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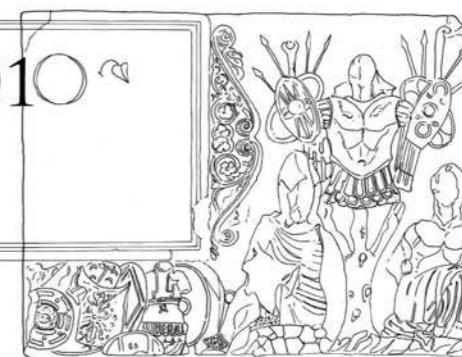
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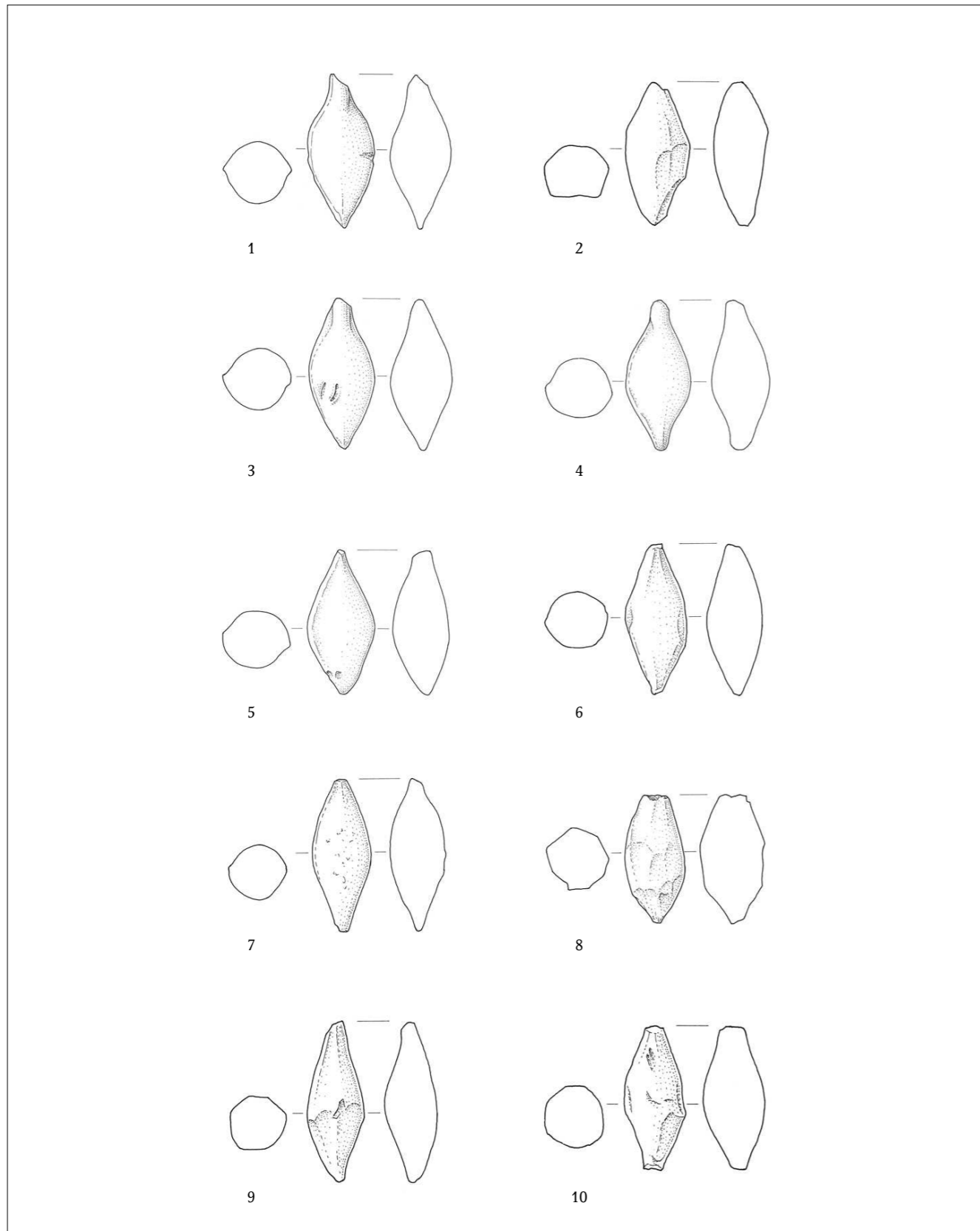


Fig. 6. Baba near Slavina. Supposed slinger's complete set. Drawing: I. Murgelj.

ROMAN STONE AND CLAY SHOT FROM THE VIMINACIUM AMPHITHEATRE

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The study of Roman military equipment from Viminacium is important to an understanding of the constitution of the Roman army and the life of soldiers and civilians not only in this camp and city, but also at other sites along the Danube limes in *Moesia Superior*. In this paper, stone and clay shot found during recent excavations of the Viminacium amphitheatre will be presented. Based on the size, shape and exact location, I will discuss the function of missiles and their connection to the amphitheatre.

VIMINACIUM AMPHITHEATRE

Viminacium is located in eastern Serbia, close to the confluence of the Mlava and Danube Rivers (Fig. 1). It was initially a military camp, where the *legio VII Claudia* was stationed from turn of the sixth into the sev-

enth decades of the first century AD.¹ A city grew next to the camp and became the capital of the province of *Moesia Superior* and later of *Moesia Prima*.²

Based on archaeological excavations, the areas of the legionary fortress and the city of Viminacium were defined on the right bank of the Mlava River. The Viminacium amphitheatre is situated in the north-eastern corner of the city, approximately 60 m from the north-western corner of the legionary fortress (Fig. 2). At the end of nineteenth century, M. Valtrović conducted the first small-scale excavations of the amphitheatre.³ Systematic archaeological investigations began in Septem-

¹ ПОПОВИЋ 1968, 36; МИРКОВИЋ 1968, 25; 1986, 35-36.

² The city was raised to the rank of *municipium* during the reign of Hadrian and to the rank of *colonia* during the reign of Gordian III.

³ ВАЛТРОВИЋ 1884, 11-12, 100-103.

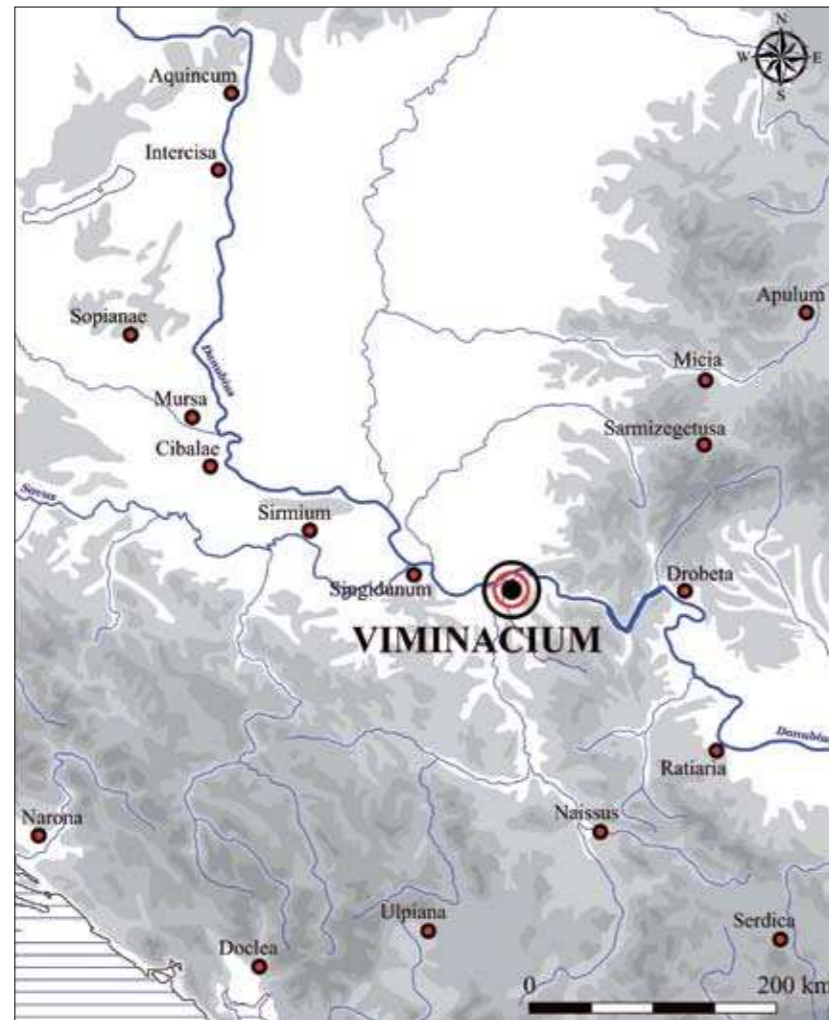


Fig. 1. Location of Viminacium.



