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MILLSTONES FROM THE SETTLEMENT COMPLEX OF AQUINCUM: PRELIMINARY RESEARCH

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Excavations carried out in several parts of the settlement complex of Aquincum (legionary fortress, Military and Civil Towns, villa estates) have so far revealed 250 complete or fragmentary hand querns and millstones of different types. Most were discovered reused in secondary contexts, but some were found in their original position (i.e. in the courtyards of town houses or villas).The cataloguing of this group of finds has just been completed (although new ones continue to be found in ongoing excavations), and therefore detailed research on the types, material, and economic significance has only just begun (in a cooperation between the University of Oxford and the BHM Aquincum Museum). This paper presents the preliminary results of this work on the find location and dating of these stones, as well as distinguishing between hand querns and water-mills. It explores the potential of this neglected group of Aquincum finds, and especially what they might suggest about the extent of the use of water-powered milling on the Roman frontier in Pannonia.

Az aquincumi településegyüttes területén végzett kutatások során (legiotábor, katonaváros, polgárváros, villaövezet) eddig mintegy 250 ép vagy töredékes, különböző típusú római kori malomkő került elő. Jelentős részük másodlagos helyzetben volt, de jó pár in situ lelet is napvilágra került (pl. polgárvárosi házak, villák udvaraiból). A leletek katalogizálása egyelőre a végére ért (noha folyamatosan bukkannak elő új darabok a feltárások során), így részletes feldolgozásuk, anyagvizsgálatuk és gazdaságtörténeti jelentőségük felmérése csak most kezdődhetett meg (a BTM Aquincumi Múzeuma és a University of Oxford együttműködésében). A jelen dolgozat e munka első eredményeit kívánja bemutatni a lelőhelyek és a keltezés vonatkozásában, illetve az egyes típusok meghatározását végeztük el (kézi- és vízimalmok). Szeretnénk ráirányítani a figyelmet erre az eddig némileg alulértékelt tárgycsoportra, ezen belül is különös tekintettel a pannoniai határvidék e szakaszán alkalmazott vízmeghajtású malmokra.

Keywords: *Aquincum, millstones, hand querns, Civil Town, legionary fortress, water-mill*

Kulcsszavak: *Aquincum, malomkövek, kézimalom, polgárváros, legiotábor, vízimalom*

Research history

Even though archaeological research has been undertaken in the settlement complex of Aquincum for more than 130 years now, and dozens of millstones and querns – both small and large – have been collected from excavations and stored either in the museum's *lapidarium* or in the archaeological park itself, relatively little work has been carried out on this group of finds (*Fig. 1*).The first researcher to study them was János Schauschek, who already observed that most of the stones belonged to hand querns (Schauschek 1949, 59–60) and described a fragment of a possible *catillus* and the working mechanism of Pompeian-type Roman mills (*Fig. 2a–b*) (Schauschek 1950, 119–121; the fragment has since been lost). The next archaeologist was Mária Pető, who mentioned 50 millstone fragments (with the first attempt to typologize them) – mainly hand querns, but without any precise find location – as

