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Kramolín hillfort revisited. Archaeological potential of a site flooded for 45 years

Návrat na hradisko Kramolín. Archeologický potenciál 45 let zatopené lokality

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KEYWORDS

Hillfort – underwater archaeology – survey – metal detecting – cultural heritage preservation

ABSTRACT

The temporary lowering of the water level in Dalešice Reservoir for maintenance in the autumn of 2021 created an opportunity to conduct an archaeological investigation of the Kramolín hillfort – a site permanently flooded since the 1970s. A small group of archaeologists reached the shore of Kramolín island by boat and performed the survey with metal detectors and GPS hand held devices. This survey produced a large collection of lithic artefacts, pottery sherds, and isolated metal artefacts from different prehistoric periods (including the Neolithic, Eneolithic, Bronze Age, Iron Age, Roman period and Early Middle Ages), which had already been identified during previous excavations. However, although the site was illegally surveyed with metal detectors earlier, several important artefacts were still found. In addition, the current state of the overlying sediment and its erosion was documented. The survey showed that the site is not yet exhausted and repeated survey in the case of the lowered water level can again provide more important information about this site.

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1. Introduction

Over the past decade, the Institute of Archaeology of the Czech Academy of Sciences, Brno was interested in surveying the eroded shores of the Mohelno and Dalešice manmade reservoirs (the two parts of the Dalešice pumped storage hydroelectric power plant) for archaeological remains (Škrdla et al. 2012; Bartík et al. 2019a). Local collaborators provided our research team (in November 2021) with information about a dam maintenance break that necessitated a significant reduction in the water level of Dalešice Reservoir (cf. information from the iDnes news agency – Nedělková 2021). This situation allowed us to conduct a surface survey on the beaches along the shores of the reservoir. In addition, the uppermost part of the flooded Kramolín hillfort rose from the water as an island accessible by boat, and we made two research trips to the site.

The Kramolín hillfort was originally a significant elevation shaped by a meander in the Jihlava River (Fig. 1). The highpoint of the hillfort reached an elevation of 377 m above sea level, c. 57 m above the bottom of valley through which the Jihlava River flowed. However, the hillfort was flooded by Dalešice Reservoir, built in 1970–1978, and since that time the Kramolín hillfort has mostly been hidden below the water level and only its highest point rises as a small island above the surface of the water when the water level is low. Leaving aside the first surface surveys of the hillfort at the beginning of the 20th century carried out by V. Čapek, V. Gross and R. Dvořák, archaeological excavations at the site began in the 1930s (F. Peštál, J. Skutil, summary in Koštuřík et al. 1986, 201–202; 2007, 11; Čižmář 2004, 152–154) and the largest salvage excavation was conducted shortly before the site was definitively flooded (Michna 1967; 1968; 1971; Kos, Koštuřík 1972; 1973; 1974; 1973–74; 1975; 1978; Koštuřík 1974; Koštuřík, Kos 1980). However, the results from the latest excavation were published only partially (Koštuřík 1975–76; 2007; Poláček 1992; 1995; Lička 1994; Lička et al. 1990; Enderová 2007). The site (uppermost part only) is visited and surveyed occasionally by amateur archaeologists when the water level is low (e.g. Kučová, Kuča 2016). The site was recently the subject of a professional survey combined with underwater archaeology, though only when the uppermost part was above water (Machová 2021).

Since the Dalešice power plant was completed and began operation in 1978, water flowing between the upper and lower reservoirs results in daily fluctuating water levels of 2–3 m in Dalešice Reservoir. The shores are eroded and intact archaeological contexts have been disturbed as a result of the fluctuating water levels and the wave action this activity generates. The Kramolín hillfort, which periodically rises from the water, faces this same erosion activity (Fig. 2: A), which increases during the drier periods of the year and over the winter, when the water level is

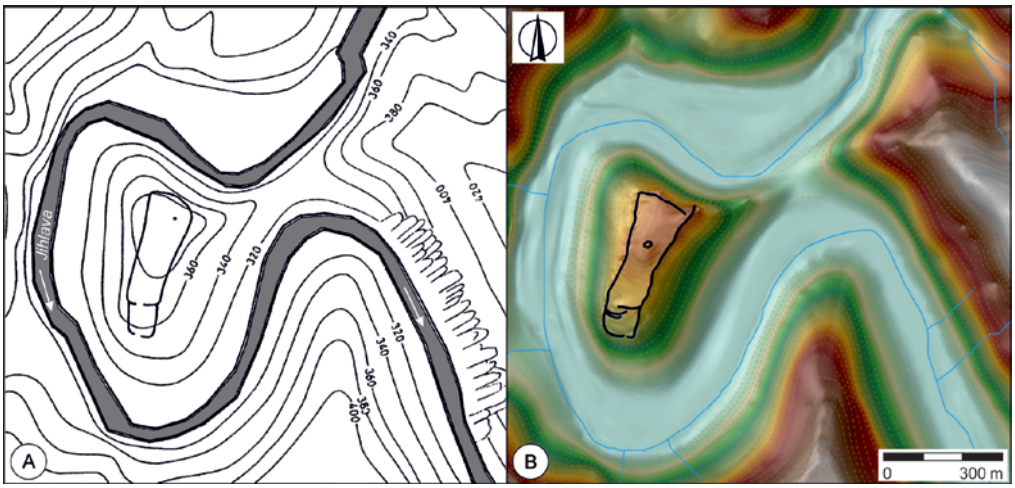


Fig. 1. Location of Kramolín hillfort on contour model of the terrain.
A – adapted based on Koštuřík 2007;
B – adapted based on Bíško 2011.

Obr. 1. *Poloha kramolínského hradiska na vrstevnicovém modelu terénu.*
A – upraveno podle Koštuřík 2007;
B – upraveno podle Bíško 2011.

lowered to allow for the retention capacity for water from melting snow. During a maintenance break in the autumn of 2021, the water level was lowered to the 374 m contour line and the water level decreased to 371.5 m during the night, creating an island with an area of roughly c. 100 × 80 m accessible for survey (see the image from the Sentinel-2 satellite captured on 6 November 2021 – EASA 2021). The expeditions focused on documenting the current state of disturbance at the site and an estimation of the extent of the destruction of archaeological material.

The aim of the study is to present the results of two short-term surveys of the hillfort that produced new information concerning the chronology and intensity of occupation. Several unique finds made at the site also provide valuable data on the use of materials and technological processes employed in production. A key part of the study is a discussion of the issue of heritage protection of this type of archaeological site gradually being destroyed by water.

2. Methods

Two raft expeditions (Fig. 2: B) were conducted to the site in November and December 2021. During the first expedition (26 November 2021), we were able to spend c. 2 hours (from 10:30 to 13:30) on the island delimited by the 373 m contour line (Fig. 3). Six people surveyed a beach up to 6 m in width (i.e. the area from where the water decreased since the maximum level in the morning), while the upper part of the island was covered with snow and inaccessible to survey (Fig. 2: C). The weather was cold, windy, with snowfall that limited the amount of time spent on the island. Two weeks later, we prepared a second expedition (8 December 2021) just after we received information about the end of the maintenance break. Unlike the previous expedition, the snow was completely melted, allowing us to survey the entire island. Ten people spent c. 6 hours (from 9:30 to 15:30) at the site. The island was delimited by the 374 m (Fig. 2: D, Fig. 3) contour line for almost the entire time, i.e. 1 m higher than during the previous visit. Although the water level began to drop late in the afternoon, the decreasing light conditions did not allow us to continue the survey. Several other visitors to the hillfort had the possibility to see the uncovered part of the hillfort several metres lower (Fig. 2: E).

Three basic methods were chosen for the survey of the hillfort: surface collection, metal detector survey (Fig. 2: F) and micro-test pits. Both forms of low-destructive survey were conducted with the support of GPS, which made it possible to study the distribution of selected types of finds. As part of the survey of the site, photo documentation was taken of the exposed contexts and several finds adhering *in situ* in the flooded cultural layer (Fig. 2: G). In order to verify its thickness in various parts of the fort, several small micro-test pits were dug. During the first expedition, the surface collection method was gradually modified to take into account the limited prospecting time and also the finding that the island's exposed beaches were covered with tens of thousands of fragments of pottery vessels (Fig. 2: H), hundreds of lithic artefacts and a small number of other types of finds. As such, only typologically and chronologically representative fragments with a certain testimonial value (decorated vessel bodies, rims, identifiable profiles, etc.) were removed from the site and the others were left in place. Due to the lack of time, GPS coordinates were also measured for only the most significant artefacts. In the case of metal detector survey (with the use of *XP Deus* detectors), the position of the majority of discovered metal artefacts could be measured. The shutdown of the pumped storage power plant did not escape the attention of other unwanted visitors, as several dozen illegal pits left by amateur metal detectorists were documented (for more information on the issue of damage to archaeological sites by illegal metal detector surveys, see Čižmář 2006; Navrátil 2015). The professional detector prospecting thus aimed to verify the current state of metal finds at the hillfort and to determine the potential for obtaining new metal artefacts from the periodically exposed parts of the site.

As part of the evaluation of acquired finds, all artefacts from non-ferrous metals were subjected to elemental composition analysis using an *ElvaX Pro* benchtop Energy Dispersive X-ray fluorescence (ED-XRF) spectrometer (Tab. 2). The following measuring conditions were used for XRF analyses: Ag X-ray tube, Fast SDD detector; Cu calibration mode, acceleration voltage 45 kV, measuring time 120 s, collimator 3 mm. Only two artefacts from precious metals (silver alloys) were subjected to non-destructive surface analysis – a La Tène coin and a fragment of an early medieval S-shaped temple ring. A sample of the metal core was collected micro-destructively from the other artefacts for a more reliable analysis of the elemental composition eliminating the influence of the surface layer of corrosion products. A sample of the metal core (5–20 mg) was taken by drilling with 1 mm diameter HSS drill bits (ČSN 221121, DIN 338) with a TiN (Titanium nitride) coating. For the purpose of studying surface traces of production technology and various forms of use-wear, detailed documentation was conducted on selected ceramic and metal finds (Fig. 8, 11) by means of the LMI ToolScan digital forensic microscopical examination system with the following measuring conditions: 2D and 3D scanning of the surface, BW camera, 3 µm/px, resolution, reconstruction of the surface by EDF and photometric stereo – lighting from eight different directions, motorised feed of XY table + sharpening of Z axis, range of XYZ 100 mm.

Fig. 2. Photographic documentation from hillfort survey. A – Upper part of the hillfort protruding from water in 2020 (photo by T. Tuček, source: mapy.cz); B – raft transport to site (photo by J. Bartík); C – snow-covered upper part of the hillfort during the first expedition (photo by J. Bartík); D – level uncovered on NW side of hillfort during the second expedition (photo by J. Bartík); E – lowest documented level uncovered on west side of hillfort in October 2021 (photo by L. Machát, source: mapy.cz); F – surface and detector survey of uncovered parts of hillfort in 2021 (photo by J. Bartík); G – lower stone of two-part manual mill protruding from the uncovered cultural layer (photo by J. Bartík); H – view of surface of uncovered cultural layer covered by numerous archaeological finds (photo by P. Škrdla).

Obr. 2. *Fotografická dokumentace z průzkumu hradiska. A – Pohled na z vody vyčnívající vrcholovou partii hradiska v roce 2020 (foto T. Tuček, zdroj: mapy.cz); B – přeprava na lokalitu za pomoci raftu (foto J. Bartík); C – zasněžená vrcholová partie hradiska při první expedici (foto J. Bartík); D – úroveň odkrytí na SZ straně hradiska při druhé expedici (foto J. Bartík); E – nejnižší zdokumentovaná úroveň odkrytí na západní straně hradiska v říjnu 2021 (foto L. Machát, zdroj: mapy.cz); F – povrchový a detektorový průzkum obnažených částí hradiska v roce 2021 (foto J. Bartík); G – spodní kámen dvoudílného ručního mlýnku vyčnívající z rozplavované kulturní vrstvy (foto J. Bartík); H – pohled na povrch rozplavované kulturní vrstvy pokrytý množstvím archeologických nálezů (foto P. Škrdla).*

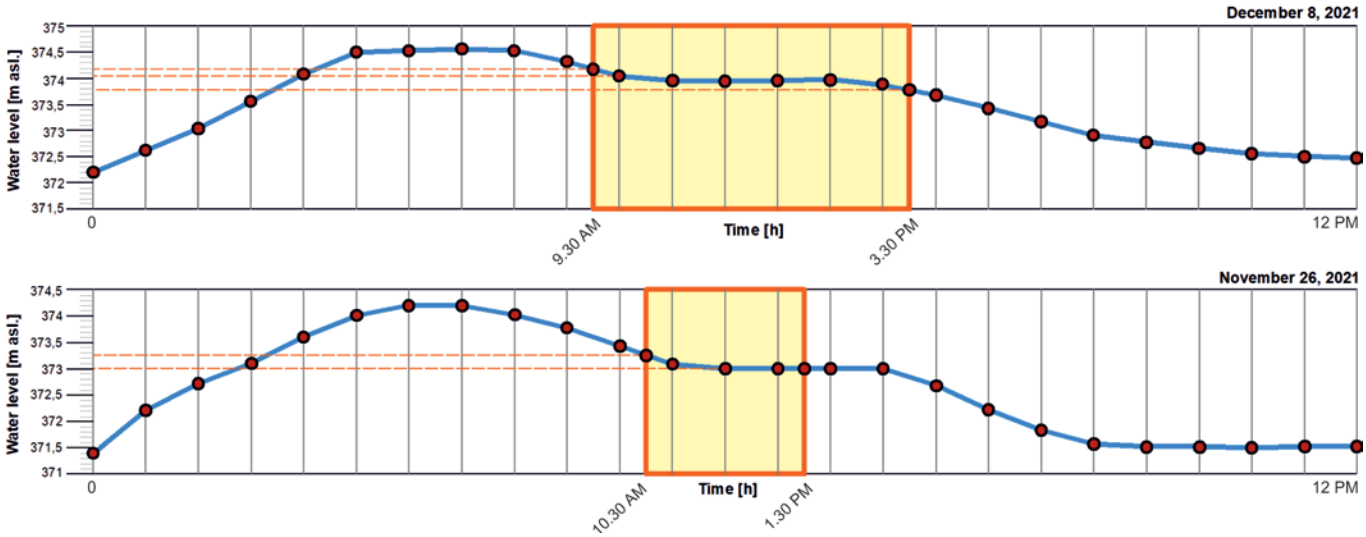


Fig. 3. Fluctuations of Dalešice Reservoir water level. Time span and water level during surveys are hatched. Source: Povodí Moravy, s. p., digitalised by K. Augustinová.

