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Steelyards from the Roman Collection of the Hungarian National Museum

Gergő Csongor Vincze

This paper describes 14 steelyards which belong to the Roman Collection of the Hungarian National Museum. The museum's inventory books mention a total number of 97 weights and 52 balances. A previous study examined 9 weights and 28 balances, out of which 14 were steelyards. Steelyards appeared in the Roman Empire from the 1st century BC. This new type of balance did not require standard weights for use and allowed a more rapid weighting process, but was not as accurate as the equal armed balances. This paper gives a short review of the research history of steelyards and a description of their function, followed by the presentation of the 14 steelyards mentioned above categorized using Norbert Franken's typology.[1]

Research history

After the invention of equal arm scales around 5500 BC, there were no significant developments in how weight was measured until the invention of unequal armed balances in the Hellenistic period. Steelyards, based on the law of the lever, appeared in large numbers starting from the 1st century BC in the Roman Empire. As compared to equal arm scales, steelyards do not require standard weights as they use their own calibrated counterweight. This results in a more rapid, albeit less accurate, method to measure the weight of objects.

Numerous steelyards were discussed in publications around the world dating back to the 19th century. These steelyards included in the collections of different museums came from various sources, some were found at archaeological sites, others were purchased from or donated by private collectors.

Oskar Paret was the first to describe how the steelyards functioned.[2] Examining steelyards found in Italy, Mario Lazarini distinguished three main types of unequal arm scales, depending on whether the suspension of the balance beam (bismars) or the suspension of load or the suspension of the counterweight was moving (Roman scales or steelyards). He divided Roman scales into further three groups depending on the number of suspension points these had (one, two or three).[3]

More detailed studies were published in the second half of the 20th century. Alfred Mutz examined the weights and scales in August and Kaiseraugst in Switzerland. He developed a method to determine the measuring range of steelyards based on their proportions and length[4] , although his methodology was later found to be incorrect by Zsolt Visy.[5] Hans R. Jenemann aimed to date and describe the evolution of Roman steelyards by examining the development of suspensions

1 Franken 1993.
2 Paret 1939.
3 Lazarini 1948.
4 Mutz 1983.
5 Visy 1992, 65.

 DOI: https://doi.org/10.37790/anhs.1.4

and the improvement of sensitivity.[6] Norbert Franken created a typology of Roman steelyards by examining the change in their shape instead of their metrological features throughout the Roman era.[7]

Through a thorough examination of a Roman steelyard in the collection of the Museum of Szentes (Hungary), Zsolt Visy established a mathematical formula which can be used to determine the measuring ranges of individual scales.[8] Previously, this could only be done by carrying out measurements with the scales themselves, the feasibility of which is largely dependent on their state of preservation or restoration. Visy's formula proved to be useful, for instance, in the study of a heavily corroded Roman iron steelyard from Schönberg in Austria, as described by Karl Oberhofer.[9]

Statera, the Roman steelyard

The Roman steelyard (*statera romana*) was a type of unequal arm balance which determined the weight of the load using a movable running weight. Vitruvius described how it worked in the tenth book of *De Architectura*[10] and similar balances were still in use around the Mediterranean in the last century.[11]

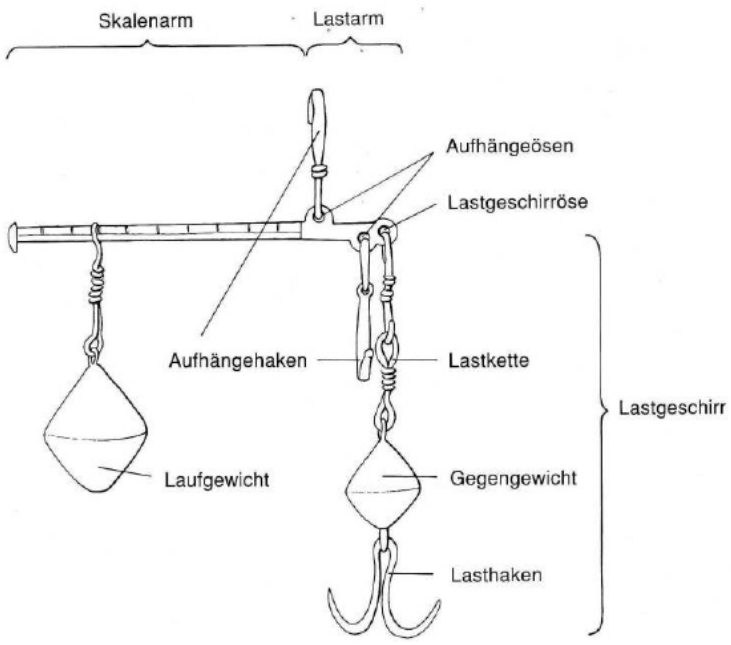


Fig. 1 Schematic representation of a Roman steelyard (after Franken 1993, 71, 1)

6 Jenemann 1989.
7 Franken 1993.
8 Visy 1978-1979.
9 Oberhofer 2003.
10 Vitruvius 10.3.4.
11 Siebert 1973, 581. fig. 28.

The design of the Roman steelyard is simple (*Fig. 1*).[12] The balance beam consists of two parts: the longer scale arm and the shorter load arm. At the end of the load arm is the suspension of the load which has two variants, either two lines of chain ending in hooks or three or four lines of chain holding a pan. The suspension points of the balance beam were also found on the load arm, normally two or three of these, rarely one.[13] The scale arm had graduations on its sides relating to the suspensions of the balance beam, which were marked by notches and Roman numbers. Different scales allowed measuring weight in different weighting ranges. The scale arm usually had a rhombic cross section rotated by 45° to the rectangular cross section of the load arm. The running weight hung from the scale arm and moved on its edges. The end of the scale arm usually had a round or rhombic shaped top that stopped the weight from falling off. The shape of the running weight was a simple geometric form or a bust.[14] Its weight usually did not correspond to a standard unit of weight, instead, it had to be calibrated to the specific steelyard.

The use of the steelyard was simple, the load to be weighted was hung at the end of load arm, the running weight was moved on the scale arm until the balance reached equilibrium and the weight of the load was read from the scale at that position. When weighting heavier loads, the steelyard was hung by a suspension farther from the scale arm and closer to the suspension of the load, thus changing the fulcrum of the balance. If the counter weight weighted 1 *libra* then on the scale the distance between the indications of a units of *libra* were equal to the distance between the suspension of the load and the suspension of the balance beam related to the scale.[15] Thus if the steelyard was hung by a suspension hook closer to the suspension of the load, the indications of the same unit of weight were closer together on the new scale. This means that the scale used for measuring larger weights was less precise on the same steelyard.[16] For this reason, when measuring weight, one always starts with the scale for the lower weight and a further scale is only used when previous one is not sufficient to determine the weight of the load.

Steelyards from the Roman Collection of the Hungarian National Museum

The fourteen steelyards examined in this paper (Cat. 1–14) are assigned to groups based on Norbert Franken's work.[17] None of the steelyards is fully intact. In most cases only the balance beam remains, the suspensions of the scale or the load were preserved in some cases; the running weight was preserved only in one case.

