

**BABEȘ-BOLYAI UNIVERSITY CLUJ-NAPOCA
FACULTY OF HISTORY AND FILOSOFY
DOCTORAL SCHOOL OF HISTORY. CIVILAZATION. CULTURE**

DOCTORAL THESIS

Abstract

**WEAPONS FOR RANGED COMBAT IN THE ROMAN ARMY IN
DACIA POROLISSENSIS
(II-III CENTURIES AD)**

Doctoral Supervisors:

Prof. univ. dr. Nicolae Gudea

Prof. univ. dr. Radu Ardevan

**Ph.D. candidate:
Claudiu Ionuț Iov**

Cluj-Napoca, 2023

Table of contents

Preface.....	8
I. INTRODUCTION.....	10
I.1. Purpose and importance of the thesis.....	11
I.2. Approach method.....	13
I.3. The level of knowledge and research regarding archer units.....	16
I.3.1. Written sources.....	16
I.3.2. Historical literature based on the study of funeral monuments.....	18
I.3.3. Archaeological sources.....	18
I.3.4. Historical literature.....	20
II.2. Archer units in the Roman army in the II-III centuries.....	23
II.3. Arrow shooter units attested in the north of province of Dacia between 106-118 AD... 24	
II.4. Arrow shooter units attested in province of Dacia Porolissensis between 118-275 AD..25	
II.4.1. Information regarding the organization of archer troops from Porolissum and the province of Dacia Porolissensis	28
II.5. Other military units from Dacia Porolissensis, not nominated as arrow shooters, in whose forts arrowheads or bow components were discovered.....	30
II.6. Conclusions.....	39
III. THE BOW, TORSION-BASED WEAPONS AND THEIR ARROWS.....	40
III.1. The level of knowledge and research regarding archers' weapons.....	40
III.1.1. On the type of the bow used.....	48
III.2. Technical analysis of weapons.....	50
III.2.1. General Information regarding the bow; brief overview of bone bow stiffeners.....	50
III.3. Torsion weapons.....	51
III.4. The arrow: definition, its composing elements: arrowhead, arrow shaft, fletchings and nock, materials used.....	52
III.5. An analysis of the arrowheads of light arrows.....	54
III.5.1. An analysis of the arrowheads of heavy arrows.....	55
IV. THE ARCHAEOLOGICAL SITUATION IN DACIA POROLISSENSIS IN RELATION TO THE SUBJECT OF THE RESEARCH.....	57
IV.1. General data related to typology: shape, size and weight of the analysed arrowhead from Dacia Porolissensis.....	57
IV.2. Bologna.....	59

IV.2.1. General information.....	59
IV.2.2. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	60
IV.2.3. Attempting to date the arrowheads (Su, Sg).....	62
IV.2.4. Conclusions.....	63
IV.3. Buciumi.....	63
IV.3.1. General information.....	63
IV.3.2. Elements composing the bows.....	64
IV.3.3. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	64
IV.3.4. Attempting to date the arrowheads (Su, Sg).....	66
IV.3.6. Conclusions.....	67
IV.4. Românași - Largiana	67
IV.4.1. General information.....	68
IV.4.2. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	68
IV.4.3. Attempting to date the arrowheads (Su, Sg).....	68
IV.4.4. Conclusions.....	69
IV.5. Romita - Certaie.....	69
IV.5.1. General information.....	69
IV.5.2. Elements composing the bows.....	69
IV.5.3. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	69
IV.5.4. Attempting to date the arrowheads (Su, Sg).....	70
IV.5.5. Conclusions.....	70
IV.6. Moigrad – Porolissum	70
IV.6.1. General information.....	70
IV.6.2. A typology of stiffeners for the tips of animal bones and horns bows.....	71
IV.6.3. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	74
IV.6.4. Attempting to date the arrowheads (Su, Sg).....	78
IV.6.5. Other component elements of arrows.....	78
IV.6.6. Conclusions.....	78
IV.7. Tihău.....	78
IV.7.1. General information.....	78
IV.7.2. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	79
IV.7.3. Attempting to date the arrowheads (Su, Sg).....	79
IV.7.4. Conclusions.....	79
IV.8. Cășeiu – Samum	79

