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Cover: St. Mamai, Gelati Tondo (silver, gilt silver), 11th century

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Pro Georgia, 2018, t. 28, s. 109-127

THROWING ARTILLERY FROM *APSAROS* ROMAN FORTRESS. ANALYZE AND INTERPRETATION OF STONE PROJECTILES FOR BALLISTA[1]

by Oskar Kubrak, University of Warsaw, with a contribution by Lasha Aslanishvili, Cultural Heritage Preservation Agency of Ajara

Stone projectiles are commonly found at archaeological sites associated with the Roman army. Random-sized stone balls, sling projectiles, as well as big iron arrowheads have been encountered at these sites. The above-mentioned types of ammunition were used in siege machines. Typical sling projectiles had an ovoid profile, while ballistic balls were round. Both Vegetius (Veg. *Mil*. IV.8) and Vitruvius (Vit. *De Arch*. X,11.3) mentioned such kinds of projectiles.

In this article, the stone projectile from the Roman fort *Apsaros* collection have been selected and grouped together according to their diameter and weight. The applied division is based on the information contained in Vitruvius (Vit. *De Arch*. X,11.3; Tab. 1). In his text, the Roman architect focused on the weight of the projectile and the width of the hole in the ballistic frame through which the ball was shot.

Unfortunately, this topic has so far not been discussed in any of the available publications. Such findings are often mentioned in general articles describing Roman army strongholds. One such example could be the collection of stone projectiles from the Roman fortress on Ai-Todor Cape (Crimea). In the 1970s and 1980s, over 1200 balls with different weights and diameters were discovered during excavation. They were found mainly in the rooms on the inside of the fortress wall.[2] Only part

[1] The author would like to thank Assoc. Prof. Radosław Karasiewicz-Szczypiorski for his support and advice during my studies of stone projectiles and in the writing of this text. Thanks are also due to Dr. Lasha Aslanishvili, the author of the first two articles about stone projectiles from the Roman fort *Apsaros*. I also want to thank the people involved in the research: Prof. Shota Mamuladze, Dr. Emzar Kakhidze, Darejan Qarcivadze, Lana Burkadze, Dr. Piotr Jaworski, Maciej Czapski and Agnieszka Makowska.

[2] V.N. D' â k o v, *Drevnosti Aj-Todora*, Âlta 1930: 23; K.K. O r l o v, *Issledovaniâ Haraksa*, AO za 1977 g., 1978: 366.; K.K. O r l o v *Arhitekturnye kompleksy Haraksa*, (in:) *Arhitekturno-arheologičeskie issledo-*

Table 1. Diameter and weight of stone projectiles as distinguished by Vitruvius (Vit. *De Arch*. X,11.3)

Ancient projectile weight	Modern projectile weight	Ancient measure of the ballistic aperture hole	Modern measure of the ballistic aperture hole
2 pounds	654.9 g	5 digits	9.25 cm
4 pounds	1 kg 309.8 g	6 digits	11.1 cm
		7 digits	12.95 cm
10 pounds	3 kg 274.5 g	8 digits	14.8 cm
20 pounds	6 kg 549 g	10 digits	18.5 cm
40 pounds	13 kg 098 g	12.5 digits	23.12 cm
60 pounds	19 kg 647 g	13 1/8 digits	24.28 cm
80 pounds	26 kg 196 g	15 digits	27.75 cm
120 pounds	39 kg 294 g	1 foot 1.5 digits	32.37 cm
160 pounds	52 kg 392 g	1 foot 4 digits	37 cm
170 pounds	55 kg 666.5 g	1 foot 5 digits	38.85 cm
200 pounds	65 kg 490 g	1 foot 6 digits	40.7 cm
240 pounds	78 kg 588 g	1 foot 7 digits	42.55 cm
360 pounds	117 kg 882 g	1.5 feet	44.4 cm

of the above-mentioned collection was published in 2015.[3] However, only 179 artifacts were studied out of the 200 stone projectiles stored in Moscow's museums. In their article, the Russian researchers only studied the fully preserved stone balls, rejecting any halves and smaller shrapnel.[4] Determining the weight for partly preserved stone balls is possible through making the appropriate calculations. A similar study was developed with the projectiles discovered in Qasr Ibrim (Egypt).[5] That study had an epigraphic character as it was concentrated on the inscriptions on the balls' surface. Another such publication about stone projectiles worth mentioning is an article written by M. Lemke, who discussed the stone ammunition from the *Novae* legionary camp (northern Bulgaria). However, the researcher only presented the findings from sector II[6] and

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vaniâ v Krymu, Kiev 1988: 26–27.; D.V. Z h u r a v l e w, G.A. K a m e l i n a, *Kamennye jadra iz Haraksa*, (in:) D.V. Z h u r a v l e w, O.L. G a b e l k o (eds), *S Mitridata Duet Weter. Bospor I Priczernomore w Anticznosti, K 70-letijo W.P.Talstukowa*, Moskwa 2015: 189.; R. K a r a s i e w i c z-Sz c z y p i o r s k i, *Forty i posterunki rzymskie w Scytii i Taurydzie w okresie pryncypatu*, Warszawa 2015: 88, 94.

3 Zhuravlew, Kamelina, 2015: 189-210.

4 *Ibid*., 190.

5 A. W i l k i n s, H. B a r n a r d, P.J. R o s e, *Roman Artillery Balls from Qasr Ibrim, Egypt*, Sudan & Nubia 10, 2006: 61–72.

6 M. L e m k e, *Stone Projectiles Discovered in the Castra Legiones Novae Near Svishtov (BG)*, (in:) ROMEC XVII. Proceedings, Zagreb 2010: 357.

Table 2. Attempt to assign the stone projectiles from the Roman fort Apsaros to the weight groups distinguished by Vitruvius (see Tab. 1). The bold font shows the balls which were in the group selected according to diameter and weight as distinguished by Vitruvius (see Tab. 3).

