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Grooves on the cortex of the Epigravettian lithic industry in the broader context

Rillen auf der Kortex von Steinartefakten des Epigravettien im weiteren Kontext

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Abstract - The southern part of the Brno urban agglomeration (Czech Republic) is a crucial region for understanding the Late Upper Palaeolithic (Epigravettian) occupation in Central Europe. Despite limited archaeological research in the urban area, the newly uncovered Brno-Štýřice IIIb site has provided additional information about the character of the Palaeolithic occupation, the hunted fauna, and climate. Our information about the Late Palaeolithic has been increased by recent finds. In this article we present two unique finds, both lithic chipped pieces with grooves on the cortex, found in a well-dated stratigraphic context at the recently excavated area. The different kinds of grooves on the cortex of the chipped stone artefacts can be understood as an example of possible intentional modification of the subjects. We will try to resolve the question of whether these pieces can be understood as non-utilitarian pieces, decorations, symbols (which are rare in the Epigravettian), or if the pieces represent the results of everyday Palaeolithic life.

Zusammenfassung - *Der südliche Teil des städtischen Ballungsraums von Brno (Tschechische Republik) stellt eine Schlüsselregion für das Verständnis der spät- jungpaläolithischen – Epigravettien – Besiedlung in Mitteleuropa dar. Trotz eingeschränkter Grabungsmöglichkeiten im städtischen Kontext lieferte die unlängst entdeckte Fundstelle Brno-Štýřice IIIb neue Erkenntnisse über den Charakter der paläolithischen Besiedlung, die gejagte Fauna und das damalige Klima. Unsere Kenntnisse über das Epigravettien wurden um neue Entdeckungen bereichert. In dem Beitrag werden zwei einzigartige Funde vorgestellt: zwei Steinartefakte mit Rillen auf dem Kortex aus einem gut datierten stratigraphischen Kontext. Verschiedenartige Rillen auf der Kortex der Steinartefakte können als mögliche, absichtlich ausgeführte Ritzungen interpretiert werden. Wir werden versuchen, die Frage zu klären, ob diese Objekte als nicht-utilitäre Stücke – Dekorationen, Symbole – verstanden werden können (die im Epigravettien selten sind), oder ob sie Spuren des paläolithischen Alltags sind.*

Keywords - Czech Republic, Epigravettian, grooves on the cortex, analyses
Tschechische Republik, Epigravettien, Rillen auf der Kortex, Analysen

Introduction

Different types of non-utilitarian (artistic) finds are common in the Palaeolithic. A huge number of these pieces are particularly connected with the Upper Palaeolithic and Mesolithic. Pieces are also abundant during the typical Gravettian (Pavlovian) phase, as well as during the late phase of the Gravettian (called Willendorf – Kostienki ca 29.5-24 ky). After the late phase of the Gravettian, before the Magdalenian culture, artistic and non-utilitarian finds in central Europe are rare. Only sporadic pieces at randomly found sites have been noticed from the period of the Epiaurignacian and Epigravettian (ca 23-15 ky), (Bánesz 1996; Cârciumaru & Niţu 2018; Niţu et al. 2023; Farbstein et al. 2012; Nerudová et al. 2019; Neugebauer-Maresch et al. 2008). Considering the paucity of the above-mentioned types, the different kinds of grooves on the cortex of lithic chipped pieces are in many cases of intentional origin and can be interpreted in some cases as one example of possible non-utilitarian finds.

The discussion about the origins of (Palaeolithic) art (or non-utilitarian pieces) and its definition and meaning are numerous and are usually connected with our ancestors' development of abstract thinking and symbolic behaviour (Handwerker 1989; Wynn 2002; Wynn & Coolidge 2008). The term "art" in the

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Palaeolithic covers a wider group of different kinds of finds, including parietal representations, personal ornaments, decorated pieces or pieces of precarious use, and art mobile (Leroi-Gourhan 1984: 30). One of the numerous definitions of the word art characterises art as symbolically charged, aesthetically transformed, and often decorated items of material culture found in hunter-gatherer or other non-western contexts (Conkey 2001). A modern definition of the word art is that art is serves non-useful, nonpractical purposes (Haviland 2000). In other words, the term art can be understood as something non-utilitarian.

According to the Merriam-Webster Dictionary definition (https://www.merriam-webster.com/dictionary/nonutilitarian), non-utilitarian means not utilitarian, particularly (something) which is "characterized by or aiming at beauty or ornament rather than utility". This group of non-utilitarian objects does not include only physical (portable or non-portable) objects but also perceptions and feelings. Many of the finds combine both utilitarian and non-utilitarian functions. This means, there is a fine line between utilitarian and non-utilitarian and their function can overlap. This is probably the reason archaeologists usually describe everything as art, non-utilitarian or symbolic when they do not understand an object's purpose or function. For this reason, we must be careful with regard to the differentiation between our current thinking and past meaning when interpreting examples of non-utilitarian or symbolic pieces (Hodder 2012; Braun 2015). Whereas a non-utilitarian piece is rather some kind of specific artefact (e.g. perforated beads, ornaments, manuports, see below), a symbolic piece (artefact) is characterised as (Palaeolithic) artefacts which have no obvious utility or model in the natural world (Haviland 2000: 219; Marshack 1976). Symbolic pieces (artefacts) may have evidence of long-term repeated utilisation and "any image could be used in a number of different ways and context… They are viable only within "artificial" or cultural contexts" (Marshack 1976). In this way, the term symbolic can be represented, for example, by shape, colour, atypical dimensions, specific technology or an unexpected type of raw material used for items. To summarise, a non-utilitarian artefact is made in a certain way, and serves no other purpose. It is the final artefact.

In contrast to symbolic and non-utilitarian artefacts, utilitarian artefacts primarily have a practical use (chipped stone industry, retouchers, hammerstones). Utilitarian artefacts can be unique as well as common, numerous or replicable. Depending on their function they can be single-purpose or multi-purpose. On the other hand, utilitarian objects can take on symbolic meaning under certain circumstances.

Non-utilitarian objects contain a large group of natural products represented by fossils, rock crystals and other unusual crystals, stones with cupules, objects with an anthropomorphic shape, pigments, bones, stones, and fossilized organic matter (Moncel et al. 2012). All these mentioned materials were collected by humans and modified by them. Apart from knapping, one of the most typical modifications is engraving. Both figurines and common Palaeolithic lithic objects were frequently decorated with grooves, incisions, or pigments. The decoration of lithic objects did not always look regular and cannot be interpreted always as art or non-utilitarian. Sometimes, there are irregular and rather unsystematic grooves present as well as incisions that look random. In this article, we focus on the grooves found on the cortical surfaces of chipped stone artefacts. These types of pieces are still very poorly documented and published.

History of the area

The urban cadastre of Brno-Štýřice is situated in the southern part of Brno (Czech Republic). Over time, several sites have been uncovered there. These sites probably represent multiple occupations of the area (Skutil 1932; see Fig. 1: B n°5; Valoch 1975; Nerudová 2016; see Fig. 1: B n°2). Environmental analyses, as well as radiocarbon dating, confirm the Last Glacial Maximum/Last Glacial Termination (LGM/LGT) dating of all the finds (Nerudová et al. 2016). The recently excavated site has been designated Brno-Štýřice III (Vídeňská).

In 2021, a small archaeological rescue excavation conducted a short distance from the first site uncovered the same stratigraphic sequence with collections of lithic artefacts and animal bones. It must be emphasized that similar settlement structures have been discovered at several other places nearby (Fig. 1: B n°1 & 2) – particularly the closest Trench II by Karel Valoch and later the area of Squares 8, 9, 10 – P, Q, R on the opposite side of Vídeňská Street (the site Brno-Štýřice III; Nerudová 2016: 19, 24, Figs. 5 & 10). For this reason, the new second site can be associated with the previous one at its eastern part/border (Nerudová et al. 2022). The last excavated site is Vídeňská 11 (Brno-Štýřice IIIb).

Site description and stratigraphy

At Vídeňská 11 (Brno-Štýřice IIIb) we uncovered and documented a smaller portion of a Palaeolithic settlement area (Nerudová et al. 2022). The site is situated on the eastern side of the street, south of Milosrdných bratří Hospital (Brothers of Charity Hospital) and only 40 metres from the well-known site Brno-Štýřice III (Figs. 1 & 2). The geomorphological position of the Vídeňská 11 site is the same as in the case of site Brno-Štýřice III. The excavated site Brno-Štýřice IIIb (49.1843825; 16.5955283; WGS-84) is located in the south-western part of Brno, approximately 300 m to the south of the current south bank of the river Svratka, at an elevation of 208 m above sea level. The Quaternary cover of the region is formed by an accumulation of eolian (loesses) and colluvial sediments deposited on a terrace consisting of clay