Obr. 3. *Kolísání hladiny vodní nádrže Dalešice. Vyznačeno je časové rozpětí průzkumů a jim odpovídající úroveň vodní hladiny. Zdroj: Povodí Moravy, s. p., digitalizace K. Augustinová.*

3. Results

3.1 Erosion of hilltop surface – current state of knowledge

Water fluctuation has caused continual erosion of Quaternary covering sediments and archaeological bearing deposits at the site of interest. Our survey documented different kinds of erosion in the uppermost and lower parts of the hilltop – while the uppermost part is completely lacking Quaternary covering sediments and is composed of bedrock covered with washed-out rock blocks, Quaternary covering sediments including artefact-bearing deposits survived in the lower parts of the accessible (i.e. unflooded during the survey) area. While archaeological materials are mostly missing in the uppermost part, their number increases as the altitude drops. The southern and western shores of the island (below the c. 375 m contour line) have the character of beaches composed of fine-grained sediment including stone artefacts, pottery sherds, osteological material, metals, etc., forming rich clusters in several parts of the beach. In addition, the test pits dug along the southern and western shores of the island document an up to 20 cm-thick black soil horizon bearing archaeological material, sporadically covered by a layer of colluvial deposits. One of these test pits contained a series of potsherds that could be refitted to reconstruct part of an Eneolithic vessel – a good example of an intact occupation layer.

3.2 Development of occupation at Kramolín hillfort – new findings

During the course of the two survey expeditions to the Kramolín hillfort in 2021 described above, over 1,300 finds were made, even despite the intentional selection. The largest part of this assemblage was fragments of pottery vessels and other small artefacts (spindle whorls, weights, figurines, etc.). The surveys also led to the acquisition of large amounts of lithic industry (especially chipped), several pieces of daub with prints of construction elements, two fragments of bone tools, two glass beads, and an assemblage of more than eighty metal artefacts from non-ferrous metals and even iron (Tab. 1). The high number of finds makes it possible to at least roughly estimate the intensity of the hillfort's occupation in individual chronological periods. The resulting data can then be compared to the results

Dating/Material	Pottery	Metal artefacts	Chipped industry	Polished industry	Macrolithic stone tools	Bone tools	Glass beads	Daub	Σ
Late Neolithic	282	-	-	9	1	-	-	-	292
Late Neolithic – Eneolithic	-	-	499	-	-	-	-	-	499
Eneolithic	99	-	1	-	-	-	-	-	100
Early Bronze Age?	-	1	-	-	-	-	-	-	1
Final Bronze Age	17	3	-	-	-	-	-	-	20
Final Bronze Age – Hallstatt period	63	-	-	-	-	-	-	-	63
Hallstat period	7	-	-	-	-	-	-	-	7
La Tène period	13	1	-	-	-	-	1	-	14
Roman period	-	1	-	-	-	-	1	-	2
Early Middle Ages	129	10	-	-	-	-	-	-	139
High Middle Ages – Modern period	6	3	-	-	-	-	-	-	9
Indeterminate	144	63	-	-	28	2	-	2	240
Σ	**760**	**82**	**500**	**9**	**29**	**2**	**2**	**2**	**1,386**

Tab. 1. Kramolín hillfort. Basic overview of archaeological material obtained during 2021 surveys.

Tab. 1. *Kramolínské hradisko. Základní přehled materiálu získaného při průzkumech v roce 2021.*

of previous excavations. However, the authors are aware that in certain periods, the material culture contains less chronologically sensitive finds, and therefore the analysis below may not fully reflect the actual intensity of occupation.

The finds were sorted into several basic groups according to the type of material and a basic chronological classification. These groups reflect the varied testimonial value of the material for a more precise dating, which led to the merging of several categories into broader chronological units in which the given element could have occurred. A more precise dating could not be established for 17.3% of artefacts, as they occurred across various periods. Table 1 visualises the resulting chronological structure of the assemblage.

Having a dominant position in the assemblage is material attributed to Late Neolithic occupation by the Moravian Painted Ware culture, which also corresponds to the results of a rescue excavation from the 1970s, the authors of which estimated that hundreds of thousands of pottery individuals belong to Lengyel occupation (cf. Koštuřík 1975–76, 106). The second most important component is finds that can be linked to the early medieval occupation of the hillfort. Evidence of occupation from several phases of the Eneolithic and the Final Bronze Age to the Early Iron Age is also more pronounced. Small assemblages of material or individual finds are then related to evidence of human activities from the Early Bronze Age (?), the La Tène period and the Roman period.

3.2.1 Paleolithic and Mesolithic

The Paleolithic or Mesolithic occupation of the Kramolín hillfort has not yet been reliably proven. However, based on a preliminary analysis of chipped lithic industry, the sporadic occurrence of lightly patinated artefacts should be noted. Among other things, the 2021 surveys also produced a patinated triangular flake from erratic flint with traces of retouch over the surface of its ventral side. Other unique artefacts are apparently in the collection from early excavations by F. Peštál (Vokáč 2003, 196) and also in the private collections of amateur collectors that visited the hillfort in the past. The connection between patinated artefacts and Paleolithic or Mesolithic human activities remains for now on the level of conjecture, especially considering that patination was already observed on several post-Mesolithic tools in the past (cf. Vencl 1964; 2020). The same problem is posed by relatively numerous trapezoid artefacts, some of which are strikingly similar to the microliths known from Mesolithic collections. Due to the fact that wear in the form of a sickle gloss is clearly visible on some of them, we lean more towards their connection with the post-Mesolithic occupation of the hillfort. Of course, recent finds obtained in the survey of the shores of the Mohelno and Dalešice reservoirs suggest that this region was visited by Late Paleolithic and Mesolithic hunters and gatherers (unpublished), and hence the identification of their activities at the Kramolín hillfort could be only a question of time and the intensity of future investigations.

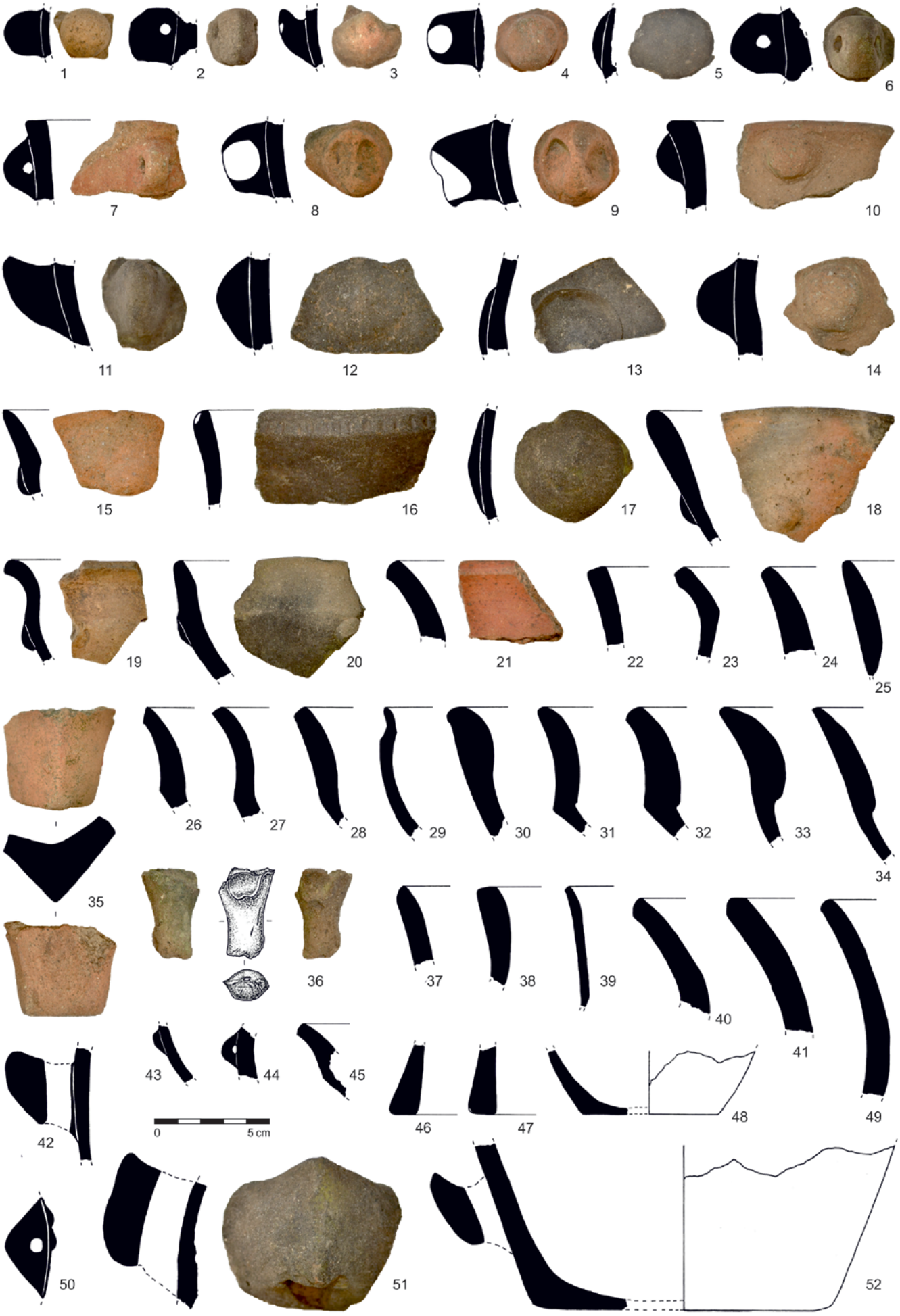
3.2.2 Neolithic

At the very end of the Neolithic, a hilltop settlement of the late stage of the Moravian Painted Ware culture (hereinafter referred to as "MPWC") was established at the site. In terms of relative chronology (Kazdová et al. 1994; Čižmář et al. 2004), the beginning of the settlement is already in phase MPWC IIa, the height of settlement in phase MPWC IIb (Lengyel III), a dating confirmed by the finds made during the 2021 survey. As was the case with the rescue excavation (cf. Koštuřík 1975–76, 106), Lengyel artefacts (in sheer numbers) dominate the material from the newly conducted surveys (Tab. 1). Although a comprehensive evaluation of the MPWC pottery assemblage is not the subject of this study, several frequently repeating elements characterising the assemblage are noteworthy. The site is known primarily for the rich occurrence of high-quality ceramic ware with a surface burnished red and black (*pseudo-terra sigilata* and *terra nigra*). Given the high occurrence of this pottery at the hillfort, its specialised production is assumed here, followed by distribution to surrounding lowland settlements. This hypothesis is also supported by the find of a larger part of an advanced form of a bicameral vertical pottery kiln dated by the authors of the excavation to the period of the Lengyel culture (Koštuřík 1975–76, 106–109; Lička 1994; Lička et al. 1990). And yet, the Neolithic age of the kiln was later challenged by several scholars specialised in the La Tène period, particularly on the basis of its similarity to an analogical type of kiln occurring at La Tène sites (e.g. Enderová 2007, 105–106; Hlava, Vích 2007, 46; Mangel, Thér 2015, 53).

Relief decoration is clearly the predominant form of decoration. The minimal appearance of impressed decoration is interesting given its abundant occurrence at MPWC IIb sites in SW Moravia (e.g. Koštuřík 1973; Kovárník 2005; 2007). Painted decoration itself is very poorly preserved, which could also be the result of the deposition environment. Enjoying exceptional popularity among individual types of relief decoration are "owl-head" projections (Fig. 4: 4, 8, 9), which occur at the site in a range of forms, including large massive knobs with the imprints of two human fingers pressing from the opposite sides. Another typical element appearing on Late Lengyel pottery at the site and which is characteristic for phase MPWC IIb (e.g. Koštuřík 1973, Kovárník 2005, 164–165; 2007, 72; Bartík et al. 2016, 77) is the highlighting of individual parts of vessels (e.g. the separation of the shoulders and bottom on the inner side of bowls, Fig. 4: 31, 32), and especially of projections (Fig. 4: 13, 17), with a groove. The spectrum of pottery vessels is dominated by various types of bowls, many of which have a characteristic thickening of the shoulders (Fig. 4: 30–34).

The Kramolín hillfort is also unique in the heavy occurrence of anthropomorphic (both female and male) and zoomorphic figurines (e.g. Koštuřík 1975–76, 110, Fig. 5; Kučová, Kuča 2016), which, in contrast to the early period of the MPWC, are found in far fewer numbers at Late Lengyel sites. The surveys in 2021 produced another fragment of a figurine (Fig. 4: 36), probably a broken-off arm (preserved dimensions: 50 × 31 × 43.5 mm). The end of the arm is interesting in that it is slightly squeezed and contains a small round hole in which another object made of organic material could be inserted (e.g. a twig or a bird feather). Noteworthy among artefacts of a ritual nature is a fragment of a furniture model (Fig. 4: 35) – a broken-off leg that could have belonged to a model of a small table, altar or throne (preserved dimensions: 50 × 31 × 43.5 mm). The reflection of the spiritual world in MPWC ceramic production was addressed in the past primarily by J. Kovárník (2004), who also records another similar find from the Kramolín hillfort in the form of a tabular leg from a ritual stool with incised decoration and three small projections (Kovárník 2004, 178–179, obr. 4: 4a–d).

