

Basalt axe production sites in the Bakony Mountains (Hungary)

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Abstract

The Bakony Mountains is one of the prehistoric 'industrial' centres of Hungary. Siliceous raw material exploitation sites are known and published from the area. Recent study on polished stone artefacts of the region resulted in the recognition of intensive artisan activity on Late Neolithic sites of the area in respect of local basalt resources. So far, the best evidence is known from survey material from the sites of Zirc, Porva and Pénteszgyőr, from the collection of E. Wolf; half products, technological tool types and fabrication debris, various hammerstones and polishers. The publication of the surface collected evidence of polished stone artefact workshops will hopefully support the systematic study of these important sites.

Keywords: Hungary, polished stone artefacts, basalt, half-products.

Résumé

La montagne de Bakony est l'un des centres « industriels » préhistoriques de Hongrie. Des sites d'exploitation des matières premières siliceuses y sont connus et publiés. L'étude récente d'outils en pierre polie issus de cette région a permis la reconnaissance d'une intense activité artisanale sur les sites du Néolithique récent en relation avec les ressources locales de basalte. Jusqu'à présent, les indices les plus probants proviennent de la collection de E. Wolf, récoltée par prospection sur les sites de Zirc, Porva et Pénteszgyőr, des préformes, différents types d'outils, des déchets de fabrication, ainsi que de nombreux perceurs et polissoirs. La publication du matériel composant cette collection de surface et témoignant de l'existence d'ateliers de fabrication d'outils polis permettra, on l'espère, l'étude systématique de ces sites importants.

Mots-clés: Hongrie, outils en pierre polie, basalte, préformes.

1. INTRODUCTION

In course of a preventive excavation on motorway No 8 in the outskirts of Veszprém (2010), a special depot find was located in a pit. The depot comprised nine basalt axe preforms and blocks to be prepared for polished stone axes. The interesting find assemblage was published by Judit Antoni (2012).

Parallel finds to the preforms and half products were searched for to establish date and context of this find assemblage. The quest for analogies coincided with another program for polished stone artefacts, trying to locate greenstone (basically, jadeite and related rocks) of long-distance origin within the framework of JADE2 project

lead and organised by Pierre Pétrequin and Estelle Gauthier (PÉTREQUIN *et al.*, 2017). In connection with these two projects we came across the evidences collected by and methodically stored in the private collection of Ernő Wolf (Zirc).

2. THE COLLECTION OF ERNŐ WOLF

Ernő Wolf is a long-time collector of antiquities, especially prehistoric finds in the vicinity of the town Zirc and its environs. He contributed to the topographic surveys of the region and took part in a number of excavations in Transdanubia. Part of his collection was described by archaeologists dealing with this territory (BIRÓ & REGENYE, 2003; REGENYE, 2000). From the rich surface

collection of finds he gathered throughout the years, this paper is concentrating on polished stone artefacts – more specifically, basalt axe preforms and half-products.

2.1. Information on the sites involved

Part of the collected material comes from sites noted and described first in the framework

SITE NAME	SITE	MRTNR	MUS	AGE	Culture	Nr. of polished stone artefacts*
Porva - Ménesjárás II.	612	MRT IV 67/W3	WE	LN, B	Lengyel Culture	3 (3)
Porva - Ménesjárás I.	613	MRT IV 67/W2	WE	LN	Lengyel Culture	9 (6)
Porva - Ménesjárás III.	614	MRT IV 67/W4	WE	LN, B	Lengyel Culture	7 (5)
Porva - Pálinkaház-puszta	615	MRT IV 67/10	WE	B	Late Bronze Age	4 (3)
Porva - Győri úti rétek	616	MRT IV 67/3	WE	LN, B	Lengyel Culture + BA	21 (19)
Porva szórvány	617	unknown (purchased)	WE	unknown	unknown	1 (1)
Tés - Kistécs	618	MRT IV 74/2-3	WE	LN	Lengyel Culture + Roman Period +- Mediaeval Period	3 (2)
Jásd - Récsenyi hegy	619	MRT IV 35/4	WE	LN	Lengyel Culture + Roman Period	3 (2)
Nagyesztergár - Purgly major	620	MRT IV 52/2A	WE		Roman Period	2 (2)
Olaszfalu - Felsőpere, Csicsóvölgy	621	MRT IV 60/W3	WE	LN	Lengyel Culture +BA, Roman Period, Avar, -Mediaeval Period	2 (2)
Borzavár - Alsótündér-major I.	622	MRT IV 18/5	WE	LN, B	Lengyel Culture + BA	2 (2)
Borzavár - Bocskorhegy	623	MRT IV 18/3	WE	LN, B	Lengyel Culture + BA	3 (3)
Zirc - Királypatak II. - Szélesrét	624	MRT IV 81/W4	WE	LN	Lengyel Culture	3 (3)
Zirc - Aklipuszta III.	625	MRT IV 81/W2	WE	B	Urnfield Culture	5 (4)
Pénzesgyőr-Halastóárki dűlő I.	626	MRT IV 66/6	WE	LN, B	Lengyel Culture + BA	6 (6)
Zirc - Királypatak I.	627	MRT IV 81/W1	WE	LN	Lengyel Culture	76 (69)
Pénzesgyőr-Halastóárki-dűlő III.	628	MRT IV 66/W1	WE	LN	Lengyel Culture	110 (98)

* in brackets, number of associated finds, e.g., raw material blocks and tools of production

Fig. 1 – Polished stone tools and related artefacts from the Wolf Collection (Zirc environs).

of the topographic survey of Hungary. It is noteworthy that the complete archaeological topographic survey of Hungary was initiated by the researchers of the Archaeological Institute of the Hungarian Academy of Sciences in the 1960s. Veszprém County was the first among the 19 Hungarian territorial units (counties) where complete topographical surveys were made. The results were published by smaller regional units, i.e. 'districts', in Hungarian, 'járás' (MRT I-IV). This regional unit was later abolished (1983) and recently re-installed (2012), see https://upload.wikimedia.org/wikipedia/commons/d/d3/Townships_%28districts%29_of_Hungary.png

This process was not completed as yet. Veszprém County is certainly one of the regions where archaeological topography is completed to a certain degree. Completion to the data of the sixties was published from the Pápa district

so far (ILON, 1995). The sites included in the topographical surveys are marked with the topographical reference number, starting with 'MRT' (MRT: Magyar Régészeti Topográfia, i.e., Hungarian Archaeological Topography).