Nine of the fourteen steelyards (Cat. 3–4, 6, 8, 10–12) were re-entered into the inventory books in the 1950's after World War II,[18] from these two earlier inventory entries were identified (Cat. 6 and 12).[19]

12 Franken 1993, 71, 1. (Skalenarm = Scale arm, Lastarm = Load arm, Lastgeschirr = Suspension of the load, Laufgewicht = running weight, Aufhängehaken = suspension hooks, Aufhängeösen = eyelets for the suspension of the balance beam, Lastgeschirröse = eyelet for the suspension of the load, Lastkette = chain for the load, Gegengewicht = counterweight, Lasthaken = hook for the load).

13 E.g. Franken 1993, list I.2, type 26.

14 Kisch 1965, 65.

15 Knorr 1982, 122.

16 Jenemann 1989, 328–329.

17 Franken 1993.

18 During Siege of Budapest the museum's collection was hastily packed away for transport to places thought to be safer. Many artefacts got mixed together and lost their original inventory numbers during this time.

19 Cat 6: 56.40.18 = 1.1874.391; Cat 12: 54.34.17 = 241.1876.14 (?), it is not yet authenticated, see explanation for 56.40.18 at 45th footnote; for 241.1876.14 at 46th footnote.

Steelyards from the early imperial era

Four balances were assigned to the group of steelyards from the early imperial era that are similar to the Pompeii[20] and Walbrook[21] types in Franken's typology (Cat. 1–4). Although Franken's identifies further subtypes, a more precise identification of these steelyards is not possible because the suspensions of the balance or the load and the running weights are missing.

Franken excluded from his typology the steelyards which are shorter than 10 cm. Despite of this Cat. 2 and 4 are assigned to this group, although Cat. 2 is broken, it couldn't have been much longer. Their suspension eyelets are similar to those Jenemann assigns to the early (mainly Italian) balances.[22]

Cat. 1 and 2 were purchased by the museum, but only the origin of the latter is known (Brigetio-Szőny). In the case of Cat. 3 and 4 the origin of the balances is not known. There is a counterweight in the eyelet of Cat. 1 at the end of the balance beam (suspension of the load), for this reason this balance might be related to the Walbrook type.[23] The scale arm of Cat. 3 has an unusually round cross section, the series of dots on its top might be the graduations of the scale. The end of its suspension hook is curved back on itself, this feature differentiates it from Franken's Valle Ponti and Pompeii types, maybe it too had a counterweight relating to the Walbrook type, or it is a provincial variant of the Italian balances. As mentioned above Cat. 2 and 4 are much smaller balances. The state of preservation of the former is very poor, while the latter is in much better condition, however, the graduation of the scale is not readable. Franken lists two similar steelyards in a later publication,[24] considering that they may be related to the Pompeii and Walbrook types.

Steelyards of the Osterburken type

Steelyards belonging to the Osterburken type[25] are easily recognizable due to their riveted suspensions, rectangular scale arms and suspension hooks. There are two steelyards, Cat. 5 and 6 that belong to this type.

Cat. 5 was found at Csákberény/Puszta-Orond in Hungary, and was donated to the museum. The end of the scale arm broke off but the graduation can be seen very clearly. On scale A[26] the short notches probably represent *semis*, while the longer ones stand for *libra*, the V probably represents 5 *librae*, the rest of the scale broke off. Scale B starts from XII (12 librae), on this scale too the *semis* and *librae* values are indicated until 23 *librae* where the scale broke off. The value of 15 *librae* is only represented by V instead of "XV", while 20 *librae* represented by XX. Scale C starts from XXXXV (45 *librae*) and the scale broke off at 75 *librae*. On this scale only the *librae* values are indicated by notches, every fifth by a V and every tenth by a X, the value of 50 *librae* is indicated by a Greek "N". The scales of Roman steelyards usually did not meet precisely, instead they overlapped each other.[27] Cat. 5 is missing its suspensions of the scale

20 Franken 1993, 77.
21 Franken 1993, 81.
22 Jenemann 1989, 327.
23 Franken 1993, list I 3.
24 Franken 1995, 430. B4, B6.
25 Franken 1993, 85.
26 In the following from the scale arm until the end of the load arm the suspensions and the related scales will be indicated by the capital letters A, B and C.
27 Visy 1992, 61.

and the suspension of the load, thus it is not possible to determine if it belongs to the earlier or latter group of Osterburken type steelyards.

From the starting values and the values before the break off point of the scales it can be concluded that scale arm of Cat. 5 was probably at least twice as long as it is now. The scale broke off at around 5,5 *librae* and scale B starts from 12 *librae*. Scale B ends at around 24 *librae* and scale C starts from 45 *librae*. Thus the weighting range scale could have ended at 12-13 *librae*, while scale B's could have extended until 46-48 *librae*. In the case of a steelyard from Gyékényes in Hungary Zsolt Visy used mathematical calculations[28] to determine the possible weighting range of the steelyard, the same method can be employed in this case as well. If it is theorised that the weighting ranges precisely meet each other, then scale A starts from 0 librae and ends with the value of 12 *librae*, which would mean 12 graduations of *libra*. The average distance between graduations of *libra* on scale A is 1,785 cm, multiplying this value by 12 (1,785 cm x 12) we get 21,42 cm (length of the scale arm without the button like or rhomboid ending piece). Doing the same for scale B which can be calculated with a weighting range starting from 12 *librae* and ending with 45 *librae*, we get 33 graduations of *librae* with the average distance of 0,65 cm, thus 0,65 cm x 33 gets us 21,45 cm. Taking the average of the two results, 21,435 cm, and dividing it by the average distance between values of *librae* on scale C (0,213 cm) results in 100,6, which can be safely rounded down to 100. Scale C starts from the value of 45 *librae*, if these 100 graduations of librae are added to the weighting range of scale C, it would be 45–145 *librae*. This would mean that Cat. 5 was able to weight loads up to around 47 kg. It is important to note these results are estimations, in the case of most steelyards the different scales did not meet precisely, instead they usually overlapped each other.

Cat. 6 was probably part of the Ráth collection,[29] but its place of origin is unknown. This is the second longest steelyard described in this paper (30,3 cm). The graduations of the scale arm are readable, the value of 50 is indicated by a Greek „N", while 100 is indicated by a Greek „P", both are made of dots. On scale A the values of semis are indicated by three dots in a triangular formation. On scale B values of *semis* are indicated by short notch and a single dot. Similar dots appear in the middle of „X" on Scale B at values of 20, 40, 45, 60, 80 and 90. The weighting ranges of scales are as follows: scale A 0–12, scale B 10–40, scale C 40–100 *librae*.[30] Thus the maximum amount of weight which could be measured was about 34 kg. Due to the suspension hooks of the balance beam this steelyard might belong to the later group of Osterburken type, but the missing suspension of the load could indicate this more precisely.

