Abhandlung

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A stonemason's toolkit from the pre-Roman limestone quarry at Măgura Călanului (Romania)

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Zusammenfassung: Im vorliegenden Artikel wird ein zufällig in Măgura Călanului, Rumänien, entdeckter Werkzeugsatz eines Steinmetzes beschrieben. Der Fund trägt dazu bei, eine seit langem bestehende Lücke in unserem Verständnis der im Steinbruch und in der Monumentalarchitektur des dakischen Königreichs verwendeten Werkzeuge zu schließen. Der Werkzeugsatz besteht aus 15 eisernen Werkzeugen, darunter doppelköpfige Spitzhacken, eine Wetzgarnitur, Spaltkeile und seltene gezahnte Werkzeuge. Das Gesamtgewicht des Werkzeugsatzes beträgt 10,93 kg. Die Analyse der Werkzeuge ermöglicht eine detaillierte Untersuchung der technischen Fertigkeiten der dakischen Handwerker. Einerseits weisen einige der Werkzeuge Analogien zu denjenigen aus dem griechischen und römischen Raum auf, andererseits zeigen andere lokale Innovationen den technologischen Austausch mit der mediterranen Welt sowie den hohen Einfallsreichtum und die hohe Anpassungsfähigkeit der dakischen Handwerker. Die offensichtliche Verbergung des Werkzeugkastens könnte auf eine Krisenzeit hindeuten, die möglicherweise mit der römischen Eroberung im Jahr 102 n. Chr. zusammenhängt. Der Fund ist von außerordentlicher Bedeutung, da es sich um eine der vielfältigsten und vollständigsten Steinmetzausrüstungen handelt, die in der europäischen Antike entdeckt wurden. Es ist davon auszugehen, dass sich der Fund auf die Erforschung des antiken Handwerks und der architektonischen Techniken auswirken wird.

Schlüsselworte: antike Steinbrüche, vorrömisches Dakien, Eisenwerkzeuge, Steinmetzarbeiten, Quaderarchitektur, Kalkstein

Abstract: This article discusses a stonemason's toolkit that was discovered by chance at Măgura Călanului, Romania. This finding helps to address a longstanding gap in our understanding of the tools used in quarrying and monumental architecture during the Dacian Kingdom. The toolkit includes fifteen iron implements, such as double-headed picks, a whetting set, splitting wedges, and rare toothed tools, weighing a total of 10.93 kg. These tools provide valuable insight into the technical skills of Dacian craftsmen. While some of them have analogues from Greek and Roman areas, others exhibit local innovations, highlighting both technological exchanges with the Mediterranean world and the ingenuity and adaptability of the Dacian craftsmen. The apparent concealment of the toolkit may suggest a crisis period, possibly related to the Roman conquest in 102 AD. As one of the most varied and complete stonemason kits discovered in European antiquity, this finding is exceptionally significant and is expected to impact the study of ancient craftsmanship and architectural techniques.

Keywords: ancient quarries, pre-Roman Dacia, iron tools, stonemasonry, ashlar architecture, limestone

Rezumat: Acest articol prezintă o trusă de unelte de pietrar care a fost descoperită întâmplător la Măgura Călanului, România. Această descoperire contribuie la completarea unui gol important în cunoașterea uneltelor folosite în exploatarea pietrei și în arhitectura monumentală din perioada Regatului Dac. Trusa include cincisprezece unelte din fier, între care se numără târnăcoape cu două capete, un set de ascuțit la rece, pene de despicare și unelte rare cu dinți, cu o greutate totală de 10,93 kg. Aceste unelte oferă o perspectivă valoroasă asupra abilităților tehnice ale meșterilor daci. Unele dintre aceste unelte au analogii în lumea greco-romană, dar altele reflectă inovații locale, fapt care evidențiază atât schimburile tehnologice cu lumea mediteraneană, cât și ingeniozitatea și adaptabilitatea meșterilor daci. Aparenta ascundere a trusei de unelte ar putea sugera o perioadă de criză, posibil legată de cucerirea romană din 102 d.Hr. Această descoperire va avea un impact semnificativ asupra studiilor privind meșteșugurile antice și tehnicile arhitecturale, dat fiind că trusa în discuție este una dintre cele mai variate și complete descoperite până acum în Europa antică.

Cuvinte-cheie: cariere antice, Dacia preromană, unelte de fier, pietrari, arhitectură monumentală, calcar

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Introduction

The Dacian power centre in south-western Transylvania, in the Șureanu Mountains (Fig. 1), functioned from the first half of the 1st century B.C. until the early 2nd century A.D., when it was conquered and destroyed by the Romans. One key expression of this power was the monumental ashlar architecture – defensive and retaining walls, towers, temples, and other structures – resulting from a blend of local traditions and Greek and Roman influences. The fortresses were built in a mountainous area at altitudes of up to 1100 meters, serving as residences for the king and noblemen who controlled the surrounding settlements. The capital of the kingdom was at Sarmizegetusa Regia (Grădiștea de Munte), known as *Sarmizegetusa to basileion* in Ptolemy's *Geography* (III, 8, 4). The imposing stone walls in these fortresses led ancient authors to remark that the Dacians had "walled up their mountains" (ὄρη ἐντετειχισμένα, Cassius Dio 68, 9, 3). The complex organisation of the entire area, including elite hubs on hilltops and extensive settlements spread across thousands of terraces cut into the slopes, has only recently begun to be uncovered through the use of LiDAR technology[1].

The limestone monumental architecture of the Dacian fortresses in the Șureanu Mountains left a lasting impression, both in Antiquity, when their walls and towers stood as a striking visual presence, and today: six of these fortresses (Grădiștea de Munte-Sarmizegetusa Regia, Costești-Cetățuie, Costești-Blidaru, Piatra Roșie, Bănița, and Căpâlna) were inscribed on the UNESCO World Heritage List in 1999[2] (Fig. 2).

The limestone quarry at Măgura Călanului

To construct these monumental buildings, a specific type of limestone that could be shaped into rectangular blocks was needed. Because the local stone did not have the required properties[3], a quarry complex was established at a considerable distance (25–40 km) from the fortresses, located on Măgura Călanului hill (560 m asl). High-quality oolitic limestone was extracted and processed at this site before being transported along challenging ridge roads which often reached elevations of over 1,000 meters and featured steep slopes[4]. Most of the fortresses used this stone[5] (Fig. 3).

The limestone extracted from Măgura Călanului hill dates to the Sarmatian stage of the Upper Middle Miocene. This oolitic limestone is relatively soft and homogeneous, making it particularly suitable for ashlar masonry. Its physical properties likely influenced the quarrying methods employed, allowing for the use of smaller and lighter tools for splitting and shaping the blocks. The stone's medium hardness would have facilitated controlled fractures and precise finishes, reducing the need for heavier equipment typically required for harder rocks. This suggests that quarrying at the site focused on precision and efficiency, optimizing the process for the material's characteristics.

Quarrying likely began in the 1st century B.C. and continued throughout the Dacian Kingdom. After the Roman conquest of Dacia, the Romans also extracted limestone from the area, though not necessarily from the same quarries[6]. The hill is now covered by forest (Fig. 4a), and the ancient quarries have been remarkably well preserved, as stone extraction ceased in antiquity. The site is not easily accessible, so during the Middle Ages and in more recent times, locals quarried stone from more accessible but lower-quality areas. As a result, the ancient quarries have remained untouched to this day.