The other sites investigated are the result of the personal fieldwork by E. Wolf. These sites are marked 'W' after the number used in the MRT volumes for denoting the locality (Fig. 1, Fig. 2).

Almost all sites contained, typically basalt, polished stone axes and/or preforms. Raw material lumps were found at three sites (17 percent of sites), technological pieces (flakes, chips) of axe production were recorded on five sites (29 percent of sites), and tools for making polished stone tools (hammerstones, polishers) were found at five sites (29 percent of sites). We must remember that these sites are merely surface collected materials without exact context.

The most productive sites in respect of polished stone tool production were Pénzesgyőr, Porva and Zirc-Királypatak (Fig. 3).

The main features of these sites can be summarised in the following.

2.2.1. Zirc- Királypatak I (81/W1)

47°14'N, 17°52' E, 445 m a.s.l.

The site is located on a NNW-SSE directed hillside, bordered by stream valleys. Late Lengyel settlement features can be observed on a patch of land approximately of 300 x 150 m extent.

Seven to eight find concentrations were observed, in a distance of 30-60 m from each other.

Archaeological finds:

Pottery: Many Late Lengyel fragments in bad state of preservation. Special forms: Spindle whorls and pottery with imprints of woven bulrush.

Chipped stone artefacts in large quantity, raw material blocks, cores, tools and production debris. Raw material is typically radiolarite, mainly mustard yellow (Úrkút-Eplény) type, followed by red and brown (Szentgál, Hárskút)

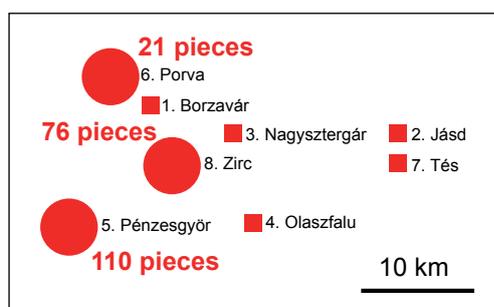


Fig. 2 – Sites with polished stone tools from the Wolf Collection mentioned in the text.

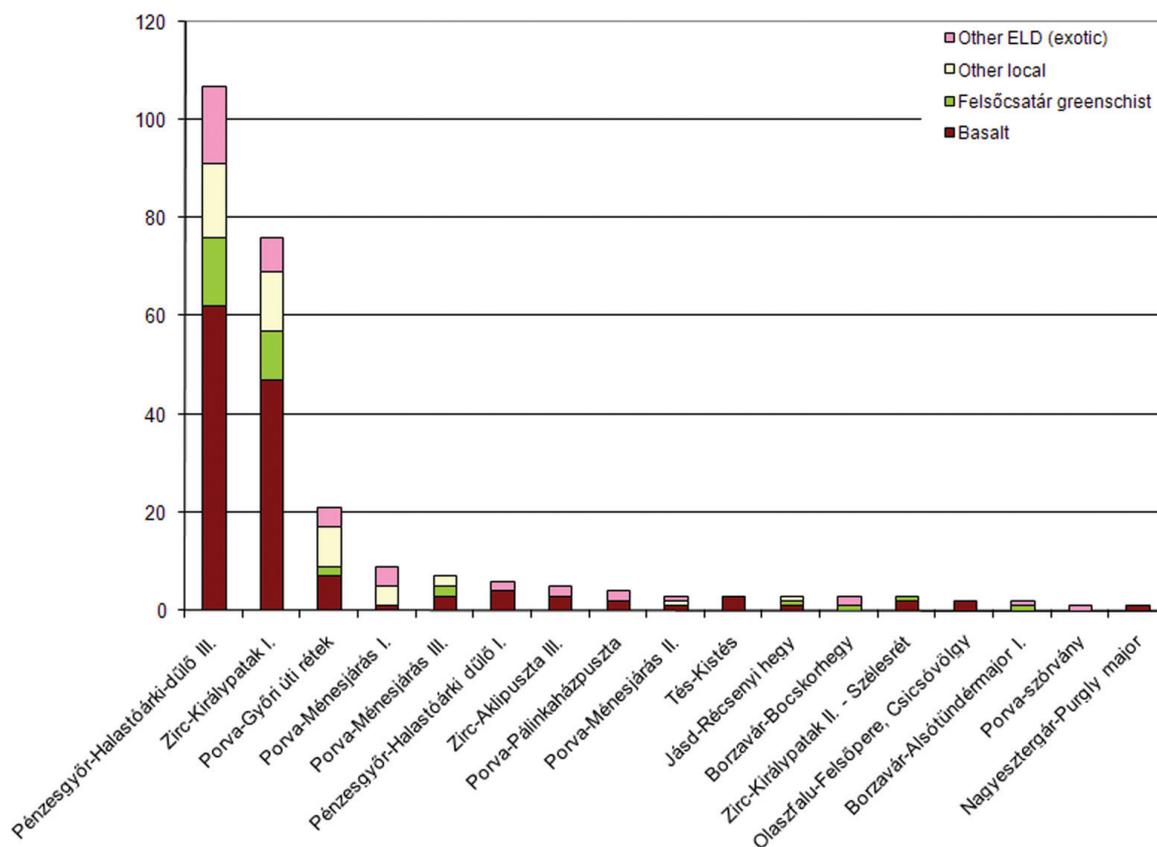


Fig. 3 – Main raw material type group distribution of the studied material.

radiolarite and inferior quality local chert (BIRÓ & REGENYE, 1995, 2003).

Polished stone artefacts: More than 70, mainly basalt and greenschist axes and chisels. Basalt raw material blocks and axe preforms in large quantities.

