Zbořený Kostelec 1: New evidence of Magdalenian settlement in Bohemia

Zbořený Kostelec 1: nové naleziště z období magdalénienu v Čechách



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KEYWORDS

Magdalenian – Upper Palaeolithic – Sázava River region – surface survey – lithics

ABSTRACT

This study presents new evidence of Magdalenian occupation in Bohemia through the analysis of a surface lithic assemblage from the Zbořený Kostelec 1 site located in the Sázava River region of Central Bohemia. Although the assemblage was recovered through surface prospection and its original spatial context was significantly disturbed by agricultural activity, its techno-typological characteristics allow its attribution to the Magdalenian. Technological characteristics, including a strong focus on regular blade production, prepared striking platforms, and use of direct soft organic percussion, correspond to the advanced blade technologies characteristic of the Central European Magdalenian. While the tool assemblage is dominated by burins, other typical Magdalenian tool types such as end-scrapers, borers and backed bladelets are present as well. The variable degree of patination observed within the assemblage is discussed in relation to post-depositional processes. Comparison with the well-known Magdalenian site of Hostim 1 demonstrates a shared technological tradition, while also revealing differences in site function. Whereas Hostim 1 appears to have had a stronger association with hunting-related activities and projectile equipment, Zbořený Kostelec 1 represents a more diversified activity area combining lithic production, tool maintenance, and domestic tasks. In comparison with Kvíc, more distinct differences in terms of the raw material economy and toolkit are observed. The study highlights the importance of surface assemblages for reconstructing Magdalenian mobility, technological organisation, and landscape use in Bohemia.

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1. Introduction

Surface assemblages represent an important source of information on prehistoric settlement, particularly in regions where stratified sites are rare. No stratified hunter-gatherer sites are present in the Sázava River region and surface sites with a high number of finds are also rare. This article presents a previously unpublished lithic assemblage from the Zbořený Kostelec 1 surface site (Central Bohemia, Czech Republic). According to the tool types that were present and their method of production, the assemblage is attributed to the Magdalenian; for the first time, it confirms Late Upper Palaeolithic occupation of the area.

Characteristics of the lithic collection from this site and its regional context are described in this article. As accessible and published materials do not provide many similar collections, to compare the assemblage with stratified material we chose Hostim 1 (Vencl 1995a) to show how it relates to the lithic collection from the radiocarbon-dated site. Then we compared the assemblage with Kvíc 1 (Benková 2003), which shows more distinct differences.

1.1 The Magdalenian in Bohemia

The Magdalenian occupation of Bohemia (Fig. 1; Tab. 1) represents the final phase of the Upper Palaeolithic in the region (broadly dated to the Late Glacial period, c. 15,000–12,000 BP; Verpoorte, Šída 2009). It corresponds to a time of significant climatic amelioration following the Last Glacial Maximum, when retreating ice sheets and the gradual establishment of more temperate environments facilitated the re-expansion of human populations into previously marginal areas of Central Europe (Maier 2015). In the Czech Republic, radiocarbon dates for the Magdalenian cover the time span of 20,000–13,500 cal BP (Verpoorte, Šída 2009; Kapustka et al. 2023), and most of the sites belong to its later phase (sensu Maier 2015); according to the lithics present at Zbořený Kostelec 1, it appears that the assemblage belongs to this later phase of the Magdalenian, too.

In Bohemia, Magdalenian settlement is comparatively less dense and less well documented than in neighbouring regions such as Moravia or southwest Germany (Maier 2015). Nevertheless, a number of important sites provide insight into the character of human occupation. These sites are predominantly located in river valleys and karstic areas, reflecting preservation and research biases and genuine settlement preferences. Rock shelters and caves, particularly in the Bohemian Karst, have yielded stratified deposits with lithic assemblages and faunal remains attributed to the Magdalenian (Eigner et al. 2026; Kapustka et al. 2026; Svoboda ed. 2002; Vencl 1995a).

Lithic assemblages of the Bohemian Magdalenian are characterised by blade and bladelet production, with a toolkit that includes backed bladelets, often rectangular microliths, and

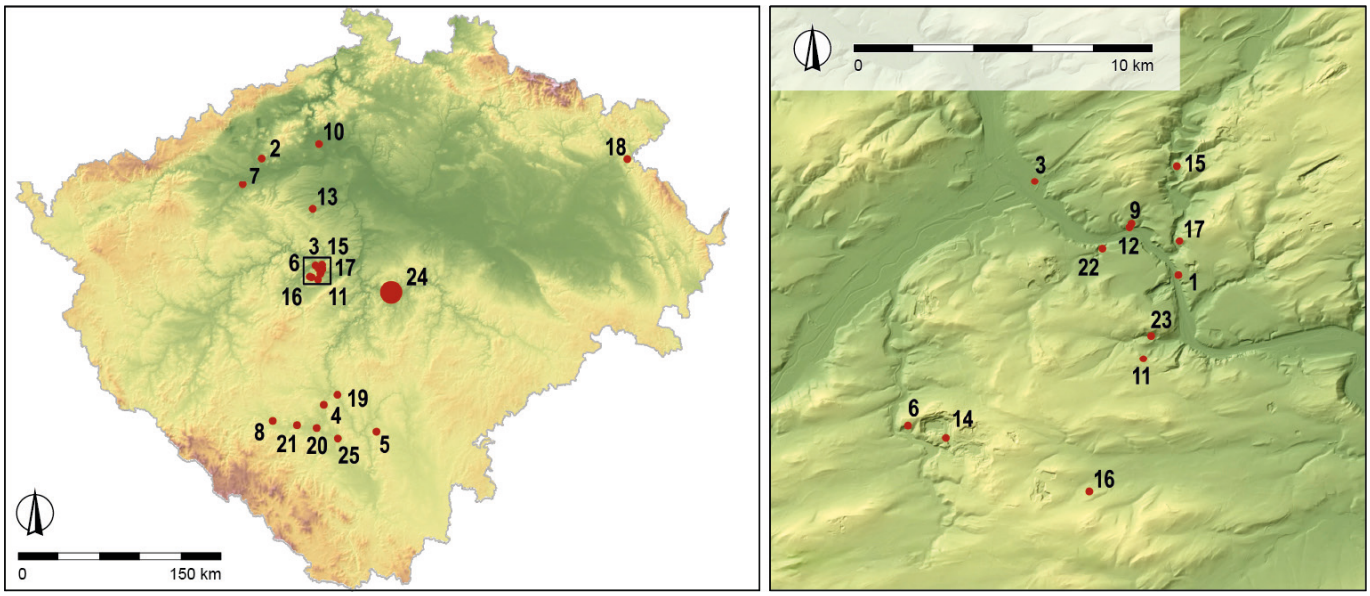


Fig. 1. Position of Zbořený Kostelec (24) within other Magdalenian sites in Bohemia. Base map: © ČÚZK, numbers on the map match numbers in Tab. 1. Author F. Adámek.

Obr. 1. *Poloha Zbořeného Kostelce (24) v rámci ostatních nalezišť z magdaleniénu v Čechách. Podkladová mapa: © ČÚZK, čísla na mapě korespondují s číslováním v tab. 1. Autor F. Adámek.*

No.	Site	District	Type of site	Type of research	Reference
1	Barrandova Cave	Beroun	Cave	Excavation	Vencl 1995a
2	Bečov 1B	Most	Openair	Excavation	Vencl 1995a
3	Beroun – Závodí	Beroun	Openair	Excavation	Vencl 1995a
4	Borečnice 2	Písek	Openair	Surface survey	Vencl ed. 2006
5	Březnice 2	Tábor	Openair	Surface survey	Vencl ed. 2006
6	Děravá Cave	Beroun	Cave	Excavation	Vencl 1995a
7	Dobříčany	Louny	Openair	Excavation	Vencl 1995a
8	Dolní Poříčí 4	Strakonice	Openair	Surface survey	Vencl ed. 2006
9	Hostim 1	Beroun	Openair	Excavation	Vencl 1995a
10	Keblice 1	Litoměřice	Openair	Excavation	Vencl 1995a
11	Koda	Beroun	Cave	Excavation	Vencl 1995a
12	Krápníková Cave	Beroun	Cave	Excavation	Eigner et al. 2026
13	Kvíc 1	Kladno	Openair	Excavation	Benková 2003
14	Dolní Cave No. 1119	Beroun	Cave	Excavation	Vencl 1995a
15	Na Průchodě	Beroun	Cave	Excavation	Vencl 1995a
16	Na Skalici	Beroun	Cave	Excavation	Kapustka et al. 2026
17	Nad Kačákem Cave	Beroun	Cave	Excavation	Vencl 1995a
18	Náchod 1	Náchod	Openair	Excavation	Vencl 1995a
19	Oslov	Písek	Openair	Surface survey	Eigner, Fröhlich 2013
20	Putim – Pikárna Hill	Písek	Openair	Excavation	Vencl ed. 2006
21	Slaník 1	Strakonice	Openair	Surface survey	Vencl ed. 2006
22	Turské maštale	Beroun	Cave	Excavation	Vencl 1995a
23	Ve Stráni	Beroun	Cave	Excavation	Vencl 1995a
24	Zbořený Kostelec 1	Benešov	Openair	Surface survey	unpublished
25	Žďár 1	Písek	Openair	Surface survey	Vencl ed. 2006

Tab. 1. Magdalenian sites in Bohemia. Numbers in the table match numbers in Fig. 1.

Tab. 1. *Lokality z období magdalénienu v Čechách. Čísla v tabulce se shodují s čísly na obr. 1.*

sometimes other types of microliths, splintered pieces, borers, burins, and end-scrapers (Vencl 1995a). Organic materials, although rarely preserved, would have played an important role, as indicated by parallels from better-preserved sites elsewhere in Europe. The technological organisation reflects a high degree of mobility and adaptability, with evidence suggesting that groups employed flexible strategies of raw material procurement. Siliceous rocks (such as erratic flint, chert) and quartzites were commonly used, often transported over considerable distances, indicating wide-ranging networks or seasonal movements. But the range of the used raw materials was much wider, and there are examples of the use of local raw materials at Hostim and Kvíc, and raw materials transported over a long distance, e.g. rock crystal and Bavarian cherts (Vencl 1995a).

Subsistence strategies during the Magdalenian in Bohemia were focused on large game hunting; particularly well documented is horse (Vencl 1995a), which is consistent with the open steppe environments with patches of forest. Faunal assemblages, where preserved, support this interpretation, although taphonomic processes have often limited their extent. Hunting likely took place in strategic locations such as valley corridors and open plateaus, where animal herds could be intercepted during seasonal migrations.

Settlement patterns suggest a system of short-term camps rather than large, permanently occupied sites. These camps were likely used repeatedly over time, forming part of broader seasonal rounds. The preference for elevated positions near water sources reflects both practical considerations and the need

for surveillance of the surrounding landscape (Vencl 1995a). In some cases, evidence of structured activity areas in Central Europe points to a degree of spatial organisation (Kozlowski et al. 1995; Ginter et al. 2005; Bałaga et al. 2008), although this is less clearly documented than in the classic Magdalenian regions of Western Europe (Gaudzinski-Windheuser et al. eds. 2011; Caron-Laviollette et al. 2019; Karlin, Julien 2019; Karlin et al. 2023; Corradini et al. 2024). However, in the Czech Republic the interpretation of the season of use and repetitive visits of the sites is (at most sites) not based on solid evidence, but rather reflects the intuition of the author of the excavation (Vencl 1995a). Thus, there should be much more work done to really understand the local nature of Magdalenian mobility and seasonality in Bohemia.

1.2 Characteristics of the Posázaví region

1.2.1 Geomorphology and geology of the Sázava River region

The Sázava River region, situated along the middle course of the Sázava River in Central Bohemia, represents a geomorphologically and geologically diverse landscape that has played a significant role in human settlement patterns since prehistory. From an archaeological perspective, its environmental setting offers a complex interplay between bedrock structure, fluvial dynamics, and topographic variability, all of which have influenced site distribution, preservation conditions, and resource availability.

The Sázava River region is formed predominantly by crystalline rocks belonging to the Moldanubian Zone of the Bohemian Massif. The bedrock consists mainly of high-grade metamorphic rocks such as gneisses and migmatites, interspersed with amphibolites and occasional bodies of granitoids. Only in the lowermost part of the Sázava Valley, close to its confluence with the Vltava River, does the river cut into Neoproterozoic siliciclastic rocks of the Barrandian area, including shales, greywackes and arkosic sandstones. These lithological contrasts have influenced valley morphology and local patterns of erosion and sediment accumulation. The structural fabric of the bedrock, including foliation and fault systems, has significantly influenced both the course of the Sázava River and the development of the valley network. Quaternary deposits are represented mainly by colluvial and alluvial sediments, with local occurrences of loess and loess-like deposits. Elevation varies considerably, typically in the range of 200–500 m above sea level, with rugged terrain dominating the landscape.

The region is characterised by the deeply incised valleys of the Sázava River and its tributaries. These valleys originated through progressive fluvial incision associated with regional uplift during the Late Cenozoic and are notable for their well-developed entrenched meanders, many of which became established during the Middle Pleistocene. Along much of its course, the Sázava flows through a narrow valley bordered by steep slopes and rocky promontories, while broader valley segments occur only locally. Relative relief commonly exceeds 80–150 m and reaches even greater values in some parts of the middle valley. These features provided advantageous locations for prehistoric and early historic settlements, particularly elevated spurs offering natural defence and visibility. Besides providing favourable settlement locations, the Sázava River Valley also formed an important natural travel corridor connecting Central Bohemia with the interior of the Bohemian-Moravian Highlands.

The Quaternary evolution of the valley is documented by a well-developed system of fluvial terraces. Morpho-stratigraphic studies have identified seven principal terrace levels (Balatka et al. 2010), reflecting alternating phases of river aggradation and incision during the Pleistocene. Higher and older terrace remnants are preserved mainly as isolated fragments above the valley margins, whereas younger terraces occur predominantly within meander bends and wider valley segments. Terrace deposits consist largely of sands and gravels and are locally of considerable thicknesses, particularly in the middle Sázava Valley, where remnants of former valley courses have been preserved. The distribution of terrace remnants along the Sázava Valley is strongly controlled by valley morphology. While extensive terrace accumulations occur mainly in broader valley reaches, especially upstream of the confluence with the Želivka River, terrace preservation is limited in the deeply incised meandering sections where erosion has removed much of the older sedimentary record. The site of Zbořený Kostelec is situated on one of the low (Late Pleistocene) terrace surfaces of the Sázava Valley, approximately 5–10 m above the actual river channel. Such positions are characteristic of many prehistoric sites in the region, combining proximity to water resources with reduced flood risk and favourable visibility across the valley corridor.

Fluvial terraces and associated alluvial deposits are particularly relevant for archaeological research, as they provide both stable settlement surfaces and sedimentary archives preserving cultural material. In addition, locally developed loess and loess-like deposits contributed to the formation of fertile soils that favoured agricultural activities during later prehistory.

Soil development in the Sázava River region is closely tied to its geological substrate and topography. Shallow, stony soils dominate on steep slopes, while deeper, more fertile soils occur on terraces and gentle inclines. This variability has influenced land use patterns over time, with more intensive settlement and agriculture concentrated in areas with favourable soil conditions.

Hydrologically, the Sázava River and its tributaries have been central to the region's development. The river not only served as a source of water and food but also as a natural travel corridor. Seasonal flooding and sedimentation processes have shaped the floodplain environment, affecting both site preservation and the archaeological record.

Overall, the Sázava River region presents a dynamic landscape where geological structure and geomorphological processes have directly impacted human occupation. Its combination of defensible topography, access to water, and diverse natural resources made it an attractive area for settlement, while its complex sedimentary environments offer valuable archives for reconstructing past human-environment interactions.

1.2.2 Palaeolithic settlement in the Sázava River region

The Sázava River region, located around the Sázava River Valley in Central Bohemia, is seen as the periphery (not only) of prehistoric settlement. The evidence of its occupation is scarce for all periods, including the Palaeolithic, reflecting both environmental constraints and broader patterns of human mobility in Central Europe. Archaeological evidence suggests that this area lay on the periphery of more intensively settled zones, such as the fertile lowlands of the Elbe basin, yet it still formed part of wider hunter-gatherer landscapes.