IV.8.1. General information	80
IV.8.2. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	80
IV.8.3. Attempting to date the arrowheads (Su, Sg).....	80
IV.8.4. Conclusions.....	80
The 21 de Su and Sg show a great diversity of types, just as in Tihău both types of weapons can be confirmed to have been in the army's equipment.....	80
IV.9. Ilișua – Arcobara.....	80
IV.9.1. General information.....	80
IV.9.2. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	81
IV.9.3. Attempting to date the arrowheads (Su, Sg).....	84
IV.9.4. Conclusions.....	84
IV.10. Livezile	85
IV.11. Orheiul Bistriței.....	85
IV.12. Gherla.....	86
IV.12.1. General information.....	86
IV.12.2. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	86
IV.12.3. Conclusions.....	87
IV.13. Gilău	87
IV.13.1. General information.....	87
IV.12.2. Typology of arrowheads (Su, Sg): shape, sizes and weight.....	87
IV.13.2. Conclusions.....	87
IV.14. Sutoru – Optatiana	88
IV.15. Turda – Potaissa.....	88
V. CATALOGUE.....	89
V.1. Bologa, Cluj county.....	89
V.1.1. Arrowheads (Su) with a wrought iron fitting tube.....	89
V.1.2. Arrowheads (Su) with a wrought iron fixing tang.....	92
V.1.3. Arrowheads (Sg) with a wrought iron fitting tube.....	95
V.1.4. Arrowheads (Sg) with a wrought iron fixing tang.....	97
V.2. Buciumi, Sălaj county.....	97
V.2.1. Bow head stiffeners made of carved bone.....	97
V.2.2. Arrowheads (Su) with a wrought iron fitting tube	98
V.2.3. Arrowheads (Su) with a wrought iron fixing tang.....	106
V.2.4. Arrowheads (Su) with a carved bone tang.....	114

V.2.5. Arrowheads (Sg) with a wrought iron fitting tube.....	115
V.2.6. Arrowheads (Sg) with a wrought iron tang.....	120
V.3. Românași – Largiana, jud. Sălaj	124
V.3.1. Arrowheads (Su) with a wrought iron fitting tube.....	124
V.3.2. Arrowheads (Su) with a bronze fitting tube.....	125
V.3.3. Arrowheads (Sg) with a wrought iron tang.....	125
V.4. Romita – Certiae, Sălaj county.....	126
V.4.1. Bow head stiffeners made of carved bone.....	126
V.4.2. Arrowheads (Su) with a wrought iron tang.....	127
V.4.2. Arrowheads (Sg) with a wrought iron fitting tube.....	127
V.4.3. Arrowheads (Sg) with a wrought iron tang.....	128
V.5. Porolissvm, Sălaj county.....	129
V.5.1. Bow head stiffeners made of carved bone and animal horn.....	129
V.5.2. Bow handles stiffeners made of carved animal horn.....	146
V.5.3. Arrowheads (Su) with a wrought iron fitting tube.....	147
V.5.4. Arrowheads (Su) with a bronze fitting tube.....	163
V.5.5. Arrowheads (Su) with a wrought iron tang.....	168
V.5.6. Arrowheads (Su) with bronze tang.....	228
V.5.7. Arrowheads (Su) with a bone and animal horn tang.....	228
V.5.8. Arrowheads (Sg) with a wrought iron fitting tube.....	239
V.5.9. Arrowheads (Sg) with a wrought iron tang.....	250
V.5.10. Nocks for carved bone arrows.....	259
V.5.11. Nocks for bronze arrows.....	260
V.6. Tihău, Sălaj county.....	260
V.6.1. Arrowheads (Su) with a wrought iron fitting tube.....	260
V.6.2. Arrowheads (Sg) with a wrought iron fitting tube.....	261
V.7. Cășeiu – Samum.....	263
V.7.1. Arrowheads (Su) with a wrought iron tang.....	263
V.8. Weapons from the castrum and the civilian settlement at Ilișua – Arcobara.....	264
V.8.1. Arrowheads (Su) with a wrought iron fitting tube.....	265
V.8.2. Arrowheads (Su) with a bronze fitting tube.....	281
V.8.3. Arrowheads (Su) with a wrought iron fixing tang.....	285
V.8.4. Arrowheads (Sg) with a wrought iron fitting tube.....	302
V.8.5. Arrowheads (Sg) with a bronze fitting tube.....	311