Weight as distinguished by Vitruvius	Amount	Projectile number
2 pounds	21	MAG 3, 4, 5, 11, 12, 17; MG 13, 14, 15, 16, 17, 28, 33, **34**, 46, 64; MAB 1; WG 5; WP 2, 3, 10
4 pounds	4	MG 2, 44, 45; MAG 22
10 pounds	1	MG **73**
20 pounds	1	MG 72

Table 3. Attempt to assign the stone projectiles from the Roman fort Apsaros to the groups distinguished by Vitruvius (see Tab. 1). The bold font shows the balls which were in the same group selected according to diameter and weight as distinguished by Vitruvius (see Tab. 2)

Diameter as distinguished by Vitruvius	Amount	Projectile number
5 digits	7	MAG 7; WP 6; MG 6, **34**, 42, 49, 61
6 digits	2	MG 66; MAG 9
7 digits	2	MG 56, 65
8 digits	2	MG **73**; MAB 2
10 digits	0	

the headquarters building.[7] One hundred similar artifacts were also found in Artaxata, one of the ancient capitals of Armenia.[8] Most of them were found on the first and eighth hill of the fourteen on which the ancient city was located.[9] A weapons workshop was discovered on the first hill.[10] The Armenian researcher divided the stone projectiles from Artaxata into five groups in terms of their weight and size.[11] The findings from Artaxata and their interpretation are helpful in discussing the collection from the Roman fort Apsaros. Stone projectiles were also discovered in other locations around the Black Sea area; however, it is difficult to prove any link with the Roman army presence. Examples of such sites include Pan-

[7] *Ibid*.: 359
[8] M. A k o p j a n, *Kamennye jdra iz Artašata*, Problemy antichnoy kul'tury, Moskwa 1986: 232.
[9] *Ibid*.: 232; B.N. A r a k l â n, *Artašat. Osnovnye rezul'taty raskopok 1970-1977 gg*., T.1, Erevan 1982: 29.
[10] Araklân 1982: 24.
[11] Akopjan 1986: 232-236.

Table 4. Selected stone balls in terms of their weight. The bold font shows the artefacts which were in the same size group (see Tab. 5).

Weight category	Amount	Projectile number
Light (max. 1 kg)	85	MG **1**, **3, 7**, **8**, 9, **13, 14**, 15, **16, 17, 18, 19**, **22**, **23**, 24, 25, **26**, **27**, **28**, **29**, **30**, **31**, **32**, **33**, 34, **37**, 38, **39**, **40**, 42, **43**, **45**, 46, **47**, **48**, 49, **50**, 52, **53**, 55, **59**, **60**, 61, **62**, **63**, **64**, **68**, **69**, **71**; MAG **1**, **2**, 3, **4**, **5**, 7, 10, **11**, **12**, 13, **15**, **16**, **17**, 18, **20**; WP **1**, 2, 3, 4, 5, 6, 7, **8, 9**, 10, 11; WG **2**, 3, **4**, **5**, **6**; MAB 1 (x4)
Medium (1-3 kg)	21	MG **2**, **41**, **44**, **51**, **54**, **56**, 57, **67**, **65**, **70**; MAG **6**, **8**, **21**, **22**, **23**; MAB **1** (**x3**), **2** (**x2**); WG **1**
Heavy (min. 3 kg)	6	MG **72**, 73; **MAB 2 (x4)**

Table 5. Selected stone balls in terms of their diameter. The bold font shows the artefacts which were in the same weight group (see Tab. 4)

Diameter category	Amount	Projectile number
Light (max. 1 kg)	85	MG **1**, **3, 7**, **8**, 9, **13, 14**, 15, **16, 17, 18, 19**, **22**, **23**, 24, 25, **26**, **27**, **28**, **29**, **30**, **31**, **32**, **33**, 34, **37**, 38, **39**, **40**, 42, **43**, **45**, 46, **47**, **48**, 49, **50**, 52, **53**, 55, **59**, **60**, 61, **62**, **63**, **64**, **68**, **69**, **71**; MAG **1**, **2**, 3, **4**, **5**, 7, 10, **11**, **12**, 13, **15**, **16**, **17**, 18, **20**; WP **1**, 2, 3, 4, 5, 6, 7, **8, 9**, 10, 11; WG **2**, 3, **4**, **5**, **6**; MAB 1 (x4)
Medium (1-3 kg)	21	MG **2**, **41**, **44**, **51**, **54**, **56**, 57, **67**, **65**, **70**; MAG **6**, **8**, **21**, **22**, **23**; MAB **1** (**x3**), **2** (**x2**); WG **1**
Heavy (min. 3 kg)	6	MG **72**, 73; **MAB 2 (x4)**

ticapaeum, Phanagoria, Iluration, Tauric Chersonese, Tasunovo, Artesian, Uzunlarskoe Gorodiše, Kepoi, and other smaller sites on the Taman Peninsula.[12] Tauric Chersonese is certainly an exception within this group, as we can be sure of the presence of a Roman garrison there in the first centuries of our era.[13]

Apsaros

The Roman fort *Apsaros* is located on the N-E coast of the Black Sea, south of the mouth of the Tchorokhi River. The main duties of

12 Zhuravlew, Kamelina, 2015: 203.

13 R. K a r a s i e w i c z-S z c z y p i o r s k i, *The Roman Army in Tauric Chersonesos. City and Burial Areas*, Światowit Vol. X (LI) 2012, fasc. A, Warszawa 2013: 79-80; R. Karasiewicz-Szczypiorski 2015: 21–55.