The oldest clear Palaeolithic evidence is from the Middle Palaeolithic period (Břicháček, Eigner 2024). Known collections are not numerous, but as this component is present at multiple locations around the Vltava/Sázava confluence, it seems clear that this area was used during the Middle Palaeolithic. Evidence from this period is scarce and typically consists of isolated lithic finds rather than stratified sites (Břicháček, Eigner 2024). The Sázava River would have served as a natural route through otherwise difficult terrain, facilitating access to water, fauna, and raw materials.

Apart from the site presented in this article, no other Upper Palaeolithic settlement is known in the region. Late Palaeolithic occupation is known from the surface site of Světlá nad Sázavou (Vencl, Rous 1998; Pajerová 2012). Site types in the Sázava River region are open-air scatters, mostly located on river terraces or elevated positions overlooking the valley. The archaeological visibility of such sites is limited by erosion, slope processes, and later land use, which have often disturbed Palaeolithic layers. Evidence of hunter-gatherer settlement is present for the Mesolithic period, too (Vencl 2011; Kapustka et al. 2024a; Kapustka, Zemanová Davidová 2024), showing that the region was attractive for the foragers even when the natural environment changed.

2. Materials and methods

This study is based on a surface collection of lithic artefacts recovered from the Zbořený Kostelec 1 site in the Sázava River region of Central Bohemia. The methodological approach combines an assessment of the environmental setting of the site, an evaluation of the circumstances of its discovery through archaeological field survey, and a techno-typological analysis of the recovered assemblage. The archaeological material was obtained through long-term surface prospection conducted on a plowed field. Subsequently, all collected artefacts were subject to systematic lithic analysis, including metric documentation, raw material identification, and classification into technological and typological categories. This integrated approach enables the archaeological potential of the site to be assessed and provides a basis for interpreting the character, chronology, and technological organisation of the recovered Magdalenian assemblage.

2.1 Prospection method

The Zbořený Kostelec 1 is situated in Central Bohemia (Czech Republic) at an altitude from 260 to 265 m a.s.l. on a flat terrace several metres (5–10 m) above the actual course of the Sázava River (Fig. 2). It is likely that any possible situations were heavily modified by post-depositional agricultural and slope processes. Evidence of the latter was observed in a shallow excavation for a small swimming pool approximately 50 m from the cultivated field (Fig. 3). The upper part of the profile is composed of clay-rich sediment containing abundant river pebbles mixed with brick fragments and other recent anthropogenic material, displaying bedding conformable with the present-day slope. This unit overlies relatively undisturbed silty sands representing the original fluvial sedimentation of the Sázava River. The site was found thanks to prospection by the local collector Jana Lajerová at the end of the 20th century and was visited repeatedly for more than 20 years. The concentration was quite restricted, but for this initial phase of the prospection the exact position of the finds was not recorded.

According to the description of various approaches to the surface survey (fieldwalking), the employed method can be described as an intensive survey (Kuna 2004, 324), non-systematic, with a primary focus on the complete recovery of surface material in the area affected by agricultural activity. Despite its selective nature, it revealed a considerable collection of lithic finds and a more systematic approach to the survey at this particular site is planned in the following seasons. According to our actual knowledge, the main concentration forms a distinct scatter of the lithic finds roughly 30 m in diameter.

2.2 Evaluation of the finds

The Magdalenian collection from Zbořený Kostelec 1 consists of only lithic pieces; no other materials were identified. The analysis of the collection followed a standard process. All finds were measured and weighed, the raw material was identified macroscopically for all pieces and under the microscope for selected items. All finds were sorted according to techno-typological categories. Typological features were the primary tool used to identify the chronological association of the finds. The lithic artefacts we discuss below are sorted into the following categories: 1. tools and retouched pieces, 2. blades and blade fragments, 3. cores and core fragments, 4. production waste (including microburins, tablets, and crested blades, etc.), 5. other waste (chips, flakes, flake fragments). Selected pieces were documented. The sample for documentation was chosen to cover all typo-technological categories present and to be representative of the presented collection. Within lithic analysis, tools and retouched pieces are understood as finished products, which allow us to see the intentions behind the observed production processes (Odell 2003; Andrefsky 2005). Especially important is the high number of present tools, which enables us to chronologically anchor this surface collection (Klíma 1956; Floss ed. 2012). Blades and blade fragments are also quite informative in demonstrating the general strategies of blank production and the (non)selective approach on preferences for blanks for tool production. Blanks also allow us to see some intentions of the producers and can sometimes aid in identifying the tools used for percussion, etc. Cores and core fragments can help confirm general lithic production activities associated with the

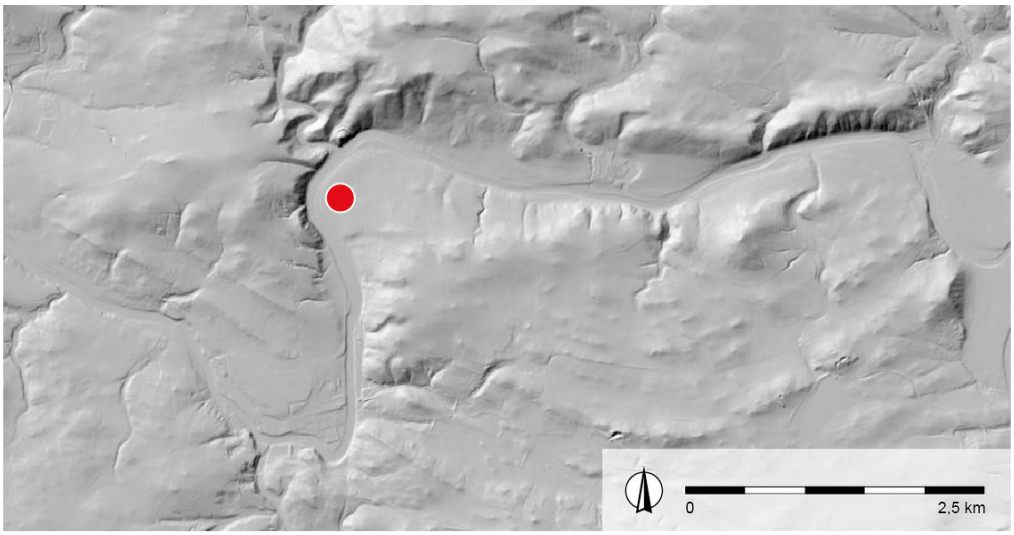


Fig. 2. Position of the site within local landscape settings. Base map: © ČÚZK; author K. Kapustka.

Obr. 2. *Poloha naleziště v rámci mikroregionu. Podkladová mapa: © ČÚZK; autorka K. Kapustka.*

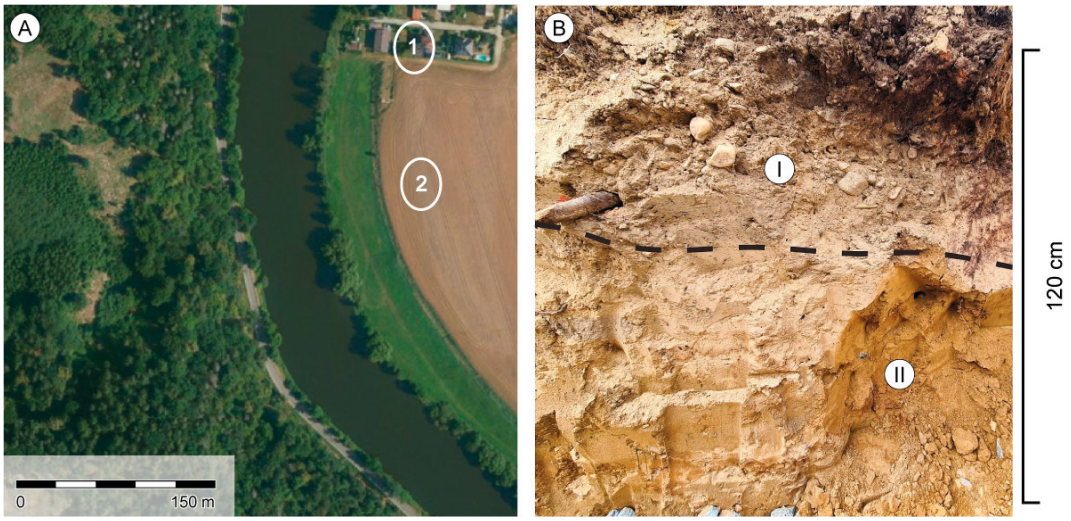


Fig. 3. A – aerial photograph with position of the construction trench (1) near the study site (2), base map: © ČÚZK; B – profile in the construction trench showing the upper archaeological horizon from which was obtained the lithic assemblage. This heterogeneous, clay-rich deposit with abundant river pebbles and modern brick fragments (I) overlies laminated loamy sands interpreted as undisturbed fluvial sediments of the former Sázava River floodplain (II). Author J. Hošek.

Obr. 3. *A – letecký snímek s vyznačením stavebního výkopu (1) poblíž studované lokality (2), podkladová mapa: © ČÚZK; B – profil v odkrytém stavebním výkopu zobrazující svrchní archeologický horizont, z něhož pochází soubor štípané industrie. Toto heterogenní ložisko bohaté na jíl s hojným výskytem říčních oblázků a moderních úlomků cihel (I) leží na laminovaných hlinitých píscích interpretovaných jako nenarušené fluviální sedimenty bývalé nivy Sázavy (II). Autor J. Hošek.*

site, which are also sensitive to temporal trends. The informative value of the other waste is usually quite low, but in this case provides important testimony of production at the site.

3. Description of the lithic collection

The lithic assemblage from Zbořený Kostelec 1 can be characterised as a highly standardised Magdalenian blade collection dominated by erratic flint, with blade and bladelet production and a toolkit rich in burins and end-scrapers. The assemblage counts 823 pieces and shows clear technological and typological affinities with the Bohemian Magdalenian.

3.1 Raw material economy

The raw material economy was mostly dependent on erratic flint, with over 97% of the collection produced from this type of rock. Taken together, all other raw materials represent only 2.3% of the collection (19 artefacts, Tab. 2). The nearest sources of erratic flint are located in North Bohemia, over 100 km to the north. Even though the collection is clearly dominated by erratic flint, the stone was used in its different variants (Fig. 4). Erratic flint represents the highest quality raw material present at the site; other raw materials are in general of lower quality and do not represent typical Magdalenian tools. However, as the only typical tools in this collection are Magdalenian, for the moment all raw materials are considered part of the collection.

Another important point is the level of the patination, which is extremely variable throughout the entire collection (Fig. 4). In Czech lithic studies, patination has traditionally been regarded as a useful indicator of post-depositional history and relative chronology rather than a direct measure of age. There are pieces that are highly patinated and, on the other hand, also fresh unpatinated pieces of clearly Magdalenian origin. There was a lot of discussion around patination as a marker of the chronological association of the lithic collections. Palaeolithic archaeologists in the Czech Republic repeatedly discussed the value of the differences in patination to distinguish artefact groups of different depositional histories or potential chronological affiliation (e.g. Vencl 1995b; Svoboda 2000; Oliva 2005). However, they also stressed that patina formation is strongly affected by raw material properties and local environmental conditions. Consequently, patination should be treated only as a supplementary line of evidence and interpreted together with the technological, typological and contextual characteristics of the assemblage. For the particular situation at the Zbořený Kostelec 1 site, the time the pieces were exposed to agricultural activities/weather conditions appears to be the most accurate interpretation of the presence/absence of the patina on various pieces. As such, pieces that were buried longer in the Magdalenian horizon seem to be fresher and less patinated, whereas pieces that spent a longer time in a secondary position are more patinated (Glauberman, Thorson 2012).

While there are some spongolites present in all occurring production categories (Tab. 2; Fig. 4), they are in a very low quantity, followed by Bavarian cherts, which are present as a core and one tool. All other raw materials (porcellanite, quartz, Krumlovský les-type chert, siliceous weathering products) are present only as debitage and are known from other sites in the Czech Republic.

The raw material economy represents a standard situation in the Bohemian Magdalenian (Vencl 1995a), where collections are often dominated by one raw material, and with some exceptions it is mostly erratic flint. Thus, this collection shows the same preference for raw material for lithic production as is common

Production categories	Erratic flint	Other raw materials	Other raw materials	Burnt	Patinated	Cortical
Cores	17	2	Spongolite, Bavarian chert	2	17	3
Blades	160	1	Spongolite	4	158	20
Debitage	464	10	Spongolite, Krumlovský les-type chert, quartz, porcellanite, chalcedony, siliceous weathering product	5	437	49
Production Waste	35	1	Spongolite	1	32	6
Tools	128	5	Spongolite, Bavarian chert	1	119	14
Total	**804**	**19**		**13**	**763**	**92**

Tab. 2. Composition of the production categories of the assemblage from Zbořený Kostelec 1.

Tab. 2. *Skladba výrobních kategorií kolekce ze Zbořeného Kostelce 1.*

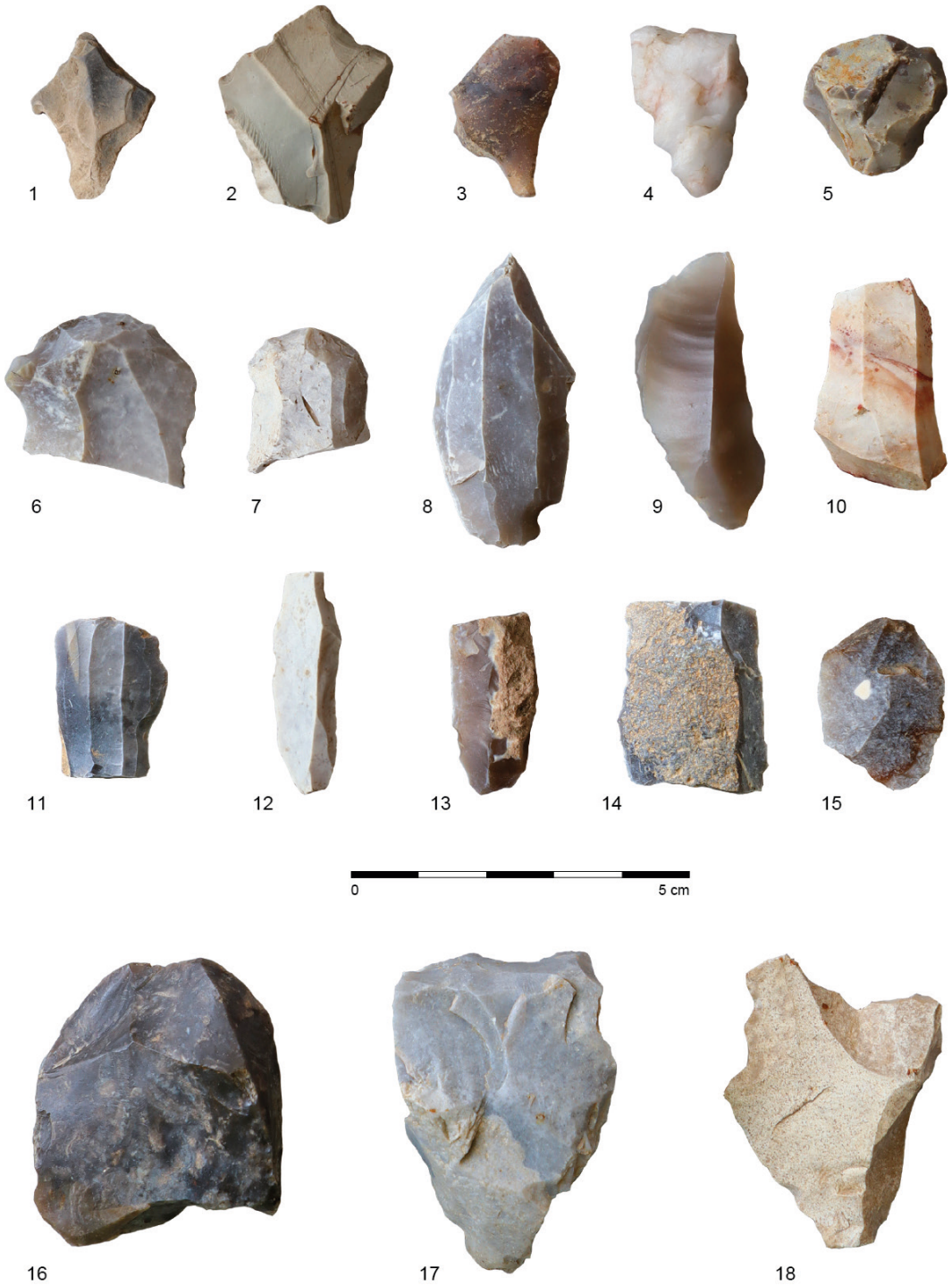


Fig. 4. Identified raw materials: 1, 2 – porcellanite; 3 – chert of the Krumlovský les type; 4 – quartz; 5 – Bavarian chert (Flintsbach); 16 – siliceous weathering products (Písek region); 17, 18 spongolites; 6–15 variants of erratic flint with different levels of patination. Photo by I. Hrušková.

