

*Categoria A*

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**Mykhailo Videiko, Tetiana Hoshko**

## **Early Medieval truncated spheroid weights: metrology, marking, chronology and territory of distribution**

**Key words:** truncated spheroid weights, Rus, metrology, marking, chronology, territory.

**Cuvinte cheie:** greutateți trunchiate sferoidale, Rus, metrologie, marcare, cronologie, teritoriu.

**Ключевые слова:** сфероидные гири, Русь, метрология, маркировка, хронология, территория.

*Mykhailo Videiko, Tetiana Hoshko*

### **Early Medieval truncated spheroid weights: metrology, marking, chronology and territory of distribution**

This study is a continuation of the previous one, in which information about the chemical composition of weights was published [Goshko, Videiko 2023]. The collection of weights originates from finds made in the historical and geographical area of Ukraine and transferred during 2018-2023 to the Archaeological Museum of the “Borys Grinchenko” Kyiv University in Kyiv. Below, we will focus on metrology, the sign system, chronology, and the area of distribution of truncated spheroid weights from this collection. This information can be useful for studying the history of the region in the 10th and 11th centuries. It can refer not only to trade, but also to the tax system and the spreading of power of the Kyiv princes in this period.

*Mykhailo Videiko, Tetiana Hoshko*

### **Greutăți trunchiate sferoidale medievale timpurii: metrologie, marcare, cronologie și teritoriu de distribuție**

Acest studiu este o continuare a celui anterior, în care au fost publicate informații despre compoziția chimică a greutateților [Goshko, Videiko 2023]. Colecția de greutateți provine din descoperiri făcute în zona istorică și geografică a Ucrainei și transferate în perioada 2018-2023 la Muzeul de Arheologie al Universității „Borys Grinchenko” din Kiev. În continuare, ne vom concentra asupra metrologiei, a sistemului de semne, a cronologiei și a ariei de distribuție a greutateților tronconice sferoidale din această colecție. Aceste informații pot fi utile pentru studierea istoriei regiunii în secolele X și XI. Ele se pot referi nu numai la comerț, ci și la sistemul fiscal și la răspândirea puterii prinților din Kiev în această perioadă.

*Михаил Видейко, Татьяна Гошко*

### **Раннесредневековые сфероидные гири: метрология, маркировка, хронология и территория распространения**

Данное исследование является продолжением предыдущего, в котором были опубликованы сведения о химическом составе гирек [Гошко, Видейко 2023]. Коллекция состоит из находок, сделанных в историко-географической зоне Украины и переданных в течение 2018-2023 годов в Археологический музей Киевского университета имени «Бориса Гринченко» в Киеве. Ниже мы остановимся на метрологии, знаковой системе, хронологии и ареале распространения сфероидных гирь из этой коллекции. Эта информация может быть полезна для изучения истории региона в X-XI веках. Речь может идти не только о торговле, но и о налоговой системе и распространении власти киевских князей в этот период.

### **Research directions and characteristics of findings**

This study is a continuation of the previous one, in which information about the chemical composition of medieval weights was published [Goshko, Videiko 2023]. The collection of weights originates from finds made in the historical and geographical area of Ukraine and transferred during 2018-2023 to the Archaeological Museum of the Borys Grinchenko Kyiv University in Kyiv. This article is about metrology, marking, chronology and the territory of distribution of truncated spheroid weights. A total of 71 finds were taken into account (fig. 1-7). These weights come from six regions of Ukraine (table 1, fig. 1).

The systematization and research of these materials is of interest for the following reasons. The most common information about truncated spheroid weights is from burials. On the territory of Ukraine, similar finds were made in Shchestovyt-sa cemetery and other burials [Skorokhod 2010, table 1]. They are already included in various catalogs [Zhukovski 2019]. Materials from settlement sites are much more difficult to take into account.

Information about new finds of truncated spheroid weights on the territory of Ukraine can be found in various publications. Since the 19th century, truncated spheroid weights have been an object of collection and there is a problem with

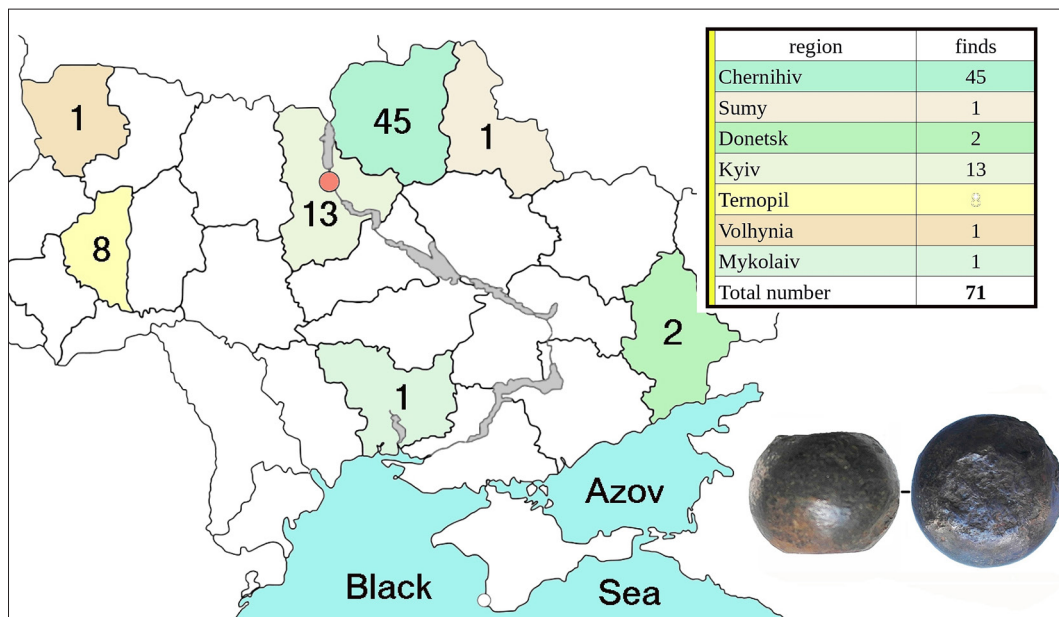


Fig. 1. Distribution of truncated spheroid weights by regions (based on table 1).

determining the location and context of the finds. A good example is one of their first publications, carried out in 1898 by K. Bolsunovski [Bolsunovski 1898].

