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FIREARM BULLETS FROM PUŁTUSK BATTLEFIELD (1806)

Firearm projectiles constitute, together with shells, the most common type of a relic being unearthed within the modern era battlefields. The bullets' measurement and displacement analysis can be crucial to the recognition of alternate battle stages, yielding information on particular formations movements, fighting intensity or the location of the battle itself.

In the years 2002-2007 the archaeological research was undertaken within the Pułtusk (Fig. 1) battlefield zone, covering the approximate 14 square kilometers area. Nearly 800 different battle-related artifact were uncovered. The largest group of discoveries comprised of lead bullets (614 pieces in total). Other finds included few lead objects (2 tems).

This article makes up for an analysis of the above category of relics. It does not, however, include the distribution of bullets within the investigated area, the latter being the subject for the future work. An attempt has been made to answer the following questions: 1. which bullets were fired by a certain party of this armed conflict and, 2. what kind of marks are present on the uncovered lead bullets. These aspects were investigated by, among others, the author of this article just after the first excavation season. Nonetheless, the first research conclusions were unsuccessful and should be verified[1].

For the need of the present article, two separate tests were performed, aiming at the identification of specific marks remaining on lead bullets.

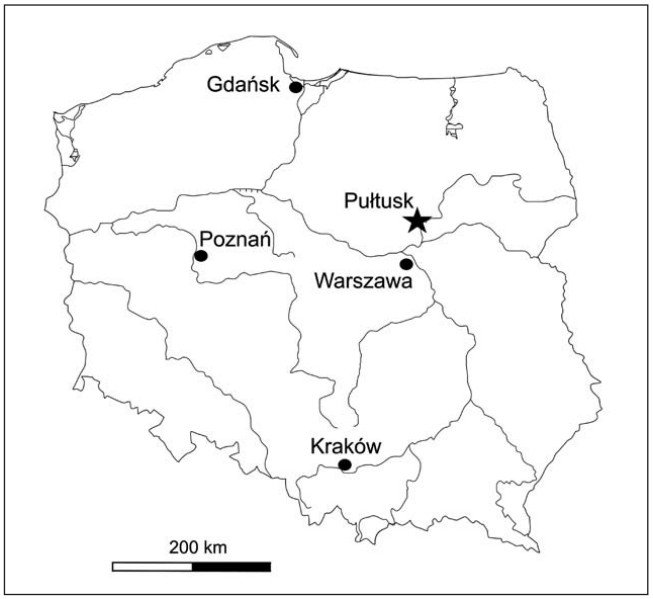

Fig. 1. Location of Pułtusk.

Short description of the battle

On December 26th 1806, just before noon, the French army began an assault towards the three lines of Russian formations which stretched from the river Narew to the forest near Moszyn village, west of Pułtusk. The Fifth Corps, led by general Jean Lannes took part in the first stage of the battle; soon the same day it was supported by the Third Corps. Russian army was commanded by general Levin August von Benningsen. The Russians outnumbered nearly twice as many the enemy infantry and cavalry and overwhelmed them with the power of artillery, but no offensive actions were taken, the defence of battle positions being the primary objective at that moment. The French gained initiative, attacking Russian lines several times, however no clear effects were observed.

The battle was fought in extreme weather conditions. The thaw made roads impassable: infantry, cavalry and artillery were stuck in mud. Strong wind and snow became another obstacle during the battle.

It was an undecided battle. Despite the French seized the town, Russian army remained steady. According to various estimations, approximately 70.000 soldiers of both armies fought in this battle. It is difficult to evaluate the total loss; different scholars estimate that 1500 to 7000 soldiers were killed, wounded and taken prisoners[2].

[1] B. Jurkiewicz, K. Karasiewicz, J. Wrzosek, *Archeologiczne badania powierzchniowe na polach bitwy stoczonej 26 grudnia 1806 r. pod Pułtuskiem,* [in:] *Pułtusk. Studia i materiały z dziejów miasta i regionu*, Vol. V, ed. J. Szczepański, Pułtusk 2003, pp. 69-77.

[2] A. Kociszewski, *Bitwa pod Pułtuskiem,* Ciechanów 1992; G. Lechartier, *Manewr na Pułtusk*, Oświęcim 2011; A.I. Mihajlovskij-Danilevskij, *Opisanie vtoroj vojny imperatora Aleksandra s Napoleonom v 1806-1807 g.*, Sankt-Peterburg 1846; F. L. Petre, *Napoleon's Campaign in Poland 1806-7,* London 1901.