Table 6. Inventory of stone projectiles found in the Roman fort Apsaros. The following abbreviations were used in the table: MAB – the Archaeological Museum in Batumi, MAG – the Gonio-Apsaros Archaeological Museum, MG – Warehouse of the Gonio-Apsaros Archaeological Museum, WG – Georgian excavation in the southern part of the fortress, WP – Polish excavation, H – A half or a smaller part of a stone projectile

Inventory Number	Collection	Number in the collection	Weight [kg]	Dimensions [cm]	Stone type
8.0.09 3n3.1 8-09:1	MAG	1	0.316	6.1–6.2	Limestone
284D 6.96.91	MAG	2	0.406	6.7–6.5	Sed. rock [sedimentary rock]
G.A.98.1302.SW.IX	MAG	3	0.700	7.1–8.1	Sed. rock
G.A.95.2758 696:806	MAG	4	0.656	6.8–7.9	Sed. rock
696:840 G.A.95 3756	MAG	5	0.626	7.8–7.4	Sed. rock
G.A. without a number	MAG	6	1.978	11.3–12.1	Limestone
2814 6-96:88	MAG	7	0.982	7.8–9	Sed. rock
GA95 2715 6-96:979	MAG	8	2.164	12–10.6	Granite
1	MAG	9	1.592	11–11.2	Limestone
GA09.3.SN3 3-09:3	MAG	10	0.448	7.4–7.65	Limestone
6-96:97	MAG	11	0.590	7.3–7.9	Limestone
9-09:4	MAG	12	0.666	7.9–7.9	Limestone
2755 6-96:83	MAG	13	0.786	7.7–8.5	Limestone
GA.0958S3 8.09.59	MAG	14	1.766	11.4–11.8	Sed. rock
11	MAG	15	0.450	7–7.3	Sed. rock
SW-XIaK II GA.96.2	MAG	16	0.232	5.5–6	Sed. rock
GA SE-22.2 VOII812	MAG	17	0.634	7.7–7.7	Light sed. rock
GA 99.5340	MAG	18	0.928	8.1–10.6	Sed. rock
Illegible number	MAG	19	1.674	11.2–11.4	Sed. rock
GA 95.2843 6:96:93	MAG	20	0.110	4.05–4.9	Sed. rock
6:6:97	MAG	21	1.078	10.1–10	Sed. rock
4	MAG	22	1.368	11.5–7.9	Sed. rock
7	MAG	23	1.932	11.7–10.9	Sed. rock
Without a number	MAG	24	1.988	8.3–8.4	Metal
GA 95 2759	MG	1	0.372	7.1–6.5	Sed. rock
1274	MG	2	1.350	9.6–9.4	Sed. rock
13	MG	3	0.411	7.5–5.4	Sed. rock
14	MG	4	0.670	8.6–5.7 **H**	Sed. rock
15	MG	5	0.404	8.2–8.4 **H**	Granite
16	MG	6	0.386	9.3 **H**	Granite
GA 95 2841 6-96:92	MG	7	0.294	5.9–5.4	Limestone

GA 2000.95 SN – III	MG	8	0.244	5.6–4.5–6.4	Sed. rock
2818	MG	9	0.748	8.3–7.1	Sed. rock
8	MG	10	0.668	10.2–10.1 **H**	Granite
6	MG	11	1.200	10.6–7.1 **H**	Sed. rock
17	MG	12	0.380	8.9–8.5	Sed. rock
2815 6:96:89	MG	13	0.718	7.2–7.5	Sed. rock
2754 6-96:82	MG	14	0.664	7.9–7.3	Sed. rock
2...9.. 32 8-09:2	MG	15	0.599	7.2–8.1	Sed. rock
2757 6-96:85	MG	16	0.732	7.9–7.8	Sed. rock
2817 6:96:90	MG	17	0.598	7.2–6.1	Sed. rock
23	MG	18	0.264	5.2–6.5	Sed. rock
24	MG	19	0.170	4.5–5.6	Sed. rock
18	MG	20	0.190	6.8–6.9 **H**	Sed. rock
20	MG	21	0.144	5.7–5.7 **H**	Sed. rock
22	MG	22	0.244	5.7–5.9	Limestone
12	MG	23	0.476	7.2–7.1	Sed. rock
Without a number	MG	24	0.986	7.8–8.7	Sed. rock
10	MG	25	0.820	8.6–7.8	Sed. rock
GA 09:5 8-09:5	MG	26	0.370	5.3–7.5	Granite
GA 95 2753 6-96:86	MG	27	0.438	6.4–7.0	Sed. rock
GA 95 2867 6-96:94	MG	28	0.578	8.0–7.1	Sed. rock
26	MG	29	0.090	4.1–4.3	Sed. rock
25	MG	30	0.150	4.7–5.2	Sed. rock
GA-04-SW-V 123	MG	31	0.332	6.0–7.0	Sed. rock
GA 2011 37 SW VIII	MG	32	0.358	6.0–6.8	Sed. rock
GA 2015. 5.3.10	MG	33	0.570	7.6–7.7	Sed. rock
19	MG	34	0.738	9.1–8.3	Granite
6	MG	35	0.614	10.6 **H**	Sed. rock
Without a number	MG	36	1.226	11.1–11.4 **H**	Sed. rock
GA 2012.45/SW IX	MG	37	0.354	5.8–6.7	Sed. rock
GA 2011.81	MG	38	0.852	8.3–6.0	Sed. rock
GA 95 2863 6-96:95	MG	39	0.356	6.4–5.4	Sed. rock
GA 07.257 SW V	MG	40	0.400	6.9–5.4	Sed. rock
GA 2011 336.SW VIII	MG	41	1.164	10.0–9.1	Sed. rock
GA 2013.673 SW VIII	MG	42	0.878	9.2–7.1	Sed. rock
Without a number	MG	43	0.520	7.3–7.6	Sed. rock
GA 2011.79 SW VIII	MG	44	1.344	7.5–10.1	Sed. rock