Fig. 2. Location of the Viminacium amphitheatre in an aerial photo (taken in 2007).

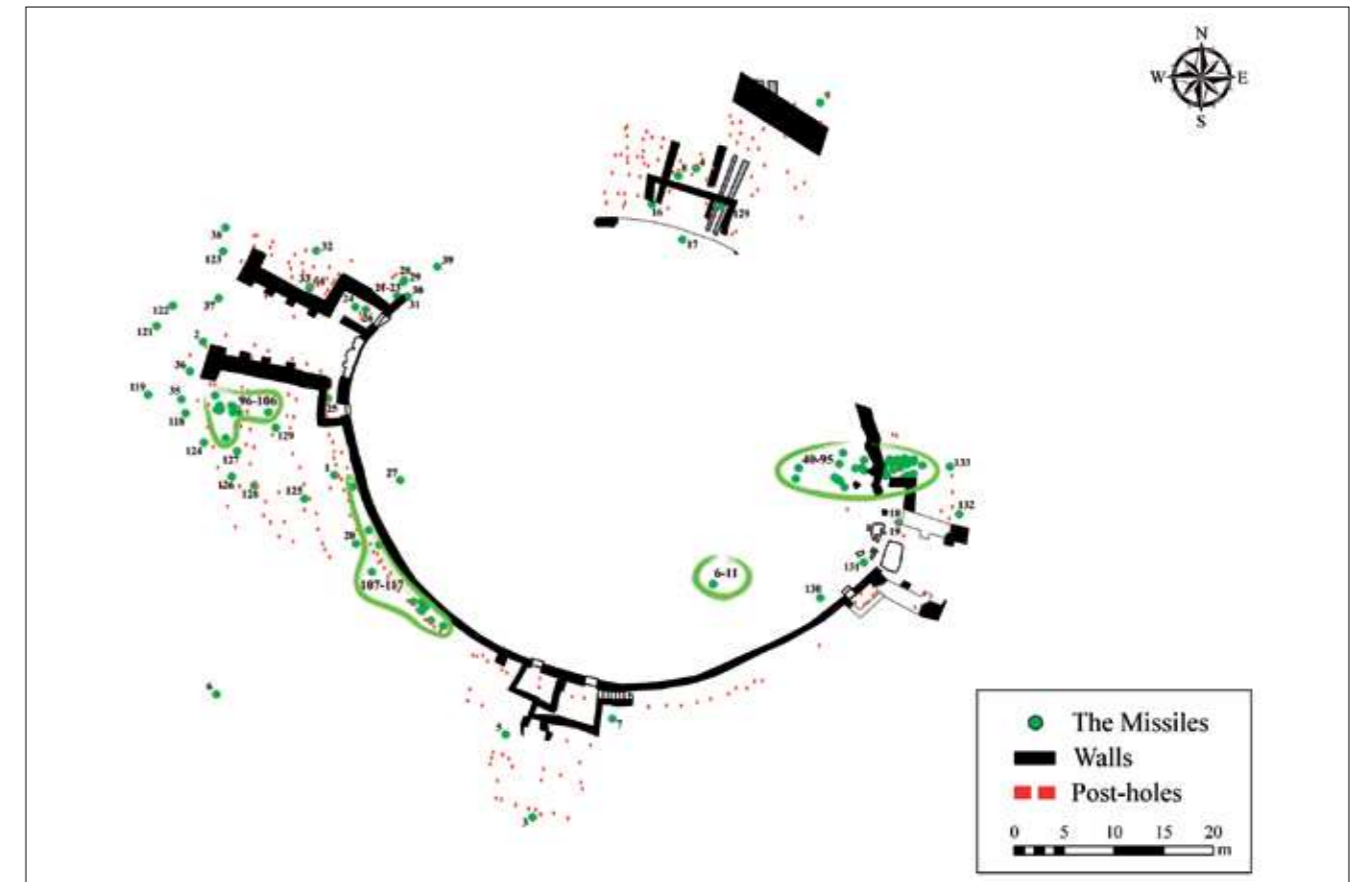


Fig. 3. Layout of the Viminacium amphitheatre.

ber 2007 and by the end of 2010 a surface of roughly 2000 m² was excavated.⁴ Traces of architecture include: the amphitheatre's stone walls, post-holes for timber beams that supported the stands, and also a part of the northern rampart of the city which lies next to the amphitheatre. The estimated overall dimensions of the amphitheatre are approximately 83.5 x 74 m, and the dimensions of the arena are approximately 55 x 45 m (Fig. 3). According to previous investigations, it is possible to conclude that the amphitheatre was built in the first quarter of the second century and that it was used until the turn of the third into the fourth century. So far, at least three construction phases may be discerned: an older, timber phase that dates to the first quarter of the second century, and two stone/timber phases that date to the period from the second quarter of the second until the end of the third century.

⁴ The archaeological excavations were conducted by the Institute of Archaeology in Belgrade, at the direction of dr. Miomir Korać.

MATERIALS AND METHODS

During recent excavations of the Viminacium amphitheatre, besides many finds made of various materials and for different purposes, 133 missiles were found. The maximum diameters⁵ and weight of the projectiles were recorded, while special attention was also accorded to the shape and material from which the shot was made of. Dating of the projectiles was based on other finds, because the shape and material of the items discovered did not change at all throughout the Roman period.⁶ Based on all of these features, including the exact location and contexts of the finds, use of the projectiles will be interpreted and discussed.

⁵ In this paper, the diameter will also refer to the maximum length of missiles of oval, irregular and unknown shape.

⁶ In contrast to this assumption, heavier projectiles that are larger in diameter may only be expected, as they could be used as shot for more powerful artillery machines.

MISSILES

The missiles from the Viminacium amphitheatre were made of stone and clay. The majority of them were made of limestone (126 projectiles), while two were made of sandstone and five were made of refined hard-baked clay (Fig. 4). Besides missiles, limestone was also used in construction of the arena wall,⁷ while sandstone projectiles are the sole finds made of that material. In addition to missiles, clay was used for making ceramics and bricks.

Missiles were found in various units and layers across the entire excavated area (Fig. 3). The majority of the projectiles were found at the area of *cavea*, fewer were found in the area of the arena, while some of them were found adjacent to the amphitheatre and one was discovered in front of the city rampart. Projectiles were discovered either as individual finds, or as smaller or larger groups of finds. Most of the missiles found in the Viminacium amphitheatre date to the period of construction and utilisation of the building, while only a few projectiles date to the time when the amphitheatre had lost its function.

Projectiles are different in shape and dimension. The diameters of missiles vary from 2.69 to 29.58 cm. Most of them have diameters between 7.22 and 13.75 cm. Projectiles weigh between 20 and 3550 g. The weight of the missiles has not always been fully preserved. The smallest projectiles suffered the least damage. Based on the ratio between diameter and weight, it may be concluded that these features are interdependent, i.e. that larger projectiles were heavier (Fig. 5). The attempt to reconstruct the actual weight of projectiles showed that the current weight can be converted into Roman duodecimal measuring system.⁸ In this system, the basic unit was the Roman pound (*libra*) with a constant weight of 327.45 g and its twelfth part, the ounce (*uncia*), weighing 27.288 g.⁹ Reviewing the reconstructed weight in Roman units, most of them reach weights between 1½ and 5 pounds, or between 491.18 and 1537 g.

Diameter and weight variations indicate different calibres of projectiles used for different purposes and ranges. According to these features and reference

⁷ The main entrances and chamber walls were made of shale and plaster.

⁸ In this translation, attention was turned on the state of preservation of each projectile. So, the preserved part was increased by the missing part, obtaining in this fashion the ideal missile weight.

