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Mikhail Treister, Andrey Chugaev

SOURCES OF METAL OF SILVER OBJECTS FROM BURIALS OF NOMADS OF ASIAN SARMATIA OF THE 2nd CENTURY BCE — 3rd CENTURY CE AFTER THE RESULTS OF ARCHAEOLOGICAL AND PB-PB ISOTOPIC STUDIES*

The paper is devoted to the complex analysis of silver objects from the burial complexes of Asian Sarmatia of the 2nd century BCE — 3rd century CE, representing both typological and cultural-historical analysis of these items in combination with the study of the isotopic composition of Pb in order to try to answer questions not only about possible centers of the manufacture of objects, but also of the sources of the metal. Pb-Pb data were obtained using inductively coupled plasma multicollector mass spectrometry (MC-ICP-MS) carried out in the Laboratory of isotopic geochemistry and geochronology of the Institute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry RAS, Moscow.

The overwhelming majority of the objects are dated within the 1st century BCE — 1st century CE time span. The stylistic features of the items indicate that their origin is associated with several production centers: 1) the workshops of the ancient cities of the North Pontic region, first of all, the Bosporan Kingdom; 2) workshops located in Asia Minor or in the Eastern Mediterranean; 3) round-bottomed goblets and some of the phalerae of horse-harness should be attributed to the products of Sarmatian craftsmen, most probably manufactured both in the Lower Volga and in the Kuban region; 4) a neck guard of the helmet of the East Celtic type, secondary used as a breastplate of horse-harness, is undoubtedly the product of the Celtic (*Taurisci*) workshop, located in the territory of modern Slovenia.

The 17 silver items demonstrate substantial heterogeneity in terms of the Pb isotopic composition. The values of $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios vary in the ranges: from 18.07 to 19.41, from 15.60 to 15.75, and from 38.3 to 40.4 respectively. The large variation ($\nu_{206/204}$ = 1.4%, $\nu_{207/204}$ = 0.2%, and $\nu_{208/204}$ = 1.2%) can be explained by the origin of the metal from several ore provinces located in the Black Sea region, Asia Minor and the Near East. The Pb isotopic composition of most of the items is consistent with deposits in the Black Sea region — Eastern Balkans (6 items) and Eastern Pontides (6 items). The Pb-Pb data indicates that silver also could come from the deposits of the Taurus (South-Eastern Turkey) and Zagros (Western Iran) Mountains.

Key words: Nomads, Asian Sarmatia, silver vessels, details of armor, horse equipment, belt sets and of ceremonial furniture, typology, chronology, stylistic features, distribution, centers of manufacture, Pb isotopic data, sources of silver, ore provinces.

About the authors: Treister Mikhail[1], Dr. phil. habil. (RUS), Independent researcher; Chugaev Andrey[2], Senior Researcher, Institute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry, Russian Academy of Sciences.

Contact information: [1]53175, Federal Republic of Germany, Bonn, Weißenburgstr. 59; e-mail: mikhailtreister@yahoo.de; [2]119017, Russia, Moscow, Institute of Geology of Ore Deposits, Petrography,

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Mineralogy and Geochemistry, Russian Academy of Sciences, Staromonetny Lane, 35; e-mail: vassachav@mail.ru.

М.Ю. Трейстер, А.В. Чугаев

ИСТОЧНИКИ МЕТАЛЛА СЕРЕБРЯНЫХ ИЗДЕЛИЙ ИЗ ПОГРЕБЕНИЙ КОЧЕВНИКОВ АЗИАТСКОЙ САРМАТИИ II В. ДО Н.Э. — III В. Н.Э. ПО РЕЗУЛЬТАТАМ ИЗУЧЕНИЯ ИЗОТОПНОГО СОСТАВА Pb

Статья посвящена комплексному анализу серебряных изделий из погребальных комплексов Азиатской Сарматии II в. до н.э. — III в. н.э., представляя как типологический, так и культурно-исторический их анализ в сочетании с изучением изотопного состав Pb, для того, чтобы попытаться ответить на вопросы не только о возможных центрах изготовления предметов, но и об источниках металла. Pb-Pb данные получены с помощью мультиколлекторной масс-спектрометрии с индуктивно-связанной плазмой (MC-ICP-MS), выполненной в лаборатории изотопной геохимии и геохронологии Института геологии рудных месторождений, петрографии, минералогии и геохимии РАН, Москва.

Подавляющее большинство предметов датируется I в. до н.э. — I в. н.э. Стилистические особенности изделий свидетельствуют о том, что их происхождение связано с несколькими производственными центрами: 1) мастерскими античных городов Северного Причерноморья, прежде всего Боспорского царства; 2) мастерскими, расположенными в Малой Азии или в Восточном Средиземноморье; 3) к изделиям сарматских мастеров следует отнести круглодонные кубки и часть фаларов конской упряжи, изготовленных, скорее всего, как в Нижнем Поволжье, так и в Прикубанье; 4) назатыльник шлема восточно-кельтского типа, вторично использованный в качестве нагрудника конской упряжи, несомненно, является продуктом кельтской мастерской таврисков, находившейся на территории современной Словении.

17 серебряных изделий демонстрируют существенную неоднородность по изотопному составу Pb. Измеренные значения отношений $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ и $^{208}Pb/^{204}Pb$ изменяются в широких диапазонах: от 18.07 до 19.41, от 15.60 до 15.75 и от 38.3 до 40.4, соответственно. Большой разброс изотопных отношений ($\nu_{206/204}$ = 1,4 %, $\nu_{207/204}$ = 0,2 % и $\nu_{208/204}$ = 1,2 %) можно объяснить происхождением металла из нескольких рудных провинций, расположенных в Причерноморье, Малой Азии и на Ближнем Востоке. Изотопный состав свинца большинства объектов согласуется с месторождениями Причерноморья — Восточных Балкан (6 шт.) и Восточных Понтид (6 шт.). Pb-Pb данные указывают на то, что серебро также могло поступать из месторождений гор Тавра (юго-восток Турции) и Загроса (Западный Иран).

Ключевые слова: кочевники, Азиатская Сарматия, серебряные сосуды, детали доспеха, конское снаряжение, поясные наборы, парадная мебель, типология, хронлогия, стилистические особенности, распределение, центры производства, данные изотопного состава Pb, источники серебра, рудные провинции.

Сведения об авторах: Трейстер Михаил Юрьевич[1], Dr. phil. habil. (RUS), независимый исследователь; Чугаев Андрей Викторович[2], старший научный сотрудник, Институт геологии рудных месторождений и петрографии РАН.

Контактная информация: [1]53175, Федеративная республика Германия, г. Бонн, Вайсенбургштрассе 59; e-mail: mikhailtreister@yahoo.de; [2]119097, Россия, г. Москва, Старомонетный пер., 35, Институт геологии рудных месторождений и петрографии РАН; e-mail: vassachav@mail.ru.

Introduction

In the process of work on the project “Forms and ways of cultural contacts of the nomads of Asian Sarmatia. Imports in the Sarmatian monuments of the 2nd century BCE — 3rd century CE” (FL-334 / 15-1) numerous objects from the burial complexes of Asian Sarmatia has been studied. There were many silver items among them. We decided not to confine ourselves to typological and

cultural-historical analysis of these items, but also to take samples to study the Pb isotopic composition in order to try to answer questions not only about possible centers of the manufacture of objects, but also of the sources of the metal. These analytical methods are destructive. Sampling opportunities were largely limited by the permissions of the museum curators and the state of preservation of artefacts — therefore, these are primarily fragmented items. However, they represent a fairly wide range. In a significant part, these are vessels, and not only of the late Hellenistic and early Imperial types, made in various workshops of the Mediterranean and the Black Sea regions, but also round-bottomed cups of the Sarmatian types, as well as details of horse-harness, belt sets and pieces of ceremonial furniture.

The study of Pb isotope composition is now widely applied in archaeology to identify sources of metal, as well as links between cultural and production centres of ancient societies (Baron et al. 2011: 1090—1100; Holmqvist et al. 2019: 6—12; Merkel 2019: 206—226; Chugaev et al. 2021: 113—115). This approach was first used in 1960s (Brill and Wampler 1965: 165—166; 1967: 63—77). It is based on the idea that ancient objects "inherit" the Pb isotopic composition of the source (deposit) of the metal and retain their "isotopic marks" throughout their existence. Comparison of such "isotopic marks" with the Pb isotopic composition of ores from ancient mining regions, as well as reference objects from known production centres, provides important additional information about the origin of artefacts.

The aim of this study was to obtain lead-isotopic "marks" for silver objects found in the burials of nomads of Asian Sarmatia, in the vast area between the Don in the west and the South Urals, and to establish for them the territorial origin of the metal source. The objects studied are from the burials dating from the 2nd century BCE to the 3rd century CE (see below section 1). Pb-Pb data were obtained using inductively coupled plasma multicollector mass spectrometry (MC-ICP-MS). The MC-ICP-MS method is superior in accuracy (± 0.02-0.03% versus ± 0.2-0.3% for TIMS) in comparison with the traditional TIMS method. This makes it possible to determine the Pb isotopic composition of objects at a new level of accuracy, to identify reliably the differences between them and to correlate with the available Pb-Pb data for mining regions and production centres.

1. Analysis of objects

1.1. Vessels of the Late Hellenistic and Early Imperial Types

1.1.1. *A cup from Titchikha*

Fragments of a silver round-bottomed goblet of the late 2nd — 1st century BCE (?) with elements of floral and geometric patterns (AG-5) were found in Titchikha in the Voronezh region (Fig. 1). The fact that this is a vessel, and not a fragmented phalera, as previously assumed (Shokov 1960: 152—154, Fig. 5; Mordvinceva 2001: 81, no. 81, Pl. 44) is evidenced by the minor thickness of the walls.

From the decoration elements a number of successively connected rhombuses (their surface is filled with dot pattern), lanceolate petals forming a rosette, as well as curls of ivy shoots are fixed. All decorative details are made in low relief and are additionally gilded. The vessel walls are very thin. Taking this fact into account, it may be suggested that the fragments belong to the outer lining of the vessel, and the decoration presented a rosette with vertical friezes in the form of chains of rhombuses. I do not know exact parallels, but it could be, for example, a round-bottomed goblet of the type of a two-partite goblet kept in Toledo and dated to the second half of the 2nd century BCE (Cat. Toledo 1977: 78—79, no. 43). Rhombuses as a decorative motif, although rarely, are known in

the painted pottery of the Hellenistic period, dated in frames of the last quarter of the 3rd — first half of the 1st century BCE (Rotroff 1997: 66).

1.1.2. *A basin from Zhutovo*

A basin from burial no. 1 of burial mound no. 28/1964 in Zhutovo in the Volga-Don interfluve, dating to the first half of the 1st century CE (Kropotkin 1970: 86, no. 729; Shilov 1974: 61, Fig. 1, *8*; 1975: 150, Fig. 58: *1*; Mordvintseva 2000: 144—145, Fig. 1: *1*; Cat. Rome 2005: 168, no. 147; Mordvintseva, Treister 2007: vol. 2, 30, no. A72.5; Skripkin 2013: 123, no. 7 (ill.)) has a complex shape: a hemispherical body and a high conical foot with a round base. The body is ornamented along the edge with chased relief friezes composed of "pearls" and Ionian *kymation*. The handles, decorated with fluting and a transverse ridge with a strip of "pearls", are soldered to separately cast attachments in the form of embossed nine-lobed palmettes. The foot-stand, hammered from a thin sheet, is decorated in the lower part with friezes made of Ionian *kymation* and pearls, but made in a different technique than the decoration of the rim of the basin, with the *ovae* embossed on the front side with a punch (AG-10) (Fig. 2).

V.I. Mordvintseva suggested that the foot-stand of the basin was made later, instead of the lost one, in another workshop, probably in the Bosporan one (Mordvintseva 2000: 144—145; 149). At the same time, attention is drawn to the fact that in order for the basin to be placed on the foot-stand, "a dent was made in the round bottom of the basin from the outside, as a result of which its surface was deformed and covered with small cracks" (Mordvintseva 2000: 144)[1].

Indeed, there is every reason to believe that the foot-stand of the Zhutovo basin was an alteration or rather a rework, which was done later. How the original foot-stands of such basins looked like give an idea the finds from Pompeii of basins with similar fluted handles with a bead of a similar shape in the center and attachments in the form of palmettes — they are low and in some cases are decorated with chased *ovae* with rosettes between them (Tassinari 1993: 93—94, 207, S2122, no. 12416; 209, S2220, no. 8214; 210, S2230, no. 11593; 240, S6100a, no. 13239)[2]. Some finds of similar handles also originate from Pompeii (Tassinari 1993: 94, 210, S2200, nos. 12099A, 18972). Some basins (rarely) demonstrate a similar design of the edge with the frieze of the Ionian *kymation* (Tassinari 1993: 93—94, 204, S2110, no. 5025; 205, S2111, nos. 3641, 1728; 207, S2122, no. 12416; 211, S2200, no. 14005; Bolla 1994: 53—55, no. 64; Pl. XLIX)[3]. The combination of pearl bands and Ionian *kymation* in the decoration of the edge is characteristic, however, even for silverware of the late Hellenistic period[4].

1.1.3. *A phiale from Verbovskiy*

A silver phiale with a strongly fragmented medallion (AG-13) (Figs. 3—4), according to V.I. Mordvintseva and Yu.P. Zaitsev, depicting the mask of Medusa (in my opinion, based on work with the object in September 2015, this assumption can hardly be considered sufficiently well substantiated due to the fact that the medallion is very fragmented), originates from burial no. 1 of

[1] Cf. The basin from the Sokokovskiy Burial-mound no. 3: Treister 2020b: 572, Fig. 4: *3*.

[2] A similar foot stand has also the basin from burial no 1 in Welvyn in England, dated to the Augustan period (Eggers 1966: 105, no. 31a, *d*; 113, Fig. 3d).

[3] See also a bronze basin from burial mound no. 13/1961 near Kudinov Farmstead (Raev 1974: 141, Fig. 3; 1986: 18—21, pl. 13—14; Kat. Frankfurt 2003: 107, no. 70; Treister 2019: 317, Fig. 4: *3*).

[4] See, e.g., a *modiolus* from the Tivoli Treasure of the mid-1st century BCE (Oliver 1965: 180—181, Fig. 5; Cat. Toledo 1977: 103, no. 60).

burial mound no. 4/1998 of the Verbovskiy-II necropolis, dating back no later than the first half of the 1st century CE (Mamontov 2000: 168 (mentioned); 2008: 171—172, Fig. 5: *5*; Mordvintseva, Khabarova 2006: 90, no. 53; Treister 2007a: 36—37; Mordvintseva, Treister 2007: vol. 2, 17, A31.1, Fig. 4) and belongs to the group of phialai with medallions. This group is represented in Sarmatian burials and remains of funeral feasts of the Lower Don region: Sadovyy Burial-mound — eight vessels with figural scenes (Cat. Paris 2001: 194—198, nos. 216—223; Kat. Frankfurt 2003: 126—130, nos. 90—97; Treister 2007a: 32—36; Mordvintseva, Treister 2007: vol. 2, 76—77, nos. A244.1—8, Pl. 17, 38—39) and burial mound no. 11/1977 of the Novo-Aleksandrovka-I group — 3 phialai with medallions decorated with gorgoneia and with a bust of Artemis (Cat. Tokyo 1991: 118, nos. 144—146; Cat. Paris 2001: 192—193, nos. 211—213; Zasetskaya 2008: 132—133, nos. 46—47; Kat. Leoben 2009: 254—255, nos. 107—108; Bespalyy, Luk'yashko 2018: 34—36, Figs. 18; 19: *8*; Pl. 2—4), as well as from the burial of the first half of the 2nd century CE in the robbed vault no. 844/2007 of the necropolis of the Ust-Alma settlement in the South-West Crimea: with a bust of Artemis or Tyche (Puzdrovskiy 2007: 170, 429, Fig. 155: *2*; 2009: 335—336, no. 13, Fig. 6: *2*; Trufanov 2009: 132, Fig. 4: *2*; Puzdrovskiy, Trufanov 2017: 17, 161, Fig. 30).

Phialai of a similar size, also on low, lathe-turned profiled foot-rings (as the vessels from Sadovyy and Novoaleksandrovka; the phialai from Verbovskiy and Ust'-Alma do not have foot-rings, which were probably lost) with overlaid medallions in the center, were widespread and are represented by three bowls from the Hildesheim Treasure in Lower Saxony (Pernice, Winter 1901: 25—28, Figs. 7—8, Pl. 3—5; Gehrig 1980: 13—14, 16—17, nos. 13—14, Pl. 3; Barr-Sharrar 1987: 138, nos. H 14—15, Pl. 70; 145; Kat. Hildesheim 1997: 37—40, nos. 2—4; Gregarek 1997: 92—93, Fig. 3; Erdrich 2002: 84, no. XX-05-9/3.2—4, Pl. 8—10), three bowls — from the Treasure found in Hermoupolis in Egypt (Mielsch 1997: 41—46, Figs. 1—5; 52—54, nos. 1—3; Mielsch, Niemeyer 2001: 5—9; 24—28, nos. 1—4, Figs. 21—26), another three pieces — from Boscoreale (Baratte 1986: 37; 78—81; 90—91), as well as a bowl with a gold medallion from the House of Menander at Pompeii (Painter 2001: 63, M14, Pl. 14, Fig. 1; Cat. Naples 2006: 220, no. 367). They are considered as the so-called *show silver* (Painter 2001: 23—25).

The phiale from Verbovskiy could have been made either in one of the Mediterranean centers or in the Northern Pontic region. The almost complete loss of the medallion does not allow a more definite attribution.

1.1.4. *Skyphoi*

Skyphoi with a non-ornamented body with walls tapering to the bottom are represented by finds from the Don region: a *skyphos* from burial no. 3 of burial mound no. 12/1980 of the cemetery near Noyy Farmstead (AG-3) (Fig. 5: *2*) (Il'yukov, Vlaskin 1992: 37, Fig. 5: *10*; 241; Mordvintseva, Treister 2007: vol. 2, 51, no. A155.2) and fragmented *skyphos* from burial no. 1 of burial mound no. 13/1996 near the Shaumyan Farmstead (AG-1) (Fig. 5: *1*) (Glebov 2002: 30—31, Fig. 2: *3*; 34).