Without a number	MG	45	0.384	6.6–5.7	Sed. rock
GA 2011:70 SW VIII	MG	46	0.618	8.2–7.8	Sed. rock
82-2011:97	MG	47	0.090	3.8–4.4	Sed. rock
Illegible number	MG	48	0.452	7.2–6.4	Sed. rock
GA 07.361 SW V	MG	49	0.992	9.4–7.6	Sed. rock
GA.07.390 SW V	MG	50	0.288	6.4–5.4	Sed. rock
GA 2011.78 SW VIII	MG	51	1.458	10.8–8.2	Sed. rock
GA 50.22.2001/231	MG	52	0.540	8.6 –7.3–5.6	Sed. rock
Without a number	MG	53	0.320	6.2–5.7	Sed. rock
GA 2011.12.SW-VIII	MG	54	1.232	9.9–8.0	Sed. rock
Without a number	MG	55	0.538	8.6–7.2	Limestone
Without a number	MG	56	2.240	11.2–13.1	Sed. rock
GA 2011.157 SW VIII	MG	57	2.416	15.1–8.9	Granite
GA 2011.337 SW VIII	MG	58	1.572	11.6–8.9	Sed. rock
Illegible number	MG	59	0.438	5.8–7.9	Granite
5778 ...	MG	60	0.334	6.2–6.4	Sed. rock
GA 07.263. SW V	MG	61	0.844	9.3–8.2	Sed. rock
GA.2011.31.SW VIII	MG	62	0.124	5.2–4.3	Sed. rock
Without a number	MG	63	0.494	7.5–7.4	Sed. rock
Without a number	MG	64	0.638	7.7–7.9	Sed. rock
32-2011:100 158 SW VIII	MG	65	2.466	13.9–10.6	Granite
GA 2011.293.SW VIII	MG	66	0.860	11.1–8.9 **H**	Sed. rock
GA 2011.335.SW VIII	MG	67	1.014	10.3–8.9	Granite
... 68:1102-23	MG	68	0.372	6.5–5.9	Sed. rock
... 12.2011:98	MG	69	0.506	7.8–6.5	Granite
GA.2011.334. SW VIII	MG	70	2.042	12.1–9.5	Sed. rock
GA 2013.754.SW VIII	MG	71	0.446	7.7–6.8	Granite
Without a number	MG	72	6.488	17.2–17.0	Sed. rock
GA.07.334.SW IX C³	MG	73	3.308	14.7–13.0	Sed. rock
GA.2012.598. SW IX	MG	74	3.114	12.9–12.5 **H**	Limestone
GA 03 SW3281	MAB	1	2.956	14.6–12.1	Granite
31	MAB	1	0.482	7.8–7.6	Sed. rock
30	MAB	1	0.838	7.8–8.4	Sed. rock
32	MAB	1	0.594	8.5–7.1	Granite
35	MAB	1	0.436	7.1–6.2	Limestone
GA 45 963	MAB	1	1.918	11.0–11.6	Sed. rock

GA 05 5205	MAB	1	2.282	12.1–11.5	Granite
Without a number	MAB	2	8.042	18.5–18.9	Sed. rock
GA 699.07 249	MAB	2	3.702	16.6–12.7	Sed. rock
1	MAB	2	2.980	13.9–14.6	Sed. rock
GA 93 575	MAB	2	2.582	15.0–14.6	Sed. rock
Without a number	MAB	2	5.022	16.1–15.6	Sed. rock
GA 95 2894	MAB	2	7.506	19.6–16.5	Granite
Without a number	WG	1	2.995	10.4–11.5	Granite
Without a number	WG	2	0.284	4.9–4.1	Sed. rock
Without a number	WG	3	0.938	9.7–7.6	Sed. rock
Without a number	WG	4	0.234	4.0–4.2	Sed. rock
Without a number	WG	5	0.660	6.4–6.5	Limestone
Without a number	WG	6	0.254	5.5–2.5–4.4	Sed. rock
59/2015	WP	1	0.312	6.1–6.5	Granite
Without a number	WP	2	0.560	7.6–8.1	Granite
Without a number	WP	3	0.735	8.0–8.7	Sed. rock
Without a number	WP	4	0.500	8.3–7.5	Sed. rock
114/2015	WP	5	0.866	9.7–8.7	Sed. rock
63/2015	WP	6	0.836	8.9–9.0	Sed. rock
GA 2014.S15 SW VIII	WP	7	0.492	7.3–8.3–5.4	Sed. rock
GA 16/14w	WP	8	0.160	5.1–4.8–3.9	Sed. rock
GA16/74W	WP	9	0.082	4.0–4.2–3.3	Sed. rock
GA16/111W	WP	10	0.642	6.9–8.3–7.9	Sed. rock
GA16/173W	WP	11	0.902	9.6–8.6–9.9	Sed. rock

the Roman garrison included controlling the river pass, as well as the land and sea route connecting Colchis with the Asia Minor Roman province.[14] The *vexillationes* soldiers from l*egio I Italica* and *XVI Gemina* may have been stationed there.[15] However, it is more likely that auxiliary Roman army units were the permanent troops based at the fort. Traces of their presence include a few stamped tiles, as well as some inscriptions and various historic sources.[16] Polish-Georgian

[14] E. K a k h i d z e, *Apsaros: A Roman Fort in Southwestern Georgia*, Meetings of Cultures in the Black Sea Region: Between Conflict and Coexistence, "Black Sea Studies" VIII, Aarhus 2008: 303.
[15] *Ibid*., 307.; M. C z a p s k i, O. K u b r a k, *Na wschodnich rubieżach Imperium Romanum: polsko-gruzińska ekspedycja archeologiczna w forcie Gonio-Apsaros w Gruzji*, ArcheoUW 3, Warszawa 2015: 57.
[16] Kakhidze 2008: 313.