Existing publications do not always contain complete information about such finds. For example, from the two truncated spheroid weights, found in Vyshhorod, the weight was determined for one [Bibikov et al. 2016, 34-35, Fig. 1]. In cases where the weight is mentioned in the publication, there may be no information about the dimensions of the products. In many cases, there are no illustrations and information about the state of preservation of the weights [Skorokhod 2010, table 1; Motsia, Skorokhod 2020, 177-178, table 7]. Cataloging and studying finds of spheroid stones from the territory of Ukraine based on such publications does not seem like an easy task.

Thus, a complete publication of this collection of truncated spheroid weights, with regard to its abundance and geographical distribution, may be useful (fig. 1-8; table 1-2). This information may be used to study the territory and time of their spreading. The collected information will also be useful for studying possible aspects of their application.

Next, the metrology of truncated spheroid weights (size and weight), marking, chronology and information about the territory of distribution will be considered. All information about

weight and dimensions is collected in Table 1. Table 2 organizes information about the spheroid weights that were found together.

#### Metrology of truncated spheroid weights

In this section, two parameters will be considered: dimensions and weight of items (table 1). The characteristics of the weight sets are also given (table 2).

The dimensions of weights are measured according to their actual condition. They may differ from the original due to corrosion. Therefore, information about the preservation and condition of the  $\mu\pi\alpha\pi\pi\epsilon\iota$  is also indicated in table 1. The dimensions are included in the interval: 13-31 mm - diameter; 11.5-19 mm - height. Information about the sizes of weights can be used in the future to reconstruct the parameters of this items [for example, Schultzén 2011].

The weight of truncated spheroid weights cannot be fully investigated due to corrosion of the iron component. Some items were cleaned of corrosion. This could also change their starting weight. The weight of items in the collection ranges from 8.44 to 98.77 g (table 1, fig. 7). According to the current weight, 9 groups are defined (fig. 7). The characteristics of the groups in order of increasing weight are as follows: 8 g, 10-12 g, 14-17 g, 20-24 g, 27-32 g, 37-42 g, 53 g, 60, 98-99 g. The graph of the distribution of finds by

Table 1. Parameters and place of findings of truncated spheroid weights.

Inventory number	Set number	Body diameter mm	Height mm	Diameter of the pads mm	Weight grams	Condition	Place of discovery
19	Set 1	20,3	17,5	13	<b>39,43</b>	Corrosion, cleaned	Chernihiv region, Nizhyn
20		19	14,5	12/10	<b>23,13</b>	Corrosion, cleaned	
21		17,3	~12	10	<b>14,8</b>	Corrosion, cleaned	
22		16	10,5	10,5	<b>12,44</b>	Corrosion, cleaned	
24	Set 2	~25	~19	~15	<b>53,3</b>	Corrosion,iron oxides, cleaned	Chernihiv region
25		19	15	~12	<b>23,77</b>	Corrosion,iron oxides, cleaned	
26		~17	-	~10	<b>16,95</b>	Corrosion,iron oxides, cleaned	
27		16,5	11,5	~12	<b>15,39</b>	Corrosion,iron oxides, cleaned	
28		16	12	~11	<b>15,57</b>	Corrosion,iron oxides, cleaned	
29		16	14	~10	<b>15,76</b>	Corrosion,iron oxides, cleaned	
30	Set 3	21	15,5	13	<b>30,89</b>	Corrosion, cleaned	Chernihiv region
31		23	18	~12,5	<b>38,83</b>	Corrosion, cleaned	
32		20	18	~10,5	<b>32,01</b>	Corrosion, cleaned	
33		17	?	?	<b>15,22</b>	Corrosion, cleaned	
34		17,5	13,5	~9	<b>16,39</b>	Corrosion, cleaned	
35		15,5	11,5	9	<b>11,76</b>	Corrosion, cleaned	
36	Set 4	31	25	~17	<b>98,77</b>	Corrosion, cleaned	Chernihiv region
37		22	~15	~13	<b>41,75</b>	Corrosion, cleaned	
38		22	~19	~12	<b>37,99</b>	Corrosion, cleaned	
39		22	18	~13	<b>38,99</b>	cleaned	
40		~21	~18	~12	<b>27,79</b>	cleaned	
41		21	~17	~12	<b>30,16</b>	Corrosion, cleaned	
42		21	~17	~13	<b>30,58</b>	Corrosion, cleaned	
43	Set 5	26	19	~18	<b>60,13</b>	Corrosion,iron oxides, cleaned	Chernihiv region
44		18	15	~11	<b>23,26</b>	Corrosion,iron oxides, cleaned	
45		19	-	-	<b>18,51</b>	Corrosion,iron oxides, cleaned	
47	Set 6	20	18,5	~11	<b>30,36</b>	Corrosion,iron oxides, cleaned	Chernihiv region
48		20	15,5	~12	<b>26,4</b>	Corrosion,iron oxides, cleaned	
49		17	?	~10	<b>15,07</b>	Corrosion,iron oxides, cleaned	
50		15	12,5	8	<b>10,8</b>	Corrosion,iron oxides, cleaned	