Grinding stones and polishers: Typically made of basalt tuff and various sandstones including very large pieces (e.g., 30 x 40 x 20 cm, 34 kg).

Hammerstones: Large quantities of worn quartzite percussion tools. On the southern side of the settlement, such large quartzite pebbles crop up *in situ*.

Daub fragments occurring in patches, some with prints of tree-branches.

No animal bones or bone tools were found on the settlement.

2.2.2. Pénzesgyőr- Halastóárki-dűlő III - Köves hegy alja (66/W1)

47°13' N, 17°48' E, 400 m a.s.l.

In the middle of the hill-top sloping N to S from the Köves hill to the Gerence stream a 480 x 250 m extent area with traces of a Late Lengyel period settlement. Concentration of finds can be observed at 10-12 points located at a distance of 40-90 m to each other.

Archaeological finds:

Pottery: Many fragments of Late Lengyel pottery in bad state of preservation. Special forms: Ladle and pottery with imprints of woven bulrush.

Chipped stone artefacts: In large quantity, raw material blocks, cores, fabrication debris and finished tools. Most of them made of dark brown (Hárskút type) radiolarite, followed by red and mustard yellow (Szentgál, Úrkút-Eplény type) radiolarites with other inferior quality local chert.

Polished stone artefacts: More than 90 pieces of polished stone artefacts made of basalt and greenschist mainly. Basalt is present in the form of raw material blocks and axe preforms as well.

Grinding stones and polishers: Relatively large amounts made of basalt tuff and various grain size sandstones, both fragmented and complete pieces.

Hammerstones: Large basalt and quartzite pebble specimens with intensive traces of use.

No daub or animal bone / bone tool was found so far on the settlement.

2.2.3. *Porva group of sites*

Porva- Győri úti rétek (MRT 67/3), 47°18' N 17°48' E 368 m a.s.l.

Porva- Felsőerdő (MRT 67/5), 47°18' N 17°48' E 385 m a.s.l.

Porva- Ménesjárás I-W hill N part (67/W2A1), 47°18' N 17°46' E 394 m a.s.l.

Porva- Ménesjárás II-Középső domb (67/W3), 47°18' N 17°47' E 384 m a.s.l.

Porva- Ménesjárás III-Keleti domb (67/W4), 47°18' N 17°47' E 387 m a.s.l.

To the NW of the village Porva, on a 2 x 2 km large area around the headwaters of the Hódos stream, on hilltops facing S traces of several small Late Lengyel settlements were located. Their extent ranges between 50-80 x 50-150 m.

At Ménesjárás I and Ménesjárás II most of the observed settlement patches are of Late Bronze Age.

Concentration of finds can be observed at several places, 20-50 m from each other.

Archaeological finds:

Pottery: Relatively few and small shards in bad state of preservation. Apart from some characteristic details (rim, handle, knobs etc.), some special pieces (ladle, spinning whorl, woven bulrush imprints) can be found.

Chipped stone artefacts: Mainly radiolarite, in relatively low number, typically finished tools. The raw material is varied, mainly of inferior quality.

Polished stone artefacts: Around a dozen axes of basalt and greenschist were found, basalt raw material only at Porva- Ménesjárás I. There were no preforms observed.

Grinding stones and polishers were found only at some of the sites. Hammerstone: One piece as Porva- Győri úti rétek.

No daub, animal bones or bone tools have been found so far.

2.3. Polished stone tools on the sites in the Wolf Collection

In the current study we did not aim at investigating the total collected material, only items related to – or possibly related to – polished stone tool production were studied.

The characteristic raw materials used were basalt, greenschist, sandstone and quartzite (Fig. 3).

3. POLISHED STONE ARTEFACTS IN THE WOLF COLLECTION: TECHNICAL SOLUTIONS FOR THE PROCUREMENT OF LITHICS

3.1. General features

Field survey for lithics in woodlands, leaf litter or even in plough land is a difficult task. Only a trained eye will know artefacts from 'simple stones', especially in the case of tool preforms and production debris, with or without traces of tool shaping. Museum collections rarely own such pieces and this is far not by chance. Till very recent times, even archaeologists did not recognise such forms or simply ignored them. The depot find of Veszprém-Kádárta (also known as Gelemér or Litér junction) is a break-through in this respect (ANTONI, 2012). Found in course of authentic excavation, a set of axe preforms could be documented (and published) that could facilitate the recognition of similar assemblages.

Another specific aspect of the basalt tools and preforms of the Wolf Collection is the thick yellowish-grey patina formed on the surface, hiding them even better on the soil surface.

The recognition of the pieces arriving to the settlement as specific raw material for further processing is often revealed only by their non-local character. Traces of processing, forming blows to get preforms can be recognised relatively easily. Polished surfaces stand out by their smoother character. Fresh injuries stand out as darker scratches or fractures.

Sawing the raw material for cutting can be observed rarely (see Fig. 7:4 and ANTONI, 2012. fig. 5), probably using a wooden plate saw.

Traces of drilling are more obvious - partly because the circular wall of the drill holes were filled with sediment preserving the surface better.

In case of a well documented excavation, the quantities of fabrication debris can be much better observed than simple field surveys (e.g. BIRÓ, 1992, Aszód-Papi földek) and compared to the total lithic industry of the site (BIRÓ,



Fig. 4 – Basalt raw material artefacts.

1998); complete publication of the Aszód lithics is in preparation of the site monograph (BIRÓ, 2012 manuscript).

In this study we cannot aim at presenting the complete lithic assemblages of the sites presented; only the forms related to polished stone tool production are presented, typical for the region (Zirc environs) and the technical solutions characteristic of the Lengyel Culture.

On the largest settlements localised (Pénzesgyőr, Porva, Zirc-Királypatak) it is evident that the non-local basalt raw material was locally processed by active tool-making procedures. On the sites we can locate all phases of the '*chaîne opératoire*' reflecting the course of polished stone artefact production. In the following we will present the process by the help of characteristic forms and stages.