There are two other examples of Osterburken type steelyards in Hungary. One of them can be seen in the exhibition of the Savaria Museum at Szombathely,[31] the other is in the collection of museum of Szentes, which was published by Zsolt Visy.[32] In his opinion this latter piece came from either Brigetio (Szőny) or Aquincum (Óbuda).

28 Visy 1992, 62–62.

29 Cat. 6. Inv. Num. 56.40.18 = 1.1874.391, it was not yet authenticated, see the explanation in footnote 45.

30 At the start of scale C we can read „"XXXXV" which would indicate the value of 45 *librae*, but looking closely at the distance of indications of the values of 5s and 10s it is clear, that scale C's „point zero" is at the value 40 *librae* and the value of 45 *librae* is at the „V" of „XXXXV".

31 Kárpáti 1898, 132.

32 Visy 1980–81, 279.

Steelyards of the Constantinople type

Steelyards of the Constantinople type[33] were in use from the late Roman era to 6th century. This type is easily recognizable, they are usually comparatively larger then steelyard of the previous types. There are usually three longitudinal grooves on the load arm of these steelyards. Inside these grooves are horizontal shafts which are connected to the suspension hooks by metal rings. Two steelyards are assigned to this type (Cat. 7 and 8).

By its size Cat. 7 is very small compared to the average Constantinople type steelyards. The suspensions of the balance beam too are unusual in the case of this steelyard. But the shape of its suspension hook is very specific to this type.[34] Still there are examples of the above mentioned unusual suspension and S-shaped hook which attaches the running weight to the scale arm.[35] Interestingly scale A has a graduation (a notch) for each value of *uncia*. The sixth graduation the notch is between two dots (this should be a *semis*), the twelfth graduation is an „X" (this should be 1 *libra*) and the eighteenth graduation is a „V" (this should be 1,5 *libra*). On scale B the graduations are further apart, notches and three dots in triangular formation alternate, latter are probably *semis* (like in the case of Cat. 6) while the notches stand for values of *librae*, the fifth graduation of *libra* is not clear, it was probably a „V". Scale C is similar to scale B, but the graduations are closer together, the tenth graduation is an „X" with three lines pointing to its centre. Despite a readability of the scales the weighting ranges are not entirely clear. While this is the only steelyard, which retained its running weight, many parts are missing, for example the suspension of the load, thus trial weightings are not feasible.

Cat. 8 is the longest steelyard in this work (41,4 cm). Most of the scale is not readable, but values of 5 *librae* and 10 *librae* are indicated by Roman numbers. This does not provide a base for dating, since these types were also used in Byzantine times and it is not known when they started to use Greek numbers for the entire scale.[36] There are many examples of the Constantinople type steelyard similar to Cat. 8.[37]

Steelyards with uncertain dating after the Roman period

The following steelyards share the way their suspension of the balance beam was made. Horizontal shafts are fixed through the beam, the ends of these shafts rested in the opposing holes drilled through the tines of the forks, which are suspended by hooks attached to them. There are even blunt rectangular „pointers" at these suspensions. The suspension of the load is similar, but without the pointer. Norbert Franken noted in his work, that these steelyards are dated later than the Roman period, but further research is lacking concerning these balances.[38] After looking through Franken's examples of these steelyards four balances were assigned to this group (Cat. 9–12). The origins of Cat. 9–11 are unknown. According to the inventory books Cat. 12 was donated to museum and came from Transylvania.[39] Due to the lack of research on these steelyards, dating was not attempted. Cat. 9 is the only steelyard made of iron on this list, its scale arm is heavily corroded. Cat. 10 is an interesting piece, the scale

33 Franken 1993, 89.
34 Franken 1993, Liste I 6.
35 Sams 1982, B1 (suspension), B2 (hook) 214. Fig. 10-8, 215. Fig. 10-12); Fourlas–Tsamakda 2012, III/41; Ross 1962, A. no. 71.
36 Sams 1982, 223–224.
37 Ross 1962, No. 73; Sams 1982, B2; Mutz 1988.
38 Franken 1993, 94.
39 Cat. 12, Inv. Num. 54.34.17 = 241.1876.14, it was not yet authenticated, see the explanation in footnote 46.

arm ends in a shape of an monkey, while the load arm and the suspensions are decorated by curving lines and geometric forms. An article written by Sándor Soproni about Roman weights also has a picture of this steelyard.[40] The interesting feature of Cat. 11 is its scale arm. On both of its scales the space between the bigger notches is separated to four parts by three smaller notches. This means this steelyard was still used in a duodecimal system. Cat. 12 is similar to Cat. 11, but is scale arm is broken and all of its suspensions are missing. Cat. 11 and 12 both have their load arm ending in a three-pronged which has parallels in the scientific literature.[41] Lionell Holland has written an article about a „pre-metric Spanish steelyard",[42] which the author dated to the 16th century. Frederick George Skinner and Wilbur Richard Knorr both dated these steelyards after the Roman period[43] similar to Franken.

Fragments of balances

In two cases only the scale arm of steelyards remained (Cat. 13 and Cat. 14). Cat. 13 has graduation only on one of its sides which might mean that it is one of the rare examples when there is only one suspension point for the balance beam. The fragment was found at Dunapentele (Dunaújváros-Intercisa) in Hungary. Cat. 14 was probably the scale arm of steelyard with three suspension points for the balance beam.

40 Soproni 1967, 5.
41 Popović et al. 1969, 157. Nr. 339; Davidson 1987, Taf 98. Nr 1662; Soproni 1967, 4.
42 Holland 2016.
43 Knorr 1982, 118; Skinner 1967, 80.

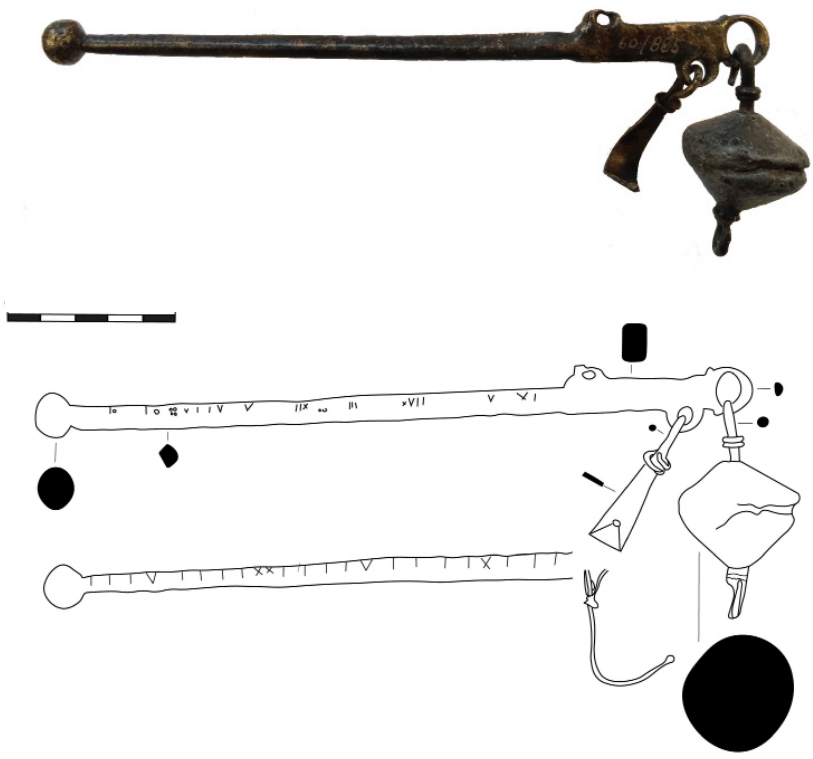
Catalogue

The suspensions of the balance beam from the scale arm until the end of the load arm and the related scales will be indicated by the capital letters A, B and C. The height of steelyards was measured a hanging position.