Surface surveys of the hillfort also produced an unusually rich collection of lithic industry dominated by chipped industry (500 pieces). In terms of the chronological representation of individual periods, based on the amount of collected pottery (in which the MPWC predominates), it can be assumed that a substantial part of the chipped industry collection will also belong to the Lengyel period of occupation. A smaller part will then naturally belong to individual Eneolithic cultures. Despite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the fact that the assemblage is a chronologically inhomogeneous unit and with respect to the materials that were used, there is a uniform trend that is apparently valid for the entire history of the site during the Neolithic and Eneolithic with a prevalence of local and regional materials dominated by chert of the Krumlovský les (hereinafter referred to as "KL") type. The coarser blueish-grey KL I variety is represented in a higher share (54.6%), which evidently also corresponds to the expansion of its extraction in the nearby Krumlovský les (Krumlov Forest, located 25 km in the most direct route) in the late stage of the MPWC (cf. Oliva 2010). The higher quality KL II variety makes up only 7.4% of the material. Other identified local materials included quartz to crystal (4.2%), siliceous weathering product of serpentinite – plasma type (1.8%) and brown opal (0.2%). One piece was also made from chert breccia (0.2%), the provenance of which is also assumed to be in Krumlovský les. Imported raw materials have a minority representation in the newly acquired assemblage. Only a few pieces of erratic flint (1.2%) and Kraków-Częstochowa Jurassic flint (likewise 1.2%) were identified, and only one piece could be determined as fine-grained quartzite of a light beige colour, probably of the Tušimice type (0.2%). However, a certain amount of caution is required with this raw material, as macroscopically similar quartzites also occur in areas of Krumlovský les, where they accompany chert breccia or form quartzite-breccia aggregates with it (Oliva 2002, 153; Vokáč 2003, 82). Burnt artefacts then make up a non-negligible share of chipped industry (29%). Interesting with respect to the regional distribution network is the relatively low share of the siliceous weathering product of serpentinite – plasma type, despite the nearby existence of a rich source of this material, including evidence of its exploitation in the period of the Lengyel culture (cf. Bartík et al. 2021).

A comprehensive analysis of chipped industry from rescue excavations of Kramolín hillfort is still missing, and only Martin Oliva's (1985) unpublished preliminary assessment is available. At least the material of finds from the earlier excavations by F. Pešťál (a total of 566 pieces) has been evaluated. And yet, the results presented by M. Vokáč (2003, 196, Tab. 42) are consistent with the newly obtained assemblage, both in terms of the documented materials and their shares. A relatively interesting component of the material spectrum in this assemblage is Moravian Jurassic chert of the Stránská skála type, for which the Kramolín hillfort is the westernmost example of its distribution (Bartík et al. 2019b; Bartík, Škrdla 2021).

On the technological side, the majority of the phases in the *chaîne opératoire* occur in the newly acquired assemblage – cores in various phases of exploitation, blades and their fragments, including flakes and other debitage in the form of fragments and chips. Predominant forms among the several dozen tools that were also found are mainly endscrapers and various types of sickle-like blades, which either are curved backed (Fig. 5: 2, 3), or their edges are retouched into the shape of a triangle (Fig. 5: 4, 5) or trapezoid (Fig. 5: 1, 6–8). Some of these even have signs of a sickle sheen or residual adhesive in the form of remnants of organic matter (Fig. 5: 5, 8). Attention will be paid elsewhere to a more detailed analysis of chipped industry, including an evaluation of techno-typological aspects.

Fig. 5. Selection of Neolithic and Eneolithic chipped stone industry. Photo by J. Bartík.

Obr. 5. *Výběr nálezů neolitické a eneolitické štípané industrie. Foto J. Bartík.*

Additional types of lithic artefacts are represented by polished and other macrolithic industry. One completely preserved slightly trapezoidal axe and larger fragments of two others from regional Želešice-type metabasite were identified among polished tools. Three bored artefacts were identified. The first artefact is a fragment of the blade part of an indeterminate axe-hammer from imported Jizerské hory metabasite, the second a fragment of an axe-hammer from Brno Massif amphibolite-diorite capturing one of its sides and roughly half of the perforation. The described axe-hammer fragment was secondarily used as a hammerstone, as the characteristic working traces on part of its perimeter indicate. Another fragment of a large axe-hammer

Fig. 4. Selection of Moravian Painted Ware culture finds. Photo by J. Bartík, drawing by K. Augustinová.

Obr. 4. *Výběr nálezů kultury s moravskou malovanou keramikou. Foto J. Bartík, kresba K. Augustinová.*

Fig. 6. Axe blanks from Želešice-type metabasite. Photo by J. Bartík.
Obr. 6. *Polotovary seker z metabazitu typu Želešice. Foto J. Bartík.*

from porphyric microdiorite was likewise secondarily modified into a massive grinder with evidence of working traces on the opposite poles. Noteworthy with regard to the study of the forms of distribution of lithic materials are two additional axe roughouts (Fig. 6; dimensions: 72 × 43 × 13.5 mm, 116 × 49 × 14 mm, weight: 53.7 and 142.7 g) made from Želešice-type metabasite (see Bartík et al. 2015), primary outcrops of which are located roughly 33 km east of the hillfort. The collection of newly obtained polished industry is supplemented by an additional two typologically indeterminable fragments of polished artefacts (one from Želešice-type metabasite, the other from Jizerské hory-type metabasite).

Macrolithic industry is typologically diverse, with various forms of grinders, hammerstones, anvil stones, sharpeners and smoothers being identified. In addition to quartz pebbles, other local metamorphic rock such as amphibolite, granulite, migmatite and orthogneiss was primarily used in its production. A massive quern (the lower stone of a two-part hand mill; Fig. 2: G) was also documented in an *in situ* position in the flooded occupation layer, but due to its large dimensions and weight, it was only photographed and left at the site.

3.2.3 Eneolithic

The distinctive Late Neolithic occupation of the site fluidly continued into the following periods of the Eneolithic, at which time, according to the results of the rescue excavation, the first phase of the rampart fortification in the eastern part of the hillfort was to have been built (Kos, Koštuřík 1973–1974, 198; Koštuřík 1981, 65, 67; Koštuřík et al. 1986, 202). Settlement by the Jordanów, Funnel Beaker and Baden cultures is documented at the hillfort, and finds of the Jevišovice culture from the Late Eneolithic and the Bell Beaker culture from the Final Eneolithic were also recorded. Pottery decorated with grooved punctures linked primarily to the early phase of the Eneolithic occupation of the hillfort should also be mentioned. The Eneolithic is also one of the few periods that has already been comprehensively processed (Koštuřík 2007).

The survey of the hillfort in 2021 produced a large amount of ceramic material (Fig. 7) representing the identical chronological spectrum identified in earlier investigations, including finds of pottery decorated with grooved punctures. Several newly discovered pieces also contained remnants of a white inlay (Fig. 7: 19). A substantial amount of ceramic material could only generally be classified to the Eneolithic, since many decorative elements occur across individual cultures. Finds from the Funnel Beaker culture dominate among determinable individuals.

Particularly noteworthy here is the expansion of the source base documenting the activities of the bearers of the Bell Beaker culture. Only four fragments of Bell Beaker pottery had previously been recorded at the hillfort, including two fragments from the bodies of decorated bell beakers (Koštuřík 2007, 286, Tab. 42). This assemblage is newly supplemented by finds of two characteristic bowl profiles with a straight edge (Fig. 7: 23, 24), in one case extended into the shape of the letter "T".

A larger part of a two-handled amphora (Fig. 7: 20) reconstructed from an accumulation of potsherds (*in situ*) acquired from the flooded occupation layer at the south-eastern edge of the uncovered part of the hillfort can then be dated to the Proto- or Early Eneolithic (cf. Koštuřík 2007; Šmíd 2017).

As mentioned above, part of the newly acquired collection of (especially chipped) industry also belongs to the Eneolithic occupation of the site. A more precise cultural classification is not possible for the majority of the debitage and tools. The find of a nearly completely preserved triangular arrowhead with a slightly concave base (Fig. 5: 10) can also be reliably dated to the Eneolithic. The projectile is made from Krumlovský les I chert, formal analogies of which can be found at many Eneolithic hillforts in SW Moravia and beyond (e.g. Grešlové Mýto, Medunová-Benešová 1973, Taf. 75: 5; Vysočany, Medunová-Benešová 1977, Taf. 42: 8; Křepice, Medunová-Benešová 1986, Taf. 53-54; Šebela et al. 2007, Obr. 147: 2). Identical arrowheads were also produced in the mining and workshop area of the Funnel Beaker culture at Stránská skála near Brno (Bartík et al. 2019b, 393, Fig. 9: 1, 2). The find of a blade with partial denticulated retouch and a lateral sheen (Fig. 5: 11) can also probably be dated to the Eneolithic.

Fig. 7. Selection of finds from the Eneolithic. Photo by J. Bartík, drawing by K. Augustinová.
Obr. 7. *Výběr nálezů z období eneolitu. Foto J. Bartík, kresba K. Augustinová.*


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
0
5 cm
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21
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23
24
25

No.	Artefact	Figure	Sample character	Ag	Cu	Pb	Sn	Zn	Fe	Ni	As	Sb	Co	Au	Bi
1	Coin	10: 27	Corroded surface	98.1	0.46	0.15	-	-	0.17	-	-	-	-	1.17	-
2	Fragment of temple ring	13: 27	Corroded surface	92.0	2.29	2.55	2.25	0.20	0.37	-	-	0.08	-	0.25	-
3	Fish-hook	7: 25	Core	< 0.01	97.1	< 0.12	0.05	-	< 0.05	-	2.82	0.01	-	-	-
4	Arrowhead	8	Core	0.20	92.8	< 0.15	3.3	-	< 0.08	1.37	2.12	0.17	0.01	-	-
5	Fragment of cheek piece from bit	9: 18	Core	0.07	89.5	0.64	9.0	-	< 0.05	0.18	0.27	0.26	0.03	-	-
6	Fragment of cutting edge from axe	9: 16	Core	0.05	96.5	0.31	2.6	-	0.01	0.13	0.27	0.07	0.06	-	-
7	Boss	9: 17	Core	0.20	73.4	19.2	6.7	-	< 0.06	-	-	0.02	-	-	0.55
8a	Fitting from a drinking horn - eyelet	12: 1	Core	0.08	88.1	1.84	5.1	4.62	0.20	-	-	0.06	-	-	-
8b	Fitting from a drinking horn - rivet	12: 1	Core	0.08	89.0	0.65	5.6	4.38	0.21	-	-	0.07	-	-	-
9	Disc with hole	13: 28	Core	-	0.07	61.2	38.5	0.13	< 0.12	0.03	-	-	-	-	-
10	Disc with hole	13: 29	Core	-	0.03	98.9	1.06	0.04	< 0.09	0.02	-	-	-	-	-
11	Thin metal strip	13: 30	Core	-	0.09	99.6	0.20	0.12	< 0.14	0.03	-	-	-	-	-
12	Temple ring	13: 26	Core	-	0.26	99.5	0.15	0.04	< 0.09	0.01	-	-	-	-	-

Tab. 2. Results of ED-XRF analysis of the elemental composition of non-ferrous artefacts.
Tab. 2. *Výsledky ED-XRF analýz prvkového složení neželezných artefaktů.*

The metal detector survey of the hillfort in 2021 did not produce finds of metal artefacts demonstrably linked to Eneolithic occupation. Problematic from a chronological perspective is the find of a simple hammered barbless fish-hook with a bent eyelet (Fig. 7: 25) made from nearly pure arsenical copper with trace amounts of tin and antimony (Tab. 2). This material is closest to material group E01 belonging to material type Va (after Junghans et al. 1968) or cluster 3 (after Krause 2003), which overlaps with Mondsee-type copper with the highpoint of its occurrence in the Early and Middle Eneolithic (Matuschik 1998, 241; Dobeš et al. 2019, 40). This material occurs throughout Europe (with various local concentrations) mostly in the Eneolithic and extending into the Early Bronze Age (Krause 2003, 127–129). Several artefacts with comparable material compositions come from Moravia: two axes (Inv. No. 6305, 536) and a spectacle-shaped pendant, all from Štramberk dated to the Proto-Eneolithic (Šikulová et al. 2010, 395–428). Finds from the hoard in Hlinsko likewise have a similar composition, despite the fact that the arsenic content is roughly a quarter (Dobeš et al. 2019, tab. 2). The same composition as the fish-hook from Kramolín is also found in somewhat later specimens of flat axes from the Late Eneolithic (Junghans et al. 1968, ANR 3402 a 3367) and two daggers from the Early Bronze Age (Junghans et al. 1968, ANR 4786; Junghans et al. 1974, ANR 19923). Based on the material composition of the fish-hook in the form of arsenical copper, we can classify it in general to the broad period between the Proto-Eneolithic to the Early Bronze Age (inclusive). At the same time, the absence of tin alloying probably suggests an age prior to the Early Bronze Age, since which time artefacts were predominantly alloyed with tin. We are missing analogical finds of fish-hooks for the Eneolithic period in Moravia. The earlier phases of agricultural prehistory are generally dominated by fish-hooks made from animal bones. Metal (bronze or copper-based) fish-hooks do not appear until the end of the Early Bronze Age (Tihelka 1960, 78; Mozsolics 1967, 68; Probst 1999, 135; Salaš 2005, 56) and, given the uniformity of the artefact, no major formal changes occurred in the following period. As such, a precise dating of the artefact remains for now an open question.