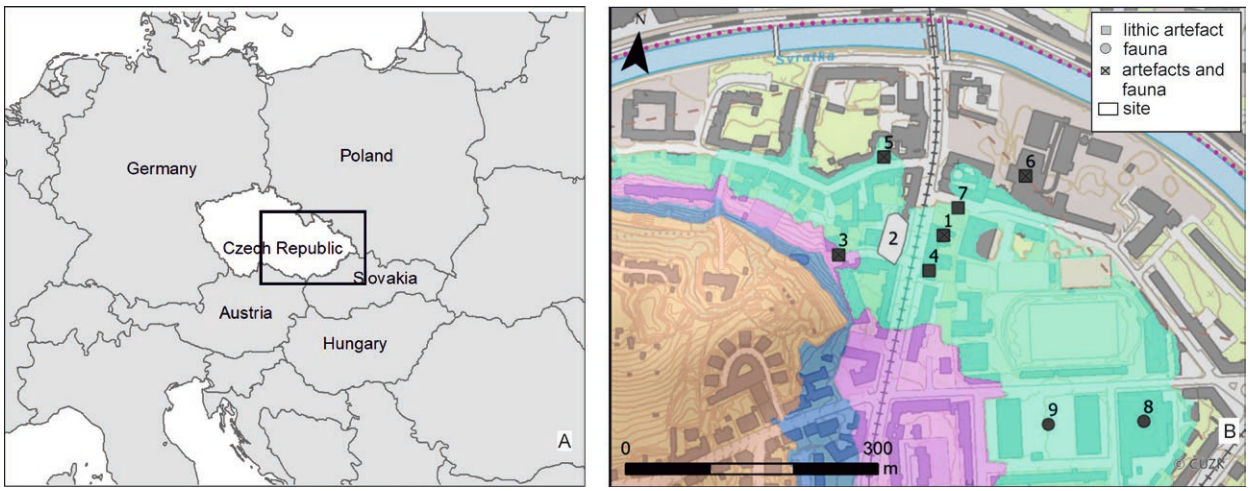

Fig. 1. A - area under study, B - detail of Brno-Štýřice. 1 – Brno-Vídeňská 11 (Brno-Štýřice IIIb), 2 – Brno-Štýřice III, 3 – Brno-Štýřice IIIa, 4* – Brno-Vídeňská 15, 5 – Brno-Kamenná, 6 – Brno-Nemocnice Milosrdných bratří (Hospital), 7*, 8* – Brno-Polní, 9* – Brno-Vojtova. *Isolated finds. Digitized by P. Neruda (source: ČÚZK 2021a, b; geodatabase of the Anthropos Institute, Moravian Museum).

Abb. 1. *A - Untersuchungsgebiet, B – Detail von Brno-Štýřice. 1 – Brno-Vídeňská 11 (Brno-Štýřice IIIb), 2 – Brno-Štýřice III, 3 – Brno-Štýřice IIIa, 4* – Brno-Vídeňská 15, 5 – Brno-Kamenná, 6 – Brno-Nemocnice Milosrdných bratří (Krankenhaus der Barmherzigen Brüder), 7*, 8* – Brno-Polní, 9* – Brno-Vojtova. *Einzelfunde. Digitalisiert durch P. Neruda (Quelle: ČÚZK 2021a, b; Geodatenbank des Anthropos-Instituts, Mährisches Landesmuseum).*

fluvial gravels and sandy gravels of Quaternary age that were detected at a depth of 202-204 m a.s.l. Generally, due to the intensive urban area, the Holocene soil inclusive of the A and B horizons is not preserved; only a relic of the B-horizon remains. This is the reason the B-horizon settled immediately upon the Pleistocene sediments. The chipped stone artefacts, fragments of animal bones, and a skull of a woolly rhino were found on one horizon in the middle part of the orange loess-like sediment of the Vichselian age (Fig. 3).

Dating

According to the identical stratigraphy and the same character of the lithics industry, all the above-mentioned sites fall into the Late Upper Paleolithic and are associated with the Epigravettian. This was confirmed also by ^{14}C data (Tab. 1).

Material

The archaeological material from Brno-Štýřice IIIb comprises lithic industry and animal bones from a well-defined stratigraphy, documented in three absolute coordinates with unstratified items found as intrusions in the pits of the post-Palaeolithic age. Stratified finds were situated in the upper part of the Last Weichselian loess-like sediment just under the Holocene B-horizon (Fig. 3). Between the non-numerous stratified lithic assemblages, there are equally frequent final blanks without cortex, as well as different blanks with a complete or partial cortex (Tab. 2).

Retouched tools are rare (Fig. 4). With regard to raw materials, erratic flint significantly prevails (88.8 %). This is supplemented by sporadic pieces of Olomučany type chert (2.0 %), cretaceous chert (spongolite; 8.0 %), and Moravian Jurassic chert (1.0 %). Apart from the last type of raw material, all the mentioned raw materials must have been imported to the site from a minimum distance of approximately 35-40 km away. The primary sources of cretaceous chert are situated in the region of Boskovická brázda; the northern outcrops are close to the town Letovice (approx. 40 km north of Brno). Spongolites were secondarily transported to the south, however, by the Svitava river, and may consequently be found in Pleistocene sandy gravel terraces in Brno, or even further away, for example, as far as below the Pavlov Hills (Přichystal 2013). Macroscopically, the spongolite has a yellow-brown honey colour. The transparent material is formed by chalcedony with typical sponge spicules (Přichystal 2013).

The Olomučany chert originated from the Moravian Karst (NNE of Brno) area, a minimum distance of about 20 km from the site, where the primary sources are located. Outcrops are located in a relic of Jurassic sediments in the vicinity of Olomučany village. The chert has a dark grey colour and, microscopically, is formed by microfossils and opaque material partly of organic origin. The opaque material is coloured rusty-brown due to the presence of iron oxides. Sponge spicules and bryozoans dominate the microfossils. The transparent material is formed by chalcedony and scarce crystals of macro quartz. The coarser grain size is typical for Olomučany chert, which helps to macroscopically distinguish it from erratic flints encountered in the Silesian and North-Moravian territory.

The most frequently used sources of erratic flint are of secondary origin (sediments transported

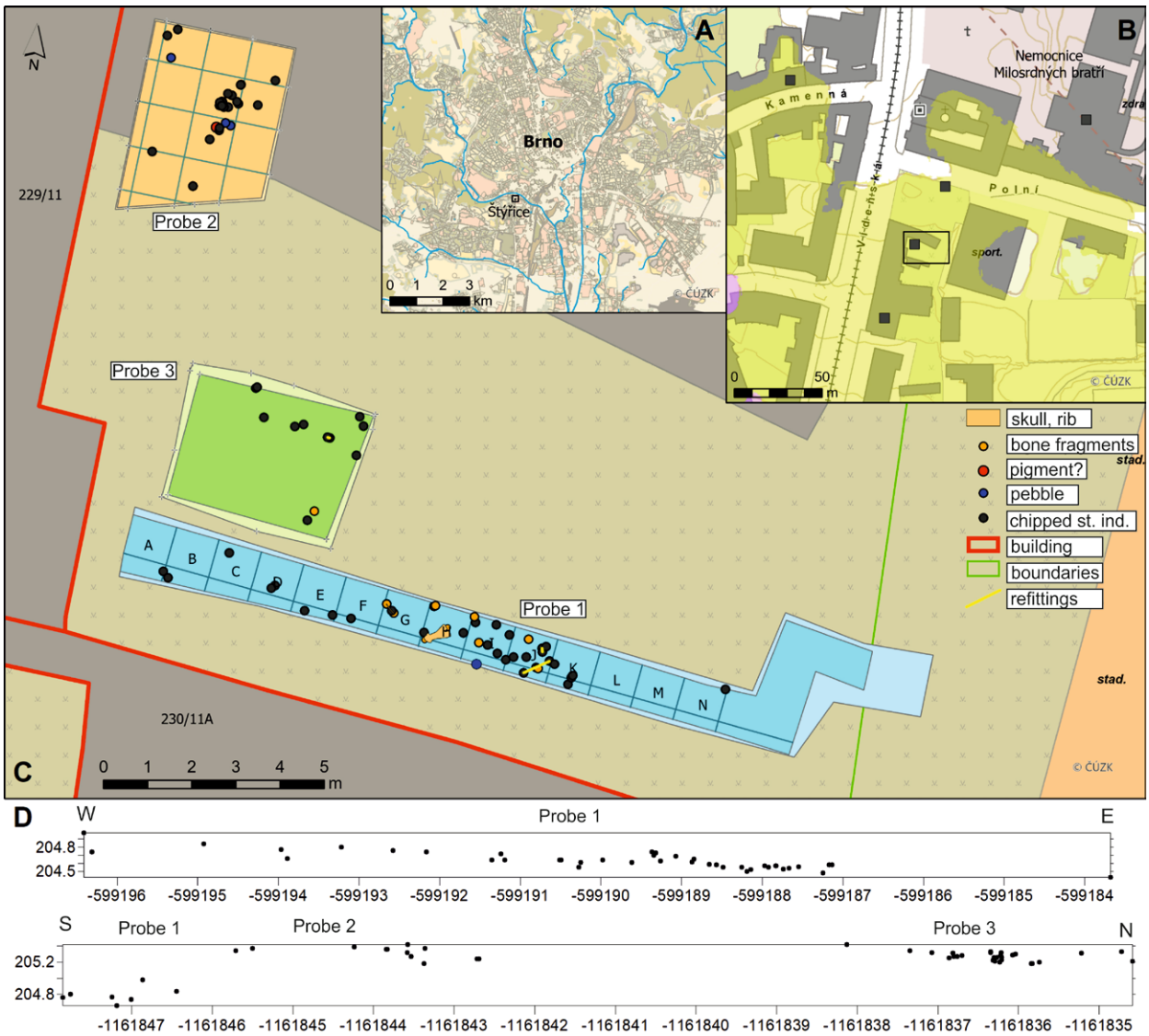

Fig. 2. Brno-Štýřice IIIb (Vídeňská 11). A – position of the site in Brno; B – black rectangle showing the position of the site within the settlement structure in Brno-Štýřice; C – horizontal plan of individual trenches (Probe 1– Probe 3) and spatial distribution of artefacts and animal bones; D – vertical distribution of finds. Digitized by P. Neruda (source: ČÚZK 2021a, b; geodatabase of the Anthropos Institute, Moravian Museum).