A. Steelyards from the early imperial era

Cat. 1: Inv. Num. 60/885 (*Fig. 2*)

Bronze steelyard with two suspension points. The scale arm has rhomboid cross section with rounded edges ending in a round button. Scale A is too worn , scale B starts from the value 7 and ends with the value 28. The values are indicated by Roman numbers. The load arm has rectangular cross section with rounded edges, the suspension eyelets are on the top and bottomand at the end of the beam are cast. Only suspension B's hook remains with its end curved back on itself. From the suspension of the load a biconical lead counterpoise (176 g) is retained with a copper wire going through it, forming a hook at both ends.



Find-site:
unknown

Way of acquisition:
Purchase from
Dr. Vilmos Lipp

Length: 22,00 cm;

Height: 7,80 cm

Weight: 292,42 g

Suspension A: 5,00 cm

Suspension B: 2,00 cm

Fig.2

Cat. 2: Inv. Num. 100.1895.7 (*Fig. 3*)

Small bronze steelyard with two suspensions. The end of the scale arm is broken off, neither scales are readable. The suspension eyelets are onthe top and bottom and at the end of the beam are cast.

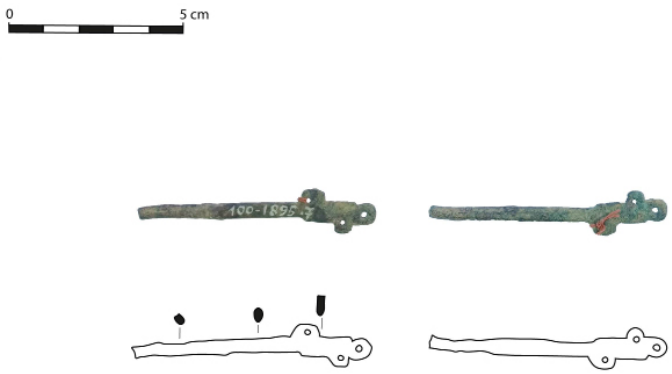


Fig. 3

Find-site:
Ó-Szőny, Komárom

*Way of acquisitio*n:
Purchase from
Kadek Institution

Length: 7,04 cm

Height: 1,30 cm

Weight: 6,3 g

Suspension A: 1,60 cm

Suspension B: 0,70 cm

Cat. 3: Inv. Num. 54.34.13 (*Fig. 4–5*)

Bronze steelyard with two suspensions. The scale arm has a round cross section ending in a round button. The scales are illegible, there is a line of dots on both the bottom and the top. The load arm's cross section is rectangular with rounded edges. The suspension eyelets are on the top and bottom and at the end of the beam are cast. Only suspension B's hook remains with its end curved back on itself.

Fig. 4

Find-site:
unknown

Way of acquisition:
unknown

Length: 22,20 cm

Height: 10,3 cm

Weight: 113,66 g

Suspension A: 3,26 cm

Suspension B: 0,95 cm

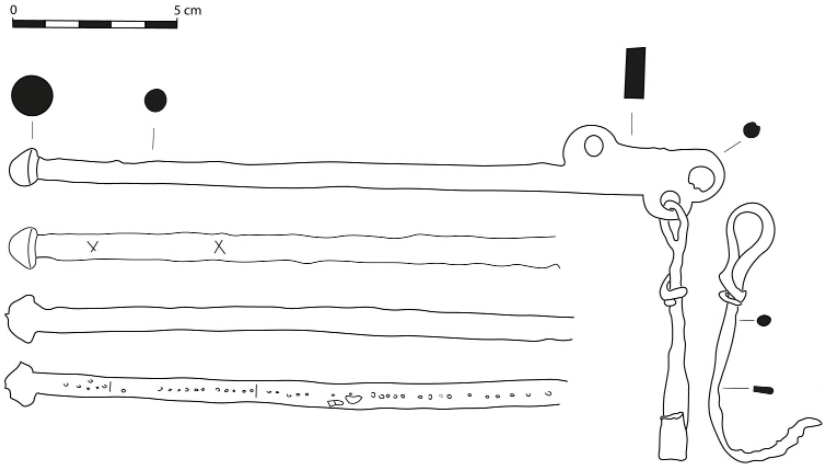


Fig. 5

Cat. 4: Inv. Num. 54.34.14 (*Fig. 6*)

Small bronze steelyard with two suspensions. Almost completely intact steelyard, only its running weight is missing. The cross sections of the scale arm and of the button on its end are both rhomboid. The scales are illegible. The load arm is very short there is barely any space for the moulded eyelets on top, bottom and at the end of the arm. Both suspension hooks are retained. The suspension of the load is made of nine horseshoe shaped wire chain links that are attached to the eyelet with a circular wire, at its other end a hook is located.

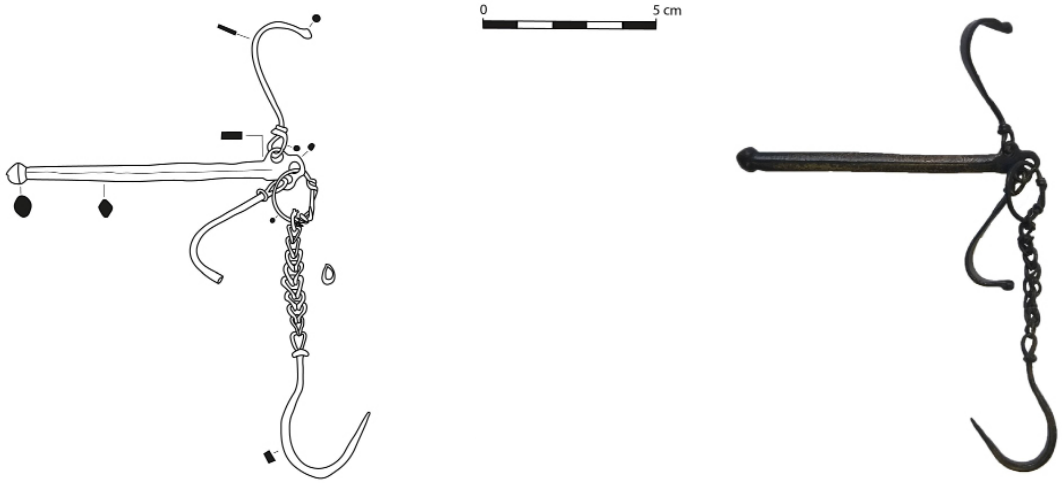


Fig. 6

Find-site:
unknown

Way of acquisition:
unknown

Length: 8, 94 cm

Height: 13,52 cm

Weight: 25,00 g

Suspension A: 0,48 cm

Suspension B: 0,23 cm

B. Steelyards of the Osterburken type

Cat. 5: Inv. Num. 86.1906.85 (*Fig. 7*)

Bronze steelyard with three suspension points. The scale arm's cross section is rhomboid. The graduations are clearly readable on the scales, but the end of the scale arm is broken off. The load arm's cross section is rectangular, the suspension points are attached by riveting, at the end of the beam there is groove for the suspension of the load, which is missing. The load arm has a cone-shaped ending. Suspension A and the other suspension hooks are missing. The graduations can be seen on the scales in the following ranges: scale A 0–5, on scale B 12–22, on scale C 45–75. Values of five and ten are indicated by Roman numbers, while the value of 50 indicated by a Greek "N".