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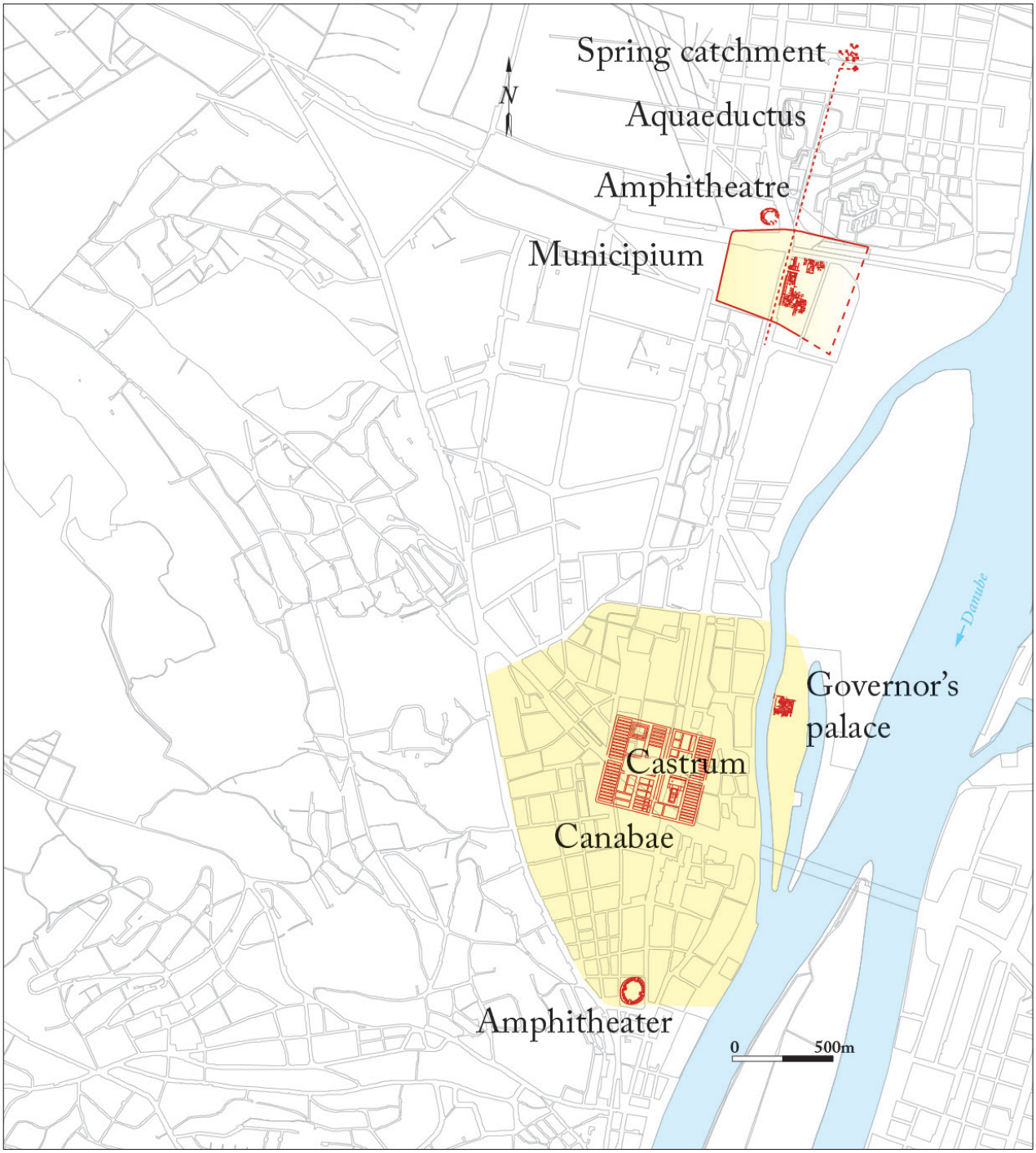

Fig 1. The settlement complex of Aquincum (drawing by Krisztián Kolozsvári)
1. kép. Az aquincumi településegyüttes (rajz: Kolozsvári Krisztián)

well as a mill rynd kept by the 1970s in the collection of the Aquincum Museum, as part of a description of Roman food processing in the light of the finds from Aquincum (Pető 1977, 148–149).[1] Apart from these works, no further articles have yet been dedicated to these finds, even though the number of millstones found during the numerous excavations had reached 250 by 2018 (see below).[2]

Aquincum millstones – reports on finds

Although no detailed work has been published on millstones, preliminary excavation reports do mention millstone fragments from the area of the legionary fortress (Pető 1976b, 116), the *canabae* (Póczy 1955, 60; Kirchhof 2009, 48 – in secondary reuse), the Civil Town (*Fig. 3*) (Póczy 1976, 425; Láng 2016,

358), and the surrounding villa estates (*Fig. 4*) (Láng 2009, 81).[3] South of the Aquincum settlement complex, the *vicus* of the *ala* fort 'Víziváros' also yielded some fragments (3 Bem József–4 Feketesas streets: Kérdő 2000, 77, Fig. 1).[4] Dozens of further fragments, mostly of hand querns, have been discovered during the numerous developer-funded excavations of the BHM Aquincum Museum in the present-day Budapest in the last decades, but nearly all of them have remained unpublished.[5]

Aquincum millstones – some figures

Because of the growing number of finds and the fact that this has so far been a rather neglected group of finds, a decision was made to collect and process all millstones of all types kept in the museum's collection. Most of them – mainly the intact pieces – are currently exhibited in the archaeological park, while the fragments are stored in the *lapidarium*. Of the 250 pieces catalogued to date, 111 are complete millstones or querns, while 139 are fragmentary (*Table 1*). Since excavations are still going on in and around Aquincum[6] their number continues to grow, by about 2–5 pieces per year, and thus their cataloguing is always in progress. The number so far catalogued (250) may not seem large, considering the size and importance of the settlement complex of Aquincum, but we must bear in mind that small fragments could well have gone unnoticed during the early excavations (particularly in the 19th century and the first half of the 20th century) so only the complete ones have made their way to the museum.

