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CERCETĂRI INTERDISCIPLINARE – МЕЖДИСЦИПЛИНАРНЫЕ ИССЛЕДОВАНИЯ – INTERDISCIPLINARY SURVEYS

Tetiana Goshko, MykhailoVideiko

Hoard of horse gear items of Cimmerian times from Kyiv region, Ukraine

Key words: Early Iron Age, Northern Black Sea region, Cimmerians, hoard, horse gear, Spectral Analysis, bronze, silver.
Cuvinte cheie: epoca timpurie a fierului, zona nord-pontică, Cimerieni, tezaur, piese de harnașament, analize spectrale, bronz, argint.
Ключевые слова: ранний железный век, Северное Причерноморье, Киммерийцы, клад, снаряжение коня, спектральный анализ, бронза, серебро.

Tetiana Goshko, MykhailoVideiko
Hoard of horse gear items of Cimmerian times from Kyiv region, Ukraine

During the earthworks near Biryuky village in Kyiv region, a hoard consisting of 91 metal items, including 3 silver and 88 bronze pieces, was found. This hoard represents items of horse gear and can be attributed to the early Iron Age – 8th century B.C. This is the first time that such items, typical of Central and South-Eastern Europe, are found in this territory. In terms of the number of the items found, this is one of the largest hoards finds known up to date. Attribution, as well as the spectral composition of the items, has been conducted. The composition of the metal elements allows to suggest Naholniy Ridge in Luhansk oblast to be the source of raw materials for manufacturing the bronze and silver items from the hoard. Thus, the questions arise about the manufacturing place of the items and of the ways the raw materials were delivered.

Tetiana Goshko, MykhailoVideiko
Depozitul de piese de harnașament din perioada cimeriană descoperit regiunea Kievului, Ucraina

În timpul unor lucrări agricole efectuate în apropierea satului Biriuki din regiunea Kiev, a fost descoperit un depozit, compus din 91 de obiecte metalice, dintre care trei piese de argint și 88 de bronz.Acest depozitconținepiese de harnașament și poate fi atribuit perioadei timpurii a epocii fierului – secolul al VIII-lea a.Chr. Aceasta este prima astfel de descoperire cu piese tipice pentru Europa Centrală și de Sud-Est din zona respectivă. În ceea ce privește numărul de obiecte pe care le conținea, acest depozit este, până în prezent, unul dintre cele mai mari. În acest articol este discutată problema cronologiei pieselor și sunt prezentate rezultatele analizelor spectrale. Elementele din compoziția metalelor permite să presupunem că sursa de materii prime pentru fabricarea pieselor din bronz și argint din acest depozit este Creasta Naholny din regiunea Lugansk. Astfel, se pot formula ipoteze de lucru referitoare atât la locul producerii pieselor, cât și la modalitățile de transportare a materiilor prime.

Тетяна Гошко, Михайло Видейко
Клад предметов конского снаряжения киммерийского времени из Киевскойобласти, Украина

Во время земляных работ у села Бирюки Киевской области был обнаружен клад, состоящий из 91 металлического предмета, в том числе 3 серебряных и 88 бронзовых. Этот клад представляет собой предметы конского снаряжения и может быть отнесен к раннему железному веку – 8 веку до н.э. Подобные предметы, характерные для Центральной и Юго-Восточной Европы, обнаружены на этой территории впервые. По количеству найденных предметов это один из крупнейших кладов, известных на сегодняшний день. Проведена атрибуция, а также спектральный состав предметов. Элементный состав металлов позволяет предположить, что Нахольный кряж Луганской области является источником сырья для изготовления бронзовых и серебряных изделий из клада. Таким образом, возникают вопросы о месте изготовления изделий и о путях доставки сырья.

Circumstances, place and description of the hoard

The hoard was discovered in the Summer of 2021 and was received for research in October 2021.The hoard finds can be categorized as a chance find, the circumstances of which are known only from the story of the person who handed it over to the specialists for further study. We are unable to establish if all the items were passed to the archeologists, or it is just a part of a

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Fig.1. Hoard of horse gear items from Biryuky.

complex. Thus, the usage of "hoard finds" notion is rather relative in this case.

The hoard consists of 91 metal items of horse gear (fig. 1-9), found during excavations in the field near Biryuky village (49°43′53″N, 30°17′14″ E 49.731389°, 30.287222°) in Kyiv region (fig. 10). According to the workers no burial signs (human or animal bones) were found. There are no more details on the finds. The man who passed the hoard finds to the specialists didn't give his name.

The village is located on the banks of the river Ros. The fields where the find was made are to the south of the village. On the map of the 19th century there are two mounds (fig. 11). Currently, they are not visible in the field. There is no information about the excavation of burial mounds in this area. The area where the find was made is the high right bank of the river. The slopes are now in some places covered with forests, which in ancient times could be continuous. Traces of an Early Iron Age settlement, whose cultural affiliation and dating have not been established, have been found in a similar area of the plateau near the neighboring village.

The hoard finds include 3 silver and 88 bronze items. Three slotted wheels are made of silver (fig. 1,5-7). The bronze items are: three-looped cheek-piece (fig. 1,1) three big round wheels with spokes (fig. 1,2-3), circle-shape plate with crossed straps inside (fig. 1,10), three triangular plates (fig. 1,4-6) and 81 round belt ornament plates (fig. 1,11). Below, the description of the items is given.

The cheek-piece (fig. 2; 6,1; lab. no. 1879)[1] weighs 95.15 g. The item is 154 mm high (long) and 8-9 mm thick. Its upper end is convex and ends

1. In parenthesis, the laboratory number of X-ray fluorescence analysis is given.

Fig. 2. Cheek-piece from Biryuky, bronze, lab. no. 1879.

with a hemisphere – 15 mm in diameter and 7 mm high. The lower end has similar ending 13 mm in diameter and 5 mm in hight. In a plane, the base bar of the cheek-piece has round tubular loops, one of which is situated close to the lower end. The inner diameter of the loops is 8 mm, the external diameter is 11 mm. There are sharp spikes on the outside of the base bar of the cheek-piece, opposite the tubes.

Three big wheels with spokes for horse gear belts are round in plan, with a big mushroom-like cap.