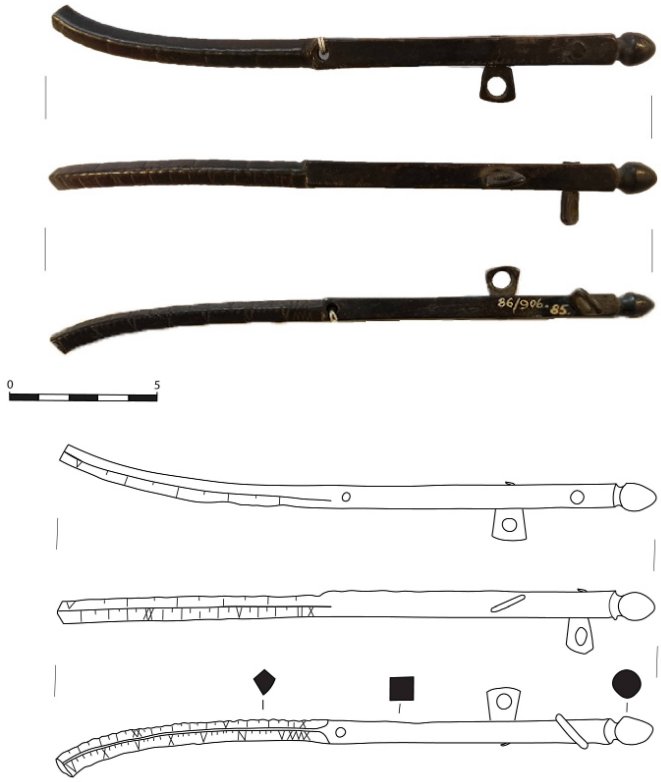


Fig. 7

Find-site:
Csákberény/Puszta-Orond

Way of acquisition:
donated by Countess Jánosné Merán (birth name: Countess Lambert)

Length: 20,4 cm

Height: 19,1 cm

Weight: 12,31 g

Suspension A: 9,45 cm
(average distance between graduations of *libra*: 1,785 cm)

Suspension B: 3,82 cm
(average distance between graduations of *libra*: 0,65 cm)

Suspension C: 1,44 cm
(average distance between graduations of *libra*: 0,213 cm)

Cat. 6: Inv. Num. 56.40.18 = 1.1874.391 (*Fig. 8*)

Bronze steelyard with three suspension points. The scale arm's cross section is rhomboid with rounded edges. The graduations can be seen on the scales, values of five and ten are indicated by Roman numbers, while the value of 50 indicated by a Greek "N" and the value of 100 by a Greek "P". The latter numbers are made of dots. The load arm's cross section is rectangular, the suspension points are attached by rivets, at the end of the beam there is groove for the suspension of the load, which is missing. The load arm has a cone-shaped ending. Suspension C is missing, but the suspension hooks A and B remain.

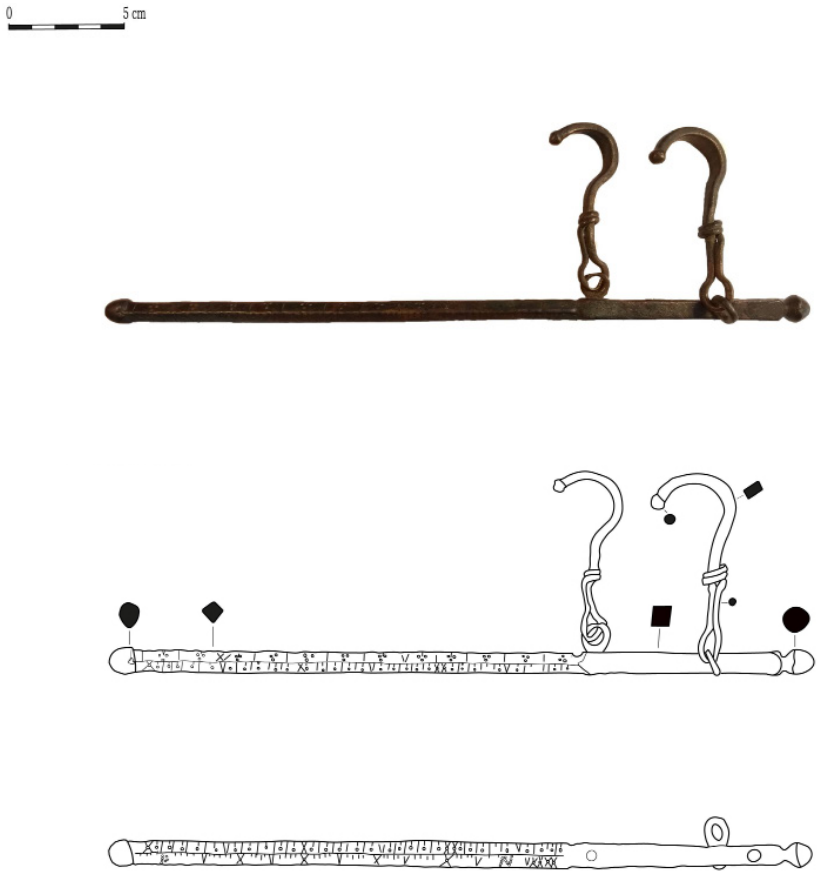


Fig. 8

Find-site:
unknown

Way of acquisition:
unknown

Length: 30,30 cm

Height: 8,50 cm

Weight: 213,98 g

Suspension A: 8,11 cm

Suspension B: 2,91 cm

Suspension C: 1,25 cm

C. Steelyards of the Constantinople type

Cat. 7: Inv. Num. 10/1951.212 (*Fig. 9*)

Bronze steelyard with three suspension points. The scale arm's cross section is rhomboid and it ends in a round conical button. The graduations can be seen on the scales. The biconical running weight (32,7g) is hanging by an S-shaped hook. The suspensions of the balance beam are attached to shafts fixed through the load arm. The suspensions are semicircular, and small metal circles connect them to the suspension hooks, but from the latter only the hook suspension A remains. The suspension hooks' end is bent back on itself. Suspension B is missing, Suspension C is bigger than A. At the end of the load arm there is groove for the suspension of the load, which is missing. The load arm has a cone-shaped ending. On scale A every sixth graduation is different (the sixth is a notch between two dots, the twelfth is an X and the eighteenth is a V). On scale B graduation is farther apart, the notches and the dots in a triangular formation are alternating. Scale C is similar to B, but the graduations are closer to each other.

