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MEDIEVAL FIREARM MOULDINGS FROM VISEGRÁD (HUNGARY)

Preface

The archaeological relics of the city have been tarnished because of the magnificence of the castle and palace in Visegrád, but there were lately possibilities to explore the buildings and objects, therefore we became a clearer picture of late medieval life in Visegrád¹. Several artefacts and objects had been discovered earlier, that told us about medieval handicrafts. Gergely Buzás and István Kováts excavated a workshop survival in 2006, which artefact is inserted in this line². The workhouse is datable for the first third of the 15th century on the basis the turned up coins and the stratigraphy, it is a unique artefact in Hungarian archeology with the smelter and artefacts inside.

The excavation

The date of the excavation was 2006, when there was a rescue excavation on the plot in Fő street 73. (Fig. 1)³. There used to be a house on this plot before and they would build a new one with a basement, so there was an opportunity to explore the area. The basement of the proposed new house was excavated with four square during the excavation, while ground-penetrating radar mensuration was made with negative result on the eastern side of the plot. Several archaeological periods and objects were seized on the area of the four segments from the beginning of the 14th century until the 18th century.



Fig. 1. The reconstruction of 15th century Visegrád. After O. Mészáros 2009, p. 287.

¹ Latest summary of archeological and historic research of the town see: O. Mészáros, *A késő középkori Visegrád város története és helyrajza (The history and topography of late medieval Visegrád town)*, Visegrád 2009.

² The excavation made by Hungarian National Museum King Matthias Museum (Visegrád).

³ Present article deals only with the excavation of the lower part of the plot since the upper part was excavated in 2006. On the upper part of the plot, close to the hill – Fő street 69-79 – a church of Visegrád from the Late Middle Ages can be found where archaeological excavations took place many times. For identification of excavation taken place on the upper part of the plot see: G. Buzás, *Visegrád egyik középkori templomának feltárása (Excavation of a Medieval church from Visegrád)*, „Műemlékvédelem”, Vol. 2007/1, pp. 43-54; G. Buzás, O. Mészáros, *A középkori Visegrád egyházainak régészeti kutatásai (Archeological research of churches of Medieval Visegrád)*, „Magyar Sion Új folyam”, Vol. 2 (44), 2008/1, pp. 92-97; O. Mészáros, *op. cit.*, pp. 46-48 and 206.

The found archaeological feature and objects start at this place in the 14th century, sith archaeological substrate has not been found from the previous Arpadian Age⁴. A pitched way belonging to the first half of the 14th century, east from the object there is a round superstructure with hedging wall, two cesspits and a burnt faced walkaway.

The road surface has been refilled around the middle of the 14th century and a soled timber house was built on it with a stone-oven.

⁴ A copper pierced coin by III. Béla (1172-1196) Hungarian king, was found at the excavation area but it has to regarded as side artefact.



Fig. 2. View of the workshop with the found objects/places.

The next period is placed in the first third of the 15th century, when a piling was built vice the timber house, and it was used by as a brazier-workhouse. They found inside the workhouse three dinky smelters and one stove (Fig. 2).

This workhouse was terminated during the 15th century and a timber house was built again, which one could L-shape and ballast covered the yard. A way ran along in this period – in the 15th-16th centuries – on the northern side of the building, which one went to east to the church. The main street of the city settled down west from the building. An other timber house was visible east from the building, which stood in the end of the 15th – beginning of the 16th century.

The buildings were perished in the Turkish period, and a farmhouse was built next time in the second half of the 18th century and it was improved several times⁵.

⁵ Brief overview about excavated objects: G. Buzás, *op. cit.*, p. 45 and the preliminary report of the excavations: M. Varga, *Előzetes jelentés a Visegrádon feltárt bronzöntő műhelyről (Preliminary report about excavated bronzemoulding workshop from Visegrád)*, „Altum Castrum Online”, 2012: <http://archeologia.hu/content/archeologia/59/varga-m-visegradi-bronzontomuhely-1.pdf>.

The findings

On the excavation were dredged up rich and various findings, part of the material can be connected to the workhouse, other part of the material could get to the upper fill lamina of the workhouse.