Preliminary data on types

Some preliminary observations can already be made concerning types and sizes. Based on the data gained from the finds catalogued so far, the following groups can be distinguished.

1. Hand querns

Most identifiable pieces where the diameter could be measured can be considered hand querns (144 pieces). Their diameter falls between 30 cm and 52 cm. Although there is no exact threshold, millstones under *c.* 55 cm (1.5 Roman feet or more) in diameter are usually considered as belonging to hand querns; those larger than that may derive from water-mills or animal-powered mills but features such as thickness, diameter of spindle hole, and drive arrangements

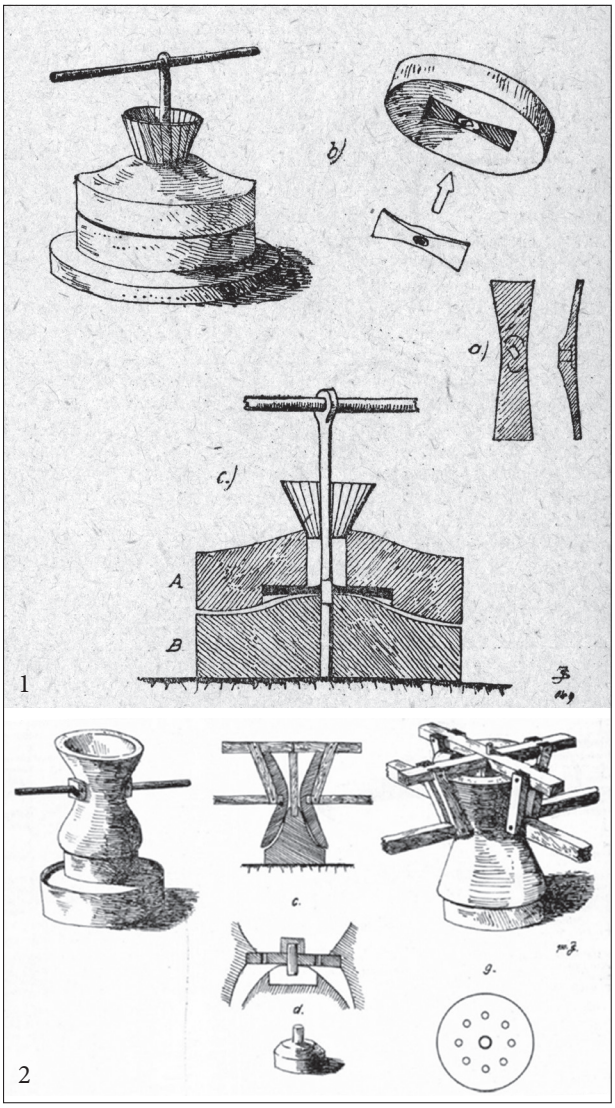

Fig 2. Reconstruction drawings of the Aquincum millstones by J. Schauschek. 1: Schauschek 1949, 59, Fig. 1; 2: Schauschek 1950, 121, Fig. 1
2. kép. Az aquincumi malomkövek Schauschek János rekonstrukciós rajzain. 1: Schauschek 1949, 59, 1. kép; 2: Schauschek 1950, 121, 1. kép

need to be considered (Baatz 1995, 9; Nagy-Szabó 2008, 16; Sulk 2018, 644, fn. 54).[7] Unfortunately, no complete mill, with both the upper and the lower stones surviving, is yet known from Aquincum. Fifty-one lower and 53 upper (runner) stones can be identified.[8] In some cases, iron and bronze elements survive in the rynd sockets of the upper stones (2013.4. 127) or traces of lead can be observed in the central hole of the millstones (2013.4 26) (*Fig. 5*). Further holes for handles are also observable on most upper stones. In one case an incised inscription – perhaps referring to the user/owner (or his/her origin) of the quern[9] – could be observed on the

side of the upper stone (2013.4.64 – legionary fortress). These relatively common hand querns were used in both civilian and military contexts.

2. Mechanically-driven stones

There are at least 34 significantly larger stones or fragments with diameters of 57 cm or more, and with either substantial thicknesses (over 10 cm) or large central holes for a massive spindle, or both, which show that they are not hand querns (*Fig. 6a–c*). Although the find spots of these large pieces are mainly unknown,[10] their morphology shows that most of these are certainly water-powered millstones, driven by a central drive from the spindle (Wilson 2020, 160–167). Running water was to hand: the Danube itself, its (artificial?) branches, and the streams coming from the Buda hills (e.g. the Aranyhegyi and Barát streams, the Rádl-ditch etc.) (Kérdő, Schweitzer 2014, 97, 109–111, 123–125).[11] Water power made milling possible on a large scale, which would have been very useful in Aquincum, where some 50–60,000 inhabitants (Póczy 2004, 14) and a legion of 6,000 soldiers would have needed to be supplied with bread, in addition to the *ala* camps and their *vici* further to the south (see above).