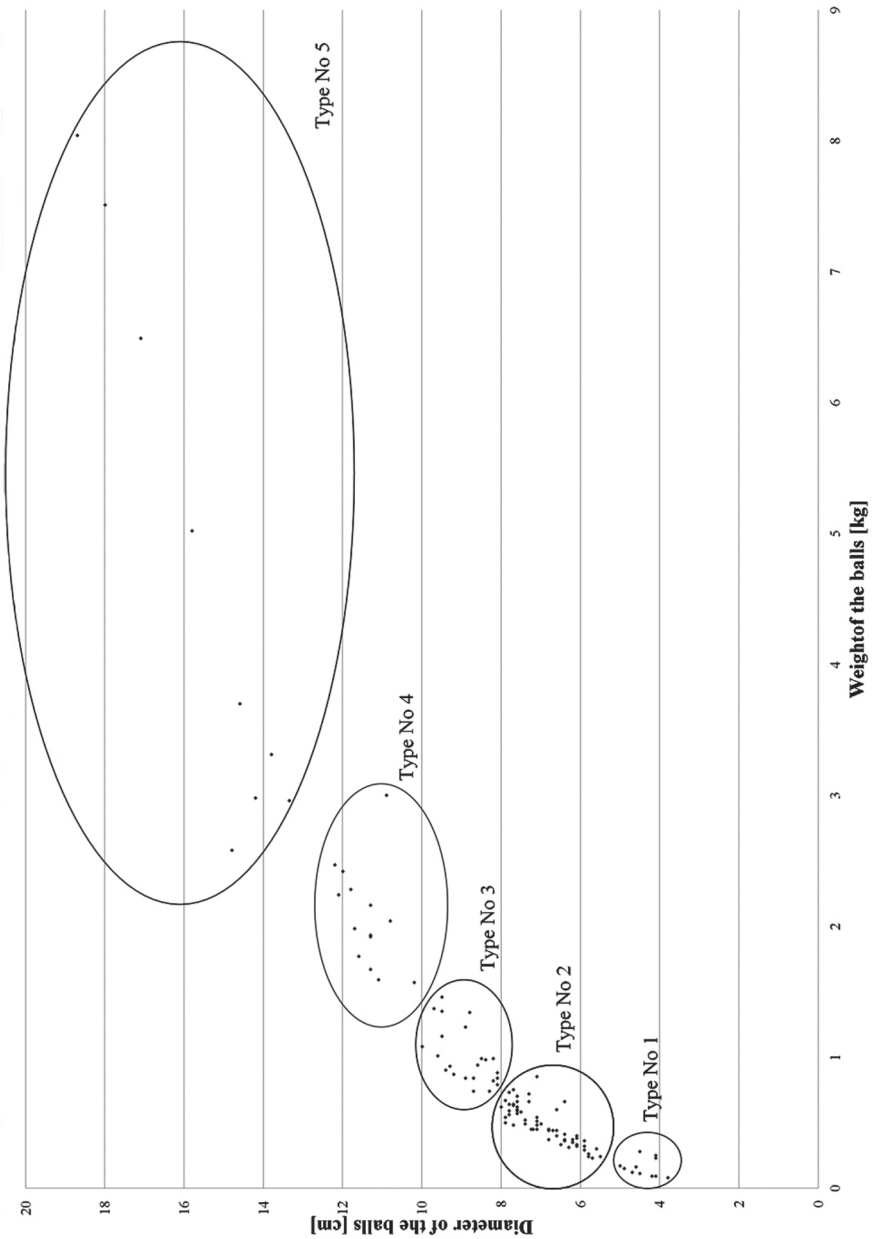

Table 7. Diagram presenting the relation between the weight and diameter of fully preserved stone projectiles found in the Roman fort *Apsaros*.

Fig. 1. Plan of the Roman fort *Apsaros* with a selection of the sector and the squares with the spots in which stone projectiles were found (after Aslanishvili 2009: 177–179): 1 – Early Roman fortress (after Karasiewicz-Szczypiorski, *Apsaros*. 2016: fig. 2); 2 – Turret No. 1; 3 – The Baths; 4 – Polish excavation trenches; 5 – Georgian excavation trenches in the southern part of the fort.

archaeological research in the fortress began in 2012 with geodetic and geophysical studies.[17] The expedition has been conducting excavations there since 2014 and it has discovered Roman baths dated to the 1st and 2nd centuries AD.[18]

Similarly as in the case of the stone projectiles from the Novae legionary camp, only part of the archaeological material from the Roman fort *Apsaros* has been published. Georgian archaeologist Lasha

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17 K. Misiewicz, R. Karasiewicz-Szczypiorski, *Gonio (Georgia). Non-invasive Surveys of the Roman Fort of Apsaros – 2012 Season*, Światowit Vol. X (LI) 2012, fasc. A, Warszawa 2013: 117–122.

18 R. Karasiewicz-Szczypiorski, E. Kakhidze, *The Roman Fort "Apsaros" in the Gonio – Early Phase. New Discoveries and Perspectives for Investigations*, Pro Georgia Journal of Kartvelological Studies 25, Warszawa 2015: 194; R. Karasiewicz-Szczypiorski, *Apsaros. Early Headquarters Building (Principia). New Localization?*, Pro Georgia Journal of Kartvelological Studies 26, Warszawa 2016, 54.; Czapski, Kubrak 2015: 61.