51	Set 7	19,5	15	12	<b>20,46</b>	Corrosion, iron oxides, cleaned	Chernihiv
52		18	17	10	<b>22,52</b>	Corrosion, iron oxides, cleaned	
53		18	~ 15	11,5	<b>21,34</b>	Corrosion, iron oxides, cleaned	
54		~23	~18,5	??	<b>35,29</b>	Corrosion, iron oxides, cleaned	
55		21,5	~16,5	13	<b>30,91</b>	Corrosion, iron oxides, cleaned	
56		18,5	~15	12	<b>22,78</b>	Corrosion, iron oxides, cleaned	
61		22	18,5	15	<b>42,84</b>	Corrosion, cleaned	
62		21	17	11	<b>30,56</b>	Corrosion, cleaned	Chernihiv region, Kozeletz
76	Set 8	22,1	17,1	12,5/11,2	<b>31,57</b>	Corrosion, a lot of iron oxides	Chernihiv region, Talalaivka
77		21,5	17,2	11,2/12	<b>31,5</b>	Corrosion, a lot of iron oxides	
78		18,3	15,9	9,2/11,9	<b>24,14</b>	Corrosion, iron oxides	
79		21,5	16,2	9,2/	<b>29,4</b>	Corrosion, a lot of iron oxides	
80	Set 9	17,1	13,9	9,1/9	<b>15,20</b>	Corrosion, a lot of iron oxides	Chernihiv
81		17	12,9	12/10,9	<b>14,75</b>	Corrosion, a lot of iron oxides	
82		22,1	19	11,9/10,9	<b>34,77</b>	Corrosion, a lot of iron oxides	Chernihiv region
65	Set 10	22,1	19,5	damaged	<b>32,27</b>	Corrosion, iron oxides, cleaned	Donetsk region, Dobropillya
66		23	17,1	13/13	<b>38, 23</b>	Corrosion, iron oxides, cleaned	
88		22,2	17,5	11,5/12	<b>39,05</b>	Corrosion, a lot of iron oxides	Sumy region, Glukhiv
23		20,5	17	10,5	<b>32,89</b>	Corrosion, iron oxides, cleaned	Mykolaiv region
75		19,4	15,9	11,5/11,2	<b>25,48</b>	cleaned	Kyiv region, Rizhky
83		21,2	16	13,1/13	<b>32,28</b>	Corrosion, a lot of iron oxides	Kyiv region, Ukrainka
84		20,6	16,5	11,5/12.1	<b>31.01</b>	Corrosion, iron oxides	Kyiv region, Brovary
85		20,5	15	13/?	<b>29,00</b>	Corrosion, iron oxides, cleaned	Kyiv region, Slavutych
86	Set 11	12,9	11	8/8	<b>8,3</b>	Corrosion, iron oxides, cleaned	Kyiv region, Yagotyn
87		21,9	15,6	12,5/12,5	<b>30,09</b>	Corrosion, iron oxides, cleaned	
92		20,1	16	12,5/12	<b>32,48</b>	Corrosion, a lot of iron oxides	Kyiv region, Brovary



57	Set 12	20	~16	12	<b>30,25</b>	Corrosion, iron oxides, cleaned	Kyiv region, Bala Tserkva
58		15	12	9	<b>11,05</b>	Corrosion, iron oxides, cleaned	
59		23	17	14	<b>37,76</b>	Corrosion, cleaned	Kyiv
60		13	11,5	8	<b>8,44</b>	Corrosion, cleaned	Kyiv
70	Set 13	22,1	15	11/11	<b>38,98</b>	Corrosion, iron oxides	Kyiv region, Brovary
71		20,2	17,1	9/8,9	<b>38,89</b>	Corrosion, iron oxides	Kyiv region, Brovary
67	Set 14	19,2	13,9	13/12	<b>23,71</b>	cleaned	Ternopil region, Shumsk
68		21,9	18	11/12	<b>38,63</b>	cleaned	
69		18,5	15,5	10,3/12	<b>23,54</b>	cleaned	
72	Set 15	19	12	12/11	<b>24,02</b>	Corrosion, iron oxides	Ternopil region, Ostrivets
73		23	17	12,1/11	<b>38,98</b>	Corrosion, iron oxides	
74		22	19	11/11	<b>37,70</b>	Corrosion, a lot of iron oxides	
90	Set 16	16,5	13	8/8,8	<b>16,96</b>	Corrosion, a lot of iron oxides	Ternopil region, Ostrivets
91		-			<b>38,97</b>	Corrosion, iron oxides	
89		19,9	17,5	11,2/10	<b>25,61</b>	Corrosion, iron oxides	Volyn region, Dubova

quantity shows the most common weights. These are groups in the range between 14-17 and 37-42 grams (fig. 7).

In the collection, 16 conditional sets of kettlebells are selected as they are received. There are from seven to two finds in each of them (table 2). There are mostly sets of two items, there are six of them. The total weight of these sets varies. It ranges from 29.95 to 77.87 g. There are three sets of 3 weights, their total weight is 101.9, 85.88 and 100.7 g. There are also three sets of 4 weights in the collection, their total weight is 89.8 g, 82.63 g and 116.61 g. These conditional sets are clearly incomplete, unlike those with 6-7 weights.

There are three sets of 6 weights, the total weight of which is 140.74 g, 145.1 g, 153.3 g. This roughly corresponds to the weight of the "Kyiv hryvnia" of 140-160 g.

The largest set contains seven items with a total weight of 305.97 grams. It includes the heaviest find in the collection weighing 98.77 grams. Without it, the weight of this set is 207.27 g. This weight generally corresponds to the "Novgorod" silver hryvnia (209 grams) and is slightly larger than the "Chernihiv" hryvnia (204 g).

Thus, four sets can be considered conditionally complete. Three of them have 6 weights, and

one has seven. Using such sets it was possible to weigh silver in the equivalent of "Kyiv" (3 sets) and "Novgorod" or "Chernihiv" hryvnias (207-204 g).

Researchers associate the weight system of spheroid weights with a common weight unit in the Scandinavian countries called ertog/ørep [Pedersen 2008, 140-144; Brather 2010]. Its ideal weight is about 8 grams. Truncated spheroid weights are known starting with a weight of 1/2 ertog [Pedersen 2008; Brather 2010; Schultzen, 2014]. From this point of view, the 10 types of truncated spheroid weights, are represented among the studied collection. Their weight approximately corresponds to values of 1, 1.5, 2, 3, 4, 5, 6.5 and 7 ertog. The most represented in the collection are weights in 2 (12 finds), 3 (13 finds), 4 (19 finds) and 5 (16 finds) ertog/øre (fig. 7).

