raskopok uchastka “R 23” v 2018 g (unpublished). In A.V. Buiskykh, A. Tvardetskiy [Twardecki] and M.V. Novichenkova (eds), *Orchet o rabotakh na uchastke R-23 v Ol'vii v 2018 g. Tom 1*, 150–181. Kyiv. Institut arkhеolohii Natsionalnoi akademii nauk Ukrainy.
- Doppelfeld, O. 1966. *Römisches und Fränkisches Glas in Köln*. Köln.
- Dussart, O. 1998. *Le verre en Jordanie et en Syrie du Sud*. Beyrouth. Bibliothèque archéologique et historique 152.
- Dzigovskiy, A. N. and Ostroverkhov, A. S. 2000. *Steklyannaya posuda kak istoricheskoe yavlenie v pamyatnikakh skifo-sarmatskogo vremeni Ukrainy, Moldovy i rossiyskogo Podon'ya*. Odesa.
- Eggers, H.-J. 1951. *Der römische Import im freien Germanien. Atlas der Urgeschichte I*. Hamburg.
- Fadić, I. and Štefanac, B. 2009. Workshop stamps on square bottles from the Zadar region. In D. Ignatiadou and A. Antonaras (eds), *Annales du 18e Congrès de l'Association International pour l'Histoire du Verre*, 206–210. Thessaloniki.
- Foy, D. and Nenna, M.-D. 2001. *Tout feu, tout sable. Mille ans de verre antique dans le Midi de la France*. Aix-en-Provence.
- Fremersdorf, F. 1939. *Erzeugnisse Kölner Manufakturen in den Funden von Kastell Saalburg und Zugmantel*. Saalburg. Saalburg Jahrbuch IX.
- Fremersdorf, F. 1961. *Im Auftrag der Archäologischen Gesellschaft und des Römisch-Germanischen Museums Köln*. Köln. Die Denkmäler des römischen Köln. Band VI.
- Fremersdorf, F. 1962. *Die römischen Gläser mit aufgelegten Nuppen*. Köln. Die Denkmäler des römischen Köln. Band VII.
- Fremersdorf, F. 1967. *Die römischen Gläser mit Schliff, Bemalung und Goldauflagen aus Köln*. Köln. Die Denkmäler des römischen Köln. Band VIII.
- Fremersdorf, F. and Polónyi-Fremersdorf, E. 1984. *Die Farblosen Gläser der Frühzeit in Köln 2. und 3. Jahrhundert*. Köln. Die Denkmäler des römischen Köln. Band IX.
- Fünfschilling, S. 2015. *Die römischen Gläser aus Augst und Kaiseraugst. Kommentierter Formenkatalog und ausgewählte Neufunde 1981–2010 aus Augusta Raurica. Text und Formenkatalog*. Augst. Forschungen in Augst 51.
- Gey, O. A. and Bazhan, I. A. 1997. *Khronologiya epokhi „gotских pokhodov“ na territorii Vostochnoy Evropy i Kavkaza*. Moskva.
- Goethert-Polaschek, K. 1977. *Katalog der römischen Gläser des Rheinischen Landesmuseums Trier*. Mainz am Rhein. Trierer Grabungen und Forschungen 9.
- Golofast, L. A. 2001. Steklo rannevzantiyskogo Khersonesa. *Materialy po arkhеologii, istorii i etnografii Kryma* 8: 97–260.



- Golofast, L. A. 2006. Steklo iz raskopok zol'nika rimskogo vremeni u podnozhia gory Mitridat v Kerchi. *Bosporskie issledovaniya* 11: 309–330.
- Golofast, L. A. and Ol'khovskiy, S. V. 2019. Kompleks stekla iz podvodnogo fundamenta v akvatorii Fanagorii. *Hypanis. Trudy otdela klassicheskoy arkheologii IA RAN* 1: 43–72.
- Gorokhovskiy, E. L. 1988. Khronologiya chernyakhovskikh mogil'nikov Lesostepnoy Ukrainy. In B.A. Rybakov (ed.), *Trudy V Mezhdunarodnogo kongressa arkheologov-slavistov* 4: 34–46.
- Grose, D. F. 1989. *Early Ancient Glass: Core-Formed, Rod-Formed and Cast Vessels and Objects from the Late Bronze Age to the Early Roman Empire, 1600 B.C. to A.D. 50*. New-York.
- Haberey, W. 1942. Spätantike Gläser aus Gräbern von Mayen. *Bonner Jahrbücher* 147: 249–284.