The first wheel with spoke (fig. 3,1; 6,2; lab. no. 1876) weighs 42.16 g, its cap is 55 mm in diameter, the cap with the spoke is 17 mm high. The spoke itself, situated on the other side of the wheel, is square in plan 15×15.5 mm, 14 mm high. It consists of four poles – each 3 mm thick, round in cross-section – connected by a narrow plate in such a way as to form a square.

The second wheel with spoke is similar in form, weighs 39.01 g (fig. 3,2; 6,3; lab. no. 1877). Its cap is 54 mm in diameter; the cap with the spoke is 16 mm high.

The spoke is square in plan, 14×15 mm, 14 mm high. It consists of four poles – round in cross-section, each 3 mm thick, – connected by a narrow plate in such a way as to form a square.

Third wheel with spoke (fig. 3,3; 6,4; lab. no. 1878) weighs 24.66 g. Its cap is 53 mm in diameter, the cap with the spoke is 14 mm high. The spoke consists of four poles – round in cross-section, each 4 mm thick – connected by a narrow plate in such a way as to form a circle (unlike the previous two items).

Three the same in shape slotted wheels with three-beam rosette inside and a loop outside are made of silver (fig. 4,1-3; 6,5-7). Wheel no. 1 is 27,5 mm in diameter, 11 mm high (with the loop), weighs 8.39 g. (lab. no. 1869); wheel no. 2 is 27,5 mm in diameter, 11,5 mm high (with the loop), weighs 8.08 g. (lab. no. 1870); wheel no. 3 is 28 mm in diameter, 12,5 mm high (with the loop), weighs 7.90 g. (lab. no. 1871).

Circle-shape wheel with crossed straps inside (lab. no. 1872) has border ornamented with incised braid, lost wax casting. The wheel is 22 mm in diameter, 9 mm high (with the loop), weighs 5.70 g (fig. 5,1; 6,8).

The plate, triangular in plan, with mushroom-like thickenings on both ends and with a raised ridge in the center and a loop on the reverse side (fig. 5,2; 6,9; lab. no. 1873), weighs 9.25 g, is 12 mm high (with the loop).

Plate, triangular in plan, with incised ornament in the shape of a button in the middle with whorls coming out from it in two directions (fig. 5, 3; 6, 10; lab. no. 1874), weights 7.17 g, is 10 mm high (with the loop).

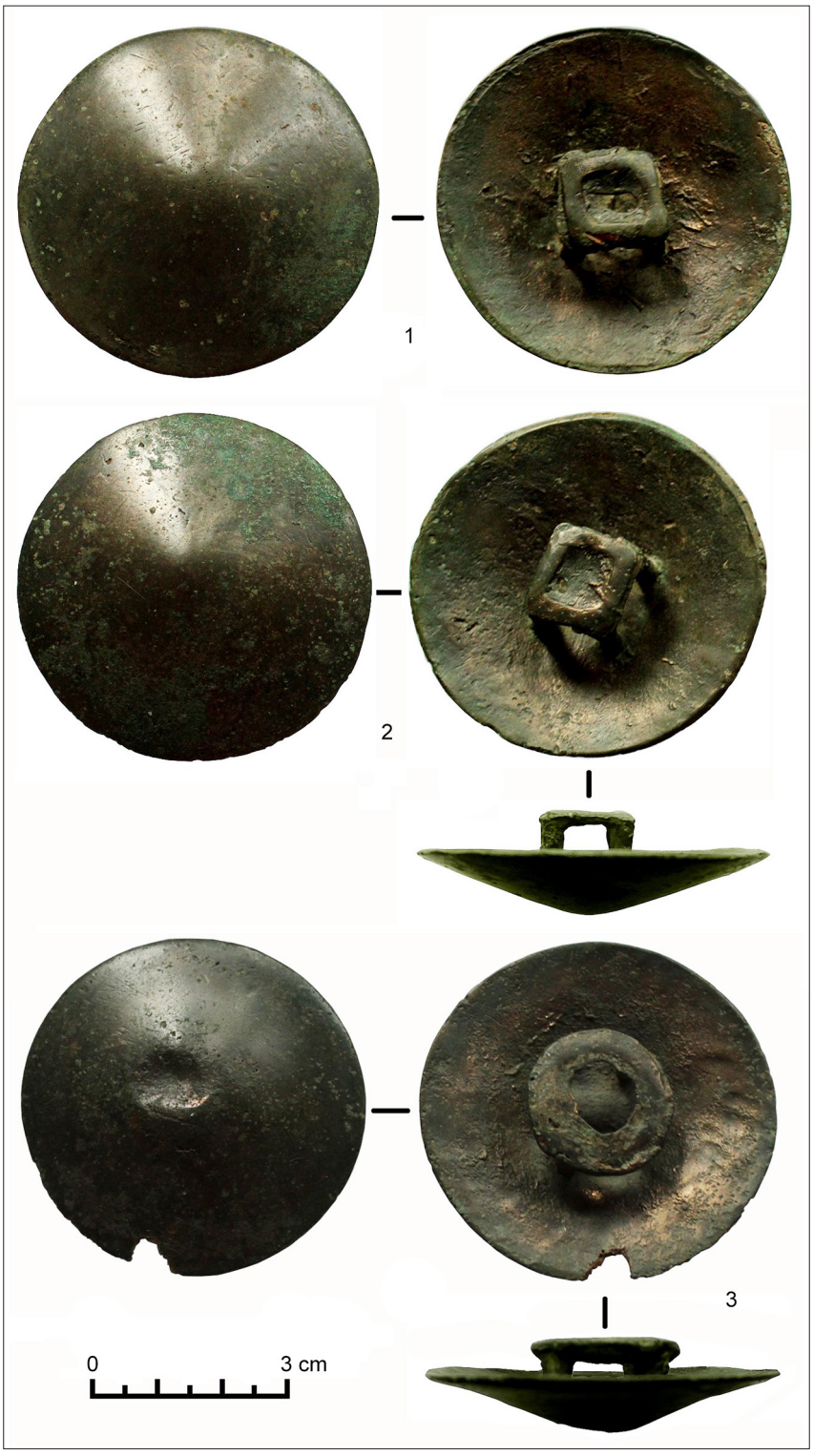

Fig. 3. Wheels with spoke from Biryuky, bronze: 1 – lab. no. 1876; 2 – lab. no. 1877; 3 – lab. no. 1878).