Researchers associate this unit of weight (and truncated spheroid weights too) not only with trade. The opinion is that this items were used in the taxation system. This taxes in the 10th-11th centuries were collected in silver, which had to be weighed. Protected from forgery by the complexity of the manufacturing technology, the spheroid weights corresponded to this purpose [Pedersen 2008]. Perhaps the finds of some of these prod-

Table 2. Sets of truncated spheroid weights: quantity, metrological characteristics.

Set nr.	Inventory numbers/ pieces	8 gr.	10-12 gr.	14-17 gr.	20-24 gr.	27-32 gr.	37-42 gr.	54-60 gr.	98-99 gr.	The total weight of the set
Set 1	19-22 (4 pieces)		12,44	14,8	23,13		39,43			89,8
Set 2	24-29 (6 pieces).			16,95; 15,39; 15,57; 15,76	23,77			53,3		140,74
Set 3	30-35 (6 pieces)		11,76	15,22; 16,39		30,89; 32,01	38,83			145,1
Set 4	36-42 (7 pieces)					27,79; 30,16; 30,58	37,99; 38,99; 41,75		98,77	305,97
Set 5	43-45 (3 pieces)			18,51	23,26			60,13		101,9
Set 6	47-50 (4 pieces)		10,8	15,07	26,4	30,36				82,63
Set 7	51-56 (6 pieces)				20,46; 22,52; 21,34; 22,78	30,91	35,29			153,3
Set 8	76-79 (4 pieces)				24,14	31,57; 31,5; 29,4				116,61
Set 9	80-81(2 pieces)			15,20; 14,75						29,95
Set 10	65-66 (3 pieces)					32,27	38, 23			60,5
Set 11	86-87 (2 pieces)	8,3				30,09				38,39
Set 12	57-58 (2 pieces)			11,05		30,25				41,3
Set 13	70-71 (2 pieces)						38,98; 38,89			77,87
Set 14	67-69 (3 pieces)				23,71; 23,54		38,63;			85,88
Set 15	72-74 (3 pieces)				24,02;		38,98; 37,70			100,7
Set 16	90-91 (2 pieces)			16,96			38,97			55,93
quantity		1	3	13	11	16	9	2	1	56 pieces

ucts on the territory of Rus are connected with the collection of taxes. There in the 10th century the formation of the taxation system was also taking place. It was established by princes related to

Scandinavian countries by origin [Androsyshuk 2022, 76-88]. It is not by chance that sets of stones were found in the burials of the cemetery in Shestovytsia. These burials are associated with



Fig. 2. Truncated spheroid weights 19-30 (numbers from table 1).

soldiers of Scandinavian origin [Skorokhod 2010]. They could be involved in tax collection.

The following regularity attracts attention. The weight of many truncated spheroid weights does not correspond to the “ideal” in the direction of excess (table 1). These are well-preserved weights with minimal losses. At the same time, they are marked according to the established “ideal” weight. This circumstance may have a good explanation if weights were used for tax collection. In this case, the difference between the established “ideal” weight of silver and the actual collected weight would always be in favor of the collector or/and his patron.

### Marking of weights

The flattened sides of the weights have a diameter of 8 to 18 mm. Some items have multiplicity markings on the flattened side (fig. 2-6; 8). It is mostly preserved on one side, while the other is damaged by active corrosion.

A punch and two types of tools were used to mark the multiplicity and rim around the perimeter of flat surfaces. They had a hollow working end in the form of a concave truncated cone. These punches differ from each other in diameter (0,2 and 0,8 mm) and cone shape. On some crowbars, one tool was used to mark the multiplicity and the rim