Fig 3. Fragment of a hand quern from the Civil Town, during excavation (photo: Orsolya Láng)
3. kép. Kézimalom töredéke az aquincumi polgárvárosból, feltárás közben (fotó: Láng Orsolya)

3. Animal-driven mills

A few of the 34 larger stones, however, belong to a type of animal or human-powered stone only recently identified, by Paul Picavet (Picavet 2021, 193–200), from examples in Gaul and Britain. These are stones typically between about 62 and 85 cm in diameter, with no fittings for a central drive but sockets on the upper face of the upper stone for fixing a turning bar driven by an animal or men. Their central holes tend to be smaller than those of water-mill stones, as they do not require such a massive spindle. Sometimes there is a pair of D-shaped sockets in the upper stone either side of the eye, to feed grain through from a hopper (in wood or leather) resting on the upper stone (e.g. 72.13.31). The grinding faces of these stones driven by muscle power are much flatter than those of the Pompeian type, and they seem to be a later development originating in northern Europe in the first or second century AD (Wilson 2020, 160–161; Picavet 2021, 193–200).

The well-known Pompeian-type of millstones seem to be absent in Aquincum: no securely identified *catillus* has been found yet, apart from the one described by Schauschek (see above). This latter has been missing since his publication, in contrast with Savaria, where two *catilli* have been found so far (Hódi 2015, 50–56; Balázs et al. 2017, 83–85). The reason could lie in the fact that Savaria was founded as a colony around AD 50 and was closely related to the Amber Road and inhabited by merchants, veterans, and with strong Mediterranean connections. By contrast, Aquincum became the capital of Lower Pannonia only in AD 106, while its inhabitants were mainly locals, veterans from all over the Empire (and their families), with fewer Mediterranean connections. It appears that the Pompeian-type of mill was not widely adopted in this part of the Empire, and that by the time Aquincum was raised to the rank of a provincial capital, the more efficient and technically more advanced water-mill had become a well established technology, and water-mills and the flatter type of animal-driven mills were preferred for larger-scale milling than could be done using hand querns.

4. Pot querns

Apart from these – relatively common – types, a few other stones are recorded from Aquincum, possibly belonging to different types of milling operation. Pot querns could be identified among the Aquincum finds (e.g. 2013.4.159), used for milling

Fig 4. Lower part of a hand quern and its base found *in situ* in the paved courtyard of the so-called villa of Harsánylejtő (photo: Orsolya Láng)
4. kép. Kézimalom also köve és bázisa *in situ* az ún. Harsánylejtői villa kövezett udvaráról (fotó: Láng Orsolya)

grain (Selmeczi 1981, 210, Fig. 4 – a modern analogy) even though in some cases their identification as stone vessels is also possible (e.g. 2013.4.82, 2013.4.164). However, their dating is still uncertain and they might well date to the Middle Ages.

5. Edge-runner stones

At least two stones with large square central sockets are not grain mills at all, but are edge-runner stones from crushing mills (2014.4.34, 2013.4.36). These look like olive-crushing mills (cf. Waliszewski 2014, 27, Fig. 1. 2), but as there are no archaeological data or written sources for olive cultivation in this part of the Empire, these mills may have been used to produce other vegetable oils or perhaps colouring liquids.

Find locations

As mentioned, unfortunately, only a small proportion of the whole material has precise data on find locations (*Fig. 7*). Most of the millstones – particularly those found before World War 2 – lack all information about their find spot. Of the 85 that do have precise find spots, 16 items were found in the legionary fortress, which could be explained by the large number of soldiers that must have been provided with flour. Thirteen of them were found in the *canabae*, 7 south of the *canabae*, and 3 in the governor's palace. A further 9 pieces were discovered in the Civil Town and in its immediate vicinity. Three can be connected to a villa estate, and 15 pieces – a relatively large

Fig 5. Hand quern with lead in the central hole, inv. no. 2013.4.26. (photo: Peter Komjáthy)
5. kép. Kézimalom, a központi nyílásban ólommal. Ltsz. 213.4.26. (fotó: Komjáthy Péter)