The plate, triangular in plan, with smooth surface and widened ends in the shape of flat circles (lab. no. 1875), weighs 9.82 g, is 10 mm high (with the loop) (fig. 5,4; 6,11).

The small round belt ornament plates with a loop (81 items). Their sizes range from 15 to 17 mm in diameter, are 11,5-13 mm high with the loop. The thickness of the metal of the plates var-

Fig. 4. Slotted wheels with three-beam rosette inside and a loop outside from Biryuky, silver: 1 – lab. no. 1869; 2 – lab. no. 1870; 3 – lab. no. 1871).

ies, correspondingly their weights vary from 2.13 to 4.99 g (lab. no. 1880-1890) (fig. 5,5; 6,12).

The described items do not make up a complete set of horse gear. A fellow cheek-piece is lacking, there are three wheels with spokes which should be a paired number, and three silver slotted wheels make only part of the set. The abundance (81 item) of same-type small bronze plates attracts attention.

Attribution and Dating of the Finds

It is the second time that a similar hoard finds of riding horse gear is found in this Upper Dnieper region. Several years ago, a similar hoard finds were found near Lelyaki village of Kyiv region (50°14′15″ N, 31°32′25″ E) i.e., on the left bank of the Dnipro River, in the Upper Dnieper region in terrace forest-steppe [Skoryi et al. 2016, 106-127, ris. 19, 1-2; 20, 1-2]. Biryuky village is situated in the basin of the river Ros (the right affluent of the Dnipro River), which from the West and from the South limits great steppe gore that approaches the Stuhna river in the North. This region is rich in kurgans, the most ancient of which date back to the Bronze Age, the most of the burials refer to the Early Iron Age. The most famous of the local kurgans is the Early Iron Age kurgan Perep'yatiha, excavated in the XIX century [Skoryi 1990]. Thus, these two hoard finds outline rather significant steppe territories on the border of forest-steppe.

The three-looped cheek-piece from near Biryuki village is one of the most diagnosable items. It can be referred to A1 type according to the classification of Metzner-Nebelsick [Metzner-Nebelsick 1994, abb.1], or to A1a type [Metzner-Nebelsick 2002, 215, abb. 97]. According to T. Bader[2] this is Vetiş type, variant B, sub-variant C [Bader 2013, 246; 284; abb. 2, b, c].Ya. Chochorovski referred similar-form cheek-pieces to "Dunakömlöd" type, early variant of "Füzesabony" [Chochorowski 1993, 62, 67; ris. 3, 8].

Most of such cheek-pieces were found in Western and Central Europe. According to Metzner-Nebelsik's, only 26 cheek-pieces of A1 type were found, nine of which come from burials, most of them – 13 come from hoard finds, and four of them are referred to as "single finds" or items of "uncertain origin" [Metzner-Nebelsick 1994, Abb. 2, 387]. Such cheek-pieces are often associated with "Thraco-Cimmerians" [Metzner-Nebelsick 1994]. Note, that previously East of the Carpathian Mountains A1 type was virtually unknown [Metzner-Nebelsick 1994, abb. 6; 216, abb. 99].

The fact that A1 type three-looped cheek-pieces were found among hoard finds and grave goods associated with European Hallstatt culture provides a perfect opportunity for cross-dating. The most ancient items come from the Carpathian region where they are referred to the 9th century B.C. and occur there till the end of 8th – the beginning of 7th century B.C. The second half of the 8th – first half of the 7th century B.C. is the time of origin and occurrence of this A1 type cheek-pieces in Central Europe, but in the Balkans, it appeared only in the 8th century B.C. The finds of these cheek-pieces in the cultural-geographical area of Ukraine, in Podillya, in particular, [Metzner-Nebelsick 1994, abb. 18], have the same dating.