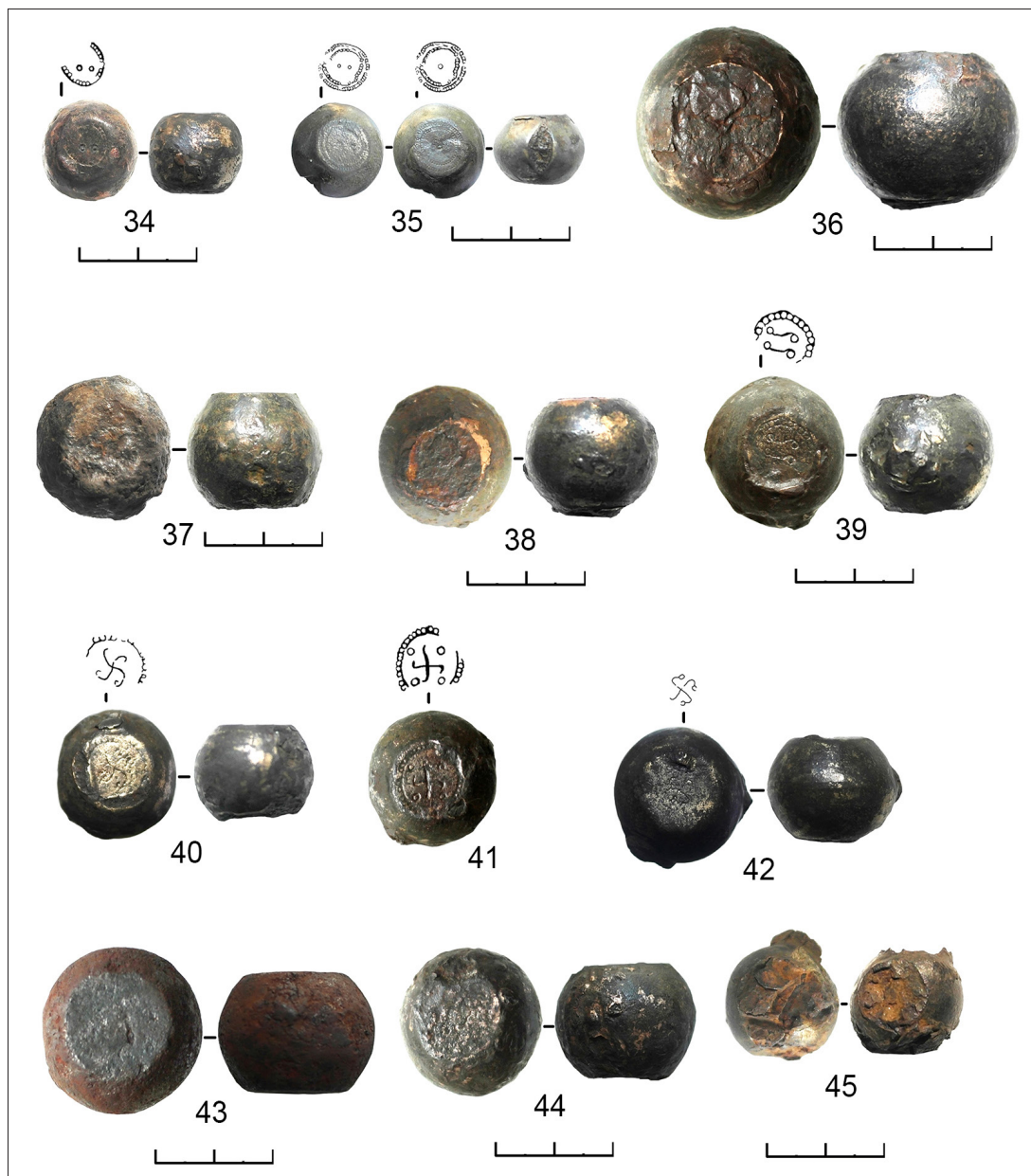


Fig. 3. Truncated spheroid weights 34-45 (numbers from table 1).

(weights 20-22; 41; 50, 61), on others – both. Tool and punch used on one item number 61.

Marking includes dots and lines. In some cases, the dots are connected by lines (fig. 8). In this way, various signs were formed. Two items (weights 22, 50) have asymmetrical markings. One dot is placed on one side, and two on the other (fig. 4). Weight number 35 is marked with a dot framed by two circles (fig. 4). In addition, a notch is made on the side to reduce weight (fig. 1).

Only two weights (29 and 34) are with 2-dot markings. The 4-dot marking was preserved on nine specimens (fig. 8, 23, 30, 32, 39, 40, 41, 42, 55, 62). Mark-

ing with 5 dots is placed on one weight number 19 (fig. 8). In two cases, the dots are connected in pairs by wavy lines (fig. 4, 39, 62). On the weight number 41 the dots are separated by a swastika (fig. 8). The rays of the swastika end with dots on three prongs (fig. 8, 30, 40, 42). The five dots on the weight number 19 are separated by three straight lines, which form a triangle in the center (fig. 4). There is one dot on the side surface of weight number 57 (fig. 8).

#### Chronology of products

Truncated spheroid weights are gener-

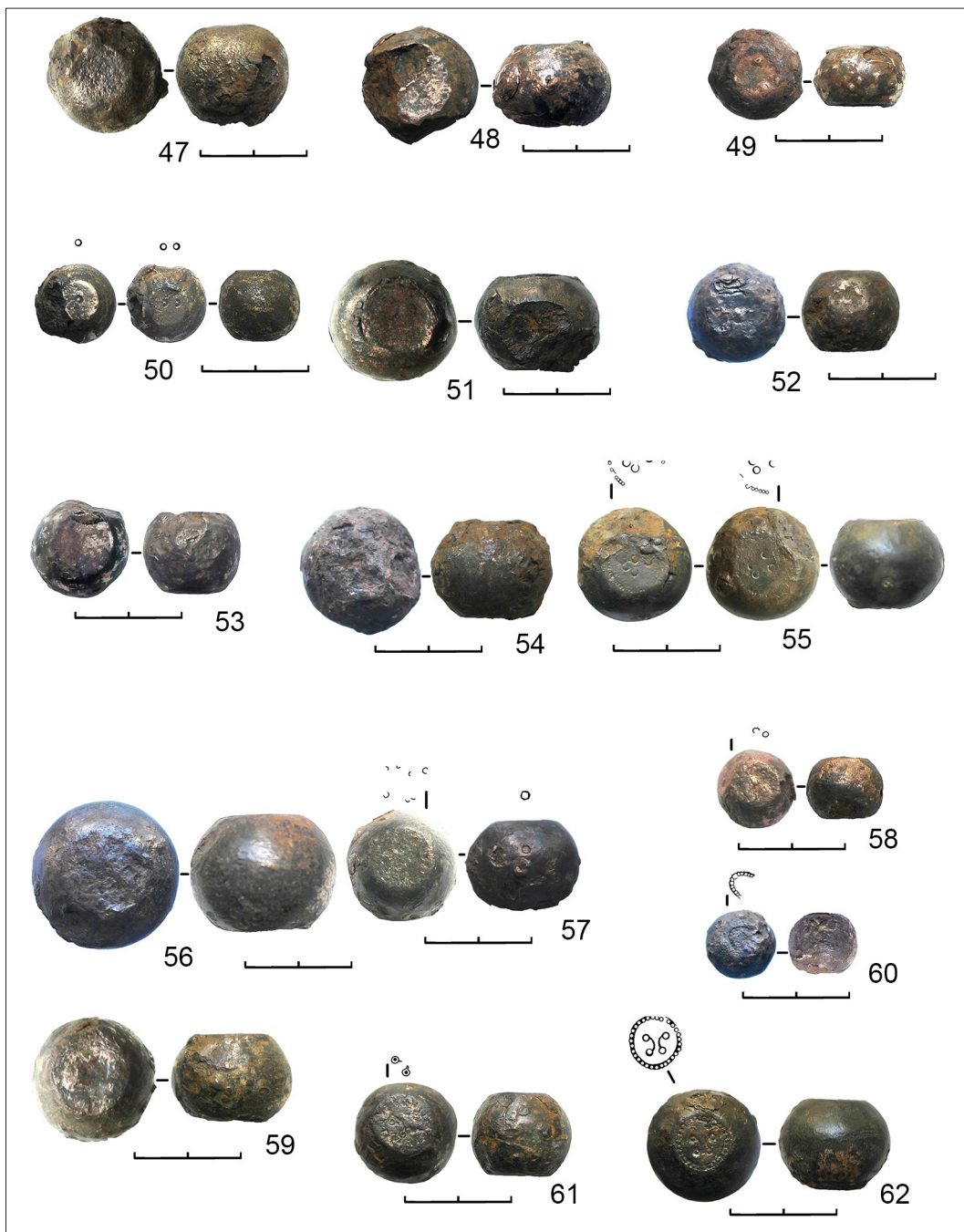


Fig. 4. Truncated spheroid weights 47-62 (numbers from table 1).

ally dated between the end of the 9th and 12th centuries [Steuer 1997]. In the absence in our case of any archaeological context, it is possible to try to determine possible dates by taking into account the markings on the weights.