Obr. 4. *Suroviny zastoupené v souboru: 1, 2 – porcelanit; 3 – rohovec typu Krumlovský les; 4 – křemen; 5 – bavorský rohovec (Flintsbach); 16 – křemičitá zvětralina (Písecko); 17, 18 – spongolity; 6–15 různé varianty silicitu glacigenních sedimentů s odlišnou mírou patinace. Foto I. Hrušková.*

in the region. The Zbořený Kostelec 1 assemblage therefore reflects a specialised procurement strategy focused on a single, highly suitable knappable material.

3.2 Technology of the lithic collection

The lithic assemblage from Zbořený Kostelec 1 provides valuable insights into the technology, reduction strategies, and character of activities undertaken at the site. The composition of the assemblage, together with the technological attributes of cores, blanks, and retouched tools, demonstrates that the site served as a spot for lithic production, use and discard. A total of 823 lithic artefacts were analysed (Tab. 2). Debitage constitutes the largest component of the assemblage, accounting for 474 specimens (57.6%). Blades and blade fragments represent 161 pieces (19.6%), while retouched tools number 133 artefacts (16.2%). Nineteen cores were identified (2.3%), and specific production waste accounts for another 36 specimens (4.3%). Such a distribution is highly informative from a technological perspective because it demonstrates the presence of a complete *chaîne opératoire*, encompassing raw material preparation, core reduction, blank production, tool manufacture, maintenance, and discard. Erratic flint dominates all production categories. Most of the pieces (92.8%) are patinated. Cortex is present on a low number of pieces (11%), which might indicate the transport of prepared cores and not unprepared nodules of the raw material. A small number of the pieces are burnt (1.6%), which might indicate the presence of a fireplace at the site; however, the low number of burnt pieces does not allow us to identify the probable location of the potential fireplace. The overall condition of the artefacts is fresh, not rolled or heavily effected by any type of surface weathering.

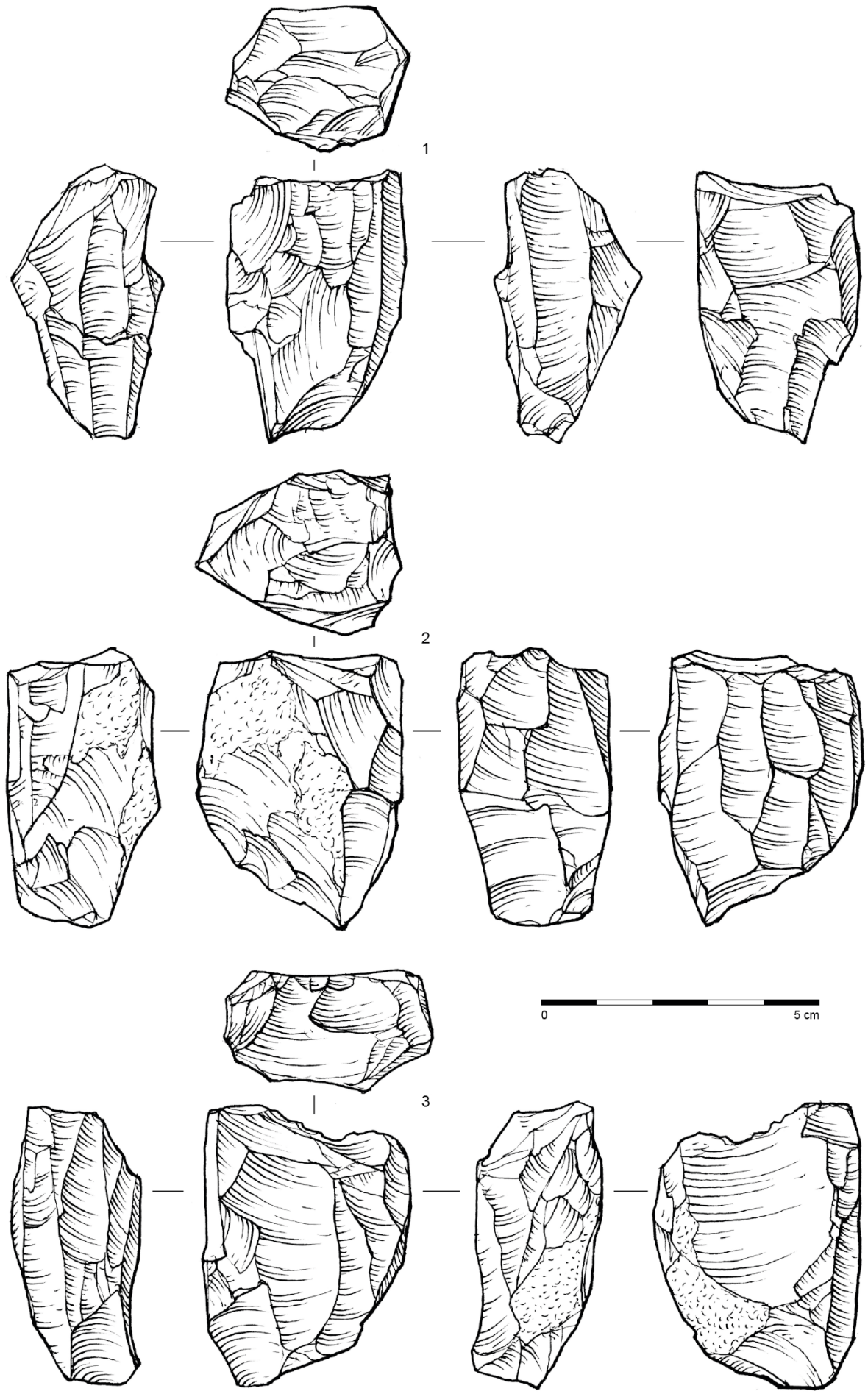


Fig. 5. Selected cores. All made of erratic flint. Drawing by M. Černý.
Obr. 5. *Vybraná jádra. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

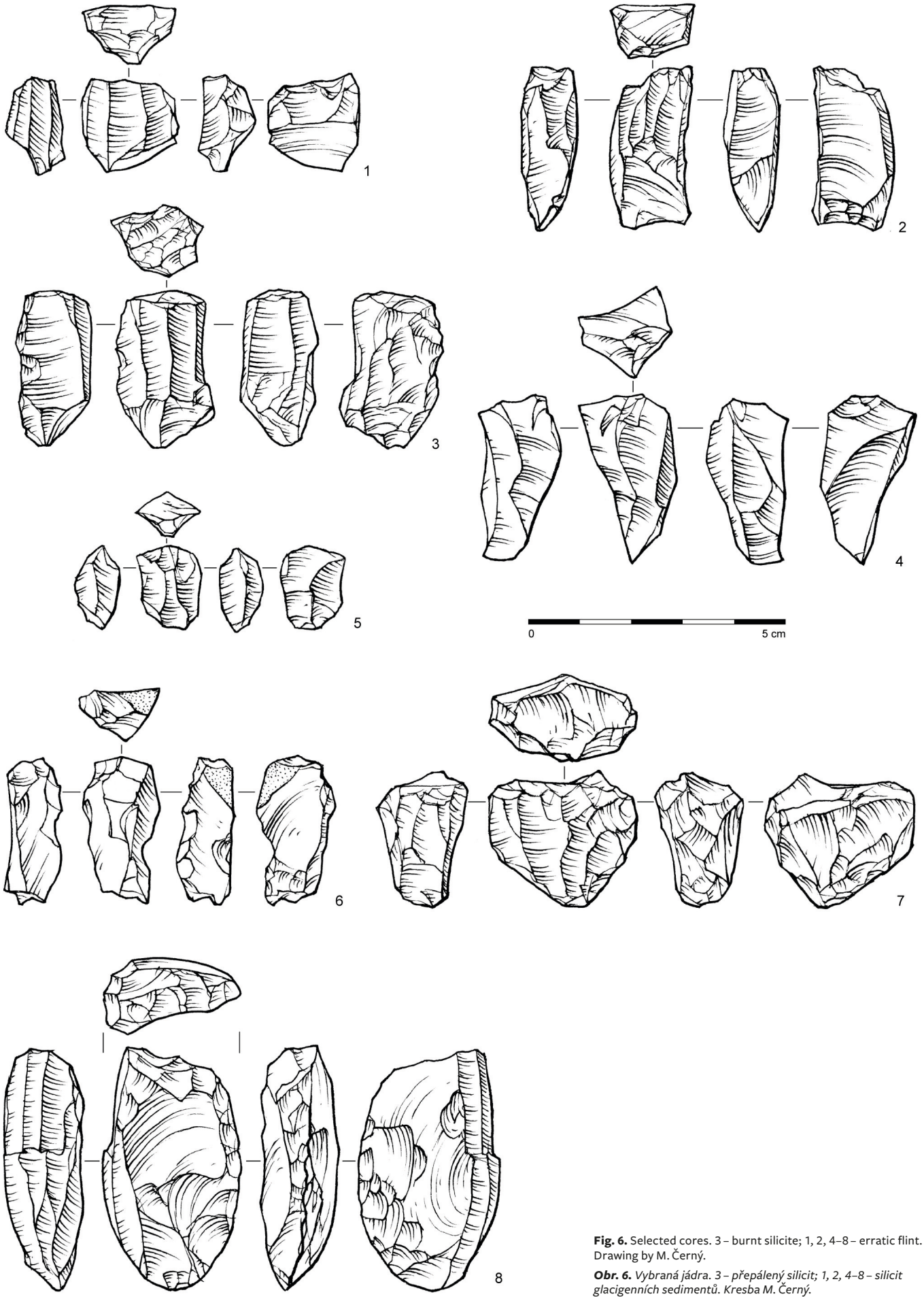


Fig. 6. Selected cores. 3 – burnt silicite; 1, 2, 4–8 – erratic flint. Drawing by M. Černý.

Obr. 6. *Vybraná jádra. 3 – přepálený silicit; 1, 2, 4–8 – silicit glacigenních sedimentů. Kresba M. Černý.*

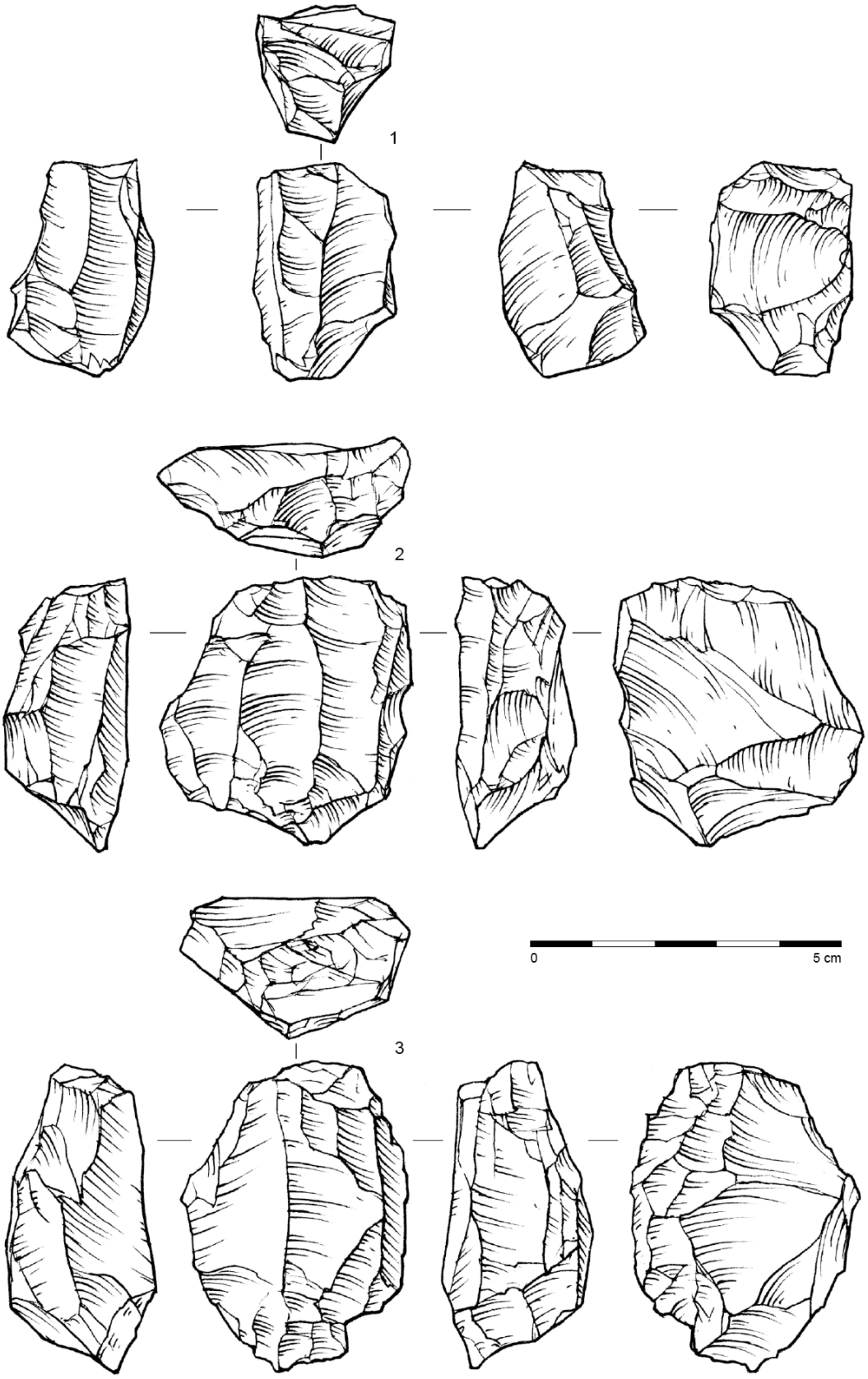


Fig. 7. Selected cores. All made of erratic flint. Drawing by M. Černý.
Obr. 7. *Vybraná jádra. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