V.8.6. Arrowheads (Sg) with a wrought iron tang.....	312
V.9. Livezile.....	322
V.10. Weapons from the castrum at Orheiul Bistriței	322
V.11. Weapons from the castrum at Gherla.....	322
V.11.1. Arrowheads (Su) with a wrought iron fitting tube.....	322
V.11.2. Arrowheads (Su) with a wrought iron tang.....	323
V.11.3. Arrowheads (Sg) with a wrought iron fitting tube.....	324
V.11.4. Arrowheads (Sg) with a wrought iron tang.....	325
V.12. Weapons from the castrum at Gilău.....	326
V.12.1. Arrowheads (Su) with a wrought iron fitting tube.....	326
V.12.2. Arrowheads (Sg) with a wrought iron fitting tube.....	329
V.13. Weapons from Sutor - Optatiana.....	331
V.14. Weapons from legionary castrum of Turda- Potaissa.....	331
V.14.1. Arrowheads (Su) with a fitting tube.....	331
V.14.2. Arrowheads (Su) with a tang.....	332
V.14.3. Arrowheads (Sg) with a wrought iron fitting tube.....	336
V.14.4. Arrowheads (Sg) with a wrought iron tang.....	338
V.15. Weapons from the towers on Dacia Porolissensis Limes.....	342
V.15.1. Arrowheads (Su) with a tang.....	342
V.15.2. Arrowheads (Sg) with a wrought iron fitting tube.....	344
V.16. Weapons from rural settlements of Dacia Porolissensis.....	345
V.17. Weapons from some Dacian fortresses in the vicinity of Dacia Porolissensis.....	345
VI. FINAL CONCLUSIONS.....	347
List of boards.....	352
VII. APPENDIX.....	358
VII.1. Tables.....	358
VII.2. Abbreviations and bibliography.....	362
VIII. BOARDS	377

Key words: Roman army, Dacia Porolissensis, Porolissum, Ilişua, bows, ballistae, arrowheads, light points, heavy points, arrowheads, typology, chronology, weight, iron, bronze, carved bone.

INTRODUCTION

Of the three provinces of Dacia. Dacia Porolissensis was the most exposed; the barbarian tribes (Marcomanni, Quadi, Sarmatians, Buri, Vandals, Free Dacians, Costoboci, Roxolani), closer or further from the borders always tried to apply pressure. (Fig 4)

Through its defensive system in the North-West, North and North-East, Dacia Porolissensis had the role of guaranteeing the peace and tranquillity in Dacia province, therefore to these parts of the Roman Empire.

Thereby, the defence of Dacia Porolissensis was ensured by the nine border fortresses: Bologa, Buciumi, Românași, Porolissum for the North-West sector, Tihău, Cășeu, Ilișua for the North sector and Livezile, Orheiul Bistriței for the North-East sector; by the four inland fortresses (Gilău, Sutor, Romita și Gherla) and last but not least by the legionary castrum of Potaissa. (Fig 5) Each one of them was located in strategical military points of greater interest with the intention of defending important passageways (Bologa, Porolissum Cășeu) or strategic commercial points, crossroads (Sutor, Romita) etc; with troops of various ethnicities and tactical weaponry particular to each troop.

The sword, the dagger, the lance, the spear, the bow, the sling are the weapons generally used by soldiers in Roman army, weapons that could be handled by a single soldier; adding to those torsion-based weapons ballistae, catapults etc., handled by multiple soldiers.

Among these weapons, I have chosen the bow and arrow, more specifically, the iron, bronze and bone arrowheads from the Dacia Porolissensis fortresses listed above.

The purpose and importance of this thesis:

The Roman Empire's expansion and then the defence, the development and the economic stability, the peace and tranquillity of the newly conquered territories was mostly due to the Roman army, to the strength and fighting style, but also to the used armament.

Although arrowheads are an important category of artefacts with a great research potential, most of them remained undiscovered. The small sizes, the fragmentary shape and the high degree of corrosion accumulated over time, or perhaps the fact that they have enjoyed a lower sensational or spectacular coefficient following their publication may be the causes of this reality.

The study of these weapons has not been so far a priority in archaeological research in Romania. This situation applies especially to Dacia Porolissensis, but to the provinces of

Apulensis and Malvensis, as well. There is a study for South Carpathian Dacia which deals with all the weapons, but generally, the author mostly describes the well-known and already published pieces.

We consider that the present study is a unique one for the entire Roman Dacia province, but perhaps, for the entire Roman Empire.