⁹ HULTSCH 1882, 159-161, 706, Tab. XIII.

data,¹⁰ minor missiles with diameters between 2.69 and 5.73 cm and weights below 186 g were defined as slingshot projectiles (*glandes*). There were 6 slingshot projectiles in the assemblage: three oval ones made of limestone (no. 1-3; Fig. 6, 1), one biconical one made of sandstone (no. 6; Fig. 6, 2)¹¹ and two spherical clay projectiles (no. 4-5; Fig. 6, 3).¹²

In the case of three projectiles made of limestone, two spherical pieces (no. 115 and 121) and one spherical projectile with a slightly flattened side (no. 122), with diameters between 6.73 and 7.35 cm and weights between 226 and 247 g, it was not possible to define whether they were used for slingshots or hurled by hand. Based on their dimensions and sources, they were either hurled by hand or with a staff sling (*fustibalus*).¹³

Assuming that missiles no. 115, 121 and 122 were not slingshot projectiles, than 127 missiles found at the Viminacium amphitheatre (no. 7-133) were either *ballista* balls or hand-thrown stones. Besides three spherical projectiles made of clay (no. 12, 15 and 89) and one made of sandstone (no. 133), the others were made of limestone. Their diameter varies between 6.73 and 29.58 cm and they weigh from 226 to 3550 g. They were roughly rounded, worked stones, while in some cases their surface was finely processed. Out of 127 missiles, 53 were spherical (Fig. 6, 4), 42 were spherical with one side slightly flattened (Fig. 6, 5), 11 were spherical with two sides slightly flattened (Fig. 6, 6), 7 were oval (Fig. 6, 7), 8 were irregular (Fig. 6, 8) and 6 were damaged to the extent so that it was not possible to reconstruct their shape (Fig. 6, 9). Among all of the missile shapes, no regularity in calibre could be observed (Fig. 5).

The largest group, consisting of 56 projectiles (no. 40-95), was located close to the eastern entrance of the amphitheatre (Fig. 7).¹⁴ This pile of stones lay beside

¹⁰ GRIFFITHS 1989; VÖLLING 1990; ВУЈОВИЋ 2007; 2009; GUDEA 2009.

¹¹ The shape and surface of this shot indicate that it may have been used as a tool.

¹² The effective range was between 100 and 200 m for clay shot and maximum c. 230 m for stone shot. The missiles were mostly dangerous at the distance of approximately 65 m (BAATZ 1990).

¹³ VUJOVIĆ 1998, 125; 2007, 304; WILKINS 2003, Fig. 51; CAMPBELL 2005, 16, 46.

¹⁴ One of these projectiles (no. 64) had a chiselled hollow, 2.22 cm in diameter and 3.98 cm in depth. Following the paper of M. Jeremić (1993, 79, Fig. 3, 8), this projectile would be defined as a stone weight. However, based on the fact that this stone was found with other projectiles similar in dimensions and the absence of corrosion in the hollow and also on similar shot found in Buciumi in Romania (GUDEA 2009, 227, Abb. 5), this stone may be defined as a missile. To conclude, this stone probably was made to be a weight, but was in secondary use and left together with other projectiles in the amphitheatre area.

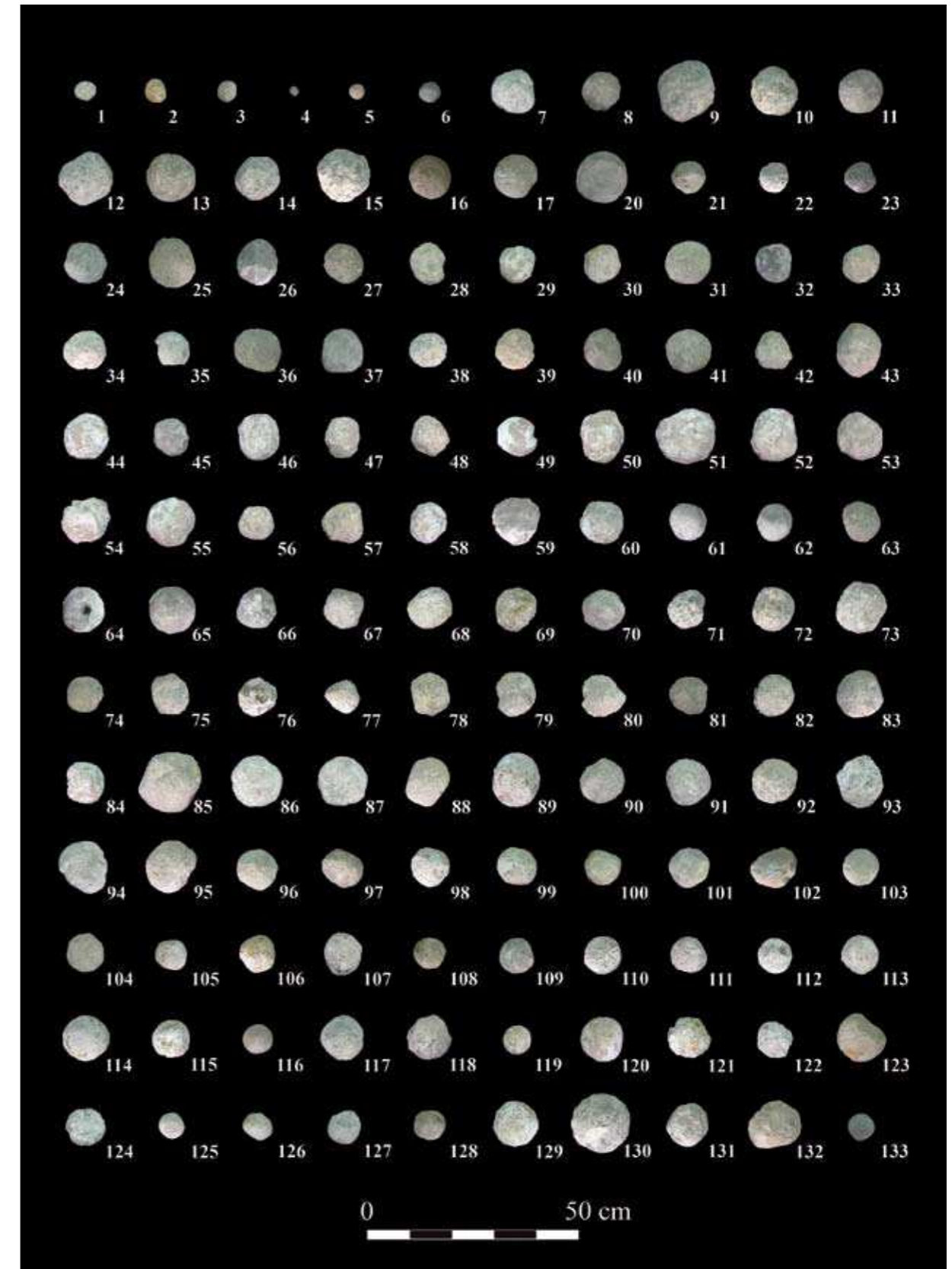


Fig. 4. Missiles.

