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Ashlar Dressing of the Romanesque Houses in the Agglomeration below the Prague Castle

ANNOTATION

The study of building stone dressing is still a new discipline, which is currently based on evolving methods of mechanoscopy and tool marks analysis. This article presents the initial results of a project systematically mapping the stone dressing in the Prague territory from the earliest structures to the present. Presented is the reconstruction of stone tools in various periods and the work with them, along with stone dressing practice during the construction of Prague Romanesque houses – a phenomenon that has no comparison in the Central Europe. Documentation of the processing of the construction material reveals the craft techniques of the late 12th and the first half of the 13th century.

SUMMARY

The presented text is the result of a project analysing tool marks on building stone blocks. From the long building history of Prague historic cities, a small but typical group of early medieval residential buildings was chosen, i. e. Romanesque houses of ashlar masonry. The main stone of Romanesque Prague was opuka, a Mesozoic rock of Upper Cretaceous series, which occurs in the vicinity. According to the written evidence from the 12th century, opuka was quarried mainly from the nearby Petřín Hill. Opuka has been used in the construction of a large number of sacral buildings, in the area of Prague Castle since the 9th century. In addition to opuka, sandstone was also rarely used.

Identification of stonemason's tool marks in historical contexts was pursued by the study of the marks left on the stone and subsequent reconstruction of the tool and its blade, as well as the work process itself. Mechanoscopy method was used for the evaluation. The tool marks examination aims to reveal the process and approach of the historical craftsman to the given product. However, the interpretation of the masonry tool marks requires control, which is only possible by experimenting with the appropriate tool. Therefore, copies of the mason's tools are created in order to simulate the way they are handled (Fig. **6**). Each tool mark, if clearly legible, can be identified and assigned to a tool. When identifying the tool mark with the blade, we pay attention to the identification of the part of the blade used, as well as to the correct determination of the part of the artefact being dressed. In the Czech environment, the English term "axe" (Cook 1999) is used for masonry tools, but also German terms die Fläche (Fig. **7**) or Spitzfläche. In their hypothetical reconstruction, we often rely on iconography or preserved stonemasonry tools.

In Prague, in addition to the church buildings and a bridge, more than 70 residential houses from the 12th and 13th centuries are recorded. According to the type of construction and its location on the plot, three basic types are distinguished: a house by the street, a house in the depth of the plot apparently serving as a kind of a safe, and stately palace-type houses. The first two types presumably served to the merchants, the third type was a kind of city seat of members of the church or secular land elite. When searching for their possible construction patterns the Strahov Monastery is usually considered since the Roman foot was applied as the basic measuring module and identical architectural elements occur. The question of a possible influence in the way of dressing the stone, of course, arises.

The period of Prague Romanesque houses construction lasted approximately for one century, from the early 12th to the first half of the 13th century. Tool marks in six of them were examined. In the exceptional house No. 16/I the documentation and subsequent analysis found three different types of masonry stone dressing, ranging from the simplest to the most special. The first type covers common ashlars used for building the perimeter walls (Fig. **9**, **10**); ashlars of the second type formed the jambs or quoins of niches in the walls (Fig. **11**, **12**) and portal quoins (Fig. **13**), and the third dressing type was used on cuboid sandstone capital and column originally bearing the vault of the central square room (Fig. **14**).

The faces of the two ashlars of the perimeter masonry (Fig. **9**, **10**) are dressed in a similar way, especially in the three initial stages. In the first phase, the stonemason cut the opuka with a hafted tool, probably a double point hammer or an axe with a point. In the second phase, the future face was determined, the dressing of which was started on two opposite sides by cutting out the perimeter margin only with the tip of the axe edge. In the third phase, the strokes of the point within the future face area removed the protrusions of the stone. In the fourth phase, the final area of the face was levelled with diagonal strokes at a relatively acute angle. The central part was cut with an axe held almost vertical, so the cut marks are disproportionately shallower. However, significant chipped depressions remained on the face after the rough dressing by the double-point hammer in the third phase. This is one of the most typical ways of dressing an ashlar block used in Prague Romanesque houses. On the second block, the face was cut in the fourth phase with an axe with a flat blade about 5 cm wide. Cutting was carried out from one place in parallel rows, which when using a hafted tool creates a fan-shaped marks. There are two options for the types of tools used. Either a double point hammer was used for the rough phase and then a flat-edge axe or an axe with a point, respectively the pointed part of this tool was used in the first phase, and then the tool was turned and the final surface was redressed with a flat edge.