The site covers more than 30 hectares, with dozens of quarry faces up to 8 meters high, numerous semi-finished blocks, and large quantities of waste scattered throughout the forest (Fig. 4c–d). Tool marks and traces of detaching and processing are visible everywhere, along with sockets, holes, and other marks (Fig. 4e–f). Recent LiDAR scanning of the area has revealed the quarry's complexity[7] (Fig. 4b).

Dacian stonemasons likely existed before the opening of the major quarries, even if they may not have been familiar with the Greek techniques for producing prismatic blocks. Instead, they were skilled in levelling artificial terraces and building retaining and defensive walls using raw or semi-finished stone. They also quarried stone for mills and other household objects and possessed advanced tools for such tasks[8]. One crucial factor for the operation of such a quarry was the existence of advanced iron metallurgy to produce the necessary tools, and the Dacian Kingdom marked the peak of ironworking in antiquity in these territories. The technique of detaching blocks from the parent rock was simple and widespread throughout millennia in all areas where stone was used for construction[9]. From ancient Egypt to just a century ago, quarrying techniques and tools

1 Peţan/Hegyi 2023; Peţan 2023.
2 World Heritage List, https://whc.unesco.org/en/list/906.
3 Cetean/Peţan/Stancu 2022.
4 Peţan 2022a, 141; 179.
5 Mârza 1995; Cetean/Peţan 2017.
6 Peţan 2022b.
7 Peţan 2022a; 2025.
8 Iaroslavschi 1997, 26–42.
9 Ward-Perkins 1971.

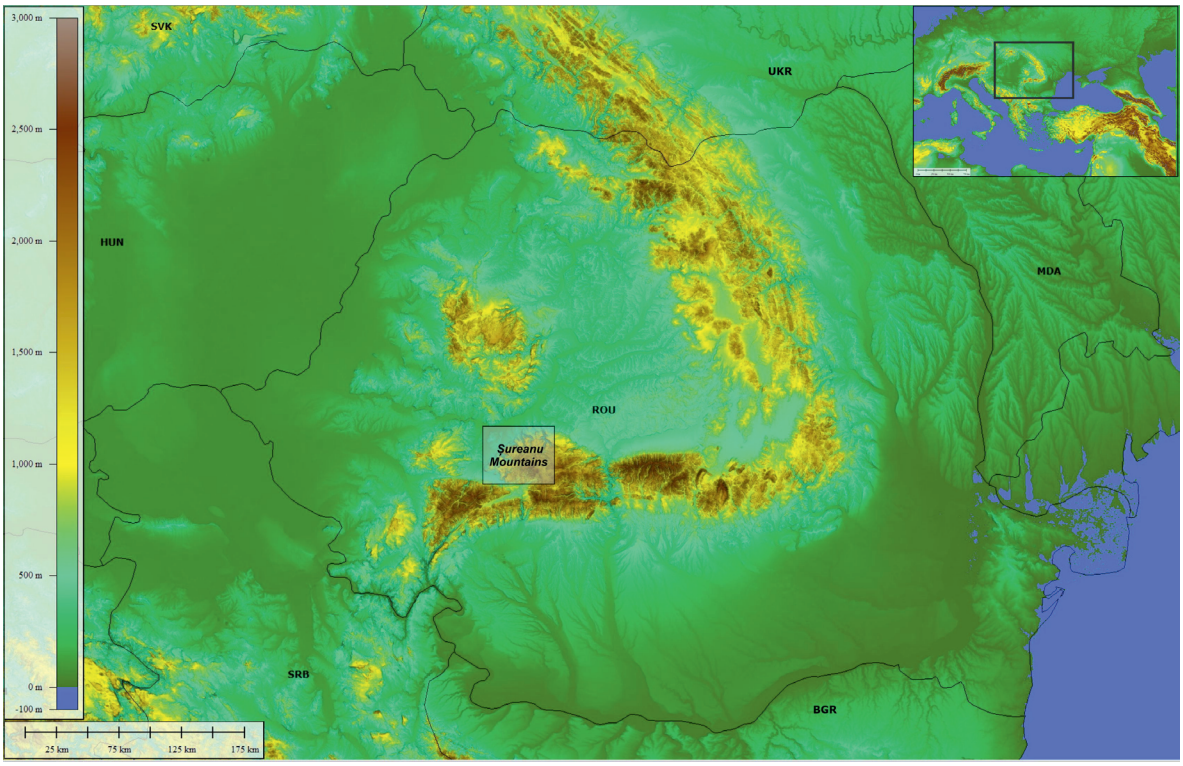

Fig. 1: The area of the Șureanu Mountains.

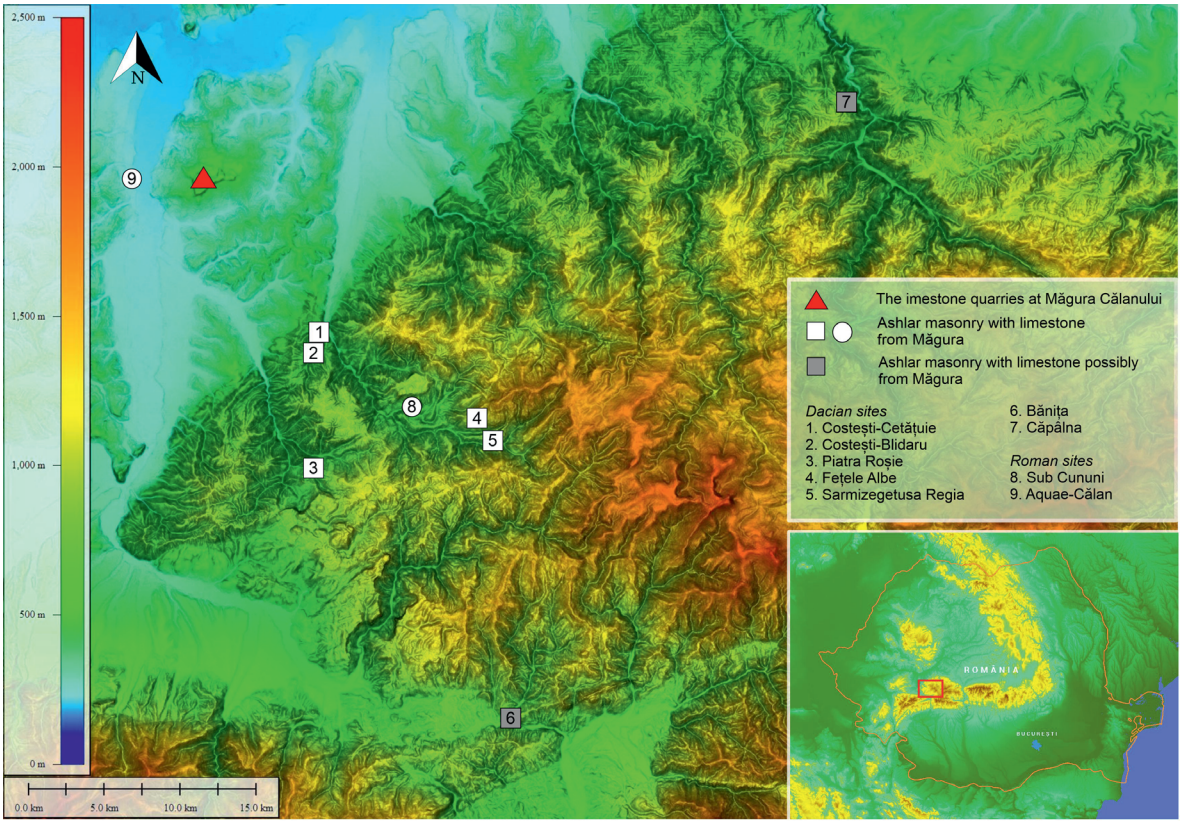

Fig. 2: Location of the limestone quarry and the most important Dacian and Roman sites in the Șureanu Mountains.