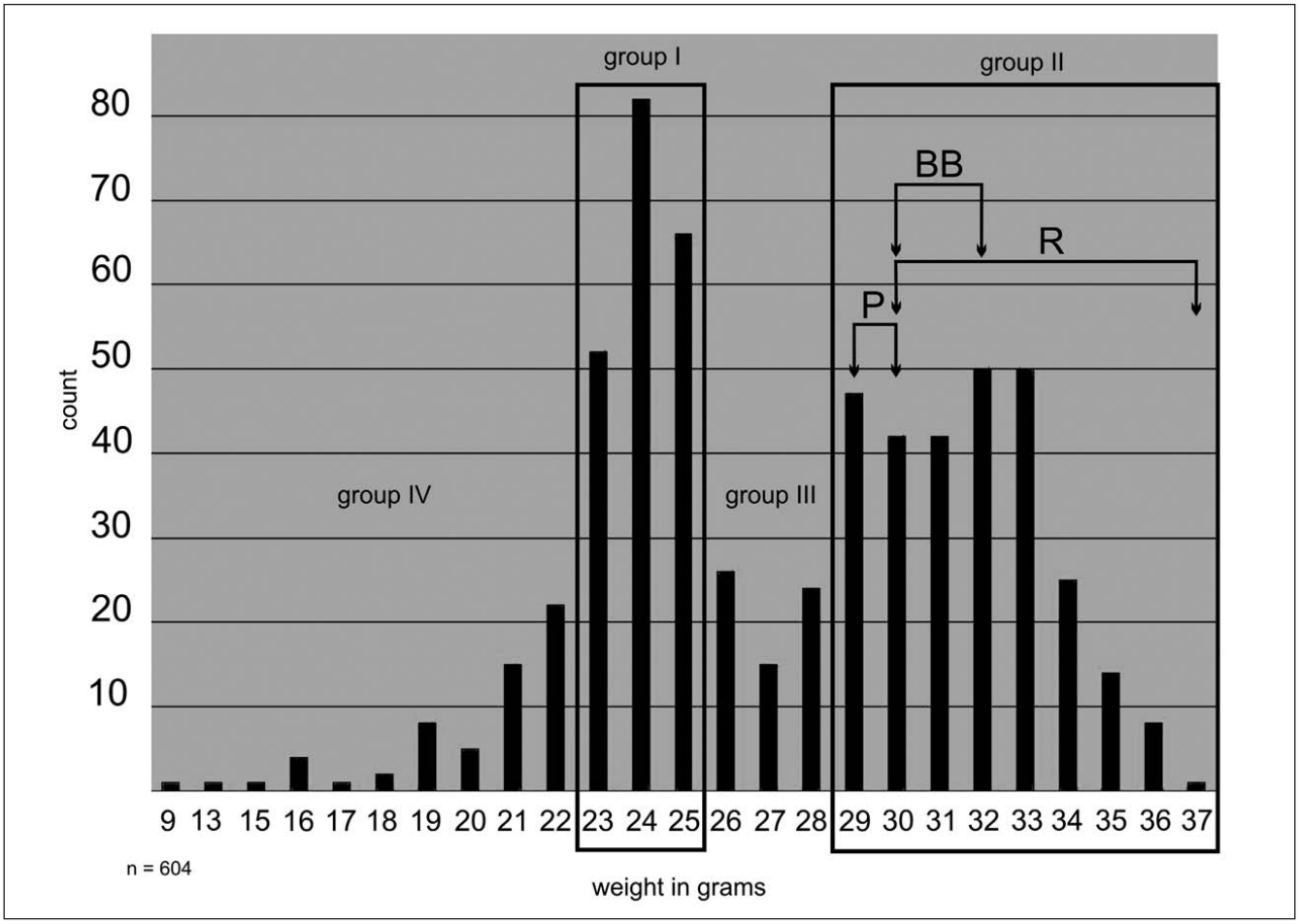

Fig. 2. Chart showing the weight and number of discovered bullets. P: Prussian weapon, R: Russian weapon, BB: Brown Bess.

Lead bullets

604 bullets, out of total number of 614 (98%), were subjected to the analysis. 10 items, due to corrosion and wastage, could not be measured nor scaled. All bullets were made of lead and, in most cases, have spherical shape. However, considering several obvious reasons, their shape is not perfectly round. They are often flattened at their edges or differ in their forms. Consequently, apart from diameter measurement, the weight as well as the diameter calculated according to Sivilich[3] were considered. Basing on the above data, bullets were classified into four groups.

Group I – French bullets

Despite the French army used firearms of a different caliber, the bullet's diameter was, at least theoretically, determined. One French pound of lead was used to cast 20 bullets[4] with the average weight of 24,45 grammes for each bullet. The diameter was 16,45 millimeters. A. Homann and J. Weise came to similar conclusions, defining the diameter of a bullet used in 1813 by the French army to 16-16,5 mm[5]. Equally, according to M. Maciejewski the diameter of a bullet used for French firearms was 16,54 millimeters while one pound of lead could produce 18 bullets[6]. Therefore, the bullet's weight should have been 27,16 grammes; applying the Sivilich formula we can estimate the diameter to 17,04 millimeters.

Considering the above conclusions, the analysed assemblage consists of 203 (33%) French lead bullets with the diameter of 16-16,5 millimeters and the weight of 23-25 grammes. This group is distinguished on a chart showing the number and weight of bullets (Fig. 2). They are additionally marked out by the method of removing the casting sprue. There are 61 bullets bearing signs of this specific method of removing the channel with pincers; 46 of them

[3] D. M. Sivilich, *What the Musket Ball Can Tell: Monmouth Battlefield State Park, New Jersey*, [in:] *Fields of Conflict. Battlefield Archaeology from the Roman Empire to Korean War,* Vol. 1, *Searching for War in the Ancient and Early Modern World*, eds. D. Scott, L. Babits, Ch. Haecker, Westport, London 2007, pp. 84-101.

[4] G. H. Cotty, *Mémoire sur la fabrication des armes portatives de guerre*, Paris 1806, pp. 20-21.

[5] A. Homann, J. Weise, *The Archaeological Investigations of Two Battles and an Engagement in North Germany from the 19th Century: A Summary of Work Carried Out at Idstedt, Grossbeeren and Lauenbur*, „Journal of Conflict Archaeology", Vol. 5, 2009, pp. 27-56.

[6] M. Maciejewski, *Broń strzelecka wojsk polskich w latach 1717-1945*, Szczecin 1991, pp. 25, 37.