3.2.4 Bronze Age

The beginning of occupation in this period is set in the Early Bronze Age, which the small number of Únětice culture finds are to represent. However, these finds come only from excavations conducted in the 1920s. The large-scale rescue excavation prior to the flooding of the site did not identify any artefacts from the Early Bronze Age (Peštál 1935–36, 23; Skutil 1941, 145; 1947, 35; Kozel 1959, 9; Koštuřík et al. 1986, 203). The peak of settlement of the Kramolín hillfort in the Bronze Age is dated to its end, when the site was occupied by bearers of the Podolí culture (Podborský 1970a, 214; Koštuřík et al. 1986, 203). The beginning of human activities in the Urnfield culture can apparently then be sought in the Late Bronze Age, as suggested by the find of a Velatice culture vessel from feature No. 5 (Kos, Koštuřík 1973–74, 203, Fig. 6: 1).

The 2021 survey of the hillfort did not produce pottery datable to the Early Bronze Age. However, a metal detector survey uncovered the unique find of a bronze arrowhead (Fig. 8), which in terms of typology and material composition stands apart from the existing spectrum of known finds from the Bronze Age in

Fig. 8. Bronze barbed arrowhead. Photo by J. Bartík, drawing by K. Augustinová, ToolScan by M. Kmošek.
Obr. 8. *Bronzová šipka s křidélky. Foto J. Bartík, kresba K. Augustinová, ToolScan M. Kmošek.*

Moravia. The elongated triangular arrowhead with barbs has a distinctly concave base. The arrowhead has a flat body and a lenticular cross-section. Its dimensions are 35 × 15 × 2 mm, with a weight of precisely 2.5 g. Typologically, this form of arrowhead has never been identified before. Arrowheads with a socket clearly dominate Moravia and the surrounding lands during the period of the Urnfield culture, whereas arrowheads with a tang appear in far fewer numbers (e.g. Říhovský 1996; Salaš 2005; Jiráň ed. 2008). Points with a socket begin to appear from the Middle Bronze Age, and before then (i.e. during the Early and Middle Bronze Age) we mainly find arrowheads furnished with a tang (Točík 1978, Taf. CXXII: 25; Stuchlík 1984, obr. 2: 8; Olexa 1992, Tab. I: 5; 2003, Tab. XII: 3, 18; Říhovský 1996, Taf. 28; Szeverényi, Kulcsár 2012, obr. 32b; Vavák et al. 2015, obr. 5: 13). Triangular barbed arrowheads continued to appear in the Bronze Age only in the form of flint projectiles (e.g. Kopacz, Šebela 2006; Kaňáková et al. 2019), several of which even represent a precise formal analogy to the artefact from Kramolín. As such, the projectile in question could be one of the first attempts at the creation of this form of artefact from a material other than stone (bone points also occur infrequently, e.g. Poulík 1943, Abb. 5: 2) and would suggest its possible dating already to the Early Bronze Age. Interpreted in this manner, it could be the earliest phase of arrowhead development in Moravia (barb – spike – socket). And yet, the material from which it is made is not very strong evidence of the domestic provenance of the artefact. Elemental composition analysis demonstrated that the arrowhead was cast from low-alloy tin bronze with a high arsenic and nickel content, a low silver and antimony admixture, and trace amounts of cobalt (Tab. 2). As such, unlike the fish-hook from arsenical copper, this material can be classified according to Krause (2003, Abb. 40–41) among "Fahlerzmetalle mit Nickel", more precisely to the minor material group labelled "Weißmetall, sehr hohe Arsen- und Nickelgehalte" forming cluster 19. Some of the analysed artefacts from Bohemia with a high-point of occurrence in the Early Bronze Age (more precisely in stage BA2) have a very similar composition: axes (4 specimens, cf. Junghans et al. 1974, ANR 10265, 10220, 10266) or a chisel and dagger (1+4 specimens, cf. Junghans et al. 1974, ANR 16283 and 11071; Frána et al. 1995, An. No. 3543, 3545, 3936). The same material occurs in a lower frequency in one axe from the Middle Bronze Age (Frána et al. 1995, An. No. 4892) and in one torc from the Late Bronze Age (Frána et al. 1995, An. No. 6203). Although the list of artefacts with a comparable composition is

Fig. 9. Selection of finds from the Final Bronze Age. Photo by J. Bartík, drawing by K. Augustinová.
Obr. 9. *Výběr nálezů z pozdní doby bronzové. Foto J. Bartík, kresba K. Augustinová.*

rather extensive, the material cannot be said to be common, at least not in Moravia. However, according to the material, it is with a high probability an artefact from the Bronze Age, more precisely perhaps directly from an early phase. And yet, its occurrence can also be sought in more distant areas, especially towards the east. Several scholars (cf. Vavák et al. 2015, 171–173) already consider a potential foreign provenance of the earliest forms of arrowheads based on analogies from the Aegean region, in which they see evidence of contacts between the central European and Mediterranean milieu. In the Mediterranean, simple forms of arrowheads without a socket continued into the Final Bronze Age (Avila 1983, 103–106), and although the dating of the Kramolín arrowhead to the Early Bronze Age seems more than probable, a later dating cannot be fully ruled out.

In terms of technology, the arrowhead was cast in a two-part mould, as is indicated by the imperfectly smoothed seams dividing the level of the two parts of the mould on the horizontal axis of the arrowhead (Fig. 8). After casting, the arrowhead was ground (predominantly in the vertical direction), though the direction of grinding is highly diverse in general, which could indicate the regular regrinding of its surface (with post-depositional processes being responsible for these marks in certain cases).

Final Bronze Age occupation of the Kramolín hillfort is represented mainly by finds of Podolí culture pottery (Fig. 9: 1–15). While part of the collection of pottery can be directly associated with this period thanks to characteristic attributes, some regularly occurring elements led us to create an auxiliary category generally dated to the period between the Final Bronze Age and the Hallstatt period (Tab. 1). New information then came primarily from metal detector survey, which, despite the limited area of investigation, confirmed the potential of the site for acquiring bronze artefacts which, due to the absence of the application of metal detectors and the quickly performed terrain work, escaped attention during the rescue excavation. The 2021 surveys produced three artefacts that can be associated with the occupation of the hillfort during the Urnfield period – an edge fragment of the blade part of a bronze axe (Fig. 9: 16), a small boss with a lug (Fig. 9: 17), and a burnt fragment of a cheek piece from a horse bit (Fig. 9: 18). The results of elemental composition analysis (Tab. 2) show that the axe and cheek piece were made from tin bronze with trace amounts of lead, arsenic, nickel, silver, antimony and cobalt. The signature of trace elements except for the content of tin (intentionally alloyed component) is very similar in both artefacts. This composition corresponds well to the results of contemporary analysed artefacts from the Czech Republic, which is relatively homogeneous from the Middle to the Final Bronze Age and is characterised by a low silver content and similar amount of nickel, arsenic and antimony admixture (Frána et al. 1997, 63). The boss deviates from this uniform composition, as it is made from leaded tin bronze with a high content of lead (19.2%) and trace amounts of bismuth, silver and antimony. Although leaded tin bronze is not a standard material in Late to Final Bronze Age Moravia, specific types of artefacts alloyed with a significant amount of lead appear throughout Europe in this period (e.g. Montero et al. 2003; Trampuž Orel 1996).

While the fragment of the axe and boss do not have an overly high testimonial value for chronological purposes, the fragment of the cheek piece for a horse bit is an important find. Given the massive quality of the artefact, it can probably be classified as a Kamyševacha type (after Dietz 1998), which is characterised by a slightly angled bar body with three tubular holes and wide mushroom-shaped terminals. However, the terminals are broken off both ends of the Kramolín specimen and only part of the body of the cheek piece with a central tubular hole protruding from both sides of the artefact has been preserved. After being damaged, the artefact was apparently designated for re-melting, as indicated by its partial melting and formal deformation. But for unknown reasons, it was never actually melted down. The preserved dimensions are 46 ×18 mm, bar diameter 8 mm. This type of bronze cheek piece occurs primarily in the Balkans and Caucasus and for now has only rarely been documented in Moravia. An analogy can be found in a cheek piece from Křtiny and in four specimens from Bučovice-Klouboučky (Mírová 2019, Fig. 40: 5, 19). Chronologically, the occurrence of these cheek pieces of horse bits falls into the Final Bronze Age (primarily Ha B2), but they also continue to appear until the very beginning of the Early Iron Age (Ha B3 – Ha C1) (Dietz 1998, 148–150; Mírová 2019, 112). This dating fully concurs with the dating of the occupation of the hillfort in the Final Bronze Age, which fluidly continued into the Hallstatt period.

3.2.5 Iron Age

Occupation of the hillfort from the Final Bronze Age continued in the Early Iron Age, which is represented at the site by Horákov culture artefacts. Finds from the Hallstatt period in fact made up one of the largest groups of material sources collected during the rescue excavation conducted prior to the flooding of the hillfort. It can also be assumed that the next phase of the hillfort fortification occurred in this period (followed later by its reconstruction during the Early Middle Ages). An interesting archaeological context in the form of a distinctive accumulation of caryopses retrieved from the thick runoff layers situated outside the palisade at the northern edge of the hillfort is then dated to the Hallstatt period (summarised in Koštuřík et al. 1986, 203 with additional references). In terms of chronology, occupation is associated in particular with stage Ha C, while later human activity is also mentioned in older literature (Koštuřík et al. 1986, 123; Goláňová 2008, 140). However, based on the new and currently ongoing processing of Hallstatt finds, occupation of the hillfort from the Late Hallstatt period has not yet been reliably proven (verbal communication from M. Novák).

Finds from the Hallstatt period made during the survey of the uncovered part of the hillfort in 2021 were mainly a collection of pottery sherds. And yet, even after taking into account the broadly dated groups of finds (Final Bronze Age – Hallstatt Period), they do not make up such a dominant share in the overall collection of acquired finds (Tab. 1) as in the case of the rescue excavation. The quality of the firing of the Horákov culture pottery from the Kramolín hillfort is typically very high, with a great amount of attention having been given to surface treatment. Many potsherds have a polished or sometimes even graphite coated surface. Decoration is also diverse and appears especially in the form of incisions and grooves, including evidence of the red or carmine coating of the vessels (Fig. 10: 5, 14, 15). In addition to pots, amphorae, urns, storage vessels and bowls, several sieve finds can perhaps also be included in the pottery production of this period (Fig. 10: 6, 16). Other ceramic forms are represented by the find of a fragment of a large clay loom weight (Fig. 10: 19) and several spindle whorls, including one damaged conical spindle whorl with a convex wall decorated along its perimeter with a series of incisions (Fig. 10: 18), all of which document textile production at the site. Also apparently related to this issue is the most interesting newly acquired Hallstatt find – a fully preserved ceramic pendant (Fig. 11). Typologically, this is a hanging circular idol with a moon-shaped cut-out (Podborský 1970b, 96; Stegmann-Rajtár 2001, 460–462). The diameter of the Kramolín specimen is 54 mm, with a thickness ranging from 5 to 8 mm and

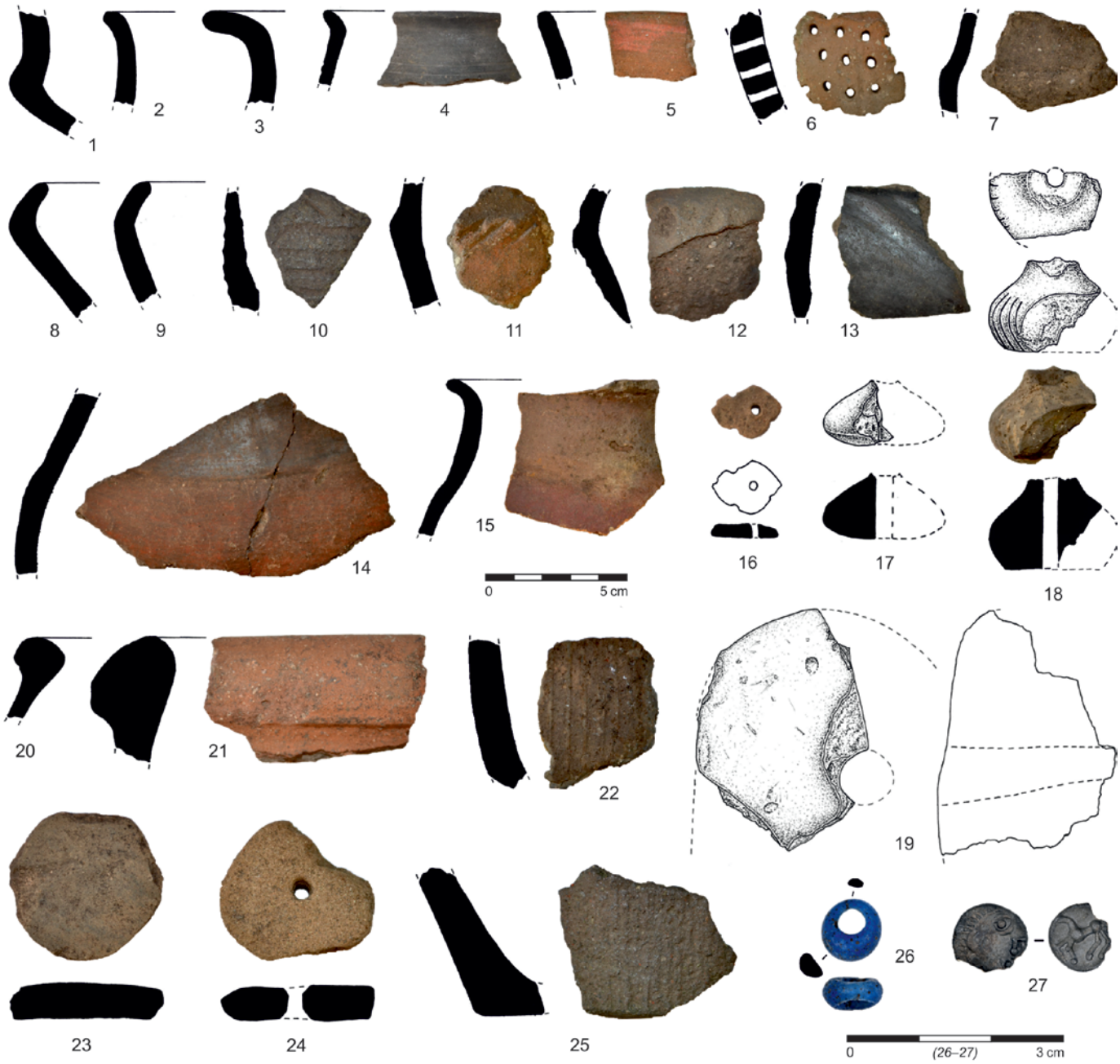

Fig. 10. Selection of finds from the Early (1–19) and Late Iron Age (20–27). Photo by J. Bartík, drawing by L. Dvořáková.
Obr. 10. *Výběr nálezů ze starší (1–19) a mladší doby železné (20–27). Foto J. Bartík, kresba L. Dvořáková.*