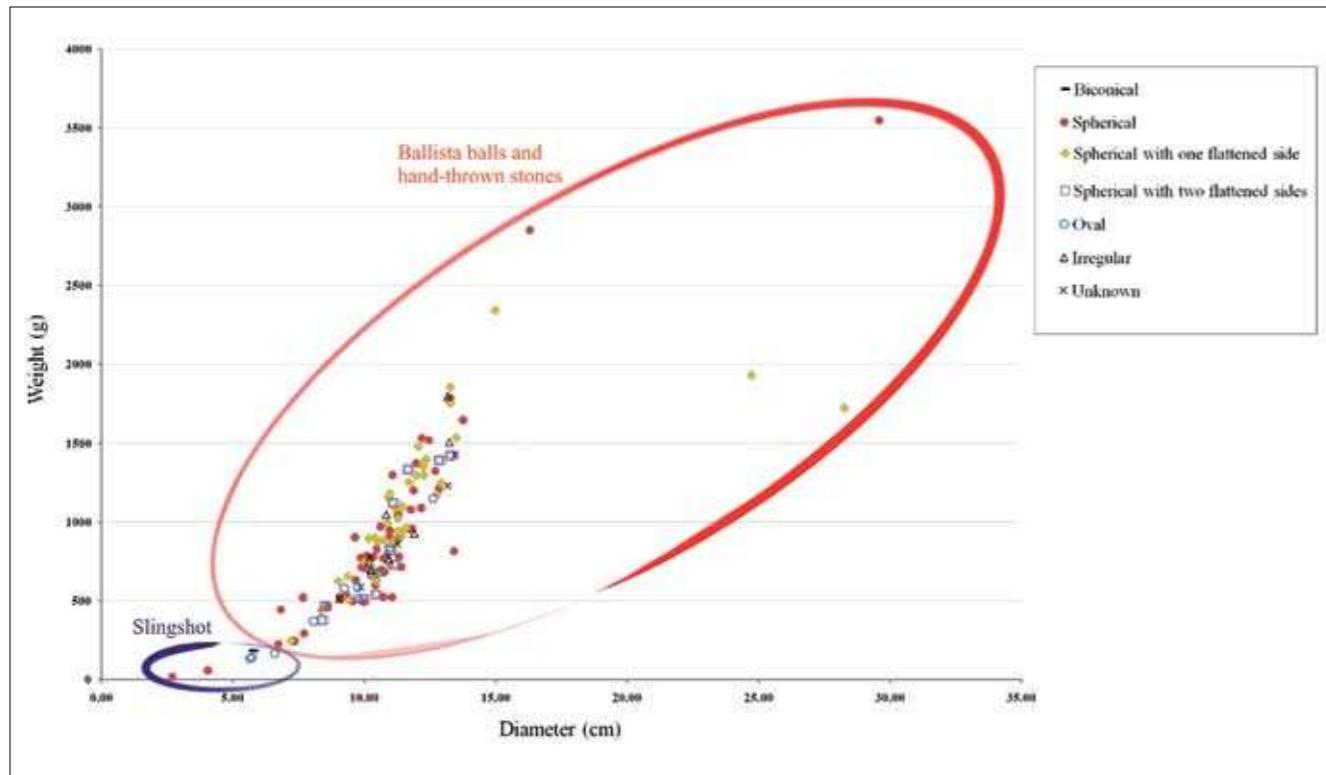


Fig. 5. Ratio between diameter and weight of the missiles.

a side-chamber that flanks the arena at the northern side of the entrance. The missiles were situated partly in the area of the arena and partly in the area of the *cavea*. They weigh mostly between 681 and 972 g or between 1297 and 1537 g, but the calibre cannot be determined with any certainty. As may be assumed based on the position of the missiles, they were probably stored by the outer face of the arena wall and during its demolition they fell together with the wall.

Another group of 11 missiles (no. 96-106) was found on a plaster surface situated to the south of the western entrance between the post-holes for wooden beams which supported the stands. Most of them weigh between 440 and 800 g, but the calibre cannot be defined. Assuming that the plaster surface may define an older phase of the timber construction of the *cavea*, then those projectiles would be connected to the period of building construction.

Another group of 11 projectiles (no. 107-117) was discovered in the vicinity of the aforementioned group, in a ditch next to the external arena wall canvas. The

missiles from the ditch mostly weigh between 525 and 780 g and besides a few exceptions, two calibres of 2 and $2\frac{1}{2}$ Roman pounds may be assumed. Considering the context of the finds, they could be connected with the time of the arena wall's construction.

A group consisting of 6 missiles (no. 10-15) was discovered in the area of the arena. Although they weigh between 1052 and 1797 g, three different calibres of approximately $4\frac{1}{2}$, 5 and $5\frac{1}{2}$ Roman pounds may be suggested.

Smaller groups consisting of two or three projectiles and individual finds were discovered in different parts and layers of the entire excavated area.

Individual finds are different in shape, diameter and weight. The features of the shot are not consistent even within the groups of missiles, although the exceptions are groups of fewer projectiles that have similar attributes.

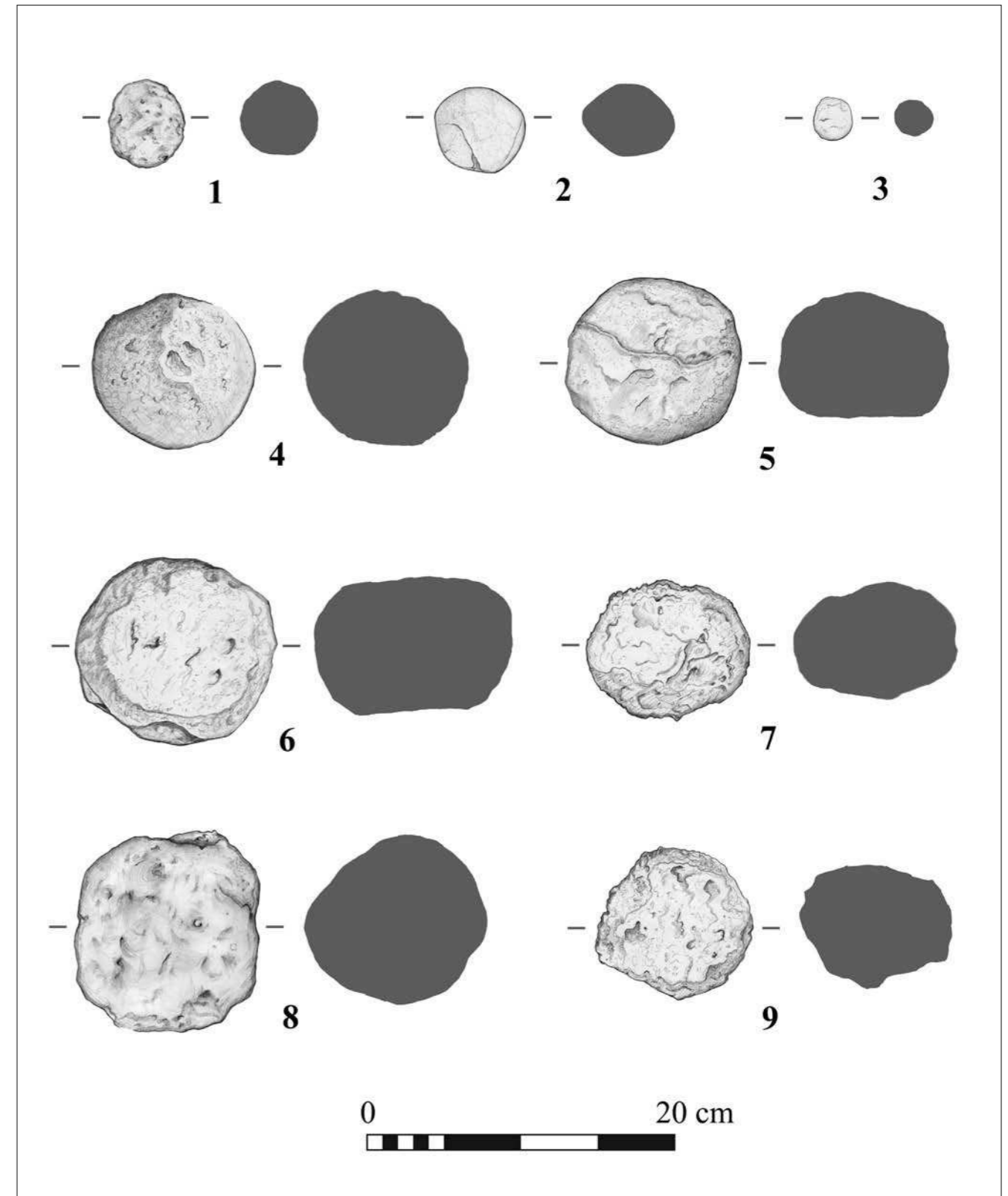


Fig. 6. Shape of the missiles - 1. oval slingshot projectile (no. 1); 2. biconical slingshot projectile (no. 6); 3. spherical slingshot projectile (no. 4); 4. spherical projectile (no. 17); 5. spherical projectile with one flattened side (no. 31); 6. spherical projectile with two flattened sides (no. 20); 7. oval projectile (no. 58); 8. projectile of irregular shape (no. 12); 9. projectile of unknown shape (no. 29) (drawings by D. Rogić).



Fig. 7. A part of the most numerous group of missiles.

