

PLUMBATA, THE ROMAN-STYLE DARTS. A Late Antique Weapon from Annamatia

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It is possible to view an unusual object in the display showing Roman military equipment at the permanent exhibit of the Intecisa Museum, a special weapon of the army in Late Antiquity, the plumbata.² The meaning of the Latin word is 'leaden', but if the construction and use of the implement is taken into account it could be called a dart in English. With this ca. 50 cm long, hand-thrown weapon the heavy infantry could have begun to disrupt the deployment of the enemy from a distance.

WRITTEN SOURCES

The name and description of the projectile weapon called a plumbata in Latin is known from numerous sources from Antiquity and the Early Middle Ages. (VERMAAT 2015) (Fig. 1)

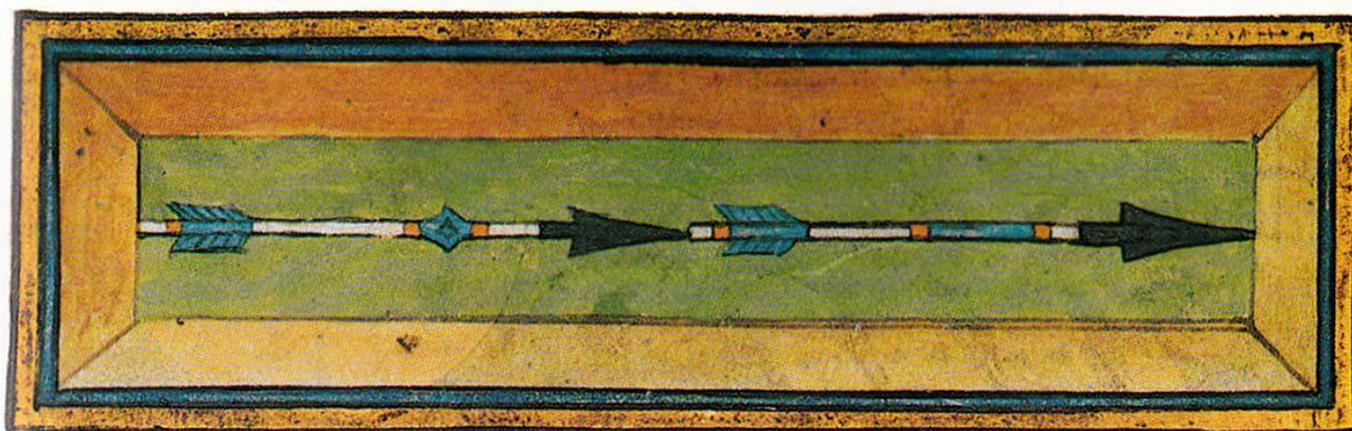


Fig. 1: Depiction of a plumbata tribolata and mamillata. The lead weight is missing from the latter (Source: <http://rekostwargames.blogspot.hu/2016/11/roman-unit-menapii-seniores.html>, date of download: 19 April 2018)

According to *Flavius Vegetius Renatus*, who lived in the Late Imperial period, the expert soldiers of two legions in Illyricum used the plumbata, and so they were called Mattiobarbuli (I 17. II 15. 16. 23. III 14. IV 21. 44.). The emperors Diocletian (284–305) and Maximian (286–305) honored the two units with the title Jovian and Herculean for their prowess. From Vegetius's description it seems that the two units used the plumbata prior to Diocletian coming to power, but it is perhaps only after this, in the last decades of the 3rd century, that its use spread to the other units of the empire as well. The heavy infantry in the front rows used them; each soldier affixed 5 of them to their shield, so that they would be ready at the start of the fight. However, the light infantry also used the plumbata, and they perhaps were not limited to only five of them. The weapon was employed in open battles, in the storming and protecting of town walls and even in maritime engagements to injure enemies.

Two types of plumbata were known to the Anonymous author who wrote the work on military science entitled *De rebus bellicis* at the end of the 4th century (chapters 10-11). One was the traditional weapon

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² The surveyor Zoltán Lévay discovered the object during a field walk in Baracs and donated it to the museum. I would hereby like to thank him for his kindness. Its inventory number is 74.28.219, and Annamatia is given as its discovery site. In the professional literature the discovery site of the item is cited Intecisa–Dunapentele–Dunaújváros. The reason for the error is that the item was placed in the display showing the equipment of the military units of Intecisa in 1975, designated as a catapult projectile. Griffiths (1995: 3) has previously indicated the mistaken designation of its function.

mentioned by Vegetius, the *plumbata mamillata*. The meaning of the word *mamilla* is ‘breast’. Their name suggests that the lead weight that gave the weapon its name had a rounded form. In contrast to this, spikes protruded from the weight of the *plumbata tribolata*. The idea may have been that the great majority of ranged weapons did not find their mark (КОЗЛЕНКО 2009: 296–297) and the *plumbatae* that fell to the ground then functioned as *tribuli*, or caltrops. This made the movement of the enemy soldiers more difficult and caused them serious injuries if they stepped on the spikes (Fig. 2). This version would have proven useful in defensive situations, when it would not have hampered the advance of their own soldiers pursuing the enemy.