a weight of 26 g. The concentration of the occurrence of these artefacts is associated mainly with the Horákov culture in Moravia. Analogical pendants with a moon-shaped cut-out are also known from settlements in Těšetice, Jaroměřice, Bulhary, Hodonice and Křenovice (Podborský 1965, 56–57; 1970b, 66, obr. 18: 8; 1993, 375, obr. 248: 21, 22). Outside of Moravia, a nearly identical artefact was found in the eastern Hallstatt cultural sphere in Lower Austrian Stillfried a. d. March (Hellerschmid, Penz 2004, Abb. 8: 14). A larger number of intact artefacts and fragments of similar pendants come from the central part of the Smolenice – "Molpír" hillfort (Stegmann-Rajtár 2001, obr. 2: 3, 4). Additional finds are known from the Transdanubia region, where they were found both within the settlements (e.g. Kajárpéc-Pokolfadomb; Németh 1996, 370–371, obr. 4: 22) and in grave contexts (Halimba, Tata; Patek 1993 obr. 73: 9–11; summarised in Stegmann-Rajtár 2001, 460). Although the function of the described artefact has not yet been reliably clarified, two interpretations are most frequently offered. The first assumes a more practical use as a lighter weight used in textile production, whereas the second envisions the possibility of use in the non-utilitarian, perhaps ritual, sphere of Hallstatt society, e.g. as a weaving idol meant to accentuate the distinct symbolism of the ritual significance of weaving, or even in connection with the lunar cult (Podborský 1970b, 96; 1993, 377; Stegmann, Rajtár 2001, 462).

A use-wear analysis of the ceramic idol from the Kramolín hillfort made it possible to conduct a relatively detailed examination and determination of its production process. In the initial phase, the pendant was shaped from clay into its rough form, including both projections creating the moon-shaped curve and the conical perforation in the upper part of the artefact.

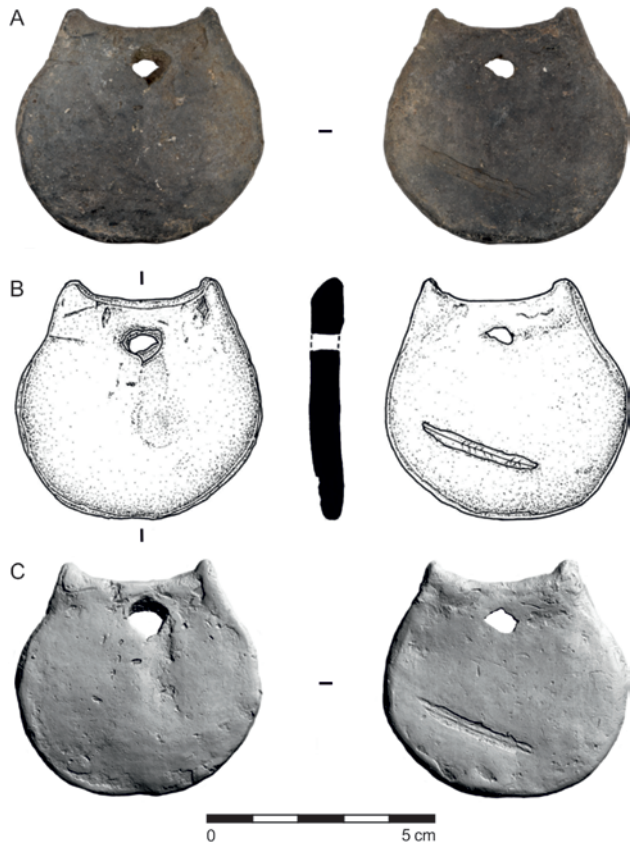

Fig. 11. Documentation of a ceramic Hallstatt period pendant. Photo by J. Bartík, drawing by K. Augustinová, ToolScan by M. Kmošek.

Obr. 11. *Dokumentace keramického závěsku z doby halštatské. Foto J. Bartík, kresba K. Augustinová, ToolScan M. Kmošek.*

An elongated leaf (probably the needles of an unspecified tree) left an oblique print in the wet clay on the bottom part of the artefact. Although this leaf print has a very distinct appearance and creates the impression of intentionality, it probably occurred inadvertently when the object was set out to dry. After the pendant was partially dried, it was fully polished in its leather-hard state, thus achieving a glossier and more refined surface. Areas of the unpolished rough surface created during the initial formation of the object are preserved in depressions, including a small imprint of papillary lines from the finger of the person who made it. The polishing process resulted in the material being pushed over the sides of the originally textured irregularities, including the edges, openings, leaf print and numerous depressions in the surface of the pendant. In the case of the leaf print, this displaced material renders a more precise identification of the leaf impossible, as it has removed the edge parts of the leaf relevant to its identification.

The occupation of the hillfort likely continued to a greatly reduced extent through most of the La Tène period. Occupation starting as early as the Proto-La Tène period (LT A) is documented by sporadic finds in the form of fragments from bowls with an omphalos and stamped decoration and a bronze Certosa fibula (Kos, Koštuřík 1972, tab. 40: 17; Koštuřík et al. 1986, 128, 203; Meduna 1974; Enderová 2007, 102, 107). P. Enderová, who conducted the most recent evaluation of La Tène finds from the hillfort, classified fragments of a ceramic situla with a distinctly oval rim and a relief rib to the Middle La Tène period (Enderová 2007, 102, obr. 6: 1, 3; 8: 1; 11: 25; 12: 7, 17). Late La Tène finds made during the rescue excavation include fragments of vessels with an oval inverted rim, some of which bear traces of the typical black coating at the rim, a fragment of a vessel body with burnished mesh ornament and part of a graphite-coated bowl decorated with an irregular combed rib (Enderová 2007, 102).

The 2021 survey of the hillfort expanded the collection of La Tène pottery by thirteen specimens, the majority of which can be dated only generally to the La Tène period, mostly likely its later stage (Fig. 10: 20–22, 25). Two discs made from potsherds (one perforated, the other unperforated) were also found (Fig. 10: 23, 24); based on the character of their ceramic matrix, they can also be dated to the Late Iron Age. The assemblage from the rescue excavation also contains six similar ceramic discs (Enderová 2007, 101), for which many analogies can also be found at other La Tène settlements, where they occur in large numbers (Meduna 1980, 129). Given that the occurrence of classic spindle whorls is rare in this period, it is thought that the discs were used in place of common spindle whorls. However, the function of unperforated discs made from potsherds is not completely clear. They could be blanks for the production of spindle whorls, pottery smoothing tools or game/counting pieces (Meduna 1980, 129).

A new find made with a metal detector of a small silver obol (Fig. 10: 27) – the first officially known Celtic coin from the Kramolín hillfort – is clear evidence of settlement at the site in the Late La Tène period. The obol had a diameter of 8.2 mm, a thickness of 1.5 mm and a weight of 0.37 g (a small piece of the coin's edge is broken off). In terms of typology, the Kramolín specimen can be identified as a relatively rare type Fa, which is dated to the Roseldorf/Němčice horizon (Kolníková 2012, 51–52). Characteristic of the obverse of this type of coin is the stylised head of a man facing towards the right, a globular eye surrounded by two arches, a linear nose, an open mouth marked with two balls, an arch-shaped ear and hair from arcuate lines separated from the face by a continuous line. In contrast, the reverse depicts a horse viewed from the left. The horse has a long arched neck, the head is missing, the mane is unmarked, and the body is represented by two larger balls (chest and buttocks) connected by a thick line; part of the arched tail is suggested, and the joints and hooves are highlighted by balls connected by lines forming legs. There is a ball above the horse's back. Compared to two known specimens from Němčice (Kolníková 2012, 146, 171, No. 884–885), the obol from Kramolín has a higher quality (or better-preserved) strike on the obverse which, besides the distinct ear, depicts the fully expressed face, just like type Fb. The Kramolín obol differs from type Fb in the separation of the hair from the face by a continuous line (Fa) in place of a row of dots (type Fb), which complements the distinguishing attributes between types Fa and Fb. The two aforementioned artefacts from Němčice were originally dated to the pre-oppida period (LT C). Based on the newly proven continuity of occupation up to the LT D1 stage (unpublished, verbal communication from M. Popelka), the dating of this type of coin was shifted towards the Late La Tène period, which is indicated by the iconography and overall form of the coin, as well as its significantly low weight (cf. Kostur, Gašpár 2018, 208).

Elemental composition analysis demonstrated that the obol from the Kramolín hillfort was made of highly pure silver (surface measurements indicate 98.1% Ag) with a relatively high admixture of gold and with an admixture of copper and lead (Tab. 2). The high silver content in the coin's alloy, with the presence of admixture elements (Au, Cu, Pb) including their quantitative share, corresponds very closely to the results of an XRF analysis of an identical coin type from Němčice (coin No. 884 of type Fa with the following composition: 95.59% Ag, 1.21% Au, 1.00% Cu, 0.96% Fe, 0.35% Pb and 0.88% Br; Kolníková 2012, 188).

Another newly identified type of artefact not previously mentioned from the hillfort is a glass artefact. A round glass bead with an asymmetrically placed hole (Fig. 10: 26), a matte finish and a translucent dark blue (cobalt) colour could be related to La Tène settlement. It should be noted that the specimen has a very simple form which in combination with the common blue colouring is not very chronologically sensitive, with a range of occurrence from the beginning of the Bronze Age to the Roman and Migration periods. However, the majority of formal analogies come from the La Tène period (Čižmářová 2021, 133), where this type of bead is labelled as type 117 (Venclová 2016, 25), which was defined in the material from the La Tène site of Němčice na Moravě. This type of bead occurs there the most frequently, including in a variant with an asymmetrical hole placement. Němčice finds of blanks and failed pieces even document their local production (Venclová et al. 2009; Venclová 2016, 25). If the chronological classification of the bead is proven accurate, this bead and the silver La Tène obol could represent the second find from the Late Iron Age with a potential production-distribution connection to the settlement in Němčice.

3.2.6 Roman period

Human activity from the Roman period was newly documented at the Kramolín hillfort, and although conclusive finds of pottery are still missing, we can reliably date to this period a detector find of an eyelet from a drinking horn of Germanic provenance (Fig. 12: 1). The hanging part has a semi-circular cross-section and the attachment plates are of a flat trapezoidal form. The dividing line between the two parts is accentuated by a pair of cut grooves. A rivet with a relatively wide round head has been preserved. According to Andrzejowski's chronology, the eyelet can be classified as type S.10, which is usually dated to stage B2 (Andrzejowski 1991, 63). This type represents a relatively variable group of hanging eyelets whose common attribute is a reduction in the size of the attachment plates, which are just slightly larger than rivets themselves. Also typical is the simple profile of the transition of the plates and the hanging eyelet (Andrzejowski 1991, Ryc. 14: i).

The eyelet and the rivet are made from identical material in the form of tin brass (the alloy of copper with tin and zinc is also known as gunmetal) with a low content of zinc with an admixture of lead, iron and traces amounts of silver and antimony. The lead content varies considerably in both parts of the artefact; the result of the uneven deposition of lead in cast artefacts is caused by lead separation of grain edges in the microstructure of the copper alloys (Chakrabarti, Laughlin 1984). Compared to finds from the earlier period, the iron content (0.2%) is a whole order higher, apparently caused by the lower quality of metal refining or perhaps generally in the use of different processing methods (e.g. cementation, recycling). Tin brass began to appear more frequently among European alloys of copper and brass during the 1st century AD and its use alongside other copper alloys readily continued in later periods up the present day. The use of tin brass in the Roman period is relatively common, with a highpoint in the 1st and 2nd centuries AD, and is linked mainly with mixing of pure brass with tin bronze (Pollard et al. 2015, 703–704).

The second find indicating human activity at the hillfort in the Roman period is an elongated rectangular bead (Fig. 12: 2) of an opaque white colour with blue lines – apparently a bead with a plant motif ("Pflanzenmuster") of type 348c belonging to group XXII, which is dated to stage C1a–b, i.e. from the second half of the 2nd century AD to the first half of the third century AD (Tempelmann-Mączyńska 1985, 58, Taf. 10). The bead is most likely a remote import.

Fig. 12. Unique finds from the Roman period. Photo by J. Bartík, drawing by K. Augustinová.

Obr. 12. *Ojedinělé nálezy z doby římské. Foto J. Bartík, kresba K. Augustinová.*

The character of local human activities in the Roman period cannot be specified in greater detail based on existing finds (due to their low number, it cannot be ruled out that the artefacts were actually brought to the site later as "curiosities" or "antiques", see e.g. Ungerman 2009), and for now we can only generally date their duration from the course of the 2nd century AD to the mid-3rd century AD.

Evidence of the spread of Germanic tribes deeper into the Bohemian-Moravian Highlands has gradually increased in recent years as a result of the boom in metal detecting as a hobby. The closest find from the Roman period in the form of an Antoninus Pius (ruled from 138 to 161 AD) coin comes directly from the cadastral area of the town of Kramolín (Koštuřík et al. 1986, 204).