- Harden, D. 1936. *Roman Glass from Karanis found by the University of Michigan Archaeological Expedition in Egypt, 1924–29*. Michigan.
- Harden, D. 1987. *Glas der Caesaren*. Milano.
- Isings, C. 1957. *Roman Glass from Dated Finds*. Groningen, Djakarta.
- Ivanova, O. S. 2009. Krasnolakovaya keramika iz raskopok mogil'nika v balke Almalyk-dere (Mangup). *Materialy po arkheologii, istorii i etnografii Tavrii* 15: 6–88.
- Jackson-Tal, R. E. 2016. Glass Finds. In O. Lipschits (ed.), *Ramat Rahel III. Final Publication of Yohanan Aharoni's Excavations (1954, 1959–1962)* II, 567–587. Winona Lake.
- Kozub, Yu. I. 1986. Steklyannye bal'zamarii iz nekropolya Ol'vii. In V. A. Anokhin, V. M. Zubar and A. S. Rusyaeva (eds), *Antichnaya kul'tura Severnogo Prichernomor'ya v pervye veka nashey ery*, 41–52. Kyiv.
- Krapivina, V. V. and Buiskykh, A. V. 2010. Osnovnye itogi rabot na uchastke R-25 v Ol'vii v 2007–2008 gg. *SYMBOAA* 1: 108–117.
- Kucharczyk, R. 2010. Glass from Houses 1 and 2 in Marina El-Alamein. *Polish Archaeology in Mediterranean* 19: 114–130.
- Kunina, N. Z. 1982. Dva steklannykh kuvshina iz nekropolya Nimfeya: In S. P. Boriskovskaya (ed.), *Khudozhestvennye izdeliya antichnykh masterov*, 119–124. Leningrad.
- Kunina, N. Z. 1997. *Antichnoe steklo v sobranii Ermitazha*. Saint Petersburg.
- Kunina, N. Z. and Sorokina, N. P. 1972. Steklyannye bal'zamarii Bospora. *Trudy Gosudarstvennogo Ermitazha* 13: 146–177.
- Lazar, E. 2003. *The Roman glass of Slovenia*. Ljubljana.
- Lierke, R. 1999. *Antike Glastöpferei: ein vergessenes Kapitel der Glasgeschichte*. Mainz am Rhein.
- Lyubichev, M. V., Shul'tse, E. and Gella E. I. 2019. Pozdnie pogrebeniya mogil'nika Voytenki i poslednyaya faza chernyakhovskoy kul'tury v lesostepi mezhdru Dneprom i Severskim Dontsom. *OIUM* 6: 13–49.
- Minchev, A. 1989. Antichno staklo ot Zapadnoto Chernomorie (I–VI v.). III. Kani. *Izvestia na Narodnia muzey Varna* 25(40): 13–26.
- Minchev, A. 1990. Antichno staklo ot Zapadnoto Chernomorie (I–VI v.). IV. Butilki. *Izvestia na Narodnia muzey Varna* 26(41): 56–78.
- Molev, E. A. 2004. Fragmenty steklyannykh sudov iz raskopok Kiteya. *Bosporskie issledovaniya* 5: 405–421.
- Novichenkova, N. G. 2015. *Gornyy Krym: II v. do n. e.– II v. n. e. Po materialam raskopok svyatilishcha u perevala Gurzufskoe Sedlo*. Simferopol.
- Pánczél, S. P. 2011. The Production of Prismatic Glass Bottles in Roman Apulum. *Marisia* 31: 175–187.
- Penn, T. M. 2018. Post-AD 79 Roman Glass from Campania: the assemblage from the villa baths at Masseria De Carolis (Pollena Trocchia). A preliminary Report. *Rivista di Studi Pompeiani* 29: 220–224.

- Poliszczuk, L. U. 2006. Szkło starożytne. In J. Bodzek (ed.), *Skarby znad morza czarnego. Złoto, rzeźba, ceramika z Muzeum Archeologicznego w Odessie. Katalog wystawy w Muzeum Narodowym w Krakowie (marzec–czerwiec 2006)*, 336–353. Kraków.
- Puklina, O. O. 2018. Skliani fiali rimskoho chasu z Ol'vii. *Arkheolohiia i davnia istoriia Ukrainy* 28(3): 68–77.