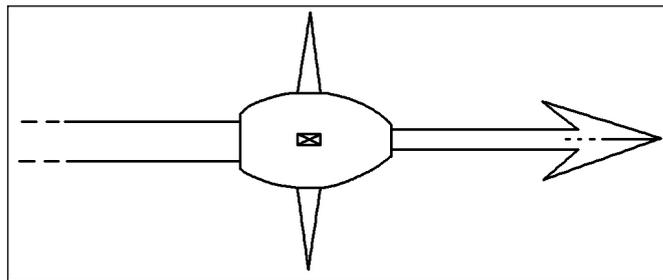


Fig. 2: Reconstruction of a *plumbata tribolata* on the basis of its description (Source: Griffith 1995: Fig. 1)

According to Vegetius the other name of the weapon was *mattiobarbulus*. It is uncertain where this word originates from and precisely what it means. The meaning of *barbulus* is ‘small beard or beard hair’. It is possible that the medieval transcribers misspelled the name, which may have been *martiobarbulus* originally. A designation similar to the latter is known from the military handbook entitled *Strategikon* (XII B 2, 4–6, 12, 16, 18, 20.). According to medieval traditions, the author of this was the Byzantine Emperor Maurice (583–603). According to this book the weapon called *martzobarbulon* was still an important part of the Byzantine arsenal in the 6th century. The meaning of *martiobarbulus* is ‘the beard of Mars’. This designation reflecting military humor may indicate that the tip of some darts may have been barbed, making their removal from the wound more difficult. It is also possible that the dense cloud of darts thrown at one time may have made the impression of a celestial, divine beard (ELLIOTT 2010: 41).

Maurice first mentions the *martzobarbulon* in the training and equipment of the heavy infantry, but does not give a number of how many the soldiers carried with themselves. In the review of the equipment of the light infantry he writes that they carried the *martzobarbulon* in leather quivers. It is generally presumed that the heavy infantry also stored them similarly, not in the old manner, affixed to their shields. The operators of catapults mounted on wagons were also supplied with *martzobarbulons*. The supplies of this weapon that was considered an expendable projectile were transported on carts alongside the other items of their equipment (saws, spades, etc.). Maurice recommends the employment of this weapon in particular against the Slavs living in forested and swampy areas.³

Emperor Leo VI (886–912) in his book entitled *Tactica* mentions in connection with the training of soldiers that the heavy infantry must practice throwing javelins, axes and *martzubarbulons*. A second term for the latter by this time was the *saliba* (VII 4). It seems that the meaning of the term had already changed by this time; they understood it to be a kind of mace that when necessary could also have been thrown (KOLIAS 1988: 176-178).

ARCHAEOLOGICAL FINDS

Collectors of antiquities had already taken note of this object type in the Renaissance period. Despite this, its precise construction and use remained unclear for a long time.⁴ Only the archaeological finds discovered in the 19th–20th centuries and experimental archaeology were able to dispel the uncertainty connected to the item. *Plumbatae* are known from more than 100 archaeological sites throughout the empire (*Encyclopédie...*). Alongside the shape of their heads, they are differentiated by the length and shape of the iron shaft below the head (Fig. 3), the lead weight and the manner in which the wooden handle is inserted

³ According to John Eagle (1989: 247) the cavalry units of Belisarius also employed the *plumbata* against the Vandals, and John the Armenian killed one of Genseric’s nephews with one in 530. This information was adopted by other authors as well, but no one cited the source. I did not find the description of the event myself: Procopius 1916.

⁴ The misunderstanding of the character of the weapon is reflected in the description provided in a footnote by László Várady, who translated Vegetius’s text into Hungarian (lead ball affixed to a leather strap, barbed sling shot).

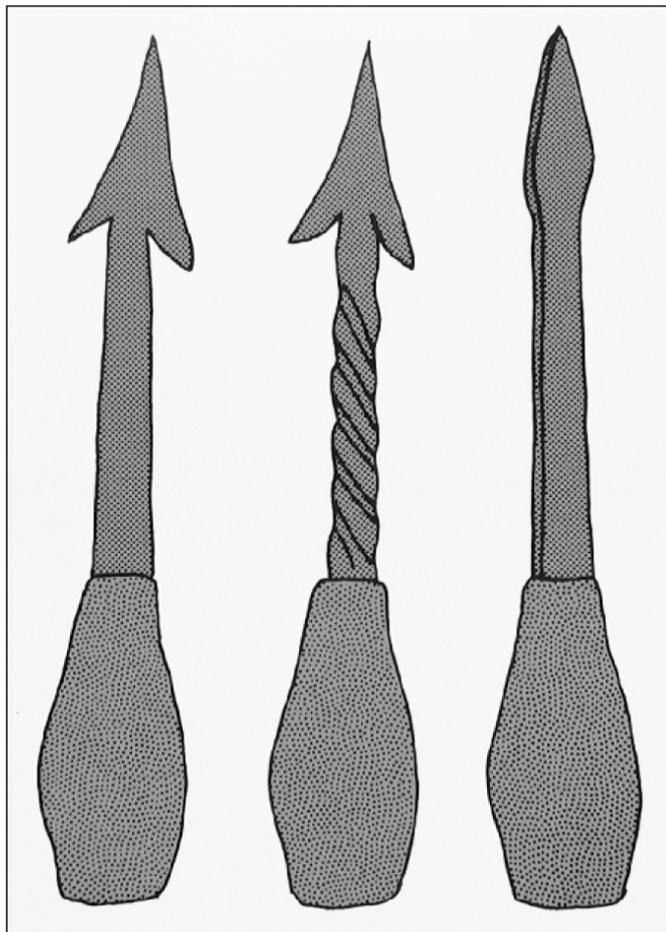


Fig. 3: Various plumbata types
(Source: Völling 1991: Abb. 2)