Fig. 3: Ashlar masonry at the Dacian fortresses in the Șureanu Mountains: (a) The entrance to the Dacian fortress at Costești-Blidaru; (b) Retaining wall at Sarmizegetusa Regia; (c) Retaining wall at Fețele Albe; (d) Residential tower at Costești-Cetățuie.

remained remarkably consistent, used both in highly organised quarries and by small-scale rural stonemasons.

The Măgura Călanului quarry supplied stone for the sites in the Șureanu Mountains, though there were other, less complex Dacian limestone quarries, as well as andesite quarries. However, the number of Dacian quarry tools discovered to date is quite small, and no tools have been found within the quarries. Quarry picks, hammers and flat chisels have been found in various contexts, often alongside other types of iron objects, in deposits or caches, but never as part of a set. Therfore, the toolkit presented below is the first of its kind discovered in pre-Roman Dacia and likely one of the most complex and valuable of its type in ancient Europe.

The stonemason's toolkit

In the summer of 2022, a local villager near the quarry accidentally discovered a cache of iron tools in the forest on the hill's western side, near the main quarry face. These tools had likely been abandoned at the foot of a tree, possibly by treasure hunters who had unearthed them. The items were donated to the Corvin Castle Museum in Hunedoara and are now part of the museum's collection. Although the exact location of the cache is unknown, it is likely that the tools were left near the discovery site due to their weight. The collection appears to be a toolkit used by a stonemason.

The toolkit consists of 15 iron artefacts, weighing a total of 10.93 kg (Fig. 5). The items are well-preserved. Each description below provides the museum inventory number, dimensions (Wt – weight, L – length, W – width, T – thickness, D – diameter), characteristics, functionality, and analogies for each item.

Fig. 4: The pre-Roman limestone quarry at Măgura Călanului (Romania): (a) Aerial view of the hill; (b) LiDAR-derived digital terrain model of the quarry; (c) The western area of the quarry; (d) waste heaps and scattered blocks in the forest; (e) tool marks on a quarry face; (f) Sockets for splitting wedges.

Fig. 5: The stonemason's toolkit from the pre-Roman limestone quarry at Măgura Călanului (Romania).

Pick No. 1

Inv. 9003295 (Fig. 6). Double-headed tool with a pyramidal head and straight pein. Wt: 2420 g, L: 255 mm, W max: 50 mm, T max: 50 mm, Blade width: 45 mm, Shaft hole D: 25 mm. Both point and blade are well-sharpened. Fractured (ancient damage); broken part: W = 50 mm, depth = 20 mm.

This type of tool was found only in the region of the Dacian capital and is referred to as the "stonemason hammer of type III" in the literature. A very similar example was found at Grădiștea de Munte – Sarmizegetusa Regia (L = 215 mm, W = 50 mm) and dated to the 1st century AD[10]. A smaller example comes from the same site (L = 140 mm, W = 45–50 mm), and another from Costești-Cetățuie (dimensions unknown)[11]. The largest example measures 320 mm and was also found at Grădiștea de Munte[12]. Roman analogies are numerous[13].

Pick No. 2

Inv. 9003296 (Fig. 7). Double-headed pick. Wt: 1640 g, L: 260 mm, W max: 50 mm, T max: 33 mm, Rectangular hole: 28 × 13 mm.

This bipyramidal tool with four edges is slender, with worn points. The double pick has been one of the most commonly used tools by stonemasons throughout history, alongside the point. It was employed to level uneven surfaces on stone blocks through repeated strikes. This appears to be the only example of its kind from pre-Roman Dacia. Another potential example was recently discovered at Sarmizegetusa Regia, featuring a round hole. However, it has not been described in detail, and the only published photograph shows only one side, making it unclear if it belongs to the same category[14]. There are no exact Greek or Roman analogies for this bipyramidal type. Although the double-headed pick is a widespread tool, most examples have bevelled edges or biconvex, stockier forms[15].

10 SCandb Project, model 431 (185 – Hammer). https://dacit.utcluj.ro/scandb/#/model/431/en.

11 Glodariu/Iaroslavschi 1979, fig. 52,8; 10.

12 Ibid. fig. 52,15; Borangic/Bădescu 2017, 93 no. 84.

13 Champion 1916, 225–226; pl. VI,14586; Bessac 1986, 44; 49; 36 fig. 8.

14 Florea *et al.* 2015, 18; 44; fig. 15,18.

15 Champion 1916, 225–226; pl. VI,28994; Röder 1957, 232 pl. 5 no. 1; Bessac 1986, outil no. 1, 15–24; fig. 2,1; Wollmann 1996, pl. CXI no. 1; Karl 2021, 104–105.

Fig. 6: Pick No. 1.

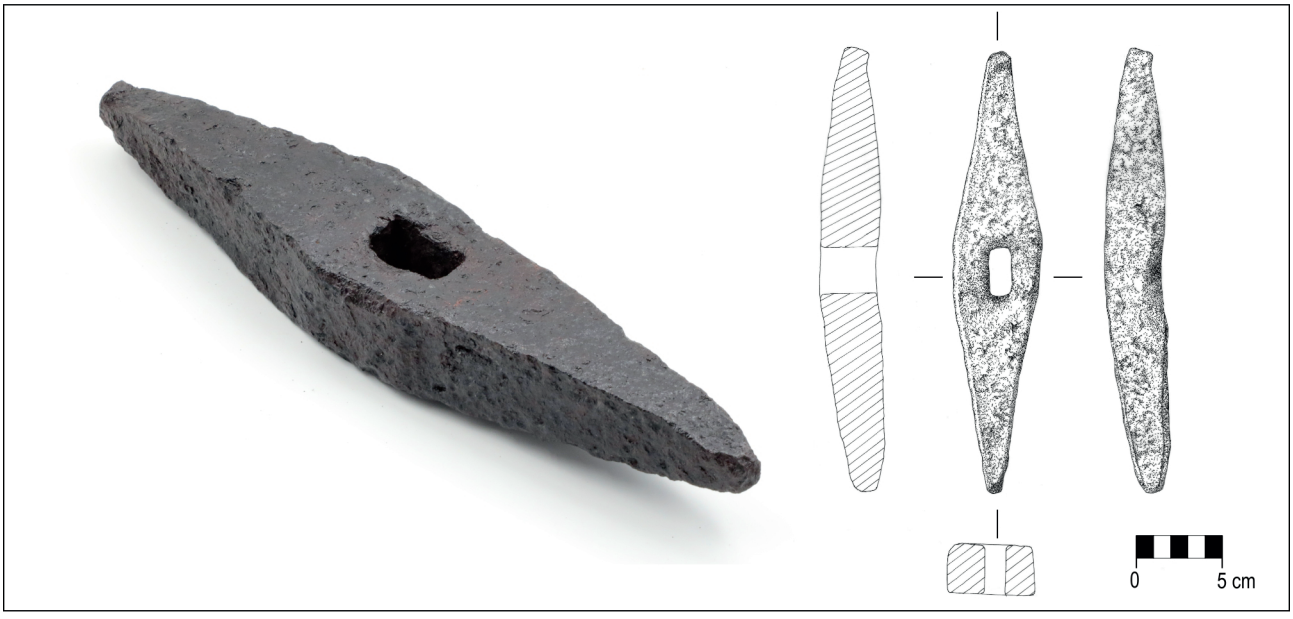

Fig. 7: Pick No. 2.