The project analysis soon revealed that the stones of the examined masonry of Romanesque houses were dressed mainly with the basic masonry hafted tool, i. e. the axe with a point. It was routinely used not only for rough processing of the block, but also for its finer final levelling. Common use is clearly indicated by the regular combination of two types of edges (pointed and flat blade). Of course, the hand chisel was also used, mainly to create a perimeter margin, but the chisel still occurs in a much more limited form than the stonemason's axe. The perimeter margin, which played a role in Roman architecture not only technologically but also visually, becomes strictly only a technological delimitation of the face area. The final levelling of the surface also often cuts over the margin.

The building material, mostly described as quarry opuka, broke off naturally in layers (Fig. **3**) Yet it was carefully worked – especially on the joint surfaces, which were eventually covered with mortar. The effort to level the surface from unwanted protrusions has been recorded at the earliest Prague church buildings (e. g. the Church of the Virgin Mary, the Monastery of St. George). Using an axe with a flat blade, the stone surfaces were gradually levelled from the corner towards the centre (Fig. **29**, **30**). The form of the perimeter masonry is also determined by the position of the stone during the dressing. In the first way, the stone is fixed with its face in a horizontal position and the flat-bladed axe cuts the surface at an angle of a maximum 45°, sometimes even vertically. This is the basic dressing of the ashlar faces in Prague which occurs in Romanesque buildings (not only houses) throughout the whole period of their construction; no progress has been observed in it. The most typical example is shown in Fig. **9**. Second type of dressing used in the Prague area is again by the flat-blade axe, but this time with the front surface tilted so that the stonemason does not cut vertically, but at a slight angle. This results in wider grooves. On many stones, the margin remains preserved, which in the previous way did not. In Romanesque houses, this style is recorded mostly in reveal quoins of openings and niches, where the margins are usually respected (Fig. **11**). The third dressing way was identified on quoining of the reveals and openings in the masonry, where the ashlars are not cut of opuka, but of sandstone. The face of the stone was gradually chiselled with a regular margin around the block and then levelled again by a chisel in parallel rows, even across the side margins (Figs. **12**, **13**).

All the mentioned methods of dressing the ashlar surfaces are typical for the whole construction period of Romanesque buildings in Prague in the 12th and first half of the 13th century. This almost uniform style of work may evoke the idea of the existence of stonemasons' workshop or guild bringing up stonemasons. Although new craft impulses were coming to Prague at that time, the research showed that their practices had not become dominant here. An example is the above mentioned construction of the Strahov Monastery, commenced in the 1140s. Foreign influences are manifested here by different dressing of the ashlar faces and tools, the use of which has not yet been registered in Prague. New techniques have been documented in niche lintels, quoins, or more sophisticated columns with capitals. Their faces are characterized by wide margin and careful parallel strokes with an axe or adze. The identified tools are of two types, both new for Prague. The first is an adze-shaped tool, characterized by a double blade, one axe-shaped and one transverse, adze-shaped. The second type was toothed tools (Fig. **33**). Although these tools were quite often used west of the Bohemia, their use has not yet been found in Prague, with the exception of Strahov. The expected influence of the Strahov Monastery on the construction of Prague Romanesque houses has therefore not yet been confirmed in the stone dressing technology. In the discussion of possible foreign influences on Prague Romanesque buildings, a paragraph from the "Vyšehrad Canon Priest" chronicle is often quoted, in which foreign stonemasons and bricklayers are documented in 1142. However, the question remains whether the operation of organized foreign guilds can be expected on the basis of a single text mention.

The toothed tools did not become common in the 11th and 12th centuries in Prague; their time came later with the arrival of the guild, which built St. Agnes Monastery in 1230s. Another style of stonework, which was not accepted in Prague in the 12th century, was "patterning", the aim of which was to level the front surface with a decorative

pattern. The "Alsatian herringbone" pattern however has become very widespread, created by chiselling "V" close to each other and in rows next to each other. This pattern occurs, for example, in Strasbourg, on the south wall of the cathedral choir in Mainz or in Hirsau (Fig. **34B**).

Although medieval Central Europe was saturated with a number of different styles and patterns, the buildings of Romanesque Prague were essentially free from these influences. During this period, the Prague stonemasons school developed a simple, practical and distinctive style, with precise dressing of the joint surfaces, in which the front faces were processed in the manner described above, i. e. using an axe with a flat edge and point, and, to a lesser extent, a chisel with a flat blade. This way of dressing was so powerful that it was used in practically all Prague buildings of that time (Fig. **28**, **29**, **30**).