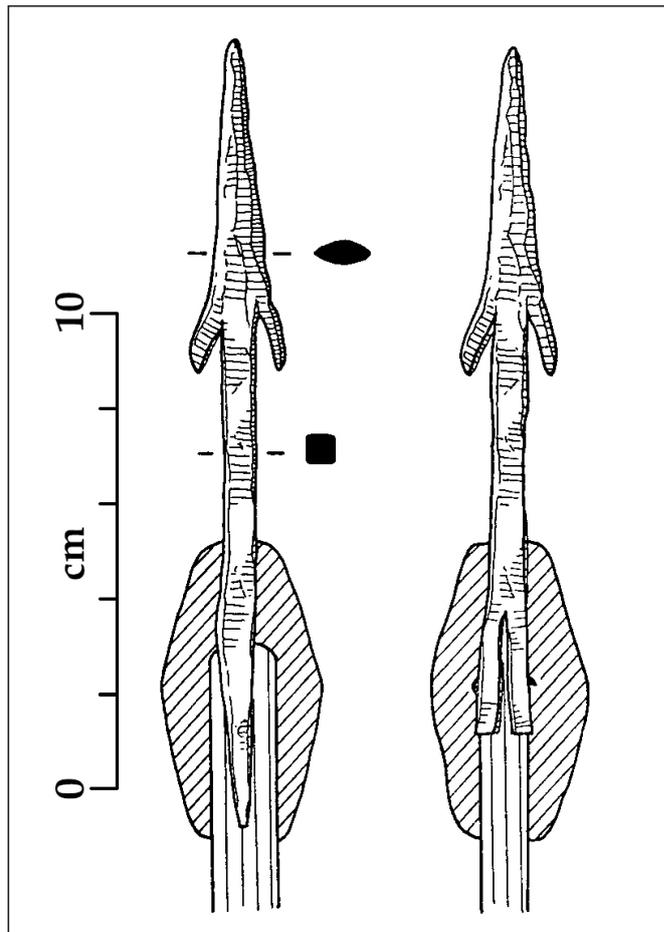


Fig. 4: The joining of the iron and wooden parts of the plumbata (Source: Sherlock 1978: Fig. 20)

(SHERLOCK 1978) (Fig. 4). For the time being, a find that can be determined to be a plumbata tribolata is not yet known. In the territory of Pannonia, more than 20 plumbatae have come to light from 11 sites,⁵ and this number is increased by an example from an unknown site in the Hungarian National Museum.

Not one of the examples discovered at excavations and clearly datable is from earlier than the 270s,⁶ which corresponds well to the data related to the spread of the weapon in Vegetius.⁷ The majority of plumbatae have been discovered in a find context from the 4th or beginning of the 5th century (PFLAUM 2007: 296–297; ХРИСТОВ 2009). The latest plumbata that can be relatively certainly dated is from the end of the 5th century or beginning of the 6th century, and was discovered in a fortification in Slovenia (CIGLENEČKI 1994: 245–248, Abb. 7, 13). For the time being, there are no finds that can be clearly dated to the Early Middle Ages that would corroborate the information from the Byzantine military handbook. According to hypotheses, the larger, heavier examples may have come from Byzantine times, which is why they were kept in separate quivers in contrast to the earlier practice (KOLIAS 1988: 176; VÖLLING 1991: 294–295). The plumbata found at Olympia is also considered to be of this type, which is not only differentiated from the rest due to its

⁵ Bad Deutsch-Altenburg (*Carnuntum*, Austria), Iža (Izsa-Leányvár, *Celamantia*, Slovakia), Pilismarót, Szentendre (*Ulcisia Castra*), Baracs (*Annamatia*), Őcsény-Soványtelek, Rumski Petrovci (Croatia), the vicinity of Žarkovci (Serbia), Zemun (Zimony, *Taurunum*, Serbia), Keszthely-Fenékpuszta, Sisak (Siscia, Croatia)

⁶ Not a single find is known from those areas that the Romans abandon in the last third of the 3rd century (Völling 1991).

⁷ The possibility has arisen that plumbatae are depicted on the gravestone of a soldier of the Legio II Parthica in Apamea (Colombo 2011: 160–161; Gagetti 2013). This would place the beginning of the use of this weapon in Syria at the beginning of the 3rd century, which contradicts Vegetius's information. Furthermore, plumbata finds are known in mass from the former territory of Illyricum, but not from Syria. It is five javelins that are actually shown on the gravestone, probably in the leather case for storing them, and the inscription states that Aurelius Mucianus taught javelin throwing (*discens lancharium*) to the recruits.



Fig. 5: The plumbata from Baracs (Intercisa Museum, photo by Tamás Keszi)

dimensions, but also because the lead was not cast around the meeting point of the iron socket and the wooden shaft, but was entirely affixed to the iron shaft.⁸

The size of the plumbatae found to this point vary between 9.8 and 27.5 cm. In its present condition the object from Baracs is barely 13.7 cm long, placing it amongst the medium-sized examples (Figs. 5–6). Its barbed iron head is three-edged, and this feature differentiates it from the majority of plumbatae that have heads that are either two-edged and barbed or four-edged and tapered. Affixed to the head is a long shaft that was forged from a metal sheet, but the two ends of the sheet were not hammered together. Originally a thin wooden shaft was inserted into this socket section and may have been affixed to the metal head with a rivet. The crumbled remains of the wood can still be identified. A lead alloy was cast around the meeting point of the wooden shaft and the iron socket (DIM 1995). This not only reinforced the connection, but also increased the weight of the item, and thus its penetrating force as well. The current weight of the weapon is 70 grams, but about a fourth of the lead weight is missing, so it may have been about 100 grams when intact.⁹ The weight of examples that have been published up to this point is 40–180 grams. The weights are generally egg-shaped, with the exceptions to this being the examples from Olympia and from Siscia, which have an angular cross section.