3.2. Examples of polished stone artefact production in the Wolf Collection

3.2.1. Natural, unworked raw material forms (Zirc-Királypatak I. 81W/1/32; Fig. 4:1)

The typical polygonal columns of the basalt 'organs' leant an easy choice for collecting raw material. Our specimen is a flat elongated fragment with triangular section probably selected to make an axehead. Dimensions: l: 22 cm, w: 7.2 cm, h: 2.3 cm, weight: 887 g.

3.2.2. Tested blocks and flakes

The base forms were selected and tested, most probably, on the geological site of the raw material and transported to the settlements for further processing. Cutting of the unwanted mass resulted in better transport and, at the same time, could reveal possible flows and inclusions in the raw material. Characteristic examples include Fig. 4.2, Zirc-Királypatak I. 81W/1/36, dimensions: l: 11 cm, w: 8 cm, h: 1.7 cm, weight: 286 g or Fig. 4.3, Péntesgyőr 66W/1/21, l: 7 cm, w: 5.3 cm, h: 4.8 cm, weight: 254 g.

On the selected pieces we can typically observe the surface of the detachment of the

flake but they also preserved natural fracture surface. The Zirc specimen was also tested for polishing: The protruding ridge was worked on a flat, wide surface. The traces of polishing are poor but visible and can be distinguished from the natural fracture surface.

Both pieces would be suitable for the production of small axeheads.

The flake from Zirc-Királypatak, 81/W/1/39 Fig. 4.4, dimensions: l: 11 cm, w: 6.2 cm, h: 2.2 cm, weight: 235 g was probably collected because of its form to serve as axehead. Conchoidal fractures can be observed on two sides rendering the piece to small or 'twisted' for the original idea but it was still preserved for potential use for a smaller chisel.

Another flake from Péntesgyőr (66/W/1/70, Fig. 4.5, dimensions: l: 16.8 cm, w: 4-8 cm, h: 3.2 cm, weight: 596 g shows an adze form: Similar to the previous piece, it cannot be considered a proper preform because it is not really suitable and would prevent the production of a real tool. We can classify these pieces as 'trial forms' where, during the tool making process, they were finally rejected.

3.2.3. Half-products and preforms

Preforms proper prepared for polishing were formed by percussion technique. At Péntesgyőr we find several such forms: 66/W/1/05, Fig. 5:1, dimensions: l: 18.2 cm, w: 6.5 cm, h: 4.8 cm, weight: 759 g and 66/W/1/09, (adze-pick preform), Fig. 5:2, dimensions: l: 18 cm, w: 5.5 cm, h: 4 cm, weight: 591 g as well as the piece 81/W/1/10 from Zirc (pick), Fig. 5:3, dimensions: l: 18.5 cm, w: 5.5 cm, h: 3 cm, weight: 510 g. These preforms represent tool types from the Early Copper Age partly influenced by the new metal (copper) picks and as such can be considered as the closest analogies of the Veszprém-Kádárta depot find (LDM 49.9780.583.4 and 49.9780.583.2; ANTONI, 2012, figs 9, 15).

Also from Péntesgyőr the chisel preform 66/W/1/25, Fig. 5.4, dimensions: l: 7.8 cm, w: 5.4 cm, h: 3.3 cm, weight: 232 g stand for half-products of an earlier phase of the Lengyel Culture.

3.2.4. Finished tools

Most of the polished stone artefacts collected are different axe, hatchet, hoe and chisel types formed with polishing on suitable

form blanks forecasting in their detached form the artefact planned.

Characteristic forms presented here include, from Porva, the hatchet 67/W/4/4, Fig. 6:1,



1



2



3



4



Fig. 5 – Half-products and preforms.

dimensions: l: 15.5 cm, w: 7.2 cm, h: 2.6 cm, weight: 533 g, another hatchet from Pénzesgyőr 66/W/1/6, Fig. 6:2, l: 12.3 cm, w: 6.2 cm, h: 2.6 cm, weight: 340 g as well as the hoe-blades 81/W/1/12 and 81/W/1/13 from Zirc-Királypatak

(Fig. 6:3, dimensions: l: 11.8 cm, w: 4.4 cm, h: 2.6 cm, weight: 266 g and Fig. 6:4, dimensions: l: 13.7 cm, w: 4.7 cm, h: 3.6 cm, weight: 333 g, respectively. From the smaller blanks, carving tools, mainly chisels of triangular or trapezoid form were