2. We believe Bader's classification gives the closest description of all the construction nuances of the given items.

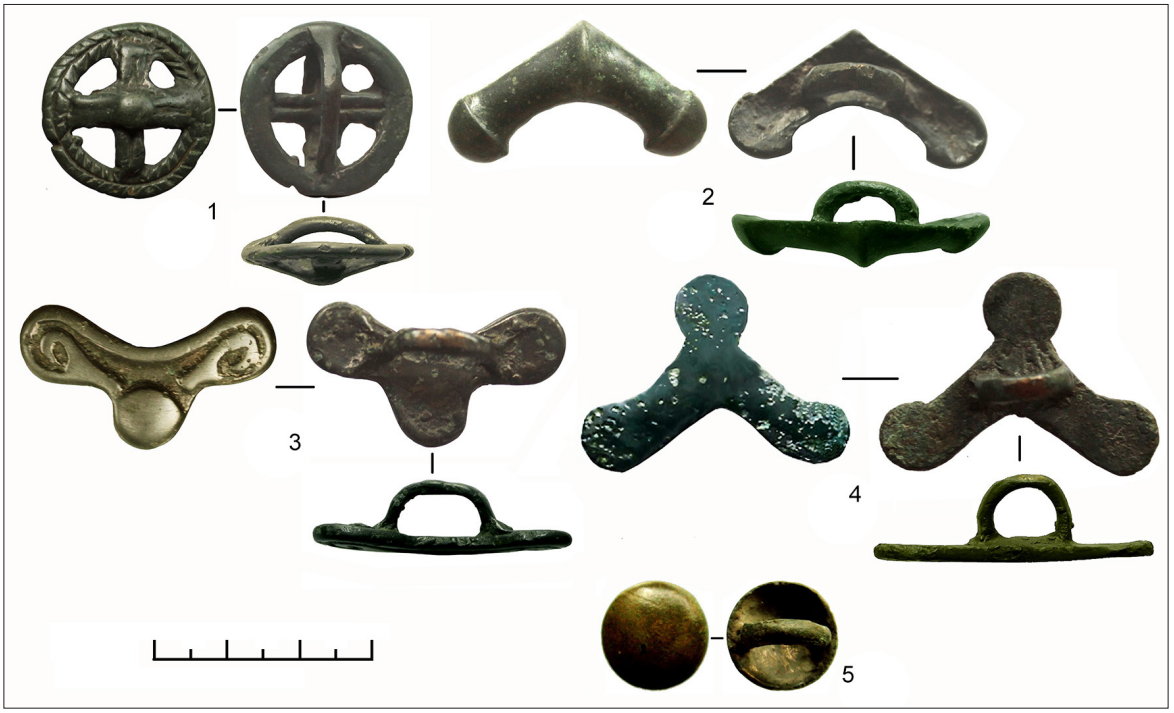

Fig. 5. Items from Biryuky hoard: 1 – Plate, triangular in plan, with mushroom-like thickenings on both ends and with a raised ridge in the center and a loop on the reverse side (lab. no. 1873); 2 – Plate, triangular in plan, with incised ornament in the shape of a button in the middle with whorls coming out from it in two directions (lab. no. 1874); 3 – Plate, triangular in plan, with smooth surface and widened ends in the shape of flat circles (lab. no. 1875); Small round belt ornament plate with a loop (lab. no. 1880-1890).

It follows from the distribution geography and the dating of the items that the occurrence of such cheek-pieces in the Carpathian region preceded their distribution both in eastern and western regions. This distribution happened almost simultaneously in the 7th century B.C.

Starting from the 10th-9th century B.C., big round wheels with spokes also have analogies in goods from the Carpathian region, there they occur up to and including the 7th century B.C. There and at the same time, we find analogies to the shaped plates. East from the Carpathian region such plates and wheels with spokes were known already beginning from the 8th century B.C. [Metzner-Nebelsick 2002, abb. 163].

Slotted wheels occur a little later, only in the 8th century, moreover, simultaneously on both sides of the Carpathian Mountains [Metzner-Nebelsick 2002, abb. 163]. Such items were found in different sizes, sometimes – ornamented. They appeared in the sites from Zolniy, Butenok, Olshana, Shevchenkivtsi, Kvitky. The similar slit ornament was also rather popular on the additional links of bits for connection with bridle belt on the North Caucasus [Valchak, 2009, 224, ris. 37]. Small belt ornament plates with a loop refer to the same chronological range [Metzner-Nebelsick 2002, abb. 152, 6; abb. 163], and they were in use even later. Small round ornament plates, the most numerous in the hoard finds, have the widest dating range – from Cimmerian up to and including the Scythian time.

Therefore, the items found near Biryuky village fit in, first of all, the scope of ancestries of the Late Bronze Age – the beginning of the Early Iron Age of the Carpathian region. East from the Carpathian region, they are rare finds. They can be dated to the 9th-7th century B.C. In our opinion, given the number of finds of the most diagnostic range of such items (cheek-pieces, big wheels and slotted wheels, pendants), the 7th century B.C. is the most probable dating of the hoard finds from Biryuky village. That being said, we remind you, that the Carpathian region is the oldest region of distribution of this horse-gear items.

Technology of the Items

The examination of the items, including with the use of a microscope, revealed that all the items

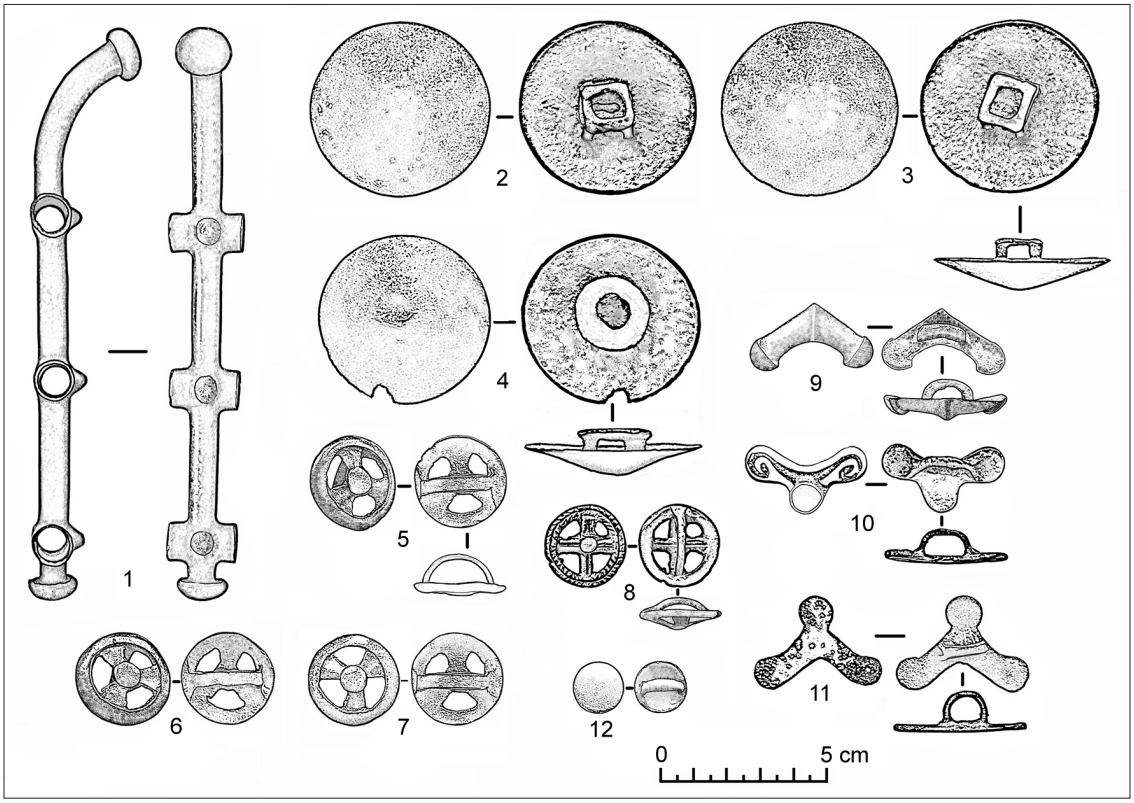

Fig. 6. Plates from hoard of horse gear items from Biryuky.

were cast on a disposable wax model. This can be proved by the following signs found on the casting: on both heads of cheek-pieces the ends are bent inwards so much that it would be impossible to remove the casting from the multiple form without ruining the form (fig. 7,1-2).