The diameter of the wooden shaft of the Baracs example has been preserved by the lead cast around it; it was a total of 9.5 mm, which implies a short shaft in reality. On the basis of the length of the metal section, it may have been 25–30 cm with a further length of 3–5 cm extending into the socket. The weight of a 30–35 cm long, 1 cm diameter wooden rod would have been 20–25 g. Feathers were affixed to the end of the shaft that stabilized its flight path, with enough room left behind the feathers to be able to grasp the dart. The weight of the full, shafted, fletched weapons may have ranged between 130 and 350 g (KOZLENKO 2008: 341). On the basis of this, the Baracs weapon would have been considered a light plumbata.

It may have been produced by one of the army's central weapons manufacturing workshops for the soldiers of the Roman fort of Annamatia that once stood within the territory of present-day Baracs (Vegetius II, 11; Bishop–Coulston 2006: 238–240). Cohors units of 500 men were stationed at Annamatia from the second half of the 1st century A.D. There is no information about precisely which units served at the fort



Fig. 6: The three-edged head of the plumbata (Intercisa Museum, photo by Tamás Keszi)

⁸ A similar solution is also seen in the larger plumbatae from Siscia (Radman-Livaja 2004: T. 8,31; 9,35). The advantage of this type may have been that the examples with broken shafts could have been more easily repaired.

⁹ The basis of the estimate is the amount of the modeling clay supplementing the lead weight (2.3–3.3 cm³) and the density of pure lead (11.34 g/cm³).

in the second half of the 3rd and first half of the 4th century, but at the end of the 4th century the equites Dalmatae, or Dalmatian cavalry soldiers, are mentioned by the *Notitia Dignitatum* (KOVÁCS 2008). A few other finds also indicate that the plumbata was not only used by infantry, but also by cavalry units (Rupnik 2009: 495). However, it is difficult to determine in which battle situations they would have been used. It is possible that they were only employed during service duties performed on foot, for example in the defense of the walls of the fort or the associated watchtowers.

EXPERIMENTAL ARCHAEOLOGY

The weapon could have been thrown in two different ways. If someone were to grasp the dart by the end and then throw it underhand by swinging their arm forward and up from behind, then – according to certain tests – it would have struck the ground 80-90 meters away, often essentially perpendicular to the surface (CONYARD 2013: 542)¹⁰ (Fig. 7). In this manner, the falling darts would not have threatened the soldiers and horses face on, but from above, avoiding their shields. Thus they could easily have been thrown over the rows of their own army or over the walls of a besieged fortification that were up to 10 meters tall. When defending, it would have been enough to just drop the weapon from the top of the wall, letting gravity perform its work. Darts thrown over the shoulder like a javelin travel a distance of 30-35 meters. Thus, using this method the soldiers were able attack enemies that were getting closer to the army's lines but were still out of the range of throwing spears. It is easy to throw them from the back of a horse with this same motion, and in this case the speed of the galloping horse would increase the impact energy of the dart.

The distance achieved naturally depends on the weight and length of the plumbatae employed; examples with a weight of 170-200 grams and 45 centimeters in length fly the furthest. The depictions in *De rebus bellicis* indicate a short shaft as well. A greater range can also be achieved with the use of a simple leather strap (amentum), which was affixed to the end of the plumbatae during the tests (CONYARD 2013: 543). These leather straps may have played a role in affixing the weapon to the shield as well, but not a single written source mentions them. In fact, the author of *De rebus bellicis* expressly states that room must be left at the end of the weapon for the hand to grasp it.