Heiko Steuer's typology takes into account the stratigraphic position of the finds established during the excavations at the port of Schleswig [Steuer 1997; Steuer 2012]. According to the

marking, our collection includes three subtypes of type B: B1 early, B1 middle and B1 late.

B1 early hillocks date back to the end of the 9th-10th century. There are 12 of them in the collection (fig. 8, 25-29, 39-42, 46, 61, 62). Type B1 middle is represented by 9 finds (fig. 8, 20-21, 23, 32, 33, 34, 50, 55, 57). They can be dated to the late 10th-11th centuries. These dates can be extended to the sets that include these kettlebells (table 2).



Fig. 5. Truncated spheroid weights 65-70 (numbers from table 1).

Weight number 35 is marked with a dot framed by two circles (fig. 8). It can be attributed to the B1 late type. This type dates back to the 11th and 12th centuries. Item number 35 was part of a set of 5 weights (numbers 30-34). Weights 32-34 belonging to the B1 middle type. So, B1 middle and B1 late types coexisting in this set. Thus, this set from the Chernihiv region can be attributed to the 11th century.

It is clear, that the use of the typology of weights built on the excavations in Schleswig for the dating of finds from the territory of Rus should

be accepted with certain caveats. It is interesting, that the excavations in Schleswig proved the presence of contacts, possibly trade, with the territory of Rus. In particular, spinning wheels made of Ovruch pyrophyllite and ceramic eggs were discovered here (exposition of the museum in Gottorf Castle).

On the other hand, weights of these types were found in the burials of the Shestovitsa cemetery near Chernigov. Researchers date it to the 10th century [Skorokhod 2010]. This corresponds to the chronology of the B1early and B1 middle

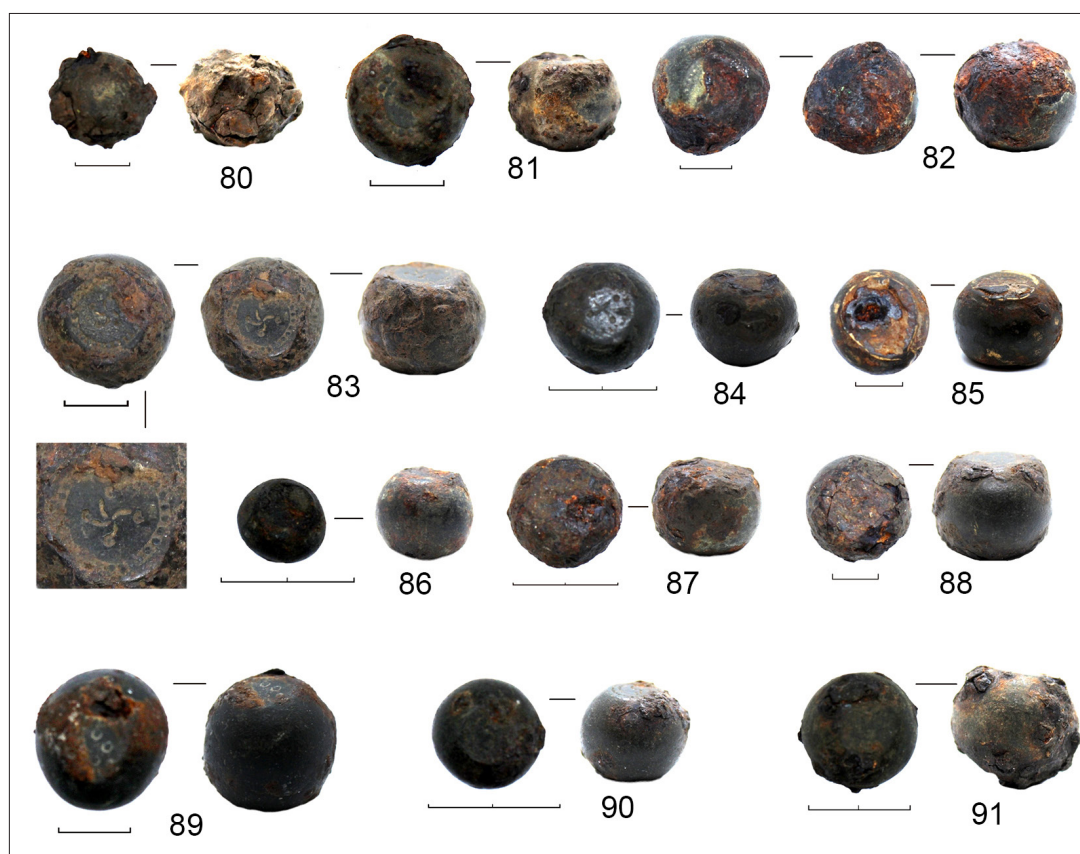


Fig. 6. Truncated spheroid weights 80-91 (numbers from table 1).

types from Schleswig. The presence of B1 late types among the finds makes it possible to extend the period of residence of spheroid truncated weights in the Chernihiv region by the 11th century. In general, the spheroid weights from the collection can be dated to the end of the 9th-11th centuries.