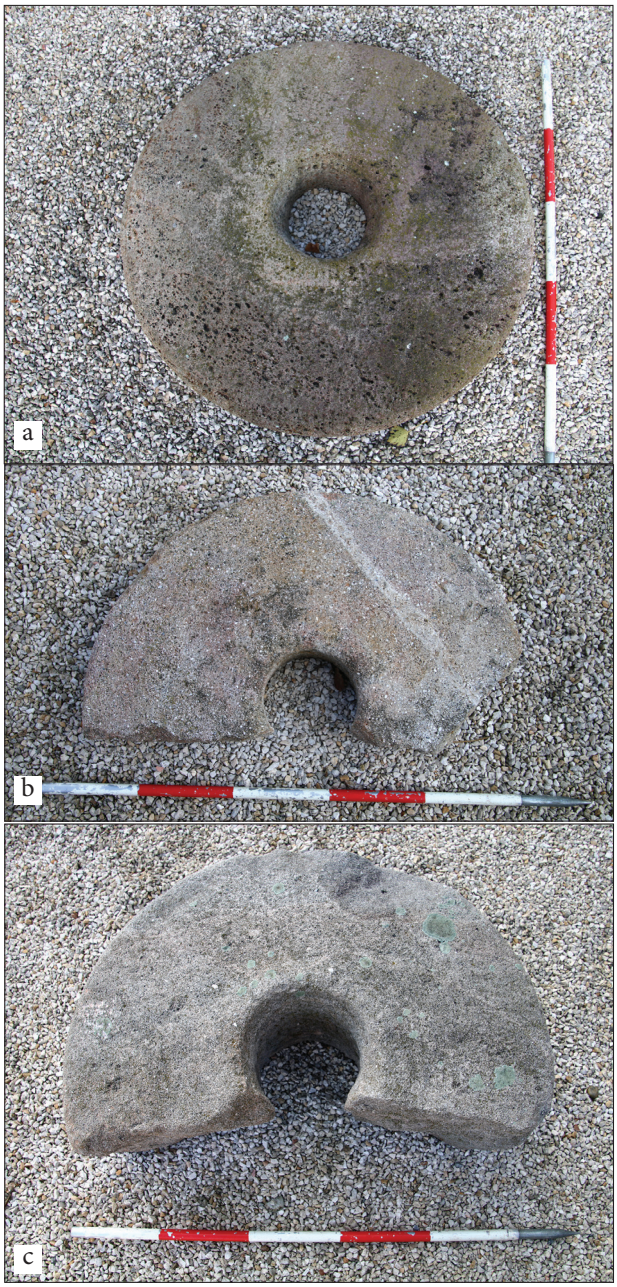

Fig 6a–c. Large millstones, possibly belonging to water-mills from the settlement complex of Aquincum (photos: Peter Komjáthy)
6. kép a–c. Nagy méretű – valószínűleg vízimalomhoz tartozó – malomkövek az aquincumi településkomplexum területéről (fotó: Komjáthy Péter)

number – were found in an Early Roman settlement in the territory of Aquincum (Harsánylejtő). Further to the south, 10 can be attributed to the *vicus* of the first *ala* fort (and possibly also the fort itself) in the Víziváros. The Roman cavalry fort at Albertfalva, further south still, also produced three querns, while five were found in its *vicus*. So far only one can be attributed to the southernmost cavalry fort, Campona.

Material and dating

Although most of the stones lack relevant excavation data, since they were discovered in the 19th century and the first half of the 20th century, some are datable, all of which are hand querns. The documented ones found in the Civil Town all date between the 2nd century and the end of the 3rd century AD,[12] while there is a piece from a 4th-century villa in the city's territory (Láng 2009, 81). Some datable pieces also come from the south-western part of the Military Town, a zone commonly associated with economic activities,[13] and from the western cemetery of the *canabae*.[14] Although most stones cannot be dated from their context, typological analysis – which is currently in progress – might help with the dating. The lithological analysis of most of the millstones and querns has begun,[15] and simple visual inspection shows that they are mostly of volcanic material (andesite, basalt etc.) whose source could have been the nearby Buda hills. In any case, material analysis of the Aquincum millstones and querns could be expected to provide new information on local and regional trading systems. So far the only such work carried out in Pannonia has been the analysis of the millstones and querns of Sala (Pannonia Superior). (Nagy-Szabó 2008).[16] Here basalt, andesite, and trachyte were all used for millstones and their provenance was the nearby Ság-hill, while the farthest site from which stones were imported was Gleichenberg, about 50–60 km away.[17]