Numerous iron findings are known from the excavation, but they have not been restored yet, that is why we cannot tell a lot about them. There are several more or less spurs, horseshoes, keys, locks, hinges, chisels, knives, hooks and buckle in this category classified.

We can find in the copper- and bronze objects several buckles, jewelleryes and accessories – rings, chaplets, studs, pins, strap ends – with varied forms and functions. Three lead seals were found on the excavation, and one of them has been ascertained. The lead seal was set on a baize baleand, which came from the city of Tournai (Flandrien, today Belgium) to the territory of the Hungarian Kingdom⁶.

⁶ M. Varga, *Késő középkori érmek Visegrád Fő u. 73. lelőhelyéről, és előzetes anyagvizsgálati eredményeik (Late medieval coins from Visegrád, Fő street 73., and preliminary results of material testing)*, 2011, pp. 13-15 (manuscript, in press). Similar lead seal known from Solt-Tételhegy: J. Szentpéteri, *A solti Tételhegy*

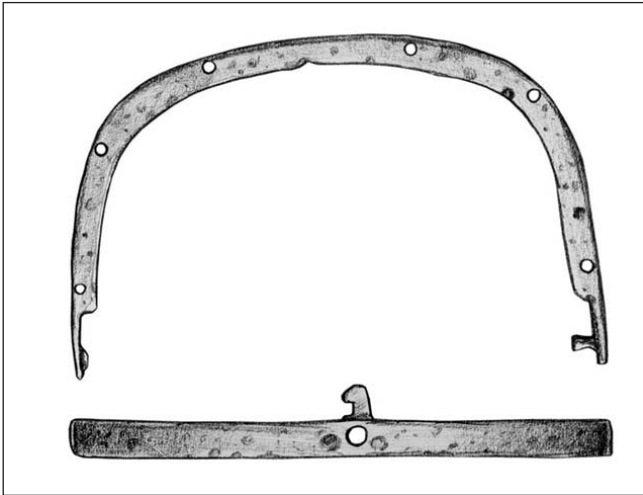


Fig. 3. One half of a brass sabretache's lock. Drawing by Zsolt Nyári.

A bronze candelabrum, thimble, pins, bronze plates and silver, bronze and lead ornaments are listed here. One half of a bronze sabretache is an unwonted and special find (Fig. 3). The object is U-shaped, there are 5 holes in a round and the studs are already missing from it. Leather or some weft was fixed to the studs. From the interlock of the sabretache left a hooked ending, it was probably cut in the missing other loopy side. Two little studs are found on the two sides of the object, with which one would the other half of the object is fixed and it made of the open the sabretache⁷.

Large and various pottery were turned up on the excavation. Jars and mouldjars are surely switched to the workhouse. Graphite triangular mouldjars turned up usually from goldsmith workshops⁸. They turned up here too in different sizes (several jar splinters), they were jars for metal smelting and casting (Fig. 4). Different shaped, rounded jars turned up too (half a dozen complete and fragmentary pieces) (Fig. 5), which probably were not used for smelting and casting⁹. The so-called „table ware” (pots, lids, cups,



Fig. 4. Pieces of a large graphite material melting pot.



Fig. 5. Small round jar.

története az őskortól napjainkig (The history of Solt-Tételhegy from prehistory to present days), „Múzeumőr”, Vol. VIII/1., (2010 tavasz) p. 6, and Verbal Communication by György V. Székely.

⁷ The closest relation to the object can be found from the findings of Bajcsa castle. From these findings two have the same shape but the sabretache locks were made from iron: L. Vándor, *The iron, wood and ivory objects of Bajcsa Castle*, [in:] *Weitscha/Bajcsa Fortress. A Styrian-type Fort in Hungary during the Second Half of the Sixteenth Century*, ed. Gy. Kovács, Zalaegerszeg 2002, pp. 87 and 129.

⁸ From the excavated graphited jars experts can conclude the function of a workshop or the work of goldsmiths. But many times only objects are found at the plots not buildings therefore only these findings can prove the existence of a goldsmith workshop.