#### Distribution area

The collection of truncated spheroid weights presented in the publication includes 71 units. They are found mainly in Chernihiv (47) and Kyiv (11) and Ternopil (8) regions. Single finds from Sumy (1), Donetsk (2), Volyn (1), and Mykolaiv (1) regions (fig. 1).

As we can see, these finds are mainly concentrated within the boundaries of "Kyiv land" and the territory around Chernihiv (table 1). At the same time, most of the finds come from the Chernihiv region. This trend fully corresponds to the territorial distribution of already known finds of these items. Finds from these two regions are dated between the late 9th and 11th centuries. These lands in the 10-11 centuries. were the core

of the Rus, a state centered in Kyiv. It was here, according to the annals, that in the first half of the 10th century, Princess Olga organized the tax collection system. Before that she took control of the some territories west of Kyiv [Androshshuk 2022, 79-80]. In the Kyiv-Chernihiv region, weights from 1 to 12 ertog are presented. The set from the Chernihiv region (7 items) is the most complete in terms of weight. It was suitable for weighing large amounts of silver. Its capabilities included hryvnia weight units of Kyiv, Chernihiv and Novgorod types. The most numerous among those items are weights from 1.5 to 5 ertog.

The Ternopil region is next in number of finds – 8 samples. They come from three sets (3, 3 and 2 items in a set). These are weights of the B1 early type, dated to the 9th-10th century. Therefore, early truncated spheroid weights appear quite early so far from Chernihiv and Kyiv. A find from the Volyn region is territorially close to them. These sets feature weights of 2, 3, 4 and 5 ertog.

The connection of these finds with archaeological objects remains unknown. The results of ar-

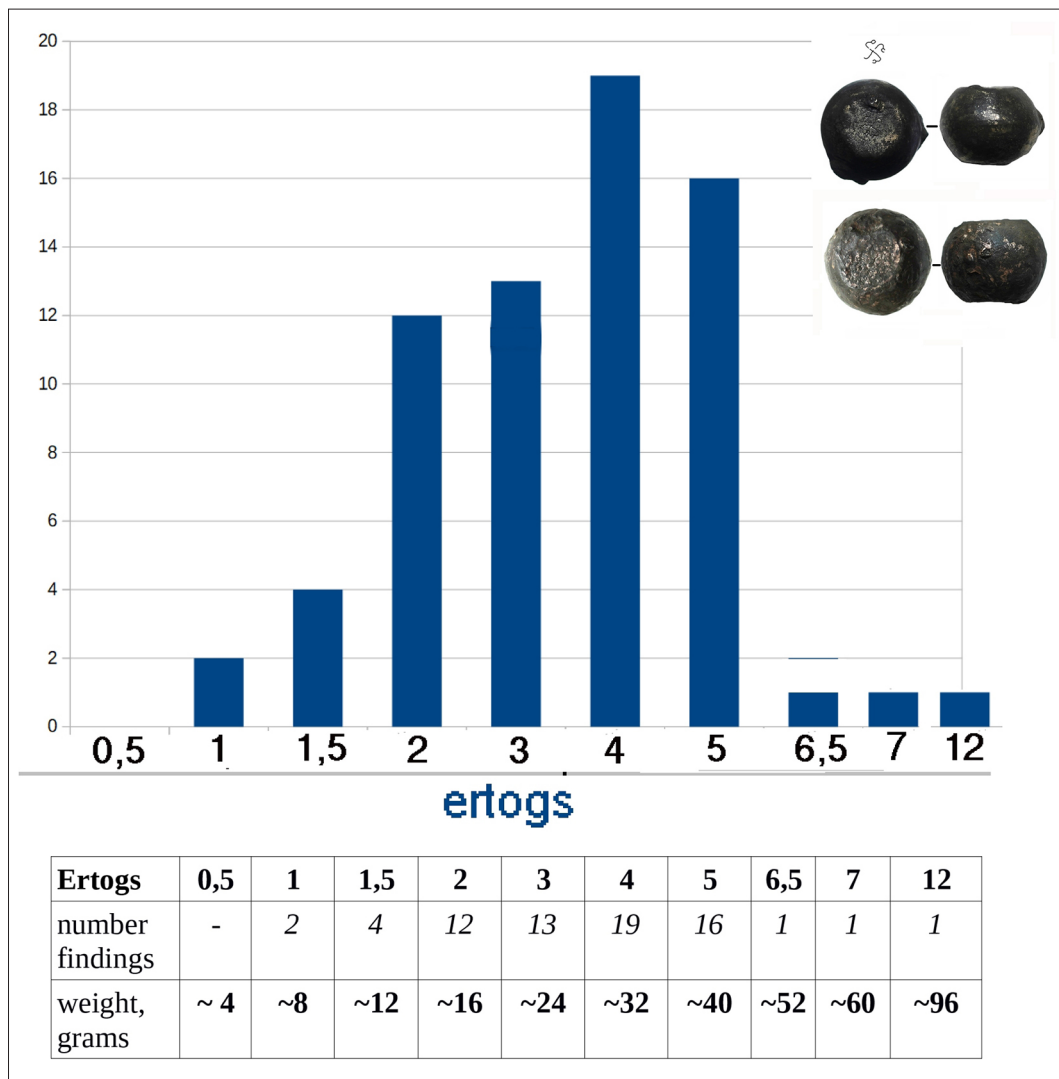


Fig. 7. Distribution of sets of truncated spheroid weights by weight.

archaeological excavations give an idea about them. Most of the finds of truncated spheroid weights come from cities such as Haithabu [Hilberg 2016] and Kaupang [Pedersen, 2008]. Similar items, but in smaller quantities, were found at the camp of the “Great Viking Army” in Britain [Hadley et al. 2016, fig. 49]. Another place of discovery is sets from burials or treasures [Shultzten 2014; Zhukovs’kii 2019; Skorokhod 2010]. In the region of Chernigov and Kyiv, finds of weights with a known context come from cities (Kyiv, Vyshhorod) and burials (Shestovytsia). Therefore, the weights from the collection are most likely related to these types of sites.