Fig. 1. A – face of an abandoned opuka quarry in Vidoule, Prague 5 (photo by K. Kovářová, 02/2021); **B** – idle opuka quarry in Přední Kopanina, Prague 6 (photo by K. Kovářová, 05/2019).

Fig. 2. Opuka quarries in Prague and the immediate vicinity (copied from KOTLÍK/ ŠRÁMEK/KAŠE 2000, Fig. 2 on p. 13).

Fig. 3. Opuka quarry face in Přední Kopanina with natural splitting in layers, which enabled simple breaking-out, and in some cases the subsequent splitting up of the slabs (photo by M. Cihla, 2008).

Fig. 4. Experimental chipping of the opuka edge with a pointed hafted tool and forming of typical shells (**A**). Picture (**B**) shows the same application with a hand point chisel. The difference is longer hitting line of the hand tool.

Fig. 5. Contour map of pick mark left by a double point hammer, hypsometric image with a longitudinal section of the tool mark, schematic illustration of the triangular shaped mark typical for the double point hammer (author M. Cihla; compiled by J. Valach, 2020).

Fig. 6. The basic position of a medieval stonemason during dressing the block face with an axe and a hand chisel with a wooden mallet (drawing by A. Musilová).

Fig. 7. The main differences between dressing with a hand-held tool and a hafted tool. The chisel leaves regular cut marks and creates a plane by successive straight strokes. Tool marks are very regularly parallel or diagonal. Hafted tools form irregular cuts; tool marks are most typically fan-shaped, spiked, always according to the stonemason's position.

Fig. 8. Types of strokes: **black arrow** with small wide wings – the stroke and its direction guided by the point of the tool; **blue arrow** – directions of strokes, indicating the position of the stonemason at work; **pink area** – the margin or its relics; **grey area with black line** – stroke guided at an angle of less than 45° and chipping; **light grey shapeless area** – touch of axe edge; **black line** – a stroke vertical to the surface or at least at an angle of 45°.

Fig. 9. Prague 1-Old Town, house No. 16/I, Franz Kafka Square 1, Romanesque cellars on plot No. 1039. Stone No. 16: 1 in the eastern perimeter wall of the main room.

Fig. 10. Prague 1-Old Town, house No. 16/I, Franz Kafka Square 1. Stone No. 16: 2 in the northern perimeter wall of the main room.

Fig. 11. Prague 1-Old Town, house No. 16/I, Franz Kafka Square 1. Niche quoin (stone No. 16: 3) in the western perimeter wall of the main room.

Fig. 12. Prague 1-Old Town, house No. 16/I, Franz Kafka Square 1. Niche quoin (stone No. 16: 4) in the northern perimeter wall of the main room.

Fig. 13. Prague 1-Old Town, house No. 16/I, Franz Kafka Square 1. Portal quoin (stone No. 16: 5) in the south wall of the main room.

Fig. 14. Prague 1-Old Town, house No. 16/I, Franz Kafka Square 1. The capital of the original column (stone No. 16: 6) from the main room.

Fig. 15. The arrow in the upper figure indicates the axe stroke on the face of the block 16: 3, in the section in Fig. **11** marked by a **yellow line**. The **arrow** shows slightly rounded cut, created by the radial stroke of the axe. The tip of the arrow hits the material and creates a chip, about 1 mm in this case. The **bottom** section is a cross-profile of the same tool mark, showing a slight rounding (wear) of the tool edge (profiles are taken with Global Mapper software).

Fig. 16. The block 16: 4 Longitudinal section of diagonal dressing with a chisel. Individual strokes are marked with an arrow. The dashed lines indicate the trimming of the left over material between the cuts; the trimming is formed by successive cuts over each other. This phenomenon is formed only by the chisel and the pressure of the hand

holding the chisel and the bounce after the subsequent stroke with a wooden mallet into the chisel (hypsometric image taken by the Global Mapper software).

Fig. 17. Prague 1-Old Town, house No. 222/I, Řetězová Street 3. Portal quoin (stone No. 222: 1) in the north wall of the south basement room.

Fig. 18. Prague 1-Old Town, house No. 222/I, Řetězová Street 3. The shaft of a cylindrical column (stone No. 222: 2) in the central basement room.