INTERPRETATION OF THE MISSILES

The presence of projectiles in the area of the amphitheatre can be interpreted as an indicator of warfare, traces of training or as part of the equipment used for Roman entertainment. The vicinity of the city ramparts indicates very intensive utilization of the area during armed conflicts, so the slingshot projectiles, *ballista* balls and hand-thrown stones are expected finds.

The proximity of the city ramparts leads to the assumption that the missiles represent traces of the city defence system while the amphitheatre was in use. Their presence in the embankment that supported the wooden structure of the *cavea* can also be explained by the fact that layers were disturbed during construction of the amphitheatre, so the missiles could be dated

back to the period prior to construction. Besides a few projectiles which belong to the time when the amphitheatre lost its function, other missiles could not be associated with civil wars and barbarian attacks during the period of the crisis of the Empire in the third and the fourth centuries.¹⁵

The finds of slingshot projectiles confirm the presence of slingers (*funditores*) in Viminacium (Fig. 8). Slingers were common units in the Roman army and played an important role in defence, but also in sieges and open combat.¹⁶ Their presence in the territory of Serbia was also evident in Belgrade (*Singidunum*), Čezava (*Novae*), Veliki Gradac (*Taliata*), Ravna (*Timacum Minus*) and Stojnik.¹⁷

¹⁵ МИРКОВИЋ 1994, 89-105.

¹⁶ GRIFFITHS 1989; VÖLLING 1990; ВУЈОВИЋ 2007.

¹⁷ САВИНОВА 1986, 263-264; ВУЈОВИЋ 1998, 124-126; 2007.



Fig. 8. Slinger, Trajan's Column, Rome, Scene CXIII-CXIV (after COARELLI 1999, Tav. 138).

In addition to the missiles which have been ascertained as those for slings, defining of the manner of use and purpose of other projectiles is very difficult. According to Vitruvius, the lightest *ballista* balls weigh 2 Roman pounds (0.655 kg),¹⁸ while M. Bishop and J. Coulston and D. Campbell suggest that artillery balls could weigh 1 mina (0.436 kg).¹⁹ Based on these data and on examples from the literature, it may be assumed that spherical and oval missiles, and also projectiles with one side slightly flattened, which weigh more than 0.436 kg, might have been hurled by an artillery machine (Fig. 9).²⁰ This assumption is very important because to date in the province of *Moesia Superior* this kind of shot has been confirmed only in Singidunum, Novae and Ravna (*Campsia*).²¹

¹⁸ Vitruvius X, 11. 3; MARSDEN 1971, 197-200; WILKINS 2003, 7.

¹⁹ BISHOP - COULSTON 2006, Fig. 29 and CAMPBELL 2002, 180, with the literature cited therein. The maximum range of *ballista* increased approximately 370 m and of *onager* approximately 450 m (BAATZ 1994, 136-145; WILKINS 2003, 61-70).

²⁰ BONDOC 2002; 2007; WILKINS 2003; GUDEA 2009. Although there were no traces of artillery machines, their presence in Viminacium may be suggested. On the storage sites for artillery machines, see MARSDEN 1969; BAATZ 1983; CAMPBELL 1984; 2002; OBER 1987; WINTER 1997; BONDOC 2002.

²¹ ВУЈОВИЋ 1998, 223-224.

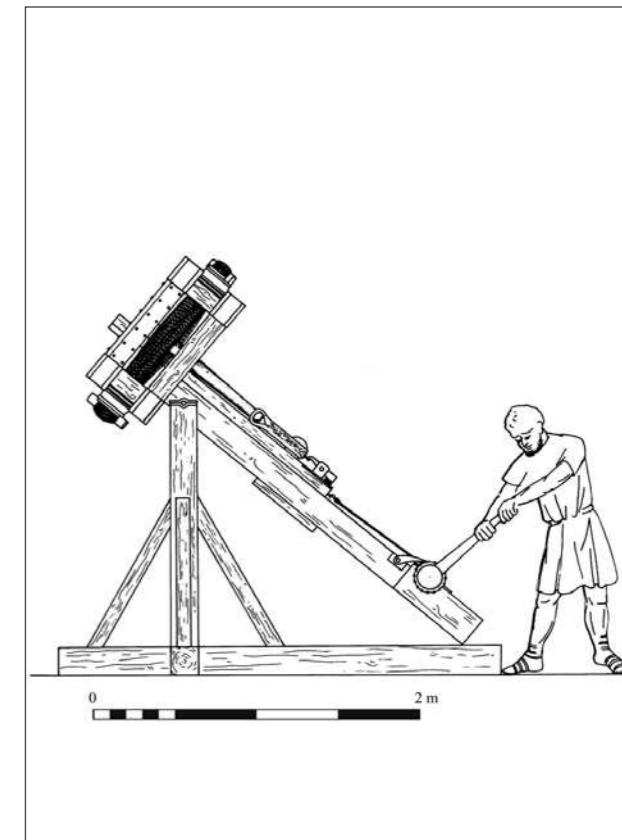


Fig. 9. *Ballista*, reconstruction of a Hatra stone-thrower (after BAATZ 1978, Fig. 7).

Based on the shape, dimensions and data given by W. B. Griffiths, projectiles which weigh less than 1 kg, and especially those with flattened sides, could be determined as hand-thrown stones.²² Accepting the hypothesis put forth by D. Baatz, it may be intimated that hand-thrown stones could weigh even more than 1 kg.²³ He suggested that there were two methods of throwing them from ramparts. Larger stones were dropped using both hands to hit a target near the foot of the wall, while smaller stones were hurled using one hand over a range comparable to that of a javelin (Fig. 10).²⁴ For projectiles of irregular and unrecognizable shape, it was not possible to reconstruct the way they were hurled.

²² GRIFFITHS 1992, with the literature cited therein.

²³ BAATZ 1983, 136.

²⁴ Stones thrown by hand had a maximum range of roughly 25-30 m (GRIFFITHS 1992, 6-8).

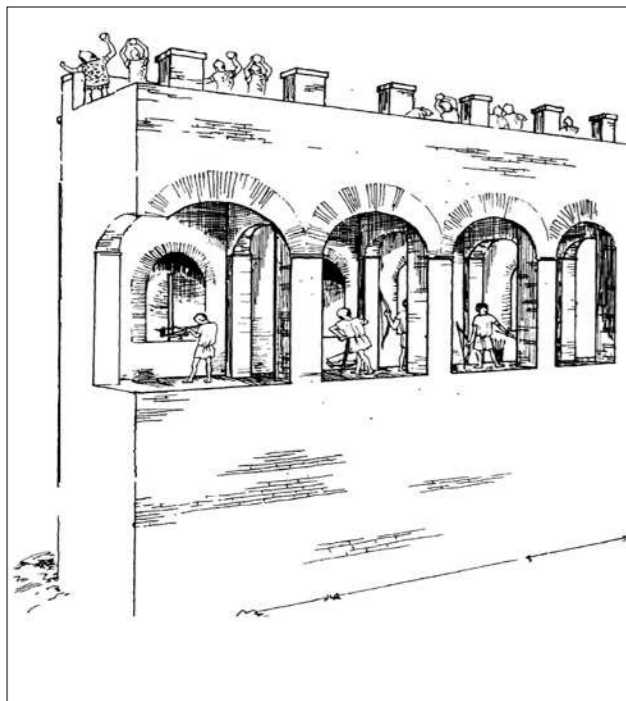


Fig. 10. Throwing stone projectiles by hands (after BAATZ 1983, Fig. 123).

Slingshot projectiles, like the other individual projectiles, may be explained as traces of warfare, while the piles of projectiles could be stored and prepared for usage during combat actions, or they were simply prepared for some future siege. Due to the different dimensions and the shapes of the missiles within each group, it was not possible to reconstruct how they were hurled.

It is well-known that storage of missiles, even of hand-throw stones of the appropriate weights, was a necessity, because during an attack a high rate of accurate fire must have often been of vital importance for the survival of the town. This could not be achieved with unworked stones of uncertain weight.²⁵ According to this assumption, we can only speculate as to why projectiles were collected in groups. One of the explanations could be the fact that during the time of the city defence, the shape and the size of stones did not play such an important role, because of the lack of the appropriate missiles.