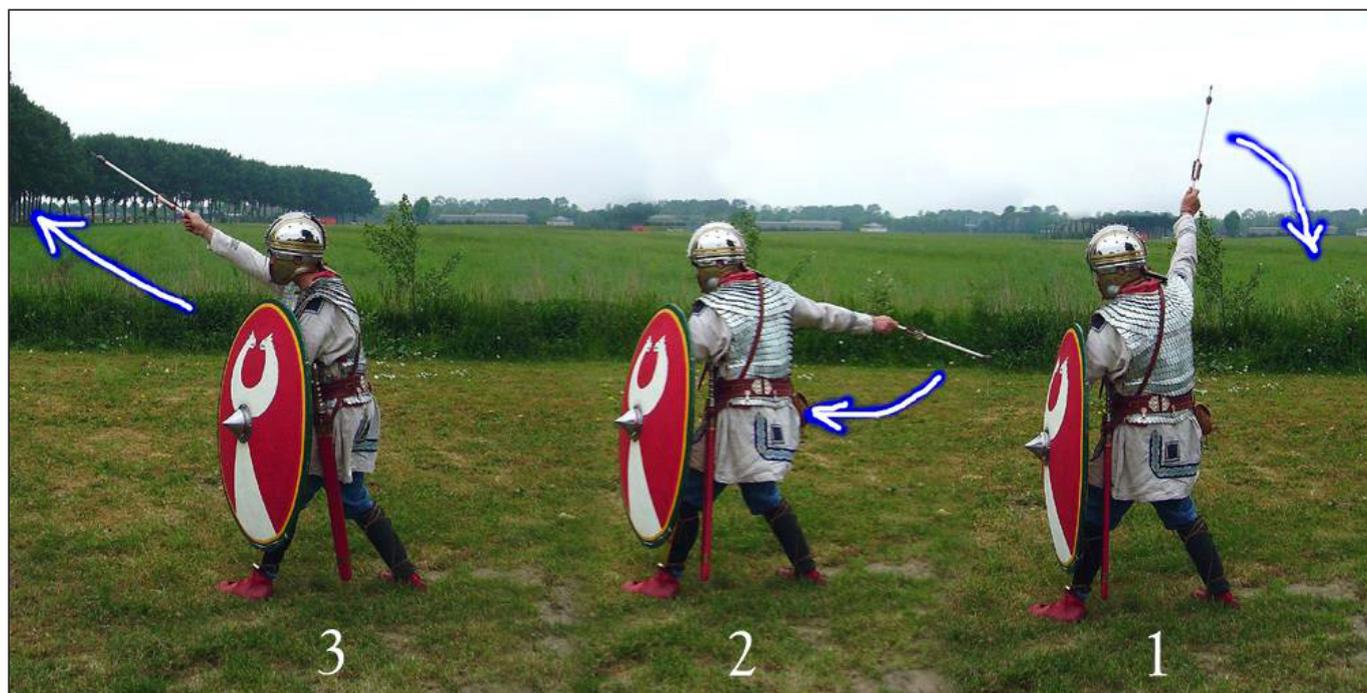


Fig. 7: The method of throwing a plumbata (Source: Vermaat, Robert: *Plumbata – de dartpijl van het Late Romeinse Rijk*)

¹⁰ Other accounts mention a significantly shorter range of 50-60 m (Elliott 2010: 41), 37–61 m (Eagle 1989: 247–253) or 33-45 m. (Vermaat 2007)

THE ORIGIN OF THE WEAPON

Numerous theories on this start from the idea that the *mattiobarbulus* name of the weapon is not the result of a corruption of the text. There are those who believe the name can be linked to the Germanic *Mattiaci*, who are first mentioned by Tacitus and were conscripted into a *cohors equitata* unit by the Romans. However, the latter were stationed in Moesia Inferior (Schönfeld 1930), and this was not a part of the provinces of Illyricum. Furthermore, according to Vegetius the weapon was originally employed by legionaries. A linguistic problem is also associated with all of this; the *mattio* form would be difficult to explain from the name *Mattiaci*.

According to other researchers, the first part of the name, *mattea*, comes from one of the Celtic languages and originally meant ‘mace’. The term – obviously together with the weapon – was absorbed into Latin and became a part of military terminology. The fault in this explanation is that the *plumbata* differs in character from maces, which were used to smash and crush, and its appearance in Illyricum in the 3rd century cannot be connected with Celtic tribes.

Yet others compare the *plumbata tribolata* to the *cateia*. The latter is mentioned by numerous authors in antiquity (DOMASZEWSKI 1899), and Virgil writes that it was a projectile weapon of the Teutons (*Aeneis* 7.741). According to the 4th century commentator on Virgil, Maurus Servius Honoratus, the Gauls also employed it. According to his explanation, the *cateia tota fere clavis ferreis illigata*. Alexei Kozlenko interprets this as the weapon was studded with iron spikes whose points protruded out, so it may have been similar to a *plumbata tribolata* to a certain extent. The problem with this explanation is that archaeologists have not yet found a *plumbata tribolata*, so it cannot be discounted that it was an invention that only existed on paper, or at least was quite rare. Therefore, it cannot be stated that it represented a transitional phase between the Germanic *cateia* and the *plumbata mammata*. Otherwise, the logical direction of development leads from the *plumbata mammata* to the *plumbata tribolata*, with the second weapon evolving from the first, expanding its function. Furthermore, the authors in antiquity do not write that the *cateia* had a point. The term *clavus* does not only mean ‘spike’, but also the ‘crimson band or strap’ running along the edge of a tunic. Thus, it is not talking about nearly the entire surface of the weapon being studded with spikes, because then it would have been difficult to wield, but that it was “bound together” with metal bands. Virgil and Gaius Valerius Flaccus (*Argonautica* 6.83) use the word *torqueo* in connection with the weapon, which in this case means something like ‘to throw wound up’. If we add to this the fact that according to Isidorus a skillfully thrown *cateia* returns to its owner (*si ab artifice mittatur; rursum redit ad eum qui misit*, *Etymologiae* 18.7.7), then it is possible to see that it is a throwing stick or boomerang given extra weight with metal fittings, and has nothing to do with the *plumbata*. Moreover, this type of object is also known from archaeological finds (BORDES–LEFORT 2016).

The sources from antiquity mention a weapon similar to the *plumbata* in connection with the Macedonian Wars, although these did not have lead weights and they were wielded differently than a *plumbata* (Polübiosz 27.11). This weapon called a *kestros* was developed by the Macedonians in their third war against the Romans, and was first employed during their military operations in 171 B.C. According to the description, it had an iron head the length of a palm, with a socket of the same length. A wooden shaft a finger wide and a span long was inserted into the latter. Three wooden wings were affixed to the center of the wooden shaft, which controlled the flight of the projectile. The weapon was placed on two cords of different lengths that were folded in half. The ends of these were held in the hand, and it was swung around like a sling, then the dart was flung by releasing one of the ends. Utilizing Polybius’s data, Livy also mentions the weapon, which he calls a *cestrosphendon* (Livy 42.65.9.). A half cubit long (22.2 cm) wooden rod the thickness of a finger (1.85 cm) was attached to a two palm long (2×7.4 cm) iron section.¹¹ The *plumbatae* are actually found in the greatest numbers from the former territory of Illyricum (Vujović 2009). However, a problem is represented by the fact that similar weapons in the territory of the Roman Empire are not known from written sources or from archaeological finds throughout more than 400 years.