⁹ We know similar jars from the royal palace at Visegrád, as well as from Péter Gróf and Dániel Gróf excavated glass maker workshop (Visegrád, Fő street 34.) P. Gróf, D. Gróf, *Az üvegmunkálás középkori emlékei (Medieval relics of the glass-working)*, [in:] *Középkori üvegek (Medieval glasses)*, ed. E. Mester,

glasses, bowls, mugs, jugs, glazed pots) set out the bigger segment of the pottery material. The pottery types of the period – 14th-15th centuries – are in evidence here too,

Visegrád 1997, pp. 7-8, fig. 363-364. Similar jar is described from Buda castle Imre Holl: I. Holl, *Mittelalterliche Funde aus einem Brunnen von Buda*, Budapest 1996, p. 42, fig. 6:10.



Fig. 6. Stove excavated from the norther part of the workshop.

and the material shows similarity with other pottery findings from Visegrád. Tiles of stove and stove decorations turned up relatively in force. We can find in the previously vessel-, mug-, and onion-shaped, but in the late age from the period of King Sigismund, and stoves from Anjou-period. The turned up tile of stove prove that there was not fancy stoves only in the palaces and castles, in cities and in house of well-off citizens.

Finds, wich suggests bones processing were found on several places of the excavation area. Stumpy cowshank ends, wrought, scoury bones signify, that bonebeads were made, but they probably made other products too. It probably isn't about permanent bonesprocessing workshop, they rather occasionally made boneproducts.

Glasses were found – in fragmentary state –, they can find cups, bottles and vials in these. We can find better quality product from Venice (or Venice's shaped home made), but it occures lower quality regional product.

Rich coins material has been published on the excavation¹⁰. We can find coins from the reign of Lewis (I.) the Great to Władysław II., which mostly throw back the money circulation of the period. The content of the materi-

als was made on the coins. The test was tended primarily to stipulate the exact content of the materials of the late medieval coins (mostly silver and silver-copper alloy), the provenance, on the strength of we could stipulate the coins without any mark of the mint.

The workhouse

A yellow loamy trampled surface is perceptible in the whole workhouse, from where, or rather from the fill stratum came up lots of charcoal, molten copper, copper slag, jars and mould parcels. The workhouse remains were seized mostly in the 2006/4. square, but it reached to the 2006/3. square. The mounting walls were built of wood, the workshop could open the east. Some serious stone building may have belonged to the workhouse, but unfortunately this one hasn't been explored yet. In the north end of the square came up an oven (Fig. 6), in which one could happen the re-temper of the bronze. From this way came up the smelter Nr. 1. in the south, with southern orifice. The smelter Nr. 2. was found southwest from the oven, with northern orifice. The smelter Nr. 3. was found southwest way from the other two, with something like wester orifice (Fig. 7).

All of the three smelters show roughly the same structure: they were built of bricks, square-shaped, they were scooped in the ground, their size is 30x40 centimetres, their remaind height is 30-40 centimetres. The smelters

¹⁰ Previous studies on composition and detailed processing of collection of coins see: M. Varga, *Késő középkori érmek...*

are unique finds in our country, because to our knowledge, in the territory of present-day Hungary haven't been excavated such smelters yet¹¹. Their identification happens mostly about written sources¹². According to the opinion of the visual and written sources, to the revealed smelters belong so called shaft-furnaces, this one included the streaming-furnaces, from which the molten material permanently flew to the fore-oven. The more exact definition of the smelters (in the scientific bibliography these are called the „pests” as well) is: copper-refreshing furnace or binary alloy-furnace of copper and plummer (Fig. 8). The copper is smelted in these with the help of plummer, silver-scum and charcoal, then it is alloyed with plummer and tin. After it the bronze will be poured into loaf-shaped moulders. Smelters signify shallow furnaces with an open breast, where there is a nose-opening in the back wall of the smelter and a tap on the front side for the smelted metal pouring out. The spandrel of the smelter was built maximum 5 feet high (approx. 150 centimetre)¹³ for putting in the smelting material easily. According to the contemporary sources their inner size had to be approx. 50x62 centimetres and the furnace used to broaden upwards¹⁴.