Fig. 8: Pick No. 3.

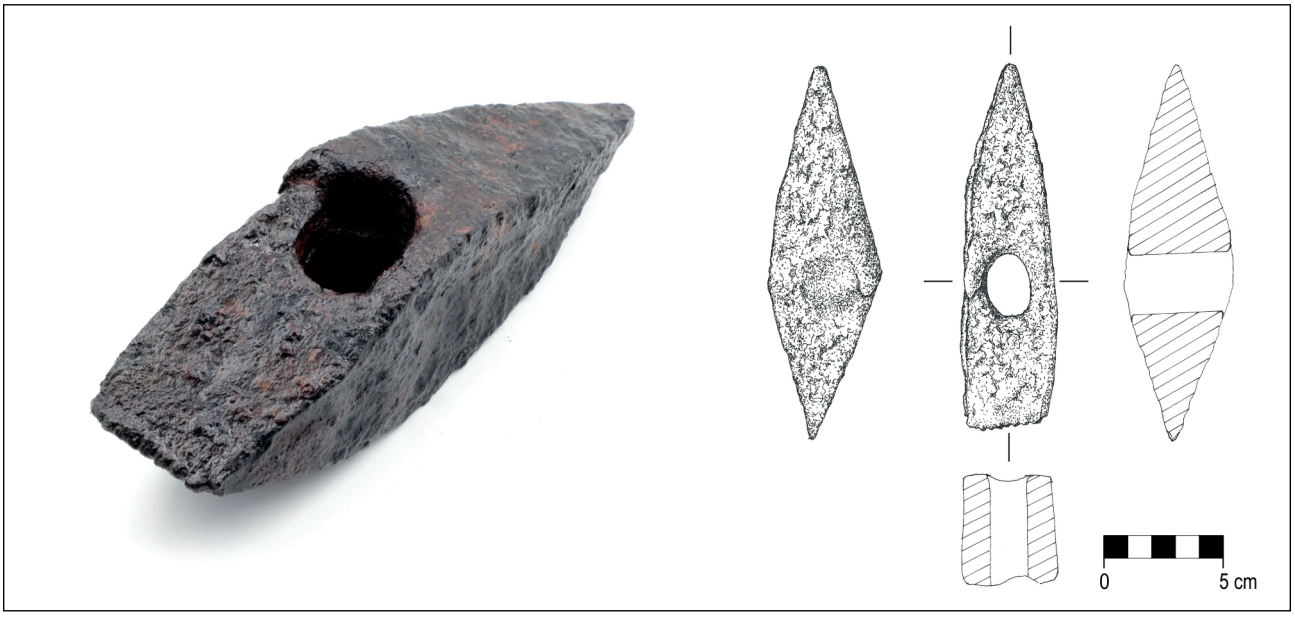

Fig. 9: Pick No. 4.

Pick No. 3

Inv. 9003297 (Fig. 8). Double-headed tool with a pyramidal head and a toothed cross-pein. Wt: 1060 g, L: 230 mm, W max: 43 mm, T max: 30 mm, Toothed edge width: 37 mm, Shaft hole D: 25 mm, Number of teeth: 9 (8 preserved).

This tool features a pyramidal head that served as a pick and a toothed horizontal blade for finishing stone surfaces, similar to a toothed chisel. This combination is unusual, with no parallels in either the Dacian or Graeco-Roman contexts. While the combination of a pick and a toothed straight pein is documented[16], there is no existing evidence for a version with a toothed cross pein. However, a somewhat similar tool does exist among Dacian implements, known as the pick-cross pein, namely a flat variation commonly referred to as the "stonemason hammer of Type II." It is possible that some of these tools had teeth, though they have not survived to present day. This flat variant is notably well-represented around the Dacian capital[17] and can also be found at Roman sites[18].

Pick No. 4

Inv. 9003298 (Fig. 9). Double-headed pick with a pyramidal head and a toothed cross pein. Wt: 810 g, L: 155 mm, W max: 38 mm, T max: 49 mm (deformed) and 44 mm; Toothed edge width: 28 mm (deformed); Oval shaft hole: 28 × 18 mm; Number of teeth: 7 (preserved, very blunt).

Similar to the previous type but smaller.

Pick No. 5

Inv. 9003299 (Fig. 10). Double-headed pick with a pyramidal head and a cross pein. Wt: 540 g, L: 135 mm, W max: 40 mm, T max: 35 and 33 mm; Blade: 30 mm; Oval shaft hole: 30 × 23 mm.

This pick resembles the previous type but lacks teeth. The blade is blunt and broken, suggesting that it may have originally featured teeth that were not preserved.

Pick no. 6

Inv. 9003302 (Fig. 11). Wt: 250 g, L: 85 mm, W max: 37 mm, T max: 20 mm (broken end: 10 mm); Active head dimensions: 16 × 30 mm; Elliptic shaft hole: 25 × 22 mm.

Small pick with a single surviving active end, likely used for precision stone working tasks such as shaping or finishing stone blocks. The opposite end is broken, suggesting it originally featured a pointed or pein-like tip. The large shaft hole indicates the use of a robust handle, allowing controlled yet forceful strikes. Analogies exist in the Dacian context[19], and in the Roman world[20].

The flat chisel

Inv. 9003300 (Fig. 12). Wt: 360 g, L: 236 mm, W max: 30 mm (cutting edge), min 18 mm, T: 11 mm (inactive head).

This flat chisel has a rectangular section, a square head, and a sharply tapered blade. It was used to finish stone or cut holes for splitting wedges. Similar chisels have been found in Dacian sites, though most are identified as blacksmith's chisels and typically have a round section[21]. This tool type is widely distributed, with many analogies in Greek and Roman contexts[22].

The point

Inv. 9003301 (Fig. 13). Wt: 250 g, L: 230 mm, W: 14 mm, T: 12 mm; Head dimensions: 21 × 19 mm; Oblique edge length of tip: 30 mm. Tapered shape.

Similar to the flat chisel, this tool was used for finishing stone or creating sockets for splitting wedges. It has been widely used from ancient times to the present, although it is rarely found at archaeological sites. Points were often reforged or discarded once broken, which makes identification challenging. Due to their common shape, stonemason points might not always have been catalogued as such[23]. This is the only known tool of this kind identified in Dacian sites.

16 Bessac 1986, fig. 8 nos. 2–4.

17 Glodariu/Iaroslavschi 1979, 106–107; fig. 52,6–7.

18 Manning 1985, 31 (C1, Type C); Duvauchelle 2005, nos. 146–149; Gaitzsch 2005, pl. 16, H5.

19 Glodariu/Iaroslavschi 1979, fig. 52,12–13.

20 Champion 1916, pl. VI, 15863.

21 Glodariu/Iaroslavschi 1979, 89–91; 107–108; pl. 18,6,16–19,24.

22 Blagg 1976, 158 fig. 1,J; Bessac 1986, 133–134; Duvauchelle 2005, 63–65; 178–179 pl. 30–31; Humphreys 2021, 147 figs. 8a2–8,3.