The *skyphoi* have circular foot rings trays and composite handles of various types with horizontal figural plates on top, the ends of which are decorated in the form of bird's heads. However, if the *skyphos* from the burial ground near Shaumyan Farmstead has handles consisting of three elements: a horizontal plate, a half-ring and a lower appendix with an attachment, then in a larger vessel from the burial ground near Novyy Farmstead the lower attachment is absent, and the loop-shaped handle is bent in such a way that its lower end is soldered to the body of the vessel directly.

The construction of the handle of the second skyphos from Novyy cemetery reminds that of the handle of the *kantharos* with egg-shaped body from burial mound no. 29/1902 near Cossack village Ust'-Labinskaya in the Kuban region (CR St. Petersbourg 1902: 78; Smirnov 1953: 19, 21, Fig. 10д;

Gushchina, Zasetskaya 1994: 31—32; 63, no. 337, Pl. 36; Mordvintseva, Treister 2007: vol. 2, 96, no. A306.1, Pl. 45, Fig. 17), which belongs to the second half of the 1st century BCE (Treister 2007a: 19—20). A complex of finds from burial no. 1 in burial mound no. 13/1996 near Shaumyan Farmstead cannot be dated later than the second half of the 1st century BCE, given the find in it of a Italic bronze ladle of the Peschate type (Glebov 2002: 31, no. 7, Fig. 2: *4*; 2004: 130; 2006: 63; Treister 2005: 233; 2020a: 42—43, Fig. 1; 47—48; Sergatskov 2006: 40, 56, Fig. 4: *4*; Raev 2006: 96—97).

1.1.5. *Spoons*

Imported silver spoons of Roman types in Sarmatian burials are rare and are represented by finds of *ligulae*: one — with traces of repair from Lebedevka in Western Kazakhstan (Bagrikov, Senigova 1968: 73, Fig. 2: *4*; 75; Cat. Mantua 1998: 234, no. 506; Treister 2005: 79; 2013: 735; Cat. San Diego 2006: 140, no. 95; Moshkova 2009: 104, Fig. 3: *1*; 105) and another fragmented one with a hoof at the end of the handle, originating from the cemetery near Novyy Farmstead in the Lower Don area (Il'yukov, Vlaskin 1992: 42—43, no. 22, Fig. 7: *12*; Mordvintseva, Treister 2007, vol. 2, 52, no. A157.1). In a similar way with a hoof at the end of the handle there is decorated also a spoon from the robbed burial of the 3rd century CE near the village of Mukhranovo in the South Urals, the metal of which is analyzed (AG-15) (Fig. 6).

1.2. Round-bottomed goblets (with animal-shaped handles)

Silver and gold round-bottomed goblets with a spherical body and a low vertical or bent outward edge with a figural handle in the form of an animal (panther, hare, deer) originate from the Sarmatian burials of the Don region and the interfluve of Volga and Don (Treister 2007a: 47—48; Zasetskaya 2011: 172—195; 2019, Pl. XXI). To this group belongs the analyzed goblet AG-2 (with the lost handle) from burial no. 2 of burial mound no. 12/1980 near Novyy Farmstead. It is a round-bottomed goblet with a weakly accentuated low neck. On the surface there are traces of solder from the attachments of a vertical handle: under the rim — a rounded one with a diameter of 1.75 cm, below — of a square shape, 1.7 × 1.7 cm (Fig. 7) (Il'yukov, Vlaskin 1992: 37—38, Fig. 5: *2*; 241; Mordvintseva, Treister 2007: vol. 2, 51, no. A155.3).

The body of some silver vessels of the group under consideration, in particular the analyzed vessel AG-11 from burial no. 2 of burial mound no. 51/2011 of the cemetery near the village Peregruznoe (Fig. 8) (Balabanova 2014: 74—75, Fig. 111: *4—6*) is pear-shaped, and the handles are executed in form of horses or panthers (hyenas) figures.

Finally, the same group of vessels includes much rarer vessels of a similar shape, decorated with engraved friezes with gilded images, which, unlike the vessels mentioned above, have two handles (in the form of figures of a wild boar and wolves) and a lid (Treister 2007a: 47—48; Zasetskaya 2019: Pl. XXIII—XXIV). One of two such vessels, the wall of which has been analyzed (AG-12), originates from burial no. 1 of burial mound no. 4/1998 of the Verbovskiy-II necropolis in the Volga-Don interfluve, dating no later than the first half of the 1st century CE (in this case, the goblet itself may be earlier). This is a fragmented vessel with a pear-shaped body and an edge, slightly bent outwards, with a horizontal band of gilding under the rim. The body is decorated with three engraved friezes gilded within the contour of the images (Mamontov 2000: 168—169, Fig. 29; 2004: 205—207, Fig. 1; 2008: 172, Fig. 4; Mordvintseva, Khabarova: 89, no. 52; Sergatskov 2006: 45, Fig. 6: *2*; Treister 2007a: 47—48; Mordvintseva, Treister 2007: vol. 2, 17, no. A31.2, Pl. 19; Figs. 7—9; Zasetskaya 2011: 190, Ill. 96б; 2019: 156, no. 58, Pl. XXIII; Skripkin 2013: 119 (Ill.), no. 277). In the upper part there are two scenes of a horseman's hunt with a spear for a wild boar.

The middle frieze represents a row of floral pattern composed of flowers and leaves. In the lower part there are three scenes of torment, one of which is almost completely preserved, and the other two are fragmented. The most fully preserved fragment shows a deer in profile to the left, which is attacked from the front and from behind by one griffin (the figure of one of them, attacking the deer from behind, is completely preserved — this is an eagle-headed griffin). The other two scenes show: 1) a feline predator (?) (from which the back of the body with a tail is preserved), attacking a horse (the head and one of the front legs with a hoof are preserved) and 2) a deer, which is attacked in front by an eagle-headed griffin (the front part of the body with the head is preserved) and the feline predator is at the back (only the head is preserved) (Figs. 9—11).

Separately preserved are two handles of the vessel in the form of smooth figures of wolves, cast in various molds, partially overlapping with their attachments in form of plates with rounded corners the figural frieze of the body. The attachments have holes in the corners for attaching the handles to the body with rivets. Holes are made in the croup of animals for insertion of the tail from organic material (Fig. 12).

On the hemispherical lid of the vessel, in the same technique as on the vessel, there is represented in the center a five-petal rosette composed of stepped elements, around which there are four figures of sea dragons with protomes of goats (?) and wolves (Fig. 13).

Animal-shaped handles adorn numerous bronze cauldrons from Sarmatian burials, and in the Northern Pontic region in the first centuries CE ceramic vessels with animal-shaped handles were common, including rare finds with polished surface (see in detail: Treister 2007a: 48; Zasetskaya 2011: 174—175; 2019: 40—41). The tradition of manufacture of vessels from precious metals with zoomorphic handles also goes back to the previous periods of the Sarmatian culture[5]. Taking into account the peculiarities of the distribution of round-bottomed goblets made of precious metals with the handles shaped as animal figures, the peculiarities of their shape and decoration, there is every reason to assume that they were made by various craftsmen in the Northern Pontic region, including the Bosporus. At least one of these goblets, given the inscription with the name of the craftsman on it, could have been made by a Bosporan metalworker with Thracian roots for a Sarmatian customer (Tokhtas'yev 2015: 894; Dana et al. 2016: 62—63; Belousov 2016: 249, no. 4.4; Treister 2021: 365—367).

1.3. Details of armor and horse equipment

In the burial of a warrior-rider of the KVCH-37 kurgan group near the village of Yashkul in Kalmykia, a horse-harness set was found, including two phalerae and a neck guard of the helmet, re-used as a bib plaque. The metal of one of the phalerae (AG-9) and the neck guard (AG-8) was analyzed. The date of the burial is under discussion (Skripkin 2000: 22; Mordvintseva 2005: 186; Glebov et al. 2014: 79; Zasetskaya 2016: 96; cf. Otchir-Goriaeva 2002: 386; 2019: 37—38), however, regardless of whether it should be dated back to the late 1st century BCE or already to the 1st century CE, it is obvious that the considered elements of the horse bridle set date from no later than the middle or the second half of the 1st century BCE.

[5] See, for instance, the vessels from Filippovka kurgan necropolis in the South Urals: Korolkova 2001: 174—177.

1.1.6. *Phalerae from Yashkul*

The phalerae consisted of a bronze basement plate (lost), overlaid with a gilded silver plate. In the center of the composition of the phalera under discussion there is figure of a goat curled up in a ring in a low relief (on the second phalera there is a feline predator). The flat field in and around the figure is covered with rows of punched circles. A round medallion with a figure is outlined with a relief ridge covered with long arcuate (inner side) and oblique (outer side) notches. A row of short arcuate notches passes between them along the top of the ridge. This composition turns into a wide flat field, the edge of which is decorated by two incised lines. Behind them, along the very edge of the phalera, there goes a row of punched semicircles. On a flat field there are three pairs of rivets: two — opposite each other, one — at right angles to their axis. The rivets probably attached the plaque to the basement (Figs. 14: *1*; 15) (Otchir-Goriaeva 2002: 360—362, Figs. 7; 9: *5—6*; 379—382; Lapa, Ochir-Goryaeva 2002: 202, no. 4; Zasetskaya 2016: 90—105, Fig. 1, Pl. 1: *д—е*; 2019: 15—16, 23—31, 41, 47, 77, 78, 85, Ill. 8; 159—160, no. 69, Pl. XXVIIa; Ochir-Goryaeva 2019: 12—15, 32—37, Figs. 10—11 (here the phalera with the image of the goat is reproduced erroneously two times)).

It has already been noted that the phalerae from Yashkul occupy an intermediate place between the two groups of phalerae: those of presumably Bactrian or Parthian workmaship, dating back to the 2nd century BCE (group 1, according to the classification by I.P. Zasetskaya) and later phalerae, which became widespread in the North Pontic region from the lated 2nd — early 1st century BCE — the phalerae of the so-called “Pontic graphic style” (according to the classification by V.I. Mordvintseva) or group 2 (according to Zasetskaya). With the first group the phalerae from Yashkul are united by the composition and construction (the presence of three loops), with the second group — by the size and filling of the background with a punched ornament (Mordvintseva 2005: 186—187; Zasetskaya 2016: 95—96; 2019: 29—30). At the same time, it should be noted that the filling of the background of the phalerae from Yashkul differs from the decoration in the form of punched dots or their rows, which are characteristic of the phalerae of group 2 and has no parallels on the other phalerae. I.P. Zasetskaya does not give an answer to the question about a possible center of the manufacture of phalerae from Yashkul (Zasetskaya 2016: 96; 2019: 31), nevertheless, it is obvious that probably the Sarmatian craftsman tried to reproduce the composition of the phalerae of Parthian (?) origin that he had before his eyes, while including in it the image of the nomadic animal style. Most likely, we can suggest their manufacture in the Lower Volga region or in the Kuban region, most likely no later than the first half of the 1st century BC. In particular, the circle-shaped framing decoration of the phalerae resembles the decoration of the edge of the phalerae (here in the form of bulges) with scenes of the tormenting of a goat from a secondary burial, discovered in 1899 in a burial mound near Cossack village Vozdvizhenskaya in the Kuban region (Mordvinceva 2001: 81, no. 85, Pl. 47; 2002: 157—161; Firsov 2010: 341, Fig. 25; 342). At the same time, the possibility of manufacture of the phalerae in the Balkans or in the North-Western Pontic region cannot be ruled out, taking into account, among other things, the attribution of the bib plaque of this horse-harness set (see below).

1.1.7. *Neck guard of the helmet of the East-Celtic type*

The breastplate of the horse set from Yashkul is a silver arc-shaped plate with a bronze rim along the edge (AG-8), decorated with four large hammered M-shaped figures; a row of rivets runs along the outer and inner edges, the heads of the rivets are decorated with cross-shaped cuts on the front side, and the resulting sections — with parallel short cuts. The rivets along the edges are fixed in

checkerboard pattern (Figs. 14: *3*; 16) (Otchir-Goryaeva 2002: 362—363, Figs. 8; 9: *4*; 370—372; Lapa, Ochir-Goryaeva 2002: 202, no. 5; 204, Fig. 5; 205; Mihaljević, Dizdar 2007: 125—126; Raev, Simonenko 2009: 75—77, Fig. 8: *1*; Simonenko 2014: 264, Fig. 11: *5*; 265; 2015: 194, 195, Fig. 63: *5*; Glebov et al. 2014: 79, 80, Fig. 1, *3*; 81; Ochir-Goryaeva 2019: 15—16, 25—27, Figs. 1: *9*; 12).

This plate, showing traces of repair, originally represented the neck guard of a helmet of the of the late group of East-Celtic (or Novo Mesto) type, the main finds of which originate from the territory of Slovenia (Schaaf 1988: 304—307; Mihaljević, Dizdar 2007: 123—128, Map 2). The production of helmets of the late group confidently correlates with the territory in the valleys of the Sava, Drava and Mura rivers, inhabited by the Celtic *Taurisci* tribes (Guštin 2008: 118—121; 2011: 126—127). It is difficult to say as a result of what events this helmet (or the neck guard of the helmet) found its way to the Sarmatians. It is assumed that, based on the chronology of the late group of East Celtic type helmets found in burials of the La-Tène D2 period, this did not happen earlier than the middle of the 1st century BCE (Glebov et al. 2014: 82: basing on the dating cited by Istenič 2010: 140—142), at the same time, Glebov and co-authors do not take into account the following. At present, the end of the La-Tène D1 period is dated, in any case, no later than 50/40 BCE (Haffner 1974: 69; Karwowski 2004: 64—65; Rieckhoff 2008: 5—7; 2018: 173—198; Stöckli 2018: 209; all with bibliography) or, especially most recently, even to 85—80 BCE (Rieckhoff 2008: 7—10, Fig. 7; 2018: 187—190, Figs. 4—5; Metzler, Gaeng 2009: 456—458, Figs. 402—403; Stöckli 2018: 209—233) (an intermediate solution — ca. 60 BCE — was also proposed: Brandt 2001: 66—67). Thus, we cannot exclude the dating of the helmet, to which the the neck guard from Yashkul belongs also to the second quarter of the 1st century BCE.

1.1.8. *The breastplate of horse harness from Titchikha*

There is reason to suggest a North Pontic origin for the bowl-phalerae or the horse-harness breastplate of hemispherical shape on a low foot-ring base with a tamga-sign in low relief within it from Titchikha on the Upper Don (Shokov 1960: 149—156, Figs. 2—4; Skalon 1961: 130, Fig. 11; Mordvinceva 2001: 81, no. 82, Pl. 44; Treister 2007a: 53; Mordvinceva, Treister 2007, vol. 2, 163, № C/1.19.5.1, Fig. 17, Pl. 74; Raev, Simonenko 2009: 65—69, 77—78, Figs. 1—3; Voronyatov 2009: 81, 82, 85, Fig. 3: *2*; 92, no. 2). Three pairs of square attachments with concave sides for the lost loops are riveted to the edge of the bowl. Researchers who recently studied the bowl concluded that “the tamga was carved in a mold and the foot-ring was cast together with it” (Fig. 17) (Raev, Simonenko 2009: 67). This circumstance suggests that the bowl was made to order (Solomonik 1959: 128) and was originally intended for performing ritual actions (Voronyatov 2009: 91, 92). The tamga-shaped sign of Pharzoius's scheme finds parallels both in the Olbia region and in the Bosporan Kingdom, and allows the bowl to be dated within the second half of the 1st century CE.

1.4. The belt set from Pervomayskiy

In a male burial no. 3 of burial mound no. 14/1984 of the Pervomaisky-VII necropolis in the Lower Volga region details of a belt set were found *in situ* on the pelvic bones of a buried person. As noted by the author of the excavations, the belt was fastened with a rounded silver buckle with two broken-off protrusions in the upper part. When working with the collection in 2015, we were able to see only one broken peg with a bent end. On either side of the silver buckle, large teardrop-shaped plaques with cloisonne decoration were found. One of the plaques (buckle), which is placed on the right on the reconstructions, has an oval-shaped hole for threading the belt and the pin with which the belt was fixed. The other smoothly curved plaque has no hole and no pin, but there is a

loop on the reverse side, which served to fix it to the belt. Silver brackets were also attached to the leather belt, alternating with spherical bronze and silver small rounded plaques. Three smaller teardrop-shaped plaques were attached to a belt on the sides of the large plaques: two on the right and one on the left side. A narrow tip was attached to a leather band hanging from the belt on the left (Fig. 18) (Mamontov 1995: 173, 175, Fig. 3: *2—9*; 2000: 18—19, Fig. 16: *2—9*; Simonenko, Lobay 1991: 50—52, Fig. 27: *3, 6*; Treister 2002: 48, App. I, 12; 2004, 194, Fig. 3: *12—14*; 213—214, no. 26; 2007b: 290, 293; Mordvintseva, Treister 2007: vol. 2, 70, no. A224.1; Brosseder 2011: 424, List 9, no. 5).

The partition strip of one of the large plaques (AG-14) was analyzed. These are drop-shaped plaques which have a bronze plate base. The front side is decorated in cloisonné technique, the bridges between the smalt inlays are made of a bronze strip of rectangular cross-section, which was soldered onto the base plate. The center of the composition is a drop-shaped cloison with a pale blue inlay. This inlay is surrounded by five ornamental bands of two types. The first, third and fourth rows from the center represent the "running wave". The rings are filled with white smalt, and the triangles formed by the bridges are filled with pale green (outer row) and light brown (inner row) inlays of smalt. The second and outer (fifth) friezes are decorated with bands composed of semi-circles, with the curved side towards the center of the plaque. The semicircles are filled with inlays of pale green and green smalt, and the triangles formed by them are filled with brown smalt (Figs. 19—20).