Preliminary conclusions

As seen above most of the millstones in the collection of the Aquincum Museum are hand querns, and most of those whose find locations are known were discovered in the legionary fortress. Owing to the lack of find locations, dating of most of the millstones is problematic, but when data are available the stones can be dated between the 2nd and the 4th centuries AD, most from the 3rd century AD. Apart from the hand querns, the important new finding is that there are a significant number of large millstones many of which seem to indicate water-powered milling. This makes sense given the need to supply thousands of people, including probably the soldiers of the legionary fortress. The water-mills could have made good use of the Danube itself and its branches as well as the streams of Óbuda. Even though the material analyses of

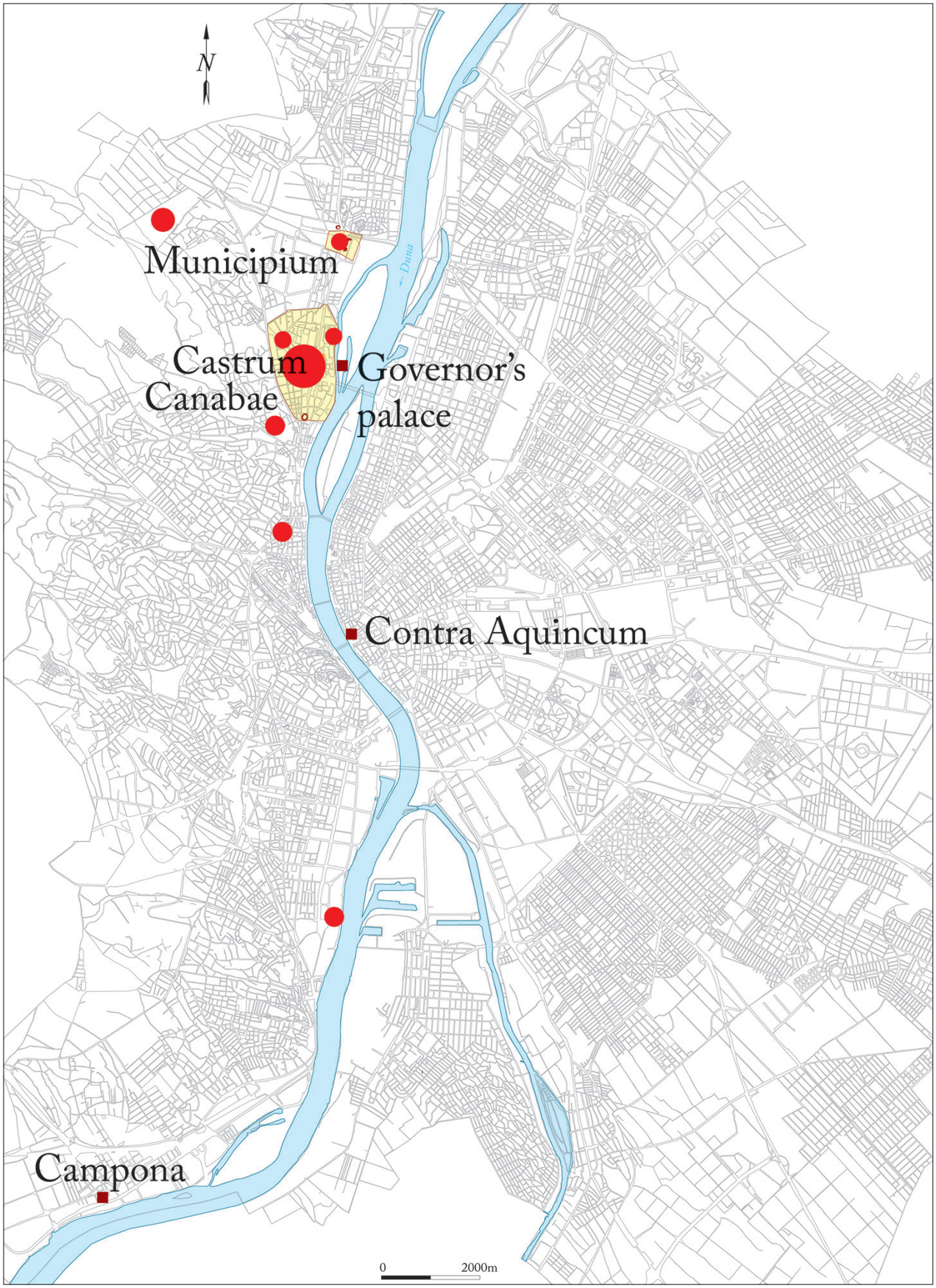

Fig 7. Find spots of millstones in the settlement complex of Aquincum (drawing: Krisztián Kolozsvári)
7. kép. Malomkövek lelőhelyei az aquincumi településegyütttes területén (rajz: Kolozsvári Krisztián)

Fig 8. Open-air exhibition of millstones in the Aquincum Museum and Archaeological Park (photo: Orsolya Láng)
8. kép. Malomkövek szabadtéri kiállítása az Aquincumi Múzeum és Régészeti Park területén (fotó: Láng Orsolya)

the millstones have just been started, which we hope will throw some light on the provenance of the stones and could even help with the typology, it can already be observed that most of the stones (particularly the hand querns) are of volcanic rock.