Abb. 2. *Brno-Štýřice IIIb (Vídeňská 11). A – Lage der Fundstelle in Brno; B – schwarzes Rechteck, Lage der Fundstelle im Rahmen der Siedlung in Brno-Štýřice; C – Horizontalplan einzelner Suchschnitte (S1–S3) und räumliche Verteilung der Artefakte und Tierknochen; D – vertikale Verteilung der Funde. Digitalisiert durch P. Neruda (Quelle: ČÚZK 2021a, b; Geodatenbank des Anthropos-Instituts, Mährisches Landesmuseum.*

during the Saale glaciation) and are situated at a distance of at least 90-100 km from Brno. The majority of these sources are in North Moravia, close to the border of the Czech Republic and Poland, and continue into Poland. Macroscopic observation shows milky-white, yellow, brown, reddish-brown, or grey colours with a glossy lustre.

Moravian Jurassic cherts are cherts of the Jurassic Age which occur in the Brno area and which are usually impossible to distinguish in detail from known raw material sources in Brno. Moravian Jurassic cherts are represented by slightly rounded pebbles which are possible to find in secondary positions (Přichystal 2013).

All the mentioned types of raw materials are typical in Moravian Upper Palaeolithic assemblages. We would like to emphasise that an almost identical spectrum of raw materials has also been noted at the nearby site Brno-Štýřice III.

The lithic industry is patinated with white patina. Almost all the pieces were covered by a thick layer of calcium carbonate ($CaCO_3$). As a result, they were inappropriate for ultrasonic cleaning. To clean the lithics, all the pieces covered by $CaCO_3$ had to be cleaned in a low concentration of Hydrochloric acid (HCl) and immediately neutralized in freshwater. Cleaning was carried out by rubbing between fingers. No abrasive materials were used. No additional chemical analyses were undertaken except for the above-mentioned cleaning. A detailed laboratory protocol has been published (Nerudová et al. 2022).

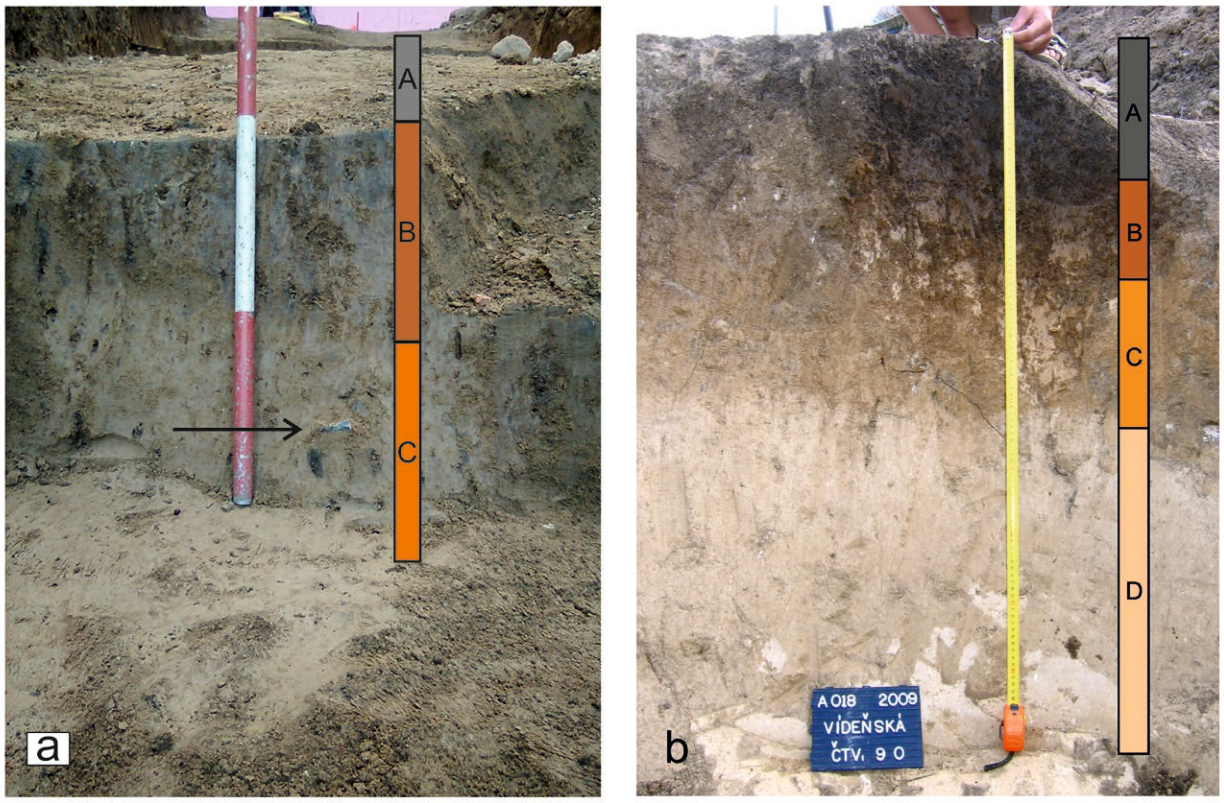

Fig. 3. Comparison of stratigraphy between Brno-Štýřice IIIb (Vídeňská 11; a) and the area of Brno-Štýřice III (b; the opposite part of the street). A – A-horizon of Holocene soil, B – B-horizon of Holocene soil, C – orange loess sediment, D – loess. Arrow – position of artefact in situ. Identical Paleontological finds and chipped stone industry were found in the middle of the C-horizon at both sites; the larger animal bones sporadically extended to the top of B-horizon. Compiled by Z. Nerudová.

Abb. 3. *Vergleich der Stratigraphie zwischen Brno-Štýřice IIIb (Vídeňská 11; a) und der Fundstelle Brno-Štýřice III (b; Gegenseite der Straße). A – Horizont A des Holozänbodens, B – Horizont B des Holozänbodens, C – orangefarbiges Lößsediment, D – Löß. Pfeil – Lage des Artefakts in situ. Identische paläolithische Funde und gespaltene Steinindustrie wurden in der Mitte des Horizonts C auf beiden Seiten entdeckt; größere Tierknochen reichten sporadisch bis zum Oberteil des Horizonts B. Zusammengestellt durch Z. Nerudová.*

During the technological analyses of the lithic industry, we distinguished the two specific pieces which are the subject of this study.

Description of the analysed pieces

Sample 1 (evidence number 136907) represents a small fragment of flake with a cortex (terminal part of a flake; Fig. 5: a – left piece). Its dimensions are 22 × 13 × 4 mm, and it weighs 1.2 g. Erratic flint was used as a raw material. The cortex of the piece is compact and light-orange in colour. Black components/spots and a locally reddish-coloured surface are visible under a binocular microscope. At the cortex, numerous parallel, converging and crossing grooves with a different depth and thickness are evident. The grooves are partially covered (incrusted) by dark-orange-coloured sediment. The ventral surface is covered by a thin white patina (Fig. 5: a – left piece). The piece is without chemical treatment. From the archaeological point of view, this small piece does not represent (apart from the grooves) a significant piece in the collection and can be characterised as waste. There are no additional technological features, retouch or use-wear traces. The fragment cannot be refitted or conjoined with another piece.

Sample 2 (evidence number 136919) represents a large flake with a cortex. Its dimensions are 61 × 40 × 14 mm, and it weighs 27.7 g (Fig. 5: a – right piece). This piece is also made on erratic flint. One line with a V-shape profile crosses the middle part of the piece. At the extremity, there is one large double groove-like line, probably of recent origin (Fig. 5: b & c); at the opposite extremity, there are three short converging grooves. As with the previous piece, the grooves are partially filled by dark-orange-coloured sediment. The ventral surface is partially covered by a thick layer of white patina (Fig. 5: a – right piece). This piece had to be chemically treated. Archaeologically, this piece is also incomplete and represents the initial stage of raw material or core preparation at the site. Unfortunately, the piece is relatively large and thick and cannot be refitted or conjoined with another piece. There are no additional technological features, retouch or use-wear trace.

Description of the reference sample

As a reference sample, we used a piece with cortex from the same raw material (e.g. erratic flint), and originating from the same collection as both of the analysed samples. Erratic flint is a fine-grained raw material from the

Site	Lab-N°	Dating (uncalBP)	Dating calBP (95.4%)	Reference
Bratčice	OxA-33454	14,395 ± 70	15,889-15,393	Nerudová et al. 2019
Brno-Štýřice, Kamenná St	OxA-24105	14,235 ± 60	15,488-15,137	Nerudová et al. 2012
Brno-Štýřice III	GrN-9350	14,450 ± 90	15,974-15,403	Valoch 1996
Brno-Štýřice III	GrA-20002	14,820 ± 120	16,566-15,852	Verpoorte 2004
Brno-Štýřice III	OxA-26961	15,625 ± 75	17,116-16,831	Nerudová & Neruda 2015
Brno-Štýřice III	OxA-28114	14,870 ± 90	16,348-15,966	Nerudová & Neruda 2015
Brno- Štýřice III	OxA-28298	15,215 ± 70	16,741-16,332	Nerudová & Neruda 2015
Brno-Štýřice IIIb	Poz-137944	15,560 ± 80	17,046-16,759	Nerudová et al. 2022
Brno-Štýřice, Hospital	GdA-459	15,650 ± 70	17,126-16,856	Škrdla et al. 2005
Brno - Stránská skála IV	GrN-13954	18,220 ± 120	20,461-19,939	Svoboda 1991
Brno - Stránská skála IV	GrN-14351	17,740 ± 90	19,943-19,195	Svoboda 1991
Brno - Stránská skála IV	Poz-101463	18,670 ± 110	20,962-20,437	Svoboda et al. 2020
Velké Pavlovice	GrN-16139	14,460 ± 230	16,258-15,136	Svoboda & Fišáková 1999
Mohelno-Plevovce KSA	Poz-57891	16,280 ± 80	17,930-17,531	Škrdla et al. 2015
Mohelno-Plevovce KSA	Poz-76195	18,970 ± 110	21,137-20,592	Demidenko et al. 2018
Mohelno-Plevovce KSB	Poz-76196	19,100 ± 110	21,737-20,783	Demidenko et al. 2018
Jaroslavice	GrA-7574	19,340 ± 100	21,790-21,060	Škrdla 1999
Stadice I	GrN-15862	14,280 ± 120	15,860-15,116	Vencl & Fridrich 2007
Stadice I	OxA-42443	14,121 ± 83	15,437-15,057	Oliva 2023

Tab. 1. Overview of ^{14}C data from Epigravettian sites in the Czech Republic. Calibration was performed according to curve IntCal 20 using the online OxCal Calibration programme (https://c14.arch.ox.ac.uk/oxcal/OxCal.html#; accessed 14.02.2023).