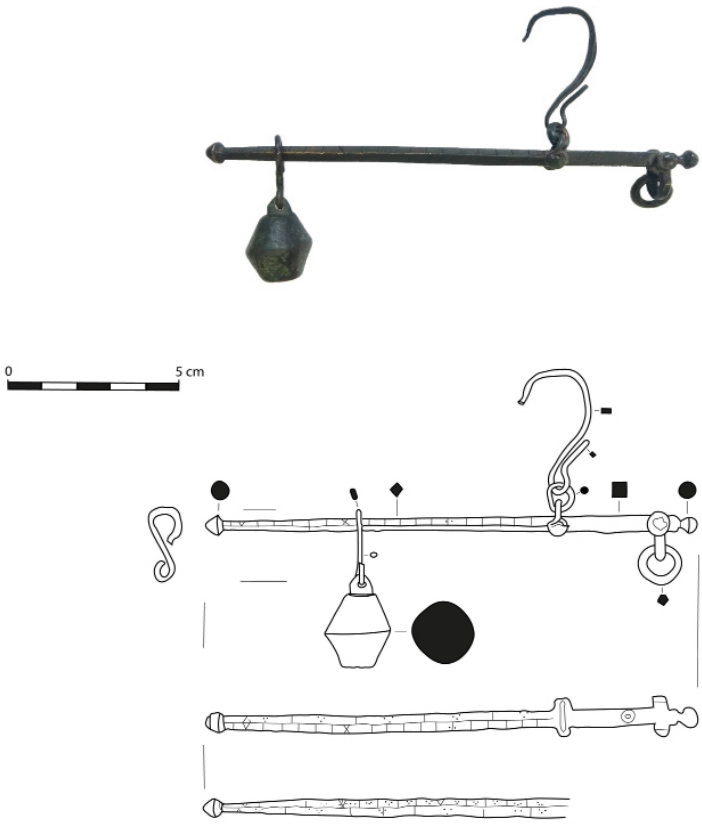


Fig. 9

Find-site:
unknown

Way of acquisition:
unknown

Length: 14,72 cm

Height: 8,95 cm

Weight: 62,47 g

Suspension A: 3,21 cm

Suspension B: 1,33 cm

Suspension C: 0,04 cm

Cat. 8: Inv. Num. 54.34.10 (*Fig. 10*)

Bronze steelyard with three suspension points. The scale arm's and its ending's cross section is rhomboid. The graduations are barely visible because of the heavy corrosion. The readable graduations are Roman numbers. On the load arm there are three longitudinal grooves. Inside these there are horizontal shafts,which are connected to the suspension hooks by metal rings, the end of the hooks are bent back on themselves, all three suspension hooks remain. The load arm's cross section is rectangular, at the end of the beam there is groove for the suspension of the load, which is missing. The load arm's ending is pointed, and its cross section is round.

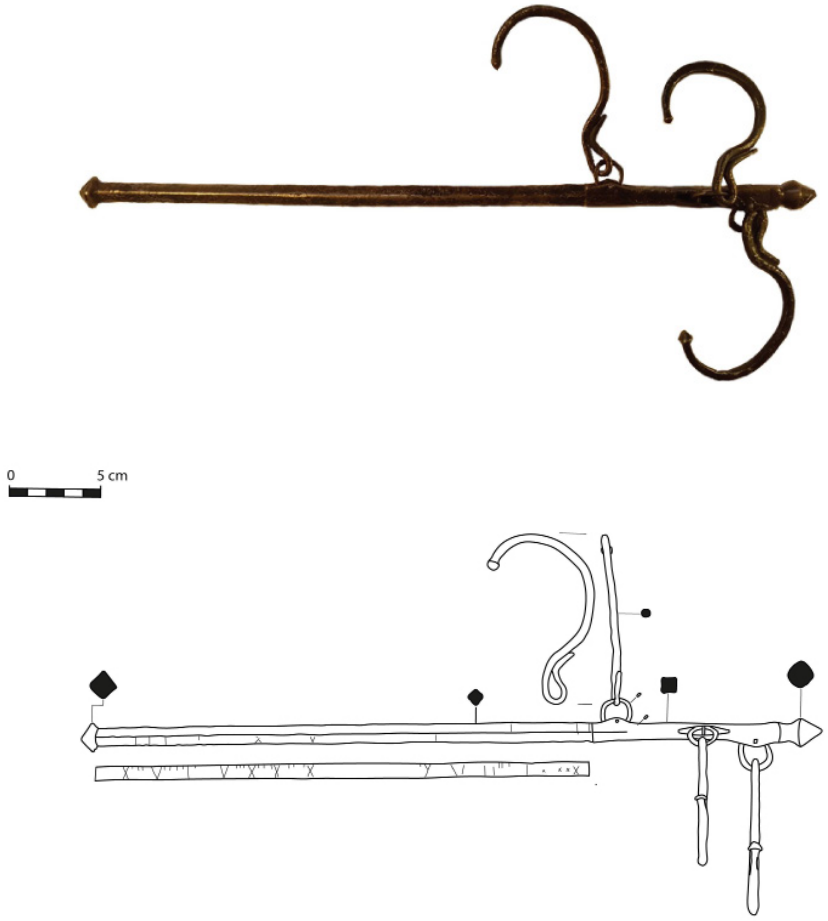


Fig. 10

Find-site:
unknown

Way of acquisition:
unknown

Length: 41,5 cm

Height: 11,72 cm

Weight: 357,15 g

Suspension A: 9,71 cm

Suspension B: 4,5 cm

Suspension C: 1,78 cm

D. Steelyards with uncertain dating after the Roman period

Cat. 9: Inv. Num. 10.1951.211 (*Fig. 11*)

Iron steelyard with two suspensions. The scale arm's and its ending's cross section is rhomboid. The scale arm is heavily corroded, only on scale B can three dots be seen. The load arm's cross section is rectangular. All suspensions are two pronged forks attached to shafts, which are fixed through the load arm. Suspension B has a small hook, suspension A's hook is missing. At the points of suspension for the balance beam, there are blunt rectangular pointers. From the suspension of the load two chains are hung down, one with four links, the other with five, the chain links are "8" shaped. The chain with five links ends in a small hook. The load arm gets flatter toward its end.