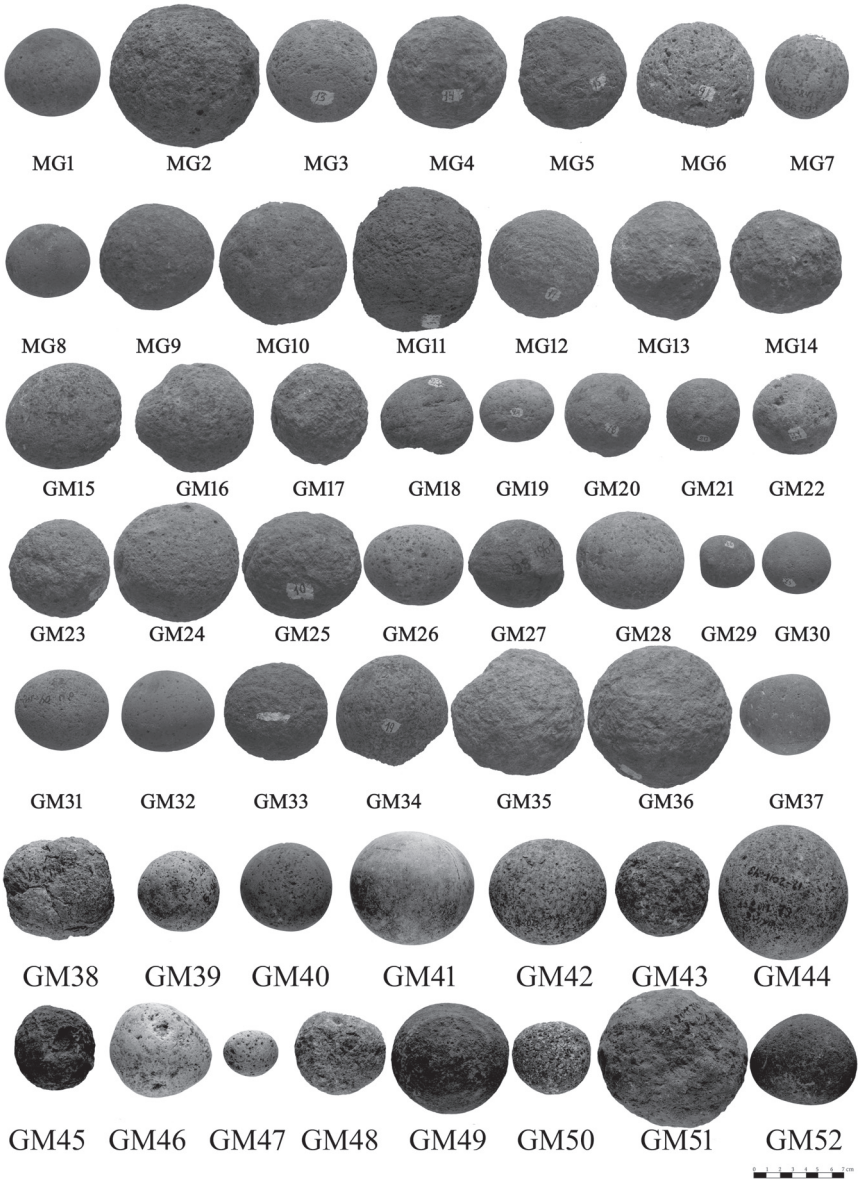

Fig. 2. Stone projectiles from the warehouse of the Gonio-Apsaros Archaeological Museum (O. Kubrak).

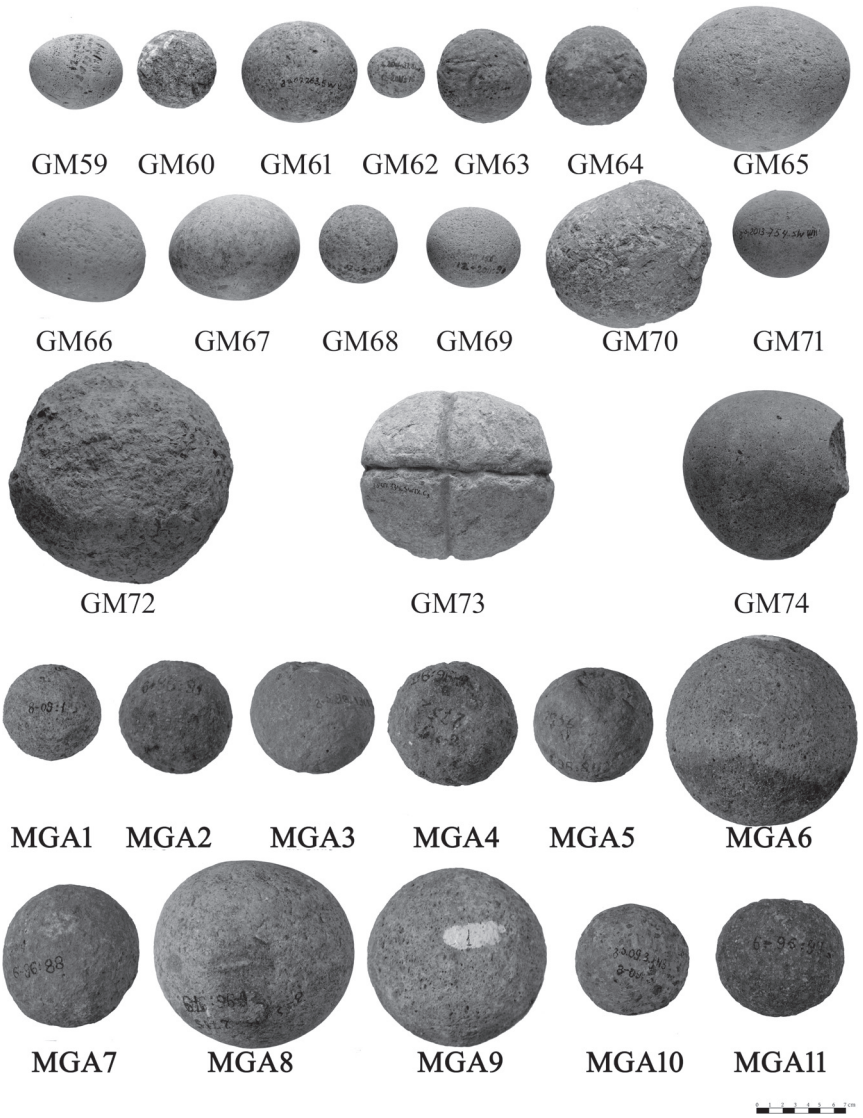

Fig. 3. Stone projectiles from the warehouse (MG) and exposition (MGA) of the Gonio-Apsaros Archaeological Museum (O. Kubrak).