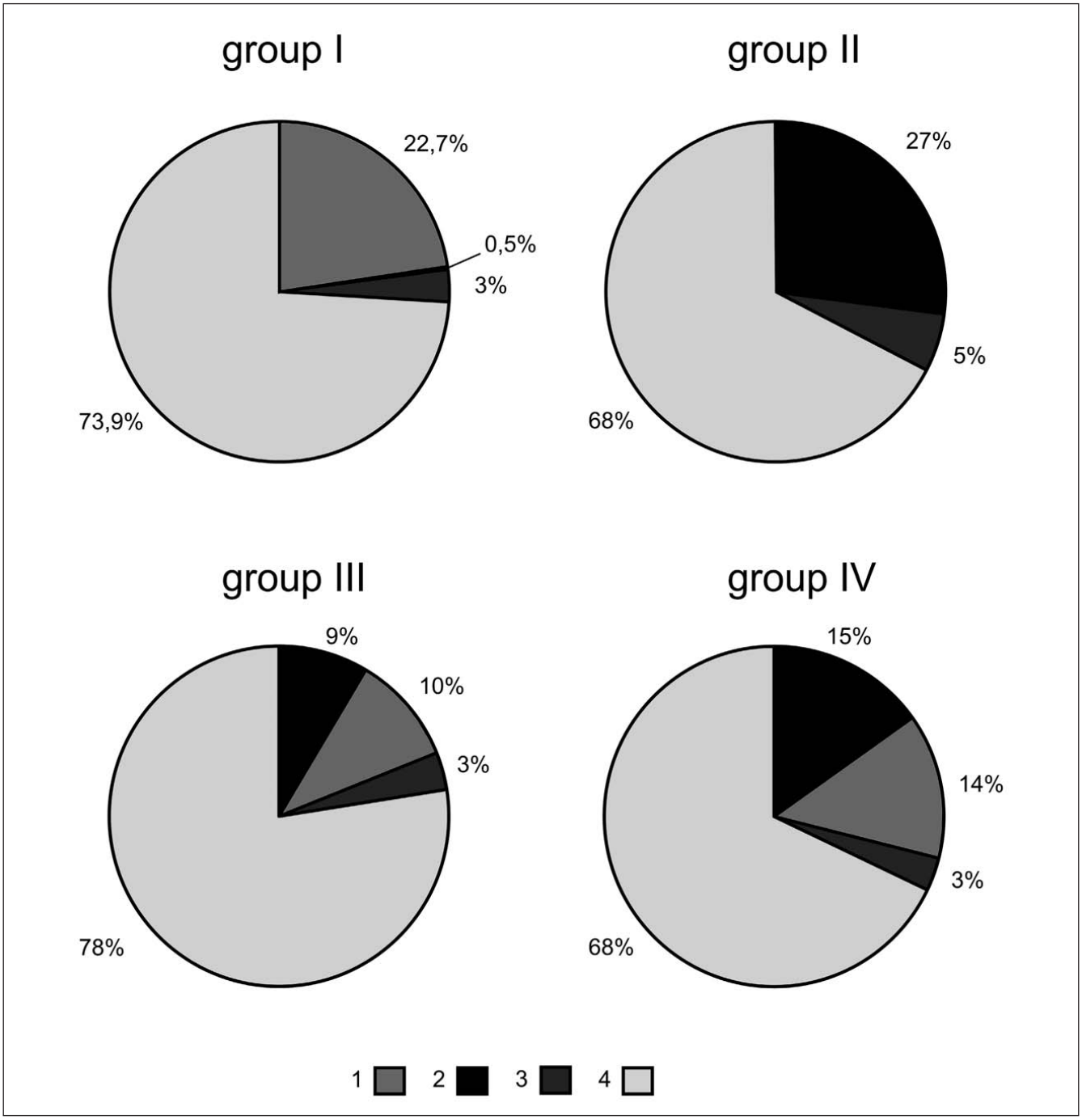

Fig. 3. Chart showing the number of casting sprue removal methods within particular groups of bullets. 1 – pincers, 2 – hammering, 3 – cutting, 4 –method of removing the casting sprue is not visible.

(75%) belong to Group I. Among the rest, there are 6 bullets where the channels had been cut off; in one case the space under the removed part was hammered down. Consequently, it can be assumed that removing channels with pincers is a typical feature for this category of bullets (Fig. 3; Fig. 4:8-11).

Group II – Russian bullets

According to various authors, during Napoleonic Wars the Russian army used 28 to 40 different calibers of firearms, considering only weapons produced in Russia. If we include captured and imported firearms, number of calibers increases[7]. As late as in 1808 several regiments were partly equipped with weapons made at the beginning of 18th century[8]. Therefore, it is extremely difficult to match particular groups of bullets with proper firearms used by the Czar's army.

Basing on, among other things, the chart of weight and number of bullets, 278 (46% of the whole assemblage)

[7] P. Haythornthwaite, *Weapons & Equipment of the Napoleonic Wars*, Poole 1979, p. 18; M. Maciejewski, *op. cit.*, p. 81.

[8] L.P. Bogdanov, *Russkaâ Armiâ v 1812 g.*, Moskva 1979, p. 173.