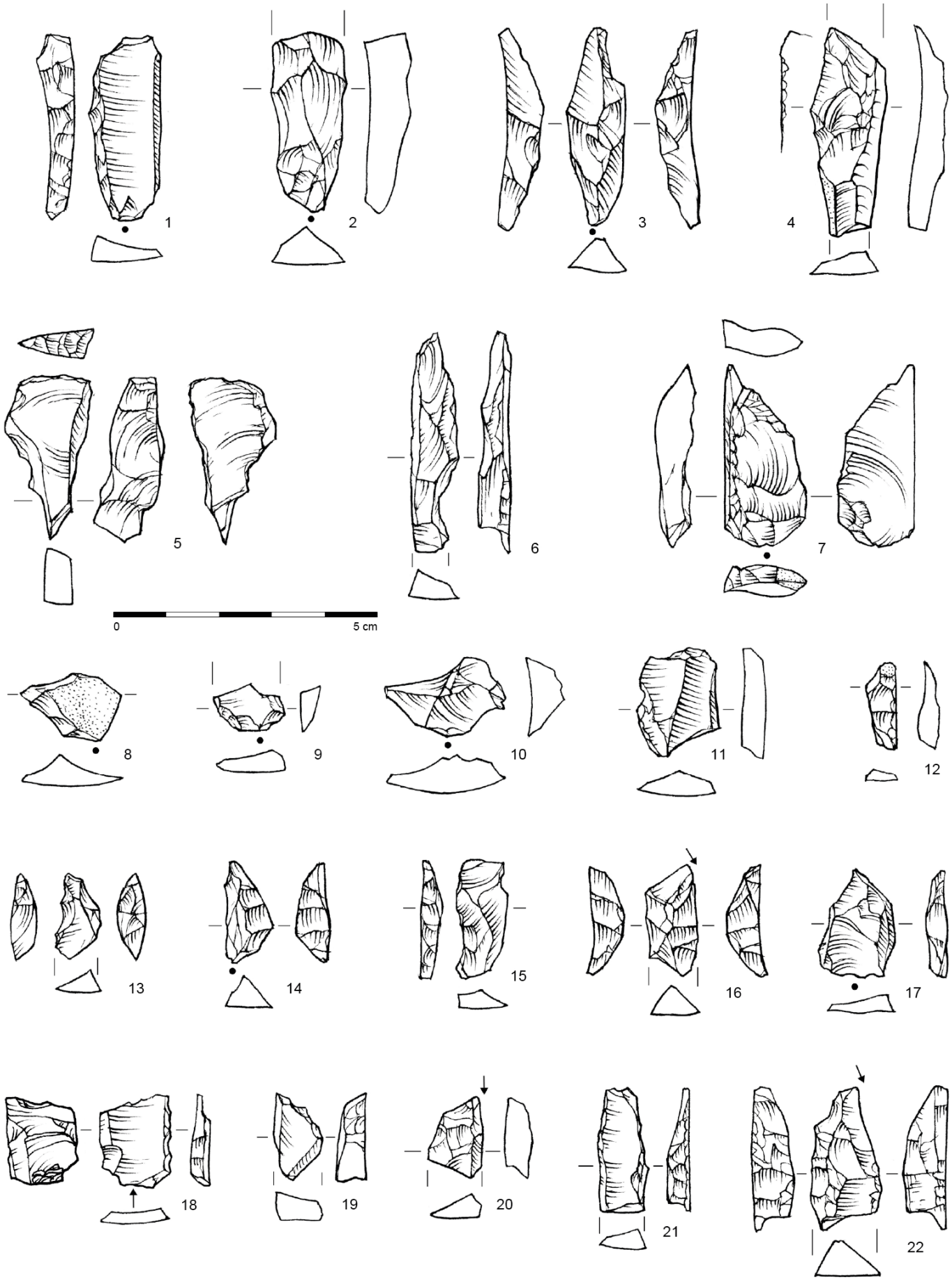
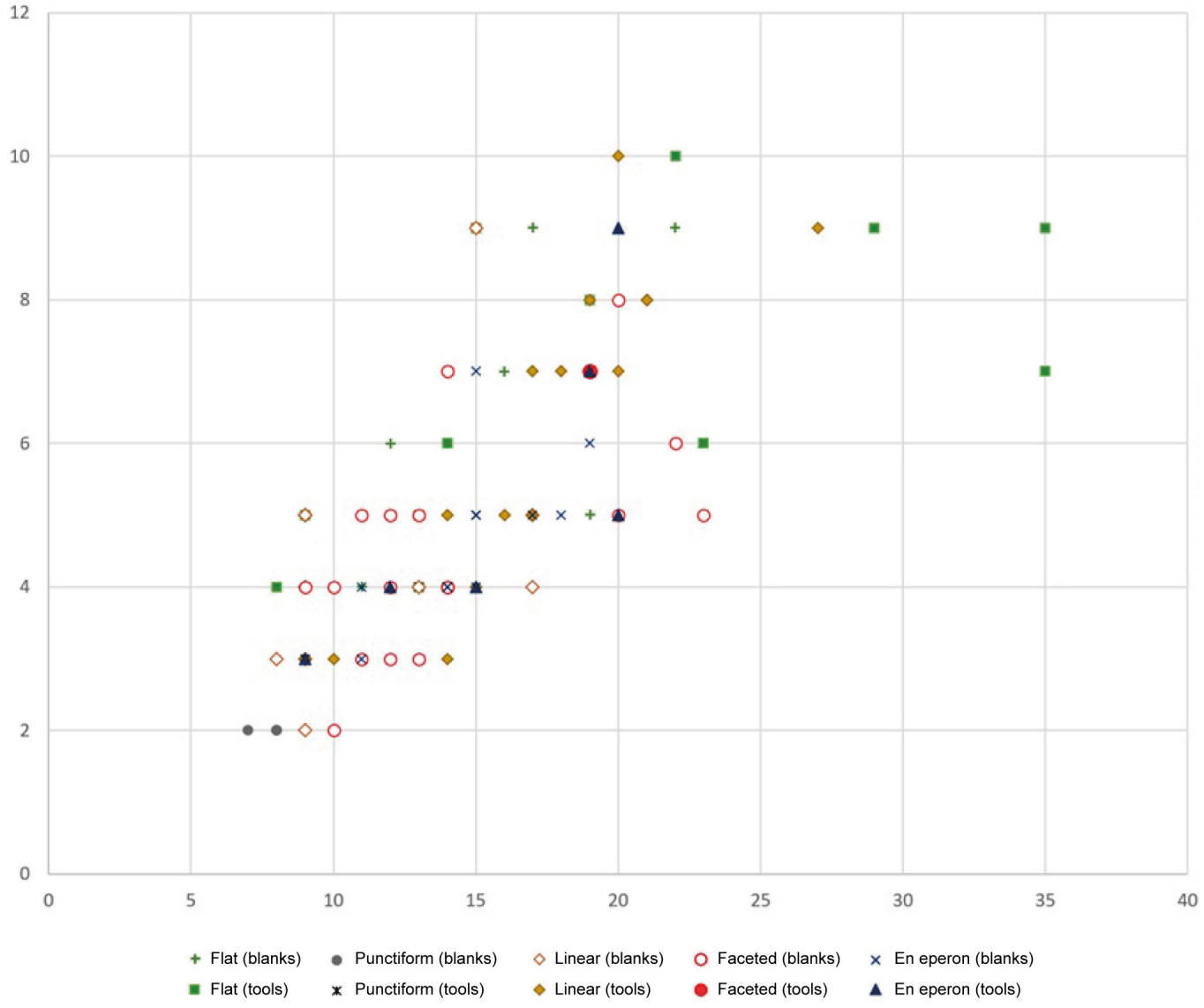


Fig. 8. Technical flakes. 8 – burnt silicite; 1–7, 9–22 – erratic flint. Drawing by M. Černý.
Obr. 8. *Výrobní odpad. 8 – přepálený silicit; 1–7, 9–22 – silicit glacigenních sedimentů. Kresba M. Černý.*

The predominance of debitage is typical for assemblages associated with primary lithic reduction and confirms that substantial knapping activities took place directly at the site. The simultaneous presence of numerous cores, large quantities of production waste, and a significant number of finished tools suggests that Zbořený Kostelec was an occupation area where lithic artefacts were produced, modified, and used. The assemblage therefore differs from specialised workshops or short-term hunting stations, where only selected stages of the reduction process are usually represented.

Particularly significant is the occurrence of nineteen cores (Fig. 5–7), seventeen of which were manufactured from erratic flint. From the 19 cores, three were present only as fragments, and thus it was not possible to identify their type. There were 11 bidirectional cores with opposed striking platforms present in the collection (68.75%). It is precisely this type of core that is characteristic for the Central European Magdalenian (Maier 2015). The best example of very clear organisation is a small but well-prepared core (Fig. 6: 8). It even has a prepared back crest, despite being small (length 49 mm) and this type of preparation was not necessary from a practical point of view. Four cores can be described as cores with a changed orientation. The cores were abandoned at various stages, but mostly as quite exhausted examples that can no longer provide the desired blanks. Their length varies from 17 to 52 mm, with a mean value of 35.8 mm. Cores primarily served to obtain regular blades and bladelets.

The economical approach to the use of the raw material is evidenced not only by the small size of the cores; the maintenance of the cores is also quite apparent. Crested blades and rejuvenation flakes are present in the collection (Fig. 8). The used technique clearly seems to be direct organic percussion, with the complementary use of a soft hammerstone for smaller sized blanks. However, the preparation of the butts is not uniform, but quite variable (Graph 1). A comparison does not show any clear relationship between the type of butt and size of the blank, and even for the blanks chosen to be retouched there is no clear preference in size or type of the percussion. In general, punctiform butts are more often present on the smaller blanks, show traces of smoothening and abrasion and are mostly the result of soft hammerstone percussion (sensu Inizan et al. 1995). Most of the other butt types show traces of direct organic percussion (Ibid.), but the preparation and type are quite variable.



Graph 1. Comparison of the width/thicknesses of present blades and tools according to the preparation of their butt.
Graf 1. *Porovnání šířky/tloušťky u čepelí a nástrojů ve vztahu k typu patky.*

The technological characteristics of the assemblage collectively indicate a reduction strategy based on the careful preparation and maintenance of cores. Several aspects support this interpretation. First, the preparation of striking platforms demonstrates deliberate investment in core management. Second, the presence of numerous blades and bladelets implies continuous maintenance of core convexities to ensure successful blank removal. Third, the occurrence of rejuvenation products among the production waste indicates repeated efforts to prolong core use and maximise raw material exploitation. Taken together, these observations point to a highly organised reduction system characterised by repeated platform preparation, the maintenance of core morphology, the systematic production of blades and bladelets, the use of a direct soft hammerstone and direct organic percussion. Such technological traits correspond closely to classic Magdalenian blade technologies documented throughout Central and Western Europe (Maier 2015).

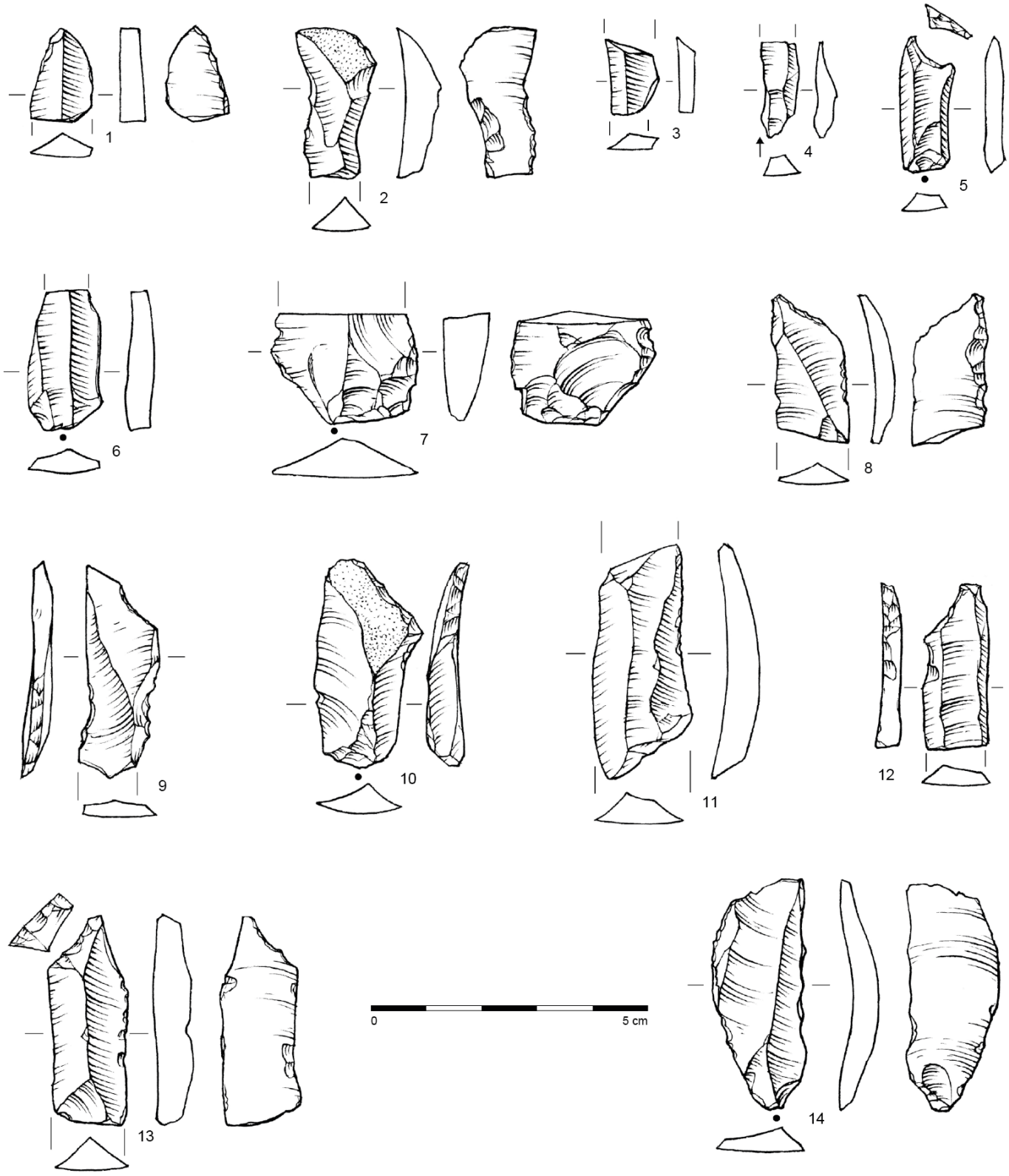


Fig. 9. Retouched and unretouched blades and blade fragments. All made of erratic flint. Drawing by M. Černý.
Obr. 9. *Retušované i neretušované čepele a jejich zlomky. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

3.3 Typology of the lithic collection

The importance of blade production is further confirmed by the composition of the tool assemblage. Among all retouched implements, blades represent the dominant blank category, accounting for 88 specimens or 66.2% of the total toolkit. Flakes constitute only 37 tools (27.8%), while it was not possible to clearly determine the blank type for eight broken tools (6%). Such a distribution indicates that blades (Fig. 9) were the preferred blanks for retouched implements and that blade production constituted the primary purpose of lithic reduction activities at the site. Nevertheless, the opportunistic aspect in which suitable flakes were used is highly visible in this collection. More standardised tools like burins (79%), borers (80%) and backed bladelets (100%) are usually on blades, and blades represented blanks from 79% to 100% of these tools (Tab. 3). In contrast, scrapers (30.5%) and splintered pieces (100%) show a more opportunistic approach with a higher percentage of flakes used as blanks from 30.5% to 100%.

The retouched tool assemblage provides equally important evidence regarding site activities and cultural affiliation. A total of 133 formally retouched implements were identified (Fig. 10–16). The composition of the toolkit reveals an emphasis on burin production, with burins (Fig. 10–11) representing the largest category with 43 specimens (32.3%), followed by scrapers (Fig. 14, 15) with 23 specimens (17.3%). Backed bladelets (Fig. 12) account for 19 pieces (14.3%), while splintered pieces (Fig. 13: 1, 2), borers (Fig. 13: 3, 4), and other types of retouched pieces occur in smaller numbers (Fig. 13). A single geometric segment was also recorded (Fig. 12: 13). The main characteristics of typical Magdalenian tool categories follow (Tab. 4).

There was no intentional flake production visible at the site, and flakes were used in an opportunistic way for tools like scrapers and splintered pieces. This is also supported by the fact that some of the tools (e.g. Fig. 13: 15) were produced on primary flakes. The size of the produced blanks/blades at the site varies if we look at their width (from 6 to 30 mm, with a mean value of 13.45 mm; most of the blades (76%) have a width of 10–20 mm, with a mean value of 14.1 mm, i.e. the present blanks are rather small.

Type	Blades	Flakes	Unknown	Total
Burins	34	6	3	43
Scrapers	13	7	3	23
Backed bladelets	19	0	0	19
Borers	4	1	1	6
Notches	1	4	0	5
Retouched pieces	17	11	1	29
Splintered pieces	0	7	0	7
Segment – microlith	0	1	0	1
Total	**88**	**37**	**8**	**133**

Tab. 3. Types of blanks for tool production at Zbořený Kostelec 1.
Tab. 3. *Typy polotovarů použité k výrobě nástrojů ve Zbořeném Kostelci 1.*

The most dominant tool are burins, and 85% of the burins for which it was possible to determine the blank type were made on blades. None of them were burnt and only 7% had some cortex on them (in all three cases up to 25%). The width of blades on which were burins were produced varied from 9 to 24 mm, with a mean value of 15.4 mm. The thickness of burins varied from 3 to 10 mm, with a mean value of 6.43 mm. Butts were present on 16 pieces; 18.75% were *en éperon* butts, 43.75% were linear butts and 37.5% were flat butts, and where it was possible to say how these were produced, it was always by direct organic percussion. Some of the burins were also produced on production waste such as crested blades (e.g. Fig. 11: 9). The collection also includes 11 burin spalls; 8 are complete, and their length varies from 12 to 40 mm, with mean width of 6 mm and thickness of 4.75 mm. This size of the burin spalls indicates the presence of rather large tools at the site.