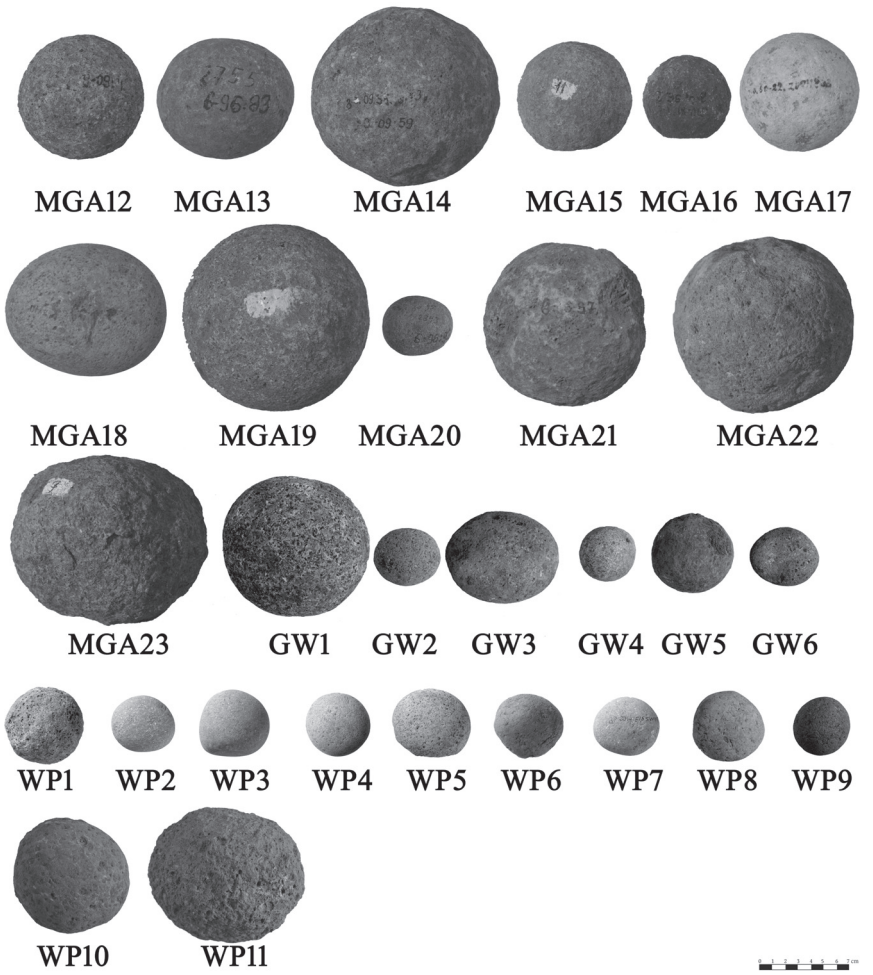

Fig. 4. Stone projectiles from the exposition of the Gonio-Apsaros Archaeological Museum (MGA), Georgian excavation in the southern part of the fortress (fig. 1.4; WG) and Polish excavation of the Roman baths (fig. 1.3; WP; O. Kubrak, A. Makowska).

Aslanishvili has written two papers about the balls found there. Firstly, the researcher distinguishes three types of stone projectiles depending on their diameter and weight.[19] In the second paper, two subtypes

[19] L. Aslanishvili, *Kvis Birtvebi*, (in:) A. Kakhidze, G. Lordkipanidze, G. Grigolia, V. Japaridze, G. KIpiani, S. Mamuladze, D. Mindorashvili, M. Khalvashi, T. Lomtatidze, E. Kakhidze (eds.), Gonio-Apsarus IV, Batumi 2004: 152–154.

Fig. 5. Stone projectiles from the Archaeological Museum in Batumi (O. Kubrak).

(A and B) are distinguished, weighing from between 100 to 900 grams, which have different diameters from the remaining balls but the same weight. The first type (according to the first selection) encompasses the largest projectiles with a diameter of 9.6-11 cm and weighing 2-3 kg, found in cultural layers dated to the 1st-2nd centuries AD.[20] The author suggests that they were shot from ballista or onagres, and their killing power had a reach of 300 to 350 meters.[21] Aslanishvili includes stone projectiles with a weight of 440-1500 g and a diameter of 7.5-9.3 cm in the second group, which is the most numerous. The Georgian archaeologist speculates that they were thrown by hand.[22] The third group applies to stone balls with a weight of 50-370 g and a diameter of 3-6 cm.[23] As Aslanishvili points out, this group has a characteristic ovoid shape.[24] The second and third groups occur in Roman, Byzantine, and Ottoman cultural layers, while the first group is characteristic for the Roman period.[25] The author of this typology indicates that the stone projectiles were most likely handmade by the soldiers, and they were produced using stone from the area of the present-day Kvariati

[20] Aslanishvili 2004: 153.
[21] *Ibid*., 153.
[22] *Ibid*., 153-154.
[23] *Ibid*., 154.
[24] *Ibid*., 154.; Aslanishvili 2009: 178.
[25] Aslanishvili 2004: 152-154.

Fig. 6. Stone projectiles from the Archaeological Museum in Batumi (O. Kubrak).

village[26]. Aslanishvili mentioned that most of the stone projectiles were found in the southern part of the late Roman fort[27] (Fig. 1). In the first centuries of our era, the Roman fort was oriented N-S along its longer axis. At the beginning of our era, a *raetentura* dated to the 1st-3rd centuries AD was located in the above-mentioned southern part of the Roman fort, and this is where the barracks were also situated.[28] In this case, the stone projectiles found near the southern defensive wall and turret No. 1 (Fig. 1.2) should be linked to the period in which this part of the fort was in use. Aslanishvili points out that the stone balls found in the Roman fort *Apsaros* may have belonged to attacking armies. This is evidenced by a finding from square 78 of sector NW 01, where the projectiles were found under a layer of broken tiles and ash, while a similar caliber of stone balls were also found outside the fort walls.[29] Analogies for the stone projectiles from *Apsaros* are observables among those from Panticapaeum, Artaxata, Wani, Carthage, Sablonetum (Ellingen), York, Nokalakevi and Anakofia.[30]

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26 *Ibid*., 154.
27 Aslanishvili 2009: 177-179.
28 See Karasiewicz-Szczypiorski 2016: 60, Fig. 2.
29 Aslanishvili 2009: 177.
30 Aslanishvili 2004: 154; 2009: 179-182.

The collection of stone balls from the Roman fort *Apsaros* is stored at the Archaeological Museum in Batumi and at the Gonio-Apsaros Archaeological Museum. Most of the projectiles are stored in the warehouses of the Gonio-Apsaros Archaeological Museum. The presented analysis also includes balls from the excavations conducted in 2014-2016 by the Polish-Georgian expedition.

Projectiles belonging to the presented collection are well preserved. Only a few of them are in the form of halves or smaller parts. The large number of balls (a total of 128) enables an analysis of the collection from different perspectives and making comparisons and combinations. Ball fragments were included in the inventory, but – so as not to falsify the results – they were omitted in the analysis showing the relation between the diameter and the weight of the stone projectiles.

Elements of the analyzed set were selected as recommended by Vitruvius (Vit. *De Arch*. X,11.3). This selection indicates that only two bullets from *Apsaros* (MG 34 and 73; Tab. 2, 3) could be included in the group established by the Roman architect.