The interpretation of the missiles as the remains of training cannot be entirely accepted. It may be suggested that the amphitheatre might have been used as a training ground for soldiers, which included hurling of stone projectiles.²⁶

²⁵ BAATZ 1983, 136.

²⁶ Vegetius II, 23; LE BOHEC 2001, 110.

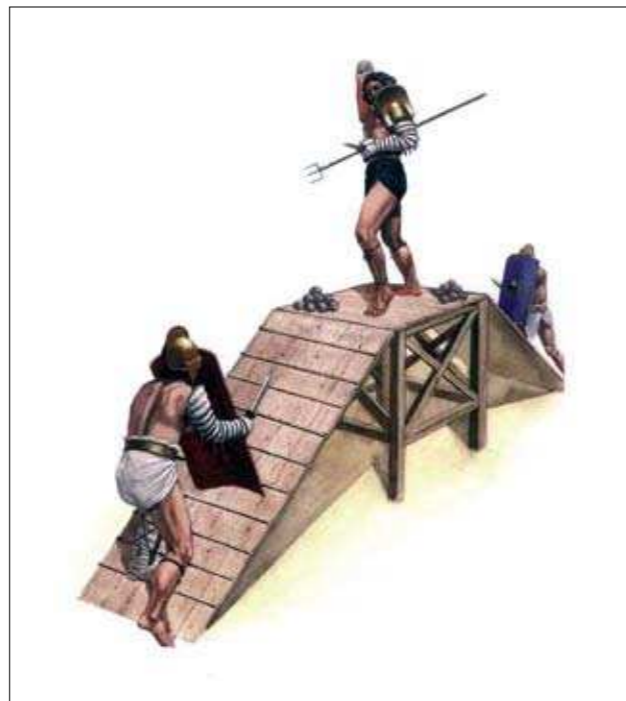


Fig. 11. Combat between a *retarius* and two *secutores* (after NOSOV 2009, 134).

Although projectiles indicate the presence of organized defence, artillery troops and slingers in the territory of Viminacium, the fact that projectiles are associated with the time of utilisation of the amphitheatre suggests that they can also be interpreted as a component of Roman entertainment. Based on the data provided by M. Junkelmann and K. Nossov, it may be assumed that some projectiles, especially the largest group of them found in the vicinity of the eastern entrance, were used in gladiatorial combat.²⁷ Both agree that stone shot was used by the *retarius* during the combat against two *secutores* at the same time (Fig. 11). The *retarius* stood on a raised wooden platform or bridge with two short flights of steps leading to it. In addition to his usual weapons, he had a supply of fist-sized round stones stacked in a pyramid, which he could throw by hand at his opponents before and while they attempted to climb his platform. If this hypothesis is correct, it may be concluded that in the Viminacium amphitheatre, gladiators known as *retarius* or *pontarius* fought, probably pitted against two *secutores*. If this was the case, the aforementioned stones were stored and prepared for future use in these spectacles.

²⁷ JUNKELMANN 2000, 112-113, 126; NOSOV 2009, 65-66.

CONCLUSION

Amphitheatre missiles are an important reference in elucidating the constitution of the Roman army in Viminacium and *Moesia Superior*. The aforementioned projectiles are significant primarily because such types of finds are rare at Roman sites in Serbia.²⁸

Among the projectiles found in the Viminacium amphitheatre, it was possible to assume that 6 missiles of smaller dimensions were used as slingshot projectiles. The other 127 missiles could be defined as *ballista* balls or hand-thrown stones. The majority of the missiles date to the period of construction and utilisation of the building. Beside these projectiles dating to the second and third centuries, a small part of the finds could date to the fourth century.

The presence of slingers and artillery may be confirmed based on the finds of stone and clay shot at the amphitheatre, which together with hand-thrown stones indicate organized defence of the city. Based on the precise location of the finds, it is possible that the projectiles were used either during attacks, in defence, in training or during gladiatorial combat.

²⁸ САВИНОВА 1986; VUJOVIĆ 1998, 124-129, 223-225, P. XXXVI-II, P. LXII; 2007; 2009.

Stone and clay shot were quite an effective weapon, so the presence of the projectiles raises the question connected to production and distribution of missiles. Comparing the material of the projectiles with the stone used in building construction and quarries and also to bricks, ceramics and clay deposits, the manner of exploitation of raw materials in the Viminacium region may be discerned.

Previous excavations at Viminacium revealed only a small part of the city area, so that data on missiles and warfare in the area of the amphitheatre may be a contribution to exploration of armed conflicts in Viminacium and the appearance of the north-eastern part of the city through different periods. Based on the finds from the latest layers, projectiles which reflect wartime operations and the necropolis which emerged above the amphitheatre walls, it seems that the amphitheatre lost its function at the turn of the third into the fourth century.