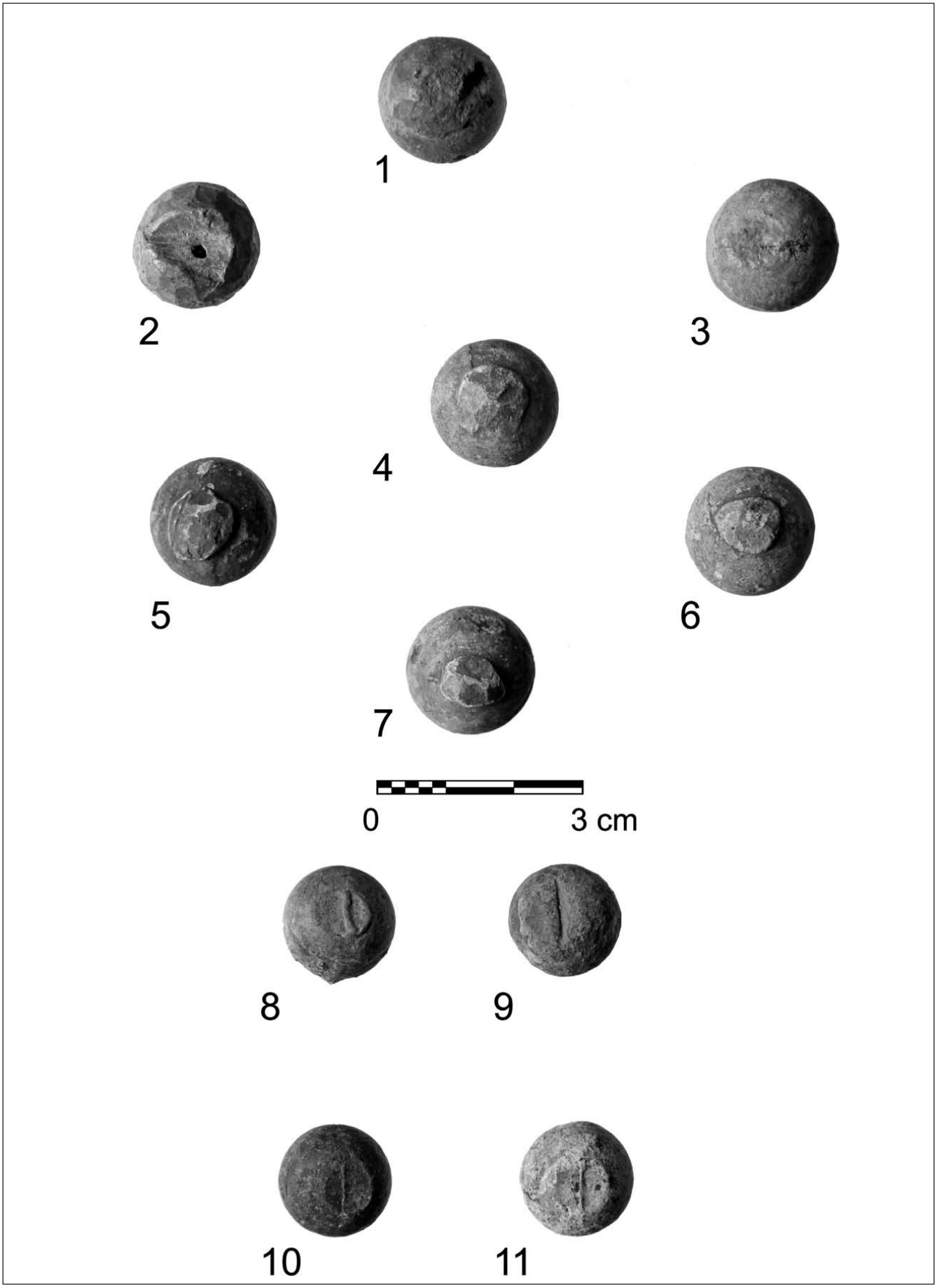

Fig. 4. Casting sprue removal methods: 1, 4-7 – hammering; 2, 3 – cutting; 8-11 – pincers. Photo by P. Kobek.

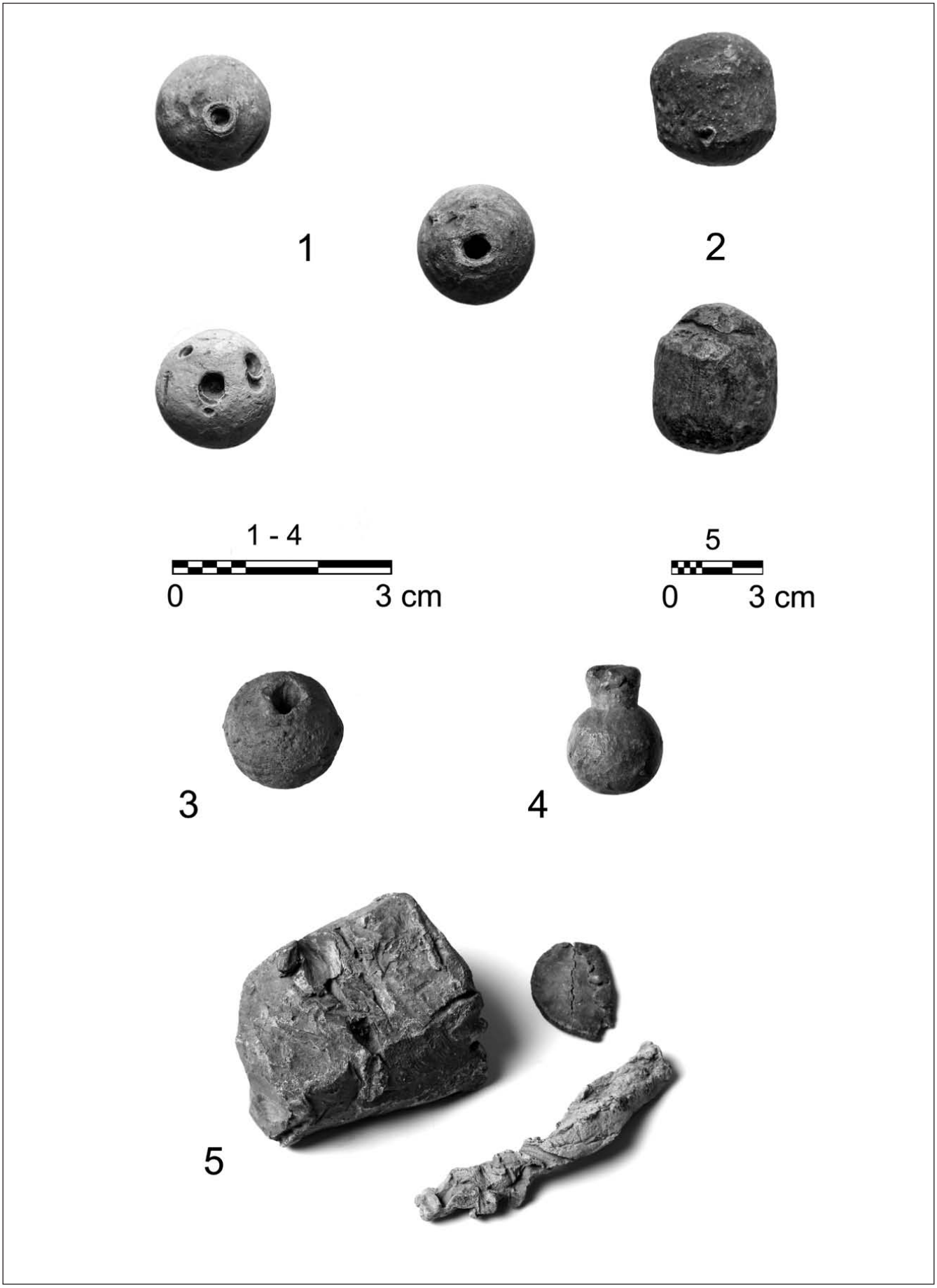

Fig. 5. 1 – Bullets with traces of a musket worm, 2 – tubular shape bullets, 3 – pullet with a quadrangular hole, 4 – bullet with casting sprue, 5 – lead material. Photo by P. Kobek.