All backed bladelets were obviously made on blades. Butts were present on only 21% of these and all were punctiform butts most probably knapped by soft hammerstone. Thus, this fits very well into the standard image of the Magdalenian, when domestic tools were produced by direct organic percussion, projectiles by the use of the soft hammerstone technique. One of the backed bladelets was burnt and none of them had any cortex. The width of bladelets varied from 5 to 16 mm, with a mean value of 8.2 mm; the thickness varied from 2 to 5 mm, with a mean value of 3.8 mm.

A total of 65% of scrapers on which it was possible to determine the blank type were made on blades. None of them were burnt and 22% had some cortex (most of them, i.e. 80% of the cortical scrapers, had up to 25% of cortex on the dorsal side, while 20% of cortical scrapers had between 25–50% of cortex on their dorsal side). The width of blades that served as blanks varies from 15 to 24 mm, with a mean value of 18.7 mm. The thickness of scrapers varied from 5 to 9 mm, with a mean value of 6.5 mm. Butts were present on only three pieces; two of them were simple flat butts and one was linear, and these pieces seem to have been produced by direct organic percussion. Scrapers on flakes were slightly more robust, with a mean width of 23.2 mm and a mean thickness of 8.2 mm.

There are six borers of two different types present in the collection: two short borers on blades (Fig. 13: 3) and four long borers (Fig. 13: 4). Five of them were made on blades and four of them have preserved butts. Three butts are flat and one is linear. The dimensions of the blades on which the borers were produced varied from 7 to 15 mm, with a mean value of 10.5 mm. The thickness of scrapers varied from 3 to 9 mm, with a mean value of 5 mm. Neither cortex nor traces of burning were present on any of the borers.

Splintered pieces (Fig. 13: 1, 2) are made on flakes, with a mean width of 20.8 mm and a mean thickness of 6.4 mm. The whole pieces vary in length from 17 to 37 mm, with a mean value of 28.8 mm. Butts were present on all five of them; three were linear and two were flat. A total of 28.5% of them were cortical, with the presence of the cortex 25–75% on the dorsal side.

Tool type	Burnt pieces	Cortical pieces				Mean width (mm)	Mean thickness (mm)	Present platforms	Used technique
		up to 10%	10–25%	25–50%	more than 75%				
Burins	0	2	1	0	0	15.4	6.4	En éperon, linear, flat	Direct organic percussion
Scrapers	0	1	3	1	0	18.7	6.5	Flat, linear	Direct organic percussion
Backed bladelets	1	0	0	0	0	8.2	3.8	Punctiform	Soft hammerstone
Borers	0	0	0	0	0	10.5	5.0	Flat, linear	Direct organic percussion
Splintered pieces	0	0	1	0	1	20.8	6.4	Flat, linear	Direct organic percussion

Tab. 4. Main characteristics of the selected tool types from Zbořený Kostelec 1.
Tab. 4. *Hlavní charakteristiky vybraných typů nástrojů ze Zbořeného Kostelce 1.*

There are also several specimens of other tool types present in the collection: four notches and a single geometric microlith. Notches are not very distinct tools; most of them are on flakes, so their metrics were not the aim of the production, but rather the opportunistic choice of suitable flakes. Although the microlith is not a typical Magdalenian tool type, it is patinated and made of flint and, thus, at least for now, the collection is understood as homogenous. Furthermore, there is a number of retouched flakes and blades; their size is similar to the size of more typical tools and they form a standard part of the Magdalenian toolkit. While some of the retouch could be the result of the use of the tools or of post-depositional processes, a use-wear analysis of the material from the site should be performed in the future.

If we compare blank preference for various tool types rather than their size (Tab. 4), it reflects the tasks for which they were used. Most of the tools are comparable. *En éperon* preparation is present only for the largest blanks, which were suitable for tasks with a heavier burden. Their similar width/thickness ratios

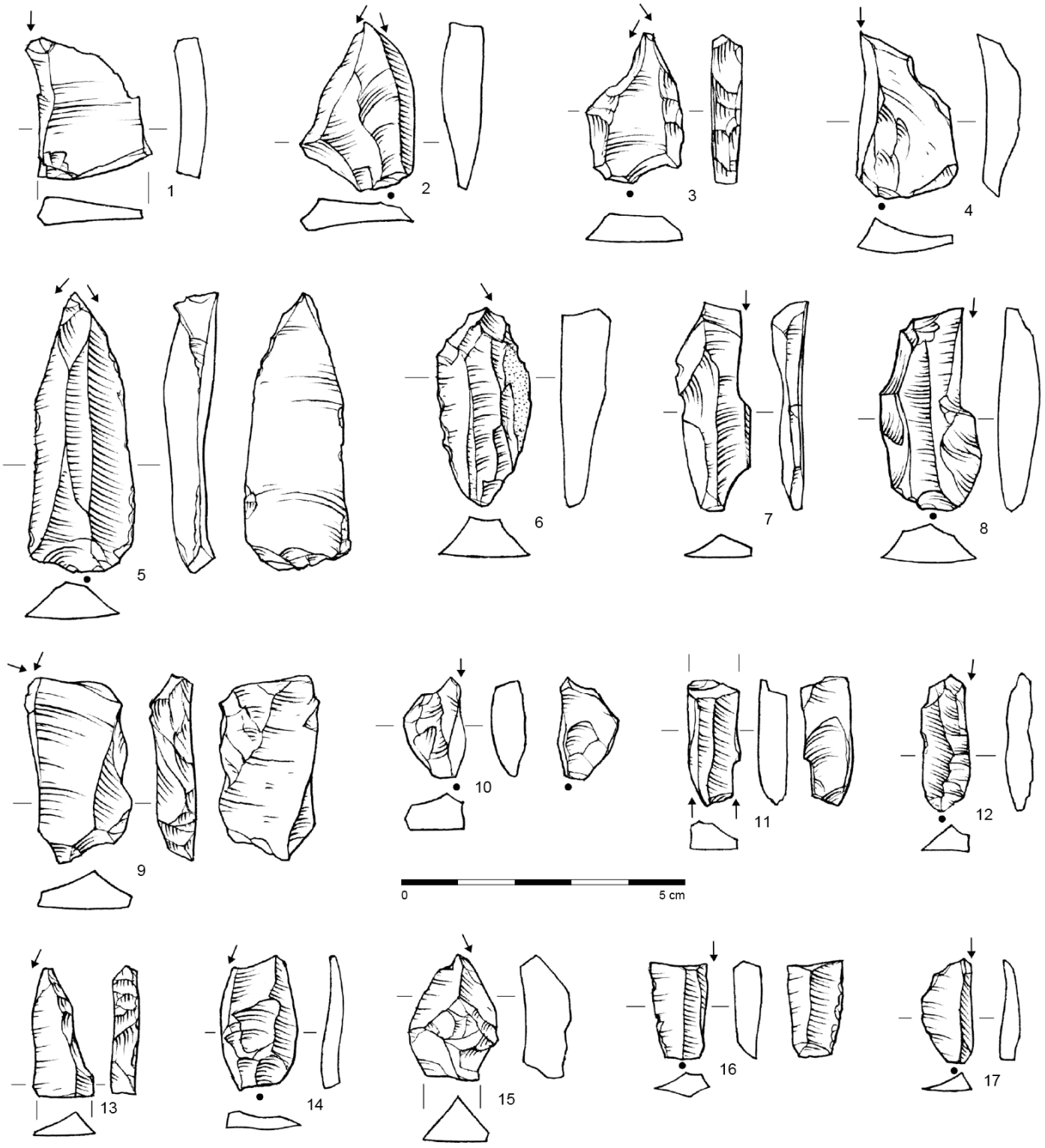


Fig. 10. Burins. All made of erratic flint. Drawing by M. Černý.
Obr. 10. *Rydla. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

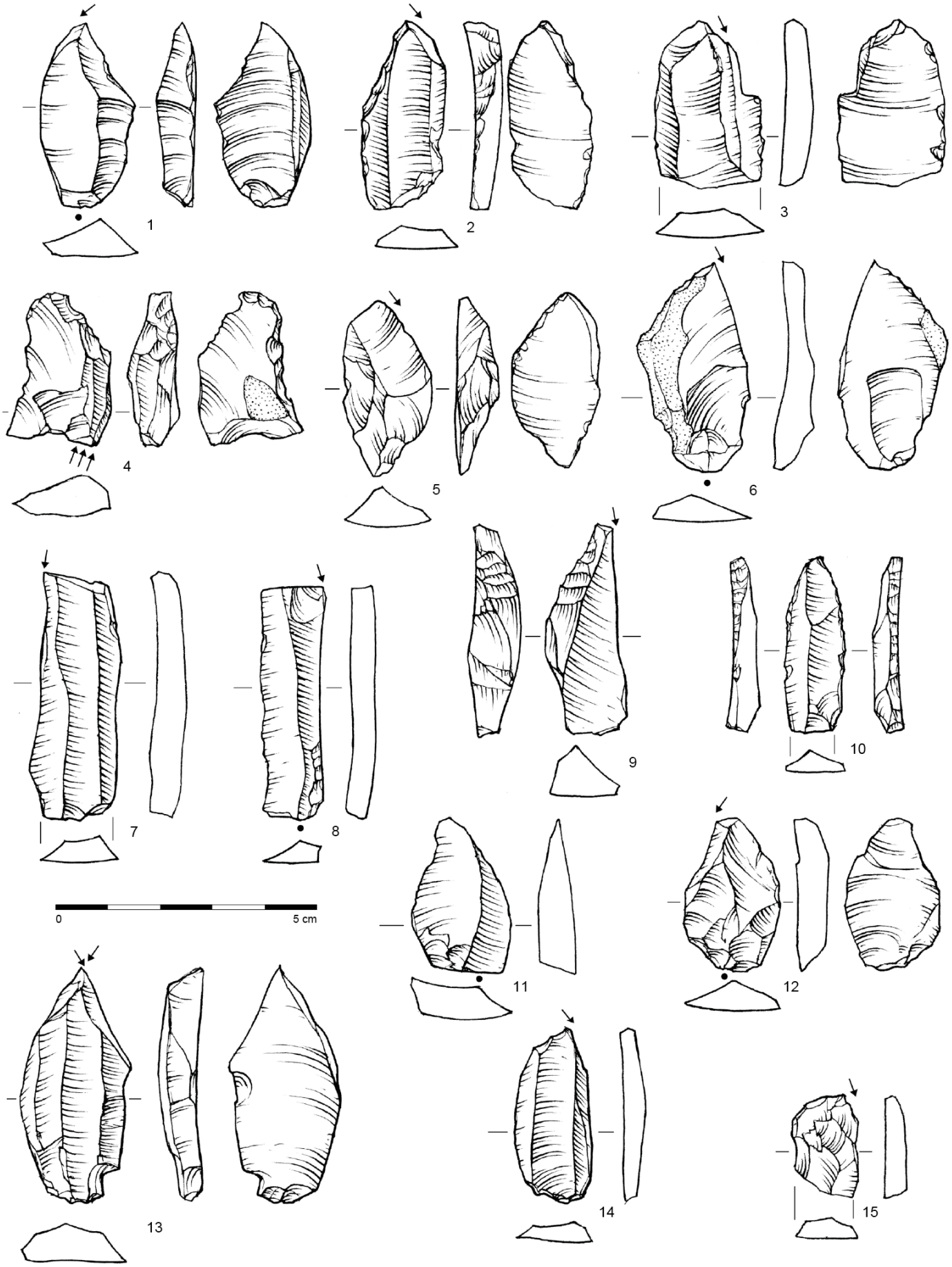


Fig. 11. Burins. All made of erratic flint. Drawing by M. Černý.
Obr. 11. *Rydla. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

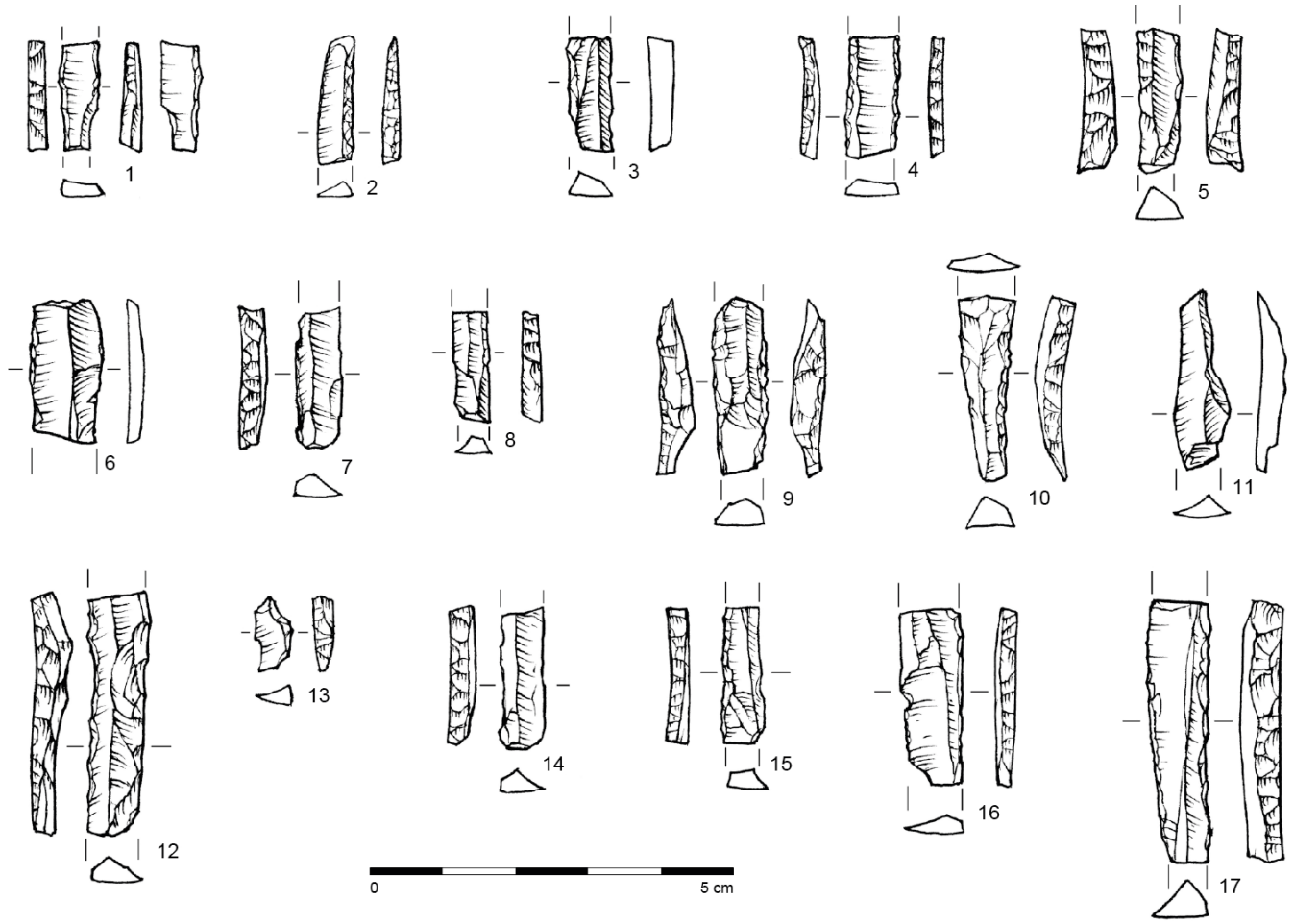


Fig. 12. Tools and technical flakes. 1–4, 6–8, 12, 14–17 – backed bladelets; 5, 9, 11 – burin spalls; 10 – broken borer; 13 – segment.. 3 – burnt silicite; 1, 2, 4–17 – erratic flint. Drawing by M. Černý.