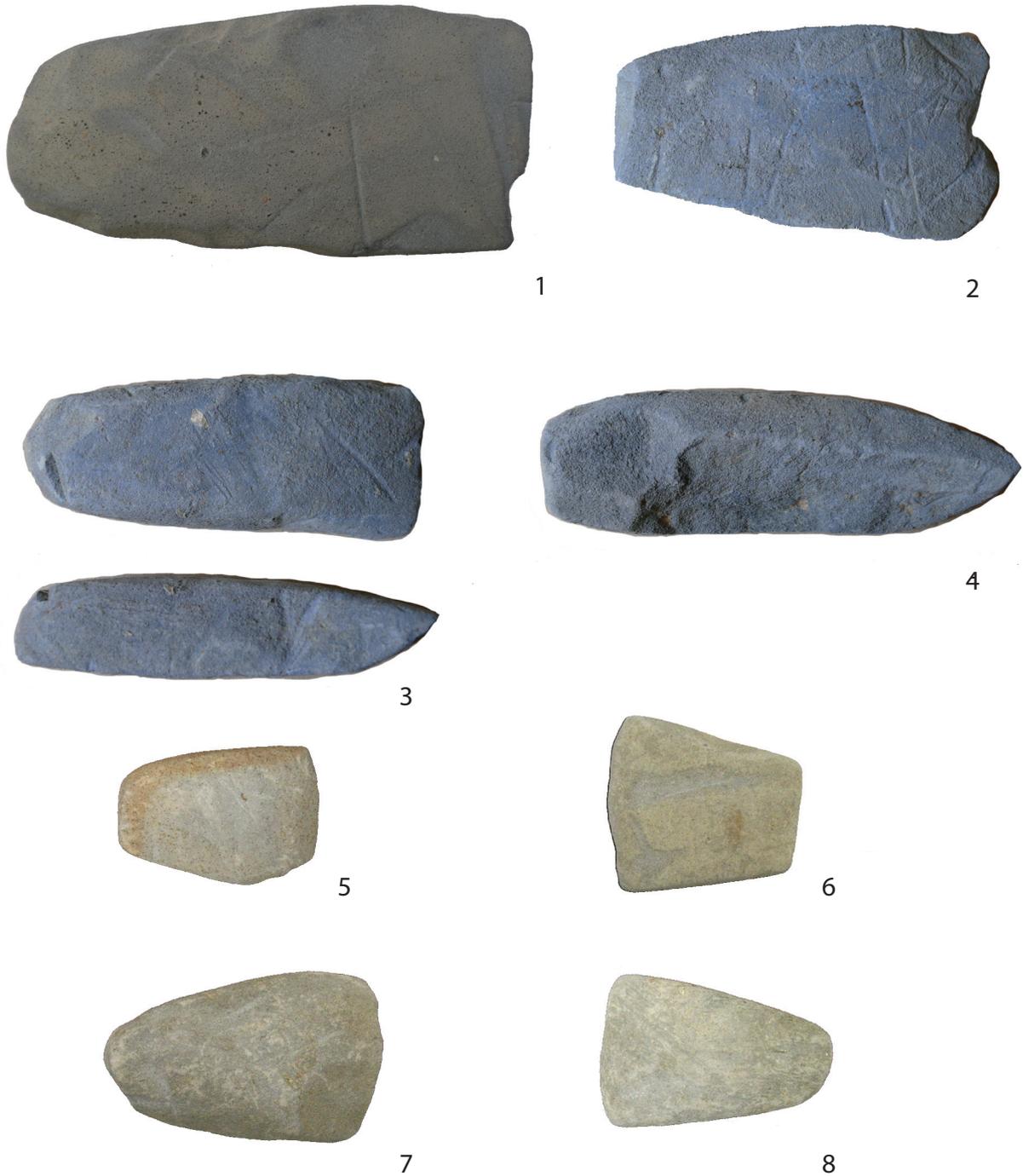


Fig. 6 – Finished polished stone tools made of basalt.

made with pointed or rounded butt, finished also with polishing. Characteristic examples include 66/W/1/88, 66/W/1/93, 66/W/1/96, 66/W/1/97, all of them from Pézsesgyőr.

66/W1/88, Fig. 6.5, dimensions: l: 6 cm, w: 4 cm, h: 1.6 cm, weight: 77 g.

66/W1/93, Fig. 6.6, dimensions: l: 6 cm, w: 5.4 cm, h: 1.2 cm, weight: 70 g.

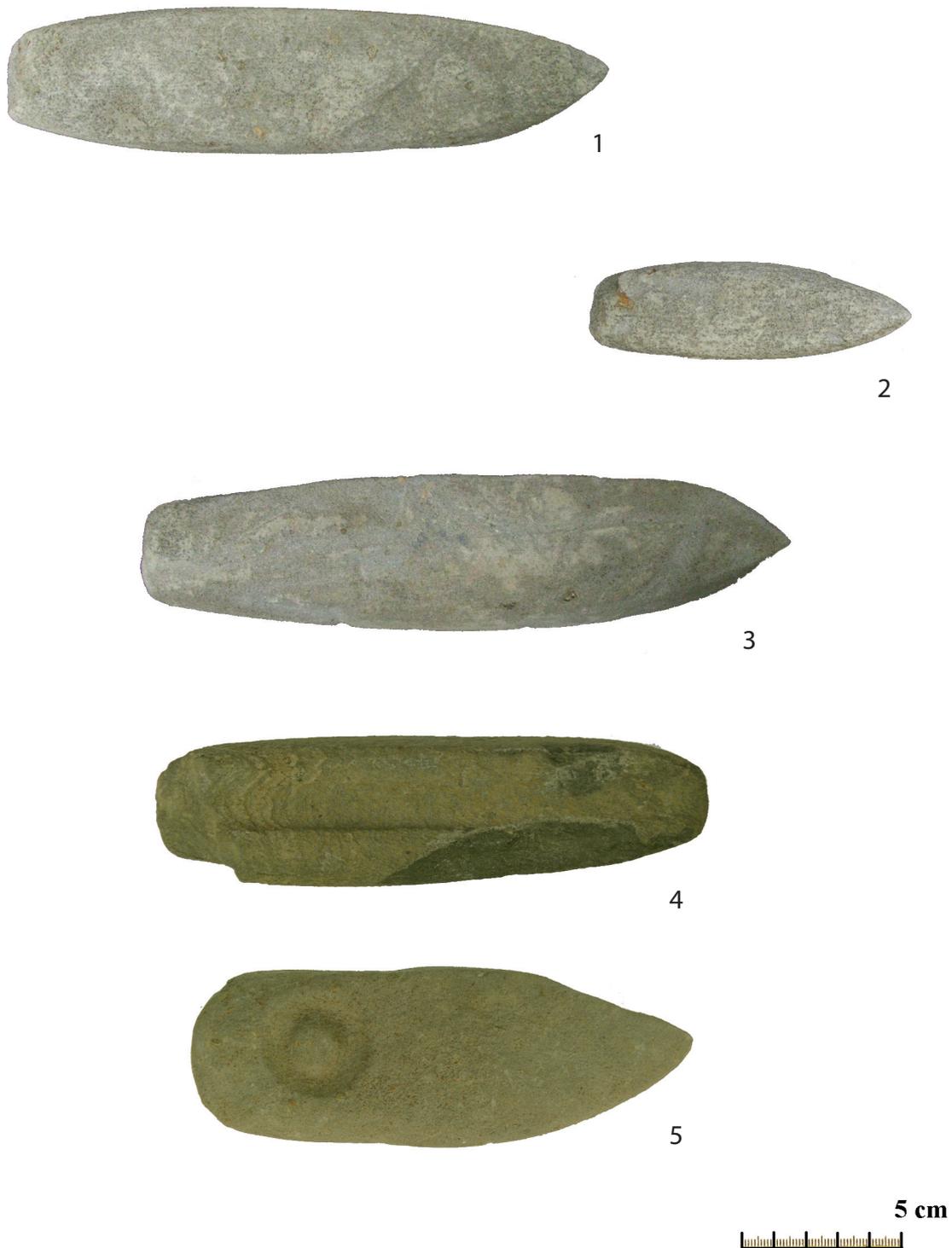


Fig. 7 – Polished stone tools made of basalt with punching technique (1, 2, 3); sawing (4) and preparation of drilling (5).