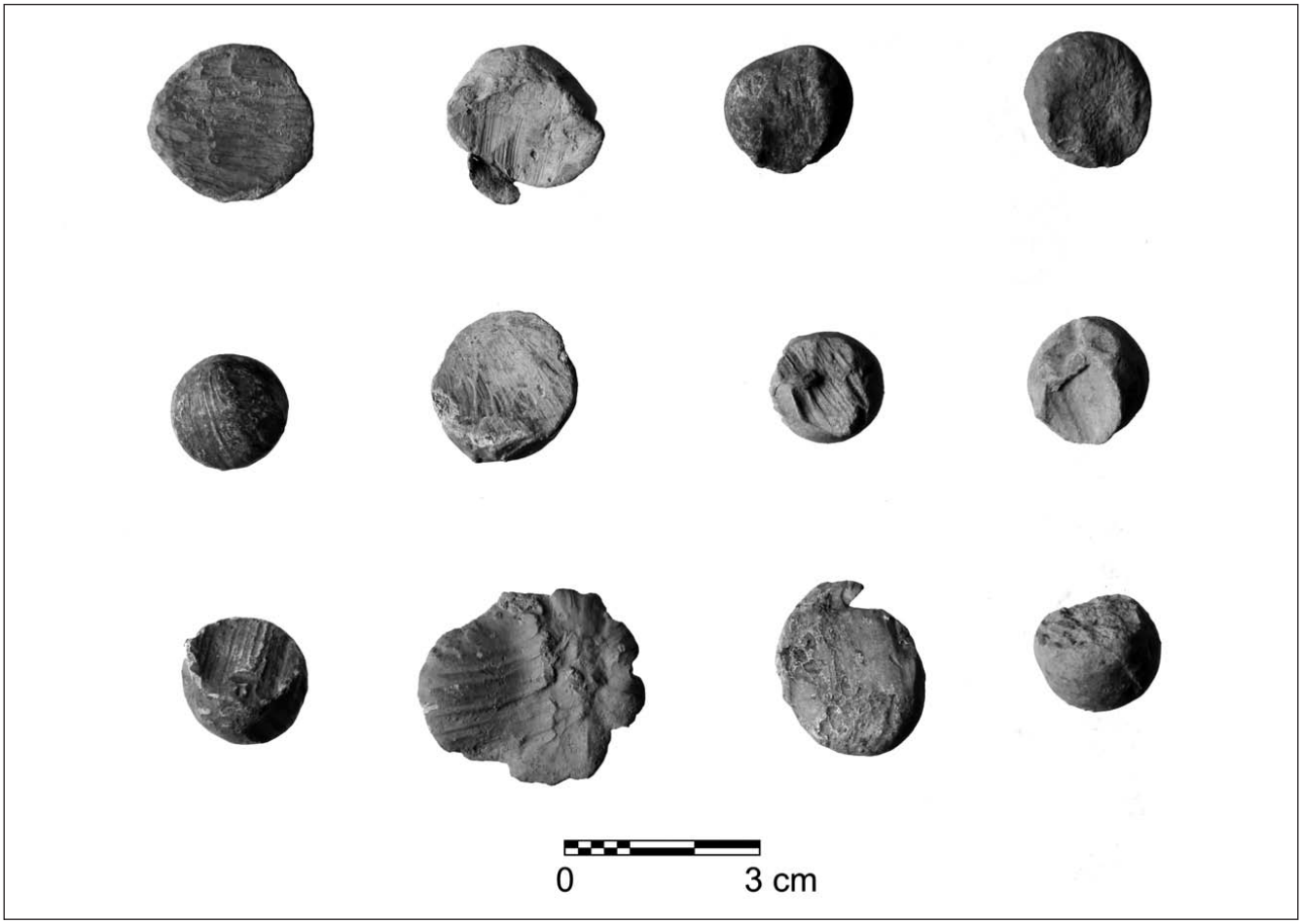

Fig. 6. Bullets deformed after hitting an object. Photo by P. Kobek.

bullets with the weight of 29-37 grammes and the diameter of 17-19 millimeters were included into this group (Fig. 2).

In the Russian army, since the first half of the 18th century, large calibers were preferred for the infantry smoothbore weapons[9]. The infantry rifle's 19,8 millimeters caliber, with the bullet's average weight of 32-38 grammes (18-19 millimeters in diameter) prevailed through the whole 18th century[10]. However, a smaller bullet weighting 30 grammes (17,6 millimeters in diameter) was used for the same caliber of the rifle type 1798[11]. Summing up, some bullets with the diameter of 17,6-19 millimeters can be connected with firearms produced in Russia (Fig. 2).

Despite this group most probably contains bullets used for different types of Russian firearms, we can assume there is also a significant number of bullets used for non-Russian firearms (Fig. 2). Those could be, for instance, lead bullets for the British musket type India Pattern, also called the Brown Bees. Such firearms were purchased by Russia in England, just before the war[12]. This bullet's diameter was 17,6-18 millimeters[13]. Other, smaller bullets with the diameter of 17,4-17,6 millimeters can be cautiously associated with Prussian weapons, mainly with the infantry riffles type 1723/40 and 1740[14]. The use of Prussian weapons by the Russian army is additionally confirmed by the discovery of a bayonet used in the above riffles.

The method of removing the casting sprue was also investigated: 90 bullets were subjected to such analysis. The channel was hammered down in 75 bullets (27%) (Fig. 4:1, 4-7) and cut off in 15 bullets (5,4%) (Fig. 4: 2, 3). It should be noticed here that within this assemblage there

[9] L.K. Makovskaâ, *Ručnoe ognestrel'noe oružie russkoj armii końca XIV-XVIII vekov*, Moskva 1992, pp. 77-78, Tab. 2.

[10] *Ibidem*, *op. cit.,* pp. 77-79, Tab. 2.

[11] *Ibidem*, p. 80.

[12] M. Maciejewski, *op.cit.*, p. 81.

[13] P. Antill, *Brown Bess (UK), small arms of the Napoleonic Wars,* http://www.historyofwar.org/articles/weapons_brown_bess.html, 2006; D. M. Sivilich, *op. cit.*, pp. 86-87.

[14] A. Wirtgen, *Die Preussischen Handfeuerwaffen. Modelle und Manufakturen 1700-1806*, Osnabrück 1976, pp. 95-99; J. Wrzosek, *Wyniki badań archeologicznych przeprowadzonych w sezonie 2009 na polu bitwy pod Kunowicami*, [in:] *Kunersdorf 1759. Kunowice 2009. Studien zu einer europäischen Legende. Studium pewnej europejskiej legendy*, eds. W. Benecke, G. Podruczny, Berlin 2010, pp. 95-101; G. Podruczny, J. Wrzosek, *Odwrót przez Dworskie Łęgi – jeden z epizodów bitwy pod Sarbinowem stoczonej 25 sierpnia 1758 roku w świetle przekazów historycznych i badań archeologicznych*, „Zeszyty Naukowe", Vol. 9, *Nowa Marchia. Prowincja zapomniana. Ziemia Lubuska – wspólne korzenie*, Gorzów Wielkopolski 2011, pp. 105-121.