The purpose of this thesis is restored in the subtitle of the paper, which is:

- to create a database for every site with its unique and published discovered weapons;
- to create a complex database for each piece, comprising as follows: 1/1 scale drawing, the piece reassembled by drawing, photography, place it was discovered, storage place, the material it was made of, method of manufacture, detailed description, current state of preservation, size in millimetres, weight, bibliography, dating and analogies;
- to compile a general typology for the entire Dacia Porolissensis province and then for each individual site/castle;
- to date these arrowheads chronologically.

To step to another level of research on this topic in the future, specifically to experimental archaeology through which we want to reach the following goals:

- to make perfectly functional arrowhead replicas, after some of the original ones, such as: those with three iron wings or those with two bone wings found in Porolissum, those with a rhomboidal shape from Ilişua, etc.).
- to make arrows, the weight, sizes and shape of these arrows will allow us to analyze the types of bows (weight and size) as well as the torsion-based combat weapons used by some Roman military units in Dacia Porolissensis.
- to test these arrows and check their way of being used, the force, the launch distance and the efficacy of the weapons from which they were fired.

These experimental archaeological tests will hopefully produce clear answers to the questions that have so far remained blurry, questions much discussed in circles of specialists who researched and published arrowheads from different provinces of the Roman Empire.

These questions are directly related to these arrowheads' size and weight:

- what size and weight were the smallest and lightest bow arrowheads used by Roman soldiers from Dacia Porolissensis?
- what are the upper limits in terms of size and weight that these bow arrowheads used by to Romanian soldiers can reach?; specifically, the minimum and maximum limits

for arrowheads that can be shot with various types (size and weight) of bows used by the archery troops of the Roman army.

- if we have other types (sizes, shape, weight) of arrowheads discovered in forts of Dacia Porolissensis, other than those used for bows, and for what types of weapons were those arrowheads used. We believe that: analysed in detail, classified as correctly as possible, these items can be valued at a higher level than the general one, all too familiar to us from specialized literature.

Studied in detail, they can be presented at their true lethal potential; they can generate surprises, information, data and historical/archaeological realities that are new or known but not accepted among archaeologists in the absence of further, clearer evidence. The weapons` analysis is important because it can provide interesting information about the Roman army, their choice in combat style or the weapons used by their enemies.

The novel part of the study is presented starting with chapter IV where I detailed the archaeological situation, the archaeological reality in relation to the weapons discovered in the forts of Dacia Porolissensis; we put special emphasis on typology: shapes, sizes and weight.

On shapes, sizes and weight

Most of the time these arrowheads are wrongly determined; a fact that inevitably leads to a smaller number of pieces, a number that directly influences the typology of weapons in a certain fort. The sizes and weight of the pieces are important factors to determine them as correctly as possible. The graphic reunification and their weighing help establishing the sizes and weights in the Roman era, when these weapons were used.

Some pieces, such as the bronze ones that have been best preserved in terms of shape, size, and weight, can be appreciated and interpreted with greater ease; for whole pieces, the current weight is similar in proportions of 95-99% to that of the Roman era.

The same cannot be said about the iron pieces; many of which have been fragmented since ancient times, then during their roughly 1750 spent underground they reached a high level of corrosion; and last but not least, the type of restoration, the place and method of preservation in some cases constitute a third factor leading to their destruction, their reduction in size and loss of initial weight.

The bone, being an animal product, goes through a diagenesis process through the degradation of its organic part as much as it undergoes changes in its mineral constituency, depending on the exposure time in the soil. Even if the sizes remain approximately the same, the weight of the bone is significantly lower.

Therefore, it is not possible to make a typology of them in the way they look today, if the pieces are not graphically reassembled and if their weight from antiquity is not known.

The graphic reassembly of the pieces, together with today's weight, helps to correctly establish the shape, sizes and initial weight, after which we can move on to manufacture replicas. For better understanding, I will give the possible antiquity sizes taken from the graphic reconstructions that I executed, see the example below for the weapons from Bologna.

I was daft enough to consider the maximum weight of 25-30 grams for all arrowheads that could have been used for bow arrows and those above 30 grams for arrows meant for torsion-based machines. It is only through future testing that we are going to be able to light on this split.

General typology

The arrowheads from Dacia Porolissensis fit into the general typology of these weapons for the other two provinces of Dacia *Apulensis* and *Malvensis*, but also for the weapons in this category in the entire Roman Empire.