66/W1/96, Fig. 6.7, dimensions: l: 8.3 cm, w: 5.2 cm, h: 1.7 cm, weight: 128 g.

66/W1/97, Fig. 6.8, dimensions: l: 6.8 cm, w: 4.4 cm, h: 1.5 cm, weight: 80 g.

The blanks of proper shape were probably further shaped by chipping prior to polishing.

In the case of the larger (17-23 cm) shoe-last form tools, used as plane or chisel the processing is the same, the rough blanks were further formed by chipping before the final polish (e.g., Péntesgyőr 66/W1/7, 66/W1/10, 66/W1/95). The corresponding dimensions were 66/W1/7, Fig. 7:1, l: 17.2 cm, w: 3.4 cm, h: 4.1 cm, weight: 458 g; 66/W1/10, Fig. 7:2, l: 18.2 cm, w: 3 cm, h: 4.1 cm, weight: 535 g; 66/W1/95, Fig. 7:3, l: 9 cm, w: 3 cm, h: 2.6 cm, weight: 130 g.

3.2.5. Form shaped by sawing

So far, only one piece was found in the Wolf Collection, the locality is Péntesgyőr 66/W1/108, Fig. 7:4. It is 16.3 cm long, 3.6 cm wide and 4.1 cm high, the weight is 486 g. It is slightly narrowing towards the butt, probably used also as a percussion tool. The complete surface is covered by yellowish brown patina. On the sides we can observe fresh dark grey flakes of injuries. The rectangular percussion surface was made even by punching. On one side of the tool along the complete length of the piece we can find a 2.1 mm deep and 0.4 cm wide marked incision, with small injury towards the butt part. The incision clearly indicates the use of a saw-blade, probably made of wood and applied together with water and sand. We could observe a similar cut on the basalt plate of Veszprém-Kádárta (inv. nr. LDM 49.9780.583.1, ANTONI, 2012, fig. 5.) These cuts stand for the initial phase of the sawing. The Veszprém-Kádárta plate might have yielded similar pieces as the Péntesgyőr tool.

3.2.6. Traces of drilling on finished tools, spoilt pieces and artefacts with secondary utilisation

In all probability, the shaft-hole objects were drilled using elder stems (*Sambucus*

nigra) adding water and sand, starting typically from one side. The top and bottom diameter of the complete shaft-holes is nearly identical and they are relatively large (approx. 3 cm); for this, they needed an elder stem of similar, not much smaller size. These shaft-hole tools are fairly large (16-26 cm long) and relatively heavy used rather as weapons and prestige insignia than tools. They are not suitable for effective working, even as a hammer and we could not locate traces of use denoting potential utilisation on these pieces. On their surface we can sometimes locate traces of chipping e.g. on the adze-form tool from Zirc-Királypatak (81/W1/2, Fig. 7:5, l: 12.7 cm, w: .7 cm, h: 4.3 cm, weight: 476 g). Seemingly the tool-maker was not very happy with the product but still tried to drill it through. The hole was started on the upper side of the implement with a stem of approx. 2.3 cm diameter and reached a depth of 0.5 cm; at that point, a conical inner plug core of 1.5 cm (below) and 0.8 cm (on top) was formed. At this point, the master finally gave it up and the piece remained unfinished or clearly spoiled.

Some characteristic forms are presented here, from Péntesgyőr 66/W1/1, Fig. 8:1, l: 24 cm, w: 120 cm, h: 70 cm, weight: 2924 g, 66/W1/2, Fig. 8:2, l: 18.5 cm, w: 10 cm, h: 5.6 cm, weight: 1519 g, 66/W1/4, Fig. 8:3, l: 15 cm, w: 9.2 cm, h: 2 cm, weight: 1321 g, 66/W1/3 Fig. 8:4, l: 14 cm, w: 9.5 cm, h: 5.5 cm, weight: 1328 g, and from Zirc-Királypatak, 81/W1/1, Fig. 9:1, l: 23.6 cm, w: -11 cm, h: 4.7 cm, weight: 1844 g. The tool 81/W1/8 (Fig. 9:2, l: 21.5 cm, w: 10 cm, h: .4 cm, weight: 2083 g.) was broken to several pieces during the drilling. The diameter of the hole was 2.4 cm, started a bit obliquely, that is, spoilt from the beginning. The drilling penetrated into the rock for a depth of 0.8 cm. Another piece from Zirc-Királypatak (81/W1/9, Fig. 9:3, l: 15.6 cm, w: 7.2 cm, h: 5.6 cm, weight: 1073 g) is the product of the secondary use of a bigger piece with shaft-hole. On the current butt part, remains of a former complete drilled hole can be observed with 2.6 cm diameter. This specimen was also broken into three fragments; according to the patina, during the re-working.