Given its construction the buckle with a slot for a belt and a pin on the frame fits into the type of belt buckles that have become widespread in Asian Sarmatia since the 3rd —2nd centuries BCE. The teardrop shape of the plaque, however, is absolutely unique. Typically, the belt plaques in question were either in the form of a ring or figure eight, or had a rectangular shape. Somewhat less common are belt plates that are relatively close to the considered ones, "plates with a rounded edge", according to the classification by M.A. Devlet (Devlet 1980: 12—13, Figs. 5; 26—28, Pl. 20—22). Their front edge is also convex, the long sides, however, do not converge at an angle, forming a teardrop-shaped figure, and the back edge of the plaques is straight. The most famous belt set with plaques of this shape, but made not of bronze, but of bone, was found in a warrior's burial in burial mound no. 2 of the Orlat necropolis in Uzbekistan (Pugachenkova 1987: 56—65; 1989a: 148—152, Figs. 70—72; 1989b: 104—108; Bernard, Abdullayev 1997: 75—78, Fig. 2; Ilyasov, Rusanov 1998: 107—159; Nikonorov, Khudyakov 1999: 141—154; Maslov 1999: 219—236; Gorbunova 2001: 138—139, Fig. 6: *а—б*; Ilyasov 2003: 267—269, 271—304, Pl. VII: *1—2*; Abdullaev 2007: 79; 88, Fig. 8; 89; 92; Francfort 2011: 309, 312, 313, Fig. 33; Grenet 2012: 11, Fig. 11 (left); 14; Gruber et al. 2012: 261—262, Fig. 21; Podushkin 2012: 37—42, Figs. 3; 5: *1—2*; 47—48; Il'yasov et al. 2013: 186—188; Olbrycht 2015: 338—340, Fig. 4; Goryachev et al. 2016: 636, Fig. 4: *1*; 638, 640—645). Their prototypes (in form) are known among the so-called Ordos bronzes originating from the Xiongnu monuments in Northern China, from Transbaikalia and the Middle Yenisei region (Devlet 1980: 12—13, Fig. 5; Bunker 1997: 79, Fig. A112; 82, A121; 304, Fig. W17; Boardman 2010: 73, no. 332, 334, 337, Pl. 44—45)[6]. The closest in shape prototypes (?) are carved horn plaques, covered with gold foil and related to a horse's garment, dating from the late 4th — early 3rd century BCE burial mound no. 36 of the Berel necropolis in Eastern Kazakhstan (Samashev, Borodovskiy 2004: 85, Fig. 5; 86; Borodovskiy 2007: 89, Fig. 67: *1*; 104, Fig. 89: *3*; Cat. New York 2012: 169, no. 20; 170, no. 29; Shul'ga 2015b: 91—92, 112, 131—133, Fig. 47: *2. 10*).

As well as the shape, the decoration of the plaques from Pervomayskiy and the technique of ornamentation — a cloisonné with sockets formed by bronze bridges, is unique for the belt plates of

[6] See also comparable in shape belt plaques from private collections: Bunker 1997: 271—272, Fig. 238.2; Boardman 2010: 73—74, no. 333, 335, 336, Pl. 44—45.

the type under consideration. The only close parallel, both in material and in decoration, is represented by the decoration plate of a casket (?) from burial mound no. 1 near Zubov Farmstead in Trans-Kuban region (Gushchina, Zasetskaya 1989: 117, no. 130; Treister 2004: 205, Fig. 7; 214, no. 28; 2007b: 291; Mordvintseva, Treister 2007: vol. 2, 119, no. B13.4, Pl. 51), on which the rows of "running waves" and rhombuses are shown, although the color scheme (red-blue) differs from the decoration of the details of the belt set from Pervomayskiy.

Taking into account our observations about the tips of the belts, decorated with cloisonné technique from the Sarmatian burials of the North Pontic region (Treister 2004: 202—205), including the tip from the Porogi with the tamga of King Pharzoius, made of wire soldered on the back (Treister 2004: 194, Fig. 3: *18—20*; 213, no. 21), there is every reason to assume the possibility of making a belt set from Pervomayskiy in one of the workshops in the North Pontic region, especially since for the time under consideration we have no evidence, either archaeological or pictorial, of the use of belt plaques of this shape, with such a decoration and made using the cloisonné technique in Parthia.

1.5. Details of ceremonial furniture

The linings of turned wooden objects found in the Khokhlach burial mound on the outskirts of Novocherkassk (Figs. 21—22), dating no earlier than the last quarter of the 1st — the turn of the 1st — 2nd centuries CE (Zasetskaya 2011, 254; Treister 2018, 153; 2021: 403) were identified as the linings of the legs of the wooden throne by K.M. Skalon and subsequently published with the same attribution in exhibition catalogues (Cat. Daoulas 1995, 56, no. 75; Zasetskaya 2008, 37, Fig. 9) and in the book by I.P. Zasetskaya (Zasetskaya 2011: 235—236, Ills. 127, 269, no. 31). There is every reason to suppose, given the constructive closeness to the finds from Filippovka, that these details are of Near-Eastern origin, given the fact that the known details of ceremonial furniture of the Parthian period, as well as images of thrones on the Parthian (see, for example, Winkelmann 2006: 134—137, Figs. 1—9) and even the Sassanian coins (Pfeiler 1977: 107—111) are quite comparable to the Achaemenid prototypes. In addition, it is quite obvious that the details from Khokhlach belonged specifically to a stationary piece of furniture of a status character. It was not a folding chair (stool), the finds of which were quite widespread, both in the Roman provinces and beyond, in the 2nd—3rd centuries CE, which are associated with the spread of the Roman washing culture (Miks 2009: 429—446; Mráv 2013: 105—144), the details of which by the way, were never made of silver, but were of bronze and iron. Given the size of the linings from Khokhlach, it is hardly possible to consider them as details of the throne, which assumed greater monumentality and larger dimensions. It is also unlikely for the same reasons that they are identified as parts of *kline*. Rather, they referred to a small piece of furniture — a chair or stool (see in detail: Treister 2018: 139—140, Fig. 22).

1.6. The finds from a burial mound on the southern outskirts of Lipetsk

From the burial of the second half of the 1st — early 2nd century CE in a burial mound excavated in 2005 on the southern outskirts of Lipetsk (Medvedev, Safonov 2007: 255—259; Medvedev et al. 2008a: 116—125; 2008b: 97—107) originate fragments of a flat plate (AG-6) and foil (AG-7). The fragmentary condition of the finds does not allow to make any suggestions regarding their attribution. Concerning the fragments of the plate (Fig. 23), the authors of the publication suggested that they belonged to a vessel, possibly a goblet (Medvedev et al. 2008a: 120, no. 12; 2008b: 101), but the fact that all the surviving fragments are flat, casts doubt on this assumption.

2. Pb isotopic composition of items

2.1. High-precision lead isotopic analysis using MC-ICP-mass-spectrometry method

The study of lead isotope compositions in the selected artefacts have been carried out in the Laboratory of isotopic geochemistry and geochronology of the Institute of Geology of Ore Deposits, Petrography, Mineralogy, and Geochemistry RAS, Moscow. For the Pb isotope analysis, one thoroughly selected piece of metal weighing 0.003—0.01 g was used. Before sampling, the surface of each item was cleared from the surface dirt and oxide films with 3 % solution of HNO_3 and distilled water. This procedure eliminated contamination of the sample with lead present in the films. Chemical decomposition of samples was carried out in a mixture of concentrated acids ($HCl+HNO_3$, 1 : 3), in which they were kept at atmospheric pressure and temperature 90 °C until complete dissolution. The chromatographic separation of Pb from silver and the associated matrix elements was performed in HBr medium on Teflon micro-columns filled with Bio-Rad AG-1X8 anion-exchange resin (0.1 cm^3). Procedural blanks were lower than 0.1 ng of Pb (Chugaev et al. 2013: 20—33).

Measurements of Pb isotopic ratios were performed on a NEPTUNE multicollector mass spectrometer (ThermoFinnigan, Germany). The obtained lead fractions were dissolved in 3% HNO_3 to concentrations of 200—400 ng/ml, which provided intensity of ionic currents at mass 208 - 3 - 6 × 10-^{11}A.

Just before the measurements, the sample solutions were doped by Tl-spike. Mass-bias correction for the measured Pb isotope ratios was performed using the reference ratio $^{205}Tl/^{203}Tl$ = 2.3889 ± 1 (Chernyshev et al. 2007: 1160—1167), employing an exponential law. The total error (±2SD) of the $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$, and $^{208}Pb/^{204}Pb$ isotope ratios estimated from the long-term reproducibility of the results of parallel analyses of standard sample SRM 981 (n=160, 2012-2016), and international rock standards AGV-1 and BCR-1 (n=15, 2012-2016), did not exceed 0.03%. These data are obtained during the same period in which the samples were measured.

2.2. Results of lead isotopic study

Pb-Pb data were obtained for 17 silver items. The results of the measurements are presented in Table 1 and Fig. 24. In total, the studied collection is significantly heterogeneous in terms of Pb isotopic composition. The measured $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios vary within wide ranges: from 18.07 to 19.41, from 15.60 to 15.75, and from 38.3 to 40.4, respectively. The coefficient of variation (ν, %) calculated for each isotopic ratio allows to estimate the scale of revealed heterogeneity of Pb isotopic composition. The estimates performed show that the values of ν for all three isotopic ratios ($\nu_{206/204}$ = 1.4%, $\nu_{207/204}$ = 0.2% and $\nu_{208/204}$ = 1.2%) are significant and exceed the analytical error (±0.03%).

It should be noted that epithermal gold-silver and silver-polymetallic deposits were the main geological-genetic type of ore deposits mined for silver in the early historical periods. These are, for example, the deposits of such famous ancient regions of silver mining as Rio Tinto (Spain), Rosia Montana (Romania), Sardinia (Italy) and a number of others (Maksimov 1981: 16—17; Durali-Mueller et al. 2007: 1559—1566; Baron et al. 2006: 241—244, 2011: 1090—1100). These deposits are characterised by high lead concentrations of up to 8 wt%, which are mainly present in the form of sulphide (galena) and is often the host of silver-bearing mineral phases. In ancient times, cupellation was widely used in the processing of ores from such deposits (Kassianidou 2003: 198—202; Craddock 2014: 1085). The use of metallic lead in one of the stages of pure silver production

was a part of this process (Kassianidou 2003: 202). The metallic lead is extracted in the initial stages of processing the same silver-bearing ores (Kassianidou 2003: 204). Thus, the cupellation did not change the Pb-Pb isotopic characteristics of the silver slags (Stos-Gale, Gale 2009: 198—200).

Deposits of these types are generally characterised by a high degree of homogeneity of Pb isotopic composition. For example, for silver ores of Kuramin zone (Uzbekistan), Baia Mare (Romania) and Banská Štiavnica (Slovakia) the values of variation coefficient for $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios respectively are: 1) $\nu_{206/204} = 0.15\%$, $\nu_{207/204} = 0.05\%$ and $\nu_{208/204} = 0.07\%$ (unpublished data), 2) $\nu_{206/204} = 0.20\%$, $\nu_{207/204} = 0.08\%$ and $\nu_{208/204} = 0.1\%$ (Baron et al. 2011: 1097—1098) -, and 3) $\nu_{206/204} = 0.16\%$, $\nu_{207/204} = 0.01\%$ and $\nu_{208/204} = 0.04\%$ (Chernyshev et al. 2007: 1163—1164) -. The above values of the parameter ν for the ore regions are almost an order of magnitude smaller compared to the scale of variation obtained for the archaeological items (Table 1). The high degree of heterogeneity of the Pb isotopic composition in archaeological items, especially in terms of the ratio $^{207}Pb/^{204}Pb$, which varies insignificantly in the deposits ($\nu < 0.1\%$), indicates that the metal of the studied items originated from different ore regions.

In the Pb-Pb isotope diagrams, the points of lead isotope composition of archaeological items demonstrate a large scatter. Among them we can identify a group of 12 points, which in the diagrams form a compact field. Within this field two groups of points, differing in the value of the $^{206}Pb/^{204}Pb$ ratio, are clearly distinguished. Items in these two groups have a homogeneous Pb isotopic composition. The first group (A) comprises items numbered as AG-3, AG-7, AG-12, AG-13, AG-16, AG-17. For them the average values of Pb isotopic ratios are: $^{206}Pb/^{204}Pb$ — 18.648±0.036 ($\nu_{206/204} = 0.20\%$), $^{207}Pb/^{204}Pb$ — 15.678±0.005 ($\nu_{207/204} = 0.03\%$) and $^{208}Pb/^{204}Pb$ — 38.846±0.035 ($\nu_{208/204} = 0.09\%$). The second group (B) includes AG-2, AG-4, AG-8, AG-9, AG-11, AG-14. The average values of lead isotopic ratios are: $^{206}Pb/^{204}Pb$ — 18.769±0.022 ($\nu_{206/204} = 0.12$ %), $^{207}Pb/^{204}Pb$ — 15.681±0.009 ($\nu_{207/204} = 0.06$ %) and $^{208}Pb/^{204}Pb$ — 38.880±0.035 ($\nu_{208/204} = 0.09$ %). The difference between these groups is expressed mainly in the different content of the radiogenic ^{206}Pb. The lead of the second group of items is characterised by a higher content of this isotope. Both groups comprise items of different ages and locations (Fig. 24).

2.3. Discussion

The significant scale of variation in the Pb isotopic composition for the studied items suggests that the metal originated from different ore regions. The geographical location of the artifacts and the typological and stylistic features of them allow us to distinguish several possible regions. These are the ore provinces of the Balkans (Romania, Bulgaria), Asia Minor (Turkey in general) and/or adjoining other territories of the Near and Middle East (regions of the modern of Iran, to a lesser degree — Iraq and Syria). Numerous epithermal gold-silver and silver-polymetallic deposits are present within these regions, some of which were exploited in ancient times (Maksimov 1981: 16—17), including the historical period to which the items we studied belong.

Pb-Pb data for epithermal gold-silver and silver-polymetallic deposits of these regions were taken from (Marcoux et al. 2002: 177—178; Gökçe, Bozkaya 2006: 95—96; Marchev, Moritz 2006: 54—55; Kouzmanov et al. 2009: 626—640; Baron et al. 2011: 1096—1097; Bozkaya 2009: 124—125; Akiska et al. 2013: 392—393; Özen, Arik 2015: 275—276; Gale, Stos-Gale 2016; oxalid.arch.ox.ac.uk: 1). It should be noted that deposits in these regions are studied with varying degrees of detail. Deposits in Turkey, Romania and Bulgaria are characterized in most detail using modern high-precision MC-ICP-MS method to measure Pb isotopic composition in the ores. In contrast, very limited Pb-Pb data are available for deposits in Iran and Syria (Gale et al. 1981: 1290—1302; Ehya et al. 2010: 191—192; Mirnejad et al. 2011: 184—185). High-precision and

reliable Pb-Pb data are not available for Iraqi deposits. These objective differences between regions in the availability of Pb-Pb data for ore deposits provide constraints on the conclusions about the sources of the metal.

Ore provinces of northern Asia Minor and the eastern Balkans (Black Sea zone)

Fields of Pb isotopic composition of silver-bearing deposits of ore provinces of western and southern parts of Black Sea area, which territorially include deposits of Western Anatolia (Western Turkey), Eastern Pontides (North-Western Turkey) and Eastern Balkans (Bulgaria, Romania), are shown on the diagram in coordinates $^{207}Pb/^{204}Pb$ — $^{206}Pb/^{204}Pb$ (Fig. 25). The same plot shows the points corresponding to the lead isotopic composition of the studied artefacts. The fields of ore regions are relatively compact and located in the central part of the diagram. Some of them, such as the fields of the Rhodope Mountains (territory of ancient Thrace), Inner Eastern Carpathians (territory of ancient Dacia) and Western Anatolia partially overlap with each other (Fig. 25).

Comparison of the Pb isotopic composition of artifacts with Pb-Pb data of ore deposits in this region, suggests that most (12) items in terms of $^{206}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$ ratios are close to ore deposits of Eastern Balkans (territory of modern Romania and Bulgaria), as well as northern (Eastern Pontides) and north-western (Western Anatolia) Turkey. The other five points, which represent artifacts AG-1, AG-5, AG-6, AG-10 and AG-15, are outside the field of ore districts. This suggests that the deposits of this region could not be a source of the metal for these items.

Let us consider in more detail the position of a group comprising 12 items. Despite the similarity in the Pb isotopic composition, their distinctive feature, as noted above, is the difference in the content of the radiogenic isotope ^{206}Pb. Group A are lower values of the $^{206}Pb/^{204}Pb$ ratio and, accordingly, points fit on the left-hand side of the plot closer to the axis of ordinates than group B. In addition, the points of group A tend to the field (Fig. 25, field 1), which correspond to polymetallic deposits of Eastern Pontides, localized in volcanogenic-sedimentary rocks of Cretaceous age. In turn, most points of the group B, fit into the area of overlapping of several fields, corresponding to the Pb isotopic compositions of deposits from three large ore districts of the considered region: the Rhodope Mountains, Baia-Mare (North—Western Romania) and Western Anatolia (Fig. 25, fields 7, 5 and 2, respectively).

Figure 26 compares $^{206}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios of groups A and B with those in the deposits of the previously considered provinces. It is well visible that the group A is also closest to the deposits of East Pontides by values of $^{206}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios (Fig. 26, field 1). The observed coincidence of Group A items by all three Pb isotopic ratios with deposits of Eastern Pontides gives reasons to consider this region as a potential source of silver. Within Eastern Pontides there are well known silver-bearing deposits, for example, polymetallic deposit Koyulhisar-Muradin-Aksu and copper-zinc deposit Harshit-Kepryubashi, which exploitation was completed in the 20th century. The Eastern Pontides is also one of the oldest silver mining areas. Early historical evidence indicates that silver mining in this area was caused by the development of the Pontic kingdom. This kingdom used silver from different regions for coin minting (Hojte 2009: 10—12; de Callatay 2009: 63—94), including the metal mined from the deposits of the Pontic mountains (Smekalova 2009: 239—240).

Position features of group B on the diagram allows us to completely exclude the deposits of West Anatolia (Fig. 26, field 2) from the number of possible regions of silver. Lead of these deposits has higher content of ^{208}Pb isotope compared to the items of group B. Most points of the group fit into the Pb isotopic composition fields of epithermal deposits of eastern Rhodope Mountains (Fig. 26, field 3) and deposits of the same genetic type of Baia Mare ore district (Fig. 26,

field 4), located within the Inner Eastern Carpathians. Archaeological and historical evidence suggests that silver-bearing ores were mined in these regions from ancient times: from the 6th to 5th century BCE in the Rhodope Mountains and from the 2nd century BCE in the Apuseni Mountains (Romania) (Kuleff et al. 2006: 245—254; Baron et al. 2011: 1093—1094). Both regions are therefore equally likely to be the source of silver for the items. In the case of items numbered AG-4 (silver phalera / breast plate of horse-harness, Titchikha) and AG-9 (silver-gilt phalerae, Yashkul), the origin of the metal can be identified more reliably. The silver phalera from Titchikha was made from metal originates from deposits of Baia-Mare region, whereas the source of metal for the silver-gilt phalera from Yashkul (AG-9) was the deposit of Eastern Rhodope mountains (Fig. 26).