23 Bessac 1986, 115; Rockwell 1994, 57.

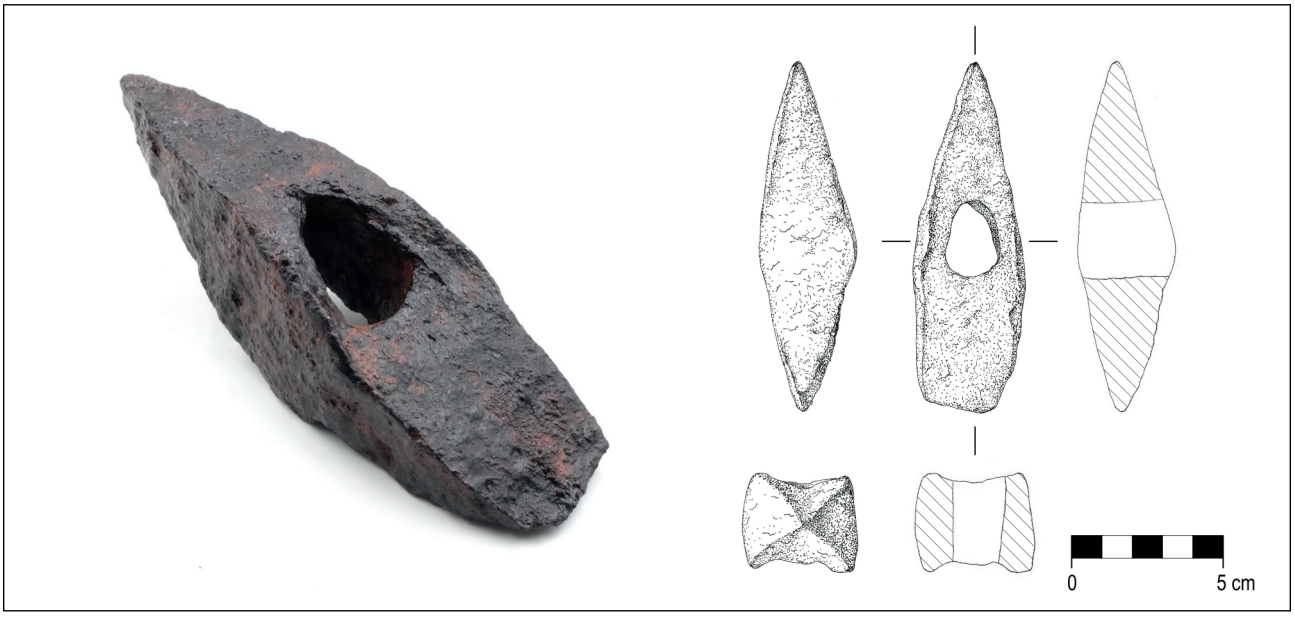

Fig. 10: Pick No. 5.

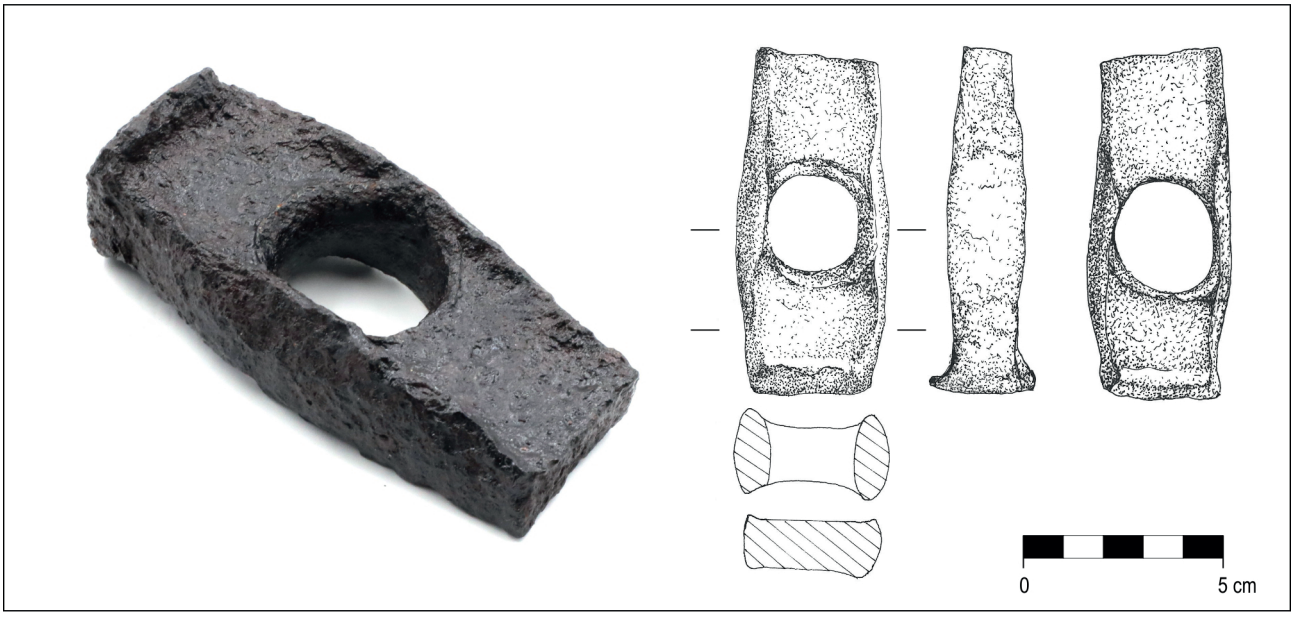

Fig. 11: Pick No. 6.

Fig. 12: The flat chisel.

Fig. 13: The point.

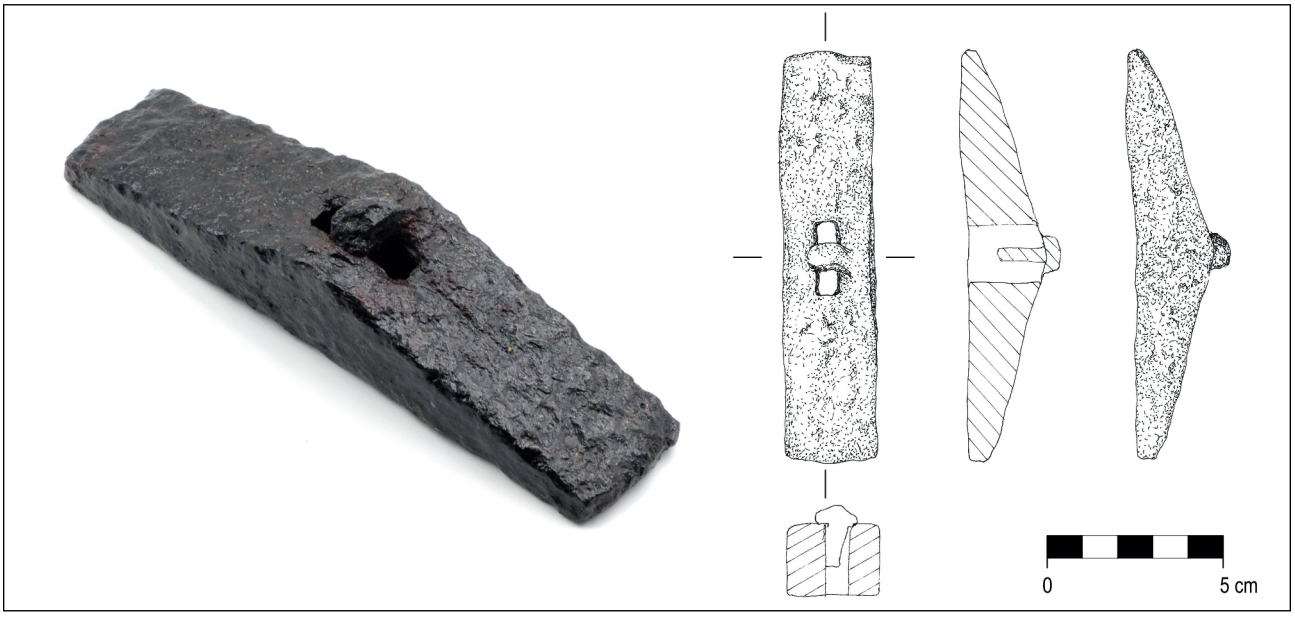

Fig. 14: The wetting hammer.