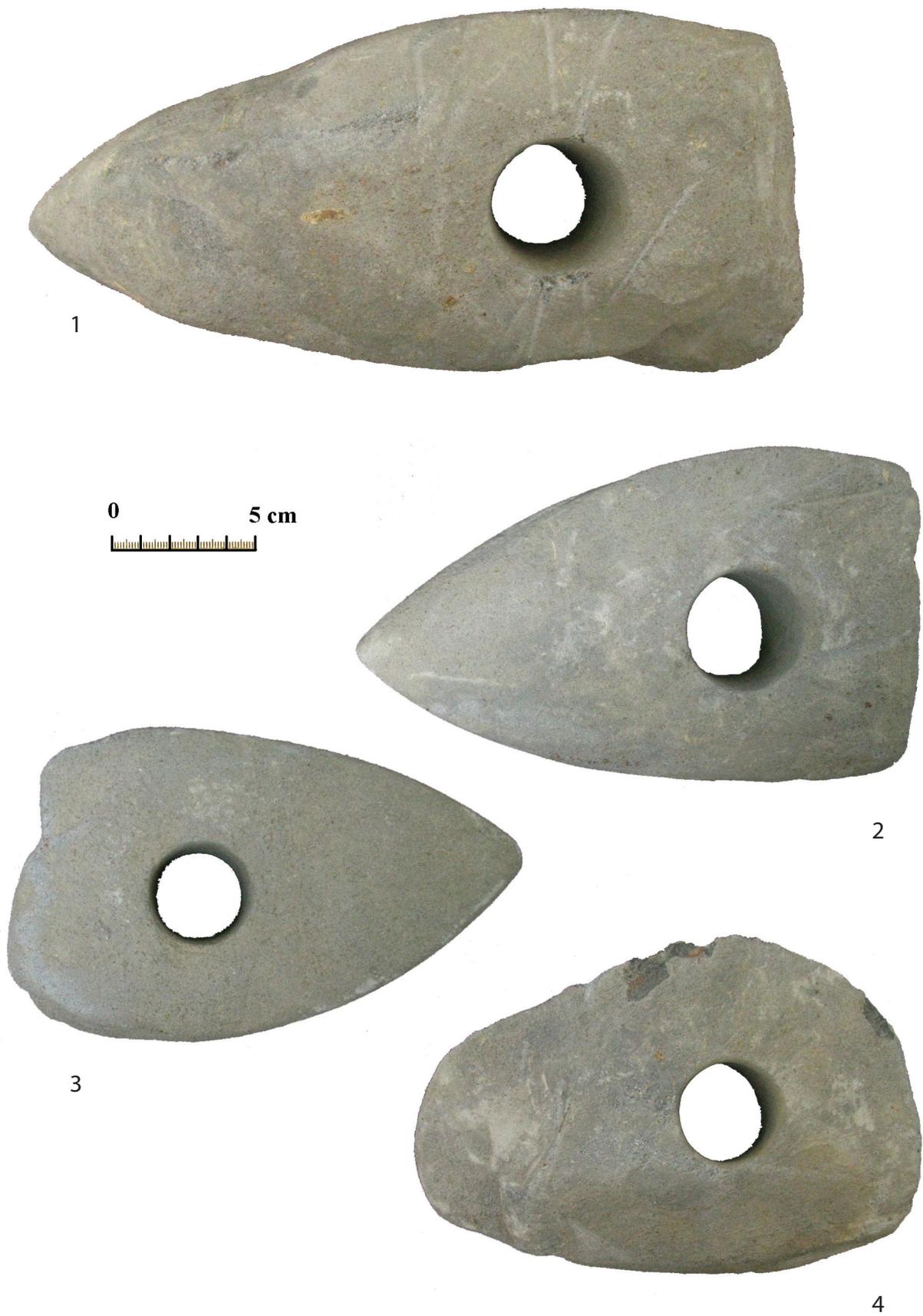


Fig. 8 – Polished stone tools made of basalt with drilled shaft-holes.



1



2



3



Fig. 9 – Polished stone tool made of basalt (1); spoilt and broken pieces (2, 3).

3.2.7. Tools for the production of the polished stone artefacts

The primary form of the tools produced were made first, selecting suitable blanks; then they were further worked by blows and chipping. Punching entered the process at a later stage. For this work, quartzite pebbles were used mainly, and the hard percussion tools show the characteristic traces of these activities. The two presented quartzite hammerstones are from Pénteszgyőr where they are probably local to the settlement. Both of them are basically oval and the traces of use can be observed on the lateral side in a stripe of 2-4 cm with characteristic small rough traces of the punching technique resembling to orange peel. In the course of work the hammerstone was held in hand by the thicker part. On this area the surface is intact or only slightly wrought.

The light coloured quartzite pebble (66/W1/109) is Fig. 10:1, l: 8 cm, w: 7.3 cm, h: 4.5 cm, weight: 401 g., the dark grey piece (66/W1/110) is Fig. 10:2, l: 8 cm, w: 7 cm, h: 4 cm, weight: 358 g.

The other important tool for the production of polished stone tools is the polisher proper, typically made of sandstone. The large polishers (50-100 cm) known from ethnographical evidence mainly, used for polishing large surfaces and setting the proper angle of sides was not found so far in Hungary. This can be explained, probably, secondary use for large boulders – for construction, millstones, etc. On the prehistoric sites we can come across the smaller, hand-held polishers, typically made of fine grained sandstone. They were used mainly for sharpening, honing the axeheads; when used up, they were easily discarded.



Fig. 10 – Tools for the production of the polished stone artefacts; hammerstones (1, 2) and polisher (3).

Such small hone stone is presented here from Porva-Ménesjárás (67/W/2/1) Fig. 10:3, l: 9.5 cm, w: 10.3 cm, h: 3.1 cm, weight: 284 g with a 7.3 cm long, 0.8-0.5 cm wide and 0.5 cm deep, slightly U shape depression for polishing edges. Apart from this long groove, a similar but shorter (ca. 3 cm long) and less deep (0.3 cm) depression is also visible that was in use probably prior to the long groove. The stone must have been a bit larger at the starting of the operation. The other side of the fine sandstone is flat and unused, the edges smoothed: This can be explained that from time to time, the piece had to be immersed into water.

4. RAW MATERIAL FOR THE BASALT AXES

The finished and used polished stone tools comprise several raw materials, notably basalt, greenschist, contact metabasite and serpentinite. They are typical for Transdanubian (especially Northern Transdanubian) Late Neolithic assemblages (FÜRI *et al.*, 2004; SZAKMÁNY, 2009).