Ore provinces of southern Asia Minor and the Middle East

Comparison of Pb isotopic composition of studied items and deposits in Asia Minor and Middle East is given in the diagram in coordinates $^{207}Pb/^{204}Pb$ — $^{206}Pb/^{204}Pb$ (Fig. 27). Pb-Pb data are shown for silver-bearing polymetallic deposits located within the Taurus Mountains (South-Eastern Turkey), Zagros Mountains of Western Iran, Kurdistan and Western Azerbaijan, Syria, as well as Palestine (Gale et al. 1981: 1290—1302; Ceyhan 2003: 55—62; Koptagel et al. 2007: 57—58; Hanilci, Öztürk 2009: 1478—1479; Ehya et al. 2010: 186—189; Mirnejad et al. 2011: 181—183; Yahalom-Mack et al. 2015: 1—2). In the diagram, the fields of the deposits in the Taurus (Figure 27, field 1) and Zagros (Figure 27, field 2) mountains are maximum and reflect significant variations of the $^{206}Pb/^{204}Pb$ and $^{207}Pb/^{204}Pb$ ratios in them.

Pb isotope composition of deposits in these provinces differ primarily in the content of isotope ^{207}Pb. Their corresponding fields (1 and 2) are separated and do not overlap with each other (Fig. 27). The Pb isotope composition field of polymetallic deposits in southern Turkey is the largest, which is located higher on the axis of ordinates in the diagram. In contrast, the field of Pb isotopic composition of Syrian deposits (Fig. 27, field 3) is the most compact and lies at the bottom of the diagram. In turn, deposits of Zagros Mountains are characterized by intermediate values of $^{207}Pb/^{204}Pb$ ratio.

Most of the Pb isotopic composition points of the items are located outside the fields of the considered ore provinces of southern Asia Minor and the Middle East. In general, the items of groups A and B are close in Pb isotopic composition to polymetallic deposits of Southern Turkey and Western Iran. However, they differ significantly from the deposits of both provinces in the isotope content of ^{207}Pb and ^{208}Pb isotopes and are characterized by intermediate values of the $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios. Two items from Group B are an exception. These are a silver round-bottomed goblet (AG-11) from Peregruznoe and a silver belt set (AG-14) from Pervomayskiy-VII necropolis. For these items, the Pb isotopic composition of all three radiogenic isotopes is identical to that of lead from deposits in the Niğde ore district located in the Central Taurian Mountains (South-Eastern Turkey). This coincidence is evidence in support of the fact that the metal has an origin from the ancient mining and metalworking centers of Asia Minor. Correspondingly, this allows us to exclude these objects from Group B, whose metal, as shown above, was produced from the ore deposits of the Balkan region. The origin of the silver of the spoon from the Late Sarmatian burial at Mukhranovo (AG-15) is also associated with the ancient centers of Asia Minor or the Near East. Its Pb isotopic composition is close to the lead of polymetallic deposits located in the Zamantı area of the Central Taurian Mountains. Deposits in this area have been mined since the Late Eneolithic period (Yener et al. 1991: 545—546), (Yahalom-Mack et al. 2015: 1—2) (Fig. 27, black dot). In addition to the territory of Asia Minor, other potential regions of silver sources are identified. First of all, these are the deposits of multi-metal

(Cu, Au, Pb, Zn, Ag) province located within the Zagros Mountains. For example, metal of two studied items, silver skyphos 1st century BCE from burial mound near the Shaumyan Farmstead (AG-1) and fragment of a flat plate 1st century CE from burial mound southern outskirts of Lipetsk (AG-6), in terms of the Pb isotopic composition is close to polymetallic deposits of the North-Western area of Zagros Mountains.

We should separately consider the results of the analysis of lead for two items: fragment of silver-gilt cup from the Titchikha (AG-5) and silver basin with foot-stand, presumably made in Italian workshops, from the burial site near the village Zhutovo (AG-10). These items vary in terms of lead isotope composition, both between themselves and from the other studied artifacts. The first of them (AG-5) is characterized by the maximum values of Pb isotopic ratios, while the silver basin (AG-10), on the contrary, has the less "radiogenic" Pb isotopic composition.

According to its Pb isotopic features, the cup metal from Titchikha (AG-5) belongs to the type of "anomalous" lead, i.e., it has high content of radiogenic isotopes ^{206}Pb and ^{207}Pb. In some deposits of the Taurus Mountain region, located within K. Maraş and Elazığ-Keban ore districts, there are ores with the same type of lead (Ceyhan 2003: 55—62): $^{206}Pb/^{204}Pb \sim 19.2$, $^{207}Pb/^{204}Pb \sim 15.71$ and $^{208}Pb/^{204}Pb \sim 39.2$. In addition, "anomalous" lead is typical of silver coins of the 9th—10th centuries CE minted in the Islamic centers of Central Asia (Merkel et al. 2013a: 62—66; Merkel 2021: 231—232). Deposits in Uzbekistan, Afghanistan, and North-Western China are considered as the main silver resource base for these centers (Merkel et al. 2013a: 62—66; 2021: 231—232). The silver-gilt cup metal from Titchikha (AG-5) is similar in values of all three isotopic ratios ($^{206}Pb/^{204}Pb = 19.4$, $^{207}Pb/^{204}Pb = 15.74$ and $^{208}Pb/^{204}Pb = 40.4$) to lead from deposits in Afghanistan (Merkel et al. 2013b: 238). This fact suggests that the metal of the cup from Titchikha (AG-5) could have originated from this region.

On the contrary, Pb isotopic composition of the basin with foot-stand from Zhutovo (AG-10) does not coincide with Pb-Pb data of ore deposits from the Black Sea basin, Asia Minor and the Middle East. Moreover, lead of the basin in terms of $^{206}Pb/^{204}Pb$, $^{207}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ ratios also differs from lead of ore deposits of the Eastern Mediterranean, including Egypt, Cyprus, and Western Asia Minor (Stos-Gale and Gale 1981: 290—291; Yener et al. 1991: 547—578; Özen, Arik 2015: 275—276). Consequently, the metal source for the basin is most likely located outside of the regions discussed above. This conclusion is consistent with the assumption that the basin was made in Italy. This suggests that the metal source could be located on the Apennine peninsula or in adjoining territories. It has been established that the silver-polymetallic deposits of the island of Sardinia are characterized by a similar lead isotopic composition (Gale, Stos-Gale 2016; oxalid.arch.ox.ac.uk: 1).

3. Conclusion

The investigated silver objects from the burials of the nomads of Asian Sarmatia cover a wide chronological range from the 2nd century BCE to the 3rd century CE. The overwhelming majority of the objects examined in this paper are dated within the 1st century BCE — 1st century CE time span. An earlier dating, and even then, hardly earlier than the late 2nd century BC, can only be assumed for the fragmented goblet from Titchikha (AG-5). Probably the most recent of the investigated objects is a silver spoon from Mukhranovo, which can be the product of an Italic or Provincial-Roman workshop of the 2nd—3rd centuries CE (AG-15). The stylistic features of the items indicate that their origin is associated with several production centers.

The silver *skyphoi* (AG-1, 3), a phalerae, or the breast bowl of the horse-harness from Titchikha (AG-4), possibly a *phiale* from Verbovskiy (AG-13) were probably manufactured in the workshops

of the ancient cities of the North Pontic region, most likely in the Bosporan Kingdom. Probably, the unique belt set from Pervomayskiy (AG-14) also belongs to the products of the North Pontic workshops.

A fragmented goblet from Titchikha (AG-5) may be associated with workshops located in Asia Minor or in the Eastern Mediterranean. There are reasons to attribute the basin from Zhutovo (AG-10) to the products of an Italian workshop — at the same time, the sample was taken from its foot-stand, possibly made in the North Pontic region. The products of the Parthian workshop most likely include the linings of the legs of a stool or chair from the Khokhlach burial mound (AG-16—17).

The neck guard of the East Celtic type helmet from Jashkul (AG-8), which was re-used as a breast plate of the horse-harness, is undoubtedly the product of the Celtic (*Taurisci*) workshop, located in the territory of modern Slovenia.

A significant part of the samples belongs to round-bottomed goblets (AG-2, 12—13), which, like the phalerae found in Yashkul (AG-9), should be attributed to the products of Sarmatian craftsmen. It is difficult to say exactly where they could have been made — this could have taken place most probably both in the Lower Volga and in the Kuban region.

The fragmentation of finds from a burial of the 1st century CE in a burial mound on the southern outskirts of Lipetsk does not allow any conclusions to be drawn about the possible centers of the plate and foil (AG-6—7) manufacture.

The results of Pb-Pb studies also show considerable diversity in the origin of silver. Five regions can be identified as potential sources of the metal. They are marked with coloured outlines in Fig. 28. Most of the studied items are close in their Pb-Pb characteristics to silver-bearing epithermal deposits of the Eastern Balkans (orange outline, AG 2, 4, 8—9) and Eastern Pontides (green outline, AG 3, 7, 12—13, 16—17). In the Eastern Balkans, we have defined two provinces (Baia Mare and the Rhodopes) as a source of silver. The deposits located within the provinces have a similar Pb isotope composition, which does not allow more reliable identification of the metal sources for the samples AG 2, 4, 8—9.

The third important source of silver for the items under discussion is southern part of Asia Minor. For four of the 17 items (AG-5, AG-11; AG-14; AG-15), the Pb-Pb isotopic characteristics are similar to those of the silver-bearing deposits of the Taurus Mountains. Deposits in this ore province were exploited since the Chalcolithic period.

The origin of at least two silver vessels (AG-1 and AG-6) may be associated with the territory of the Parthian Empire. Their lead-isotope “markers” are identical to polymetallic deposits of the largest metallogenic province of Zagros Mountains, located in the west of Iran. The find of a silver basin on a foot-stand (AG-10) in Zhutovo serves as a proof of, that Roman silver objects were acquired by the nomads of Asian Sarmatia. In this case, the hypothesis based on typological and stylistic analysis of the vessel is confirmed by the similarity of its lead-isotope "markers" and those of silver deposits of Sardinia.

The objects investigated in this study have a significantly broad chronological range (from the 2nd century BCE to the 3rd century CE), during which time the sources of metal could naturally change. However, a comparison of chronological positions of objects with the regions from which the metal possibly originated, did not reveal any clear regularity in the change of silver sources. For example, the metal for the objects dating to the relatively narrow chronological frame of the 1st century BCE — 1st century CE (AG-1, 4, 6—9, 12—14, 16—17) originate from all the ore provinces, mentioned above. In addition, during this period a repeated income of metal from one and the same region of the south of Asia Minor, Taurus Mountains (AG-5, 11, 14—15) is registered. It should be noted that our earlier Pb-Pb studies of silver objects from the 5th—4th centuries burials of the nomads of South Urals, including the objects of the Achaemenid circle, has

shown that their metal originated mainly from the deposits of Asia Minor and Iran (Chugaev, Chernyshev 2012: 243—245) (Fig. 29). On the contrary, the obtained results for the items from the later burials of the nomads of Asian Sarmatia, presented in this paper, show a greater territorial variety (first of all due to the provinces of Eastern Balkans) of silver sources. This seems to reflect the change in the political and trade contacts of the nomads in this period.

Even if we exclude "distant imports", such as a silver neck guard of an East-Celtic helmet re-used as phalera of horse-harness from Yashkul (AG-9), an Italian basin with foot-stand from Zhutovo (AG-10), a Asian Minor or East Mediterranean silver-gilt cup from Titchikha (AG-5), the stylistic and typological features of the investigated silver objects from the burials of nomads of Asian Sarmatia, dating from the 2nd century BCE to the 3rd century CE and the Pb-Pb data indicate that their metal is of various origin and their sources encompass a vast territory, including the Balkan Peninsula in the west, Asia Minor, the Middle East and Western Iran — in the south.

Table 1. **Results of the study of the Pb isotopic composition in silver artefacts from the burials of nomads of Asian Sarmatia**

No.	Description and origin of objects	Date	Figure	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
AG-1	Silver skyphos. Schaumyan Farmstead. Burial mound no. 13/1996, burial no. 1.	1st century BCE	5: *1*	18.6032	15.6404	38.6628
AG-2	Silver round-bottomed goblet. Novyy Farmstead. Burial mound no. 12/1982, burial no. 3.	second half of the 1st — first half of the 2nd century CE	7	18.7772	15.6792	38.8843
AG-3	Silver skyphos. Novyy Farmstead. Burial mound no. 12/1982, burial no. 3.	second half of the 1st — first half of the 2nd century CE	5: *2—4*	18.6650	15.6749	38.8970
AG-4	Silver phalera / breast plate of horse-harness. Titchikha. Finds by P.D. Leonov, 1939.	1st century CE	17	18.7743	15.6676	38.8162
AG-5	Fragments of silver-gilt cup (?). Titchikha. Finds by P.D. Leonov, 1939.	end of 2nd — 1st century BCE	1	19.4122	15.7504	40.3784
AG-6	Fragments of a plate or a vessel (?). Lipetsk burial mound, 2005.	second half of the 1st — early 2nd century CE	23	18.4285	15.6556	38.5551
AG-7	Fragments of foil. Lipetsk burial mound, 2005.	second half of the 1st — early 2nd century CE		18.6873	15.6834	38.8563
AG-8	Silver breastplate of horse-harness. Yashkul. Burial mound no. 1/1988, burial no. 1.	1st century BCE	14: *3*; 16	18.7929	15.6793	38.8871
AG-9	Silver-gilt phalerae with the image of a he-goat. Yashkul. Burial mound no. 1/1988, burial no. 1.	1st century CE	14: *1*; 15	18.7298	15.6808	38.8699
AG-10	Silver basin with foot-stand. Zhutovo. Burial mound no. № 28/1964.	second half of the 1st century BCE — first half of the 1st century CE	2	18.0716	15.5989	38.2058

Table 1. **Results of the study of the Pb isotopic composition in silver artefacts from the burials of nomads of Asian Sarmatia (continuation)**

No.	Description and origin of objects	Date	Figure	$^{206}Pb/^{204}Pb$	$^{207}Pb/^{204}Pb$	$^{208}Pb/^{204}Pb$
AG-11	Silver round-bottomed goblet. Village Peregruznoe. Burial mound no. 51/2011, burial no. 2.	second half of the 1st — early 2nd century CE	8	18.7599	15.6858	38.9058
AG-12	Silver-gilt round-bottomed goblet. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1.	second half of the 1st century BCE — first half of the 1st century CE	9—13	18.6145	15.6718	38.7933
AG-13	Silver phiale. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1.	second half of the 1st century BCE — first half of the 1st century CE	3—4	18.6879	15.6817	38.8586
AG-14	Silver belt set. Pervomayskiy-VII. Burial mound no. 14/1984, burial no. 3.	1st century CE	18—20	18.7819	15.6957	38.9148
AG-15	Silver spoon. Village Mukhranovo. Burial mound. Chance find, 1996.	2nd — 3rd centuries CE	6	19.0201	15.7373	39.5520
AG-16	Silver lining of the chair leg. Khokhlach burial mound.	1st century CE	21	18.6169	15.6805	38.8438
AG-17	Silver lining of the chair leg. Khokhlach burial mound.	1st century CE	22	18.6140	15.6731	38.8251

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Fig. 1. Fragments of a silver-gilt cup (?). Titchikha. Finds by P.D. Leonov, 1939. Voronezh, Regional Local Lore Museum, inv. no. 143, book 6, no. 15. Photos by M. Treister, 2015.



Fig. 2. Silver basin with a foot-stand. Zhutovo. Burial mound no. № 28/1964. Astrakhan, State United Historical-Architectural Museum-Reserve, inv. no. 12315. Photos by M. Treister, 2015.



Fig. 3. Silver phiale. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1. Volgograd, Regional Local Lore Museum, inv. no. 31513/15. Photos by M. Treister, 2015.