Traces of work with the model are clearly visible on the wheels with spokes: there are glued seams on the outer side in the connection areas of the poles (fig. 7,3). On the front side of the slotted wheel ornamented with "braid", a seam of two ends of braid joining and the overlapping on the loop can be traced. The braid itself is drawn over the wax (smooth contour) (fig. 7,4-5). Small plates also keep traces of work with the wax model: glued seams between a loop and a cap (fig. 7,6).

Perhaps, in conclusion, the finished items were polished from the front side to make them shinier, as the surface resulting from such casting is almost ideal and doesn't require additional refinement.

Research Method of Metal Composition

A total of 22 items were spectrally analyzed: all the large items and 11 small plates. The composition of the metal elements was determined in the laboratory of the Institute of Archeology of the National Academy of Science of Ukraine with the use of the method of reference-free non-destructive analysis on X-ray fluorescence spectrometer CEP-01 AAEC.412131.001, modification "ElvaX Light" with extended range towards light elements.

Registration of ordinary spectra was performed at emitter voltage of 40-49kV, and light spectra at the voltage of 10-15kV. The time for building up each spectrum was 180 seconds. Registration of fluorescent radiation from the test sample was performed with the use of Si-Pin detector manufactured by Amptek (USA) with thermos-electric cooling.

During sample studies, the following operation modes of X-ray tube (MOXTEK, Pd anode material) were set: voltage 45 kV, anodal current ranging 0-100mkA. The results for bronze items are given in Table 1, for silver items – in Table 2.

It is worth noticing, that the sample analysis was conducted on the spot of surface clean of oxides. Sometimes such a technique provokes criticism based on the claim that the concentration ratio of some elements, first of all of tin, in surface

layers of metal may be exaggerated [Szabó et al. 2018, 77-82]. This claim is fair, however, most often we deal with museum items and in this case, disturbance is highly undesirable. Besides, we believe that a small exaggeration of tin ratio in the surface layer would have no considerable effect on the final result – the determination of metal composition. The comparison of the analysis conducted on corrosion-damaged surfaces of the items and samples, taken from "the body" of an item, revealed that tin content results are generally comparable [Saprykina 2016, 196].

Spectral Analysis of Bronze Items

As shown in Table 1, all the analyzed items from hoard finds have very similar chemical composition, their main elements are tin, lead, arsenic and antimony (whole or close to whole percentage). In the vast majority of samples, tin is present in tenths or hundredths of percentage and only in two samples there are traces or no tin at all. Silver is stably present in tenths (except for no. 1886), as is nickel. The graph of correlation dependence of such pairs of elements as tin-lead, tin-arsenic, tin-antimony and nickel-cobalt testifies that metal from Biryuky village belongs to composite tin-lead-arsenic-antimony alloys as all the pairs of elements manifest stable interdependence. The same interdependence can be observed in the graphs of arsenic-lead, arsenic-silver, arsenic-antimony, arsenic-nickel, and, partially, arsenic-zinc (fig. 8).

What conclusions can be drawn from the results of the analysis, taking into account the results of the previous research? According to Bartseva's research results, in the metal of pre-Scythian times from the territory of Ukraine the percentage of tin-lead-arsenic recipes is 10% of all identified by her. In fact, high additives of antimony (tenths of a percent) are usual for all the artificial recipes identified by her [Bartseva 1981, 9]. Concerning the bridle , new types of recipes (~3%) like tin-lead and tin-lead-arsenic bronzes were identified.

Lab no.	Item	Sn	Pb	Zn	Bi	Ag	Sb	As	Fe	Ni	Co	Cl	S	P
1873	Triangular plate	9.632	2.763	<0.095	-	0.342	0.868	0.573	0.117	0.266	0.062	0.342	0.042	2.233
1875	Triangular plate	17.94	2.564	<0.08	-	0.317	0.779	0.453	<0.072	0.249	<0.091	0.315	0.05	2.005
1876	spoke	8.622	2.753	trace	-	0.264	0.655	0.463	trace	0.283	<0.101	0.42	0.061	2.463
1877	spoke	12.356	1.888	<0,119	-	0.331	0.767	0.53	trace	0.284	<0.116	0.222	0.043	4.791
1878	spoke	8.895	1.969	<0,094	-	0.374	1.058	0.585	0.21	0.327	<0.114	0.482	0.048	1.779
1879	cheek-piece	13.624	4.124	0.14	-	0.27	0.654	0.947	<0.088	0.277	0.151	0.694	0.074	2.24
1880	plate	16.209	3.236	<0.086	-	0.499	1.367	0.621	1.615	0.122	trace	0.971	0.06	1.219
1881	plate	8.598	3.089	0.302	-	0.229	0.516	0.475	0.433	0.308	0.14	0.425	0.083	2.85
1882	plate	14.98	2.453	0.268	-	0.335	0.693	0.428	0.071	0.195	-	0.597	0.049	1.604
1883	plate	11.848	2.473	0.12	-	0.542	1.085	0.809	0.605	0.229	0.138	0.606	0.052	3.048
1884	plate	17.791	2.855	0.299	-	0.714	1.448	0.764	0.176	0.169	<0.093	0.492	0.048	1.916
1885	plate	15.131	2.522	0.175	-	0.288	0.68	0.54	<0.069	0.313	<0.092	0.35	0.059	2.256
1886	plate	12.134	2.611	0.141	-	-	1.103	0.622	<0.108	0.209	0.071	0.654	0.06	0.779
1887	plate	16.697	4.353	0.256	-	0.553	1.38	0.828	0.448	<0.117	<0.104	0.699	0.081	2.292
1888	plate	11.256	3.222	0.118	-	0.378	1.067	0.787	trace	0.303	<0.098	0.528	0.069	1.903
1889	plate	14.641	2.41	0.162	-	0.321	0.703	0.42	trace	0.325	<0.108	0.293	0.061	2.455
1890	plate	13.65	2.486	0.054	-	0.388	0,924	0.605	<0.105	0.364	<0.106	0.734	0.066	0.82
1872	ornamented wheel	14.96	1.763	-	-	0.157	0.178	0.345	0.178	0.197	0.152	0.817	0.043	1.193
1874	triangular plate	17.076	0.985	<0.123	0.099	0.279	0.191	2.737	0.165	0.359	0.371	0.599	0.051	1.351

Table 1. Results of analysis of bronze items from hoard finds found near Biryuky village.