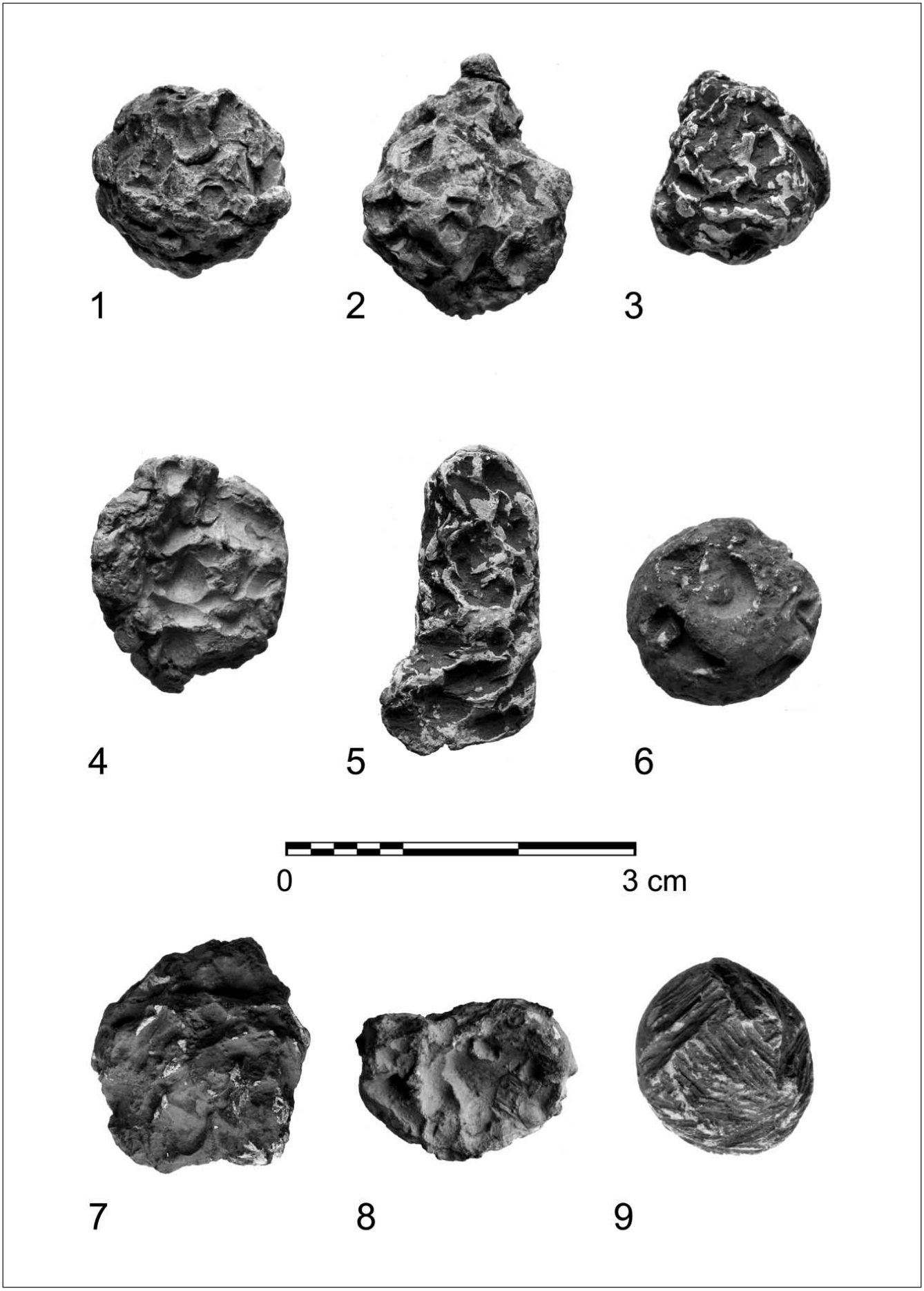

Fig. 7. Outcomes of the experiment. Photo by P. Kobek.

aren't any bullets with the pincers-removed casting sprue (Fig. 3).

Group II contains two bullets with a tubular shape (Fig. 5:2). According to various authors, such bullets were shaped purposefully to cause larger wounds[15].

Group III

This group contains 65 (11% of the whole assemblage) lead bullets with the average weight of 26-28 grammes and 16,8-17,2 millimeters of diameter. It is problematic to distinguish the provenance of particular bullets. Most probably those are both French and Russian bullets. There are 10 bullets with casting sprue removed with pincers and 9 bullets with the channel area hammered down (Fig. 3).

Group IV

Group IV consist of 58 (9%) bullets weighting 9-22 grammes, 11-15 millimeters in diameter, used probably for pistols, riffles, firearms used by the Russian cavalry (e.g. Cossack formations) or even hunting weapons not related with the battle (especially small bullets 11-12 millimeters in diameter).

This group includes the only bullet (13,5 millimeters) in which the casting sprue was not removed (Fig. 5:4).

Marks on lead bullets

For the last 200 years, since the day the battle was fought, the lead bullets have undergone different transformations. Apart from marks being the result of removing the casting sprue other marks and deformations were recognized.

Deformations caused by hitting an obstacle

It is the most frequent type of deformations, present on 63 bullets (10,4%). Generally, those are severe deformations, showing the huge energy released in the moment of impact. Some bullets bear traces of more than one hit (ricochet?) while the others are less deformed, indicating different hardness of an object the bullet hit (Fig. 6)[16].

Marks caused by the musket worm

The device used by riflemen to remove unspent charges and bullets caused typical drills observed on only 3 bullets 3 (0,5%), (single bullet in group I, III and IV). Two or three grooves with visible signs of drilling are typical for such method of removing stuck bullets (Fig. 5:1)[17].

Marks caused by animal teeth

There are 15 bullets (2%) with marks left by the pig's teeth. The deformations are observed as deep grooves of different shapes, which in some cases led to complete deformation of a lead bullet (Fig. 7:5). One bullet had narrow, long ridges (Fig. 7:9) interpreted as marks caused by a rodent[18]. Similar marks are often recorded on bones[19].

Other marks

There are 5 different marks (0,8%) which remain unidentified. Those are various cuts, grooves and ridges caused by using the wrong method of removing the unspent bullet or by other several factors such as farming activities (Fig. 5:3).

Outcomes of the experiment

An experiment was carried out in order to confirm the recognition and identification of particular marks detected on lead bullets[20].