Tab. 1. *Übersicht von ^{14}C-Daten aus den Epigravettien-Fundstellen in der Tschechischen Republik. Die Kalibrierung erfolgte gemäß Kurve IntCal 20 unter Verwendung des Online-Kalibrierprogramms OxCal (https://c14.arch.ox.ac.uk/oxcal/OxCal.html#; abgerufen am 14.02.2023).*

Character of lithic pieces	N	%	N	%
	Stratified artefacts		Unstratified artefacts	
Cortical blank	5	6.8	-	-
Crested blank with 1 core side	1	1.4	-	-
Trimming flake	5	6.8	4	15.3
Blank with lateral cortex	9	12.3	-	-
Final blank without cortex	25	34.2	11	42.3
Flake rejuvenated striking platform	3	4.1	-	-
Blank with lateral part of core	-	-	2	7.6
Reduced blade core	-	-	1	3.8
Flake rejuvenated striking platform	-	-	1	3.8
Blank rejuvenated exploited surface	2	2.7	-	-
Reparation of crested blade	1	1.4	-	-
Blank with plunging termination (outrepassé)	1	1.4	-	-
Fragment	9	12.3	6	23.0
Burin blow	8	10.9	-	-
Splinter (< 0,5 cm)	3	4.1	-	-
Core rest	-	-	1	3.8
Fragment of a retouched tool	1	1.4	-	-
Total	73	100	26	100
Manuport?	5	-	-	-
Red inorganic material?	1	-	-	-
Neolithic artefact	-	-	3	-

Tab. 2. Brno-Štýřice IIIb. Overview of the chipped stone industry sorted according to stages of production.

Tab. 2. *Brno-Štýřice IIIb. Übersicht der Steinartefakte, nach Produktionsstadien sortiert.*

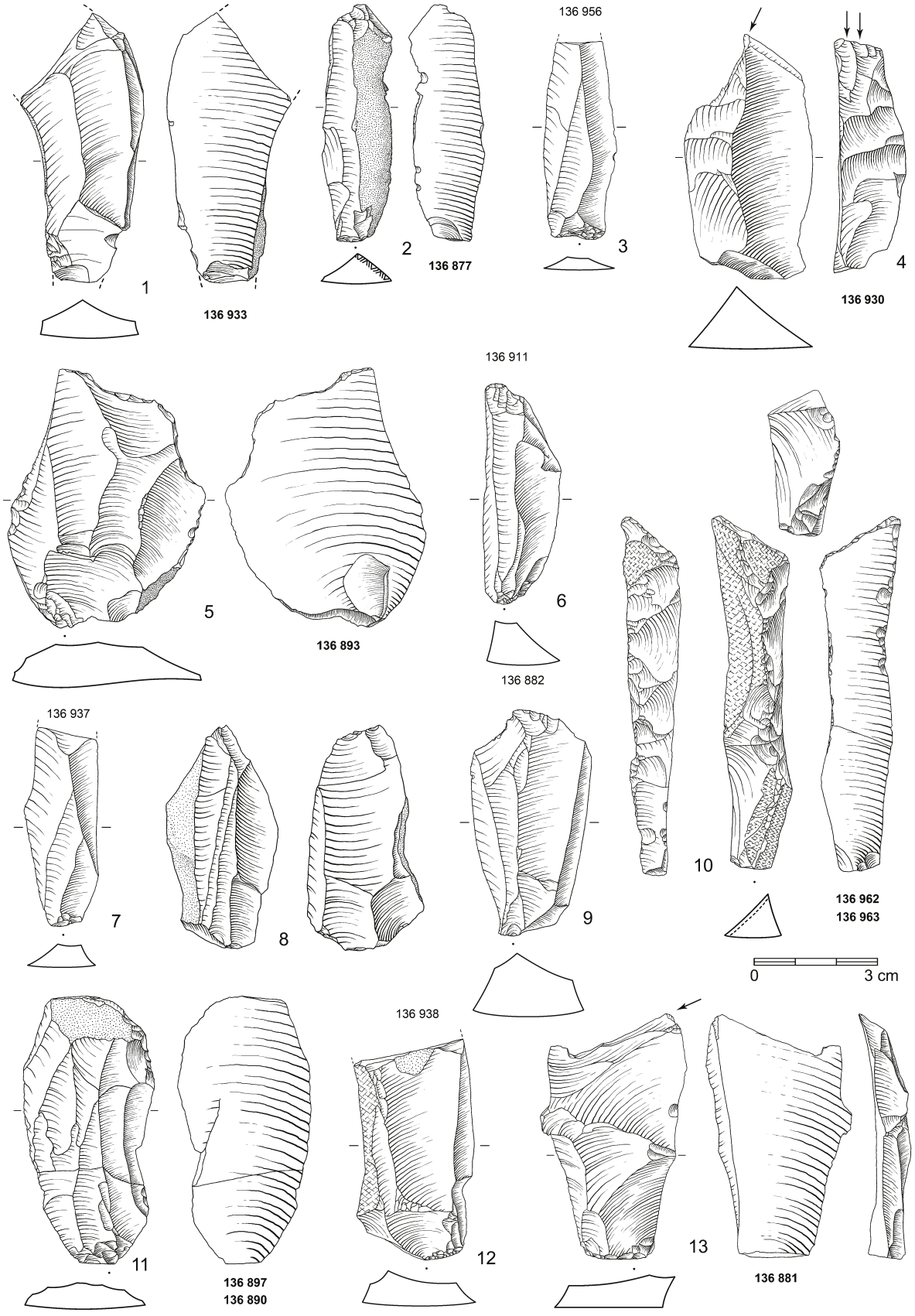

Fig. 4. Brno-Štýřice IIIb (Vídeňská 11). Selection of chipped stone industry from the stratified context (1-7, 9-13): 1-3, 6, 7, 12 – unretouched blades, 4, 13 – burins, 5 – flake with edge damage, 9 – massive blade,10 – crested blade, 11 – trimming flake. A bidirectional core (8) was found in the unstratified context in the Neolithic Age pit. All pieces are made from erratic flint. Drawing by T. Janků.

Abb. 4. *Brno-Štýřice IIIb (Vídeňská 11). Auswahl der Steinartefakte aus dem stratifizierten Kontext (1-7, 9-13): 1-3, 6, 7, 12 – Klingen, 4, 13 – Stichel, 5 – Abschlag mit Kantenbeschädigung, 9 – massive Klinge, 10 – Kernkantenklinge , 11 – Präparationsabschlag. Ein bidirektionaler Kern (8) wurde im nicht stratifizierten Kontext in einer neolithischen Grube entdeckt. Alle Stücke wurden aus erratischem Feuerstein hergestellt. Zeichnung T. Janků.*