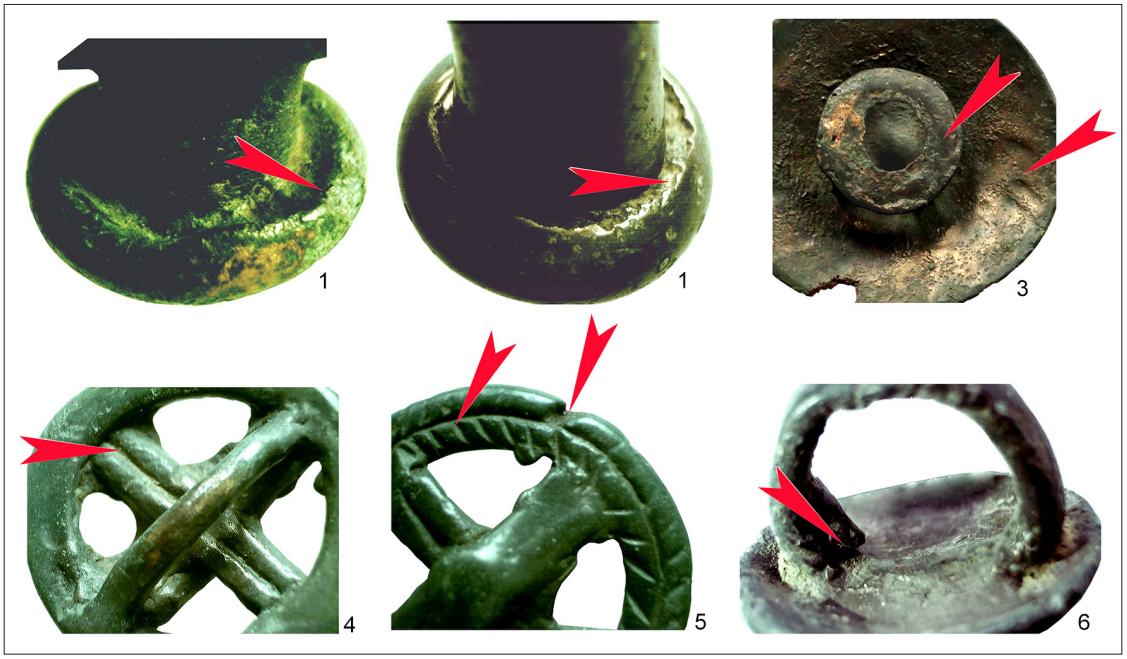

Fig. 7. Hoard of horse gear items from Biryuky: Traces of work with a wax model; 1-2 – heads of cheek-piece; 3 – plate; 4-5 – braided plate; 6 – glued seams between the loop and the hat on small plaques.

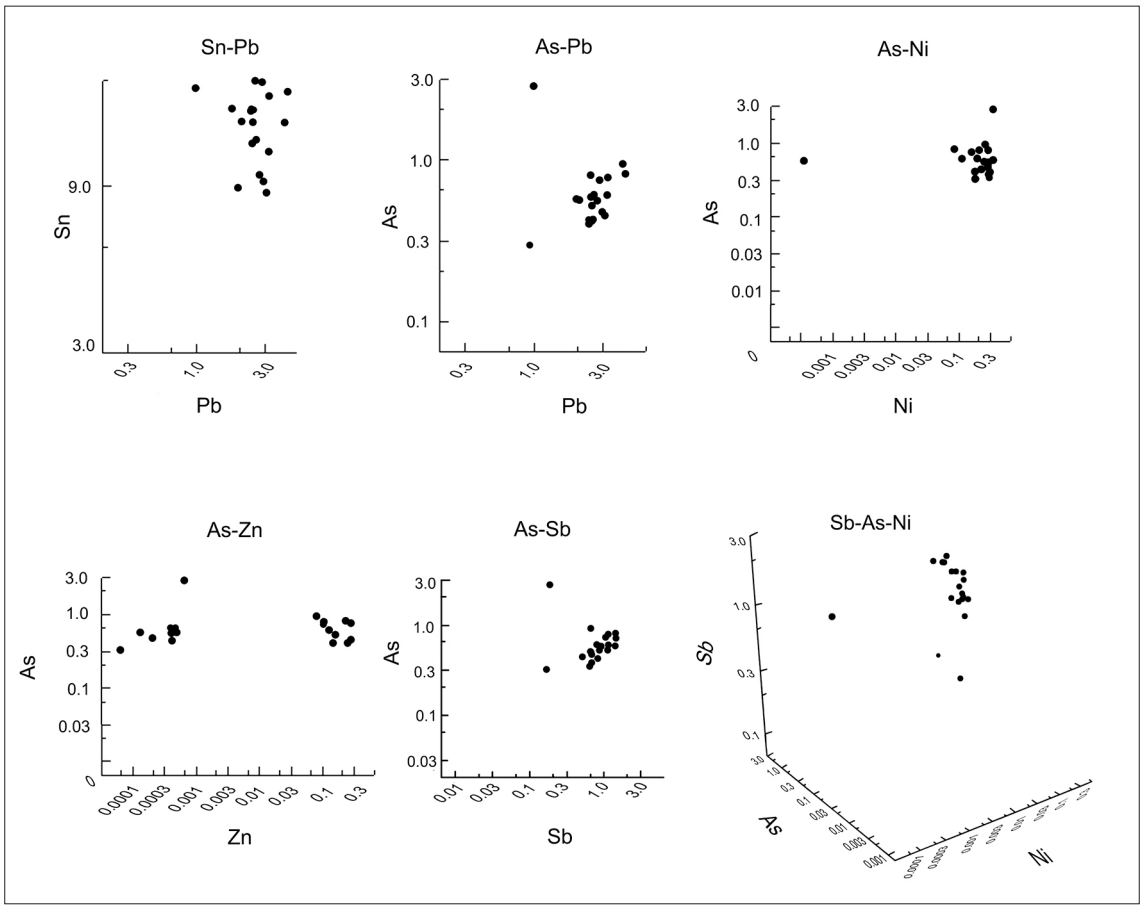

Fig. 8. Graphs of the correlation between the concentrations of some elements in the metal from Biryuky.