¹¹ Griffiths (1989: 260) expressed uncertainty in connection with the existence of the weapon. The reason for this is that the existence of the *kestros* is not verified in a source independent of Polybius.

Pliny does mention a weapon that on the basis of its name could be linked to the plumbata. In his work on natural history he writes that the bird called a cinnamoligus builds its nest from sticks that can be used to produce cinnamon. The Arabs knock the difficult to reach nests down with arrows weighted with lead (*plumbatis sagittis*) (Naturalis historia 10.97; 12.85) so that later they may trade in the spice. Others also adopted Pliny's data. Three-edged arrows weighted with lead have been found in the military fort of Haltern in Germany.¹² These perhaps were part of the equipment of eastern warriors who participated in Varus's unsuccessful campaign against the Germanic tribes in 9 A.D. The problem in this case is that more than 270 years separates them from the actual plumbata, and in addition the manner in which the weapon was used is not known.

However, it is not even certain that the origins of the plumbata must be sought from other peoples. The possibility has arisen that it was developed from the traditional Roman weapon, the *pilum*. The penetrating force of this was also increased by extra weight attached to the shaft. It took nothing more than a reduction in the size and weight of the weapon so that it could be thrown further. The reduction in size resulted in a more uncertain trajectory, so the weapon was provided with stabilizing wings modeled on those of arrows. Experience could have led the soldiers to realize that it was possible to throw them further by holding onto their ends, just as occurred with the modern examples from experimental archaeology.

The development and systemization of a weapon that was of local significance in the beginning may have been caused by the increase in the importance of ranged weapons in the 3rd – 4th centuries in the wars fought against the barbarians. The units equipped with the plumbata could not only be deployed in close combat, but also prior to this in ranged engagements – supplementing or replacing bowmen – thereby reducing the momentum of the charging enemy. It could have been effective against those barbarians who entered battle without helmets or shoulder guards, or against cavalry, since the horses in general were not protected by armor or shields. The effectiveness of the weapon is shown by the fact that it was able to supplant the *pilum*, which the Roman legions had used for nearly 500 years (BISHOP 2017).

THE PLUMBATA AS A SYMBOL OF POWER?

Many things depend on the military success of emperors and kings – the security of their people and their states, and often their own lives and the lives of their families as well. In these circumstances it is natural that weapons appear amongst royal symbols, indicating their abilities as military leaders to their subjects. Examples are the lances and scepters (which is a coronation accessory refined from a mace) of European kings or the gilded bow of the Huns. This idea also arose in connection with the plumbata, that some 3rd – 4th century emperors were depicted with plumbatae in their hands on coins minted for special occasions (ESTIOT 2008; DROST–ESTIOT 2010).

Reason for doubt is provided by the fact that it is worthwhile to select a weapon that is effective, devastating and well known. However, portraits on coins disappear precisely at the time, the beginning of the 4th century, when according to archaeological finds the use of the plumbata flourished throughout the empire.

On one version of these coins, which appears during the time of Emperor Probus (276–282), the rulers hold in their right hand a projectile weapon with its head pointing down, and in their left hand two other weapons with their heads pointing up (Fig. 8).



Fig. 8: Aureus of Emperor Maximian (286–305) from 290–292 (Source: RIC VI Siscia, Drost–Estiot 2010: Fig. 16)

¹² Their weights were 19 and 49 grams, so much lighter than the Late Roman plumbatae (Völling 1991–1992).



Fig. 9: Bronze coin of Emperor Constantine from 306-307 (RIC VI Aquileia 98b, <http://numismatics.org/collection/1984.146.1689>, date of download: 19 April 2018)



Fig. 10: Aureus of Emperor Diocletian (284-305) from 288-290 (Source: RIC V/2 Roma 140, Drost-Estiot 2010, fig. 17)

According to Sylviane Estiot the size of the weapons suggests the plumbata. But in this case it is not worthwhile to compare the size of the weapons to the bust. There is only little space available on the coin, so it cannot be expected that every element on them will be depicted at the same scale. According to Estiot, the depiction of the weapon in the right hand faithfully renders the most effective method of throwing the plumbata, an underhand forward motion with an extended arm. However, the emperor's hand holds the weapon not at the end, but nearer to its head, just as must be done in the case of larger projectile weapons.

A further problem is that the projectile weapons depicted on the coins lack the guiding feathers. Sylviane Estiot explains this by saying that these were not yet mounted on weapons in the 3rd – 4th century; Vegetius does not mention their presence and the plumbatae could not have been affixed to a shield without damaging their fletching, so it was just devised by the 4th century Anonymous. However, Vegetius does not describe other weapons going into detail, so the failure to mention the fletching does not mean it was lacking. There is no proof that the projectiles could not be affixed to a surface without damaging their fletching. According to the experiments, a plumbata without fletching is not sufficiently effective, so the text and illustrations of Anonymous authentically depict the construction of the weapon. It is possible to conceive that the development of the plumbata was continuous; they were originally produced without flights, and they were only provided with feathers to stabilize their trajectory later, at the beginning of the 4th century, when this type of coin was no longer minted. But why would Emperor Probus have selected a not particularly effective, newly developed, relatively unknown weapon that floundered through the air as a symbol of power when other choices were available?¹³

Finally, the lead weight that gave the weapon its name is not on any of the projectile weapons seen on the coins. According to Estiot, a weight can be seen on one of them, but this is debatable. What he sees as a weight is instead one of the fingers of the ruler. If a weight were actually visible on the coin, even that would not be decisive in itself, since in the 3rd century the pilum was given a similar weight.