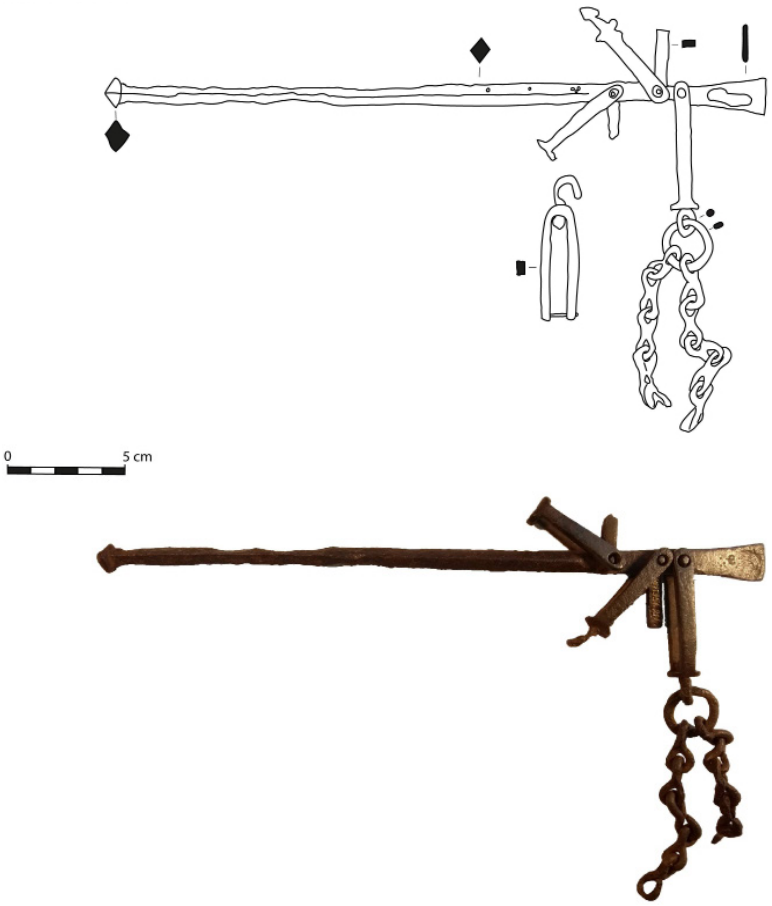


Fig. 11.

Find-site:
unknown

Way of acquisition:
unknown

Length: 28,30 cm;

Height: 18,09 cm

Weight: 209,37 g

Suspension A: 29,50 cm

Suspension B: 0,94 cm

Cat. 10: Inv. Num. 54.34.11 (*Fig. 12–13*)

Bronze steelyard with two suspensions. The scale arm's cross section is rhomboid and it ends in the shape of a sitting monkey, the hole between the monkey's legs shows signs of use. The graduations are clearly readable on the scale arm and on its two sides a line of X can be seen (with around 0,48 cm intervals). The load arm's cross section is rectangular. All suspensions are two pronged forks attached to shafts, which are fixed through the load arm. The suspension hooks rotate freely in the forks. The suspension of the load is missing. At the points of suspension for the balance beam, there are blunt rectangular pointers with a slight inclination. The suspensions and the pointers a decorated by curving lines, circles and triangles. The load arm is decorated by notches and narrows towards its end.

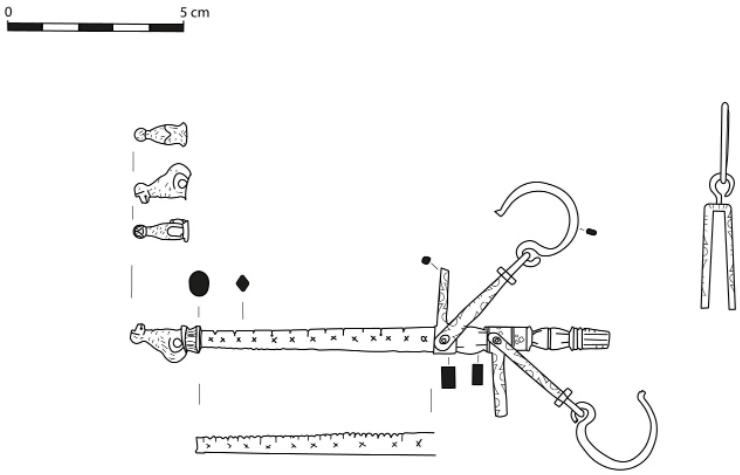


Fig. 12

Find-site:
unknown

Way of acquisition:
unknown

Length: 13,69 cm

Height: 6,65 cm

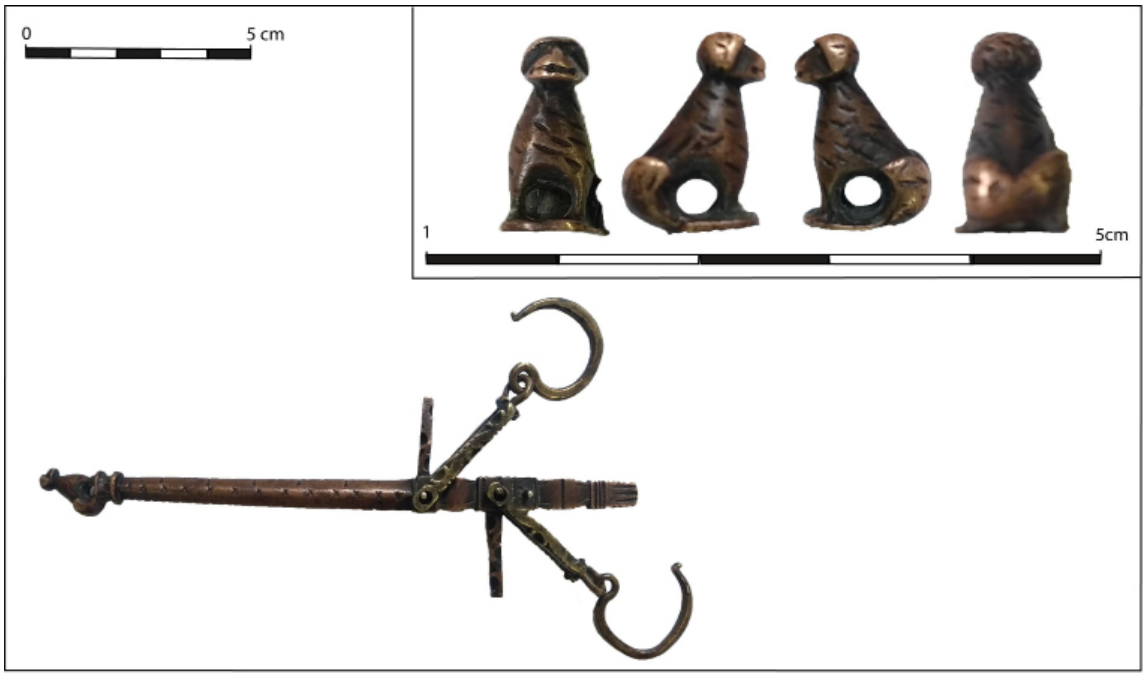
Weight: 38,5 g

Suspension A: 2,18 cm

Suspension B: 0,62 cm

Literature:
Soproni 1967, Abb. 2.