Obr. 12. *Nástroje a technické úštěpy. 1–4, 6–8, 14–17 – čepelky s otupeným bokem; 5, 9, 11 – rydlové třísky; 10 – zlomený vrták; 13 – segment.. 3 – přepálený silicit; 1, 2, 4–17 – silicit glacigenních sedimentů. Kresba M. Černý.*

enabled knappers to produce them using the same techniques and in the same sequences. The only exception is represented by backed bladelets, which were definitively produced in a different way, as is common for Magdalenian projectile production.

The high frequency of burins may therefore indicate specialised craft activities involving the production and maintenance of osseous technologies. Scrapers constitute the second major formal tool category. Their presence indicates hide-processing activities, including cleaning, thinning, and the preparation of animal skins. Particularly noteworthy are the backed bladelets, which represent 14.3% of the toolkit. These artefacts are among the most diagnostic components of Magdalenian lithic assemblages and are commonly interpreted as elements of composite hunting weapons. Their small size, regular morphology, and backed retouch suggest use as inserts in projectile points or barbed weapon systems. The occurrence of borers and notched tools adds further diversity to the toolkit. Borers were likely used for perforating organic materials. Splintered pieces are also present and may reflect heavy-duty activities involving the processing of tough materials. Their exact function remains uncertain and a determination would be necessary to conduct a use-wear analysis of materials from this site.

The overall structure of the toolkit demonstrates a balance between hunting-related implements, domestic tools, and artefacts associated with the working of organic materials. This diversity indicates that the site supported a wide range of activities rather than a narrowly specialised function. The assemblage therefore reflects a complex character of the site. Furthermore, the balanced representation of all reduction stages implies repeated episodes of occupation rather than a single short-term occupation site. Successive visits to the locality would have resulted in the accumulation of both manufacturing debris and discarded tools, producing the diverse assemblage observed today. Such a pattern is consistent with the recurrent use of strategically favourable locations during the Magdalenian period.

4. Zbořený Kostelec within context of other Magdalenian sites in Bohemia

The lithic assemblage from Zbořený Kostelec represents a coherent and technologically homogeneous manifestation of the Bohemian Magdalenian, dominated by erratic flint and blades produced by direct organic percussion. All stages of the reduction sequence are present, demonstrating that the site was not merely a place of tool disposal but rather a location where lithic production formed an integral component of settlement activities. The assemblage combines evidence for core preparation, blade production, tool manufacture, tool maintenance, and the use of finished implements, indicating a broad spectrum of activities characteristic of repeatedly occupied residential locations.

The possibility of different cultural and chronological association should be considered. The collection is from surface survey and it might be mixed. Tools from sites from later prehistoric periods in this region, especially Late Palaeolithic and Mesolithic locations, look different (in terms of typology, technology and metrics) and were produced on more variable raw materials (Vencl, Rous 1998; Kapustka, Zemanová Davidová 2024). Another

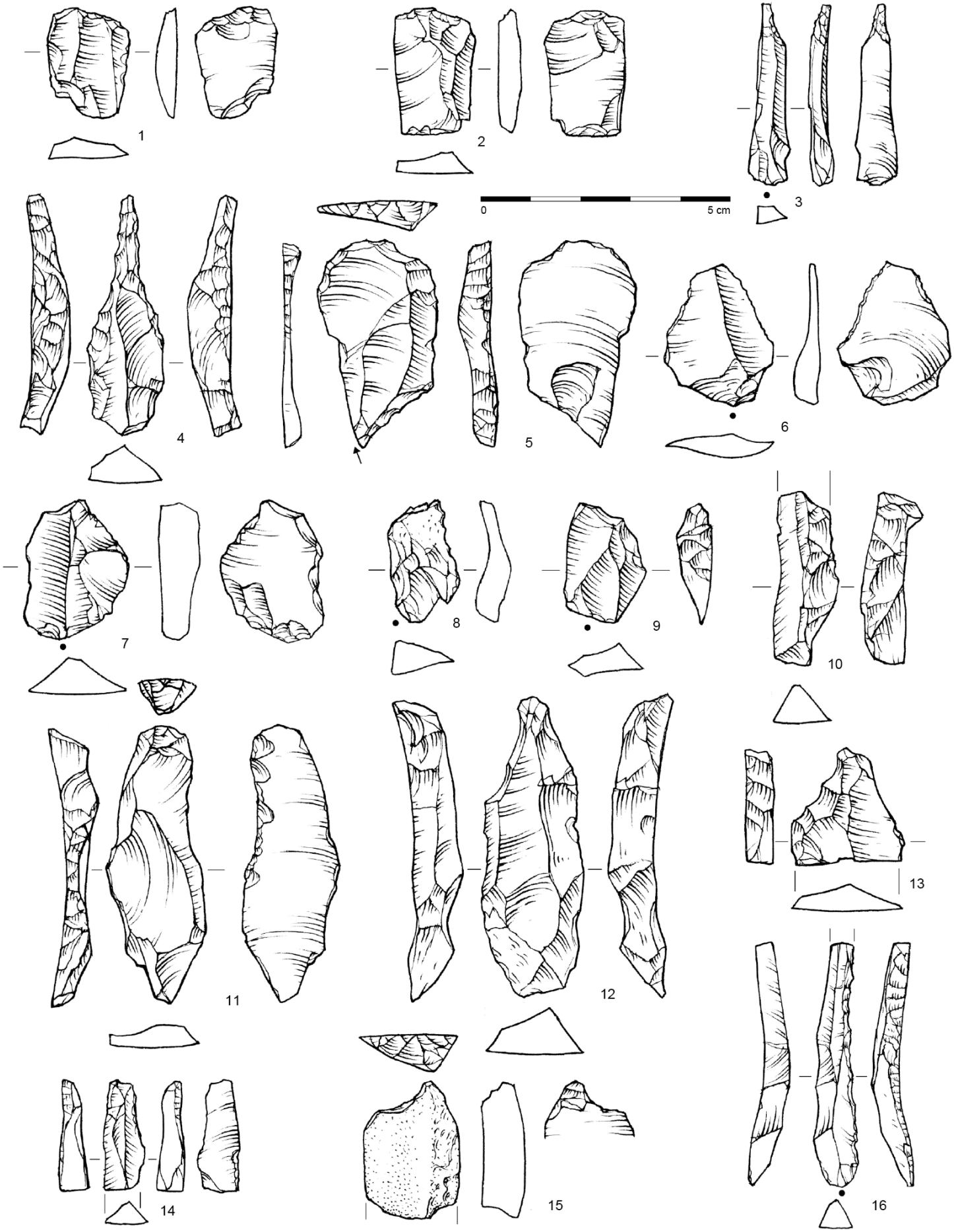


Fig. 13. Tools and technical flakes. 1, 2 – splintered pieces; 3, 4 – borers; 5 – combined tool; 6–9, 13, 15 – retouched flakes; 10, 14, 16 – burin spalls; 11, 12 – technical flakes. All made of erratic flint. Drawing by M. Černý.

Obr. 13. *Nástroje a výrobní odpad. 1, 2 – dlátka; 3, 4 – vrtáky; 5 – kombinovaný nástroj; 6–9, 13, 15 – retušované úštěpy; 10, 14, 16 – rydlové třísky; 11, 12 – výrobní odpad. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

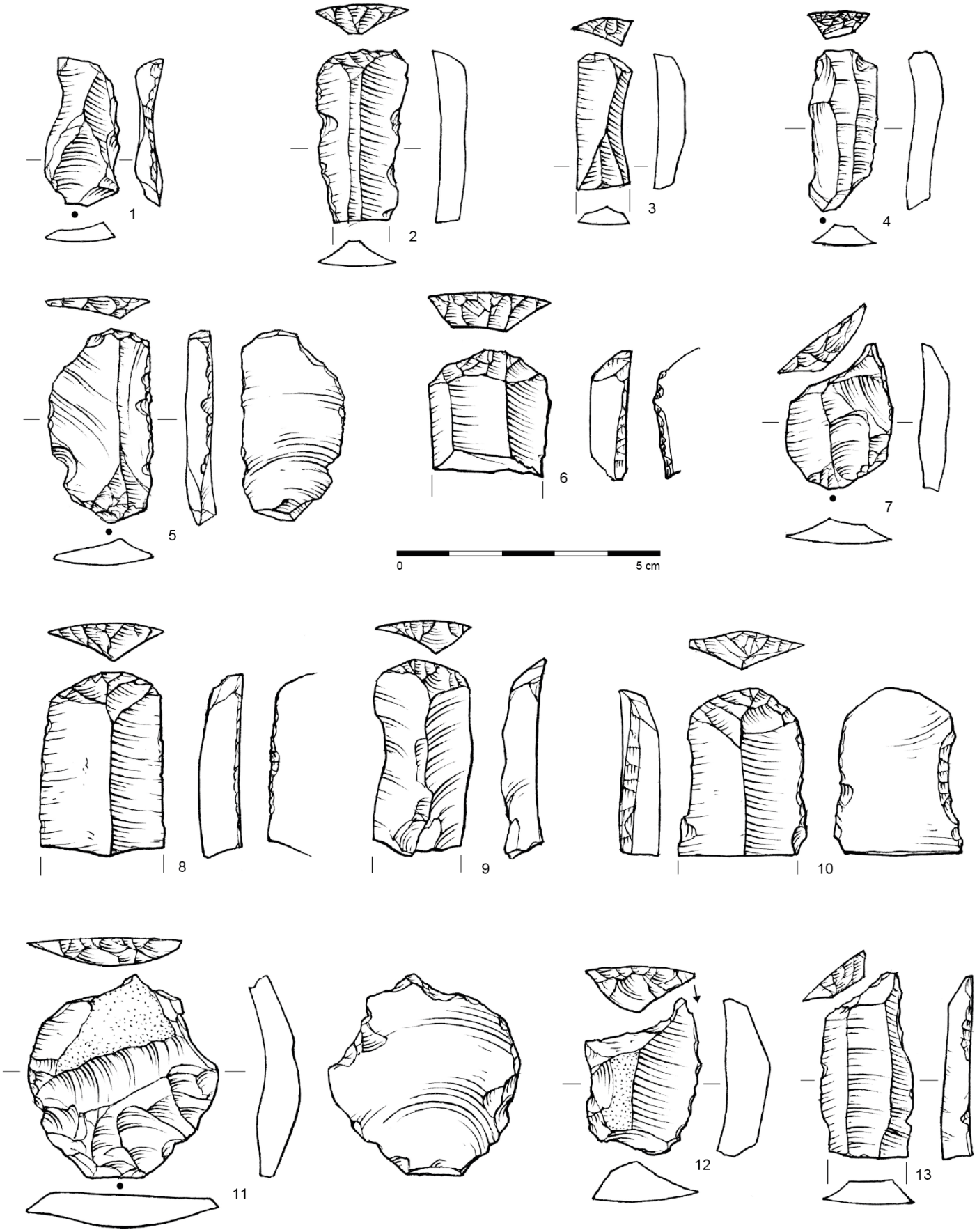


Fig. 14. Tools. 1 – retouched flake; 2–11, 13 scrapers; 12 – combined tool. All made of erratic flint. Drawing by M. Černý.
Obr. 14. *Nástroje. 1 – retušovaný úštěp; 2–11, 13 – škrabadla; 12 – kombinovaný nástroj. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

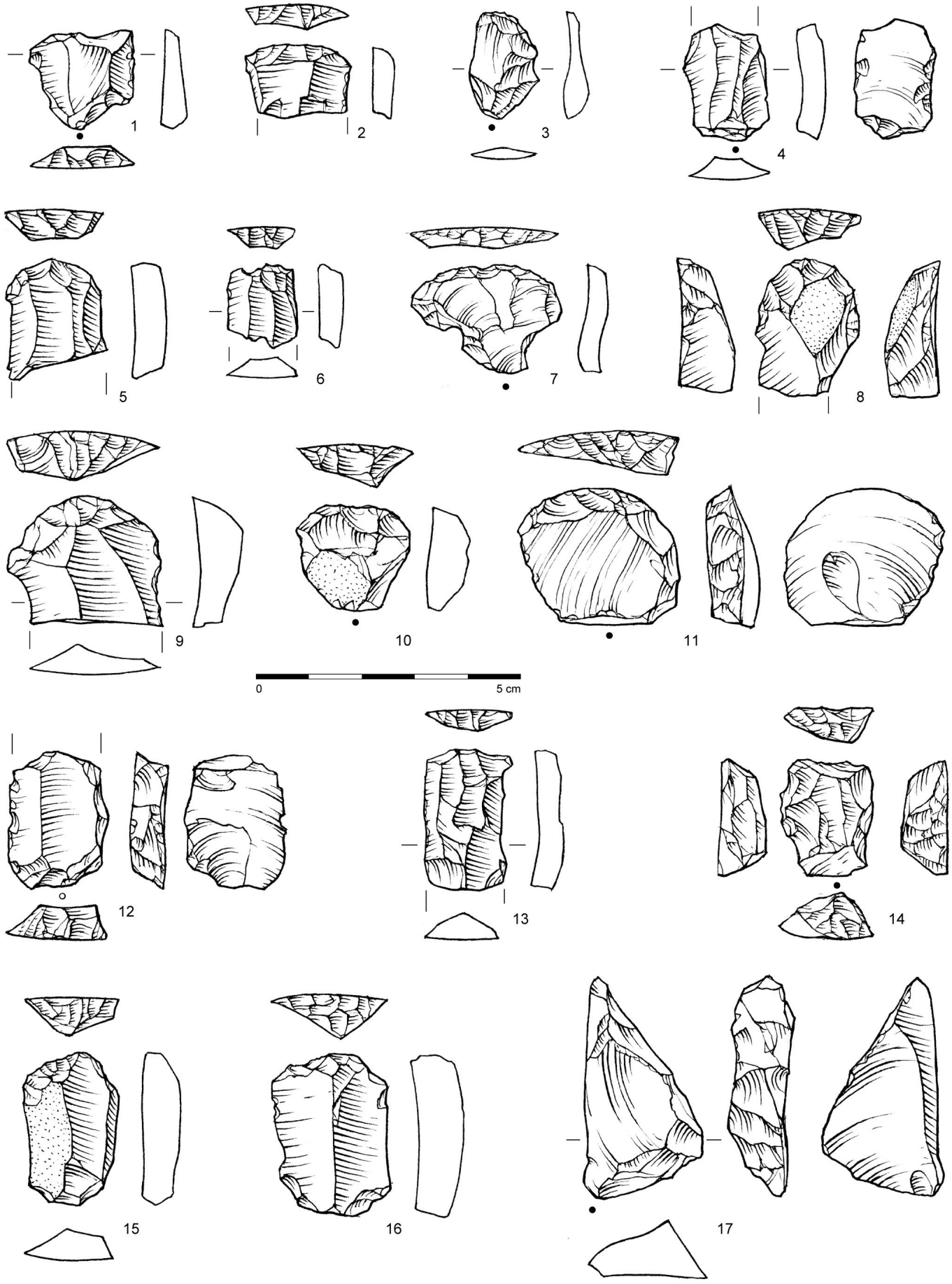


Fig. 15. Tools and technical flakes. 1–16 – scrapers; 17 – technical flake. 10 – Bavarian chert of the Flintsbach type, all others made of erratic flint. Drawing by M. Černý.
Obr. 15. *Nástroje a výrobní odpad. 1–16 – škrabadla; 17 – výrobní odpad. 10 – bavorský rohovec typu Flintsbach, vše ostatní silicit glacigenních sedimentů. Kresba M. Černý.*