Ten lead bullets were cast. Some of them had their casting sprues cut off with pincers, the others had the remaining channel spots hammered down. Due to this, marks identical to those from discovered bullets were created.

Several bullets were placed inside the barrel and removed with a modern copy of a musket worm. Again, the mark caused by this device is identical with those observed on bullets from the year 1806.

Marks recognized as pig's teeth traces were also subjected to analysis and verification. A wild boar's (Sus scrofa), aged 3-5 years and domestic pig's (Sus scrofa f. domestica), aged 17-22 months, molar teeth were imprinted in modeling clay. As a result, similar grooves and deformations were recorded (Fig. 8).

This category of lead bullets can be supplemented by some fragments of two lead chunks (Fig. 5:5). First of them, resembles in its shape a slightly irregular cuboid, measuring 83x75x46 millimeters and with a total weight of 1700 grammes, has visible traces of cutting and tearing. This item, due to its original depository location within the investigated area, can be linked with the Russian army. Considering its weight, this artifact can be assumed a lead piece of exactly 4 Russian pounds (4,15 pound)[21]. The second relic is much smaller, rod-shaped, with traces of cutting. It measures 100x15 millimeters and weights 100,4 grammes. Additionally, there is a third artifact – an oval badge, slightly bent at one of its edges, with measurements and weight of 41x2 millimeters and 23 grammes respectively. Possibly, this badge could have been a part of a flintlock.

[15] D. M. Sivilich, *op. cit.*, p. 95.

[16] *Ibidem*, pp. 89-90.

[17] *Ibidem*, *op. cit.*, p. 90; A. Homann, J. Weise, *The Archaeological Investigations...,* p. 34, fig. 4.

[18] D. M. Sivilich, *op. cit.*, p. 93.

[19] A. Sołtysiak, *Death and decay at the dawn of the city*, Warsaw 2010, fig. 29.

[20] I would hereby like to thank Mrs Anna Gręzak PhD from the Warsaw University Institute of Archaeology and Mr Wojciech Krajewski from the Museum of the Polish Army, Warsaw, for their help during the experiment.

[21] I. Ul'ânov, *Regulârnaiâ Pehota 1801-1855*, Moskva 1997, p. 207.

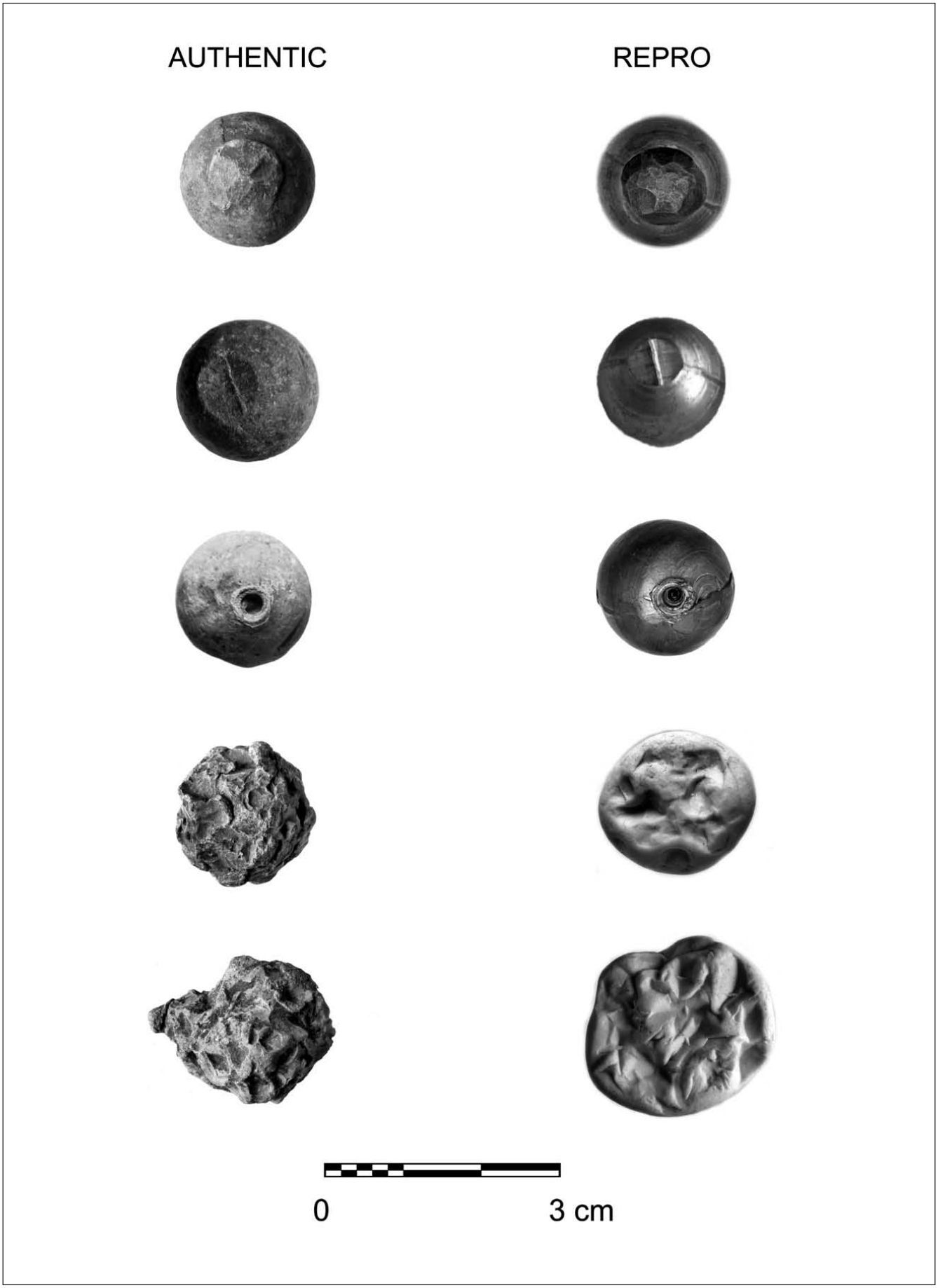

Fig. 8. Outcomes of the experiment. Casting sprue removal methods (pincers, hammering); traces of a musket worm; marks caused by animal teeth. Photo by P. Kobek.