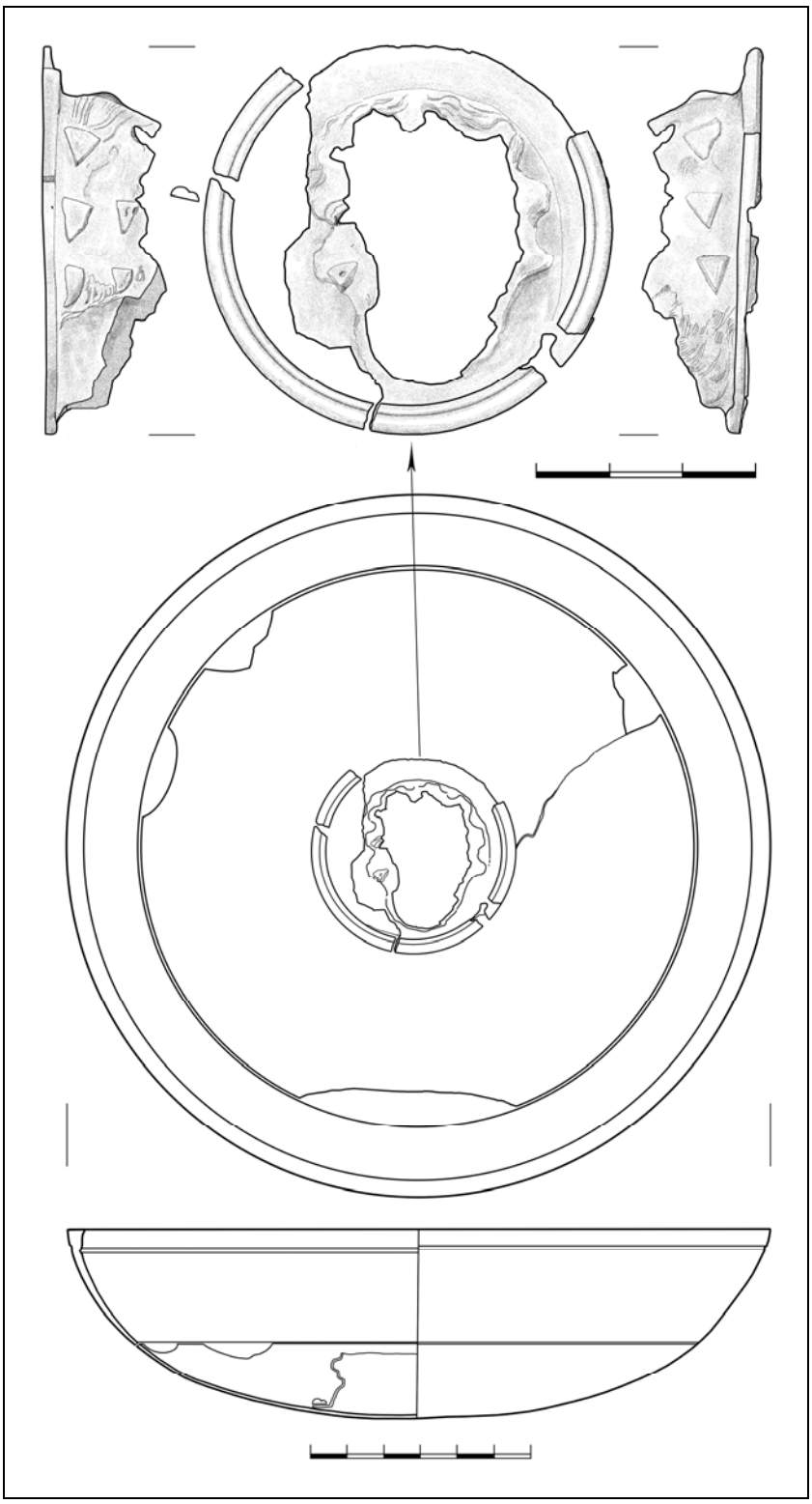

Fig. 4. Silver phiale. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1. Volgograd, Regional Local Lore Museum, inv. no. 31513/15. Drawings by N. Bespalaya, 2015.

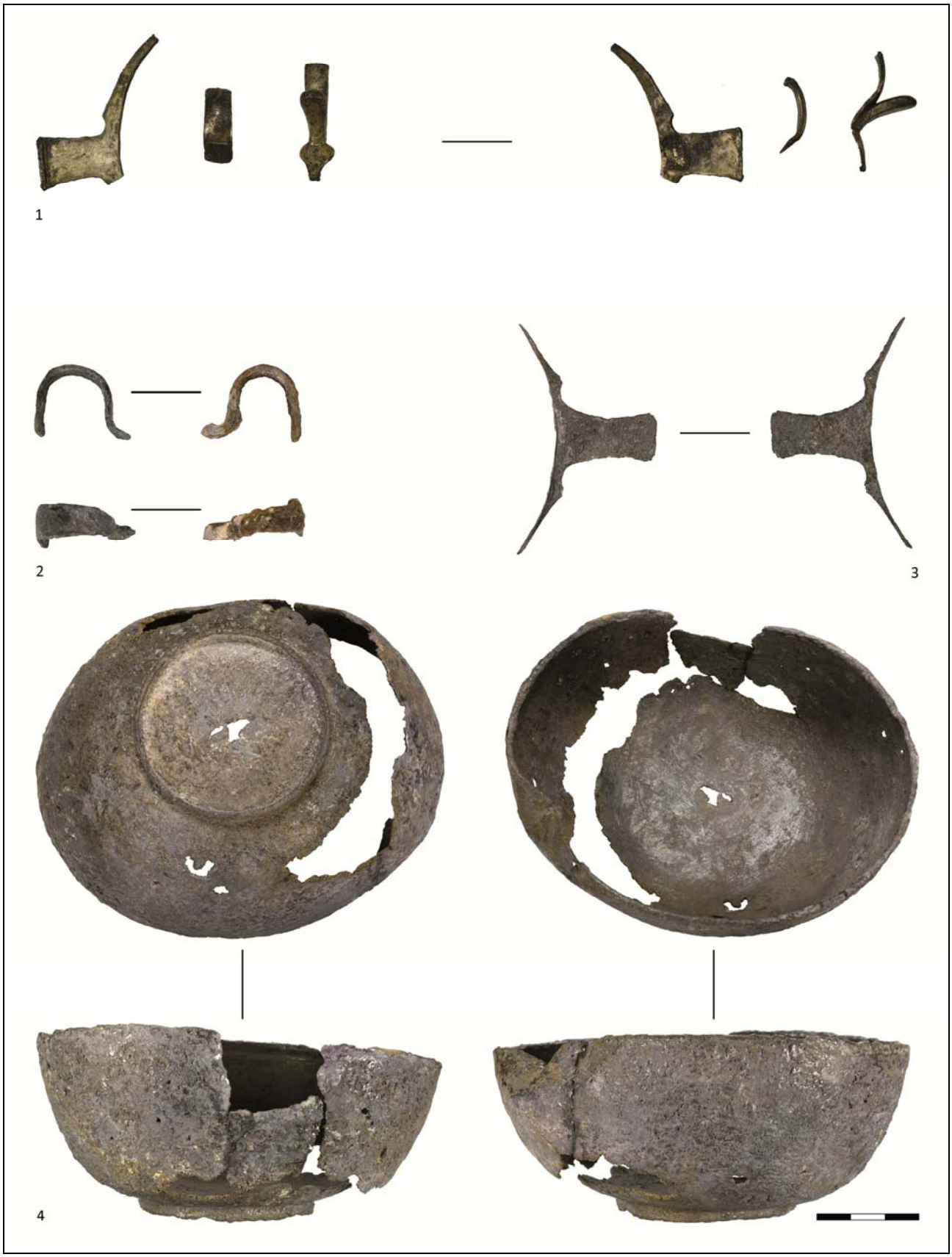

Fig. 5. Silver skyphoi and their fragments. *1* — Schaumyan Farmstead. Burial mound no. 13/1996, burial no. 1. Tanais, Archaeological museum-reserve, inv. no. 333, AO-17; *2—4* — Novyy Farmstead. Burial mound no. 12/1982, burial no. 3. Aksay, Military-Historical Museum, inv. no. 17910/440. Photos by M. Treister, 2015.

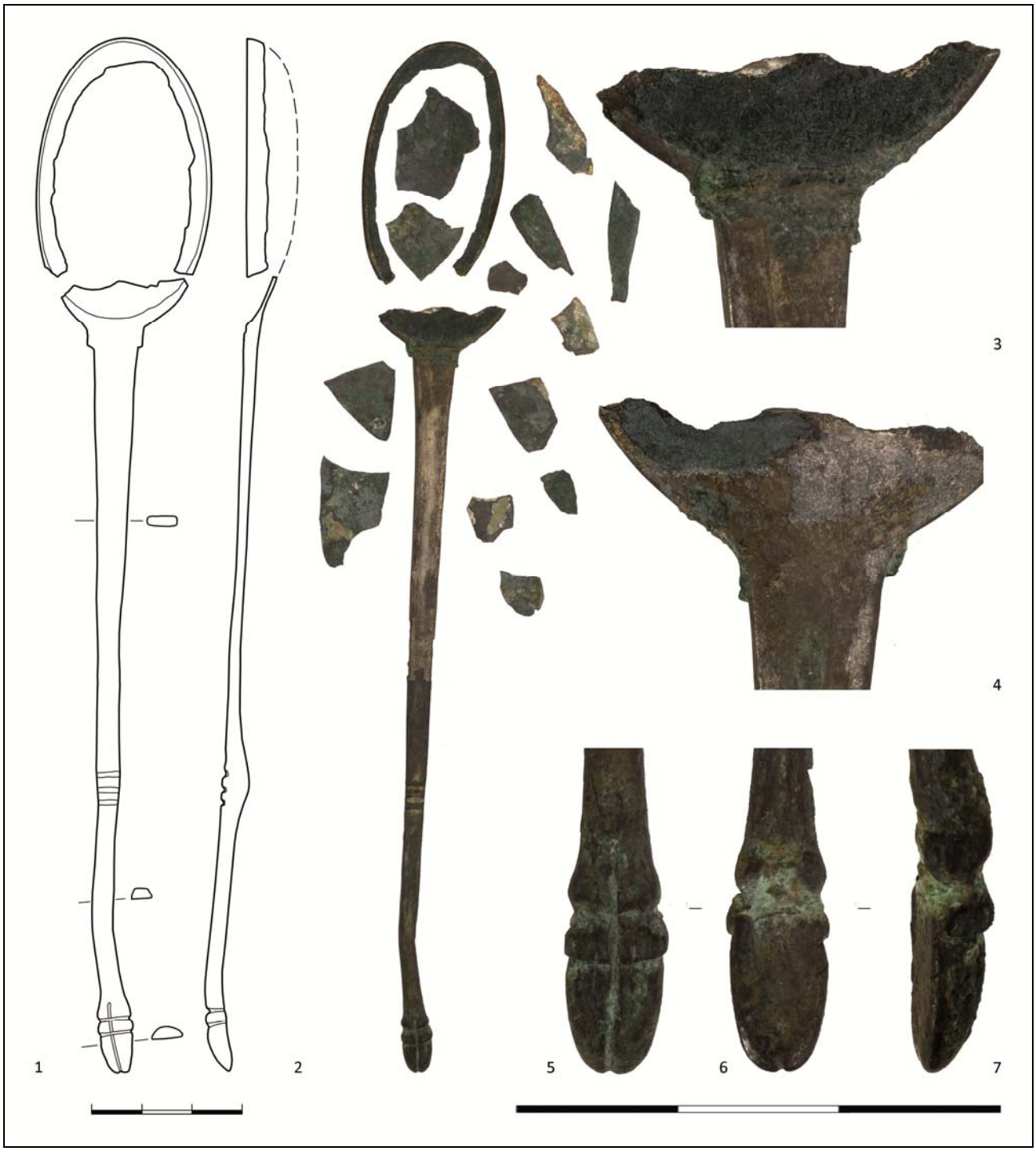

Fig. 6. Silver spoon. Village Mukhranovo. Burial mound. Chance find, 1996. Orenburg, State Pedagogical university, without inventory number. Photos by M. Treister, drawings by N. Bespalaya, 2015.



Fig. 7. Silver round-bottomed goblet. Novyy Farmstead. Burial mound no. 12/1982, burial no. 3. Aksay, Military-Historical Museum, inv. no. BX-1859/591. Photos by M. Treister, 2015.



Fig. 8. Silver round-bottomed goblet. Village Peregruznoe. Burial mound no. 51/2011, burial no. 2. Volgograd, Regional Local Lore Museum, inv. no. 33573/3. Photos by M. Treister, 2015.

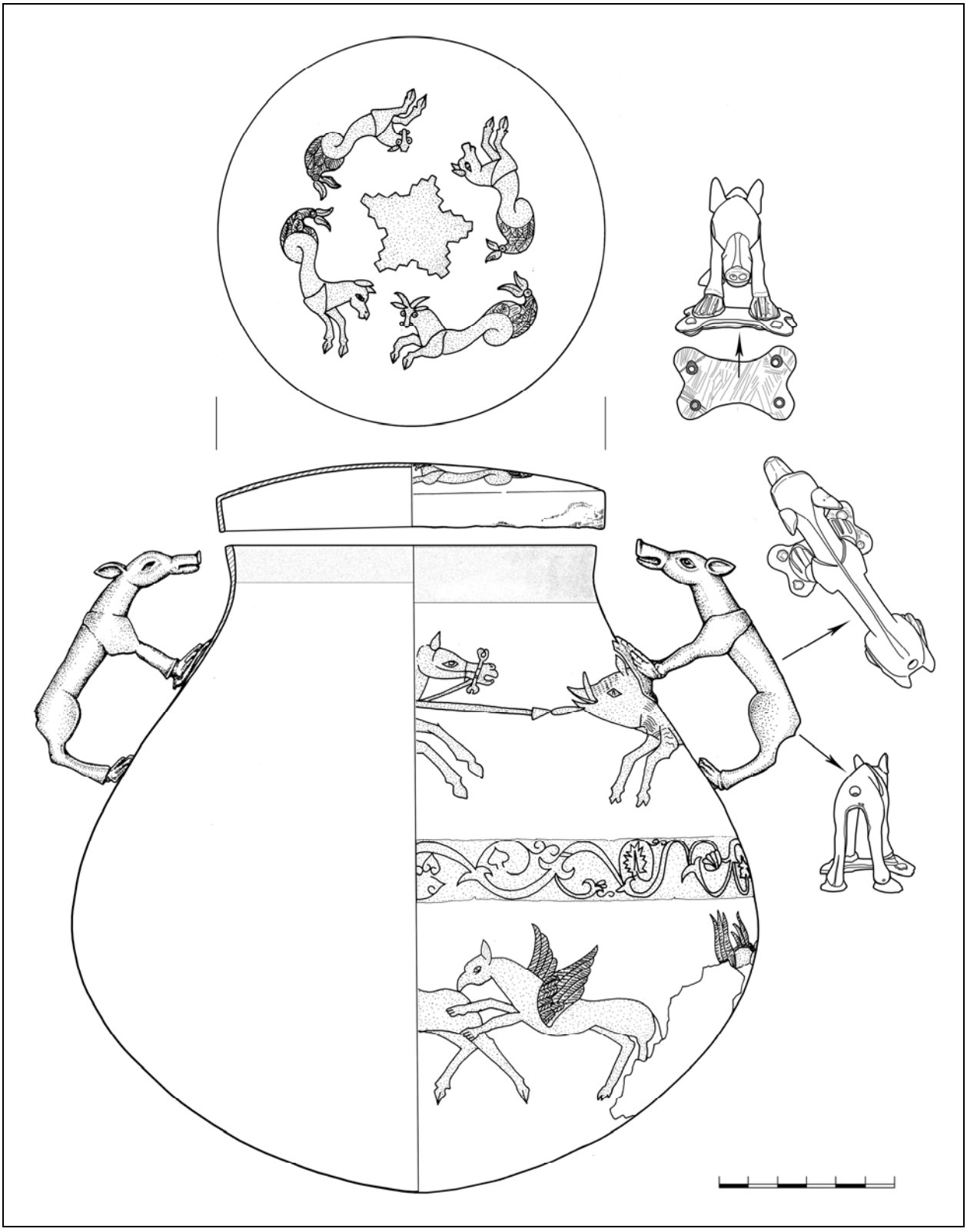

Fig. 9. Silver-gilt round-bottomed goblet. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1. Volgograd, Regional Local Lore Museum, inv. no. 31513/15. Graphic reconstruction by N. Bespalaya, 2015.

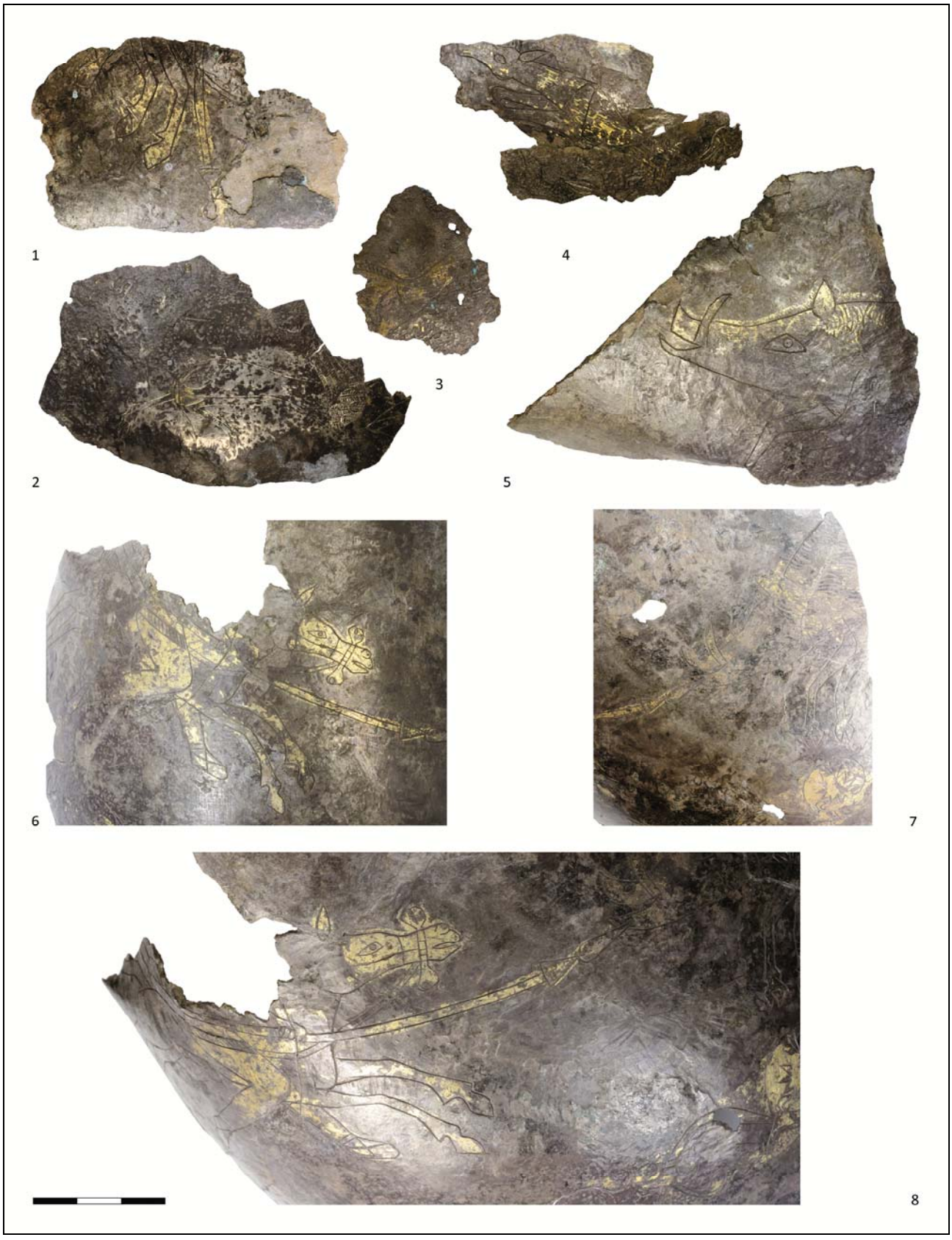

Fig. 10. Silver-gilt round-bottomed goblet. Fragments of walls. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1. Volgograd, Regional Local Lore Museum, inv. no. 31513/15. Photos by M. Treister, 2015.