The moulds

The moulds made of clay were excavated from almost every part of the plot. Generally speaking these artefacts were excavated in a fragmentary condition; this made their identification more difficult. Firstly we thought that it was about moulds of a kind of tube and as it turned out later, we had not been so far from the truth. The identification of the findings was hard, because such things have not been discovered yet – at any rate we don't know something like these from published assemblage. Among the moulds there are some smaller ones and bigger ones as well, their cross-sectional view is a circle, a square or hexagonal; that's why we can suppose that during the excavation were found the casting moulds of several objects (Fig. 9). Every mould could be put



Fig. 7. Smelter Nr. 1.

together from two pieces. Then in the middle of this cylindrical mould was placed another cylindrical-shaped tube, this one gave the round form from inside. So the smelted bronze could be poured from above into the mould, this way was produced the tube. On the bottom or on the top of the mould was taken a clay-plug to prevent the bronze pouring out or the contamination coming in. After this, when it was necessary, the inside of the tube could be formed by perforation, respectively the superfluous materials (burrs) during the moulding were taken away from outside.

Several metal objects were tested by Zoltán May (Hungarian Academy of Sciences – Institute of Materials and Environmental Chemistry) and Mária Tóth (Hungarian Academy of Sciences – Institute for Geological and Geochemical Research) with the XRF (X-ray fluorescence) investigational method. The content of the materials by one of the objects – there was some bronze molden stuck in the mould – was 70% copper and 17% tin. An other similar moulding-piece contained 62% copper and 13% tin. In addition both mouldings contained in a smaller quantity zinc, stibium, plummer, nickel and iron. On the strength of this we can state that for the moulding it was used the so-called potin, which was very current in the Middle Ages, inter alia these proportions were used by the moulding of churchbells. In our days by the moulding of churchbells the requirement of the proportion is even 77-80% copper and 20-23 tin¹⁵.

¹¹ Presumably a similar function but different shaped (round) smelter was excavated by Emese Lovász and Miklós Makoldi at Diósgyőr-Várfürdő in 2006, the findings are dated to the 16th-17th centuries. Verbal Communication by Miklós Makoldi and E. Lovász, *A diósgyőri vár (Diósgyőr castle)*, „Várak, kastélyok, templomok”, Vol. 2008/2, pp. 4-7.

¹² Mainly based on the works of Theophilus elder and Georgius Agricola: P. Theophilus, *A különféle művéségekről (On various arts)*. With the notes and preface of V. Takács, Budapest 1986; G. Agricola, *Tizenkét könyv a bányászatról és kohászatról (De re metallica)*. Translated by R. Becht, ed. L. Molnár, Budapest 1985.

¹³ Foot – metre unit, there are many different types but the most frequently used is 1 foot=31,6 centimetre.

¹⁴ G. Agricola, *op. cit.*, pp. 372-376, 404-406, 502-505, Figs. 198 and 253. The work of Agricola was born almost 100 years later then the operation of the workshop, nevertheless, this is the most useful source. The workshop, stove and smelter descriptions are not quite the same as the ones found in Visegrád. Further studies are in progress.

¹⁵ E. Benkő, *Erdély középkori harangjai és bronz keresztlőmedencéi (Medieval bells and bronze baptismal fonts of Transylvania)*, Budapest-Kolozsvár 2002, pp. 35-47.



Fig. 8. Copper and lead combining furnace. After G. Agricola, 1985. fig. 253.