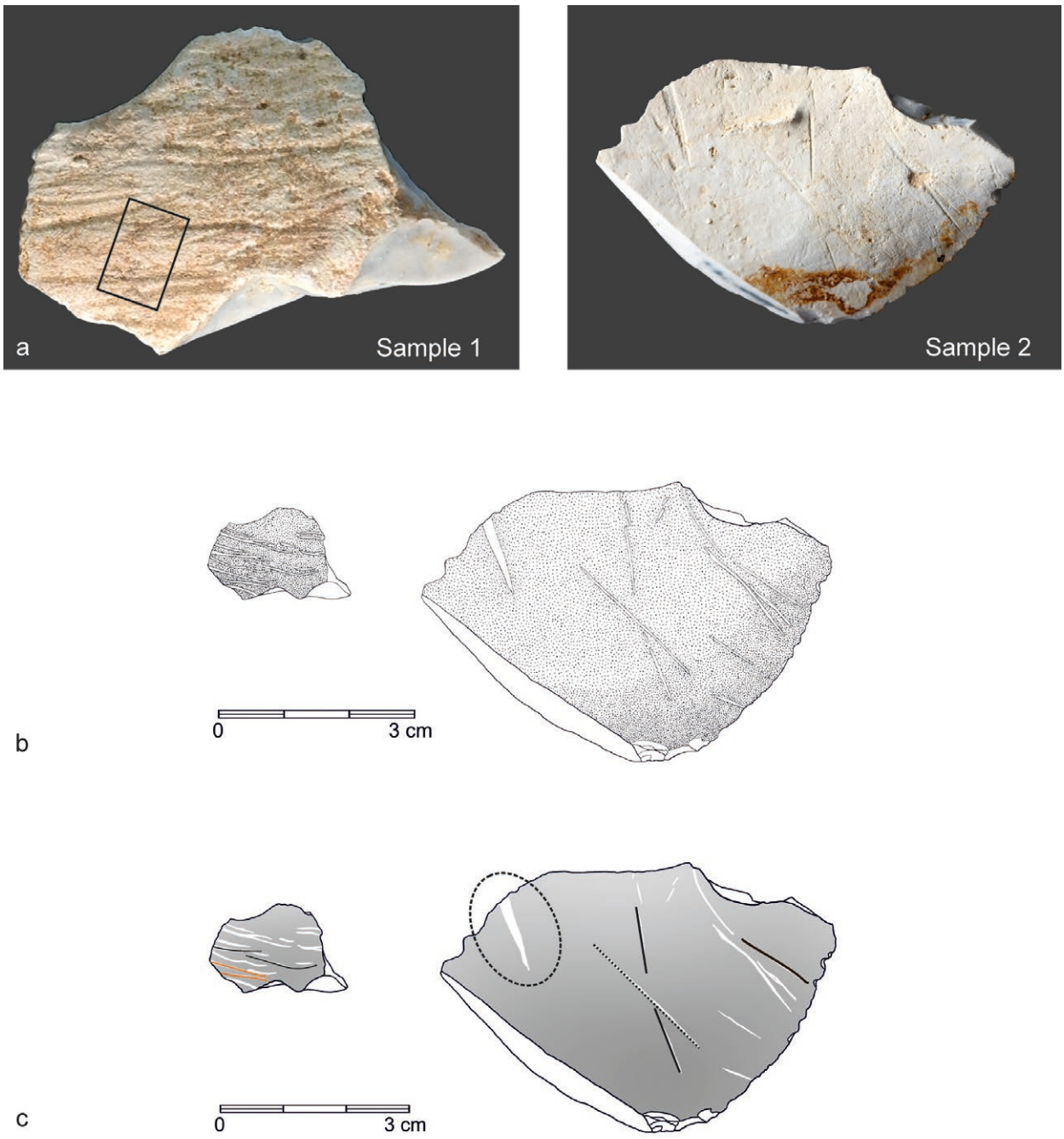

Fig. 5. The pieces under study. The rectangle shows the position of the detailed analyses (a). Photo: P. Neruda. The dashed oval shows a double groove-like line, probably of recent origin (c). Black lines indicate V-shape grooves, orange lines indicate U-shape grooves, and the dotted line indicates a double groove-like line. Drawing T. Janků, graphic Z. Nerudová.

Abb. 5. *Untersuchte Stücke. Das Rechteck zeigt die Lage der detaillierten Analysen (a). Photo: P. Neruda. Das gestrichelte Oval zeigt die doppelte Rillenlinie, wahrscheinlich eine neuzeitliche Beschädigung (c). Schwarze Linien bezeichnen V-förmige Rillen, orangefarbige Linien bezeichnen U-förmige Rillen und die punktierte Linie bezeichnet eine doppelte Rillenlinie. Zeichnung T. Janků, Graphik Z. Nerudová.*

continental glaciation of northern Moravia and Silesia or more northerly territories, which occurred at least twice during the Middle Pleistocene (Tyráček 2011). Erratic flint can be divided into Cretaceous (Maastrichtian) and Tertiary (Danian) types, based on their colour (Maastrichtian flints are dark, Danian flints are bright); chemical composition and present microfossils are the same for both types (Ličmanová et al. 2018).

The reference sample is represented by a medial fragment of the blade with a lateral cortex (Fig. 6: a). The cortex is light orange and compact; under the binocular microscope, it is porous, and some spots are coloured by a black pigment (ink) of post-excavation origin. Except for the cortex, all surfaces are patinated by intensive white patina. In the middle part of the piece is a visible short unintentional (natural) groove, which is parallel to the central ridge. No additional intentional modifications of the surfaces are evident except for one piece of damage originating from the excavation origin and irregular edge damage which

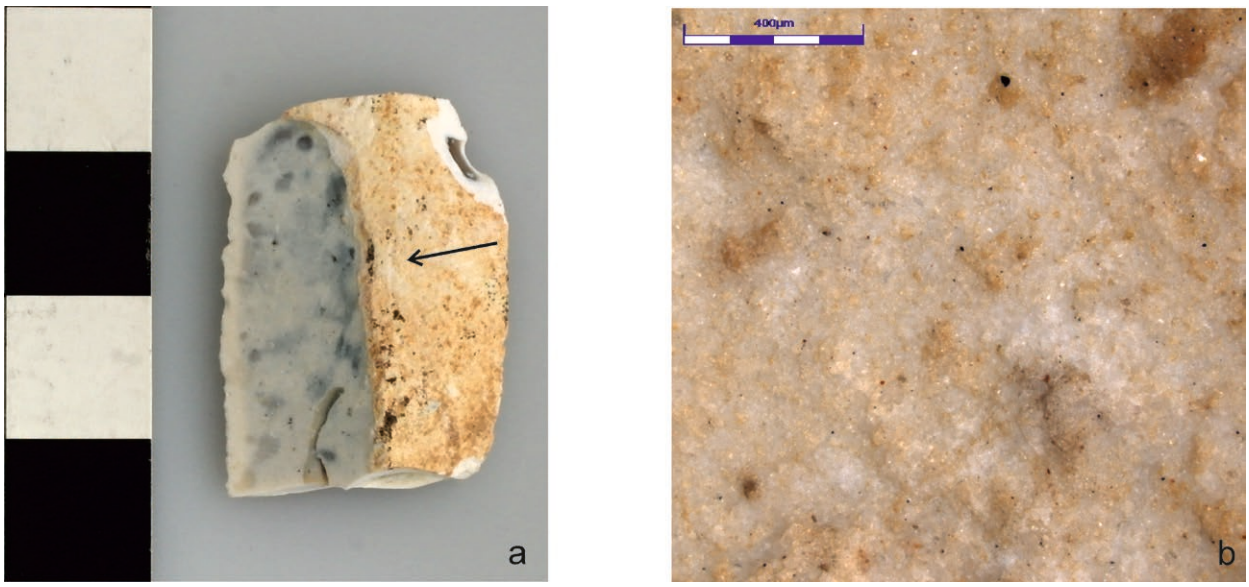

Fig. 6. Macro (a) and micro (b) photos of the reference sample. The arrow shows the flat groove of natural origin. Micro photo: P. Lepcio, macro photo: Z. Nerudová.

Abb. 6. *Makro- (a) und Mikro- (b) fotos des Referenzstücks. Der Pfeil zeigt den flachen Kratzer natürlichen Ursprungs. Mikrofoto: P. Lepcio, Makrofoto: Z. Nerudová.*

is probably associated with soil movements (Stapert 1976; Keeley 1980).

The reference sample was not used for further analyses; it served as a comparison of the character of the cortex, and the unintentional groove character (see chapter Method).

Method

The striations on the artefacts were recognized macroscopically and first studied by binocular microscope to exclude an unintentional origin. In the studied samples, two types of grooves were recognised where the grooves were filled by some kind of incrustation (sediment). These were exclusively present in Sample 1 (Fig. 5). One very distinct fresh groove with clear margins and without any incrustation was present in Sample 2 (Fig. 5: Sample 2 – dashed oval), as were grooves with incrustation (Fig. 5: Sample 2 – black and dotted line). We did not experiment with this sample because, with this kind of raw material, it is obvious how different original and fresh grooves are on the analysed samples (comp. Fig. 5: Sample 2 and Fig. 6). Because the grooves are mostly parallel and do not show any motif, it was not necessary to follow the order of the grooves (Fritz 1999). We focused on the striations filled by incrustation. For detailed analyses, we used an Olympus Lext OLS4100 confocal laser scanning microscope equipped with 10× and 20× magnification lenses. The confocal principle together with point-by-point laser scanning is capable of producing 3D images of the surface, while subsequent full-colour confocal snapshots added the true-colour information. All these processes were compiled automatically by the Olympus LEXT OEM software. We analysed some spots on the surface of the piece (Sample 1) in detail. To exclude a natural origin of the grooves we compared the surface of the cortex between the original artefacts and a reference sample. The selected Sample 1 was measured in two steps. The first measurement was done with a 10× magnification lens, merging 3 × 3 individual images and the second measurement with a 20× magnification lens, merging 2 × 2 individual images. Merging was performed with a motorized microscope stage using the built-in stitching function in the OEM software. The striation depth and width were obtained from several randomly selected height profiles. The profile positions are visualized in figure 7, and the individual profiles with highlighted groove marks are plotted in figure 9. The distance between the grooves was determined from the local minima of the two neighbouring profiles.

Results

Microanalysis of the original sample

The individual diagrams show the analysed profiles 1-8 (Figs. 7-9). In detail, we focused on one groove (Fig. 7: c, d & e) and we measured three different cross-sections perpendicular to this longitudinal groove (profiles 1-3; Fig. 7: a & b). To analyse the distance between the individual grooves, we enlarged profiles 2 and 3 to neighbouring parallel grooves (Fig. 7: a & b). Profile 4 shows the individual cross-section of the next parallel groove and profiles 5 and 6 show the course of the third parallel groove (Fig. 7: c & d). The final profiles, 6 and 7, are crossing the two parallel grooves (Figs. 7: c & 9), and probably cross the third parallel groove above profile 4. There is significant