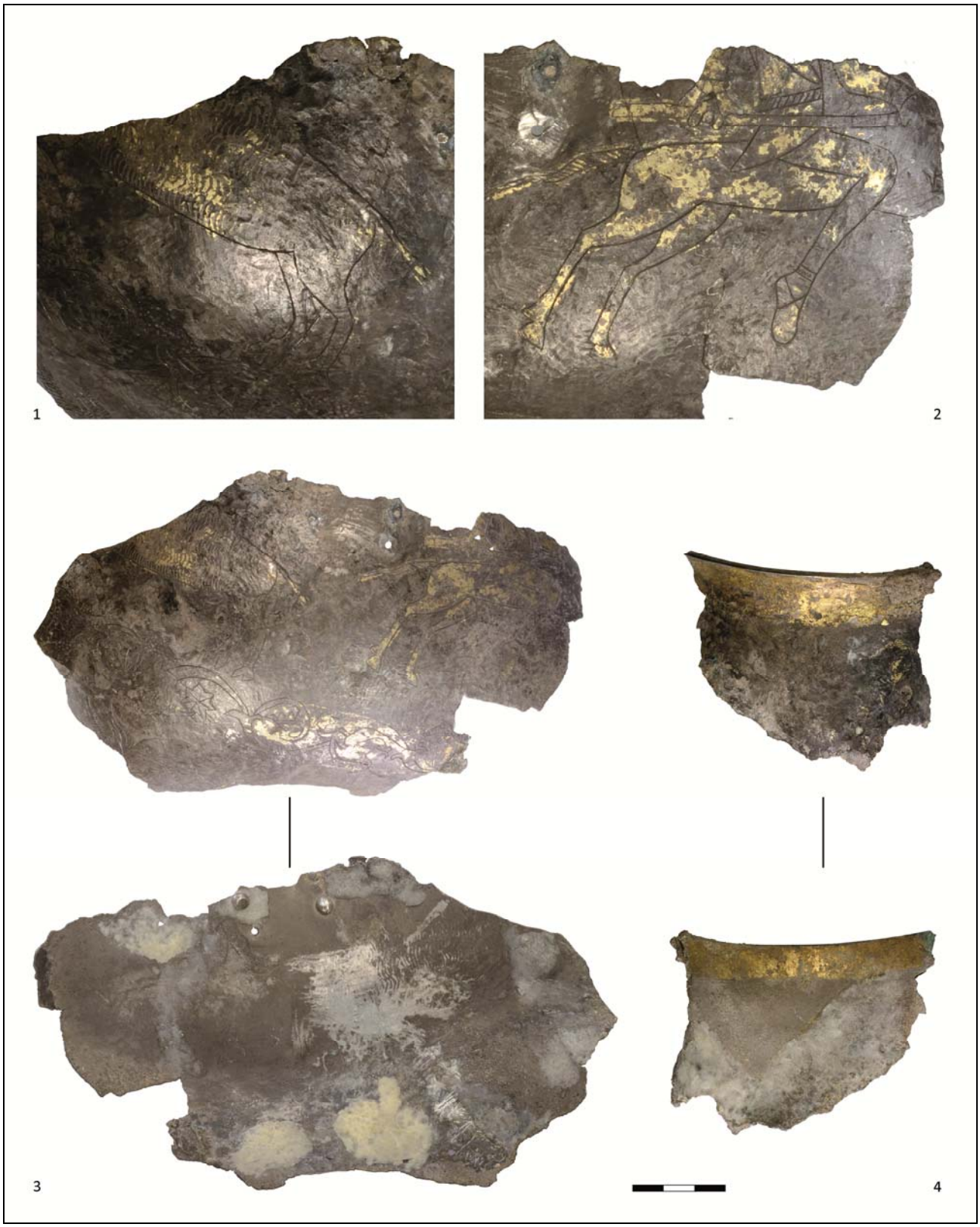

Fig. 11. Silver-gilt round-bottomed goblet. Fragments of walls. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1. Volgograd, Regional Local Lore Museum, inv. no. 31513/15. Photos by M. Treister, 2015.



Fig. 12. Silver-gilt round-bottomed goblet. One of the handles. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1. Volgograd, Regional Local Lore Museum, inv. no. 31513/15. Photos by M. Treister, 2015.

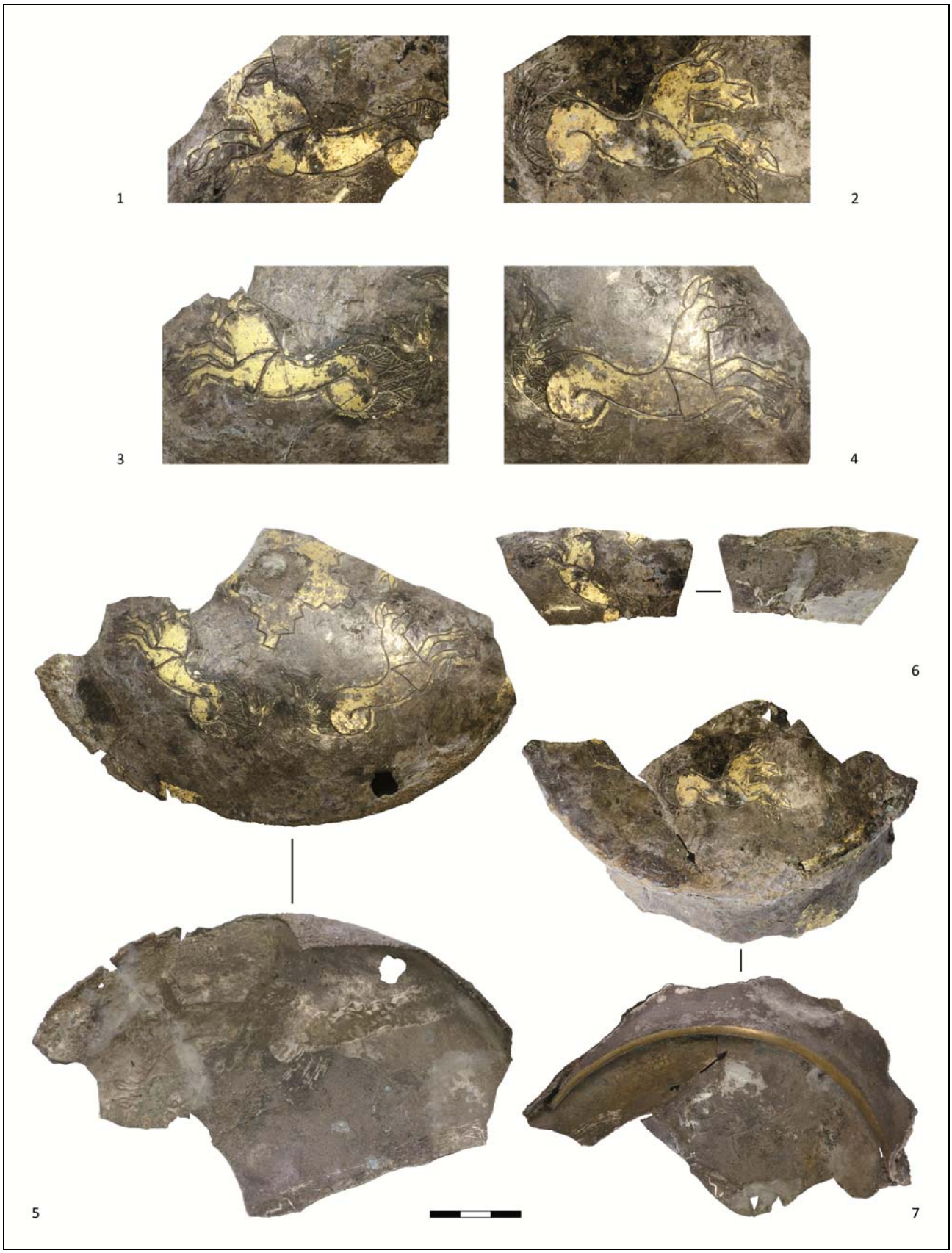

Fig. 13. Silver-gilt round-bottomed goblet. Fragments of the lid. Verbovskiy-II. Burial mound no. 4/1998, burial no. 1. Volgograd, Regional Local Lore Museum, inv. no. 31513/15. Photos by M. Treister, 2015.

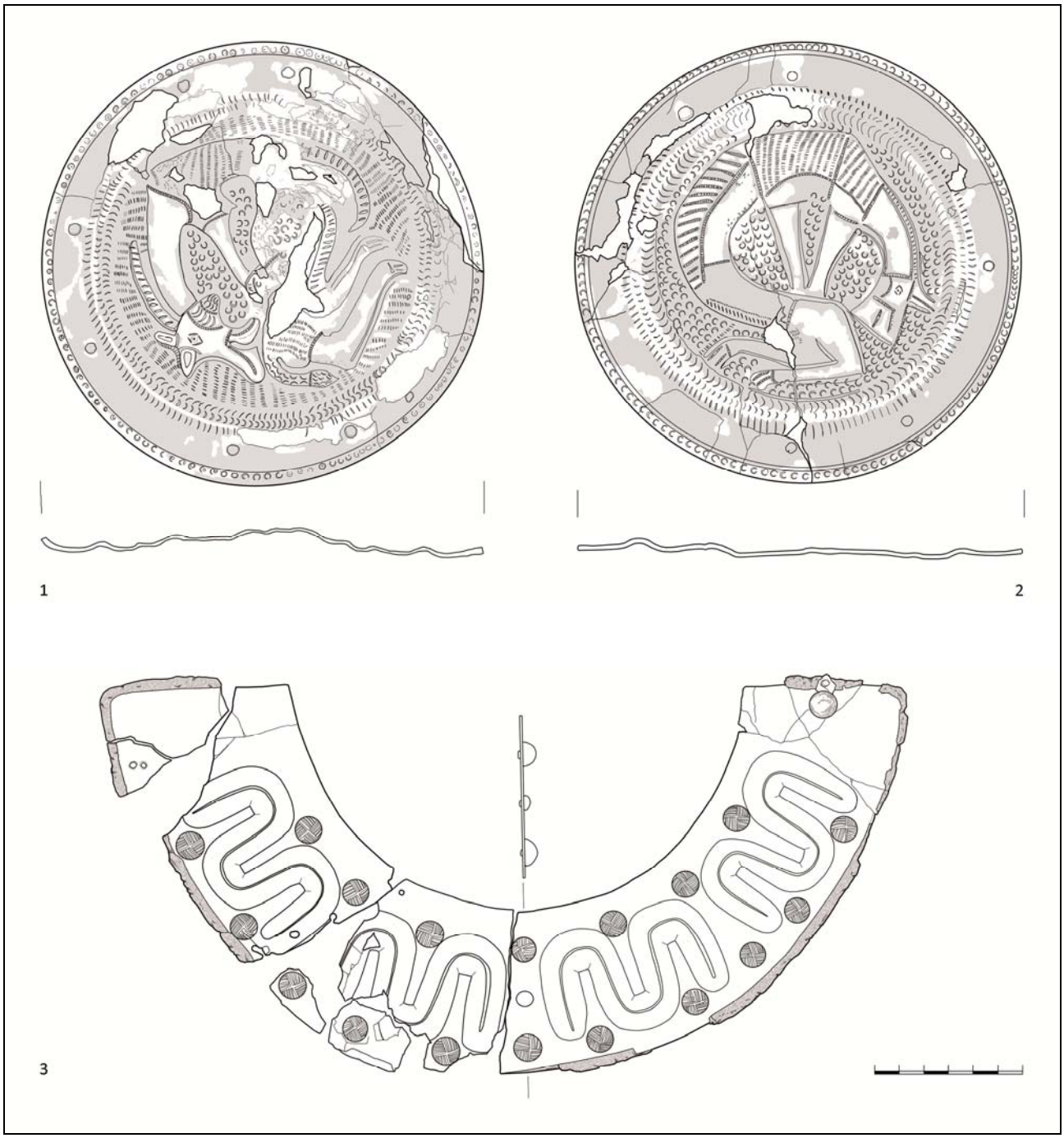

Fig. 14. Silver-gilt phalerae and breastplate of horse-harness. Yashkul. Burial mound no. 1/1988, burial no. 1. Elista, National Museum of Kalmykia, inv. no. КП 7652/3—5. Drawings by N. Bespalaya, 2015.



Fig. 15. Silver-gilt phalera with the image of a he-goat. Yashkul. Burial mound no. 1/1988, burial no. 1. Elista, National Museum of Kalmykia, inv. no. КП 7652/5. Photos by M. Treister, 2015.

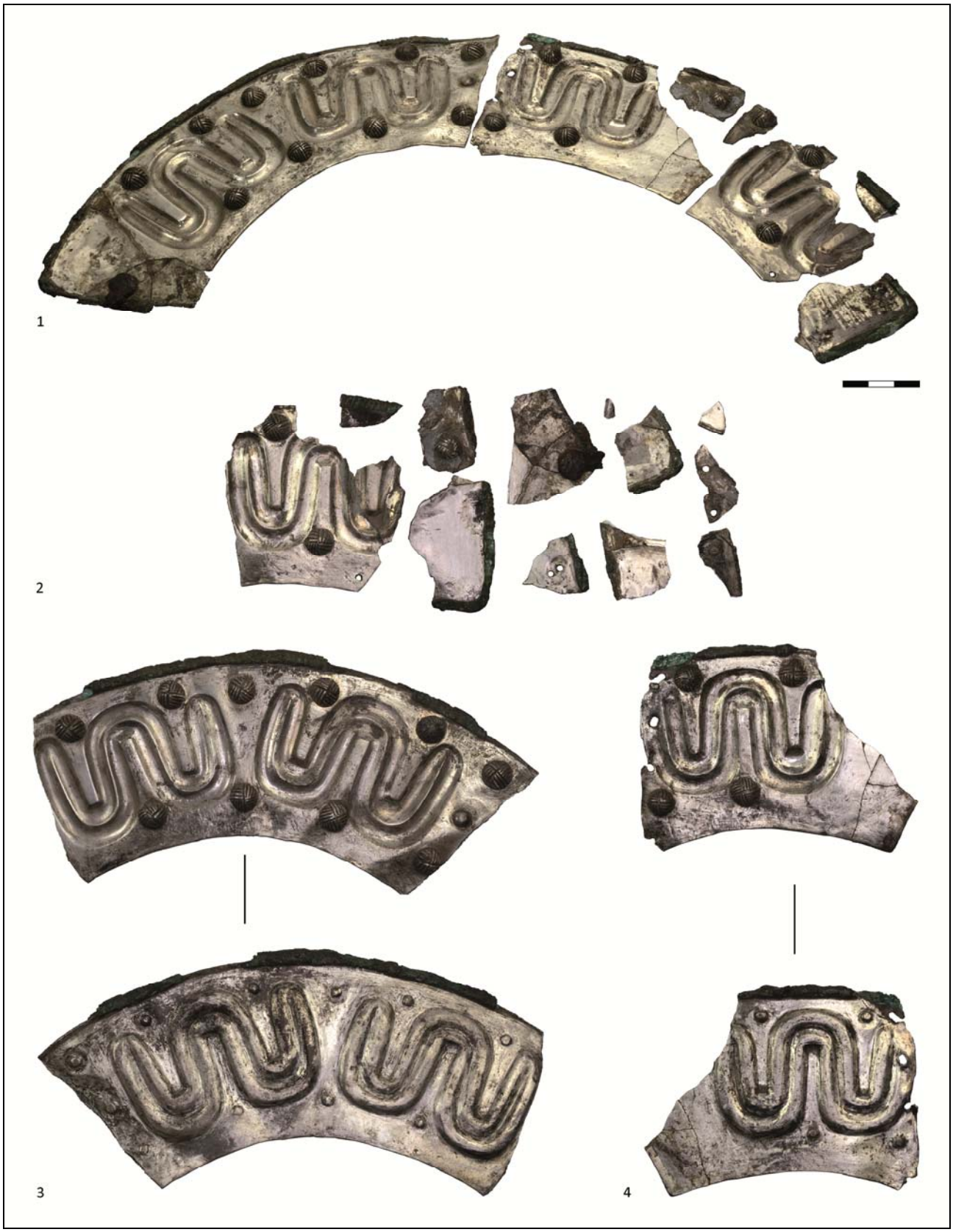

Fig. 16. Silver breastplate of horse-harness. Yashkul. Burial mound no. 1/1988, burial no. 1. Elista, National Museum of Kalmykia, inv. no. КП 7652/3. Photos by M. Treister, 2015.



Fig. 17. Silver phalera / breast plate of horse-harness. Titchikha. Finds by P.D. Leonov, 1939. Voronezh, Regional Local Lore Museum, inv. no. 143, book 6, no. 15. Photos by M. Treister, 2015.



Fig. 18. Silver belt set. Pervomayskiy-VII. Burial mound no. 14/1984, burial no. 3. Volgograd, Regional Local Lore Museum, inv. nos. 21573—21578. Photos by M. Treister, 2015.