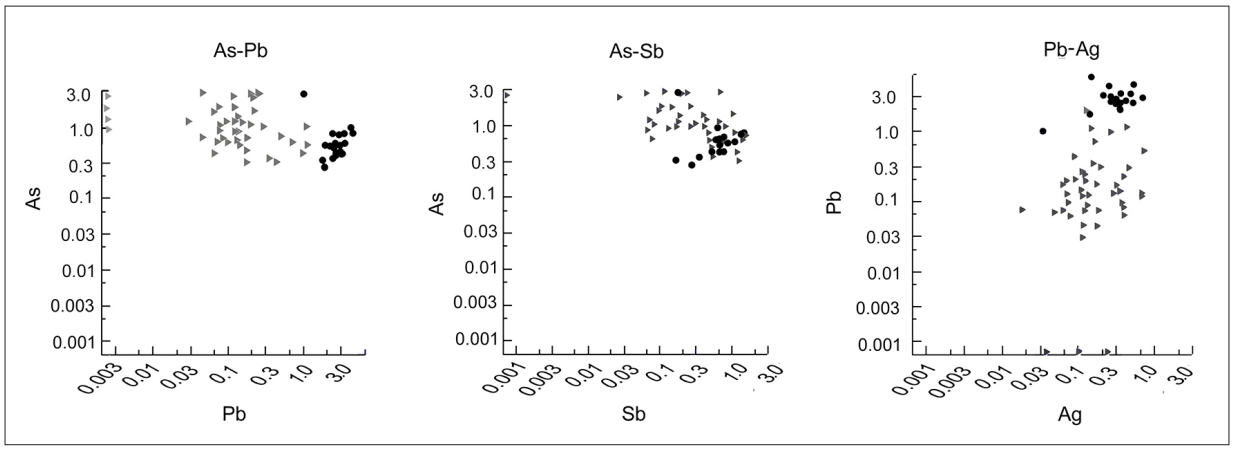

Fig. 9. Graphs of the correlation between the concentrations of some elements in the metal from Biryuky and Shyroke: ▹ - Shyroke; ● – Biryuky.

When comparing chemical and metallurgical features of monuments from Upper Dnipro and Kuban, full correspondence was not found [Bartseva 1981, 11]. That's why Bartseva came to the conclusion, that each of the compared regions had its own production [Bartseva 1981, 12].

Our search for the corresponding metal composition in Central Europe had no effect. However, it is clear, that Cimmerian metalwork could not come from nowhere and disappear likewise. In the current situation, we conducted a comparative analysis with the metal previously analyzed in our laboratory. Comparison of metal from Biryuky with the metal from the cemetery of Bilozerka Culture near Shyroke village in Kherson domain produced interesting results. Antimony is present in almost all the bonze samples from Shyroke. Sometimes it reaches as much as a whole percent (1.033-1.514%). Zink makes 2.298% in one occasion. There were complex tin-lead-antimony-arsenic alloys [Goshko 2019, 165] among identified metal compositions of bronzes from Shyroke.

The given correlation graphs of metal from Biryuky and Shyroke demonstrate interdependence of such pairs of elements as arsenic-lead, arsenic-antimony, tin-silver (Fig. 9). Besides simi-

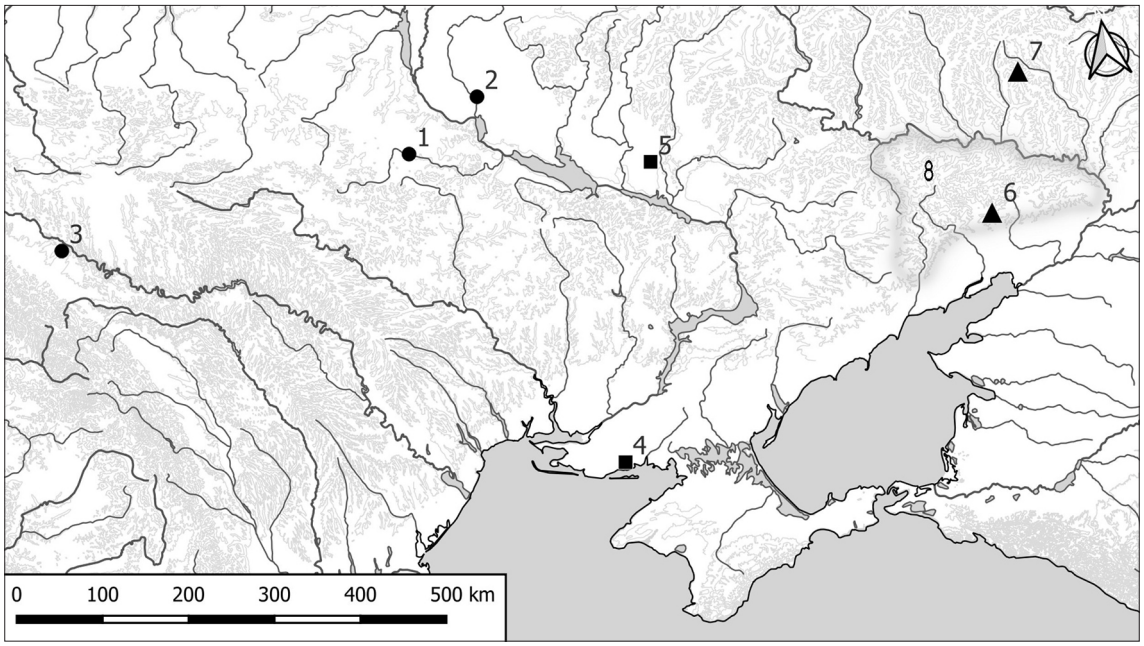

Fig. 10. Locations mentioned in the text: 1 –Biryuky; 2 – Lelyaky; 3 – Medynia; 4 – Shyroke; 5 – Butenky; 6 – Bobryky; 7 – Zhuravske; 8 – Naholniy ridge.