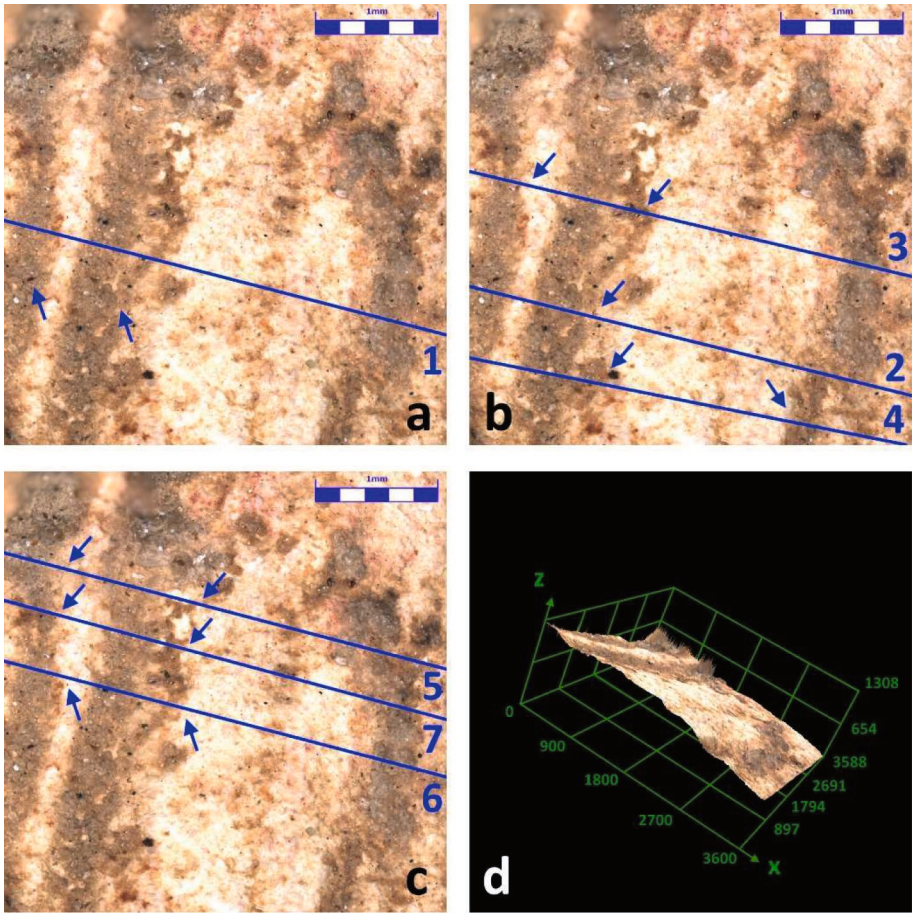

Fig. 7. Sample 1, magnification 10×. Micro photo and 3D model P. Lepcio.
Abb. 7. *Probe 1, Vergrößerung 10×. Mikrofoto und 3D Modell P. Lepcio.*

differentiation between the profiles. The value of measurements ranges from very shallow/flat profiles (profiles 1, 2 and 4), over deep U-shape profiles (profiles 3, 7 and 8) to sharp V-profile (profiles 5 and 6). The depth and breadth of the profiles also vary significantly. The minimum depth of the grooves is around 100 µm (well visible on profiles 1, 3, 5 and 8), and the maximum depth is around 120-150 µm (profiles 5, 6 and 8). The breadth of the grooves is up to several hundreds of microns (Fig. 7: c & d; Fig. 9: profile 5).

We suppose the variability of the shapes is influenced by the intensive filling of the bases of grooves (well visible in figure 8: c & d and figure 9). Together, the same intensive character of incrustation of all grooves and depressions on the surface of the sample illustrates that the age of the grooves is rather of the Palaeolithic period than of recent origin.

Discussion and conclusion

Are the grooves intentional or not? How can we interpret the findings from Brno-Štýřice IIIb Firstly, we can exclude a recent origin for the grooves because patina and incrustation covered them. Moreover, one piece (Sample 2) was covered by a thick layer of calcium carbonate, and this covered the grooves. From the character of the grooves, we can exclude the possibility of the grooves being made by an iron tool during excavation. Additionally, the intentional origin of the grooves is the repetition of similar findings from both well-stratified and unstratified collections in the Czech Republic as well as abroad.

In Moravia (Czech Republic), such pieces were occasionally published decades ago. This type of piece was probably published for the first time by Bohuslav Klíma. He documented a unique piece from the Gravettian site in Dolní Věstonice – the terminal part of a blade with a lateral cortex with a series of crossing lines (Klíma 1969: Fig. V:69). A few years later, Karel Valoch published the first stratified Late Gravettian (Epigravettian) industry known in the former Czechoslovakia with a refit of three large semi-cortical flakes (Valoch 1975). At the cortex of these pieces, two longer lines running over all three dorsal surfaces are evident, together with, probably, two short parallel lines situated just at the border between the left and middle flake (Fig. 10). Two stratified pieces from the Mohelno-Plevovce Epigravettian site were briefly published a few years ago (Škrdla et al. 2014: Fig. 4: 6 & 20). Both pieces are endscrapers made from erratic flint.

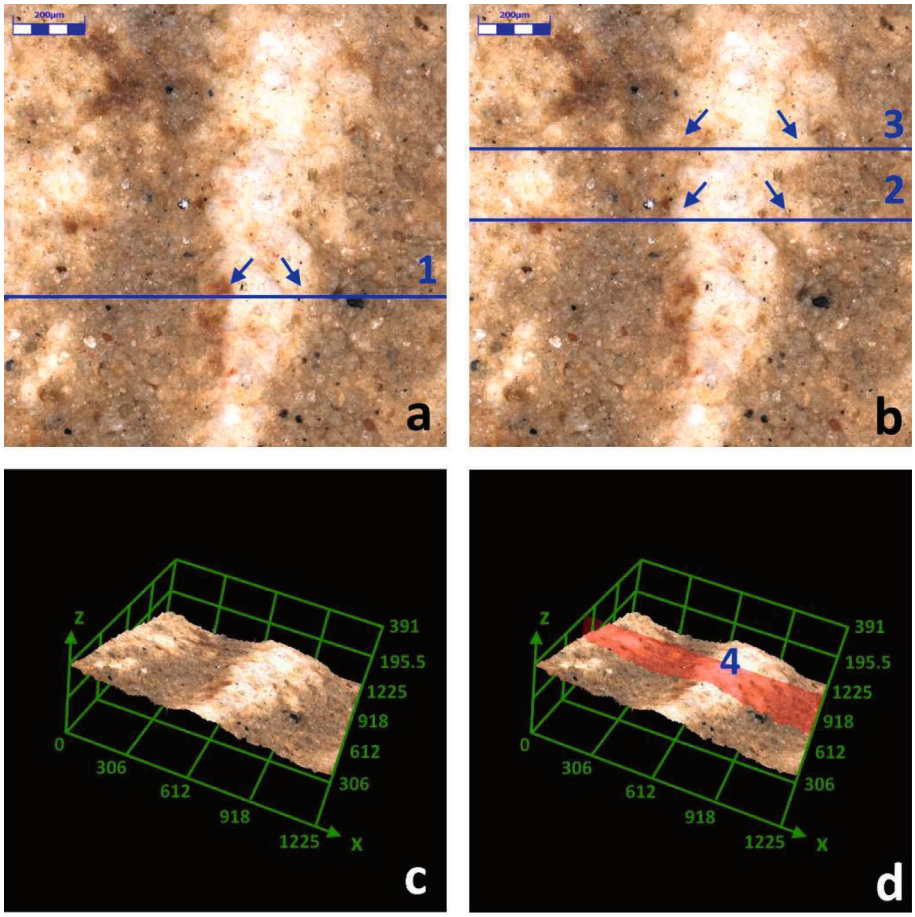

Fig. 8. Sample 1, 20× magnification and 3D models. Micro photo and 3D models P. Lepcio.
Abb. 8. *Probe 1, Vergrößerung 20× und 3D Modelle. Mikrofoto und 3D Modelle P. Lepcio.*

Unfortunately, most of the lithics with grooves are known from unstratified surface collections. Martin Oliva summarised all Aurignacian chipped stone artefacts on which he observed grooves at the cortex. According to the character and orientation of the grooves, he divided the grooves on the cortex of lithic tools into several groups – a) grooves without any system (represented by the pieces from the Nová Dědina I, Kvasice I, Žlutava II sites), b) parallel grooves with pieces from the Slatinice I and Nová Dědina III sites, c) converging type of grooves (a piece from the Kvasice I site), d) intersecting grooves (pieces from the Nová Dědina I, Žlutava I and Napajedla sites), e) several intersecting grooves (pieces from the Otaslavice I and Slatinice sites), and f) rows of incisions represented by a piece from the Lhotka site (Oliva 1982; Fig. 11).

Unfortunately, at the time of writing, none of the above-mentioned artefacts has been studied in detail regarding the character and origin of the grooves.

Other examples are known from collections outside the Czech Republic. In the past, many pieces have been studied in detail in order to resolve their intentional or unintentional origin. In Italy, relatively frequent grooves at the cortex of the chipped stone industry in the abri Riparo Tagliente (Leonardi 1976; 1988) from both the Mousterian and Epigravettian layers were reported (Fig. 12: 2-5 & 9-11). Individual findings were published from the Mousterian layer in the abri Solinas near Fumane Cave (Fig. 12: 1), the Mousterian (?) layer in the Quinzano Cave (Fig. 12: 6), and the Epigravettian layer from Piancavallo (Fig. 12: 12; Leonardi 1988). Some pieces are known also from the Mousterian context in Grotta Maggiore di San Bernardino (Peresani et al. 2014).

If we are looking only at the grooves of the cortex of the chipped stone industry, we can mention the piece from Temnata Cave layer VI, on the surface of which are located twenty engraved lines (Crémades et al. 1995). A unique piece is from the Qafzech Cave in Israel. A series of parallel lines on the cortex of the Levallois core suggests the lines were intentionally engraved and the piece is probably of a non-utilitarian character (Hovers et al. 1997). A Middle Palaeolithic object with semi-circle lines incised at the cortex has been described from the Quneitra site in the Golan Heights (Marshack 1996; d'Errico et al. 2003). Recently published are the grooves on the cortex of a block of tested raw material from the Aurignacian site Barbas III (Ortega et al. 2022). Grooves found on the fragment of a flake at the Aurignacian site Cantalouette II and interpreted as a bird, are associated with mobile art (Ortega et al. 2015).