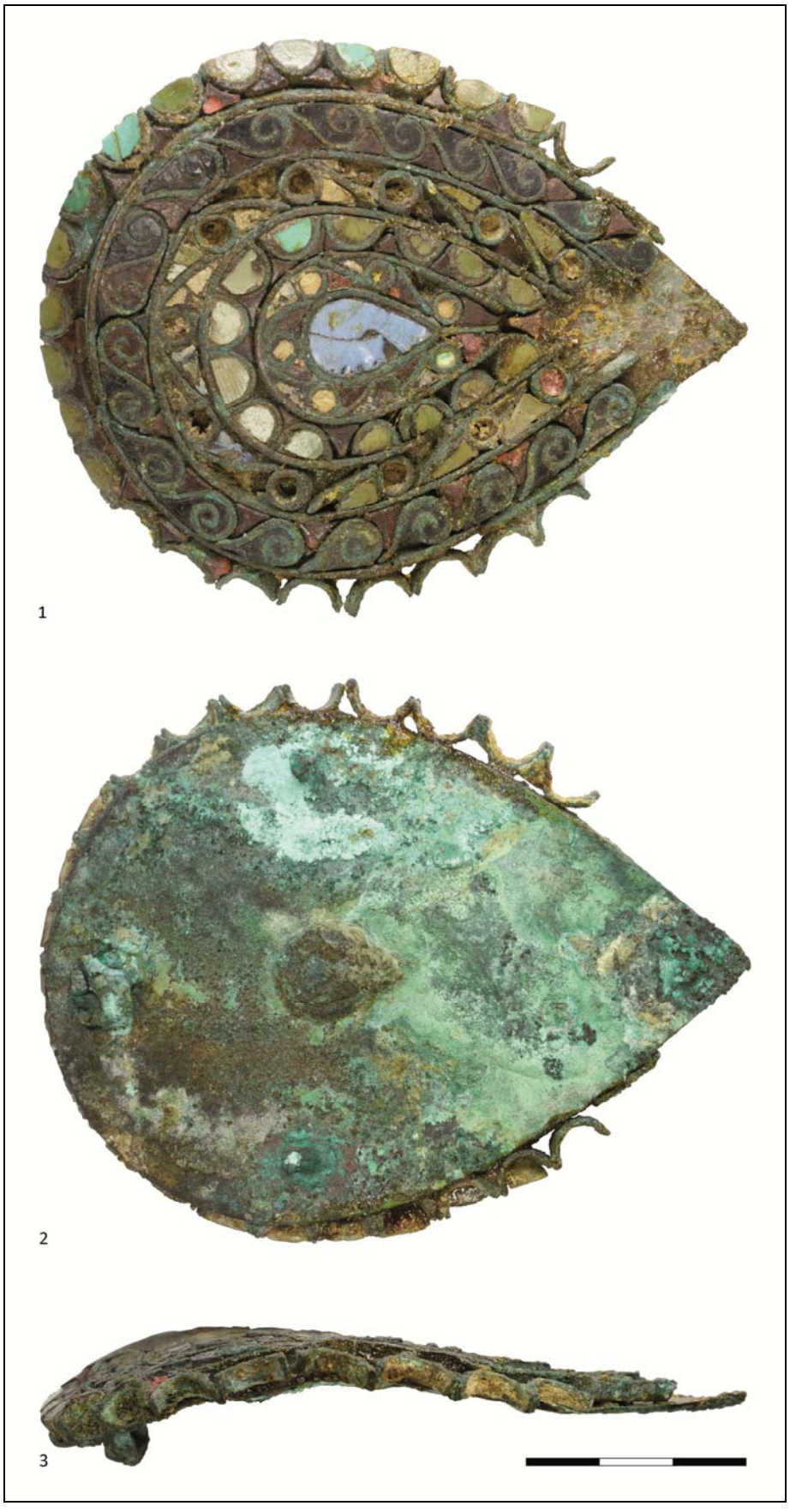

Fig. 19. Silver plaque of the belt set. Pervomayskiy-VII. Burial mound no. 14/1984, burial no. 3. Volgograd, Regional Local Lore Museum, inv. no. 21573. Photos by M. Treister, 2015.

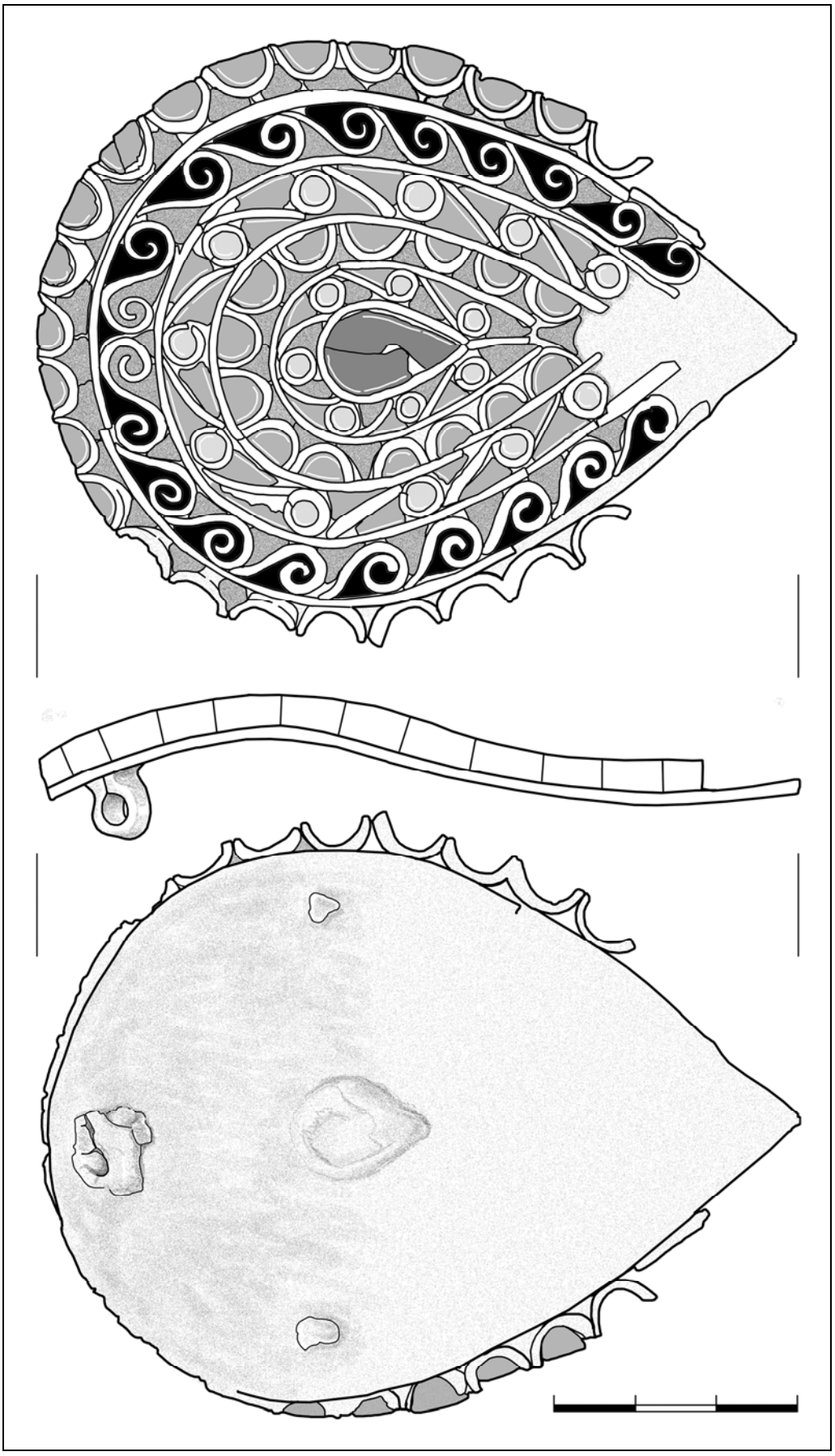

Fig. 20. Silver plaque of the belt set. Pervomayskiy-VII. Burial mound no. 14/1984, burial no. 3. Volgograd, Regional Local Lore Museum, inv. no. 21573. Drawings by N. Bespalaya, 2015.



Fig. 21. Silver lining of the chair leg. Khokhlach burial mound. Saint Petersburg, State Hermitage, inv. no. 2213/28. Photos by M. Treister, drawings by N. Bespalaya, 2015.

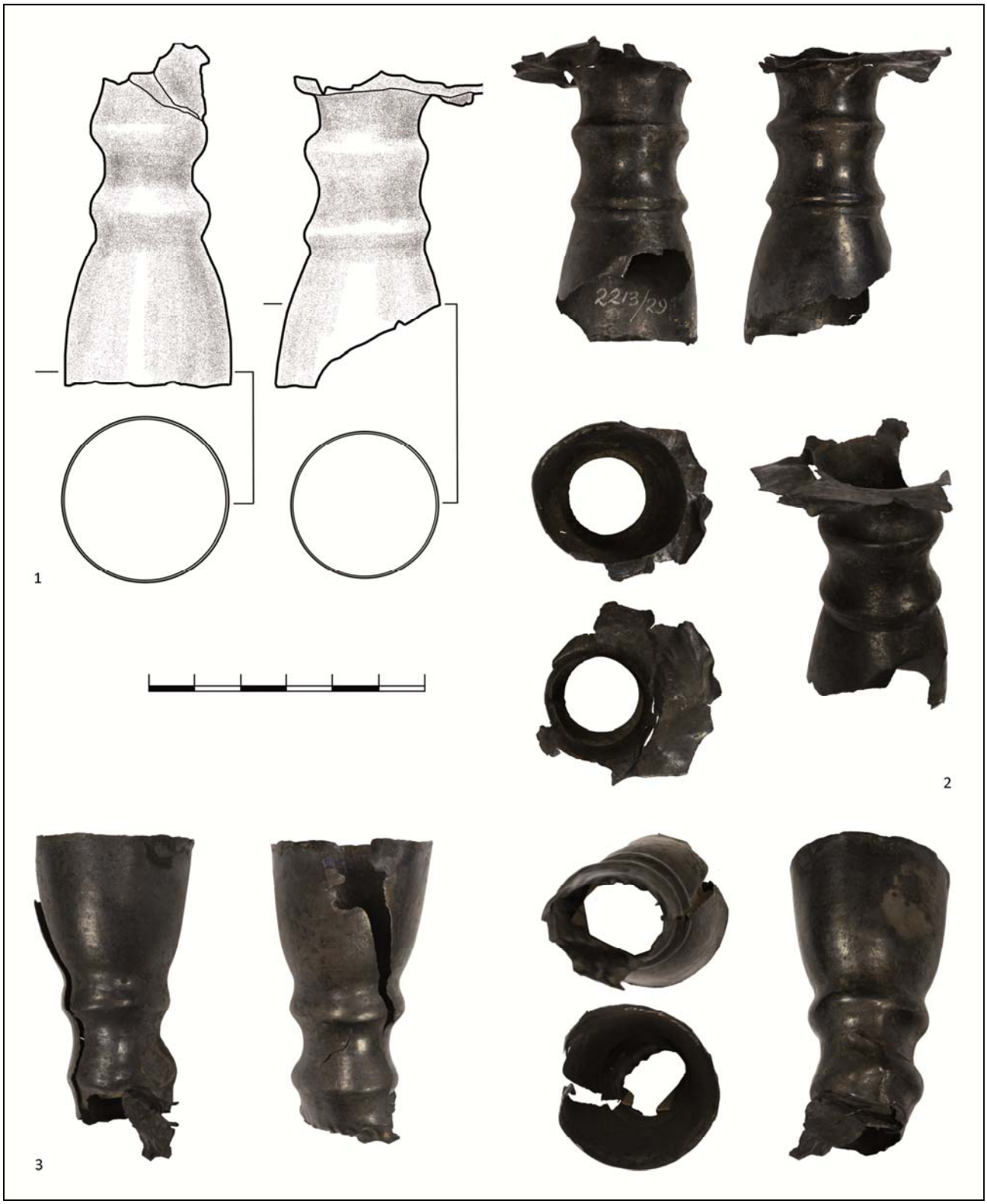

Fig. 22. Silver lining of the chair leg. Khokhlach burial mound. Saint Petersburg, State Hermitage, inv. no. 2213/29, 33. Photos by M. Treister, drawings by N. Bespalaya, 2015.



Fig. 23. Fragments of a plate or a vessel (?). Lipetsk burial mound, 2005. Lipetsk, Regional Local Lore Museum, without inventory number. Photos by M. Treister, 2015.

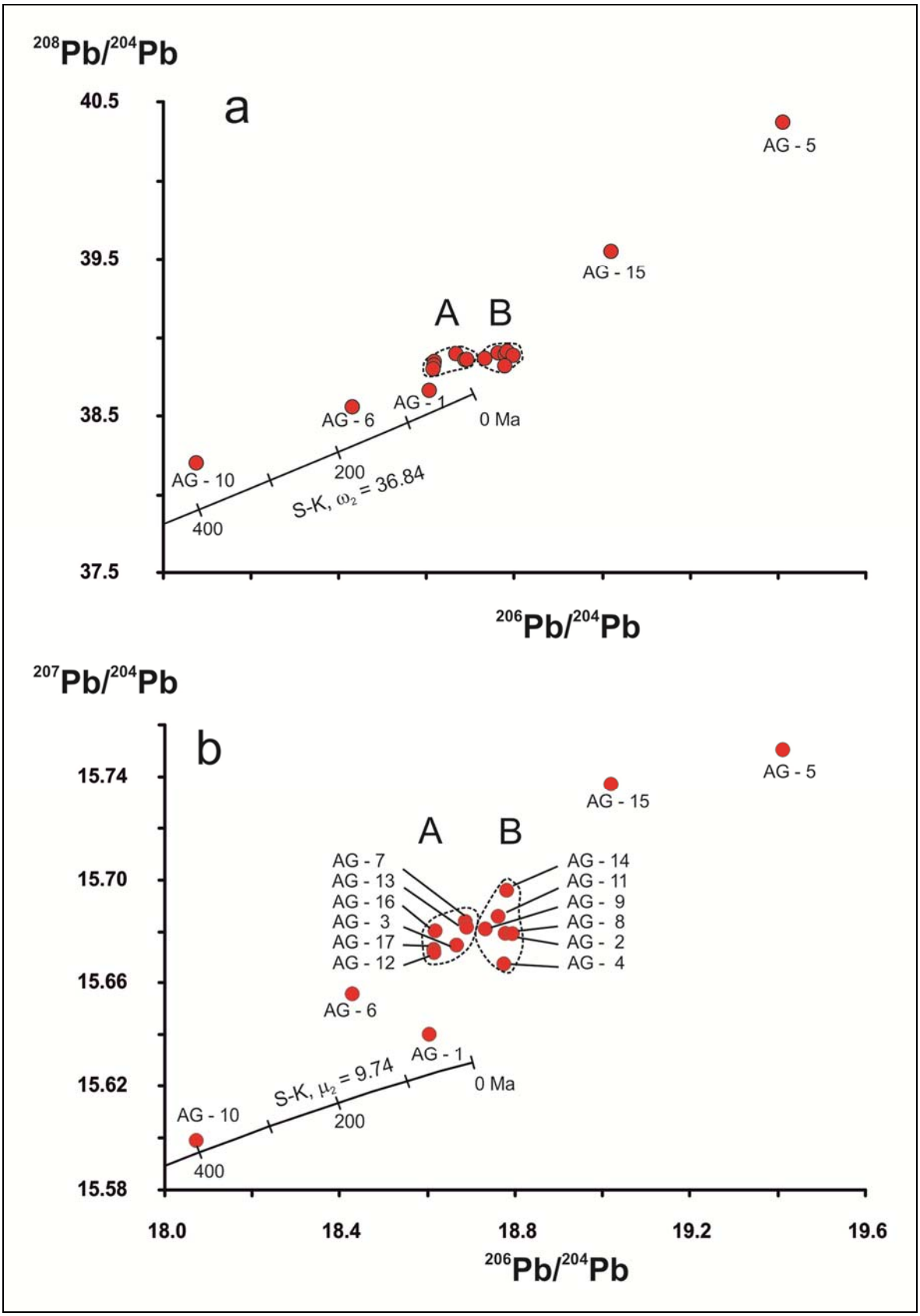

Fig. 24 (a, b). Comparison of the Pb isotopic composition of silver items from the nomadic burials (2nd century BCE — 3rd century CE) of Asian Sarmatian. The Pb-Pb diagrams show the average crustal growth curve (after Stacey and Kramers 1975: 207—221). **The dotted lines mark the fields (A and B) of Pb isotopic composition of two groups of items, the metal of which has different sources.**

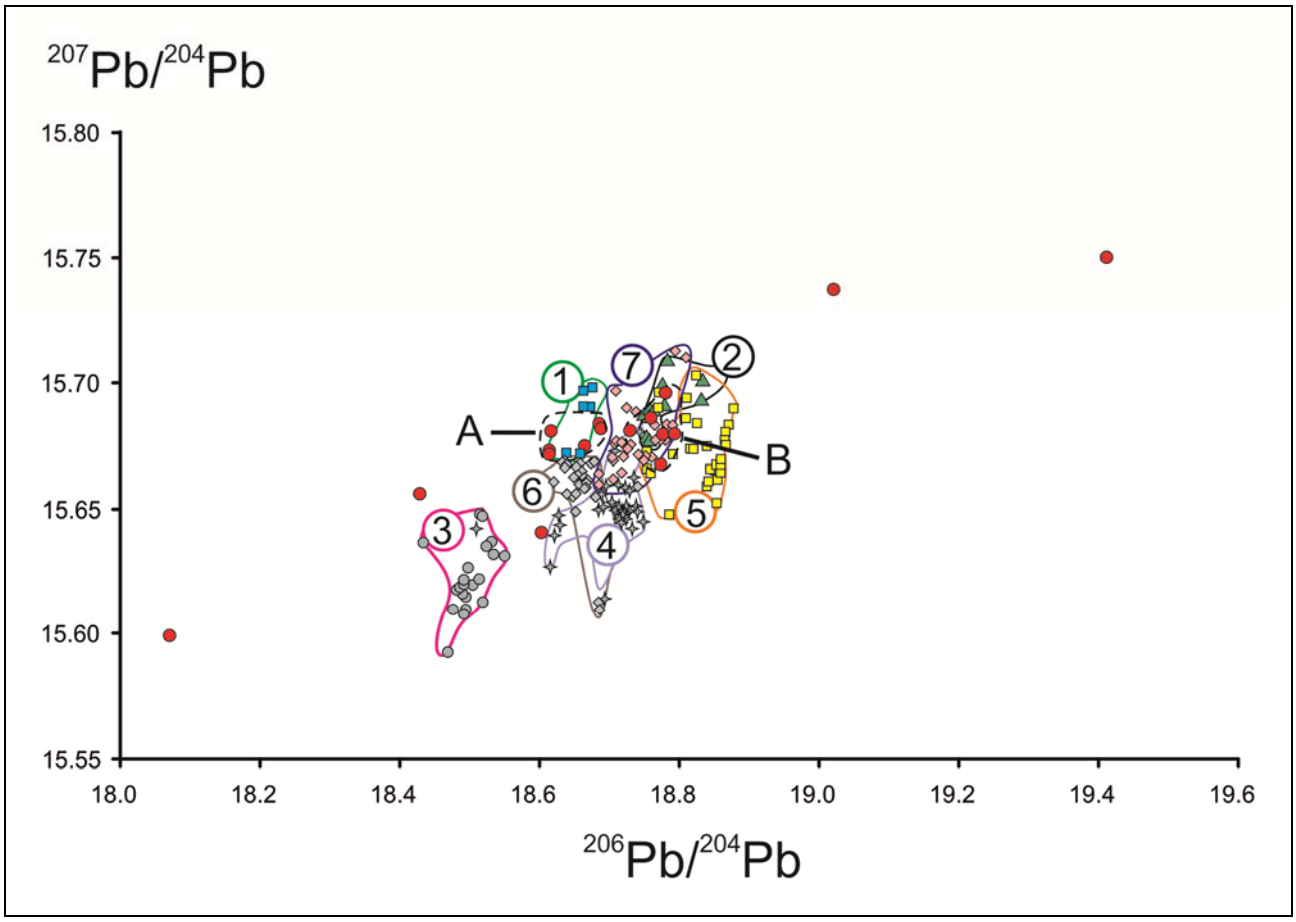

Fig. 25. Comparison of the Pb isotopic composition of items (red dots) of groups A and B (black dotted line), and silver-bearing and polymetallic deposits of ore provinces (fields): *1* — Eastern Pontides (North-Eastern Turkey); *2* — Western Anatolia (Western Turkey); *3* — Panagyurski district (Balkan Range, Central Bulgaria); *4* — Burgas district (Strandzha mountain region, South-Eastern Bulgaria); *5* — Baia Mare (Inner Eastern Carpathians, Romania); *6* — Roşa Montana (Apuseni Mountains, Western Romania); *7* — Rhodope Mountains (Southern Bulgaria).