Fig. 15: The field anvil.

The whetting hammer

Inv. 9003303 (Fig. 14). Wt: 350 g, L: 128 mm, W max: 29 mm, T max: 23 mm; Blade widths: 25 mm and 26 mm; Shaft-hole dimensions: 19 × 10 mm; Nail: L = 20 mm (5 mm outside, 15 mm inside the eye, head bent over the eye).

A tool commonly found in farming households, primarily utilized for sharpening scythes. This design has remained largely unchanged since antiquity and continues to be used in various European regions. In the context of the Dacian stonemason's kit, this hammer was likely used for sharpening chisels, in conjunction with a field anvil (see below). A small iron wedge is lodged in the shaft hole. Numerous Greek and Roman analogies, including with preserved wedges[24].

The field anvil

Inv. 9003304 (Fig. 15). Wt: 1820 g, L: 230 mm, W max: 48 mm (at the hole level; below: 40 mm), T: 36 mm; Head: 40 × 38 mm; Round hole diameter: 8 mm; Trapezoidal hole: 27 × 17 × 14 mm; Incised cross: 25 × 25 mm. Convex square head; very sharp point.

This anvil was part of a set with the whetting hammer, specifically used for chisel sharpening. The round hole was probably intended for hanging the anvil when not in use. Alternatively, the hole may have served to attach the anvil to the hammer with a cord, keeping both tools together. The rectangular hole held a stopper, preventing the anvil from sinking too deeply into the ground when struck but which is now lost. The stopper may have been made of metal and has since disappeared, or it could have been made of wood and has decayed over time. The incised cross likely served as an ownership mark, a common practice among ancient craftsmen to identify their tools. No Dacian analogies are recorded. Similar items were found in Roman Britain and in Roman Gaul, though these were all interpreted as anvils for scythe sharpening, equipped with iron brackets or a nail to prevent sinking[25].

Wedge No. 1

Inv. 9003305 (Fig. 16a). Wt: 320 g, L: 78 mm, W: 56 mm, T: 14 mm (below head); Head: 60 × 25 mm; Groove length: 30 mm; Triangular profile.

Metal wedges used for stone splitting were essential tools, placed into chiselled sockets. Once positioned, the wedges were struck to produce controlled fractures in the stone[26]. Although commonly found in Greek and Roman contexts[27], no such wedges have been found at Dacian sites to date. However, their use in Dacian stoneworking is evident from the presence of wedge holes in stones within quarries, left *in situ* when quarrying activities ceased (Fig. 4 f).

Wedge No. 2

Inv. 9003306 (Fig. 16b). Wt: 220 g, L: 82 mm, W max: 38 mm, T: 13 mm; Head: 38 × 18 mm.

Wedge No. 3

Inv. 9003307 (Fig. 16c). Wt: 330 g, L: 80 mm, W: 35 mm, T: 22 mm (below head); Head: 32 × 50 mm.

Wedge No. 4

Inv. 9003309 (Fig. 16e). Wt: 410 g, L: 115 mm, W: 45–50 mm, T max: 16 mm; Curved profile; Head: 45 × 25–30 mm.

Wedge No. 5

Inv. 9003308 (Fig. 16d). Wt: 150 g, L: 84 mm, W max: 25 mm, T: 18 mm (below head); Head: 30 × 22 mm.

24 Very similar items at Christensen 2005, 76 nos. 10828b; 10828; 13663; 85 fig. 36. The second one also has an iron wedge preserved in the shaft hole.

25 Evans 1894, 143–144; Champion 1916, 229 and pl. VIII/25803, 28995; Gaitzsch 1985, 192, pl. 3, type G; Manning 1985, 59, pl. 25, F62; Mallet 2007, 7–8; Higelin 2018, 4–11.