About the early firearms

The first memoirs about the early hand-held firearms are dated back to the middle of the 14th century, as long as in Hungary we know the first memoirs about these from the end of the 14th – from the beginning of the 15th century. These arms were smaller than cannons, so we cannot regard these ones as real hand-held firearms, either. These were principally a transition between the two types, probably that is the reason why these weapons were called handguns. Their firepower was small yet and it was impossible to shoot punctually with them. The handgun was not very useful in a battle, that's why it was rather used by the siege. The enemy was frightened first of all by the explosions, the fire and the smoke. Later, in the 15th century even the horsemen began to use this type of weapon. The early arms were made from copper and iron, later this place was taken over by the bronze. In those times it could not be moulded from iron without any air-bubbles. But at the beginning of the 15th century it was turned back to the wrought iron tubes. The majority of the early arms was laid on a sort of stand or platform (more often on a wooden one). Mostly it was all about dinky ones, which were fixed to the platform with a band or it was put a haft into the empty tail of the gun¹⁶. In the opinion of the experts the gun of Tannenberg was the oldest one before, but it has been discovered ultimately a similar gun

made from bronze in the castle of Otepää (Estonia), which is dated back to the year of 1396, so far this handgun is the oldest hand-held firearm¹⁷. The latest elaboration of the Hungarian hackbuts is the work of István Figura, whereas the bronze guns from Poland have been resumed recently by Piotr Strzyż¹⁸.

We cannot take cognizance surely of it which type of arms the excavated moulds in Visegrád belonged to. In the Hungarian assemblage almost every manual bronze firearm is fragmentary. The length of the barrel by the only undamaged piece (Mostar) is 56 centimetres, whereas the other ones are 6,3–11,5–30 centimetres long. These were excavated in Visegrád, in Vác and in Nagykanizsa, and the station of either of them is unknown. Every barrel is octagonal, their calibre is between 11-13-16-18 millimetres¹⁹. There are more possibilities, because among the moulds there are some ones with round and octagonal cross-sectional view as well. But it seems to be sure that we have got such a hand-held firearm made from bronze, which size is smaller than the iron-made ones, and only one person might use it. The barrel

¹⁷ A. Mäesalu, *Weapons in Otepää castle in 1396*, „Castella Maris Baltici”, Vol. V, 2001, pp. 93-94.

¹⁸ I. Figura, *Harquebuses in Hungary*, Thesis, PTE BTK Department of Archaeology, Pécs 2010; P. Strzyż, *Einige Bemerkungen über mittelalterliche Feuerwaffenwendung in Polen*, „Studia Universitas Cibiniensis, Series Historica” Supplementum No. 1, 2011, pp. 139-145.

¹⁹ K. Kozák, *A magyarországi szakállas puskák fejlődéstörténetéről (From the Hungarian harquebuses genetic)*, „Archaeologiai Értesítő”, Vol. 101, 1974, pp. 290-291.

¹⁶ J. Lugs, *Handfeuerwaffen – Systematischer Überblick über die Handfeuerwaffen und ihre Geschichte*, Vol. 1, Berlin 1982, pp. 11-14; J. Kalmár, *Régi magyar fegyverek (Old Hungarian weapons)*, Budapest 1971, pp. 192-193.