We are still at the beginning of this research, and there is a long way to go before this so far neglected group of finds can tell us more about eating habits, applied technologies, and the economic history of Roman Aquincum (*Fig. 9*).

Notes

1 However, several baking ovens were also mentioned in preliminary reports, mainly considered to be part of commercial bakeries (Kaba 1956, 153–158; Szilágyi 1965, 235; Pető 1977, 149).
2 Nevertheless, some further basic research had been done on the subject, particularly by a Hungarian researcher regarding the similarities and differences between Celtic and Roman period hand querns (Selmeczi 1981, 206–211).
3 A further millstone was found as a stray find close to the villa in 2017. Unpublished. Courtesy Fanni Fodor.
4 Further site: 9–13 Medve street: (2 fragments), unpublished; information courtesy of the late Katalin Kérdő.
5 Nor were they mentioned in preliminary reports of the excavations.
6 Nowadays, mainly development-led excavations are carried out in Budapest and only one or two planned research excavations. The number of archaeological interventions performed by the Budapest History Museum (of which the Aquincum Museum is also part) in Budapest – regarding all archaeological periods – was as high as 552 in 2022.
7 A. Wilson considers stones with a diameter larger than 55 cm as likely to come from mechanically powered mills: Wilson 2020, 160.
8 Based on their characteristic features, such as form and surface of the stone, rim, number and size of holes, side hole for handle, or spout.
9 Inv. no. 2013.4.64.: [ER]AVIS(sci)? It could even refer to the origin of the user.
10 For find locations, see section 'Find locations.'
11 A similar phenomenon could be observed in the *vicus* of Salisberg where ditches supplied a possible watermill (Sulk 2018, 642).
12 Inv. no. 2013.4.52, 2013.4.53, 2013.4.54 and 2013.4.55: currently in the garden of House no. VIII, though probably collected from other buildings of the Civil Town. 2013.4.81: found with building debris west of the Aquincum Civil Town. Relatively late, most probably also a 2nd–3rd-century horizon. Preliminary report on this part of the area: Lassányi,

Láng 2014, 20; 2013.4.153 (=75.7.6.): with no precise dating. Pető 1976a, 32; Pető 1977, 149 and figs. 5–6; 2013.4.132: end of the Antonine era. Courtesy P. Zsidi (information from the excavator, unpublished).

13 3rd Distr., 24 Szőlő str.: inv. no. 2013.4.185, 2013.4.186, 2013.4.187, 2013.4.189. Unpublished. Courtesy P. Vámos. On the function of the SW part of the *canabae*: Póczy 1983, 258–262.

14 3rd Distr., 102 Bécsi road: inv. no. 2013.4.192. Possibly reused in a secondary context. Unpublished. Courtesy F. Fodor.

15 Performed by György Szakmány and his colleagues in the University of Technology and Economics.

16 Similarly local are the material of the millstones from Porolissum (mainly volcanic but also sedimentary rock): Gudea 1997, 237.

17 See previous footnote.

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MALOMKÖVEK AZ AQUINCUMI TELEPÜLÉSEGYÜTTES TERÜLETÉRŐL: ELŐZETES EREDMÉNYEK