26 Rockwell 1994, 55.

27 Dworakowska 1983, 138–145.

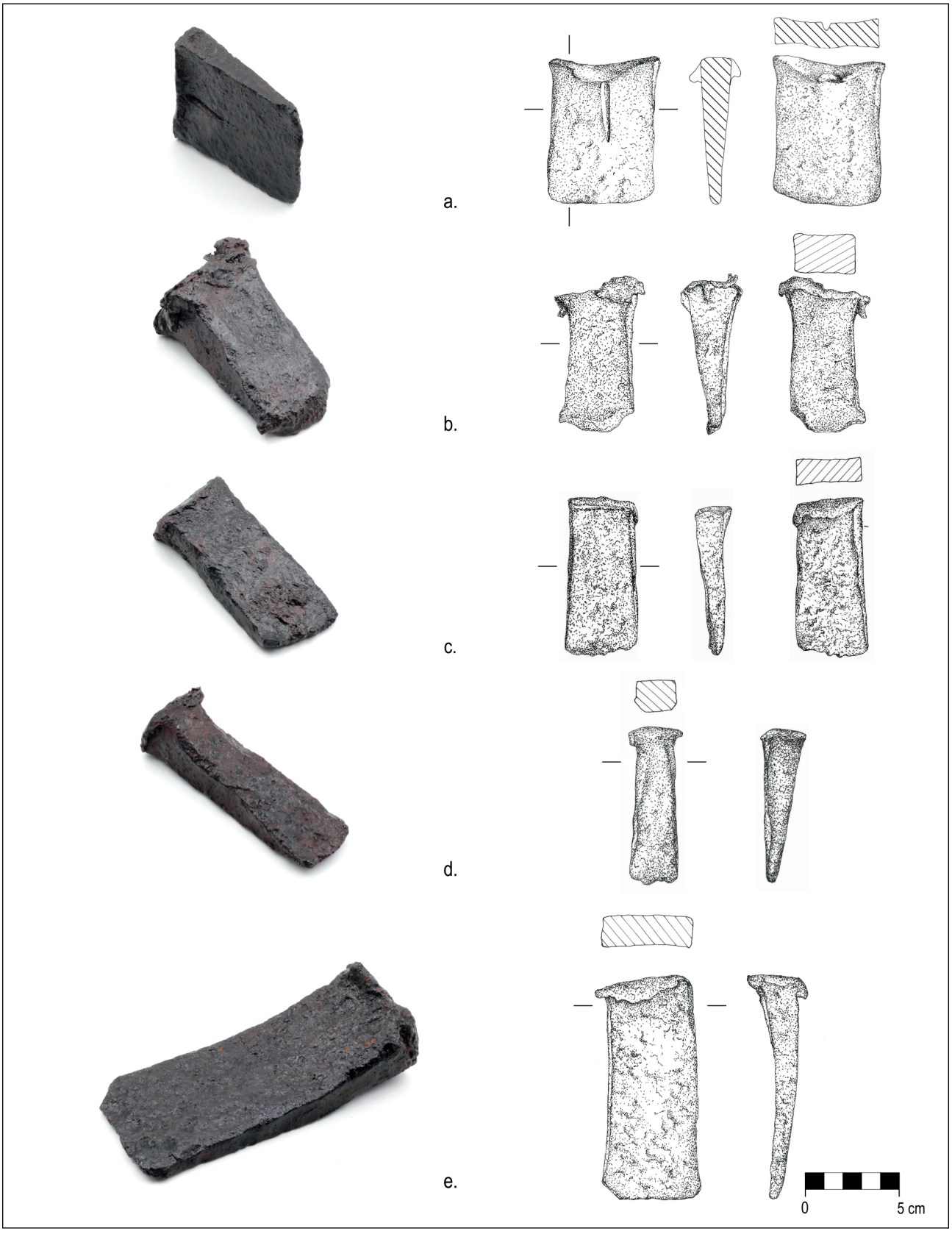

Fig. 16: Wedges No. 1–5.

Tab. 1: Synoptic table of dimensions and inventory numbers for tools in the Dacian stonemason's toolkit from Măgura Călanului.

No.	Inventory No.	Type	Wt (g)	L (mm)	W max (mm)	T max (mm)	Additional Characteristics
1	9003295	Double-headed pick	2420	255	50	50	Blade width: 45 mm; Shaft hole D: 25 mm; Broken part: W = 50 mm, depth = 20 mm.
2	9003296	Double-headed pick	1640	260	50	33	Rectangular hole: 28 × 13 mm;
3	9003297	Double-headed pick	1060	230	43	30	Toothed edge width: 37 mm; Shaft hole D: 25 mm; Number of teeth: 9 (8 preserved).
4	9003298	Double-headed pick	810	155	38	49	Toothed edge width: 28 mm (deformed); Oval shaft hole: 28 × 18 mm; Teeth: 7 (blunt).
5	9003299	Double-headed pick	540	135	40	35	Blade width: 30 mm; Oval shaft hole: 30 × 23 mm.
6	9003300	Flat chisel	360	236	30	11	Rectangular section; Square head; Cutting edge W max: 30 mm, W min: 18 mm.
7	9003301	Point	250	230	14	12	Head dimensions: 21 × 19 mm; Oblique edge length of tip: 30 mm.
8	9003302	Small pick (broken)	250	85	37	20	Active head dimensions: 16 × 30 mm; broken head: 10 mm; Elliptic shaft hole: 25 × 22 mm.
9	9003303	Whetting hammer	350	128	29	23	Blade widths: 25 mm and 26 mm; Shaft hole dimensions: 19 × 10 mm; Nail: L = 20 mm (bent over the eye).
10	9003304	Field anvil	1820	230	48	36	Round hole D: 8 mm; Trapezoidal hole: 27 × 17 × 14 mm; Incised cross: 25 × 25 mm.
11	9003305	Wedge	320	78	56	14	Head: 60 × 25 mm; Groove length: 30 mm.
12	9003306	Wedge	220	82	38	13	Head: 38 × 18 mm.
13	9003307	Wedge	330	80	35	22	Head: 32 × 50 mm.
14	9003308	Wedge	150	84	25	18	Head: 30 × 22 mm.
15	9003309	Wedge	410	115	50	16	Head: 45 × 25–30 mm; Curved profile.

Discussion

The kit includes several categories of tools. The first category consists of direct percussion tools, commonly referred to as picks. The stonemason's double pickaxe was a common tool in the Greco-Roman world, but the Dacian version differs from its Mediterranean counterparts by featuring a bipyramidal shape, rather than the typical biconvex form[28]. Other tools in this category are composite, with both ends designed for different functions. Among them, the picks combined with a toothed[29] cross-pein are particularly innovative, with no known Greek or Roman parallels so far. This combination may represent a local adaptation, similar to the pick-flat cross-pein type known in Dacia but featuring unique characteristics.

The second category consists of tools for indirect percussion. The flat chisel and the point are commonly found throughout Greco-Roman antiquity and remained essential tools in traditional stonemasonry until modern times. These tools have a long history of use across various periods and cultures.

An interesting category is the cold set consisting of a field anvil and a whetting hammer. It is well known that in quarries, many blacksmiths would have been engaged daily in sharpening and repairing the metal tools used by stonemasons[30]. However, no evidence has been found to suggest that stonemasons themselves performed cold sharpening of their tools on-site. The whetting hammer in this set is a common tool still used today (albeit with a slightly different form) in many areas, including Romania[31], but typically for scythe sharpening. The piece from Măgura Călanului is the first of its kind found in a quarry context, among stonemason tools, which strongly suggests that it was used for stoneworking, excluding its use in agricultural operations.

28 Typical Dacian iron ingots are bipyramidal in shape, suggesting only minimal processing to obtain this type of pick. See Iaroslavschi 1997, 182, pl. XXX, fig. 6–7, 9.

29 Romanian researchers have noted that, although traces of toothed tools are visible in many areas – both in the fortresses and quarries – such tools have not been recovered until now (see Iaroslavschi 1997, 41).

30 Dolci 1988, 81; Russel 2018, 734.

31 Biblioteca Digitală a României, https://culturalia.ro/entities/5117745d-74ba-4159-8363-d3f247c5d389/view.

The field anvil is a very rare type in antiquity, with similar examples documented only in Britannia and Gallia during Roman times, where they were used for scythe sharpening. Comparable types continued to be used until recently for similar purposes in France, Spain and even in Romania[32]. Its placement in a stonemason's toolkit suggests that it was adapted specifically for stoneworking use, where maintaining sharp chisels or points was crucial for efficient stonecutting. The flat chisel (and possibly other tools) often used in quarry operations would dull quickly with repeated use but could be easily sharpened on-site using this set without needing a blacksmith.

This cold set sheds new light on quarry and stoneworking operations and the variety of tools that could benefit from cold sharpening techniques. The presence of this unique anvil in the toolkit highlights the adaptability and innovation of Dacian craftsmen, who repurposed existing tools and technologies to meet the specific needs of their work. The possibility that hammers and anvils of this type were used for more than just scythe sharpening opens new avenues for future research in broader geographic areas. The longevity of this type of whetting hammer is remarkable, as slightly modified versions are still in use today in Romanian rural areas for sharpening scythes with field or stump anvils.

The final category includes stone-splitting wedges, consisting of five pieces of varying sizes. The differences between them are significant enough to suggest that they were not used simultaneously in the same task. The wedge sockets preserved in the quarry have uniform sizes on the same stone block but differ from block to block. This indicates that the wedges were chosen based on the characteristics of the stone and the size of the block to be detached. In the quarry, deeper or shallower, wider or narrower holes can be found, corresponding to the use of wedges of different sizes. Typically, several wedges of the same size were employed during a single operation. It is possible that the stonemason hid only one wedge from each potential set.