In the thesis I divided them into two groups, according to the type of weapon they were used for, as follows:

- I. "Light" arrowheads for bows (Su)
- II. "Heavy" arrowheads for torsion-based weapons (Sg).

We have divided each of these groups into other subgroups depending on the type of gripping in the wooden shaft, as it follows:

- A. affixed with a fitting tube
- B. affixed with a tang/nail.

In turn, we have divided the subgroups in many categories depending on the shape of the active part:

1. pyramid shape
2. rhombus shape
3. leaf shape
4. number 1 shape - hook – with a wing
5. shape with two wings or shallow tail
6. shape with three wings
7. other shapes

The last form of categorisation is that based on the profile of the active part:

- a. square profile
- b. rectangular profile

- c. star-shaped profile
- d. triangular profile
- e. round profile
- f. trapezoidal profile
- g. hexagonal profile
- h. octagonal profile
- i. lenticular profile
- j. rhomboid profile
- k. combined profile (round -square)
- l. other profiles

Below in the text we will use these abbreviations, for example IA1a = light arrow for fitting tube bow with the active part in pyramid form and square profile.

Example: I will present the archaeological situation in Bologna.

The arrowheads from Bologna fit into the general typology of these weapons for Dacia Porolissensis province, but also for the other two provinces of *Apulensis* and *Malvensis*. From the old research (1967-1976) comes a fairly large number of weapons (60 pieces) **Fig. 53** whereof 37 lances, 4 spears; bow arrowheads there are 11 pieces of which 6 with fitting tube and 5 with tang; bolts there are 4 pieces whereof 3 pieces with a fitting tube and 1 piece with a tang. If we add the 9 different knives, we reach a total of 69 weapons. The lance heels were not at hand, so I was unable a count, however they certainly exist in the MNITC warehouse, whereas for the knives I made a selection then and they are higher in number. In table no. 4 I have listed the weapons I analysed. All these weapons are unique, they have never been systematically published. They are mentioned by N. Gudea on page 41 and on page 91, where he provides a synoptic table with the typological-chronological ordering of the assault weapons which appeared in the fort. In the new research (2012-2020) carried out in the forts's *praetorium*, no arrowheads were discovered. I emphasize that at Bologna all arrowheads are made of iron.

For the weapons from Bologna there results the following typology extracted from the general typology, as it follows:

- I. "Light" arrowheads for bows (Su)
- II."Heavy" arrowheads for torsion-based weapons (Sg).
 - A. Affixed with a fitting tube
 - B. Affixed with a tang/nail.
 - 1. Pyramid shaped

2. Rhombus shaped
3. Willow leaf shaped
 - a. Square profile
 - b. Rectangular profile
 - d. Triangular profile
 - g. Hexagonal profile
 - i. Lenticular profile

Thus, we have formed the following combinations of heads in respect to their typology:

Bow Light Arrowheads (Su) 11 pieces:

Su. with iron fitting tube - 6 pieces: **Fig. 54:** IA1g -1 head fig. 52/1, Pl. I no. 1; IA2a - 1 head pl 52/2 no. 2, Pl. I no. 2; IA2b - 1 head pl 52/3, Pl. I, no. 3; IA3i - 3 heads pl. 52/4-6 no. Pl. I, no. 4-6.

Su. with an iron tang/nail - 5 pieces: **Fig. 55:** IB2a - 4 heads; pl 55/1-5; Pl. II, no. 1-4 as per catalogue; IB2d - 1 head pl 55.1/5. Pl. II no. 5.

Heavy Torsion-Based Combat Weapons Arrowheads (Sg) - 4 Pieces:

Sg. with iron fitting tube - 3 pieces: **Fig. 56:** IIA – 3 heads; IIA1a - 2 heads, Pl. III, no. 1.2; IIA1b - 1 head no. Pl. III, no. 3.

Sg. with an iron tang/nail 1 piece: **Fig. 57:** IIB- 1 tip; IIB1a - 1 tip Pl. IV, no. 1.

If the arrowheads were all intact, their size would be different from that of today. For example, I will show the piece number 4 from the catalogue and the sizes of the piece after the graphic reassembly.