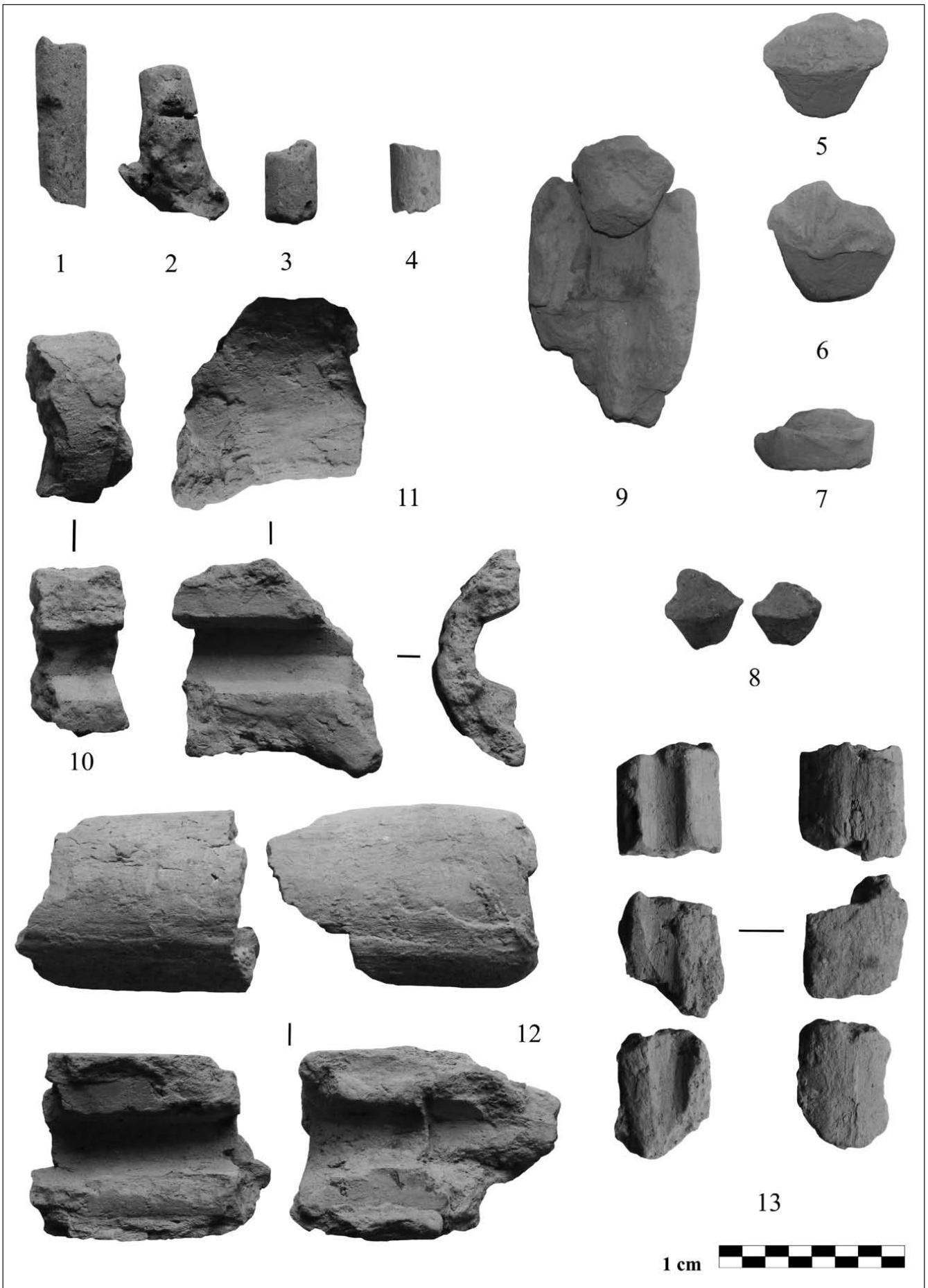


Fig. 9. Mouldings.

might attenuate from the end to the muzzle and probably it could be a muzzle-loading one. Its calibre might be between 19-24 millimetres. There are some pieces among the mould-fragments which ones have not succeeded in already identifying, so we can attempt yet the whole reconstruction.

Conclusion

Several branches can be attached to the metal-work in Visegrád, and we have got for almost everyone archaeological data. We know a blacksmith, a moneyer, a bell founder and a goldsmith as well²⁰.

There are several objects in the assemblage of the workshop that suppose the existence of a workshop for bronze casting/bronzesmith/weapon-smelter. The several dozens of crucibles and melting pots in different sizes and forms, workshop garbages and castings, together with the more than fifty casting moulds refer us not only to the creating of smaller works, but of barrels (maybe hand-held firearms too) in this workshop in the first third of the 15th century. Several sources can testify that the firearms were already in use in the first half of the 15th century, these sources mention among others gunsmiths and weapon-smelters in Košice

(Kassa) and in Bratislava (Pozsony)²¹. Barrels became harder and more solid when copper was alloyed with tin, it is proved by the material content tests of the castings as well. The barrels were made from potin like the majority of the medieval churchbells.²² Moreover was going on in the workshop occasionally the forgery of coins of Sigismund's Age²³, and it could be make some smaller bronzesmith-works too. During the putting down of the oven – more exactly below the fireplace – was turned up a coin from the period of King Sigismund too, and so we can state that the fireplace together with the furnaces and the working of the workshop could not be in function earlier than the 1430s.²⁴

In the Hungarian archaeological assemblage it have not been proved so far similar excavated smelters and such workshops specialised for making guns – only a cannon-founder workhouse is known -, so the excavated workhouse in Visegrád dated on the first third of the 15th century is a unique artefact in the medieval archaeological research anyway. The particular elaboration of the assemblage is expected further on in some minor and major studies and monographies.