Fig. 13



Cat. 11: Inv. Num. 54.34.12 (*Fig. 14*)

Bronze steelyard with two suspensions. The scale arm's cross section is rhomboid and it ends in a round button. On scale A and B three smaller notches separate the distance between two bigger notches into four parts. The suspensions of the balance beam are missing, only the worn down shafts and the blunt pointers remain. In the fork of load's suspension a circle rotates freely. From this circle two chains are hung down each with three links, one connects to the hook made of a sheet of metal, the other's third link is broken in half. The load arm ends in three prongs.

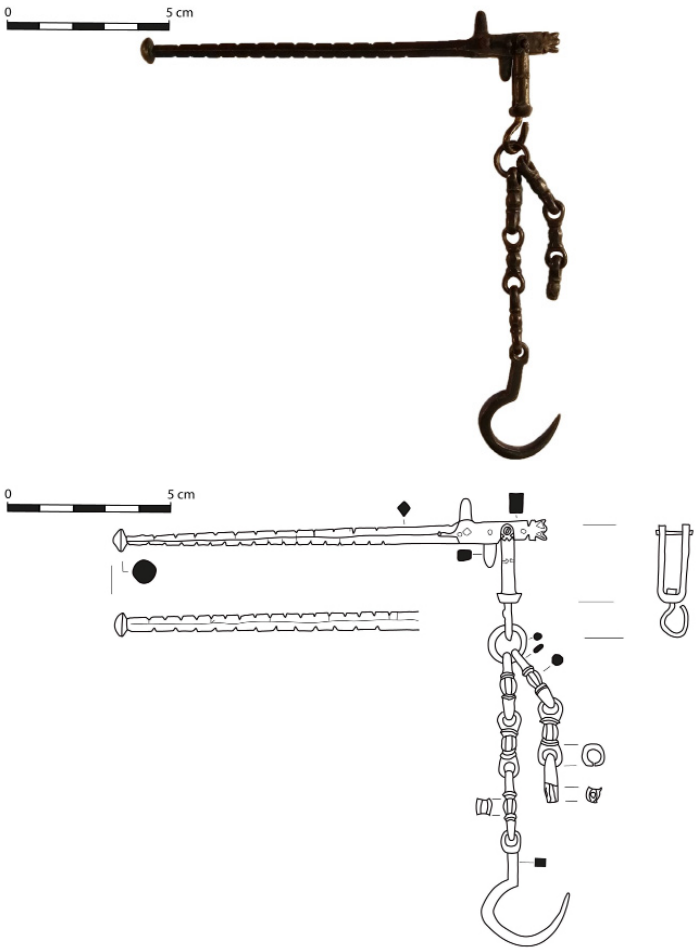


Fig. 14

Find-site:
unknown

Way of acquisition:
unknown

Length: 13,5 cm

Height: 14,30 cm

Weight: 48,8 g

Suspension A: 1,24 cm

Suspension B: 0,46 cm

Cat. 12: Inv. Num. 54.34.17 = 241.1876.14 (*Fig. 15*)

Bronze steelyard with two suspensions. The scale arm's cross section is rhomboid, its end is broken off. All the suspensions are missing. The worn down shafts and the blunt pointers remain. The load arm's cross section is rectangular ant it ends in three prongs.

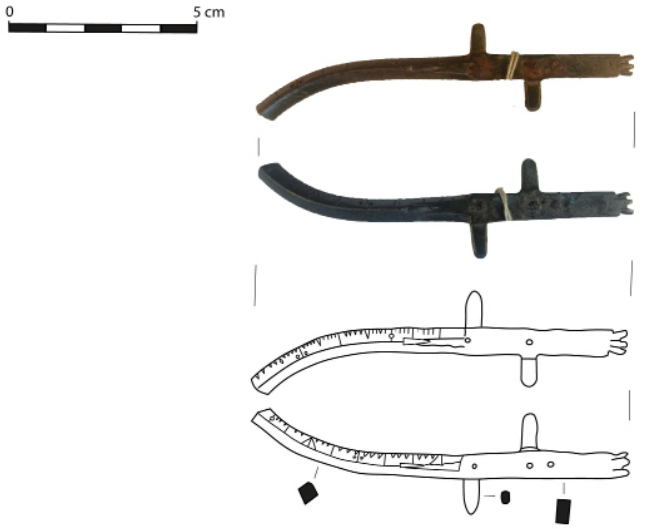


Fig. 15

Find-site:
unknown

Way of acquisition:
unknown

Length: 10,4 cm

Height: 2,54 cm

Weight: 29,7 g

Suspension A: 1,99 cm

Suspension B: 0,54 cm

E. Fragments of balances

Cat. 13: Inv. Num. 28.1908.511 (*Fig. 16*)

Broken off scale arm of a steelyard. Only one of its sides has graduations. Its cross section is trapezoidal and ends in a round cone.

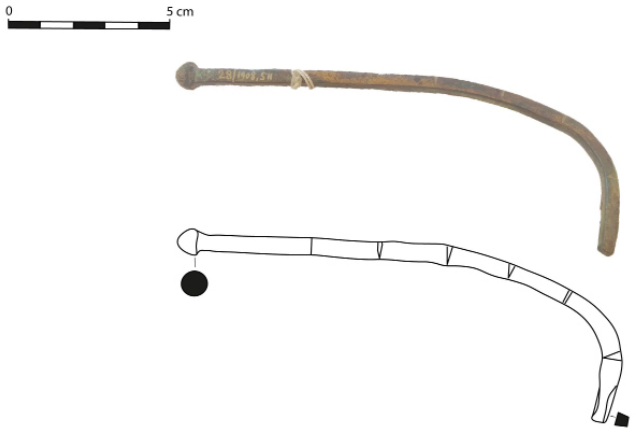


Fig. 16

Find-site:
Dunapentele

Way of acquisition:
Purchase from István Paksi

Length: 14,10 cm;

Weight: 29 g

Literature: Radnóti 1957, 78.

Cat. 14: Inv. Num. 63.22.237 (*Fig. 17*)

Bronze scale arm of a steelyard with three suspension points. Its cross section is rectangular and ends in a round button.

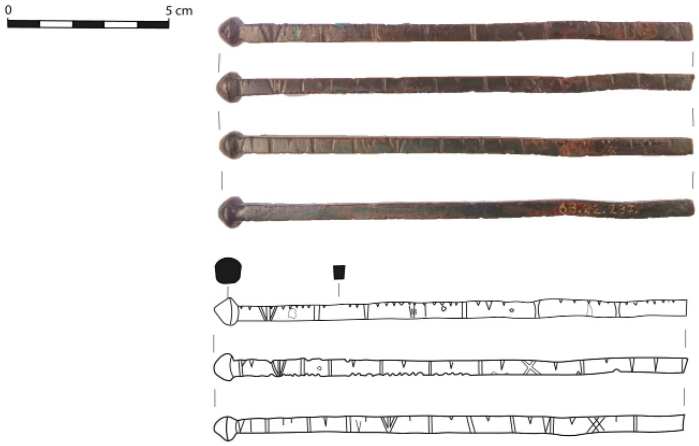


Fig. 17

Find-site:
Szőny

Way of acquisition:
Tussla collection

Length: 14,90 cm

Weight: 29,38 g

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