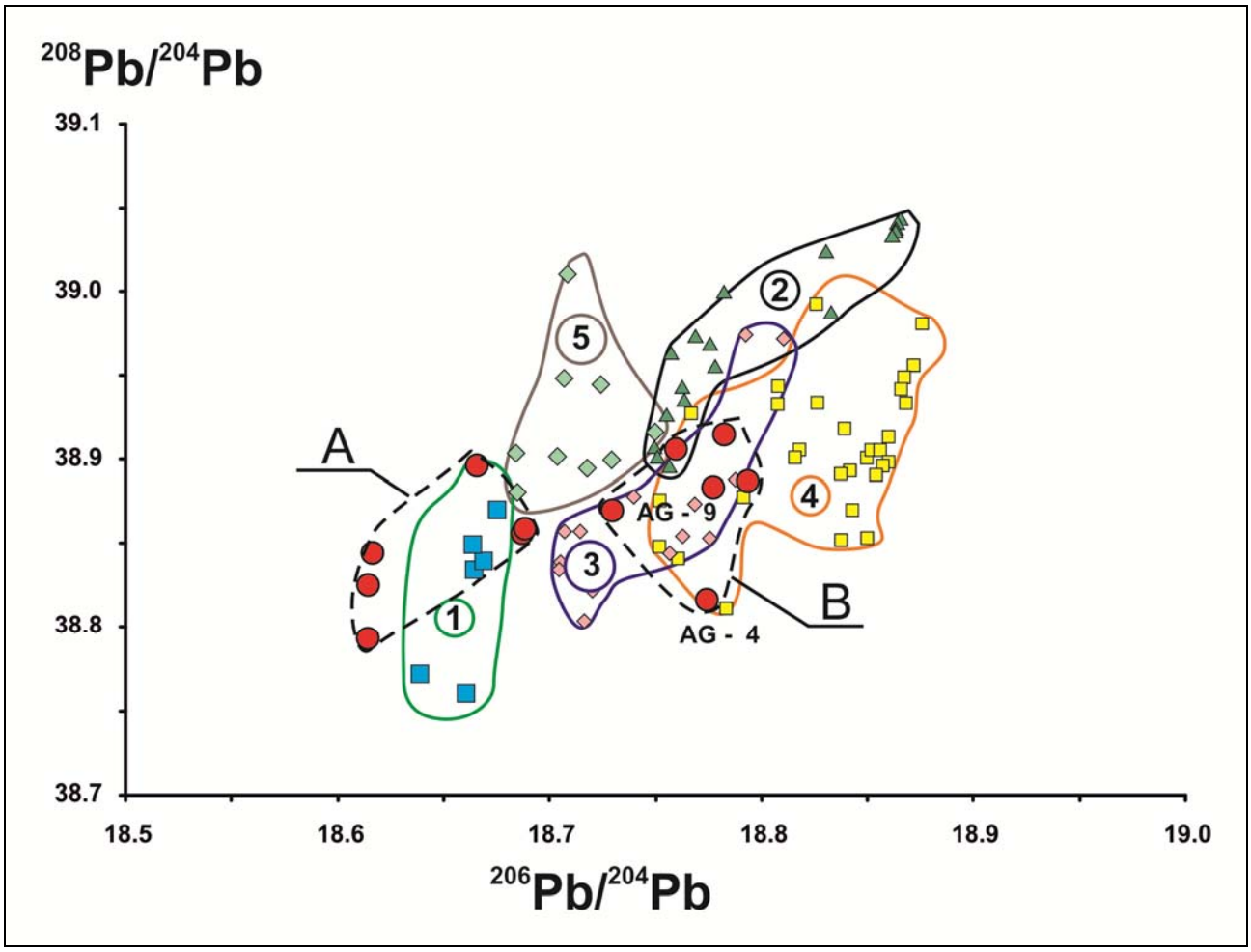

Fig. 26. Comparison of the Pb isotopic composition of investigated objects (groups A and B, black dotted line) and silver-bearing and polymetallic deposits of ore provinces (fields): *1* — Eastern Pontides (North-Eastern Turkey); *2* — Western Anatolia (Western Turkey); *3* — Eastern Rhodope Mountains (Southern Bulgaria); *4* — Baia Mare district (Inner Eastern Carpathians, Romania); *5* — Central Rhodope Mountains (Southern Bulgaria).

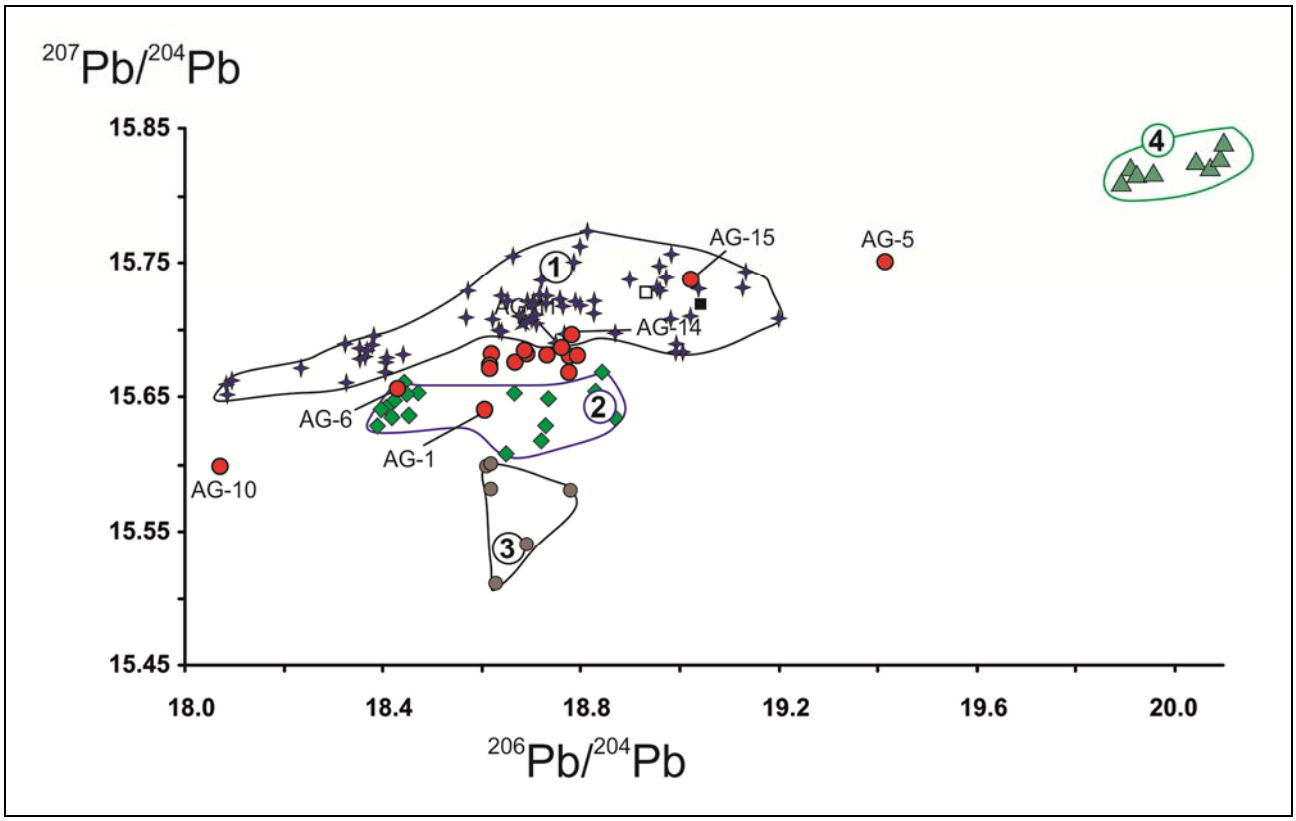

Fig. 27. Comparison of Pb isotopic composition of investigated objects (red dots) and silver-bearing and polymetallic deposits of ore provinces in the Middle East (fields): *1* — Taurus Mountains (Southern Turkey); *2* — Zagros Mountains (Western Iran); *3* — Syria, Central Asia: *4* — Panjshir district (Afghanistan). **White square in field 1 — Pb isotopic composition of the deposits from Palestine. Black square in field 1 — Pb isotopic composition of a lead artifact found in the northern Negev desert (Israel).**

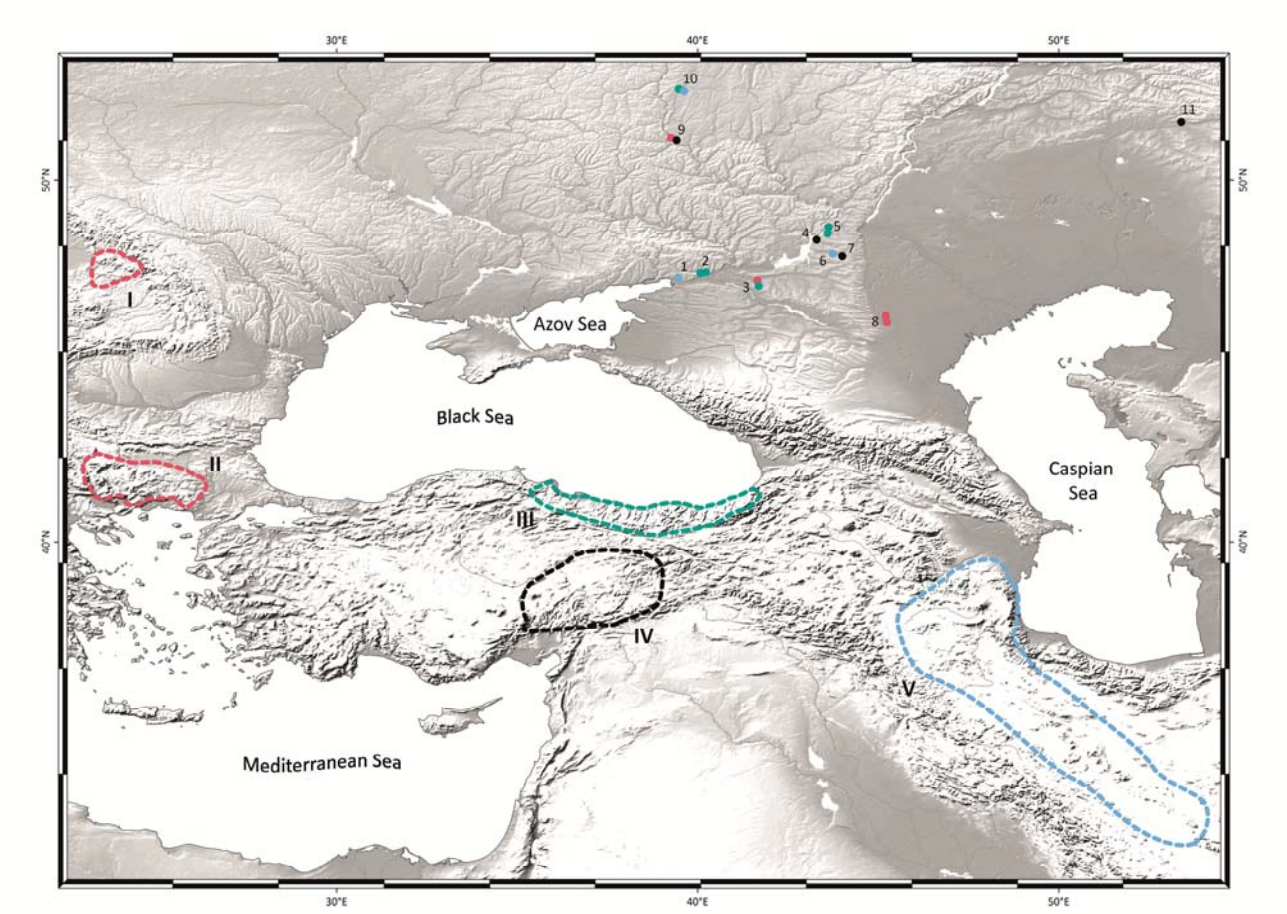

Fig. 28. Map of finds of investigated objects and the suggested territories of their metal sources. The locations of finds are marked by circles (the colour of the circle corresponds to the outline colour of the metal source region), the numbers correspond to samples: *1* — AG-1; *2* — AG-16—17; *3* — AG-2—3; *4* — AG-14; *5* — AG-12—13; *6* — AG-10; *7* — AG-11; *8* — AG-8—9; *9* — AG-4—5; *10* — AG-6—7; *11* — AG-15. **The contoured fields correspond to the locations of the ore provinces:** I — Baia Mare (Inner Eastern Carpathians, Romania); II — Rhodope Mountains (Southern Bulgaria); III — Eastern Pontides (North-Eastern Turkey); IV — Central Taurus Mountains (Southern Turkey); V — North-Western part of Zagros Mountains (Western Iran).

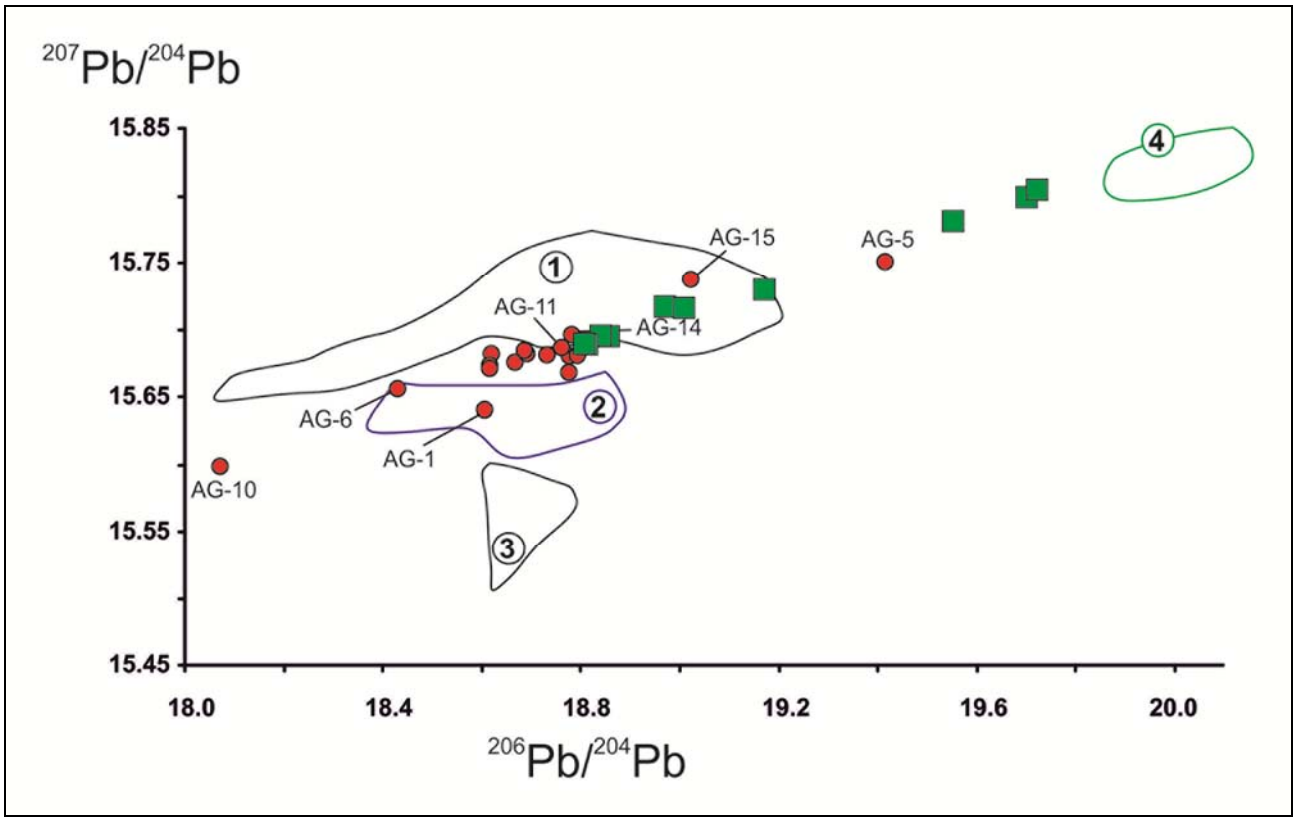

Fig. 29. Comparison of Pb isotopic composition of investigated objects (red dots), silver objects from the 5th — 4th centuries BCE burials of the nomads of South Urals (green squares, Chugaev, Chernyshev 2012: 243—245) **and silver-bearing and polymetallic deposits of ore provinces in the Middle East** (fields)**:** *1* — Taurus Mountains (Southern Turkey); *2* — Zagros Mountains (Western Iran), *3* — Syria, Central Asia: *4* — Panjshir district (Afghanistan).