Production debris, preforms and raw material blocks for polished stone axes were found exclusively of basalt raw material. Therefore we can suppose that the production of basalt tools took place on these sites whereas other raw materials (greenschist, contact metabasite and serpentinite) were probably brought to the site in finished artefact form.

The basalt raw material used belongs to the young (Plio-Pleistocene) basalts of the Balaton Highland and the Kisalföld (Little Hungarian Plain), respectively (FÜRI *et al.*, 2004). More exact location cannot be given for the time being. In course of the study of the Veszprém-Kádárta depot find (ANTONI, 2012), I. Oláh and co-authors tried to specify the source proper of the basalt preforms and raw material block (OLÁH *et al.*, 2012). They suggested as possible provenance the lava benches of Boncsos-tető (Hegyisd) and its vicinity, not excluding basalts of Hegyestű, Somló and Haláp either.

All these basalt outcrops are more, than a day's journey on foot from the archaeological sites mentioned in this paper; in fact, Veszprém-Kádárta is even further from the sources (Fig. 11, Fig. 12).

5. CONCLUSIONS

Important local production of basalt polished stone artefacts could be spotted on the Late Lengyel sites from Zirc environs. In spite of the character of acquisition (no systematic excavations; collection of field surveys alone), the scale of production is comparable to the known Hungarian polished stone tool production sites: Aszód (BIRÓ, 1992), Sé (BIRÓ, 1984), Zengővárkony (SCHLÉDER *et al.*, 2002; BIRÓ *et al.*, 2003). Preforms and raw material blocks are present on the sites comprising only

	Veszprém - Kádárta (ANTONI 2012)	Pénzesgyőr	Zirc	Porva
Kabhegy	32	35	36	45
Sághegy	80	70	74	66
Somló	50	40	50	52
Hegyestű	41	48	56	60
Boncsos-tető (Hegyisd)	42	49	57	61
Haláp	50	55	65	67

Fig. 11 – Approximate distance of the most prominent basalt sources of the Balaton Highlands and the Hungarian Plain from the sites of the Wolf Collection (Zirc environs).

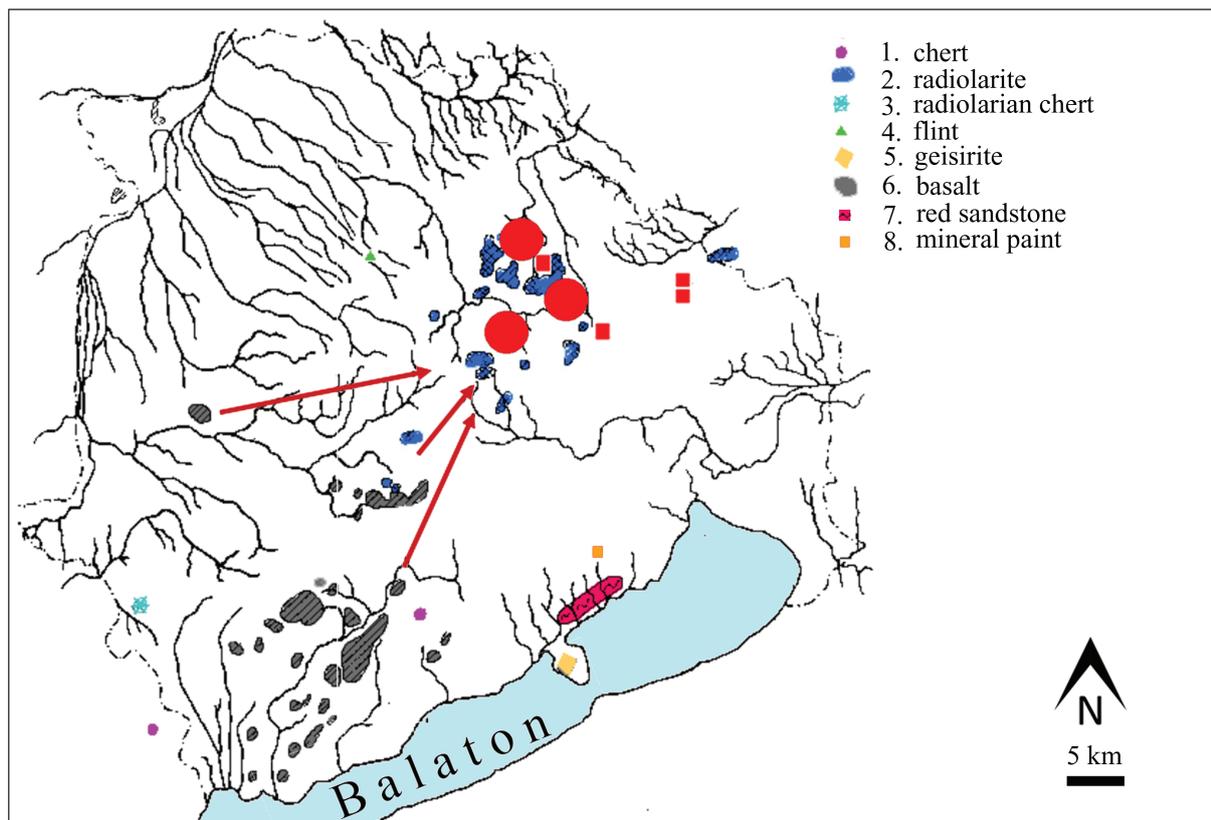


Fig. 12 – Possible provenance for the basalt artefacts in the Wolf Collection.

basalt. These preforms are so far the only known analogies to the depot find of Veszprém-Kádárta (also known as Gelemér or Litér junction). The actual basalt outcrops are in a distance of at least 40 km (or more typically 40-60 km) from the localities.

Other polished stone raw materials were imported to the site in ready-made form including exotic raw materials like greenschist, serpentinite, contact metabasite and even jadeite.

The sites presented here can be assigned to workshop districts II and III, respectively, in the terms of Biró & Regenye (2003).

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