Preserved sizes: (fragment)

Lp = 46.79 mm; Lp tube = 26.61mm; dp tube = 10.30 mm; Lp tip = 20.18 mm; dp tip = 13.91 mm

Sizes from antiquity: (graphical compilation)

L = 75 mm, L tube = 40 mm, d tube at base = 12 mm, d tube wall = 1.5 mm, L tip = 35 mm, d tip in the middle = 16/4 mm

These are the sizes for the head no. 4 from Bologna that we should use in an experimental archaeology study so as to create the replica, in order to test it and try to figure out what type of weapon it was used for, the power of the weapon (bow)...etc.

The basis of the work is detailed in the 265 pages that make up the catalogue of discoveries in which I have described pieces such as: bone bow head stiffeners, light bow arrowheads made of iron, bronze and bone; iron and bronze heavy arrowheads for torsion-

based fighting machines (manuballistae, scorpio, ballistae), as well as bone and bronze arrow nocks.

The pieces were discovered in the **Bologa** fort 15 heads (Su, Sg); **Buciumi** 43 heads (Su, Sg), 1 bow end stiffener; **Romita** 4 heads (Su, Sg), 1 bow end stiffener; **Românași** 3 heads (Su, Sg); **Porolissum** 220 (Su, Sg), 38 bone bowhead stiffeners, 1 bone nock and a bronze nock. From the fort on the Pomet hill, the Roman customs and quarter; **Tihău** 5 (Su, Sg), (Su, Sg); **Cășeiu** 1 (Su), **Ilișua** 102 (Su, Sg), fort and quarter; Orheiul Bistriței 7 (Su, Sg); **Gherla** 6 (Su, Sg); **Gilău** 7 (Su, Sg); **Turda** 19 (Su, Sg); **towers on the Roman limes** 5 (Su, Sg), the Dacian fortress **Ciceu Corabia** 2 (Sg). Thus, we have a total of 470 pieces, approximately 80% of which we have physically examined, measured, weighed, described, drawn, graphically reassembled and photographed. The rest of approximately 20% are published pieces, many of them without inventory numbers, which made it almost impossible for me to physically research them, others are lost in museums warehouses, while others I did not have access to for various reasons. These heads were published without a scale or a description for various reasons.

From the researched ones, I replicated 5 heads, in order to establish a threshold between the weight of light arrows for bows and heavy ones for torsion-based fighting machines (manuballistae, scorpio, ballistae, cheiroballistras).

Below I will exemplify some of these iron, bronze and bone arrowheads.

12. Buciumi; Su (Pl. VI, fig. 5.)

Place of discovery: fort, the space between the two towers of the western gates (right nn) fap.

Place of storage: MJIAZ, C.C. 58/1967.

Material: wrought iron.

Manufacturing method: by forging, the active part sharpened by forging and grinding.

Description: complete, not affected by corrosion, fitting tube almost complete; the active part complete, its head very slightly bent following a contact with a hard object. It has the shape of number 1- or a hook, the tube has a truncated cone shape and a round profile; the active part has a pyramidal shape and a triangular profile, the hook or arm has a rhomboidal profile. It has straight sides and very sharp edges.

Current state of preservation: very good; restored by mechanical cleaning and lamination with paraffin.

Sizes: Lp = 51.42 mm; Lp tube = 30.00 mm; Lp tube hole = 12.80mm; dp tube = 11.53 mm; dp tube wall = 1.05 mm; Lp tip + arm = 44 mm; dp tip = 10.55/5.00 mm.

Weight = 7 grams.

Bibliography: Chirilă et al 1972, 63/9 framed with spears, pl. LXI/9; Iov 2022 p. 129/11, p. 137 pl. I/11.

Date: 106-114 AD

Analogies: None found.

2. Românași / Largiana; Su (Pl. V, fig. 6.)

Place of discovery: fort; 1996, S. 1, meter 4, a = 40 m; fact

Place of storage: MJIA Zalău; C.C. 1/ 2013.

Material: bronze.

Manufacturing method: by casting, the active part sharpened by grinding.

Description: complete, the fitting tube is very slightly deformed and bent at the base, it has a hole for a fixing nail, it has 2 horizontal lines with 2.50 mm between them; active part complete, very slightly blunted at the tip. The shapes can be observed very well: the tube has a truncated cone shape and a round profile, the active part has a pyramidal shape and a square profile. It has straight sides and sharp edges.

Current state of preservation: very good, unaffected by corrosion; it has a beautiful light green patina.