3.2.7 Early Middle Ages – Modern period

The early medieval settlement of the Kramolín hillfort shows signs of centrality, which is true especially for the Late Hillfort (c. 950–1200 AD) period (Poláček 1995; 1996, 285–298; Procházka 2009, 145–147; 2011, 615–616). The relevant finds come both from sunken features of various types and from the remains of wood-and-earth fortifications and the homogenised settlement layer. Although only a small number of subsurface features can be attributed with certainty to the Middle Hillfort phase, most of the artefacts were obtained from the settlement layer. The character of pottery documents – based on the vessel fragments of the Mikulčice and Blučina types – contacts with the territorial core of the Moravian principality, as well as gilded silver forgings, which testify to the presence of a part of the local population with a relatively high social status. It is possible to consider a planned centre for settling a region previously only sparsely populated. The period characterised by the reign of members of the Přemyslid dynasty under the sovereignty of the Prague prince is more prominently represented (1055–1197 AD). A probably single-part hillfort with an area of roughly 1.2 ha was enclosed by a fortification with a front and rear stone wall and an inner earth core interspersed with wooden grids or horizontal strengthening construction elements. Gates on neither the south nor north side have been investigated. Pit houses of a regular ground plan differ from a large number of other irregular pits. One even featured an entrance passage, though a heating device was missing. We justifiably conclude, including on the basis of preserved remains from Přerov and from contemporary Polish centres, that the residential development was of a surface character (Procházka 2018; Urbańczyk ed. 2004). The number of subsurface features as well as the cultural layer rich in finds document intense settlement, which is also typical for other contemporary sites with analogical functions. The find of a pit with pottery from the same period as from beneath the rampart indicates that Late Hillfort settlement preceded the construction of the fortification.


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Three *denarii* helped specify the early medieval dating – two Moravian and one Bohemian coin from 1061–1092. L. Poláček evaluated a substantial part of the pottery finds and established three main ceramic groups – with graphite, sandy and with a considerable share of coarse mica (muscovite), where the group with graphite is the largest. In terms of typology, these are pots, storage vessels and beakers. From the rest of the finds and without a more detailed analysis, the finds of glass rings, bronze temple rings (diameter of c. 2.3 cm), a crystal bead and two bronze rings are represented (Poláček 1992-I, 49–90; 1992-III, Fig. 18–57; 1995). Unlike other contemporary centres, especially nearby Rokytná (part of Moravský Krumlov), with which it also has common material culture, the hillfort does not appear in written sources. Although it evidently played a somewhat smaller role than the larger Rokytná in the Přemyslid administrative system, we can assume the presence of a permanent Přemyslid garrison, *milites secundi ordinis,* with the family members of soldiers and other personnel (Procházka 2009, 145–149 with older literature). Late Hillfort settlement is also known from the area on the west side of the Kramolín hillfort on the right bank of the River Jihlava, in the cadastral area of Čalonice. Based on the higher share of everted pot rims, this settlement began perhaps somewhat earlier than the left-bank settlement, though it lasted with certainty into the first half of the 13th century (Poláček 1992-I, 91–98; 1992-3, obr. 48–5).

The recently obtained assemblage also contains an early medieval component. The mostly heavily fragmented pottery includes a smaller Middle Hillfort component (c. 17 fragments; Fig. 13: 1–8) composed mostly of light brown medium- to coarse-grain pottery with simple rims, most of which have a conical cut (4–5 pieces, Fig. 13: 1, 3, 7). The vessels are decorated with a comb-like tool, which produced groups of horizontal incisions, wavy lines and punctures, as well as with a single-point engraving tool, which created horizontal incisions and wavy lines (Fig. 13: 4–7, 15). A noteworthy find is a rim fragment with steep wavy lines at the interface of the neck and shoulder (Fig. 13: 8) with analogies from the Mikulčice settlement at the Žabník site, perhaps already of post-Great Moravian age (Bartošková 2007, 697–698, 704, Fig. 23: 7, 707).

The larger Late Hillfort component includes heavily fragmented and relatively thick-walled pottery (thickness at neck 7–13 mm, minimum wall thickness c. 6 mm) with a slightly prevalent representation of a class with a heavy admixture of fine-grained graphite (L. Poláček's group 1, 1992) and a soft reduction firing (Fig. 13: 9–25). "Sandy" pottery (group 2) is slightly in the minority (a ratio of 15 : 13 among pot rims). Oxidation post-firing was observed in only a small number of cases (Fig. 13: 17, 22). Raised rims with a band, tapering towards the top, are dominant (27 fragments; Fig. 13: 9–14, 18). They are still undecorated, except for one case with a pair of wide wavy lines; the rim from one pot is a prototype for a "cornice" rim (Fig. 13: 17). Raised rims are predominant in the comparative assemblages evaluated by L. Poláček (1992-I, 73). The only rim that does not belong in this group is roundly finished (Fig. 13: 16). Common incised decoration developmentally linked to the Middle Hillfort predecessor includes mainly horizontal incisions and grooves, wavy lines and slits (Fig. 13: 17–18, 22, 24). Rims of more robust storage vessels (diameters at rim level > 30 cm) are mostly modelled on the raised rims of pots; classic club-shaped rims, which occur in the 12th century, were not recorded (Fig. 13: 20–21, 23). The outer rim surface is not yet decorated. One rim is everted, widened and cut conically (Fig. 13: 20). Standing out from the assemblage is a thick (at least 13 mm) fragment refitted from three potsherds that was apparently secondarily deformed by fire. The surface of the fragment is covered with vitreous blisters and has traces of oxidation post-firing – the surface and broken edge are coloured in shades of grey. The fabric is coarse-grained, without graphite. The inner smooth side reveals forming from coils. A rounded rib is the end of the vessel body (Fig. 13: 25). Another unusual fragment with a curved neck and a horizontally-cut and slightly expanded rim from a ceramic fabric with a strong admixture of graphite is difficult to attribute to known Late Hillfort forms from the Czech lands. It appears that the diameter of the mouth was at least 23 cm (Fig. 13: 19). Neither of the presented forms can be positively attributed to the Early Middle Ages without reservations.

Considering the coin finds, the present pottery can be dated to the period between the late second half of the 11th century to roughly the middle or third quarter of the 12th century (cf. Goš 1977; Balcárková et al. 2017, 9–277).

The metal detector survey produced a total of 69 iron artefacts or their fragments, which can be tentatively divided into several groups. Dominating from a functional perspective are fragments of building materials – nails, mostly their shanks, the fragmentary condition of which prevents a more detailed description. Nails with preserved heads are dominated by smaller specimens whose length rarely exceeds 50 mm and which feature a vertical head of roughly a diamond shape (Fig. 14: 12–15). These nails, which can probably be classified as Vb types in the typology of R. Krajíc (Krajíc 2003, 67, Fig. 71), could in fact in several cases represent a specific type of nail – horseshoe nails. However, the specimens recorded from Kramolín are missing the highly characteristic turn of their tips, which in many cases could also be related to the state of their preservation. And yet, thanks to their massiveness and overall dimensions, some of them can be reliably categorised as construction nails (Fig. 14: 11). Also belonging to this category is a find of one slightly deformed nail with a massive horizontal head (Fig. 14: 10), a type IIIa according to R. Krajíc, which is one of the most widespread types of fasteners at medieval sites (Krajíc 2003, 66, obr. 71). Construction hardware (fasteners) is also represented in the assemblage by two fragments of a flat, two-armed cramp of type III/1 according to R. Krajíc (Fig. 14: 17; Krajíc 2003, 76, obr. 79). Several unidentifiable iron fragments, including a small iron ring (Fig. 14: 16) can also be placed in the category of construction hardware with some caution. None of the aforementioned construction material is chronologically sensitive; thanks to their ideal qualities, the individual types of nails and even two-armed cramps can be found from the late phases of prehistory up to the Modern period.

Fig. 13. Selection of finds from the Early Middle Ages. Photo by J. Bartík, drawing by L. Dvořáková.
Obr. 13. *Výběr nálezů z období raného středověku. Foto J. Bartík, kresba L. Dvořáková.*

Fig. 14. Selection of iron artefacts from a period between the Early Middle Ages and Modern period. Photo and drawing by P. Žákovský.
Obr. 14. *Výběr železných artefaktů z období raného středověku až novověku. Foto a kresba P. Žákovský.*

Two fragments of keys can also be classified among construction hardware or to the category of locking mechanisms. The first of these is essentially a fully preserved hook key forged from a single piece of iron bar of a rectangular section, the end of which is wound in a drop-shaped eyelet with a small volute terminal (Fig. 14: 2). These keys, type II according to R. Krajíc (Krajíc 2003, 89–90, obr. 90), occur in large numbers at early medieval sites (e.g. Klíma 1980; Dostál 1988, 144), but are also found sporadically at high medieval sites (e.g. Hejna 1962, 466, obr. 8:1; Slivka 1981, 264, obr. 14: 9; Krajíc 2003, 89–90). An analogical key was found during an excavation at the hillfort in Rokytná (Novotný 1961, tab. 42:1; 1981, obr. 10:6). Preserved from another key, this time a turning key, is a fragment of its hollow shank with a shoulder and oval or roughly cordate bow at its end; both the bow and shoulder have traces of the soldering medium (Fig. 14: 3). The given shape clearly corresponding to turning key type XII according to R. Krajíc (Krajíc 2003, 92, obr. 90) apparently occurs before the end of the 14th century, but is characteristic of the Late Middle Ages up to the end of the 18th century, when they occur in relatively large numbers (e.g. Hoffmann, Mende 1995, 146–158; Weissenberger 2011, 25–26, 103–109).

The category of craft and agricultural tools is represented in the given assemblage by finds of only three thin points of an oval cross-section, which can probably be identified as fragments of awls (Fig. 14: 6–8), which are generally common finds at medieval sites (cf. Krajíc 2003, 152–153). In contrast, the find of a small solid iron hammer with distinctive polls on both sides is relatively unique and has few similar analogies in material published to date in Central Europe (Fig. 14: 1). Given the dimensions and shapes of the actual working parts, the tool was probably used to hammer scythe blades. Although similar forms of the working parts of hammers are known from high medieval sites (e.g. Huml 1967, 10, tab. V:17; Drda 1978, 12, tab. II:15), due to the overall nature of the studied find we lean towards a Modern period or even recent age in this specific case.

Only fragments of two small knives with a tang (Fig. 14: 4–5) can be placed in the category of artefacts connected with personal items from the studied assemblage. In both cases, this is a universal form regularly found in the archaeological material in large numbers from as early as the La Tène period up to the Modern period.

The category of artefacts connected with equestrian equipment is represented in the acquired assemblage by only four fragments of horseshoes (disregarding the challenged interpretation of several small nails mentioned above). Three of these can be positively classified as horseshoes with narrow shanks, the caulks of which were formed by simply bending the shanks, or which were without caulks (Fig. 14: 19–21). If it is possible to determine, the shanks of individual horseshoes had rectangular perforations for nails, which were placed in relatively shallow grooves. More or less distinctive undulation of the outer edge can be described as a characteristic attribute of these horseshoes. The character of the majority of the fragments of horseshoes classifies them as type I/1 according to J. Kaźmierczyk. This type appears especially in the 11th–12th century, possibly extending into the 13th century, nearly throughout the whole of Europe (e.g. Kaźmierczyk 1978, 19–30; Novotný 1979; Baxa 1981, 428–439; Clark 1995, 95–96). The find of one massive screw-in caulk, undoubtedly from a recent horseshoe (Fig. 14: 18), differs completely from this group.

The lone find from the category of war gear was a fragment of a small arrowhead composed of a cone socket with a highly visible seam and a remnant of the actual point (Fig. 14: 9). However, the artefact is heavily damaged in the area of the point, rendering it impossible to determine whether it was equipped with barbs or was a simple bodkin point. In the second case, the arrowhead would probably correspond to points of type B according to V. Serdon (2005, 97–98), type A3 according to A. Ruttkay (1976, 328), or type T 1–3 according to B. Zimmermann (2000, 41–44); these authors agree that the greatest occurrence of the arrowhead was mainly in the 10th–12th century. The arrowhead of the given type from Kramolín, which (barbed or barbless) undoubtedly served in archery, can probably also be dated to this period.

Looking at the acquired assemblage of iron artefacts from Kramolín in terms of chronology, we can distinguish three groups. The first and largest of these is composed of artefacts whose dating purely on the basis of a typo-chronological analysis is not possible, as these were items used over a long time horizon in unaltered form. This naturally mainly concerns iron fragments unclassifiable in greater detail, as well as construction material or hardware in the form of nails and two-armed cramps. Fragments of knives and awls can also be placed in this group. The second group then contains artefacts, which can be linked with greater probability to the functioning of the Kramolín hillfort in the 11th and 12th centuries: a nearly intact hook key, three horseshoe fragments with an undulating outer edge and a fragment of a small arrowhead. The smallest group is composed of artefacts of Modern or recent age, including a screw-in caulk and perhaps a fragment of a turning key and a solid iron hammer.

The character of the studied assemblage corresponds to the composition of assemblages obtained with metal detectors and from other, mainly forest sites, which are mostly connected to defunct or still existing roads, where artefacts linked to the use of routes in the long-term horizon from the late phases of prehistory up to the Modern period are especially found (cf. Vích, Žákovský 2012). In our case, the group of artefacts related to life at the Kramolín hillfort during the Late Hillfort period is interesting and important, and the absence of artefacts of a demonstrable high and the late medieval period is also noteworthy.