CATALOGUE OF MISSILES²⁹

1. Limestone; Oval; d-5.66 cm; h-4.78 cm; m-133 g (reconstructed weight in Roman units ca. 5 ounces); Fig. 4, 1.
2. Limestone; Oval; l-6.59 cm; h-5.73 cm; m-165 g (ca. 6 ounces); Fig. 4, 2.
3. Limestone; Oval; l-5.73 cm; h-4.77 cm; m-142 g (ca. 6 ounces); Fig. 4, 3.
4. Clay; Spherical; d-2.69 cm; m-20 g (ca. 1 ounce); Fig. 4, 4.
5. Clay; Spherical; d-4.04 cm; m-59 g (ca. 2.25 ounces); Fig. 4, 5.
6. Sandstone; Biconical; d-5.77 cm; h-4.62 cm; m-186 g (ca. 1 ounce); Fig. 4, 6.
7. Limestone; Spherical with one flattened side; d-11.71 cm; h-10.55 cm; m-1253 g (ca. 4 pounds); Fig. 4, 7.
8. Limestone; Spherical; d-10.23 cm; m-682 g (ca. 4 pounds); Fig. 4, 8.
9. Limestone; Spherical; d-16.30 cm; m-2854 g (ca. 8 pounds and 9 ounces); Fig. 4, 9.
10. Limestone; Spherical; d-12.18 cm; m-1536 g (ca. 4 pounds and 9 ounces); Fig. 4, 10.
11. Limestone; Spherical; d-11.27 cm; m-1052 g (ca. 3 pounds and 3 ounces); Fig. 4, 11.
12. Limestone; Irregular; d-13.17 cm; m-1797 g (ca. 5 pounds and 6 ounces); Fig. 4, 12.
13. Limestone; Spherical; d-12.45 cm; m-1520 g (ca. 4 pounds and 8 ounces); Fig. 4, 13.
14. Limestone; Spherical with two flattened sides; d-11.09 cm; h-9.47 cm; m-1120 g (ca. 3 pounds and 6 ounces); Fig. 4, 14.
15. Limestone; Spherical; d-13.26 cm; m-1789 g (ca. 5 pounds and 6 ounces); Fig. 4, 15.
16. Limestone; Spherical; d-10.96 cm; m-905 g (ca. 2 pounds and 10 ounces); Fig. 4, 16.
17. Limestone; Spherical; d-10.95 cm; m-949 g (ca. 3 pounds); Fig. 4, 17.
18. Limestone; Spherical; The shot was lost during excavations
19. Clay; Spherical; The shot was lost during excavations
20. Limestone; Spherical with two flattened sides; d-13.26 cm; h-8.46 cm; m-1422 g (ca. 4 pounds and 5 ounces); Fig. 4, 20.
21. Limestone; Spherical with two flattened sides; d-8.50 cm; h-7.54 cm; m-465 g (ca. 1 pound and 6 ounces); Fig. 4, 21.
22. Limestone; Spherical; d-7.70 cm; m-294 g (ca. 1 pound); Fig. 4, 22.
23. Limestone; Spherical; d-7.66 cm; m-519 g (ca. 1 pound and 7 ounces); Fig. 4, 23.
24. Limestone; Spherical with one flattened side; d-10.17 cm; h-8.68 cm; m-897 g (ca. 3 pounds); Fig. 4, 24.
25. Limestone; Spherical with one flattened side; d-12.24 cm; h-10.46 cm; m-1353 g (ca. 4 pounds and 2 ounces); Fig. 4, 25.
26. Limestone; Spherical with one flattened side; d-10.93 cm; h-8.67 cm; m-1157 g (ca. 5 pounds and 4 ounces); Fig. 4, 26.
27. Limestone; Spherical; d-11.04 cm; m-525 g (ca. 3 pounds and 3 ounces); Fig. 4, 27.
28. Limestone; Spherical; d-10.77 cm; m-684 g (ca. 2 pounds and 2 ounces); Fig. 4, 28.
29. Limestone; Unknown; d-10.22 cm; m-775 g (ca. 3 pounds and 7 ounces); Fig. 4, 29.
30. Limestone; Spherical with one flattened side; d-10.97 cm; h-9.29 cm; m-726 g (ca. 4 pounds and 6 ounces); Fig. 4, 30.
31. Limestone; Spherical with one flattened side; d-11.28 cm; h-8.28 cm; m-1024 g (ca. 3 pounds and 2 ounces); Fig. 4, 31.
32. Limestone; Spherical with one flattened side; d-10.24 cm; h-7.95 cm; m-689 g (ca. 2 pounds and 2 ounces); Fig. 4, 32.
33. Limestone; Spherical with one flattened side; d-10.27 cm; h-7.95 cm; m-664 g (ca. 2 pounds and 2 ounces); Fig. 4, 33.
34. Limestone; Spherical; d-10.47 cm; m-831 g (ca. 2 pounds and 7 ounces); Fig. 4, 34.
35. Limestone; Spherical; d-9.56 cm; m-500 g (ca. 4 pounds and 6 ounces); Fig. 4, 35.
36. Limestone; Irregular; d-11.90 cm; m-927 g (ca. 2 pounds and 11 ounces); Fig. 4, 36.
37. Limestone; Spherical with one flattened side; d-10.88 cm; h-9.15 cm; m-989 g (ca. 3 pounds and 2 ounces); Fig. 4, 37.
38. Limestone; Spherical; d-9.98 cm; m-492 g (ca. 3 pounds); Fig. 4, 38.
39. Limestone; Spherical with two flattened sides; d-9.95 cm; h-6.06 cm; m-510 g (ca. 1 pound and 7 ounces); Fig. 4, 39.
40. Limestone; Spherical; d-10.71 cm; m-526 g (ca. 4 pounds and 4 ounces); Fig. 4, 40.
41. Limestone; Spherical with one flattened side; d-11.41 cm; h-8.31 cm; m-910 g (ca. 2 pounds and 10 ounces); Fig. 4, 41.
42. Limestone; Unknown; d-9.87 cm; m-587 g (ca. 7 pounds); Fig. 4, 42.
43. Limestone; Spherical; d-13.41 cm; m-817 g (ca. 5 pounds); Fig. 4, 43.
44. Limestone; Spherical with one flattened side; d-12.37 cm; h-10.91 cm; m-1399 g (ca. 4 pounds and 4 ounces); Fig. 4, 44.
45. Limestone; Spherical with one flattened side; d-10.31 cm; h-7.71 cm; m-685 g (ca. 2 pounds and 2 ounces); Fig. 4, 45.
46. Limestone; Spherical with one flattened side; d-12.06 cm; h-9.42 cm; m-1481 g (ca. 4 pounds and 7 ounces); Fig. 4, 46.
47. Limestone; Spherical with one flattened side; d-10.76 cm; h-8.36 cm; m-887 g (ca. 2 pounds and 9 ounces); Fig. 4, 47.
48. Limestone; Oval; d-10-96 cm; h-8.66 cm; m-837 g (ca. 2 pounds and 7 ounces); Fig. 4, 48.
49. Limestone; Spherical; d-10.65 cm; m-700 g (ca. 2 pounds and 4 ounces); Fig. 4, 49.
50. Limestone; Spherical with one flattened side; d-13.50 cm; h-9.98 cm; m-1537 g (ca. 4 pounds and 10 ounces); Fig. 4, 50.
51. Limestone; Spherical with one flattened side; d-14.98 cm; h-12.01 cm; m-2343 g (ca. 7 pounds and 4 ounces); Fig. 4, 51.
52. Limestone; Spherical with one flattened side; d-13.27 cm; h-11.36 cm; m-1756 g (ca. 5 pounds and 5 ounces); Fig. 4, 52.
53. Limestone; Spherical with one flattened side; d-12.92 cm; h-11.08 cm; m-1247 g (ca. 4 pounds); Fig. 3, 53.
54. Limestone; Spherical with one flattened side; d-11.98 cm; h-10.036 cm; m-1297 g (ca. 4 pounds and 4 ounces); Fig. 4, 54.
55. Limestone; Spherical with one flattened side; d-12.24 cm; h-10.65 cm; m-1380 g (ca. 4 pounds and 3 ounces); Fig. 4, 55.
56. Limestone; Spherical with one flattened side; d-9.05 cm; h-7.86 cm; m-625 g (ca. 1 pound and 11 ounces); Fig. 4, 56.
57. Limestone; Unknown; d-11.25 cm; m-863 g (ca. 10 pounds); Fig. 4, 57.
58. Limestone; Oval; d-10.61 cm; h-7.63; m-681 g (ca. 1 pound and 1 ounce); Fig. 4, 58.
59. Limestone; Spherical; d-11.77 cm; m-1080 g (ca. 5 pounds); Fig. 4, 59.
60. Limestone; Spherical with one flattened side; d-11.46 cm; h-8.08 cm; m-1100 g (ca. 3 pound and 5 ounces); Fig. 4, 60.
61. Limestone; Spherical; d-9.64 cm; m-904 g (ca. 2 pounds and 10 ounces); Fig. 4, 61.
62. Limestone; Spherical with one flattened side; d-9.39 cm; h-8.39 cm; m-656 g (ca. 2 pounds); Fig. 4, 62.
63. Limestone; Irregular; d-10.16 cm; m-749 g (ca. 2 pounds and 4 ounces); Fig. 4, 63.
64. Limestone; Spherical with one flattened side with chiselled hollow, 2.22 cm in diameter and 3.98 cm in depth; d-11.18 cm; h-9.30 cm; m-1089 g (ca. 3 pounds and 4 ounces); Fig. 4, 64.

²⁹ In the catalogue, the letters d, h and m refer to: d – maximum diameter or length of the shot, h – height and m – weight. The reconstructed weight specified in the catalogue is based on the state of preservation of each projectile and it was translated to Roman units of weight.