Translated by Katalin Horváth and Krisztián Szigetvári

Streszczenie

Średniowieczne formy odlewnicze broni palnej z Wyszehradu (Visegrád) na Węgrzech

Pracownię metalurgiczną w Visegrádie tworzyło kilka działów (zakład kowalski, mennica, ludwisarnia i warsztat złotniczy) i prawie dla każdego z nich dysponujemy danymi archeologicznymi. Wśród odkrytych w pracowni znajduje się kilka takich, które świadczą o istnieniu w tym miejscu odlewni brązu i broni oraz kowalstwa brązowego.

Kilkadziesiąt tygli i naczyń odlewniczych o różnych rozmiarach i formie, odpadki produkcyjne i odlewy, razem z ponad 50 egzemplarzami form odlewniczych świadczą o produkcji w tym warsztacie w 1. tercji XV. stulecia nie tylko drobnych przedmiotów, ale także i luf (najprawdopodobniej broni ręcznej).

Kilka źródeł pisanych poświadczą użycie broni palnej w 1 poł. XV w. Wspominają one także o kowalach i odlewnikach wytwarzających broń palną w Koszycach i w Bratysławie.

Z przeprowadzonych badań wynika, że lufy stają się bardziej wytrzymałe, kiedy miedź łączy się z cyną, co zostało udowodnione na podstawie analiz próbek odlewów. Lufy produkowano z spiżu, podobnie jak większość średniowiecznych dzwonów.

W omawianym warsztacie sporadycznie również fałszowano monety Zygmunta Luksemburskiego oraz produkowano mniejsze przedmioty z brązu. Podczas eksploracji pieca, dokładniej pod paleniskiem,

znaleziono monetę z czasów króla Zygmunta Luksemburskiego, co pozwala stwierdzić, że pracownia nie może datowana wcześniej niż na lata 30. XV w.

W materiałach archeologicznych z terenu Węgier nie ujawniono, jak do tej pory, podobnego warsztatu i pracowni specjalizującej się w produkcji broni; znani są natomiast tylko wytwórcy broni. Opisany kompleks z Visegrádu, datowany na 1. tercję XV w., jest więc odkryciem unikatowym. Planowane jest szczegółowe opracowanie zbioru znalezisk w mniejszych i większych studiach i monografiach.

²¹ F. Temesváry, *Pisztolyok. A Magyar Nemzeti Múzeum tűzfegyver-gyűjteménye I. (Pistols. The Hungarian National Museum's fire weapons collection I.)*, Budapest 1988, pp. 14-15; K. Kozák, *op. cit.*, p. 298, K. Kozák, *Magyar nyélbeütős szakállas puskák (Hungarian harquebuses with stocks)*, „Folia Archaeologica”, Vol. IX, 1957, p. 167. Even Kozák Károly noted that in the beginning of the 15th century the production of bronze made hand-held firearms started in the Hungarian Kingdom. There are accounts about it.

²² From the collection of Visegrád Museum we know pieces from bronze harquebuses firearms: Inv. nr.: 55.4564. and 61.7.9.15.

²³ M. Varga, *Késő középkori érmek...* Flat, small and round pieces were cut out from the copper plates which were made into fake coins with the help of coining die. Parvus, quaring and denarius sized flat discs were cut out from copper plates.

²⁴ Inv. nr.: 2010.1.1.28. CNH II. 124. A, H 578. (CNH II.= L. Réthy, *Corpus Nummorum Hungariae. II.*, Budapest, 1907; H=L. Huszár, *Münzkatalog Ungarn von 1000 bis Heute*, Budapest 1979); This coin of Sigismund was minted only from 1427.

²⁰ O. Mészáros, *op. cit.*, pp. 39-41.