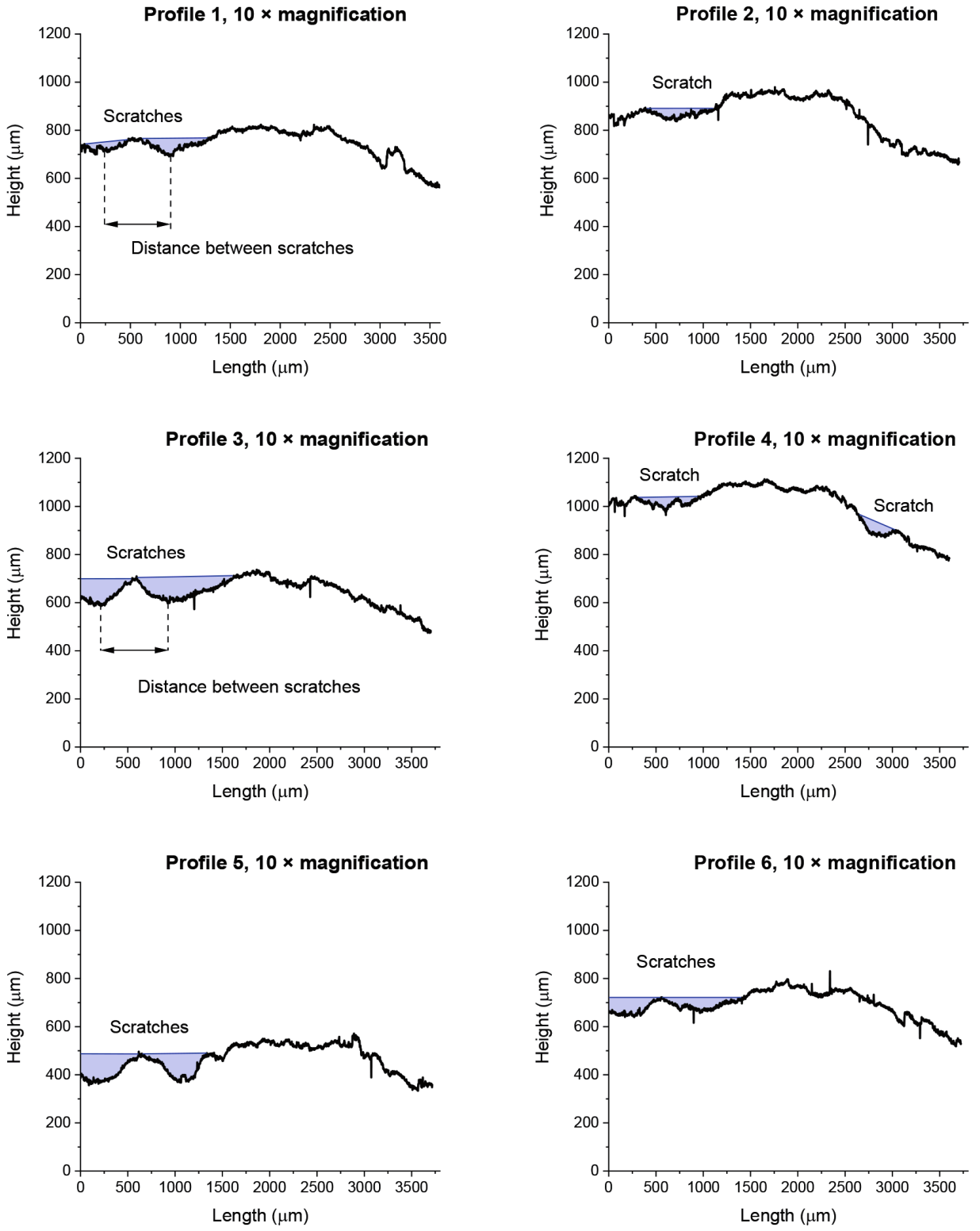

Fig. 9. Graphs - individual profiles. The values at the x and y axes are in microns (μm).

Abb. 9.*Graphen – einzelne Profile. Werte auf der x und y-Achse sind in Mikrometer (μm).*

The number of items has been increased by the discovery at a rescue archaeological excavation at a new site situated in the cadastre of Brno-Štýřice (Czech Republic), where two pieces of chipped stone with grooves at their cortex were uncovered. With regard to a similar finding – refits of three cortical flakes with grooves on the surface – discovered earlier at a short distance from this new site (Valoch 1975), we analysed both newly discovered pieces with a focus on confirming or disproving the intentional origin of the grooves.

Although the analysed lithic industry was deposited in the LGM/LGT periglacial loess-like sediment, we can

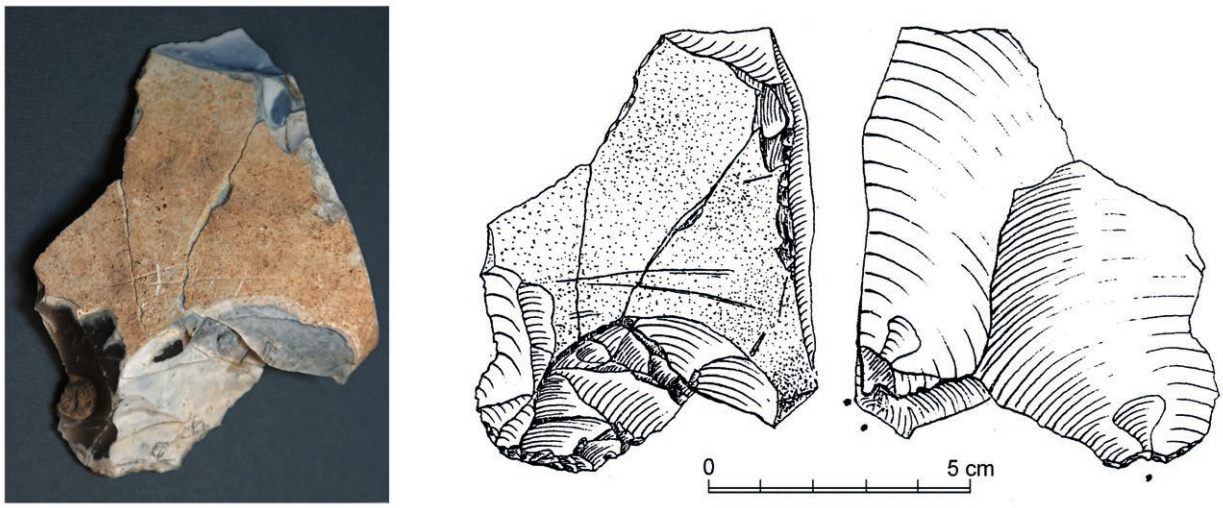

Fig. 10. Refit of three semi-cortical flakes with easily visible grooves. The pieces were found in 1972 during the first excavation of the Epigravettian site later named Brno-Štýřice III. According to (Valoch 1975), photo Z. Nerudová.

Abb. 10. *Zusammensetzung von drei semi-kortikalen Abschlägen mit gut sichtbaren Rillen. Die Stücke wurden im Jahre 1972 während der ersten Grabung auf der Epigravettien-Fundstelle gefunden, die später als Brno-Štýřice III bezeichnet wurde. Nach Valoch 1975, Foto Z. Nerudová.*

exclude natural origins like cryoturbation and gelifluction as a result of grooves on the pieces. According to Keeley, striation originating from soil movement is up to 60 µm wide, as deep as 50 µm and has a U-shape cross-section (Keeley 1980). The grooves at Sample 1 are relatively deep, easily visible macroscopically and are situated only on the cortex surface of the pieces. No additional grooves were found on the rest of the items. Patina and incrustation covered the grooves. We noticed the depth and breadth of the grooves vary significantly, which is probably the result of different intensities of movement. No shiny patina, patches, or lines of bright friction polish as a product of freeze-thaw cycles in sediment were found (Michel et al. 2019).

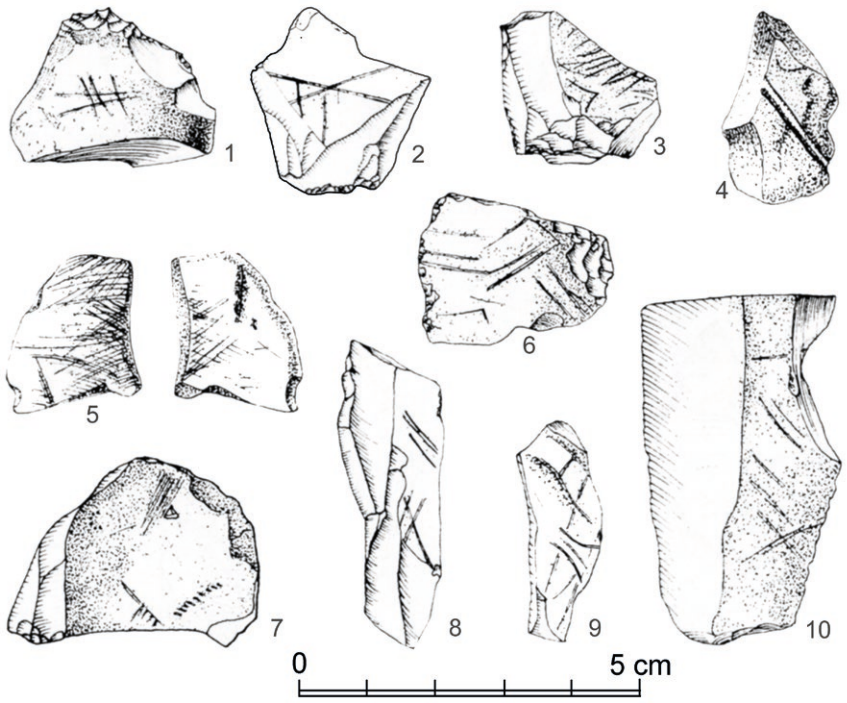

Fig. 11. Selected artefacts with grooves from Moravian (Czech Republic) sites. 1 – Otaslavice I, 2, 4-6 – Nová Dědina I, 3 – Nová Dědina III, 5 – Mladeč Cave, 7 – Lhotka, 8 – Žlutava I, 9 – Slatinice I (according to Oliva 1982).