The Ternopil region is particularly interesting with its finds of 3 sets of truncated spheroid weights. The expansion of Kyiv princes to the west of the land of the Drevlians, according to chroni-

cle sources, dates back to the end of the 10th century. Then local cities were destroyed and new fortresses were built. The new government relied on them and military power. Also through this region in the 9th-10th centuries trade routes to the west passed, as evidenced by relevant finds. Among them are things of Scandinavian origin [Androshchuk 2022, 83-85].

If the sets of weights from the regions of Ternopil and Volyn are related to the taxation of the conquered territories, then there are two possibilities. The first possibility is the use of archaic sets with type B1 early until the end of the 10th century. The second possibility is to use them at an earlier time. This circumstance may be the evidence of some historical events, unknown from written sources.



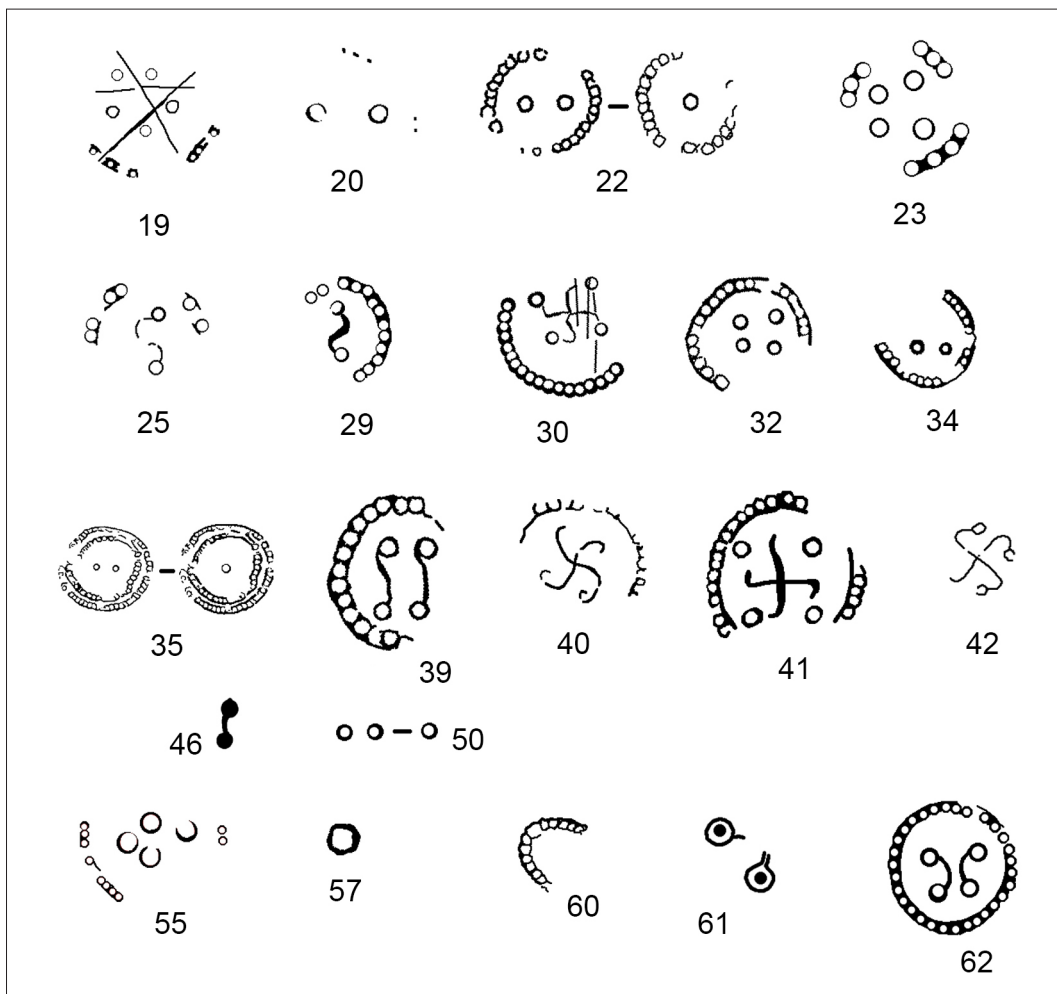


Fig. 8. Marks on truncated spheroid weights (numbers from table 1).

Finds from the Donetsk region (type B1 middle) are located on the border between the lands of Rus and the Khazar Khaganate. The find from the Mykolaiv region comes from the Dnieper Way, which was active in the 10th-13th centuries. In these cases, finds of truncated spheroid weights at these places can be associated with trade and/or military campaigns in the regions.

### Conclusions

The collection provided additional information on metrology, marking, chronology and the distribution of truncated spheroidal weights in the territory of Ukraine. The metrology is within the standard system for spheroidal weights. Not all types of differential weights are presented. The marking scheme corresponds to European standards of the late 9-10-11 centuries. The finds of spheroidal weights are represented by types that

can be dated to the 10th-11th centuries. A large part dates back to the 10th century. In all respects (technology, metrology, symbol system), these products correspond to spheroid weights, which were widely used in Europe during the Viking Age.

Most of the finds come from the territory that at that time was occupied by the state known as Rus with its capital in Kyiv. It is quite logical that this is where most of the finds come from (58 out of 71). Here they could be used for trade and tax collection. If so, then for a hundred years there was a steady need for a certain number of sets. As the analyzes of raw materials showed, at least part of these truncated spheroid weights could be produced in the Chernihiv region. This is evidenced by the use of swamp ore for the production of iron [Goshko, Videiko 2021; Goshko, Videiko 2023, 144]. Perhaps this is related to significant corrosion of products for which low-quality iron was used.

The territory on which the finds of weights were made is larger than the territory of the state with center in Kyiv. Three sets (a total of 8 finds) from the Ternopil-Volyn region may indicate early trading activity involving the Scandinavians. They

can also be considered as an indicator of the subordination of this territory to Kyiv at the end of the 10th century. Few finds in the south (Mykolaiv region) and east (Donetsk region) can be associated with trade and/or military activity.

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