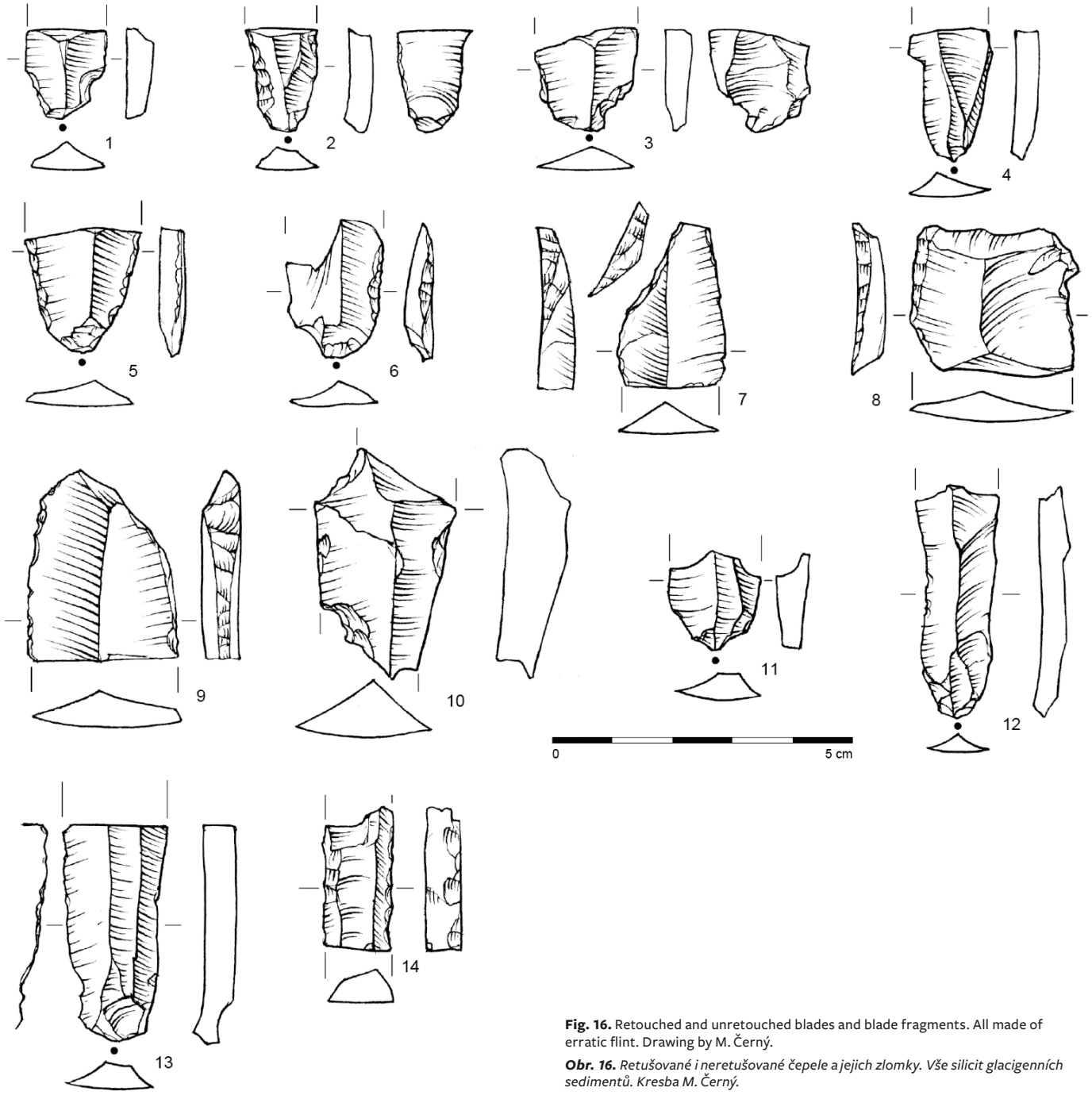


Fig. 16. Retouched and unretouched blades and blade fragments. All made of erratic flint. Drawing by M. Černý.

Obr. 16. *Retušované i neretušované čepele a jejich zlomky. Vše silicit glacigenních sedimentů. Kresba M. Černý.*

cultural entity that should be taken into account is Epigravettian, which has some similar characteristics. Epigravettian occupations are present in the Czech Republic (Šída et al. 2021; Nerudová et al. 2022) during the later part of the Upper Palaeolithic. In Moravia, Epigravettian sites are particularly well documented (Škrdla et al. 2016; Nerudová et al. 2022; Stevens et al. 2025), and there is clear evidence of the presence of the Epigravettian in Bohemia, too (Šída et al. 2021; Kapustka et al. 2024b); in Bohemia, however, knowledge of the Epigravettian is far less detailed and based mostly on surface lithic collections. An Epigravettian attribution of the Zbořený Kostelec assemblage therefore cannot be ruled out solely on chronological grounds. At the technological level, however, such an interpretation appears less convincing. Epigravettian assemblages from Moravia and neighbouring regions may also contain substantial blade and bladelet components, although their technological organisation and tool composition differ between sites and are also distinct from the collection of Zbořený Kostelec 1 (Lengyel et al. 2021; Šída et al. 2021; Nigst et al. 2026). An especially relevant parallel is provided by Kůlna Cave, where an initially anomalous radiocarbon determination raised the possibility of an Epigravettian occupation within a sequence otherwise attributed to the Magdalenian. Detailed analysis of the debitage and core technology, however, demonstrated technological uniformity across the relevant layers and argued against the presence of a distinct Epigravettian industry (Nerudová, Moník 2019). The case illustrates the importance of distinguishing chronological possibility from technological attribution. In the case of Zbořený Kostelec, an Epigravettian age should therefore remain a possibility to be tested by independent chronological evidence, particularly radiocarbon dating, rather than being inferred from the lithic technology itself. Given the present evidence, the technological coherence of the assemblage and its close affinity with the Central European Magdalenian provide stronger grounds for a Magdalenian attribution.

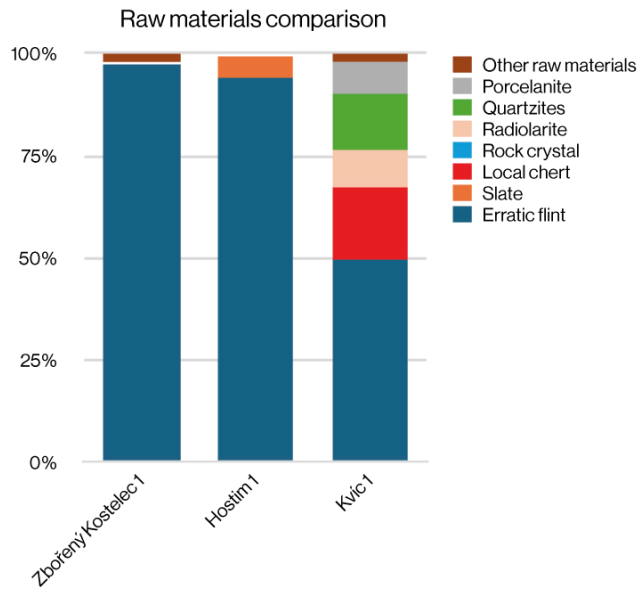
Technologically, the collection is firmly rooted within the blade-oriented tradition typical of the Central European Magdalenian. The prevalence of blades among retouched implements, the occurrence of carefully prepared *en éperon* butts, and the generally standardised dimensions of the blades point to a controlled reduction strategy. Such features are difficult to reconcile with expedient flake production and instead indicate a deliberate technological system focused on the production of regular blades and bladelets. The assemblage therefore demonstrates a considerable degree of technological expertise. Core exploitation appears to have been organised in a manner aimed at maximising the production of regular blanks suitable for subsequent transformation into formal tools.

From a typological perspective, the assemblage is dominated by burins, followed by borers, scrapers, and backed bladelets. This composition is characteristic of Magdalenian assemblages throughout Central Europe, yet the relative proportions of individual tool classes are noteworthy. Burins constitute nearly one-third of the entire toolkit, making them the most prominent component of the collection. This high frequency suggests that activities involving the working of osseous materials, particularly antler and bone, played an important role at the site. Burins are commonly associated with the manufacture and maintenance of organic implements, including projectile components, needles, points, and other artefacts typical for Magdalenian technological systems.

The substantial scraper component indicates that hide processing also formed an important aspect of site activities. Together, burins and scrapers account for approximately half of all formal tools, suggesting that Zbořený Kostelec 1 was not exclusively focused on hunting-related tasks but rather functioned as a location where a broader range of domestic and technological activities took place. Backed bladelets, although less numerous than burins and scrapers, remain a significant component of the assemblage. Their presence confirms the manufacture and maintenance of composite hunting weapons and places the assemblage firmly within the technological traditions of the Magdalenian. However, the relative scarcity of backed bladelets compared with some other Bohemian sites may indicate differences in site function or activity structure.

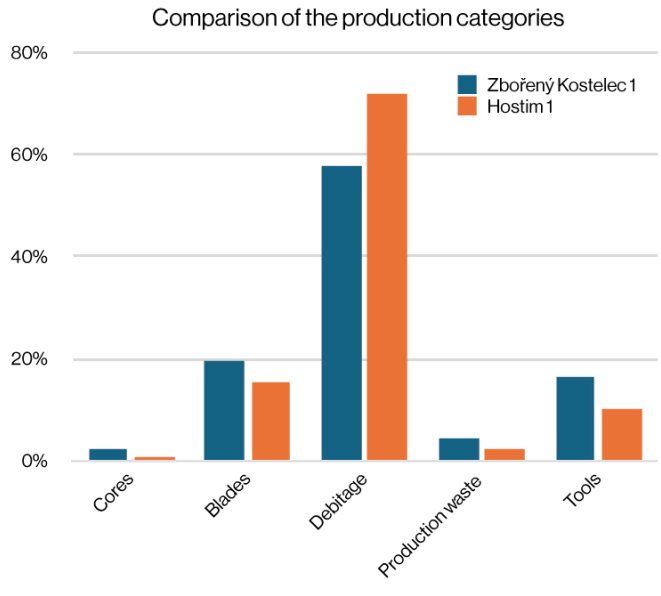
It is not easy to compare this collection to other Bohemian assemblages. Most of the surface collections that might seem a good match for comparison are obviously mixed and/or considerably smaller in the number of finds (e.g. Borečnice 2, Březnice 2, Dolní Poříčí 4, Žďár 1; Vencl ed. 2006), or they are not properly published yet (e.g. Putim – Pikárna Hill, Bečov 1b; Oliva 2016). The nearest large and radiocarbon dated collection is Hostim 1, which contains c. 16,000 pieces (Vencl 1995a; Kapustka et al. 2023). A comparison with this particular collection helps us to anchor in time the surface survey collection and shows how it is linked to material from the nearest stratified Magdalenian site in Central Bohemia. Both sites belong to the same cultural and technological tradition and share a number of characteristics. In both assemblages, erratic flint dominates the raw material spectrum (Graph 2) and blade production constitutes the principal reduction objective. The production categories have slightly different proportions, but they still remain highly comparable (Graph 3). The toolkits contain the classic Magdalenian combination of burins, scrapers, backed bladelets, borers, splintered pieces and various retouched blade forms (Graph 4). These similarities leave little doubt that both assemblages originated within the same technological tradition and reflect broadly comparable lithic production systems.

Despite these similarities, several differences emerge that are archaeologically significant. The first concerns raw material procurement. Although both sites relied primarily on erratic flint, the dependence on this material is even more pronounced at Zbořený Kostelec 1. The nearly exclusive use of erratic flint suggests a highly focused procurement strategy and perhaps a more restricted raw material catchment area. Hostim 1, by contrast, exhibits slightly greater diversity and the use of local cherts and slates, too (Vencl 1995a).



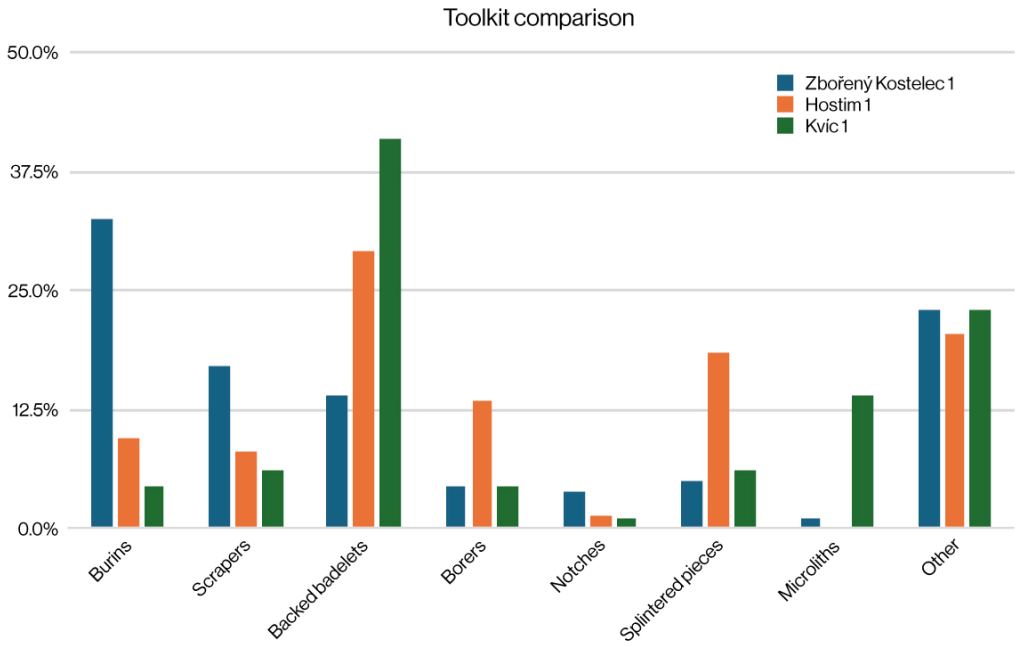
Graph 2. Comparison of the raw material composition of the collection from Zbořený Kostelec 1 with the assemblage from Hostim 1 and Kvíc 1.

Graf 2. *Porovnání procentuálního zastoupení přítomných surovin v kolekci ze Zbořeného Kostelce 1 se souborem z Hostimi 1 a Kvíc 1.*



Graph 3. Comparison of the production categories of the collection from Zbořený Kostelec 1 with assemblage from Hostim 1.

Graf 3. *Porovnání skladby výrobních kategorií na lokalitě Zbořený Kostelec 1 se souborem z Hostimi 1.*



Graph 4. Comparison of the toolkit from Zbořený Kostelec 1 with the assemblage from Hostim 1 and Kvíc 1.

Graf 4. *Porovnání procentuálního zastoupení přítomných nástrojů ve Zbořeném Kostelci 1 s kolekcí z Hostimi 1 a Kvíc 1.*

More substantial differences are evident in the technological composition of the assemblages (Graph 3). Zbořený Kostelec 1 contains proportionally more cores, more blades, and a considerably larger share of formal tools. In contrast, Hostim 1 is characterised by a larger proportion of debitage products. The differences become even more apparent when the toolkits are compared (Graph 4). Hostim 1 is characterised by a particularly high share of backed bladelets and splintered pieces, whereas Zbořený Kostelec 1 is distinguished by the predominance of burins and a stronger scraper component. This discrepancy may partly reflect differences in collection history and assemblage formation. The most probable reason for this difference is the way the collection was obtained; the surface survey collection lacks small sized debitage and chips (Zbořený Kostelec 1), but they form an important part of the excavated collection from Hostim 1.

A different image is provided by the open-air assemblage from Kvíc containing around 20,000 pieces (Benková 2003), which appears considerably more distinct from Zbořený Kostelec 1 than Hostim 1. The most striking difference concerns raw material procurement (Graph 2). Whereas Zbořený Kostelec 1 and Hostim 1 relied almost exclusively on erratic flint, the Kvíc assemblage exhibits a much more diversified raw material spectrum. Erratic flint represents only about half of the assemblage (49.5%), while local cherts (17.7%), quartzites (14.2%), radiolarites (9%), and porcellanites (7.5%) all form substantial components. This variability indicates a considerably broader procurement strategy and a stronger use of locally available lithic resources than observed at Zbořený Kostelec 1. Such differences probably reflect not only local geological conditions but also different patterns of mobility and raw material management within the Bohemian Magdalenian.