Összefoglalás

A BTM Aquincumi Múzeumának gyűjteményében őrzött, több, mint 250 db különböző állapotú és méretű, római kori malomkővel eddig keveset foglalkozott a kutatás. A leletcsoport közelmúltban megindult szisztematikus katalogizálásának és feldolgozásának első állomása a jelen cikk, amelyben egyelőre az előzetes eredmények foglalhatók össze. Ezek szerint a kövek túlnyomórészt kézimalmokhoz tartoztak, melyeknek jelentős része – ahol ez megállapítható volt – az aquincumi legiotáborból került elő. A legtöbb esetben sajnálatosan hiányzó pontos lelőhelyadatok miatt keltezésük problematikus, azonban ahol ezek rendelkezésre állnak, a Kr. u. 2–4. század közé, közelebbről a 3. századra datálhatók. Új információ, hogy a kézimalmok mellett – a mérettartományok figyelembevételével, amelynél a határ kb. 55 cm-es átmérőnél húzható meg – számos nagy méretű malomkő is megtalálható, amely elsősorban vízi erővel meghajtott malmok jelenlétét feltételezi. Ez annál is inkább valószínűnek látszik, mivel az itt állomásozó 6000 fős legió, valamint a több tízezer polgári lakos – elsősorban liszttel történő – ellátása leginkább nagy (ipari) méretekben történhetett. Vízimalmok működhettek a Dunán és annak ágain, valamint a budai hegyekből lefutó vízfolyásokon is. Noha a malomkövek nyersanyagának vizsgálata még folyamatban van, amely reményeink szerint adatokkal szolgálhat majd a kövek származási helyére és talán segíthet a tipologizálásnál is, az már most megállapítható, hogy a malomkövek jelentős részben (különösen a kézimalmok) vulkanikus eredetű anyagból készültek. A kutatásnak egyelőre a kezdetén vagyunk, és még rengeteg feladat áll előttünk, mielőtt az eddig igen mostohán kezelt leletcsoportot „szóra bírhatjuk”, de a malomkövek reményeink szerint igen sokat elárulnak majd nemcsak a korabeli étkezési szokásokról és az alkalmazott technológiáról, hanem a római kori Aquincum gazdaságtörténetéről is.

Table 1. Extract from the Excel catalogue of the Aquincum millstones (Orsolya Láng)
1. táblázat. Az aquincumi malomkövek excel táblázatos nyilvántartása, részlet (Láng Orsolya)

Cat. No.	*Inv. no.*	*Old inv. no.*	*Description (upper/ lower stone)*	*Measurements (cm)*	*Diameter (cm)*	*Thickness (cm)*	*Hole diameter (cm)*	*Find location*	*Old location*	*Present location*	*Remarks*	*Classification*
122	2013.4.103.		lower	d: 33; hole (d): 2.5; h: 9	33	9	2.3		Lapidarium below 2nd shelf	Lapidarium, shelf		Hand quern
103	2013.4.104.		?	33 × 23 × 11; hole (d): 3			3		Lapidarium 2nd shelf	Lapidarium, shelf		Hand quern
108	2013.4.105.		lower?		33	10			Lapidarium 2nd shelf	Lapidarium, shelf		Hand quern
106	2013.4.106.		?	45 × 28 × 11.5; hole (d): 11		11.5	11		Lapidarium 2nd shelf			Hand quern
199	2013.4.106.		?	d: 64; h: 11; hole (d): 7	64	11	7		Lapidarium	Lapidarium		Water-mill stone?
204	2013.4.107.		?	d: 60; h: 10	60	10			Lapidarium	shelf		Water-mill stone?
85	2013.4.108.		upper?	d: 70; hole (d): 15; h: 12	70	12	15		Lapidarium South, floor	Lapidarium		Water-mill stone
87	2013.4.109.	72.13…?	lower ?	d: 49; hole (d): 12; h: 10	49	10	12		Lapidarium South, floor	Lapidarium		Hand quern
89	2013.4.110.	72.13…?	upper?	d: 37; hole (d): 4; h: 13	37	13	4		Lapidarium 2nd shelf	Lapidarium		Hand quern
111	2013.4.111.		upper?	49 × 28 × 10; hole (d): 8.5; recess: 10 × 5		10	8.5		Lapidarium 2nd shelf	Lapidarium, shelf		Check - what is diameter?
195	2013.4.112.		lower	30 × 12 × 3					Big Store			?
104	2013.4.113.		lower	d: 33; hole (d): not measured; h: 10	33	10			Lapidarium 2nd shelf	Lapidarium, shelf	with hole for handle?	Hand quern
205	2013.4.114.		upper	16 × 14 × 12					Lapidarium	shelf		Hand quern

Cat. No.	*Inv. no.*	*Old inv. no.*	*Description (upper/ lower stone)*	*Measurements (cm)*	*Diameter (cm)*	*Thickness (cm)*	*Hole diameter (cm)*	*Find location*	*Old location*	*Present location*	*Remarks*	*Classification*
215	2013.4.115.		lower	d: 35, h: 9; hole (d): 2	35	9	2	II. Ganz u. 16, SU 1499, sector no. 18, SE quarter, 1998 (H.T.)	conservators' workshop	II.		Hand quern
117	2013.4.116.		lower?	d: 42; hole(d): 3; h: 10	42	10	3	III. Kórház u. 6-12, 1992, Szirmai K.	Lapidarium 2nd shelf	V.		Hand quern
196	2013.4.117.			d: 43.5; h: 10; hole: 8.5	43.5	10	8.5		Big Store	III.		Hand quern