The non-ferrous inventory of metal artefacts is made up of one lead temple ring (slightly deformed, with an S-shaped loop, wire of a round cross-section Ø 12–14 mm, weight 1.25g, Fig. 13: 26), a fragment of a silver temple ring (hammered upper part of the wound part of the loop of an Ag temple ring, four fine lengthwise grooves from the outer side, partially worn down, perhaps from use. Similar grooves also appear on the opposite side, though only in the curve – the transition to the lower part of the loop, width 4.4 mm, sheet metal thickness 0.55 mm, weight 0.39 g, Fig. 13: 27), two incomplete lead discs (smaller round lead disc preserved c. 90%, Ø 17 mm, thickness c. 3 mm, Ø centre hole 3 mm, weight 3.25 g, Fig. 13: 28, larger lead disc, preserved c. 75%, Ø 18 mm, irregular thickness, c. 2–4 mm, Ø centre hole 3 mm, weight 4.89 g, Fig. 13: 29 and a thin metal strip from the same material – rectangular lead metal strip. A triangular projection bent backwards extends from one longer side of the strip (dimensions 22 × 15 × 2 mm, weight 2.46 g, Fig. 13: 30).

A surface elemental composition analysis revealed that the fragment of an S-shaped terminal of a larger temple ring is made from silver with admixtures of copper, tin and lead and with trace amounts of gold, zinc and antimony. The higher content of copper, tin and lead could indicate a silver alloy with tin or tin-lead bronze. The second S-shaped temple ring preserved intact is somewhat atypical in its composition of nearly pure lead with an admixture of copper and tin and trace amounts of zinc and nickel. Lead may have been used to make this temple ring to deceive the customer into thinking it was silver; despite the similarity in appearance, lead does not have the same lustre and luminosity as silver, though the lower price compensates for these inadequacies. In any case, lead temple rings are relatively rarely occurring in the early medieval period, or are the least common from the perspective of material. The material most commonly used in the production of S-shaped temple rings is bronze, followed by silver, copper (perhaps silver-plated), tin and, finally, lead (Krumphanzlová 1974, 56). Several tin temple rings were found in the largest Moravian cemetery of the 11th–12th century AD in Uherské Hradiště-Sady (Galuška et al. 2018, 175, 182, 186, 198, 204, 209, 229, 241, 262, 264, 323, 336, 341, 348–349). One of the extremely rare finds of lead temple rings is reported from Srby in western Bohemia (Schejbalová 2013, 97). We also encounter the copper alloy with a relatively increased but minor share of lead, already together with tin (Ottenwelter et al. 2012, 4–5, Tab. 1–2). Temple rings were common women's ornaments in the Late Hillfort period, the beginnings of which in Moravia seem to be somewhat delayed compared to the surrounding countries (Ungerman 2010), and the size of which corresponds to the 11th century and the beginning of the 12th century. The occurrence of lengthwise grooves, especially on silver temple rings, is not unusual during the highpoint of Late Hillfort flat cemeteries. The number of grooves varies: the width of the hammered upper part of the loop is typically c. 4.5–5 mm (Šikulová 1959, 117; recently Jelínková 1999, 15, tab. XXIV, grave 23; 60, tab. XLIX).

The second group of early medieval artefacts from non-ferrous metals is composed of two discs with a hole (one lead, the second from an alloy of tin and lead) and perhaps also a thin lead strip. The lead artefacts are nearly pure and contain only trace amounts of tin, copper, zinc and nickel. A disc (No. 3) from an alloy of tin and lead (general Sn and Pb ratio of 2 : 3) has nearly the same amounts of trace elements. At the very least, both discs can be classified to the period between the Early and High Middle Ages (e.g. Beneš, John 2021).

Finds of lead discs with a central hole have been increasing in recent years, though their presence at Late Hillfort sites was recorded long ago (e.g. Holubowicz 1956, 242, rys. 93: 7, 8; 245; Wachowski 1974, 180–181). They occur at open settlements with an assumed market function (Macháček, Měchura 2013, 279; Balcárková et al. 2017, 350; Bláha, Hejhal, Skala 2013), at silver ore mining locations (Bodnar et al. 2007) and also at hillforts (Měřínský 1986, 61, obr. 28, 2–4, 62; Procházka, Kouřil 2018, 60; Michna 1984, 339; Kouřil, Gryc 2014, 142; 2018, Wachowski 1974,

180–181; Moździoch 2002, 156, where footnote 363 lists numerous other Polish castles with similar finds). They were found in Poland in contemporary graves too (e.g. Dziekanowice; Wrzesiński, Wrzesińska 2006, 344). Moreover, they have been registered at Middle Hillfort (800–950 AD) sites, including an artefact from central Bohemian Tismice with a diameter of 2.11 cm, although it is also without a connection to a specific archaeological context. The connection with sites of this period is still unprovable (Profantová et al. 2020, 244, weight not provided). This type of artefact is not known from the earlier excavation assemblages (Poláček 1995), which is also true for the majority of hillfort sites excavated in Moravia earlier (e.g. Novotný 1978; 1981). The mentioned discs with a hole represent only one type of lead artefact, and they often occur together with other lead artefacts – type I in the typology of R. Bodnar and D. Rozmus. It should be noted that full discs without a hole are also found in a smaller number of cases (type 1b; Bodnar et al. 2007, 18). The prevailing interpretation today is that these were weights, more recently, the hypothesis of their function as "commodity money" was accepted as one of the possible interpretations (Rozmus 2019, 252–253).

The Kramolín finds can be compared with the larger assemblage of 18 discs acquired in a metal detector survey at the Rokytná hillfort in 2011–2012, where two spherical bimetallic weights were also found (kindly provided by J. Videman, temporarily deposited at the Institute of Archaeology of the Czech Academy of Sciences, Brno). The weights of the discs fall into a relatively fluid range of 1.70 to 4.71 g, with an average weight of 3.43 g, with artefacts weighing 5.5 g and especially 7.98 g diverging considerably. The values fall into groups: 1) c. 1.7–1.8 g; 2) 2.5–2.6 g; 3) 4.13–4.71 g; the others occur individually (3 g, 3.6 g). A comparable assemblage from the Czech Republic is known from the open site of Roudnice in the Hradec Králové region, where a large assemblage of lead artefacts, including 29 discs with a hole and four globular bipolar weights, were accompanied by pottery from the 10th–13th century and two coins from the second half of the 11th century (Bláha et al. 2013, 291–294) collected in a surface survey. The lower limit of the weight range was lower than in the Rokytná group (1.083 g), while the upper limit was also slightly lower (6.992 g). However, on average the relevant artefacts were somewhat heavier (3.93 g), with the majority of finds falling into the interval of 4–5 g. This assemblage also had clusters of artefacts with lower weights (e.g. three artefacts around 2.9 g); the range is more fluid. A rather late collection from Rataje in the Tábor region was most recently published (late 12th–13th century; Beneš, John 2021). Fourteen weighed discs with a diameter of 12–22 mm can be arranged in a fluid weight range of 1.82–4.61 g with a relatively high average of 4.485 g. A comparison was also provided by an assemblage of 83 discs from Opole in Upper Silesia in a weight range of 0.5–8.7 g, with clusters in the ranges of 2.5–3.8 g and 3.5–3.8 g. Polish literature assumes a uniform weight system in the territory of the Piast dynasty, with the basic unit being a fraction of the weight of the dirhem (c. 3.5 g). However, there is no consensus on the size of this fraction; according to K. Wachowski it is 1/7, or 0.5 g. Also important is the information that scales and weights did not appear at this administrative centre before the end of the 11th century (Wachowski 1974, zvl. 174–175, 180–181, 193; 2002; Wrzesiński, Wrzesińska 2006, 350–351; Michna 1978, 108, 113). The basic weight unit of a substantial part of Western Europe in the High Middle Ages was the Carolingian pound, from which 240 *denarii* were minted. However, it should be noted that the weight pound was more variable that the "number" pound. Nonetheless, it was based on a unit corresponding to the equivalent of 153 wheat grains, i.e. roughly 8.16–8.18 g, which corresponds to the theory of the connection between the formation of mass units and the need to quantify cereals and bread (Withöft 1983; Suchodolski 1986). Among other things, Jiří Sejbal assumed on the basis of a lead coin weight find from Přerov (6.13 g) that the Carolingian pound was still the authoritative unit in Moravia in the first half of the 11th century and *denarii* of Břetislav I (1034–1055) were still derived from it, even though their weight fell to approximately 1 g. Increasing monetisation in the Přemyslid principality forced the introduction of a lighter unit, a silver mark (*hřivna* in Czech) weighing 211 g in the mid-11th century and therefore lighter *denarii* falling well below 1 g, irrespective of the decline in the silver content (to the Bohemian silver mark in detail, see Radoměrský 1952, 53–73; Pánek, Hladík 1968; Sejbal 1990, 294–298; examples of the weights of *denarii*, e.g. Videman, Paukert 2009). This Bohemian silver mark was derived from the Nordic silver ingot with a similar weight, whose fractions the set of spherical bimetallic weights correspond to. Thanks to the extensive use of metal detectors, these artefacts are also rapidly increasing in the Czech lands. The most common weight around 37–42 g points to a connection with the Nordic silver mark (roughly 1/5), with the lighter weights from Rokytná corresponding to the fractions of this unit (16.25 g and 20.25 g; we thank Pavel Kouřil for the weight information; cf. the weight of two Olomouc pieces around 22 g; Dehnerová, Šlézar 2014, 146; also e.g. Michna 1978; Kouřil, Gryc 2018, 207; Kouřil, Procházka 2018, 64; Profantová et al. 2020, 252; Vích et al. 2021, 366; summarised especially in Steuer 1997, in particular 281–322). The weight of lead discs corresponds to smaller cuboctahedron weights, also forming a set (e.g. in Schleswig 0.35–4.25 g; Steuer 1997, 281–285; recently e.g. Kilger 2008). Relating lead, unfortunately unlike "Nordic" weights unmarked rings, to silver marks, undoubtedly also of variable weights or to other units will be a task for further research. The occasional common occurrence with bimetallic weights also supports a probable connection. And yet, it seems that the precise weight was not all that important as the order in the mass scale of the set (Steuer 1997, 281–290). The classic division of the silver mark into a "*lot*" (1/16), "*věrduňk*" (1/4) and "*kventlík*" (1/64) is well documented in the Czech lands with the introduction of a slightly heavier silver mark in the 13th century accompanied by finds of sets of bowl-shaped "*lot*" weights (Sedláček 1923, 156; Doležel 2008). However, an earlier origin of this system based on the division of the early medieval Nordic "*marka*" into eight ounces was assumed (Nohejlová-Prátová 1975, 46; Sejbal 1997, 102). But more recently, the weighing of new sets of lead weights (mostly of a different shape than the Moravian and Czech types), the Viking Scandinavia and contemporary England allow us to consider the unit "light øre" (24.59 g) and closely related heavier "Dublin" øre (26.6 g), with the smallest parts weighing c. 4 g (Kilger 2008, especially 279–318; Haldenby, Kershaw 2014).

But there is another way that will need to be explored, and that is the question of the function of at least small lead discs as "account money", combined with simple numerical tools of the abacus type (Otisk 2015). Here, the weight variance of these objects would not play a significant role. In any case, the increasing number of finds of rings and weights indicates a higher than previously assumed level of especially internal trade from the 11th century to the first half of the 12th century.

The testimony of additional metal artefacts on the social-economic profile of local residents is limited. Awls document the presence of specialised production, horseshoes an equestrian component. Unfortunately, other iron artefacts from the rescue excavation at the site are no longer available.

3.2.8 Undatable finds

The acquired finds also include a significant assemblage (17.3%) of undatable artefacts (Tab. 1). In addition to a certain percentage of ceramic and metal artefacts, these also include fragments of daub, animal bones and even a small number of bone artefacts, e.g. a fragment of a bone awl (Fig. 15: 1), which cannot be chronologically classified without the use of scientific dating methods.

3.3. Spatial distribution of finds

In spite of the limited time we could devote to prospecting the hillfort, we tried to locate as many artefacts as possible, giving priority to metal finds and chronologically sensitive artefacts with a higher testimonial value. If we look at the spatial distribution of the selected and most significant finds, we can see that they are located in the investigated area in the northern part of the hillfort (Fig. 15). Most finds were recovered below the

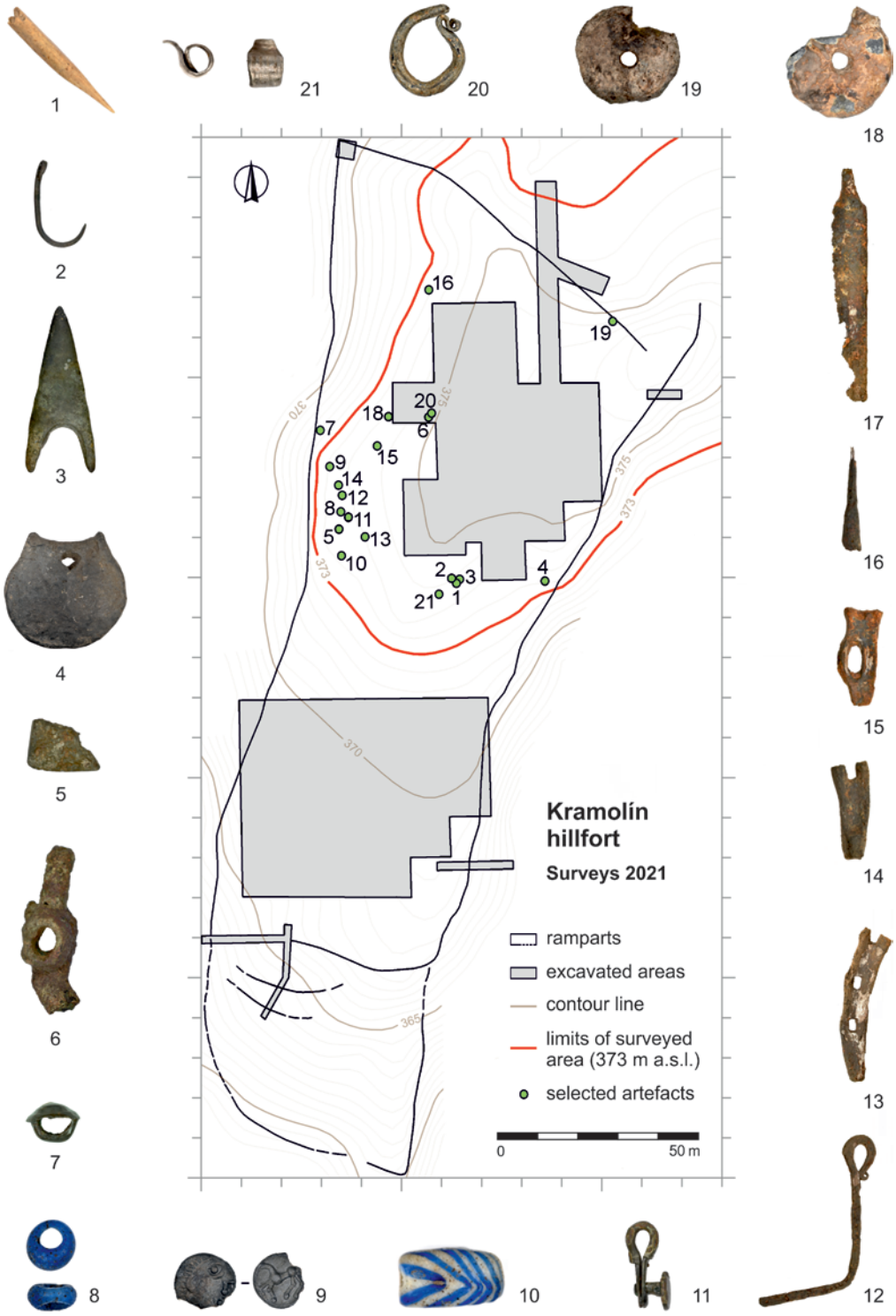

Fig. 15. Plan of hillfort designating areas accessible for survey in 2021 and a distribution of selected finds. Graphic by J. Bartík, P. Škrdla.