In the current author's opinion, the stone projectiles from *Apsaros* can also be divided into three groups in terms of their diameter, i.e. small, medium, large, as well as into three groups in terms of their weight: light, medium and heavy (Tab. 4, 5). Such a simple division was used in the preliminary analysis of this collection. In contrast to attempts to adapt the projectiles to the scheme proposed by Vitruvius, my own compilation enables establishing many more similarities in the analysis, presenting the relation between the weight and diameter within a single group and differences between neighboring groups (Tab. 4, 5). One successive method involved the creation of a diagram presenting the relation between the mass and the diameter of the balls (Tab. 7). The values adopted on the axes of the coordinate system include the weight (to a hundredth of a kilogram) and the diameter (the arithmetic mean of the balls' dimensions in at least two axes). This compilation includes only fully preserved projectiles, i.e. 116 artifacts. Based on the obtained results, the ammunition was divided into five types numbered 1 to 5.

Type No. 1 – consisting of 11 balls (9.5% of the collection). These are stone projectiles with a diameter of up to 5 cm and a weight of up to 0.28 kg. The smallest stone ball is WP9 and the largest is MG19.[31] The

[31] The MAG, MG, MAB, WP, and WG abbreviations provide information about the places where the stone projectiles were stored or found. The abbreviations are explained in the inventory description (see Tab. 6).

projectiles classified to this type were made of sedimentary rocks. At this phase of research, it is not possible to specify the type of rock material used to make them.

Type No. 2 – consisting of 58 balls (49.93% of the collection) with a diameter amounting to between 5.5 and 8 cm and a weight from 0.24 to 0.75 kg. This is the most numerous type of balls found in the Roman fort *Apsaros*. Part of the second group and the whole third group as distinguished by Aslanishvili could be included in type No. 2.[32] The smallest projectile is MG8 and the largest is MG16. The stone balls No. MG38, MG17 and WG5 were classified to type No. 2, even though their weight is greater than that of the other balls, but their diameter corresponds to type No 2. Most of the projectiles were made of sedimentary rocks (51 stone balls), while in eight cases the material was defined as limestone, and the seven remaining balls as made of granite.

Type No. 3 – consisting of 23 balls (19.83% of the collection) with a diameter of between 8.1 and 10 cm and a weight of between 0.74 and 1.46 kg. The stone projectiles included in the second group as established by the Georgian scholar have been categorized as belonging to this group.[33] The smallest ball in the type No. 3 group is MAG13, while the heaviest ones would be MG51, MAG21, and MAG22. Most of the bullets were made of sedimentary rocks (21 stone balls). In one case, it was limestone, while the other two projectiles were made of granite.

Type No. 4 – consisting of 15 balls (12.95% of the collection) with a diameter of between 10.2 and 12.2 cm and a weight of between 1.57 and 2.42 kg. The first group as selected by Aslanishvili could be included in type No. 4.[34] The smallest ball of this type is MG58, while the largest one is MG65. The projectile WG1 is heavier than the adopted weight limit for type No 4. Despite the diameter norm for type No. 4, its weight is similar as for type No. 5. Ten balls of this type were made from sedimentary rocks, while three projectiles – from limestone and five – from granite.

Type No. 5 – consisting of 9 balls (7.79% of the collection) with a diameter of over 13.35 cm and weight of over 2.58 kg. The lightest projectiles of type 5 balls could correspond to the first group as proposed by Aslanishvili.[35] The smallest ball of this type is MAB1 and the largest is MAB2. In this type, it is hard to distinguish a norm in the relation

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32 Aslanishvili 2004: 153-154.
33 *Ibid*., 153.
34 *Ibid*., 153.
35 *Ibid*., 153.

between the weight and the diameter, because only a few projectiles have been found matching the presented type. Seven balls were made from sedimentary rock and two – from granite.

Summary

The paper presents the results of the study of a collection of 128 stone projectiles found in the Roman fort *Apsaros*. 116 fully preserved examples were used in the material analyzed. In the presented study, the diagram presenting the relation between the diameter and the weight of the projectiles provided the most fruitful analysis results. It has been established that the weight of the stone balls was dependent on the type of raw material used for their production.[36]

Based on this statement, the author has distinguished five types of stone projectiles among the balls that are similar in diameter and weight. The most numerously represented are type No. 2. In this case, it can be assumed that this caliber of ammunition was used by the Roman garrisons in *Apsaros*. In the case of lighter and heavier projectiles with the same diameter (matching the hole in the frame of the same ballista), the lighter ones could have been shot longer distances and the heavier ones were certainly shot shorter lengths.

[36] See M. K a m i e ń s k i, W. S k a l m o w s k i, *Kamienie budowlane i drogowe*, Warszawa 1957.

Throwing Artillery from *Apsaros* Roman Fortress. Analyze and Interpretation of Stone Projectiles for Ballista

Stone balls are commonly found at archaeological sites associated with the Roman army. They represent a great variety of sizes and were used for siege engines, as projectiles for slingshots and large metal arrowheads.

During the archaeological research conducted in the Roman fort of *Apsaros* 115 stone balls of a variety of sizes and weights were found. This collection has been analyzed and organized according to their diameter and weight. The results were compared with the published research of stone balls from other places where the Roman army had been stationed. The stone balls from Apsaros were compared to the information about the ballista and their projectiles contained in Vitruvius's text (*Vit. De Arch*. X,11.3).

All the stone balls found in *Apsaros* have been arranged in a chart. The coordinate system shows the relation between the mass and the diameter of the individual bullets. By using this method, we have established a better distribution of the collection of stone balls, dividing them into five groups as opposed to the three groups previously introduced. In all cases for which it was possible, the place where the projectiles in the fortress were found has also been provided. The localization of the findings was compared with the probable localization of the Roman fort of *Apsaros* from the first centuries of our era.

The research of stone balls from the Roman fort *Apsaros* was possible thanks to the cooperation between Polish and Georgians archaeologists during the Gonio-Apsaros expedition. The joint expedition consists of researchers from the Institute of Archaeology of the University of Warsaw, the Polish Center of Mediterranean Archaeology of the University of Warsaw and the Cultural Heritage Preservation Agency of Adjara.