In the second version of the coins, according to Estiot the weapons are depicted in the hands of the

¹³ It must be noted that if they genuinely are plumbatae that are depicted on the coins in question, this would not mean that the appearance of the weapon should be dated earlier. After all, in contrast to Estiot's opinion (2008: 186), the research does not place the appearance of the weapon in the 4th–5th century, but instead in the last third of the 3rd century.

emperor in the proper order they would be used during a battle; in his right hand he has a javelin and in his left hand he has his shield along with the plumbatae for later (Figs. 9-10) However, Vegetius states precisely that the plumbata makes the soldiers similar to archers, because they showered them on the enemy before the other projectile weapons. The experiments also show that the range of the plumbata exceeded that of the larger projectile weapons. Furthermore, the weapons held in the left hand of the emperor extend beyond the shield. The proportion of the weapons to one another is telling; the weapons larger than the shield cannot be identified as plumbatae that were hardly a half a meter in length. Thus, the depiction is similar to what is seen in one of the reliefs at the Mainz fort; the soldier holds a javelin ready to throw in his right hand and extra javelins in his left hand, which extend beyond the shield (GOLDSWORTHY 2003: 55). Even the numbers correspond to the weapons depicted in the figure on the coin, one javelin in the right hand and two in the left. The consistent depiction suggests that the equipment included three of this type of weapon, in contrast to the plumbata, which Vegetius understands that each soldier carried five.

Therefore, for the time being – no matter how tempting the thought – it is not possible to state that the plumbata was a symbol of the power of the ruler.

BIBLIOGRAPHY

BISHOP, MIKE C. 2017:

The Pilum: The Roman Heavy Javelin. Oxford–New York, Osprey Publishing.

BISHOP, MIKE C.–COULSTON, JONATHAN C. N. 2006:

Roman Military Equipment: From the Punic Wars to the Fall of Rome. Oxford, Oxbow Books.

BORDES, LUC–LEFORT, ANTHONY–BLONDEL, FRANCOIS 2016:

A Gaulish Throwing Stick from Normandy: Experimental Study. *EXARC JOURNAL Digest* 2016-1. 18–21. <https://exarc.net/issue-2015-3/ea/gaulish-throwing-stick-discovery-normandy-study-and-throwing-experimentations> (Hozzáférés: 2017. november 2.)

CIGLENEČKI, SLAVKO 1994:

Höhenbefestigungen als Siedlungsgrundeinheit der Spätantike in Slowenien. *Arheološki vestnik* 45. 239–266.

COLOMBO, MAURIZIO 2011:

La lancea, i lanciarii, il pilum e l'acies di Arriano: un contributo alla storia dell'esercito romano. *Historia* 60/2. 158-190.

CONYARD, JOHN 2013:

Recreating the Late Roman Army. In: *War and warfare in late antiquity*. Ed. Sarantis, A.–Christie, N. Leiden–Boston, BRILL, 523-567.

DIM, DAVID 1995:

Experiments to Examine the Manufacturing Techniques Used to Make Plumbatae. *The Arbeia Journal* 4. 13–19.

DOMASZEWSKI, ALFRED VON 1899:

Cateia. *Paulys Real-Encyclopädie der classischen Altertumswissenschaft. Neue Bearbeitung*. Hrsg. Georg Wissowa. III, 2 Stuttgart, J. B Metzlerscher, 1786.

Tamás Keszi • *Plumbata, or the Roman-Style Darts. A Late Antique Weapon from Annamatia*

DROST, VINCENT–ESTIOT, SYLVIANE 2010:

Maxence et le portrait militaire de l'empereur en Mattiobarbulus. *Revue Numismatique* 166. 435–445.

EAGLE, JOHN 1989:

Testing Plumbatae. In: *Roman Military Equipment: the Sources of Evidence*. BAR International Series 476. Ed. C. van Driel-Murray. Oxford, British Archaeological Reports, 247–253.

ELLIOTT, PAUL 2010:

Death from above. Mattiobarbuli and Plumbata. *Ancient Warfare*. Volume IV, Issue 3. 38–43.

ESTIOT, SYLVIANE 2008:

Sine arcu sagittae: la représentation numismatique de plumbatae/mattibarbuli aux IIIe–IVe siècles (279–307 de n. è.) *Numismatische Zeitschrift* 116/117. 177–201.

Encyclopédie des petits objets archéologiques. <http://artefacts.mom.fr/de/result.php?id=PBT-4001&find=PB&pagenum=1&affmode=vign>. (Hozzáférés: 2017. szeptember 21.)

GAGETTI, ELISABETTE 2013:

22–23. Cuspide di plumbata. In: *Costantino e Teodoro, Aquileia nel IV secolo. Fondazione Aquileia*. Eds. C. Tiussi–L. Villa–M. Novello. Milano, Fondazione Aquileia–Electa, 216–217.

GOLDSWORTHY, ADRIAN 2003:

The Complete Roman Army. London, Thames & Hudson.

GRIFFITHS, W.B. 1989:

The Sling and its Place in the Roman Imperial Army. In: *Roman Military Equipment: the Sources of Evidence*. Ed. C. van Driel-Murray. Oxford, British Archaeological Reports, 255–279. /BAR International Series 476./

— 1995: Experiments with Plumbatae. *The Arbeia Journal* 4. 1–11.