Conclusions

Analysing the two basic parameters – bullet's weight and diameter – two separate groups were distinguished, which can be linked with both armies. Its number (481 items) constitute almost 80% of the investigated assemblage.

Bullets linked with the French army are significantly standardized in their weight and diameter. The casting sprue was removed with pincers. Bullets attributed to the Russian army displayed wider range of weights and diameters, what adequately illustrates lack of firearms unification in Czar's army. The casting sprue was removed and the remaining spot was hammered down.

It was not possible to link all bullets with the right army. Group III comprises of bullets used by both two armies. Those bullets' parameters did not allow further identification.

Each battlefield yields artifacts not related with the investigated historical occurrence. These include, for instance, lead bullets. Group IV comprises of such artifacts: bullets used in hunting or private weapons or lost in the last 300 years. Undoubtedly, some pistol or riffle bullets, related with the Pułtusk Battle, were among them as well. However, considering the their insufficient number within particular weight categories, those bullets were regarded as accidental finds of a marginal significance.

45% of all discovered bullets displayed various types of traces. Apart from the described method of casting sprue removal, the most common are deformations caused by an hit impact, traces made by the musket worm and animal teeth as well as unidentified marks caused by natural depository or mechanical factors. Some of the most interesting include bullets with traces of animal teeth, represented mainly by wild boars. Searching for food, wild boars grinded and chewed bullets dug from the ground. Marks of a domestic pig and a wild boar teeth do not differ in the chewing surface shape; the only difference is the size (boars have bigger teeth)[22]. The location where bullets were unearthed (far from human settlements) and the existence, in the 19th century, of a forest, suggests the presence of wild boars. Additionally, there are at lest 2 reasons why rodents bit and chewed those bullets. First, for a specific period of time after the battle had been finished, lead bullets could be covered with human blood and flesh. Second, the chemical property of lead and its compound lead (II) acetate also called the lead sugar with characteristic sweet flavour[23].

The collected raw lead material was most probably used by the Russian army to produce bullets. Bigger chunk, weighting 4 Russian pounds, could have been a part of a single soldier's equipment, ready to cast bullets himself. Smaller artifact is either a part of military equipment or a battle non-related object.

Streszczenie

Pociski do broni strzeleckiej z pola bitwy pod Pułtuskiem (1806 r.)

W latach 2002-2007 na obszarze pola bitwy pod Pułtuskiem prowadzono badania archeologiczne, które swoim zasięgiem objęły około 14 km². W ich wyniku pozyskano prawie 800 różnego rodzaju artefaktów związanych z bitwą. Wśród nich największą grupę stanowią ołowiane pociski do broni strzeleckiej, których znaleziono 614. Wśród pozostałych znalazły się między innymi także niewielkie ilości surowca ołowianego (2 sztuki).

Niniejszy artykuł stanowi analizę tej kategorii znalezisk. W jej zakres nie wchodzi jednak dystrybucja pocisków, która będzie tematem odrębnej pracy. Podjęto natomiast próbę odpowiedzi na pytania: które pociski zostały wystrzelone przez daną stronę konfliktu oraz jakiego rodzaju ślady widnieją na ołowianych kulach.

Na potrzeby niniejszego artykułu wykonano też dwa doświadczenia mające na celu identyfikację niektórych śladów widocznych na ołowianych pociskach.

Bitwa pod Pułtuskiem została stoczona 26 grudnia 1806 roku przez wojska francuskie i rosyjskie. Starcie nie przyniosło jednoznacznego zwycięstwa żadnej ze stron. Chociaż Francuzi zajęli miasto to jednak siły rosyjskie nie zostały rozbite i zachowały zdolność bojową. Według różnych obliczeń w starciu wzięło udział około 70 tysięcy żołnierzy obu armii.

Z całkowitej liczby 614 pocisków do analizy przeznaczono 604 (98%). 10 egzemplarzy z powodu zaawansowanej korozji i różnego typu ubytków nie nadawało się do przeprowadzenia podstawowych pomiarów tzn. określenia średnicy i wagi. Wszystkie pociski odlane zostały z ołowiu i w zdecydowanej większości przypadków mają kształt kulisty. Jednak z oczywistych względów nie jest to kształt idealnej kuli. Często są one lekko spłaszczone na biegunach lub w inny sposób odbiegają od tej formy. W związku z powyższym oprócz pomiarów średnicy podstawowym parametrem branym pod uwagę była waga oraz średnica wyliczona na podstawie wzoru Sivilicha. Na podstawie tych danych pociski podzielono na cztery grupy.

Grupa I – pociski do broni francuskiej. W analizowanym zbiorze za pociski pochodzące z broni francuskiej uznano 203 (33% całego zbioru) ołowianych kul o średnicy 16-16,5 mm i wadze 23-25 g. Wyróżnia je ponadto charakterystyczny sposób usunięcia kanału wlewowego za pomocą obcęgów.

[22] A. Lasota-Moskalewska, *Archeozoologia. Ssaki*. Warszawa 2008, p. 106.

[23] D. M. Sivilich, *op. cit.*, p. 93.

Grupa II – pociski do broni używanej przez armię rosyjską. Do omawianej grupy zaliczono 278 (46 % całego zbioru) pocisków o wadze 29-37 g i średnicy 17-19 mm (Fig. 2). W 75 kulach (27%) kanał wlewowy usunięto poprzez zaklepanie a w 15 (5,4%) przez odcięcie.

Grupa III – Do grupy tej zaklasyfikowano 65 (11% całego zbioru) kul ołowianych o wadze 26-28 g i średnicy 16,8-17,2 mm. Wśród tej kategorii trudno jest wskazać, które z nich wystrzelone zostały przez daną stronę konfliktu. Najprawdopodobniej znajdują się tutaj pociski używane zarówno przez armię rosyjska jak i francuską.

Grupa IV – W tej grupie znajduje się 58 (9% całego zbioru) pocisków o wadze 9-22 g i średnicy 11-15 mm, używanych prawdopodobnie do pistoletów, sztucerów, broni używanej przez rosyjską konnicę (np. formacje kozackie) czy w końcu do broni myśliwskiej nie związanej z bitwą (zwłaszcza małe pociski o średnicy 11-12 mm).

Na analizowanych pociskach odnotowano następujące ślady: zniekształcenia powstałe na skutek uderzenia w przeszkodę, ślady użycia grajcara, ślady zębów zwierzęcych.