Fig. 19. Prague 1-Old Town, house No. 222/I, Řetězová Street 3. Ashlar (stone No. 222: 3) of the central pillar in the northern basement room.

Fig. 20. Prague-Old Town, No. 222/I, Řetězová 3. Oblong ashlar in perimeter masonry of the SW wall of the middle room. **Letter "N"** means the undressed quarry-face, originating from natural tectonics. **Red "V" arrows** indicate the direction of work with a hafted point chisel. **Blue "U" arrows** show strokes with an axe blade. **Yellow wavy arrows** mean typical strokes with a hand point chisel and a wooden mallet. **Arrows on the edges of the block** show fine dressing of the shape probably by a hand point chisel and a wooden mallet.

Fig. 21. Prague 1-Old Town, house No. 459/I, Malé náměstí 11, Michalská Street 25. Ashlar (stone No. 459: 1) in the eastern perimeter wall of the main room.

Fig. 22. Prague 1-Old Town, house No. 459/I, Malé náměstí 11, Michalská Street 25. Ashlar of the niche jamb (stone No. 459: 2) in the western wall of the main room.

Fig. 23. Prague 1-Old Town, house No. 549/I, Old Town Square 19. Ashlar (stone No. 549: 1) in the northeast wall of the entryway with the stairs.

Fig. 24. Prague 1-Old Town, house No. 553/I, Celetná Street 2, Kamzíková Street 7. Ashlar (stone No. 553: 1) in the southern perimeter wall of the main room.

Fig. 25. Prague 1-Old Town, house No. 31/I (non-existent, today No. 16/I) in Kaprova Street. Ashlar of the niche quoin (stone No. 31: 1) in the north-western perimeter wall of the room.

Fig. 26. A cross section of the tool mark on ashlar 31: 1 indicating a slightly rounded blade of an axe like tool. The tool mark is shown in the schematic Fig. **25** in **red**.

Fig. 27. Iconography of pointed axe – typical tool of Prague Romanesque stonemasonry, at that time very common in Europe. **1**, **3** – Jena, manuscript Chronica sive historia de duabus civitatibus, 12th century (Thüringer Universitäts- und Landesbibliothek Jena, Ms. Bos. q. 6, fol. 10v, 20r); **2** – Brioude, Basilica of St. Julien, 12th century, wall painting on a nave pillar; **4** – Chartres, Notre Dame 1220/25, stained glass in the northern choir chapell (according to BINDING 2001: 1+3 – p. 72, entry 209+210; 2 – p. 39, entry 96; 4 – p. 53, entry 141).

Fig. 28. Prague Castle, III. Courtyard, Church of St. Bartholomew, mid-12th century. Diagonal tool marks after dressing the face.

Fig. 29. Prague Castle, Black Tower, face of the interior perimeter masonry, 12th century. Diagonally centred tool marks after dressing the face.

Fig. 30. Prague, Strahov Monastery, after 1143. Romanesque staircase within the wall thickness in the western wing of the convent, diagonal tool marks of predominant two directions.

Fig. 31. Prague Castle, Basilica of St. George, SE corner of the north wall arcade of the main church nave, after 1142. Fine margin with the edge of an axe, oblique dressing in rows to form the plane. Wide cuts indicate tilting of the block less than 45°.

Fig. 32. Prague Castle, Church of St. Bartholomew, SE corner, 12th century. Fine margin made by the chisel, the front surface is carefully levelled by the chisel in successive parallel rows.

Fig. 33. Prague, Strahov Monastery. **A** – a Romanesque staircase within the masonry in the west wing of the convent; **B** – cellarium, the upper face of the abacus of a Romanesque column, after 1143. Exceptional use of tools with a toothed blade within Romanesque Prague.

Fig. 34. Parallels. **A** – Doksany (Litoměřice district), monastery staircase, after 1145; wide margin chopped by a chisel, face levelled with an axe with fine teeth (photo by M. Panáček, 2008); **B** – Hirsau (Bavaria), monastery complex. "V" tool marks formed by diagonal cutting from opposite edges into the shape of the appropriate letter (photo by M. Panáček, 2007); **C** – Worms, Dome, south side of the portal, 1190; Alsatian herringbone pattern in

dressing the facial surface (photo by M. Panáček, 2007).

Fig. 35. Prague Castle, Bishop‘s House, eastern facade, 12th century. "Spiked work" tool marks on the opuka ashlar surface. On the right, experimental vertical strokes with an axe. Even chipping equally levels the opuka face.

Translation by Linda Foster