KOLIAS, TAXIARCHIS G. 1988:

Byzantinische Waffen. Ein Beitrag zur byzantinischen Waffenkunde von den Anfängen bis zur lateinischen Eroberung. Wien, Verlag der Österreichischen Akademie der Wissenschaften. /Byzantina Vindobonensia. Band XVIII./

KOVÁCS, PÉTER 2008:

Militaria from Annamatia. In: *The Enemies of Rome. Proceedings of the 15th International Roman Military Equipment Conference, Budapest 2005*. Ed. László Kocsis. Budapest, Association for Roman Military Equipment Studies, 273–278. /Journal of Roman Military Equipment Studies. Volume 16./

KOZLENKO, ALEXEI 2008:

Barbarian Throwing Clubs and the Origins of Roman Plumbatae. In: *The Enemies of Rome. Proceedings of the 15th International Roman Military Equipment Conference, Budapest 2005*. Ed. László Kocsis. Budapest, Association for Roman Military Equipment Studies, 341–343. /Journal of Roman Military Equipment Studies. Volume 16./

PFLAUM, VERONIKA 2007:

The supposed Late Roman hoard of tools and a steelyard from Vodice near Kalce. *Arheološki vestnik* 58. 285–332.

Tamás Keszi • *Plumbata, or the Roman-Style Darts. A Late Antique Weapon from Annamatia*

PROCOPIUS 1916:

History of the Wars, Books III and IV. With an English Translation by H. B. Dewing. London–New York, William Heinemann–G. P. Putnam’s Sons. /The Loeb Classical Library LXXXI./

RADMAN-LIVAJA, IVAN 2004:

Militaria Sisciensia. Nalazi rimske vojne opreme iz Siska u fundusu Arheoloskoga muzeja u Zagrebu. Zagreb, Arheološki Muzej. /Musei Archaeologici Zagrabienensis, Cat. et Monogr. Vol. 1./

RUPNIK, LÁSZLÓ 2009:

New Plumbata Mamillata Find from Szentendre. In: *EX OFFICINA... Studia in honorem Dénes Gabler*. Hrsg. Szilvia Bíró. Győr, Mursella Régészeti Egyesület, 491–499.

SCHÖNFELD, MORITZ 1930:

Mattiaci. *Paulys Real-Encyclopädie der classischen Altertumswissenschaft. Neue Bearbeitung*. Hrsg. Wilhelm Kroll. XIV, 2 Stuttgart, Alfred Druckenmoller, 2320–2322.

SHERLOCK, DAVID 1978:

A Roman 'Mars-barb' from Burgh Castle. *Proceedings of the Suffolk Institute of Archaeology* XXXIV. 141–143.

VERMAAT, ROBERT 2007:

Testing Late Roman Plumbatae 1 – Veerse Dam. (https://dokupdf.com/download/vermaat-robert-m-2007-testing-late-roman-plumbatae-1-veerse-dam-2007-5a3a8c17d64ab2a614ea86e2_pdf, Hozzáférés: 2017. november 2.)

— 2015: Plumbatae. In: *The encyclopedia of the Roman army*. Vol. II. Ed. Yann Le Bohec. Chichester, Wiley Blackwell, 754–756.

VÖLLING, THOMAS 1991:

Plumbata-Mattiobarbulus-Martzobarboulon. Bemerkungen zu einem Waffenfund aus Olympia. *Archäologischer Anzeiger* 1991. 287–298.

— 1991–1992: Plumbatae sagittae? Anmerkungen zu Waffenfunden aus dem augusteischen Lager von Haltern. *Boreas* 14–15. 293–296.

VUJOVIĆ, MIROSLAV B. 2009:

The Plumbatae from Serbia. *Journal of the Serbian Archaeological Society* 25. 203–218.

КОЗЛЕНКО, АЛЕКСЕЙ В. 2009:

Плюмбата в римской армии IV–VI вв. *Античный мир и археология* 13. 290–300.

ХРИСТОВ, МИХАИЛ 2012:

Късноримска plumbata от обект „Цари Мали град“ при с. Белчин, общ. Самоков (Предварително съобщение). – A late Roman “plumbata” from “Tzary Maly grad” near Belchin village, Samokov region (preliminary notes). *Годишник на Асоциация за антропология, етнология и фолклористика »Онгъл«*. – *Yearbook of »Ongal« Association for Anthropology, Ethnology and Folklore Studies* 10. 358–366.

RECOMMENDED LITERATURE

De Rebus Bellicis. Part I. Ed. by M. W. C Hassal. Part 2. Ed. by Robert Ireland. Oxford, British Archaeological Reports, 1979. /BAR International Series 63/

Tamás Keszi • *Plumbata, or the Roman-Style Darts. A Late Antique Weapon from Annamatia*

DENNIS, GEORGE 2010:

The Taktika of Leo VI. Text, Translation, and Commentary by George Dennis. Corpus Fontium Historiae Byzantinae. Vol. XLIX. Washington, D. C., Dumbarton Oaks.

DENNIS, GEORGE T.–GAMILLSCHEG, ERNST 1981:

Das Strategikon des Maurikios. Wien, Verlag der Österreichischen Akademie der Wissenschaften. /Corpus Fontium Historiae Byzantinae. Volumen XVII. Series Vindobonensis/

GOLDSWORTHY, ADRIAN 2003:

The Complete Roman Army. London, Thames & Hudson.

MILNER, N. P. 2001:

Vegetius: Epitome of Military Science. Liverpool, Liverpool University Press.