Obr. 15. *Plán hradiska s vyznačením plochy přístupné pro průzkum v roce 2021 a distribucí vybraných nálezů. Grafika J. Bartík, P. Škrdla.*

southern and western margins of the aforementioned area corresponding to the state of preservation of the covering sediments. In these areas, there are still remains of the cultural layer that is gradually being washed away by water erosion. On the northern, north-eastern and eastern sides of the exposed part of the hillfort, the surface consists of only stony bedrock and the remains of the covering sediments are rarely preserved here. It should be stated that the resulting distribution of artefacts might have been influenced to some extent by illegal metal detector surveys and surface collections. From unofficial sources, we record several hundred items removed from the site, including a silver *denarius* of Conrad I (1061–1092).

While working on the plan with the distribution of finds, we also tried to delimit the investigated area that was accessible at the time of our survey. However, we found that on current digital maps, the Kramolín hillfort is already covered with water and on archival (paper) maps, the hillfort is not mapped in sufficient detail. We managed to find a detailed map of the hillfort in a 1 : 100 scale, which our predecessors had made during the rescue excavation, and which is currently stored at the State District Archive in Třebíč (deposited under numbers 775 004 – 775 006). This map contains altitude measurements in a 10 × 10 m square grid and shows the original plots on the top of the Kramolín hillfort, which we used to place the map in the coordinate grid together with the help of the 1957 archival map in a 1 : 5,000 scale (source: State Administration of Land Surveying and Cadastre). It should be noted that the elevations in the map were given in the Balt system after levelling and thus are compatible with the current water level data. The aforementioned map with the excavated areas and ramparts was used in a reduced form in the publication of P. Koštuřík (2007). The detailed plan of the Kramolín hillfort created by us thus combines the topography and elevation data from the archival map (the grid with measured points was newly digitised using *Surfer* software) with the original plotting of the excavated areas and ramparts. In the resulting plan, we included the 373 m a.s.l. contour line, which, according to data from the pumped storage power plant (Fig. 3), represents the lowest accessible level of our survey. Based on the resulting plan and the conducted survey, it is clear that at this level it is not possible to comment in detail on the current state of preservation of the ramparts, whose major part is situated even lower below the water level (cf. Machová 2021).

4. Conclusion

The Kramolín hillfort is still listed in the database of the National Heritage Institute as a protected cultural monument (ÚSKP No. 35513/7-2812; NPU 2015). Although most of it is located below the surface of Dalešice Reservoir, when the water is low, part of the hillfort is exposed and accessible by boat. The hillfort was visited in this condition in 2021 by several members of a team of authors with the aim of verifying the site's current archaeological potential. Unlike earlier attempts employing the methods of underwater archaeology (cf. Machová 2021), we took advantage of the temporary lowering of the water level for repairs to the dam of Dalešice Reservoir to visit the hillfort, a possibility that can be utilised again in the future to study the site.

The survey produced a large amount of archaeological material from various prehistoric periods, the Early Middle Ages and the Modern period. Unidentified activities from the Roman period were documented at the site for the first time. Existing knowledge of the site was significantly expanded by several specific finds unique from a typological perspective, for the elemental composition of their material used in their production (e.g. a copper fish-hook, a bronze barbed arrowhead, a La Tène obol, a Hallstatt pendant with a moon-shaped cut-out, glass beads, an early medieval lead temple ring and discs). The majority of these finds were made with a metal detector, indicating that thorough survey with this tool could in the future not only bring interesting finds but also new information concerning human activities at the site, which was flooded before the mass introduction of metal detectors and hence is untouched from this perspective (only the highest points of the hillfort have been robbed by illegal metal detectorists, which was even documented by our survey) and therefore well preserved.

In conclusion, it should be emphasised that the archaeological potential of the site is far from exhausted and therefore archaeologists of the Institute of Archaeology in Brno will continue to study the hillfort. These efforts will require strong cooperation in the planning of major reductions in the water level between Povodí Moravy, s. p., the Dalešice Pumped Storage Power Plant and the Institute of Archaeology, which would perform further detailed investigations.

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Resumé

Archeologický ústav AV ČR, Brno, v. v. i., se již více než dekádu věnuje dokumentaci eroze a záchranné archeologii v prostoru soustavy vodních nádrží, ze kterých sestává přečerpávací vodní elektrárna Dalešice. V listopadu 2021 jsme zachytili informaci (např. Nedělková 2021), že z důvodu práce na hrázi dojde k výraznějšímu snížení hladiny vodního díla Dalešice (dále VD Dalešice). Rozhodli jsme se proto využít situace a po několika dekádách od zatopení prozkoumat aktuální stav známého hradiska v Kramolíně.

Od uvedení přečerpávací vodní elektrárny Dalešice do provozu (1978) dochází vlivem její činnosti k periodickým pohybům vodní hladiny VD Dalešice s denní amplitudou 2–3 m, což způsobuje erozi sedimentů tvořících břehy nádrže. Tato eroze postupně odhaluje a rozrušuje archeologické situace, které následně vyžadují rychlé zdokumentování před jejich úplným zničením. V roce 2021 jsme se zaměřili na kramolínské hradisko, které bývá při vyšších stavech hladiny zcela zatopeno, ale při snižování vodní hladiny z důvodu přepouštění vody do spodní nádrže se jeho nejvyšší část pravidelně vynořuje nad hladinu. Tento jev je intenzivnější v sušších periodách a v zimních měsících (z důvodu zajištění retenčního prostoru pro vodu z tajícího sněhu), kdy je vodní hladina na nižší úrovni. Z důvodu údržby hráze byla na konci roku 2021 hladina výjimečně snížena na hodnotu 274 m a vlivem přepouštění klesala v nočních hodinách až k úrovni 271,5 m. Rozsah obnažené plochy hradiska tak dosahoval rozměrů přibližně 100 × 80 m.

Cílem návštěvy hradiska bylo využít dočasného snížení vodní hladiny k dokumentaci míry eroze, zjištění množství na povrchu volně ležícího archeologického materiálu a stanovení potenciálu, který lokalita skýtá pro další (zejména detektorový) průzkum. Na ostrov tvořený obnaženou částí hradiska byly s pomocí raftu podniknuty dvě výpravy. Poprvé 26. 11. 2021 jsme na lokalitě ve sněhové vánici strávili přibližně dvě hodiny od 10:30 do 13:30, kdy se hladina držela na kótě 373 m. Pro průzkum byl

volný (nezasněžený) pouze pás pláže v šířce až 6 m (po maximální úroveň, kam dosahovala hladina v noci a kde se tudíž nedržel sníh). O necelé dva týdny později jsme akci zopakovali, protože sníh roztál a byla možnost prozkoumat i vrcholovou část hradiska, která byla při první návštěvě pokrytá sněhem. Přestože jsme na lokalitě strávili přibližně pět hodin od 9:30 do 15:30, hladina se po většinu doby držela na úrovni těsně pod 374 m. V pozdějších hodinách sice začala hladina klesat, pokračování průzkumu už ale nebylo z důvodu nevhodných světelných podmínek možné.

I přes omezený čas, který mohl být věnován průzkumu hradiska, jsme se snažili zaměřit polohu co největšího množství artefaktů, přičemž upřednostněny byly zejména kovové nálezy a chronologicky signifikantní artefakty s vyšší výpovědní schopností. Pokud se podíváme na plošnou distribuci vybraných nejvýznamnějších nálezů, můžeme vidět, že obklopují prostor již prozkoumané plochy v severní části hradiska (obr. 15). Nejvíce nálezů se pak podařilo získat pod jižním a západním okrajem výše vzpomínané plochy, což koresponduje i se stavem dochování pokryvných sedimentů. V těchto místech totiž stále zůstávají dochovaná rezidua černě zbarvené kulturní vrstvy, kterou postupně rozplavuje vodní eroze. V severní, severovýchodní i východní části obnažované partie hradiska je povrch tvořen již jen kamenitým podložím, zbytky pokryvných sedimentů jsou zde dochovány už jen zřídka. Na základě provedených terénních pozorování ovlivněných maximální úrovní snížení hladiny (373 m) není možné blíže se vyjádřit k aktuálnímu stavu zachování valového opevnění, to se z větší části nacházelo ještě níže pod vodní hladinou, jak prokázala nedávná prospekce s využitím metod podvodní archeologie (cf. Machová 2021).

V průběhu dvou výše popsaných prospekčních expedic na kramolínské hradisko v roce 2021 se podařilo získat i přes záměrnou selekci více jak 1 300 nálezů. Největší část z nich náleží fragmentům keramických nádob a dalších drobných předmětů (přesleny, závaží, figurální plastika atd.). Získána byla ale i početná kamenná industrie (zejména štípaná), několik kusů mazanice s otisky konstrukčních prvků, dva fragmenty kostěných nástrojů, dva skleněné korálky a soubor více jak osmi desítek kovových artefaktů z barevných kovů i ze železa (tab. 1).

V souboru převažuje materiál náležející mladoneolitickému osídlení kultury s moravskou malovanou keramikou, což koresponduje i s výsledky záchranného výzkumu ze 70. let, v rámci kterého podle odhadu autorů výzkumu náleží lengyelskému osídlení statisíce keramických jedinců (cf. Koštuřík 1975–76, 106). Druhou nejvýznamnější komponentu představují nálezy spojitelné s raně středověkým osídlením hradiska a s pozdějšími středověkými a novověkými lidskými aktivitami. Výrazněji jsou zastoupeny ještě doklady osídlení z vícera fází eneolitu a pozdní doby bronzové až starší doby železné. Drobné soubory materiálu či jednotlivé nálezy pak náležejí svým charakterem do starší doby bronzové (?) a do doby laténské. Nově se na hradisku podařilo doložit blíže neurčené aktivity v době římské. Dosavadní poznání lokality významně rozšířilo i několik specifických nálezů, které jsou unikátní buď z hlediska typologie, anebo z pohledu prvkového složení materiálu (tab. 2) použitého k jejich výrobě (např. měděný rybářský háček, bronzová šipka s křidélky, laténský obolus, halštatský závěsek s měsícovitým vykrojením, skleněné korálky, raně středověká olověná záušnice, olověné kotoučky s možnou funkcí závaží ad.). Většina z výše zmíněných nálezů byla získána pomocí detektoru kovů. Tato skutečnost naznačuje, že právě důkladná detektorová prospekce by mohla v budoucnu přinést nejen další zajímavé nálezy, ale poskytnout i nové poznatky o lidských aktivitách na lokalitě – ta totiž byla zatopena ještě před masovým nasazením detektorů kovů, a je tak z tohoto pohledu nedotčená, a tudíž dobře zakonzervovaná (pouze nejvyšší partie hradiska byly vykradeny ilegálními hledači – což bylo doloženo i průzkumem v roce 2021).

Námi provedené prospekce otevírají velmi aktuální otázku – jakým způsobem přistoupit k ochraně lokality (s doloženým rozplavováním pokryvných sedimentů s nálezy a jejich odnosem amatérskými hledači) z pohledu památkové péče a jakou zvolit metodiku jejího dalšího výzkumu? Nutno zde vzpomenout rovněž podstatný fakt, že hradisko Kramolín je stále vedeno v databázi Národního památkového ústavu jako památkově chráněná kulturní památka (rejst. č. ÚSKP 35513/7-2812; NPU 2015). Míra ochrany lokality však aktuálně neodpovídá jejímu významu a lze ji hodnotit jako jednoznačně nedostatečnou. Průzkumy v roce 2021 prokázaly, že archeologický potenciál lokality dosud nebyl zdaleka vyčerpán. Hradisko proto bude i nadále sledováno pracovníky brněnského Archeologického ústavu. Nutná však bude v budoucnu dobrá koordinace plánování výrazných snížení hladiny mezi Povodím Moravy, s. p., ČEZ, a. s., vodní elektrárnou Dalešice a Archeologickým ústavem AV ČR, Brno, v. v. i., tak aby mohlo dojít k provedení včasného archeologického průzkumu s aplikací detailněji koncipované metodiky.

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