Abb. 11. *Auswahl von Artefakten mit Rillen aus mährischen Fundstellen (Tschechische Republik). 1 – Otaslavice I, 2, 4-6 – Nová Dědina I, 3 – Nová Dědina III, 5 – Mladeč Höhle, 7 – Lhotka, 8 – Žlutava I, 9 – Slatinice I (nach Oliva 1982).*

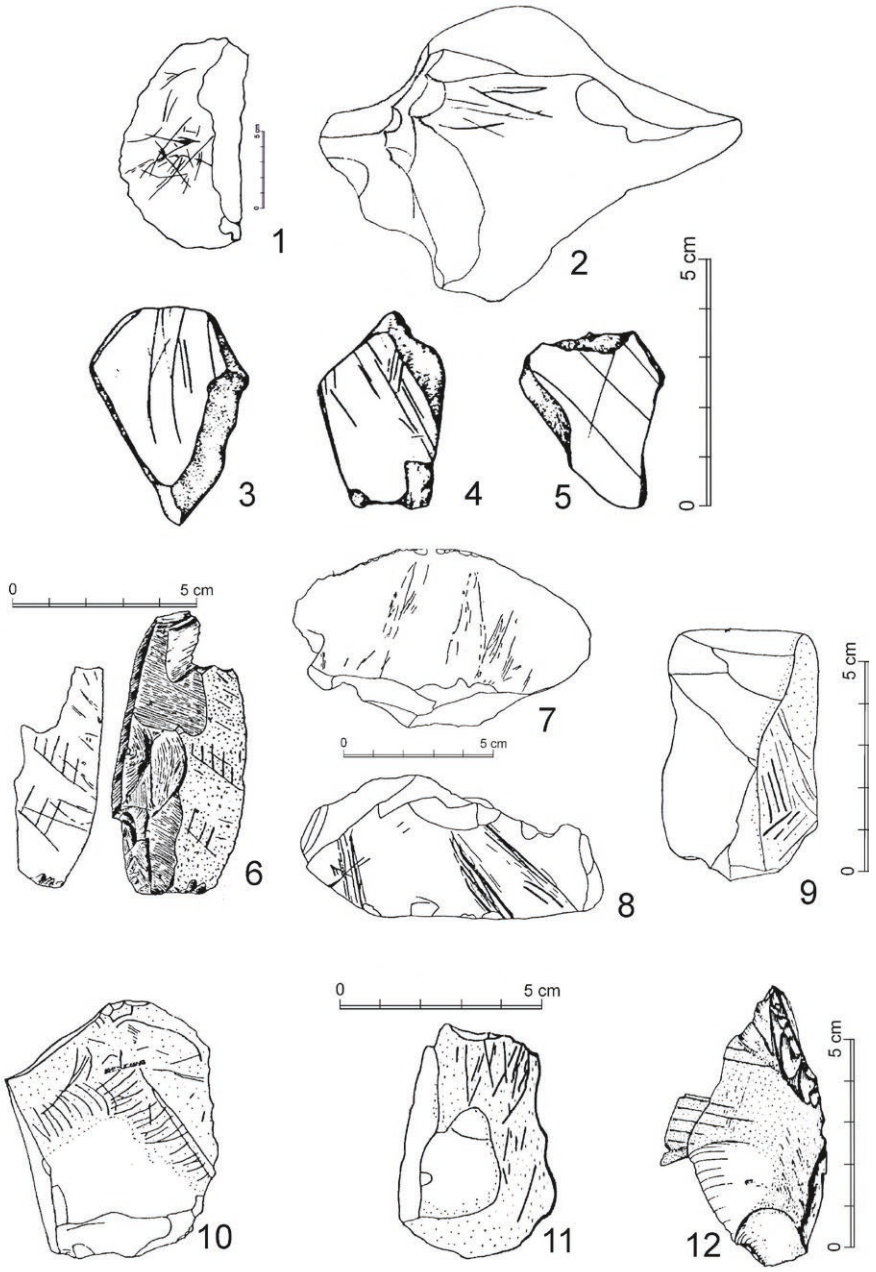

Fig. 12. Selected examples of pieces with grooves on the cortex: 1 – Abri Solinas, Mousterian, probably intentional grooves; 2-5 – Abri Riparo Tagliente, Mousterian, intentional grooves; 6 – Quinzano Cave, Mousterian (?), incisions; 7-8 – Abri Tagliente, Mousterian, probably intentional incisions; 9-11 – Abri Riparo Tagliente, Epigravettian, linear and geometrical engraving; 12 – Piancavallo, Epigravettian, rectilinear subparallel incisions. Images are in scale down and to different scales (according to Leonardi 1988).

Abb. 12. *Ausgewählte Beispiele von Artefakten mit Rillen auf der Kortikalis: 1 – Abri Solinas, Mousterian, wahrscheinlich absichtliche Rillen; 2-5 – Abri Riparo Tagliente, Mousterian, absichtliche Rillen; 6 – Quinzano-Höhle, Mousteria (?), Einschnitte; 7-8 – Abri Tagliente, Mousterian, wahrscheinlich absichtliche Einschnitte; 9-11 – Abri Riparo Tagliente, epigravettianische, lineare und geometrische Gravur; 12 – Piancavallo, epigravettianische, geradlinige subparallele Einschnitte. Bilder sind verkleinert und in verschiedenen Maßstäben (nach Leonardi 1988).*

Secondly, on the surface of the artefact, we identified two types of profiles: U-shaped and V-shaped (Fig. 7: c). Although U-shape profiles are the results of post-depositional processes (d'Errico & Villa 1997; d'Errico 1998; Zilhão & d'Errico 2003), in this case, we can suppose that the U-shaped profiles are incomplete because they are partially filled by carbonised sediment (Fig. 7). We cannot exclude the intentional origin of U-shaped profiles, but mechanical removal of the filling could damage the surface of the artefact. The V-shaped cross-section resulting from the use of a stone edge is undoubtedly of an intentional origin (Brumm et al. 2020).

We can mention some analogies which interpret simple types of grooves at the cortex, as we present here on pieces from the Brno-Štýřice IIIb site. The analogies differ according to the character of the lines (grooves) and the number of grooves on one surface. A large number of grooves on the cortex obtained by repeated movements, which are subparallel and have variable depth, is interpreted as the result of cleaning of the cortex, or as an intervention to reduce the thickness of the cortex. The cleaning (scraping) of the cortex confirmed the origin of groove analyses of pieces from Riparo Tagliente, Grotta Fumane and Grotta di San Bernardino (Peresani et al. 2014). Unfortunately, we have no other piece with similar traces. The grooves on the analysed smaller Sample 1 are numerous and can be characterised as recurrent and parallel. Due to the small dimensions and fragmentation of analysed Sample 1, we cannot interpret this piece as a kind of non-utilitarian piece. Due to the fragmentation of this piece, the interpretation of the grooves is rather uncertain.

Our pieces usually have one or more grooves. These types of striations are the result of a single movement and repeated gestures. The interpretation of such intentional grooves varies between utilitarian and non-utilitarian depending on the number and arrangement of the incisions (Peng et al. 2012; Peresani et al. 2014; Brumm et al. 2020; Ortega et al. 2022). If we disregard the non-utilitarian meaning of the grooves, we can look for a practical explanation. One interesting interpretation of such grooves is that the cortical flake served as a support for cutting actions associated with household activities (Lorblanchet 1999). This is evidenced by the occasional presence of grooves only on some surfaces and the irregular character of the striations (Peresani et al. 2014). For this purpose, an implement like a tool of a burin character could have been used (d´Errico 1988).

The grooves found on the largest piece (Sample 2) look unsystematic and random and are similar to the first pieces found at the site in 1972 (Fig. 10).

Generally, we suppose, the grooves presented by our study do not represent decoration, symbol, or mobile art, known from many Palaeolithic sites. The interpretation of grooves on the cortical pieces as a result of cutting actions in which the cortical pieces were used as support is acceptable. Our counter-arguments are mostly the small dimensions of the cortical artefacts, the unsuitable (convex) shape, and an uneven or irregular surface. Lastly, the grooves are on different types of blanks, retouched tools, cores, and pebbles. We suppose the striation found on the two pieces from the Vídeňská 11 site can be interpreted as the result of knapping processing, more precisely as a result of testing the homogeneity of the nodule (Inizan et al. 1999) and testing the thickness (and quality) of the cortex. The different shape profiles, depth and breadth of grooves correspond to this observation. The result of rubbing the Upper Cretaceous flint with a stone hammer is striations (linear polishes; Sano 2012: Fig. 37: b), using sandstone for the preparation of the ridge results in linear polishes (Sano 2012: Fig. 45) and contacts from other flints bring a short, stripe-like appearance and non-oriented appearance (Sano 2012: Fig. 85: c). Similar striation, which is the result of friction or percussion stone on stone has also been described by Semenov (Semenov 1957) as an example of late Palaeolithic chipped stone industry.

Although we cannot directly associate the grooves at the cortex of the chipped stone industry found at Brno-Štýřice IIIb with artistic Palaeolithic pieces *sensu stricto*, we can understand these types of pieces as a kind of evidence of infrequent "insights into technology" or "know-how" of Palaeolithic peoples. These (incised) pieces are occasionally published from both well-stratified as well as unstratified contexts mentioned from a relatively wider area (Italy, Czech Republic, France, North America, Southwest Asia) and documented from different periods (Mousterian, Aurignacian, Gravettian, Epigravettian, Late Paleolithic, Neolithic (Brumm et al. 2020 with further references).

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Inhalt - *Contents*