The typological composition of the two assemblages also differs markedly (Graph 4). While Zbořený Kostelec 1 is clearly dominated by burins (32.5%) and scrapers (17%), Kvíc is characterised by an exceptionally high share of backed bladelets (41%) together with a substantial component of geometric microliths (14%), whereas burins and scrapers are comparatively scarce (4.5% and 6%, respectively). This composition suggests a much stronger emphasis on the production, maintenance, and replacement of composite hunting weaponry than at Zbořený Kostelec 1. In contrast, the predominance of burins and scrapers at Zbořený Kostelec 1 indicates more intensive activities related to the working of osseous materials and hides, together with a broader range of domestic tasks. Despite these functional differences, both assemblages share the technological foundations of the Bohemian Magdalenian, particularly the blade-oriented reduction strategy and the use of high-quality siliceous raw materials. The differences between Kvíc and Zbořený Kostelec very likely have chronological value. Once the Zbořený Kostelec 1 assemblage is enlarged after obtaining lithic materials from a planned excavation, it would be helpful to compare the collections in greater detail. Together, the comparison of all three sites demonstrates that considerable functional variability existed among Bohemian Magdalenian sites despite their shared technological tradition.

The Hostim 1 assemblage appears to emphasise activities related to hunting equipment and weapon maintenance. The high frequency of backed bladelets suggests the intensive production, repair, and replacement of composite projectile armatures. This composition is consistent with a site closely connected to hunting activities and perhaps functioning as a repeatedly occupied aggregation or logistical site within a broader settlement network. In contrast, Zbořený Kostelec 1 presents a different image. The dominance of burins and the substantial scraper component indicate that activities connected with the processing of organic materials and hides were particularly important. The most distinct is Kvíc 1, with the presence of rectangles that might indicate a different chronological position of the collection. The assemblage suggests a location at which hunting equipment was certainly maintained and repaired, but where a wider range of domestic and technological tasks was also carried out.

At the same time, there are technological similarities between the assemblages. All sites demonstrate the same approach to raw material exploitation, the same preference for regular blade blanks. Hostim 1 and Zbořený Kostelec 1 show the same butt preparation techniques and the identical reliance on soft hammerstone percussion. Consequently, the assemblage from Zbořený Kostelec 1 should be understood not as an anomalous or

isolated occurrence, but as a fully integrated component of the Bohemian Magdalenian settlement network, sharing a common technological tradition with Hostim 1.

The assemblage also contributes to broader discussions concerning the value of surface collections in Palaeolithic archaeology. Although the original archaeological context has been affected by long-term agricultural activity and the precise spatial distribution of artefacts was not recorded during the earliest stages of collection, the technological and typological integrity of the assemblage remains remarkably well preserved. The study demonstrates that carefully documented surface collections can provide substantial information regarding chronology, technological organisation, raw material procurement, and site function, particularly in regions where stratified Palaeolithic sites are rare or absent. In this respect, Zbořený Kostelec 1 highlights the continuing research potential of surface assemblages and the importance of systematic field survey for identifying previously unknown components of the prehistoric settlement record.

5. Conclusion

The lithic assemblage from Zbořený Kostelec 1 represents an important addition to the growing corpus of Magdalenian evidence from Bohemia and significantly enhances our understanding of Late Upper Palaeolithic settlement in the Sázava River region. Although recovered through long-term surface collection, the assemblage displays a high degree of technological and typological coherence. Its composition, technological organisation, raw material economy, and tool spectrum provide convincing evidence for attribution to the later phase of the Magdalenian and demonstrate that the site formed part of the broader settlement network of hunter-gatherer groups occupying Bohemia during the Late Glacial period.

One of the most significant contributions of the assemblage lies in its geographical position. The Sázava River region has traditionally been regarded as a peripheral area within the framework of Bohemian prehistory, largely due to the scarcity of known archaeological sites and the absence of stratified Palaeolithic deposits. The discovery and analysis of the Zbořený Kostelec assemblage demonstrates that this perception is at least partly a consequence of research history and preservation biases rather than a true reflection of prehistoric settlement intensity. The site provides clear evidence that the Sázava River Valley formed an integral component of the Magdalenian settlement landscape and likely served as an important travel corridor linking different parts of Central Bohemia. While the location of the site on a low river terrace overlooking the Sázava River is not the typical location of known Magdalenian sites in Bohemia.

From a technological perspective, the assemblage demonstrates a highly organised blade-oriented production system characteristic of the Central European Magdalenian (Maier 2015). The dominance of erratic flint, accounting for more than 97% of the assemblage, reflects a deliberate and highly selective procurement strategy focused on obtaining a raw material particularly suitable for the production of regular blades and bladelets. The overwhelming preference for a single raw material is fully consistent with patterns documented at other Magdalenian sites in Bohemia (Vencl 1995a) and confirms the central role of erratic flint within regional technological traditions. At the same time, the presence of a small number of artefacts manufactured from Bavarian chert, spongolite, quartz, and other raw materials illustrates that Magdalenian groups operating in the region had access to wider raw material networks and maintained a degree of mobility extending beyond the immediate surroundings of the site.

The technological characteristics of the lithics indicate a sophisticated reduction strategy involving the careful preparation and maintenance of blade cores. The presence of well-prepared striking platforms is particularly significant, because these attributes are among the most diagnostic indicators of advanced Magdalenian blade technology. Lithics (especially butt type and size) clearly indicate the use of direct soft organic percussion.

Equally important is the evidence for the complete lithic reduction sequence. The assemblage contains cores, preparation products, production waste, blanks (blades, bladelets), finished products (tools) and also broken tools, indicating that all major stages of lithic production took place directly at the site. This observation distinguishes Zbořený Kostelec 1 from specialised task-specific sites and suggests that the site functioned as a place where lithic production, tool maintenance, and tool use were closely integrated. The presence of substantial quantities of debitage alongside a diverse toolkit demonstrates that various activities were conducted here, suggesting the complex character of this site.

The composition of the toolkit further contributes to the interpretation of site function. Burins constitute the dominant tool category, followed by scrapers, retouched pieces, and backed bladelets. This combination reflects a broad spectrum of activities extending beyond hunting alone. The high frequency of burins suggests the intensive working of bone and antler, activities closely associated with the manufacture and maintenance of organic technologies that played a central role in Magdalenian lifeways. Scrapers indicate the processing of animal hides, while backed bladelets provide direct evidence for the production and maintenance of composite tools.

The comparison with Hostim 1 provides an important regional perspective. Despite differences in assemblage composition and probable site function, both sites share fundamental technological characteristics, including reliance on erratic flint, systematic blade production, careful butt preparation, and the presence of characteristic Magdalenian tool types. These similarities demonstrate that Zbořený Kostelec 1 belonged to the same technological and cultural tradition as the better-known Magdalenian sites of Bohemia. At the same time, the higher share of burins and scrapers and the lower representation of backed bladelets at Zbořený Kostelec 1 may indicate differences in activity structure and site role within the broader settlement cluster. Comparison with Kvíc further demonstrates that considerable variability existed among Bohemian Magdalenian sites. Whereas Kvíc is characterised by a more diverse raw material economy and a toolkit dominated by backed bladelets and geometric microliths, Zbořený Kostelec exhibits a much stronger emphasis on burins and scrapers. These differences most likely reflect functional variability within a shared technological tradition rather than chronological differences, highlighting the diversity of settlement activities within the Bohemian Magdalenian. While Hostim 1 appears to have been more closely associated with hunting equipment and projectile production, Zbořený Kostelec 1 seems to represent a more diversified residential activity area where a wider range of domestic and technological tasks was performed. On the other hand, backed bladelets are usually the smallest tools, and the chance of finding them during a surface survey is lower than for burins and scrapers, thus, the share of these tools in the toolkit might be biased by the way the collection was assembled. While both comparative collections are considerably larger, they were obtained by excavation and in Central Bohemia they form the best possible options of published comparative materials.

Finally, the site underscores the need for further research of the Sázava River region. The discovery of such a substantial Magdalenian assemblage suggests that additional sites may remain

undetected within the Sázava River Valley and its surrounding uplands. Geophysical survey, further systematic surface survey and targeted test pits are planned for this site in the near future. Concerning the existing collection itself, use-wear analysis studies in particular might help us refine interpretations of site function.

CRediT authorship contribution statement

Katarína Kapustka: Conceptualisation, Writing – original draft, Data curation, Formal analysis.
Tereza Zemanová Davidová: Writing – original draft, Data curation, Writing – review & editing.
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Petr Lajer: Data curation, Writing – review & editing.
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Vojtěch Lajer: Data curation.

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Resumé

Studie představuje nové naleziště z období magdalénienu v Čechách a prezentuje dosud nepublikovaný soubor štípané industrie z povrchové prospekce na lokalitě Zbořený Kostelec 1. Koncentrace se nachází v oblasti Posázaví ve středních Čechách. Povrchové nálezové soubory představují významný zdroj informací o pravěkém osídlení zejména v regionech, kde jsou stratifikované lokality vzácné nebo zcela chybí, což je i případ Posázaví. Z tohoto regionu jde o první jednoznačně magdalenienský soubor (obr. 1, tab. 1). Kolekce ze Zbořeného Kostelce patří svou početností i doloženým charakterem k významnějším kolekcím v Čechách. Na základě typologických a technologických znaků je soubor přiřazen k magdalénienu, tedy závěrečné fázi mladého paleolitu, a rozšiřuje tak poznání sídelních strategií pozdně paleolitických populací v oblasti českého vnitrozemí.

Magdalénien v Čechách je datován do období pozdního glaciálu, přibližně mezi 15 000–12 000 BP, kdy po vrcholu posledního glaciálu dochází k postupnému oteplování klimatu a obnově lidské přítomnosti v rozsáhlejších částech střední Evropy. Známé lokality jsou často situovány v říčních údolích, krasových oblastech nebo na vyvýšených polohách a zahrnují jak stratifikované jeskynní lokality, tak povrchové nálezové koncentrace. Typickým rysem magdalenienských industrií jsou propracované výrobní postupy, jejichž cílem je produkce pravidelných čepelí, které byly dále modifikovány do podoby nástrojů. Mezi charakteristické nástroje patří především čepelky s otupeným bokem, obvykle doprovázené rydly, škrabadly, vrtáky a dalšími retušovanými artefakty.

Posázaví představuje z hlediska paleolitického osídlení region, který je obvykle vnímán jako periferie. Přesto však řeka Sázava mohla tvořit důležitou komunikační osu i migrační koridor a zdání periferie je dáno spíš stavem poznání, resp. stavem dochování archeologických pramenů. Dosavadní archeologické doklady paleolitické aktivity v regionu jsou omezené a často pocházejí z povrchových nálezů.

Lokalita Zbořený Kostelec se nachází na nízké říční terase cca 5–10 m nad tokem Sázavy (obr. 2). Koncentrace nálezů byla identifikována na obdělávaném poli díky dlouhodobé prospekci místních sběratelů, kteří lokalitu opakovaně navštěvovali po dobu více než dvaceti let. Přestože přesná prostorová dokumentace jednotlivých nálezů nebyla v počáteční fázi provedena, hranice koncentrace byly vymezeny na poměrně malé ploše. Bylo získáno množství materiálu, který byl technologicky a typologicky analyzován a chronologicky zařazen. Celkem bylo analýze podrobeno 823 kusů štípané industrie (tab. 2). Byla zaznamenána jejich velikost, hmotnost a surovina, z níž byly vyrobeny. Na základě analýzy pak byly roztříděny do technologických kategorií: jádra, čepele a fragmenty čepelí, výrobní odpad, ostatní odpad a retušované nástroje.

Z hlediska surovinového spektra je soubor homogenní (obr. 3). Převažuje silicit glacigenních sedimentů, který tvoří přes 97 % všech artefaktů. Ostatní suroviny jsou zastoupeny

pouze okrajově. Tento obraz odpovídá situaci známé z dalších českých magdalenienských lokalit, kde je tato surovina často preferovaná díky svým kvalitám pro výrobu čepelové industrie. Přítomnost suroviny pocházející ze vzdálenějších zdrojů zároveň ukazuje na širší mobilitu nebo síť kontaktů paleolitických skupin z období magdalénienu.

Významnou charakteristikou souboru je různý stupeň patinace artefaktů. Některé kusy vykazují výraznou patinu, zatímco jiné, včetně jednoznačně magdalenienských artefaktů, zůstávají zcela nepatinované. Patina proto není interpretována jako přímý ukazatel stáří, ale jako výsledek kombinace vlastností suroviny, podmínek uložení a délky expozice povrchovým procesům. V české paleolitické archeologii byla patina využívána především jako pomocný znak při hodnocení rozdílných depozičních historií nebo možného chronologického členění souborů. Současně však bylo opakovaně zdůrazňováno, že její vznik závisí na lokálních podmínkách a nemůže být používán samostatně, aniž by bylo odhadované stáří předmětu v souladu s technologickými a typologickými aspekty souboru.

Materiál ze Zbořeného Kostelce ilustruje celý postup výroby mladopaleolitických nástrojů. Přítomna jsou jádra (obr. 5–7), preparační úštěpy i výrobní odpad (obr. 8), polotovary (hlavně v podobě čepelí), ale také četné hotové nástroje (obr. 9–16). Produkce byla jednoznačně zaměřena na výrobu pravidelných čepelí a čepelek. Dominuje metoda odbíjení přímým úderem za použití měkkého organického otloukače, která je pro tuto kulturu typickým výrobním postupem. Preferovaným polotovarem na výrobu nástrojů byly jednoznačně čepele (tab. 3). Patky vykazují velkou variabilitu, a to jak u polotovarů – čepelí, tak i u hotových nástrojů (graf 1).

Nástroje jsou zastoupeny 133 retušovanými artefakty (tab. 3). Nejpočetnější jsou rydla následovaná škrabadly a čepelkami s otupeným bokem, přítomné jsou také vrtáky i retušované čepele. Výrazná převaha rydel představuje jeden z nejcharakterističtějších znaků souboru.

Soubor byl porovnán především s kolekcí z Hostimi 1, která je ve středních Čechách svým charakterem nejpodobnější. Naleziště Hostim 1 je tábořiště v otevřené krajině z mladší fáze magdalénienu, které je časově ukotveno rovněž radiouhlíkovým datováním (max. rozsah 13851–11933 cal BC; Kapustka et al. 2023). Obě kolekce vykazují podobné technologické vlastnosti, jako surovina převažuje silicit glacigenních sedimentů (graf 2). Produkce probíhala na obou nalezištích za použití organického otloukače a byla zaměřena na produkci pravidelných čepelí a čepelek. Oba soubory obsahují všechny výrobní kategorie, přičemž jejich procentuální zastoupení je srovnatelné (graf 3). Liší se proporce zastoupených nástrojů, na Hostimi jsou hojněji zastoupeny čepelky s otupeným bokem, zatímco ve Zbořeném Kostelci převažují škrabadla a rydla (graf 4). Tento rozdíl může odrážet odlišné funkční zaměření lokalit – zatímco Hostim mohla představovat významnější místo spojené s loveckými aktivitami a výrobou lovecké výzbroje, Zbořený Kostelec pravděpodobně sloužil jako víceúčelové sídliště se širším spektrem činností.

Odlišný obraz poskytuje srovnání s lokalitou Kvíc, která se od Zbořeného Kostelce liší jak surovinovým spektrem, tak skladbou nástrojů. Zatímco ve Zbořeném Kostelci téměř výhradně dominuje silicit glacigenních sedimentů, v Kvíci jsou ve větší míře zastoupeny také lokální suroviny. Výraznější jsou rovněž rozdíly v zastoupení jednotlivých typů nástrojů. Kvíc se vyznačuje vysokým podílem čepelek s otupeným bokem a geometrických mikrolitů, které jsou spojovány především s výrobou a údržbou loveckých zbraní, zatímco ve Zbořeném Kostelci převažují rydla a škrabadla, ukazující spíše na intenzivnější zpracování kostěných materiálů a kůží. Srovnání obou lokalit tak dokládá, že navzdory společným technologickým principům existovala v rámci českého magdalénienu značná funkční variabilita jednotlivých sídlišť. Rozdíly mezi Kvící a Zbořeným Kostelcem mohou mít také svou chronologickou hodnotu.

Soubor ze Zbořeného Kostelce tak představuje přínosnou kolekci pro poznání magdalenienského osídlení Čech. Přestože pochází z povrchového sběru a postrádá původní stratigrafický kontext, jeho technologická a typologická charakteristika jednoznačně potvrzuje uvedenou chronologickou příslušnost. Lokalita ukazuje, že i regiony považované za okrajové mohly být součástí komplexního sídelního systému pozdně paleolitických lovců a sběračů a že povrchové nálezové soubory mohou významně doplnit poznání jejich mobility, technologie a využívání krajiny.

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