Sizes: Lp = 82.45 mm; Lp tube = 42.25 mm; Lp tube hole = 35 mm; dp tube in the middle = 6.60 mm; dp tube wall = 0.50 mm; dp hole for fixing nail = 2.50 mm; Lp tip = 40.20 mm; dp tip = 6.60/6.65 mm.

Weight = 8 grams.

Bibliography: unique.

Date: 3rd century AD

Analogies: Porolissum, Ilișua/*Arcobara*.

157. Porolissum; Su (Pl. I, fig. 1.)

Place of discovery: A 1985, S 88; square L 28-29, a = 1.65 m.

Place of storage: MJIAZ; old site excavations Op. 94.

Material: carved bone.

Manufacturing method: cut, carved and polished.

Description: fragment, the entire active part has been preserved, as well as a small part of the fixing nail; the shapes are clearly visible: the nail has a cylindrical shape and an irregular rhombus section; the active part has an irregular triangular shape and a triangular profile, one of the sides has a semi-round longitudinal groove in the middle which is actually the place of the bone marrow, the other 2 sides each have a longitudinal crack. It has straight sides, the

edges and the top of the active parts are very sharp. The traces of the tools with which it was made can be seen all over it.

Current state of preservation: very good, very well preserved; uniform yellowish colour without spots.

Sizes: Lp = 43.88 mm; Lp nail = 3.78 mm; d top nail = 2.90/3.50 mm; L tip = 40.10mm d tip = 13.06/15.15/15.81mm.

Weight = 5.334 grams.

Date: 2nd century AD

Bibliography: Gudea 2006 p. 410/15; Vass 2010.

Analogies: Bucumi

After analysing the weapons, I reached the following conclusions:

- the army of Dacia Porolissensis was heavily equipped with this type of weapon - the bow, especially in Buciumi, Ilişua, but mostly Porolissum fort, but bow arrowheads were discovered in all researched forts in Dacia Porolissensis.
- we can see that the weapon is known and used to some extent by all the attested units in Dacia Porolissensis, even by those that were not attested as arrow shooters.
- at Porolissum we have the smallest arrows discovered, structured on some well-defined categories examples:
 1. trilobite/ 3 iron wings tips, unique in Dacia Porolissensis;
 2. carved bone heads, unique in the entire Roman Empire.
- next to Micia, Porolissum is the second fort in respect to the number of bone bow head stiffeners discovered in Roman Dacia.
- at Ilişua there are the tips with rhombus shape and a small square section, specific for this fort, with shapes and sizes that show the characteristics of the units there, but also the features of the workshop and the blacksmith who made them.
- the lack of bone stiffeners for bow ends from Ilişua compared to the large number of discovered arrow tips may show that probably the soldiers stationed in this fort used a different type of bow that did not have such bone plates at its ends.
- heavy arrowheads used for torsion-based combat machines (manuballistae, scorpio, ballistae, cheiroballistra) discovered in all of forts across Dacia Porolissensis, even in those that were extremely little researched (Tihău, Orheiul Bistriței), clearly show that the auxiliary

units also used these weapons, which were placed in the towers of the main gates, the curtain wall towers or the fort's corner towers.

- very important are the discoveries of such heads in or near various Dacian forts (Ciceu Corabia, Bistrita-Năsăud county) or Stârciu (Sălaj county), which clearly show that during the siege of these fortresses by the armies of the Roman Empire, probably immediately after the end of the Dacian wars between 105-106 BC, these weapons: scorio, ballistae, cheiroballistra were used. We could say that the weapons belonged to legions' detachments attested in northern Dacia as early as 106, but we note that in forts these weapons were discovered in all the layers of habitation, from the deepest, which in Porolissum reaches more than 4 m in depth, to those from the surface under the grass, so these weapons remained in use and were also used by the auxiliary units throughout the period under Roman rule;

- the lightest iron or bone arrowheads weigh 4-5 grams, the replicas I made confirm the weight of the original pieces;

- the weight limit of arrowheads used for bows can be set at 20-25 grams and with some exceptions, it can reach up to 30 grams. These arrowheads were discovered especially in forts such as Bologa, Buciumi, Romita, Cășeiu, where infantry units from the west of the Roman Empire were also stationed and they probably used larger bows, the so-called longbows, which are flatbows or easy recurve bow, mono- or bi-composite.