The five splitting wedges weighing between 150 and 400 grams were designed for soft limestone or small blocks, requiring less force to create precise fractures. In contrast, heavier wedges found in other ancient contexts illustrate a different approach to stoneworking. At Pergamon, for example, wedges weighing up to 2 kilograms each were employed in marble quarries, where the hardness and density of the stone necessitated heavier tools[33]. Similarly, at Jerusalem, wedges ranging from 2.4 to 3.8 kilograms were used for splitting dense, high-quality limestone intended for monumental constructions, likely during the late Second Temple period, around the 1st century AD[34]. Fifteen splitting wedges, weighing a total of 15.8 kg, were found within the Roman marble quarry at Spitzelofen[35]. These examples demonstrate how ancient stonemasons tailored their tools to accommodate the unique properties of different materials and meet the specific demands of architectural projects.

It is worth questioning whether all 15 pieces belonged to a single craftsman. We know very little about the organisation and operation of the quarries at Măgura Călanului. However, the presence of multiple quarry faces in close proximity suggests that several teams may have worked in parallel. This toolkit could have belonged to a master mason who led a work unit, overseeing a team of workers and assistants responsible for many tasks, which would require a diverse array of tools.

Moreover, the fact that no two pieces in this collection are identical indicates that it was a personal kit owned by one individual. It is also possible that the set is incomplete, either due to the conditions of its discovery or because the owner intentionally chose to hide only a portion of the tools.

Most tools in this toolkit are small to medium-sized and primarily designed to finish work. This suggests that the toolkit likely did not belong to a quarryman, whose main role was to extract stone from the bedrock. Instead, it may have been owned by a stonemason who focuses on splitting smaller blocks and refining their surfaces. This distinction is consistent with the toolkit's contents, which lack the heavier tools typically associated with quarrying, such as large wedges and heavy picks. The emphasis on precision tools indicates that the craftsman was skilled in shaping and preparing stone blocks for construction or decorative purposes, effectively bridging the gap between extraction and final installation. These finishing operations took place inside the quarry to minimise the volume of stone transported.

Given the accidental nature of the discovery, there may be some doubts about the tools being truly from antiquity. However, there are strong arguments supporting their origins in the ancient period. The tools in this kit were likely used to extract and shape dimensioned blocks for ashlar architecture, with toothed implements specifically employed for the precise finishing of prismatic blocks. Ashlar architecture, a luxurious building fashion, was practised in this region only during the Dacian kingdom and the Roman

32 Mallet 2007; Higelin 2018; Biblioteca Digitală a României, https://culturalia.ro/search/a25ca107-af5d-49bc-baec-706fcc403843/view.

33 Gaitzsch 2005, 85–86 pl. 69,4.

34 Weksler-Bdolah 2017.

35 Karl 2021, 105–107.

provincial period. After the abandonment of the province by the Romans in the mid-3rd century AD, there were no longer political structures, power centres, or elites to initiate large-scale construction projects involving this type of stonework. The practice of building with *opus quadratum* was not revived. From the Early Middle Ages onward, stone blocks from ancient buildings were often reused, but no new blocks were quarried due to the high production and transportation costs. Medieval architecture in Transylvania is characterised by *opus incertum* masonry with mortar, and *opus quadratum* is exceedingly rare. No evidence suggests that these quarries were reopened during the Middle Ages. Furthermore, some of the tools in the kit have exclusively Roman analogues, strongly indicating that they date back to antiquity.

Whether the kit belonged to a stonemason from the Dacian kingdom or the Roman provincial period remains to be clarified. Dio Cassius (LXVII, 7, 4) mentions that Emperor Domitian provided King Decebalus with significant sums of money and skilled craftsmen. Among these craftsmen, it is possible that there were stonemasons. It is, however, unlikely that the Romans used the quarries at Măgura Călanului after the conquest of Dacia, as there is no evidence to support this. Roman settlements at the foot of the hill indicate that quarrying operations were inactive at least on the hill crest during Roman times[36]. Secondly, some of the tools in the kit have no (close) Roman analogues. Lastly, the fact that the kit was hidden in the quarry suggests a moment of danger or crisis. The entire quarry appears to have been abandoned suddenly – numerous stones remained ready for splitting, with holes drilled for wedges, yet the work was never completed. Such a moment could have occurred in AD 102, when the Roman army led by Trajan conquered parts of the Dacian Kingdom. Quarry activity likely ceased at that point, and although the stonemasons may have hoped to return, this never happened. Alternatively, the tools might have been left in the quarry by the craftsmen to avoid the burden of transporting them daily, given their weight. Similar patterns have been observed in Roman quarries where numerous tools – though not complete sets – have been discovered and could potentially have been left behind for practical reasons. However, this hypothesis requires further evidence[37].

Conclusions and research perspectives

The stonemason's toolkit from Măgura Călanului is a remarkable find, both as a set and in terms of each individual tool. Stonemason tools are rare in archaeological contexts, typically found only when damaged, abandoned, or deliberately hidden alongside other tools, often in quarries or construction sites where they were used. Tool kits are even rarer, and the one from Măgura Călanului has the potential to be the most varied and complete stonemason kit discovered to date, containing 15 distinct pieces, each one unique. It provides invaluable insight into the techniques and tools used for monumental stonework in Dacia, which, until now, were largely speculative. Furthermore, it offers a broader perspective on the cultural and technological exchanges between Dacia and the Greco-Roman world.

In pre-Roman Dacia, the most extensive construction projects and the largest-scale stone extraction occurred around the kingdom's capital, where walls and towers were built using ashlar masonry inspired by Hellenistic and Roman techniques. Despite the clear evidence of stoneworking activity, only a few stonemason tools, such as picks and chisels, have been found in this region. These were usually found in caches alongside other tool types, particularly in the capital area. This recent discovery fills that gap, shedding light on the tools used by Dacian stonemasons.

The toolkit contains several notable surprises regarding the types of tools used. Some pieces are unique and likely represent local innovations, while others have Greek or Roman analogues yet are previously undocumented in Dacia. Some tools share widespread forms but differ functionally, while others are very rare in antiquity. This diversity reflects both external influences and local adaptations, highlighting the ingenuity of Dacian stonemasons.

The discovery at Măgura Călanului deepens our understanding of stonemasonry in Dacia, challenging previous assumptions about construction and quarrying in this region. It also prompts questions regarding the origins of these tools and the circumstances leading to their preservation in such a complete state. Future research may reveal a connection between these tools and the tool marks on quarry faces and stones, potentially confirming their use at the site and providing insights into the specific techniques employed in Dacian stoneworking. Metallographic, microstructural analyses, and studies of use-wear (such as scanning electron microscopy, mass spectrometry, or wear trace analysis) could provide valuable information regarding the manufacturing techniques and usage of these iron tools, offering a

36 Pețan 2022b, 24–27.

37 For instance, at Spitzelofen, over 30 tools were recovered from various parts of the quarry, but they were not found in working areas or along access routes, which challenges the idea that they were stored there for convenience. See Karl 2021, 102–103.

more detailed understanding of how they were crafted and employed by Dacian craftsmen.

Initiating systematic archaeological research in this exceptionally well-preserved pre-Roman quarry – where no prior investigations have been conducted – is essential. As one of Europe's best-preserved pre-Roman quarries, it presents a rare opportunity to explore a unique combination of Greco-Roman stoneworking techniques and local Dacian innovations. An interdisciplinary project here could transform our understanding of ancient tool use, resource management, and cross-cultural technological exchanges that shaped practices in antiquity. Moreover, the quarry's complex organisation and sophisticated techniques offer compelling evidence of the substantial authority and control exercised by the Dacian king or elite over resources and skilled labour, underscoring the broader power dynamics within the society.

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