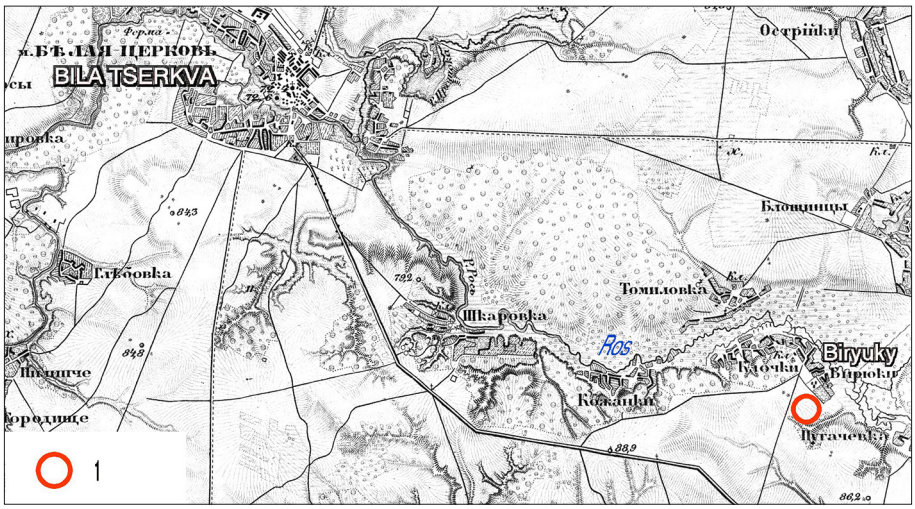

Fig. 11. Place, were the Biryuky hoard was found (1) marked on the map from 19th century (fragment of Shubert's map, List 24-8-1).

larities between two collections of the samples, there are also considerable differences manifested mainly in reduced concentration of a number of elements in metal from Shyroke – Zink (Zn), Lead (Pb), Nickel (Ni) and especially Ferrum (Fe). Complex presence of arsenic, antimony, zink in bronze alloy (all the metal from Biryuki and partially metals from Shiroke) can be explained by the use of fahlore (general formula Cu12(Sb, As)4S13). In Ukraine such ores are present in Nagolniy ridge in Lugansk domain (admixed with Fe, Ag, Zn, Mn, Ni, Bi, As). Archeological literature has already discussed the probability of these ores usage [Demchenko et al. 2000, 43-44]. Thus, laboratory studies prove the reality of such possibility.

Based on researches of V.O. Pazuhin, which prove the possibility of obtaining antimony-arsenic bronze with different concentration via joint melting of arsenic pyrite, red arsenic ore, and gray antimony ore, Tatarinov was prone to think "that Donetsk mining and metallurgy center produced not only "chemically" pure copper, but also arsenic, antimony and arsenic-antimony bronzes. Then, he believes, this so-called "primary copper" was alloyed with tin and so bronze with very unusual double alloy of tin and arsenic was produced" [Tatarinov 2018, 68].

Summing up the above, we note that the metal for casting all the bronze details of horse-gear from the hoard finds, most probably, comes from Naholniy ridge deposits (fig. 10,8).

Spectral Composition of Silver Items

Silver items of this period are quite rare finds, as well as the study of their composition. Therefore, concerning three silver slotted wheels, it is impossible to determine the origin of the silver, for now. Table 2, with the results of analysis of silver wheels from Biryuky village, demonstrates high content of copper from 4.345 to 4.587% (lab. №1869, 1870), as well as the presence of bismuth (0.082, 0.124%) and gold in tenths of percent in two analyses and the lead. It allows the suggestion that silver also comes from mines of Nahol-

Lab no.	Item	Ag	Cu	Bi	Au	Sn	Pb	Zn	Sb	As	Fe	Ni	Cl	S	P
1869	Slotted wheel 1	92.297	4.345	0.082	-	-	-	<0,027	-	-	0.098	-	0.763	0.086	0.24
1870	Slotted wheel 2	90.394	4.587	0.124	0.219	-	0.044	trace	-	-	0.227	-	2.708	0.124	0.273
1871	Slotted wheel 3	76.089	11.352	0.069	0.168	8.259	0.252	trace	0.412	0.532	0.394	trace	0.479	0.032	0.94

Table 2. Results of analysis of bronze items from hoard finds found near Biryuki village.

niy ridge with its well-known Bobrykivske and Zhuravske deposits. These are the deposits where silver occurs in association with sphalerite (mineral Zink), chalcopyrite (copper-pyrite with Zink 1%), bournonite (CuPbSbS3), fahlore (Cu12(Sb, As)4S13) and boulangerite (Pb5Sb4S11).

The metal of wheel 3 (lab. an. #1871), with high content of copper (11.352%) and tin (8.259%), most likely, is re-melt of other goods.

Conclusions

The discovery of the Cimmerian times "hoard" with details of horse-gear near Biryuki village in the Middle Upper Dnieper region is rather a distant east point on the archeological map of the spreading of Carpathian type goods. A hoard finds of similar items was discovered further to the East in this region, near Lelyaki village.

The Middle Upper Dnieper region, taking into account the archeological map marked with different finds of that period, seems to be a border region between territories controlled by Cimmerians from the South and by Hallstatt from the North. This probable borderline is outlined both by finds of details of riding horse gear and weapons of Cimmerian and Hallstatt origin correspondingly [Metzner-Nebelsick 2002, Abb. 105, 167]. The same maps reveal that specific Cimmerian types of horse-gear and weapons came to Central Europe mostly from the South, through steppe territory, further North via Danube.

Similar alloy compositions were not known in Central Europe. Thus, silver and bronze items could be manufactured from the raw materials coming from the regions further to the East, namely from Naholniy ridge in Luhansk region (Ukraine). It could be proved that this horse-gear, similar in type to the items from the Carpathian region, was produced in Upper Dnieper region, most likely in the 8th century B.C.

Given the relatively early period (at least from the 9th century B.C.) of spreading similar riding horse gear in the Carpathian region, we can assume, that the expansion of Hallstatt culture to the East could be one of the consequences of emergence of own horse cavalry there. The limits of such an expansion may be determined, in particular, by such hoard finds as the ones found near Biryuki and Lelyaki villages.

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