- Reida, R. M., Heiko, A. V. and Sapehin, S. V. 2016. Pokhovannia 115 Shyshatskoho mohyl'nyka zi sklianyim ornamentovanyim kubkom. *OIUM* 5: 20–28.
- Reida, R. M., Heiko, A. V. and Sapehin, S. V. 2021. Sklianyi kubok z eklektychnymy oznakamy z pokhovannia 112 Shyshatskoho mohyl'nyka. *Arkheolohiia* 4: 95–109.
- Rikman, E. A. 1975. *Pamyatniki sarmatov i plemen chernyakhovskoy kul'tury. Arkheologicheskaya karta Moldavii*. Kishinev.
- Rütti, B. 1991. *Die römischen Gläser aus Augst und Kaiseraugst*. Augst. Forschungen in Augst 13(2).
- Saveliev, O. K. 2017. Rimskiy import I v. n. e. v T're i nekotorye voprosy rimsko-varvarskikh kontaktov v Severo-Zapadnom Prichernomor'e. *Stratum plus* 4: 119–134.
- Shabanov, S. B. 2011a. Steklyannye sosudy iz mogil'nika Neyzats (po materialam raskopok 1996–2010 gg.). *Bosporskie chteniya* 12: 421–427.
- Shabanov, S. B. 2011b. Steklyannye sosudy iz mogil'nika Neyzats (po materialam raskopok 1996–2011 gg.). *Materialy po arkheologii, istorii i etnografii Tavrii* 17: 141–191.
- Shabanov, S. B. 2013. Steklyannye sosudy iz raskopok Inkermanskogo i Chernorechenskogo mogil'nikov (iz kollektzii Bakhchisarayskogo zapovednika). *Krym v sarmatskuyu epokhu (II v. do n. e.–IV v. n. e.)* 1: 155–170.
- Shabanov, S. B. 2017. Kleyma na steklyannykh sosudakh rimskogo vremeni iz Severnogo i Severo-Zapadnogo Prichernomor'ya. *Problemy istorii, filologii i kul'tury* 1: 88–104.
- Shabanov, S. B. 2019. Steklyannye kubki s „sotovym” ornamentom pozdnerimskogo vremeni iz Severnogo Prichernomor'ya i Kavkaza. *Khersonesskiy sbornik* 20: 315–321.
- Shabanov, S. B. 2020. Steklyannye sosudy rimskogo vremeni iz mogil'nika Opushki v Krymu (po materialam raskopok 2003–2019 gg.). *Problemy istorii, filologii i kul'tury* 2: 110–134.
- Shchepachenko, V.I. 2022. Sklianyi posud piznorymskoho chasu z Viitenkiv: tekhnolohichniy aspekt. *Arkheolohiia* 1: 121–153.
- Son, N. O. 1988. Skliani posudyny z Tiry. *Arkheolohiia* 63: 47–56.
- Sorokina, N. P. 1957. Tuzlinskiy nekropol'. Moskva. *Trudy Gosudarstvennogo istoricheskogo muzeya* XXVI.
- Sorokina, N. P. 1962. Steklo iz raskopok Pantikapeya 1945–1959 gg. *Materialy i issledovaniya po arkheologii SSSR* 103: 210–236.
- Sorokina, N. P. 1965. Steklyannye sosudy iz Tanaisa. In D. B. Shelov (red.), *Drevnosti Nizhnego Dona*, 202–238. Moskva.
- Sorokina, N. P. 1971. O steklyannykh sosudakh s kaplyami sinego stekla iz Prichernomor'ya. *Sovetskaya arkheologiya* 4: 85–101.
- Sorokina, N. P. 1973. Steklyannye sosudy iz mogil'nika Kharaks. In: D. B. Shelov (ed.), *Kavkaz i Vostochnaya Evropa v drevnosti*, 183–189. Moskva.
- Sorokina, N. P. 1976. Pozdneantichnoe steklo iz Ol'vii. In I. B. Brashinskiy, K. S. Gorbunova, N. P. Shul'ts, G. A. Tsvetaeva and I. G. Shurgaya (eds), *Khudozhestvennaya kul'tura i arkheologiya antichnogo mina*, 199–209. Moskva.
- Sorokina, N. P. 1977. Antichnye steklyannye sosudy iz raskopok nekropolya bosporskogo goroda Kepy na Tamanskom poluostrove. *Antichnyy mir i arkheologiya* 3: 115–144.
- Sorokina, N. P. 1978. Antichnoe steklo v sobranii Odesskogo Arkheologicheskogo muzeya. In P. O.