65. Limestone; Spherical; d-11.97 cm; m-1374 g (ca. 4 pounds and 3 ounces); Fig. 4, 65
66. Limestone; Spherical with one flattened side; d-10.53 cm; h-8.65 cm; m-876 g (ca. 3 pounds and 6 ounces); Fig. 4, 66.
67. Limestone; Irregular; d-10.92 cm; m-763 g (ca. 3 pounds and 6 ounces); Fig. 4, 67.
68. Limestone; Spherical with two flattened sides; d-11.65 cm; h-9.21 cm; m-1334 g (ca. 4 pounds and 2 ounces); Fig. 4, 68.
69. Limestone; Spherical with one flattened side; d-11.58 cm; h-8.43 cm; m-964 g (ca. 4 pounds and 2 ounces); Fig. 4, 69.
70. Limestone; Spherical with one flattened side; d-11.38 cm; h-9.11 cm; m-929 g (ca. 3 pounds and 8 ounces); Fig. 4, 70.
71. Limestone; Spherical; d-10.41 cm; m-602 g (ca. 5 pounds and 6 ounces); Fig. 4, 71.
72. Limestone; Spherical; d-11.32 cm; m-781 g (ca. 5 pounds and 10 ounces); Fig. 4, 72.
73. Limestone; Irregular; d-13.23 cm; m-1506 g (ca. 5 pounds and 8 ounces); Fig. 4, 73.
74. Limestone; Oval; d-9.76 cm; h-6.36 cm; m-514 g (ca. 1 pound and 7 ounces); Fig. 4, 74.
75. Limestone; Spherical with two flattened sides; d-10.99 cm; h-7.08 cm; m-819 g (ca. 2 pounds and 7 ounces); Fig. 4, 75.
76. Limestone; Spherical; d-10.03 cm; m-709 g (ca. 2 pounds and 3 ounces); Fig. 4, 76.
77. Limestone; Unknown; d-9.04 cm; m-514 g (ca. 3 pounds); Fig. 4, 77.
78. Limestone; Spherical; d-10.85 cm; m-791 g (ca. 3 pounds); Fig. 4, 78.
79. Limestone; Spherical with two flattened sides; d-11.14 cm; h-7.10 cm; m-730 g (ca. 3 pounds); Fig. 4, 79.
80. Limestone; Spherical; d-11.32 cm; m-902 g (ca. 4 pounds and 2 ounces); Fig. 4, 80.
81. Limestone; Irregular; d-10.25 cm; m-694 g (ca. 4 pounds and 2 ounces); Fig. 4, 81.
82. Limestone; Spherical; d-10.61 cm; m-972 g (ca. 3 pounds); Fig. 4, 82.
83. Limestone; Spherical with one flattened side; d-12.27 cm; h-10.90 cm; m-1298 g (ca. 4 pounds and 2 ounces); Fig. 4, 83.
84. Limestone; Spherical with one flattened side; d-11.29 cm; h-8.65 cm; m-994 g (ca. 3 pounds); Fig. 4, 84.
85. Limestone; Spherical; d-29.58 cm; m-3550 g (ca. 12 pounds); Fig. 4, 85.
86. Limestone; Spherical with one flattened side; d-28.27 cm; h-9.66 cm; m-1724 g (ca. 5 pounds and 4 ounces); Fig. 4, 86.
87. Limestone; Spherical with one flattened side; d-13.28 cm; h-9.46 cm; m-1857 g (ca. 5 pounds and 8 ounces); Fig. 4, 87.
88. Limestone; Oval; d-12.61 cm; h-8.87 cm; m-1149 g (ca. 3 pounds and 7 ounces); Fig. 4, 88.
89. Limestone; Spherical; d-13.75 cm; m-1649 g (ca. 6 pounds); Fig. 4, 89.
90. Limestone; Spherical; d-11.76 cm; m-954 g (ca. 3 pounds); Fig. 4, 90.
91. Limestone; Spherical; d-12.70 cm; m-1325 g (ca. 4 pounds and 2 ounces); Fig. 4, 91.
92. Limestone; Spherical; d-11.81 cm; m-963 g (ca. 3 pounds); Fig. 4, 92.
93. Limestone; Unknown; d-13.18 cm; m-1230 g (ca. 5 pounds and 6 ounces); Fig. 4, 93.
94. Limestone; Unknown; d-13.46 cm; m-1429 g (ca. 5 pounds and 6 ounces); Fig. 4, 94.
95. Limestone; Spherical with two flattened sides; d-12.84 cm; h-9.39 cm; m-1392 g (ca. 5 pounds); Fig. 4, 95.
96. Limestone; Spherical; d-10.72 cm; m-771 g (ca. 3 pounds); Fig. 4, 96.
97. Limestone; Spherical with one flattened side; d-10.48 cm; h-7.12 cm; m-626 g (ca. 2 pounds ounces); Fig. 4, 97.
98. Limestone; Spherical; d-9.87 cm; m-774 g (ca. 2 pounds and 5 ounces); Fig. 4, 98.
99. Limestone; Spherical; d-10.10 cm; m-788 g (ca. 2 pounds and 5 ounces); Fig. v, 99.
100. Limestone; Spherical with one flattened side; d-9.41 cm; h-7.20 cm; m-508 g (ca. 1 pound and 7 ounces); Fig. 4, 100.
101. Limestone; Spherical with one flattened side; d-10.33 cm; h-7.19 cm; m-703 g (ca. 2 pounds and 2 ounces); Fig. 4, 101.
102. Limestone; Spherical; d-11.41 cm; m-716 g (ca. 3 pounds and 3 ounces); Fig. 4, 102.
103. Limestone; Spherical; d-9.07 cm; m-508 g (ca. 1 pound and 7 ounces); Fig. 4, 103.
104. Limestone; Oval; d-9.74 cm; h-6.50; m-585 g (ca. 1 pound and 10 ounces); Fig. 4, 104.
105. Limestone; Spherical with one flattened side; d-8.36 cm; h-6.40 cm; m-440 g (ca. 1 pound and 5 ounces); Fig. 4, 105.
106. Limestone; Oval; d-9.24 cm; h-6.65; m-579 g (ca. 1 pound and 10 ounces); Fig. 4, 106.
107. Limestone; Spherical with one flattened side; d-10.42 cm; h-8.74 cm; m-900 g (ca. 2 pounds and 9 ounces); Fig. 4, 107.
108. Limestone; Spherical with one flattened side; d-8.37 cm; h-6.12 cm; m-377 g (ca. 1 pound and 2 ounces); Fig. 4, 108.
109. Limestone; Spherical; d-9.06 cm; m-526 g (ca. 1 pound and 8 ounces); Fig. 4, 109.
110. Limestone; Spherical with one flattened side; d-10.31 cm; h-5.94 cm; m-667 g (ca. 2 pounds and 1 ounce); Fig. 4, 110.
111. Limestone; Spherical; d-9.67 cm; m-633 g (ca. 2 pounds); Fig. 3, 111.
112. Limestone; Spherical; d-9.35 cm; m-533 g (ca. 1 pound and 8 ounces); Fig. 4, 112.
113. Limestone; Spherical; d-10.34 cm; m-780 g (ca. 2 pounds and 5 ounces); Fig. 4, 113.
114. Limestone; Spherical; d-11.86 cm; m-1203 g (ca. 3 pounds and 8 ounces); Fig. 4, 114.
115. Limestone; Spherical; d-9.89 cm; m-714 g (ca. 2 pounds and 3 ounces); Fig. 4, 115.
116. Limestone; Spherical; d-7.67 cm; m-525 g (ca. 1 pound and 8 ounces); Fig. 4, 116.
117. Limestone; Spherical; d-11.25 cm; m-890 g (ca. 2 pounds and 9 ounces); Fig. 4, 117.
118. Limestone; Spherical with one flattened side; d-10.98 cm; h-10.27 cm; m-1181 g (ca. 3 pounds and 8 ounces); Fig. 4, 118.
119. Limestone; Spherical; d-7.35 cm; m-246 g (ca. 10 ounces); Fig. 4, 119.
120. Limestone; Spherical; d-11.07 cm; m-1300 g (ca. 4 pounds); Fig. 4, 120.
121. Limestone; Spherical with one flattened side; d-11.11 cm; h-7.98 cm; m-879 g (ca. 2 pounds and 10 ounces); Fig. 4, 121.
122. Limestone; Spherical with one flattened side; d-10.01 cm; h-8.42 cm; m-747 g (ca. 2 pounds and 4 ounces); Fig. 4, 122.
123. Limestone; Spherical with two flattened sides; d-12.77 cm; h-8.94 cm; m-1175 g (ca. 5 pounds and 4 ounces); Fig. 4, 123.
124. Limestone; Spherical with one flattened side; d-10.43 cm; h-5.57 cm; m-541 g (ca. 1 pound and 8 ounces); Fig. 4, 124.
125. Limestone; Spherical; d-6.73 cm; m-226 g (ca. 9 ounces); Fig. 4, 125.
126. Limestone; Spherical with one flattened side; d-7.22 cm; h-5.35 cm; m-247 g (ca. 9 ounces); Fig. 4, 126.
127. Limestone; Spherical; d-8.61 cm; m-461 g (ca. 1 pound and 6 ounces); Fig. 4, 127.
128. Limestone; Oval; d-8.07 cm; h-5.74 cm; m-370 g (ca. 1 pound and 2 ounces); Fig. 4, 128.
129. Limestone; Spherical; d-12.16 cm; m-1091 g (ca. 3 pounds and 5 ounces); Fig. 4, 129.
130. Limestone; Spherical with one flattened side; d-24.73 cm; h-9.91 cm; m-1931 g (ca. 6 pounds); Fig. 4, 130.
131. Limestone; Irregular; d-10.83 cm; m-1047 g (ca. 3 pounds and 3 ounces); Fig. 4, 131.
132. Limestone; Spherical; d-12.48 cm; m-1213 g (ca. 5 pounds and 6 ounces); Fig. 4, 132.
133. Sandstone; Spherical; d-6.82 cm; m-445 g (ca. 1 pounds and 5 ounces); Fig. 4, 133.

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