- Karyshkovskiy (ed.), *Arkheologicheskie issledovaniya Severo-Zapadnogo Prichernomor'ya*, 267–274. Kyiv.
- Sorokina, N. P. 1979. Steklyannye sosudy IV–V vv. i khronologiya Tsebildinskikh mogil'nikov. *Kratkie soobshcheniya Instituta arkheologii* 158: 57–67.
- Sorokina, N. P. 1982. Steklyannaya posuda kak istochnik po istorii ekonomicheskikh svyazey Prichernomor'ya i lokal'nogo steklodeliya pervykh vekov n. e. *Trudy Gosudarstvennogo Istoricheskogo muzeya* 54: 40–42.
- Sorokina, N. P. 1994. Steklo iz rimskoy kreposti serediny I–III vv. n. e. v nizov'e Dunaya (gorodishche u sela Orlovka). In S. B. Okhotnikov (ed.), *Drevnee Prichernomor'e*, 177–185. Odesa.
- Sorokina, N. P. and Gushchina, I. I. 1980. Steklyannye izdeliya iz mogil'nikov pervykh vekov n. e. yugo-zapadnogo Kryma. *Trudy Gosudarstvennogo Istoricheskogo muzeya* 51: 89–100.
- Stern, E. M. and Schilic-Nolte, B. 1994. *Frühes Glas der alten Welt, 1600 v.Chr.–50 n. Chr.* Stuttgart.
- Strzheletskiy, S. F., Vysotskaya, T. N., Ryzhova, L. A. and Zhestkova, G. I. 2003–2004. Naselenie okrugy Khersonesa v pervoy polovine I tysyacheletiya novoy ery (po materialam nekropolya „Sovkhoz 10“). *Stratum plus* 4: 27–277.
- Symonovich, E. A. 1964: Steklyannye kubki iz Zhuravki. *Kratkie soobshcheniya instituta arkheologii* 102: 8–12.
- Taylor, M. and Hill, D. 2003b. Ribbed bowls and their manufacture <http://www.theglassmakers.co.uk/archiverandomanglassmakers/poster03.htm> (checked 18 September 2018).
- Turova, N. P. and Chernysh, S. A. 2015. Rannesrednevekovyy mogil'nik Aloniya na yuzhnom beregu Kryma (po materialam raskopok 1998. 2001. 2002 gg.). *Materialy po arkheologii, istorii i etnografii Tavrii* 20: 133–184.
- Twardcki, A. and Buiszykh, A. 2021. The Cherniahov Culture in Olbia Pontica in the light of Polish-Ukrainian excavations 2016–2018. *Sprawozdania Archeologiczne* 73(2): 251–273.
- Vinokurov, N. I. 2014. Nekropol' antichnogo gorodishcha Artezian v Krymskom Priazov'e. *Materialy raskopok 1999–2007. Simferopol–Kerch. Bosporskie issledovaniya. Supplementum* 12.
- Vysotska, T. M. 1964. Pro vyrobnytstvo skla v piznoantychnomu Krymu. *Arkheolohiia* 16: 7–20.
- Weinberg, G. D. and Goldstein, S. M. 1988. *Excavations at Jalame Site of a Glass Factory in Late Roman Palestine*. Columbia.
- Weinberg, G. D. and Stern, E. M. 2009. *Vessel Glass*. New Jersey. The American school of classical studies at Athens. The Athenian Agora XXXIV.
- Whitehouse, D. 2001. *Roman Glass in The Corning Museum of Glass. Vol. II*. Corning, New York.
- Yatsenko, E. G. 2005. Glasgefäße der Römerzeit und Spätantike aus Tanais. *Eurasia Antiqua* 11: 277–312.
- Yatsenko, E. G. 2006. Steklyannye chashi-fialy vtoroy poloviny II–serediny III v. n. e. iz Tanaisa. *Trudy Gosudarstvennogo Istoricheskogo muzeya* 159: 130–152.
- Yatsenko, E. G. 2007. Kolleksiya steklyannykh izdeliy iz Tanaisa IV–V vv. n. e. *Drevnosti Bospora* 11: 473–499.
- Yurochkin, V. A. and Trufanov, A. A. 2007. Khronologiya mogil'nikov Tsentral'nogo i Yugo-Zapadnogo Kryma 3–4 vv. n. e. In Yu. P. Zaytsev and V. I. Mordvintseva (eds), *Drevnyaya Tavrika*, 359–397. Simferopol.